The Overconfidence and Self-Attribution Bias of Investors in the Primary Market

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Abstract

We analyze the investment performance of 6,993 investors bidding in 77 discriminatory IPO auctions in the Taiwan stock market between January 1996 and April 2000, and find that frequent bidders in these auctions have lower returns than infrequent bidders. The frequent bidders bid too aggressively and evaluate the IPO firms too optimistically, resulting in inferior performance. Such underperformance is revealed not only among individual investors but also institutional investors. Frequent investors are quite successful in their first few auction bids, but their returns are gradually reduced in subsequent auctions. The multivariate model analyses and analysis of the possibility of perverse incentives of brokerage firms suggest that our findings cannot be explained by rational hypotheses, whereas in contrast, the theories on overconfidence and self-attribution bias can explain the increase in bidding frequency and the deterioration in return performance for bidders in IPO auctions.

Keywords: Overconfidence; Self-attribution bias; IPO auctions

JEL: G14, G24

1. Introduction

Several of the prior studies have shown that investors can be extremely overconfident with regard to the precision of their judgment.[1] Barber and Odean (2000), for example, analyzed the investment performance of individual investors in a large discount brokerage house and find little difference between the gross returns of individual investors who traded frequently and those who traded infrequently. However, after accounting for trading costs, frequent traders were found to have underperformed the relevant benchmarks; thus, such resultant poor performance may be attributable to excess trading activities by overconfident investors.

A number of interesting questions remain unresolved in this area, and thus, need to be further addressed. The first refers to whether the performance of both individual investors and institutional investors is affected by overconfidence; the second is whether, in addition to trading costs, trading skill and stock selection ability are also to blame for the underperformance of frequent traders; and finally, the question remains as to what it is that makes investors become so overconfident.

In an attempt to shed some light on these issues, we examine the performance of investors in the primary market in Taiwan adopting a unique (and remarkably complete) dataset comprising of bidding price and quantity, and the identity of investors, in 77 IPO auctions taking place in the Taiwan stock market between January 1996 and April 2000.

This comprehensive dataset facilitates the direct testing of two alternative hypotheses. Firstly, the rational expectations model of Grossman and Stiglitz (1980) argues that rational investors will not engage in trading if the expected returns are insufficient to offset the costs; thus, rational investors are seen as correctly assessing the expected profits from trading. Conversely, the theoretical models developed by

[1] Refer to Lichtenstein et al. (1982) for a review of the literature.

Odean (1998) and Gervais and Odean (2001) suggest that overconfident investors trade more than they would if they were rational, overestimating their expected profits, and as a result, engaging in costly trading, even when their expected trading profits are insufficient to offset the costs of trading. In the Odean (1998) framework, it is found that overconfident investors believe that they have superior information even when this is not actually the case. The overconfidence hypothesis predicts that such investors will trade more, thereby reducing their returns.

In the analysis in this study, we classify investors into four groups based upon the number of IPOs in which they had placed bids. Investors with a high number of bids are analogous to those trading frequently in the Odean (1999) and Barber and Odean (2000) frameworks. In our analysis, a comparison of the investment performance of the four groups classified by bidding frequency will provide clear evidence for, or against, the overconfidence hypothesis in the primary market.

Furthermore, by analyzing the dynamic changes in investment performance, particularly for frequent bidders, we are able to test whether the self-attribution bias hypothesis can explain the performance (or rather, underperformance) of overconfident investors. The literature on both psychology (Kahneman and Tversky, 2000) and behavioral finance (Baker et al., 2006) suggests that self-attribution is an important source of overconfidence. Hirshleifer (2001) notes that since investors tend to take too much credit for their own success, thereby leading to overconfidence. Gervais and Odean (2001) demonstrate, in a multi-period setting, that self-attribution bias does cause traders to become overconfident.[2]

IPO auctions began in Taiwan in 1995, with their use becoming popular as a selling mechanism from 1996 to 1998. We do not consider the age of investors as contributing

[2] Daniel et al. (1998) propose a model of securities market under-reactions and over-reactions also based on the overconfidence of investors on the precision of private information and self-attribution bias causing asymmetric shifts in investors' confidence as a function of their investment outcome.

to their overconfidence; instead, we regard the number of IPO auctions in which investors placed bids as being representative of their experience. The dataset facilitates the observation of the dynamic changes in investment performance from initial bids to subsequent high-order bids.

The model of self-attribution bias predicts that overconfident bidders will be successful in their first few bids, but that they will gradually develop some level of overconfidence; and indeed, experienced bidders who have become overconfident will exhibit greater optimism with regard to the prospects of IPO firm. This leads to overconfident investors being more likely to bid again and then exhibiting their optimism through their aggressive bidding on IPO firms. Since their future bids will be driven by overconfidence, they will invariably display inferior performance.

The literature on the primary and secondary markets suggests that individual investors are less informed than institutional investors.[3] Bloomfield et al. (1999) demonstrate that investors who are less informed may suffer from overconfidence, given their informational disadvantage, and trade more aggressively than investors who are better informed. Their argument implies not only that individual investors can have superior performance because they are less informed, but also that they are overconfident, and as a result, may trade too aggressively.

Barber and Odean (2000) also find overconfidence among individual investors, and subsequently go on to argue that male investors are more overconfident than female investors (Barber and Odean, 2001). Our unique dataset of 6,993 investors in 77 discriminatory auctions which took place in the Taiwan stock market between January 1996 and April 2000 allows us to distinguish between the bids made by institutions and individuals, as well as the gender of individual investors.

[3] Michaely and Shaw (1994) argued that, not only do institutional investors devote resources to gathering information, but they sometimes also have access to corporate information that is unavailable to individual investors.

We begin by analyzing the investment performance of four groups sorted by their bidding frequency: (i) Group 1: bidders in one to four auctions (regarded as 'infrequent bidders'); (ii) Group 2: bidders in five to eight auctions; (iii) Group 3: bidders in nine to twelve auctions; and (iv) Group 4: bidders in thirteen or more auctions (regarded as 'frequent bidders'). Our empirical results provide support for the hypothesis that overconfidence leads to excessive bidding: the gross return (adjusted net return) of an average 'infrequent bidder' is 8.29 percent (9.23 percent), whereas the comparative return for an average 'frequent bidder' is only 4.43 percent (4.95 percent). The differences between the gross returns, net returns and adjusted net returns are all statistically and economically significant. Furthermore, although institutions have higher returns than individuals, there is still evidence of overconfidence within institutions.

On the further decomposition of investment performance into 'stock selection' performance and 'bidding' performance, we find that frequent bidders perform worse than infrequent bidders from both aspects. This implies that overconfidence leads frequent bidders not only to bid too aggressively, but also to have an overly optimistic view of the prospects of IPO firms. This over-optimism improperly raises the feasible sets of positive 'net present value' (NPV), leading to erroneous bids at some auctions, with such aggressive bidding resulting in the bidder paying an excessive amount to secure the auctioned IPO shares, thereby lowering his investment performance.

Focusing on frequent bidders, we analyze the dynamic changes in investment performance from the initial bid to their subsequent high-order bids. In their first few bids, overconfident investors earn a gross return (adjusted net return) of 12.99 percent (11.68 percent); these returns are higher than those for infrequent bidders. However, the investment performance of overconfident investors becomes increasingly worse with a rise in the number of bids placed; at ≥13 auctions, the gross return (adjusted net

return) is reduced to –0.35 percent (0.24 percent).

The difference in the gross returns (adjusted net returns) of low-order bids vis-à-vis high-order bids is 13.34 percent (11.44 percent), with 14.87 (14.00) times of standard error; this is consistent with the predictive model of self-attribution bias proposed by Gervais and Odean (2001). Since investors are successful in their first few bids, this causes them to improperly revise their beliefs; as a result, such successful bidders become overconfident investors. These investors are far too optimistic about the prospects of IPO firms, resulting in their tendency to bid at more auctions, and to bid more aggressively, than a fully rational investor. This explains the deterioration in the performance of overconfident investors in high-order bids.

This study contributes to several strands of the literature, beginning with the literature on overconfidence. To the best of our knowledge, this is the first study to examine investor overconfidence using primary market data. We provide evidence to show that both individual and institutional investors are prone to overconfidence in the primary market; this is in line with the prior studies which find overconfidence amongst individual investors in the secondary market (Odean, 1998; Barber and Odean, 2000). However, in contrast to the Barber and Odean (2001) finding, that male investors are more prone to overconfidence than female investors, we find no evidence of males achieving lower investment returns in the primary market.

We also contribute to the literature on self-attribution bias. A number of recent studies have examined self-attribution bias, for example, amongst on-line investors in the secondary market (Barber and Odean, 2002), in analysts' earnings forecasts (Hilary and Menzly, 2006) and in the acquisition decisions of managers (Doukas and Petmezas, 2007; Malmendier and Tate, 2008). We complement the literature by introducing our comprehensive dataset on IPO auctions in the primary market, with our results demonstrating that self-attribution bias is the main source of investor overconfidence.

Our study also contributes to the literature on IPOs. In a bookbuilding selling mechanism, institutional investors are assumed to be informed, as are investors who place multiple bids, so they are allocated more shares in the bookbuilding IPOs (Aggarwal et al., 2002; Cornelli and Goldreich, 2003). We add to the literature by providing evidence on IPO auctions. Our results show that institutional investors have higher returns than individuals, but that investors with multiple bids in a single auction perform worse.

The remainder of this paper is organized as follows. Section 2 provides a brief introduction to the IPO auction mechanism in Taiwan, followed in Section 3 by a description of the data and the methodology adopted. The results on the performance of investors in IPO auctions are presented in Section 4, with Section 5 reporting the results of the return decomposition. Section 6 presents the dynamic performance of frequent bidders. Finally, the conclusions drawn from this study are presented and summarized in Section 7.

2. The IPO Auction Mechanism in Taiwan

Introduced in December 1995, the discriminatory auctioning of IPOs in Taiwan represents the first stage of a sequential hybrid selling procedure which comprises of the auction itself and a follow-on fixed-price offer. Prior to the introduction of this sequential hybrid, underwriters and issuing firms in Taiwan had traditionally used a pure fixed-price method to distribute IPO shares. Between December 1995 and February 2005, underwriters and issuing firms could select between the two methods to distribute new shares in the primary market.[4]

[4] During our sample period, from December 1995 to April 2000, a total of 77 issuing firms chose the sequential hybrid method for the distribution of their IPO shares, while 255 firms chose the pure fixed-price method. From April 2000 to February 2005, only 13 firms used the sequential hybrid method. Similar to other markets, the auction method has lost market share in the primary market in Taiwan. In this study, we do not focus on the regularity of, or the choices between, the different selling mechanisms. Refer to Sherman (2005) for a discussion on these issues.

In the pure fixed-price method, underwriters and issuing firms select comparable firms and set the issue prices according to a formula prescribed by the Securities and Futures Commission (SFC) in Taiwan. The size of the order to which an investor can subscribe normally ranges from one to three lots (1,000 shares per lot). If the IPO is over-subscribed, underwriters will carry out a lottery to allocate the shares

Conversely, the auction selling procedure is a market-driven mechanism which leaves the decision making to investors. Under this sequential hybrid procedure, 50 percent of the IPO shares are auctioned, followed by a fixed-price open offer for the remaining shares. Prior to such discriminatory auctions taking place, underwriters and issuers will announce the number of shares to be auctioned, the minimum acceptable price (i.e., the auction base price) and the initial price range for the follow-on fixed-price offers. Investors submit their bids to a brokerage firm and pay a fee of NT$500 for each bid[5], with each eligible investor being permitted to submit a single, or multiple, price/quantity bid(s), just as in a sealed-bid auction, for up to 6 percent of the auctioned shares (i.e. 3 percent of the total IPO shares). The submission period normally lasts for one calendar week.

After collecting the bids from brokerage firms, the Securities Dealers Association (SDA) computes a cumulative demand curve and then fills the orders from the highest to the lowest bidding prices until all of the auctioned shares have been distributed, with all bids with the same bidding price being randomly filled. All winning bidders must pay the price that they bid. If the IPO is under-subscribed, the issuing firms will take all of the unsold shares and combine them with the 50 percent originally designated for sale in the subsequent open offer.

On the next business day following the auction day, the SDA announces the schedule of the price/quantity for each individual winning bid, the identity of each

[5] The exchange rate that prevailed during our sample period was approximately NT$ 30 per US$ 1.

winning bidder and the offer price for the subsequent fixed price offer which the underwriter conducts about three calendar weeks after the announcement of the auction results. The fixed-price offer lasts for one calendar week, with the selling procedure being similar to the pure fixed-price method. The IPO date is set at two calendar weeks from the closing date of the fixed-price offer.

The timing of the sequential hybrid selling process is illustrated in Figure 1.[6]

<Figure 1 is inserted about here>

3. Data and Methodology

3.1 Data

We analyze the bidding behavior of investors in 77 IPO auctions taking place in Taiwan between January 1996 and April 2000.[7] Table 1 reports the descriptive statistics of the bidding information available to investors in these 77 IPO auctions, with Panel A providing the descriptive statistics of the application data (i.e., all bids), and Panel B detailing the descriptive statistics of the allocation data (i.e., successful bids).

As shown in Panel A, the average number of investors submitting bids in the IPO auctions is 705, of which 32 are institutional investors and 673 are individual investors. Of the 673 individual investors, 411 are male and 262 are female. The average number of bids submitted by investors in the IPO auctions is 987, of which 57 are submitted by institutional investors and 930 are submitted by individual investors. Male investors accounted for 580 of the 930 individual bids, and female investors accounted for 350. Finally, the average number of lots submitted by investors in an IPO auction is 29,613, of which 7,575 lots are submitted by institutional investors and 22,039 are submitted by individual investors. Of these 22,039 lots, 13,810 are submitted by male investors

[6] Refer to Lin, Lee, and Liu (2007) for a detailed discussion on the auction mechanism in Taiwan.

[7] A further 13 IPO auctions took place after April 2000; however, these samples were discarded because the application and allocation date were not available.

and 8,229 by female investors.

<Table 1 is inserted about here>

These statistics reveal that some investors submit multiple bids in the auctions. On average, institutional investors submit 1.78 bids, with 132.2 lots in each bid, as compared to 1.38 bids and 23.7 lots for individual investors, implying that institutional investors are more deliberate than individual investors. These statistics also show that individual investors, particularly male investors, are the key participants in Taiwanese IPO auctions, in terms of both the total number of bidders and the number of bids or lots submitted.[8] This situation, whereby individual investors are more active than institutional investors in IPO auctions, is similar to that in the secondary market in Taiwan.

As shown in Panel B, the average number of successful investors in an IPO auction is 155; nine are institutional investors and 146 are individual investors. Of the 146 successful individual investors, 90 are male and 56 are female. The average number of successful bids allocated in an IPO auction is 200, of which 14 are submitted by institutional investors and 186 are submitted by individual investors; of these 186 bids, 117 are made by male investors and 69 by female investors. Finally, an average of 7,976 lots is allocated to successful investors in an IPO auction, of which 1,891 are allocated to institutional investors and 6,085 to individual investors; of the 6,085 lots allocated to individual investors, 3,753 are allocated to male investors and 2,332 to female investors.

The analytical framework in Table 1 is based upon the IPO auctions. We now turn our attention to investors, stacking up the bidders across the 77 IPO auctions. A total of 27,725 investors participate in the auctions, with 20,732 of these subsequently being excluded from our sample because they do not receive any allocations of shares. Our final sample therefore comprises of the remaining 6,993 investors who had succeeded

[8] There are six IPO auctions in which institutional investors do not submit shares.

in having at least one bid filled from the 77 IPO auctions.

The descriptive statistics of our sample are presented in Table 2. Of the 6,993 investors, 430 are institutional investors, 3,747 are male and 2,816 are female. The mean number of IPO auctions in which these investors submit bids is 3.86, whilst the mean number of IPO auctions in which their bids are successful is 2.21, giving a success rate of 57.3 percent.

<Table 2 is inserted about here>

In order to test the overconfidence hypothesis, we classify all investors into four groups according to the number of IPOs in which they have submitted bids. The frequency of participation by bidders in IPO auctions in the primary market in this study is analogous to the number of trades by investors in the secondary market described in the Odean (1998) and Barber and Odean (2000) studies. We assigned the participating bidders as follows: Group 1 (1-4 auctions); Group 2 (5-8 auctions); Group 3 (9-12 auctions); and Group 4 (≥13 auctions). Of the 6,993 investors, 5,165 are assigned to Group 1, 1,066 are Group 2, 405 are Group 3, and 357 are Group 4. We define investors in Group 1 as 'infrequent bidders', while investors in Groups 4 are 'frequent bidders'.

The performance of these four different groups, particularly the relative difference between Groups 1 and 4, is helpful for identifying the competing hypotheses. The rational expectations model predicts that performance between these four different groups will be indifferent, while the theory on overconfidence predicts that infrequent investors (Group 1) will outperform frequent investors (Group 4).

3.2 Methodology

3.2.1 Measuring return performance

The focus of our analysis is the return performance of investors in the 77 IPO

auctions. We measure the gross and net profits and investment capital of a bidder in an IPO auction using the quantity of shares in the successful bid, the bidding price, the subsequent market price of the IPO, and the submission fees and transaction costs. We accordingly calculate both the gross and net returns of bidders in the 77 IPO auctions.

Based upon the auction rules, bidders can place multiple orders. All of bidders must commit 30 percent of the capital when submitting their orders; and must then settle the remaining 70 percent of the capital in those cases where their bid is successful; in those cases where their bids fail, they will be provided with a full refund. Accordingly, we assume that the investment capital of bidder i in auction j($D_{i,j}$) is:

$$D_{i,j} = \sum_{k=1}^{bs} Q_{i,j,k} \cdot P^{b}_{i,j,k} + .3 \cdot \sum_{k=bs+1}^{b} Q_{i,j,k} \cdot P^{b}_{i,j,k} , \quad (1)$$

where $Q_{i,j,k}$ is the shares of order k placed by bidder i in auction j, and $P^{b}_{i,j,k}$ is the bidding price of order k. Bidder i places a total of b orders in this auction, and has bs ($bs \le b$) successful orders and $b - bs$ unsuccessful orders. Thus, if bidder i places an order of $Q_{i,j}$ shares at price $P^{b}_{i,j}$ in auction j, and if $P^{b}_{i,j}$ is higher than the clearing price, then the investment, $D_{i,j}$, will be $P^{b}_{i,j} \cdot Q_{i,j}$. Conversely, if $P^{b}_{i,j}$ is lower than the clearing price, indicating a failed bid, the investment will be $.3 \cdot P^{b}_{i,j} \cdot Q_{i,j}$. Finally, if bidder i does not bid for shares in auction j, then both $Q_{i,j}$ and $D_{i,j}$ will be zero.

We calculate the gross profit ($I^{g}_{i,j}$) and net profit ($I^{n}_{i,j}$) for bidder i in auction j as:

$$I^{g}_{i,j} = \sum_{k=1}^{b} Q_{i,j,k} \cdot (P^{1}_{j} - P^{b}_{i,j,k}) , \quad (2)$$

and

$$I^{n}_{i,j} = \sum_{k=1}^{b} \left\{ Q_{i,j,k} \cdot \left[(1-c) \cdot P^{1}_{j} - P^{b}_{i,j,k} \right] - F \right\}, \quad (3)$$

where P^{1}_{j} denotes the subsequent market price of auction j, c is the transaction costs, and

F represents the submission fees for each auction bid.[9] Both the gross profit ($I^g_{i,j}$) and net profit ($I^n_{i,j}$) will be zero if bidder i does not bid for shares in auction j. In those cases where bidder i bids for $Q_{i,j}$ shares, all of which fail, then $I^g_{i,j}$ will be zero and $I^n_{i,j}$ will be negative as a result of the submission fees, F. The overall profit or loss is dependent on the bidding price, the subsequent stock price in the market, the transaction costs and the submission fees. The gross and net returns for bidder i in auction j are:

$$R^g_{i,j} = \frac{I^g_{i,j}}{D_{i,j}} \quad \text{and} \quad R^n_{i,j} = \frac{I^n_{i,j}}{D_{i,j}} . \tag{4}$$

Since the time length between the auction and the first day in the market is too long to be ignored, adjustment for the market return in the corresponding period is necessary. We calculate the adjusted net return as:

$$AR^n_{i,j} = R^n_{i,j} - Rm_j , \tag{5}$$

where Rm_j is the market return, which is measured by the value-weighted return of stocks in both the Taiwan Stock Exchange and over-the-counter market, in the period from the end of the auction to the first day in the market during which the stock does not hit its price limit.[10]

Given that the profits and investments vary across auctions and bidders, the gross and net returns also vary across bidders. The gross and net returns for each bidder are:

$$R^g_i = \sum_{j=1}^{77} w_{i,j} \cdot R^g_{i,j} \quad \text{and} \quad R^n_i = \sum_{j=1}^{77} w_{i,j} \cdot R^n_{i,j} \tag{6}$$

where $w_{i,j}$ is the dollar investment in auction j by bidder i, divided by the total dollar investment by bidder i. For all bidders, summing $w_{i,j}$ across all auctions (77 IPO

[9] The transaction costs during our sample period included a 0.1425 percent commission and a 0.3 percent transaction tax levied on the seller. Investors paid NT$500 submission fees for each auction bid.

[10] For the purpose of brevity, in the remainder of the text, we refer to the 'adjusted net return' as the net return after adjusting for the corresponding market return.

auctions) is equal to 1.

We estimate the aggregate gross and net returns of all bidders as:

$$VR_k^g = \sum_{i=1}^{n_k} x_i \cdot R_i^g \quad \text{and} \quad VR_k^n = \sum_{i=1}^{n_k} x_i \cdot R_i^n \ , \tag{7}$$

where n_k is the number of bidders in group k, and x_i is the dollar investment by bidder i , divided by the total dollar investment of all bidders in group k. We estimate the gross and net returns earned by average bidders as:

$$ER_k^g = \frac{1}{n_k} \sum_{i=1}^{n_k} R_i^g \quad \text{and} \quad ER_k^n = \frac{1}{n_k} \sum_{i=1}^{n_k} R_i^n \ . \tag{8}$$

3.2.2 Decomposing return performance

Our main area of interest in this section is in gaining an understanding as to why there are differences in return performance across different investors in IPO auctions. We hypothesize that the differences in the returns are attributable to both bidding behavior and the ability to select appropriate stocks. In order to test this, we decompose the gross and net returns of each bidder into two parts, their bidding performance and their stock selection performance.

We first decompose the gross and net profits as:

$$I_{i,j}^g = \sum_{k=1}^{b} Q_{i,j,k} \cdot (P_j^w - P_{i,j,k}^b) + \sum_{k=1}^{b} Q_{i,j,k} \cdot (P_j^1 - P_j^w)$$

and $$I_{i,j}^n = \sum_{k=1}^{b} Q_{i,j,k} \cdot (P_j^w - P_{i,j,k}^b) + \sum_{k=1}^{b} \left\{ Q_{i,j,k} \cdot \left[(1-c) \cdot P_j^1 - P_j^w \right] - F \right\} \tag{9}$$

where P_j^w is the value-weighted average price of successful bids in auction j. In the right-hand side, the first part is the measurement of bidding performance, while the second part refers to stock selection performance.

Bidders have positive bidding performance in those cases where the successful bidding price, $P_{i,j}^b$, is lower than the aggregate bidding price in the auction. It is likely

that such bidders have information on the pricing of the IPO firm or market conditions, and that they are patient investors, with regard to placing orders. Conversely, bidders have negative bidding performance if the bidding price is higher than the aggregate bidding price. Such bidders are likely to be impatient uninformed investors, or those who demonstrates overconfidence with regard to placing orders. Ideally, the aggregate bidding performance of all bidders is zero.

Similarly, bidders have better stock selection performance if they enjoy subsequent higher capital gains on the IPO in the market. Such bidders are likely to be informed in the selection of IPO firms. Bidders with lower subsequent capital gains on the IPO in the market demonstrate inferior stock selection performance. Such bidders may be uninformed investors, or overconfident in the selection of IPO auctions.

4. The Performance of bidders in IPO auctions

In this section, we present the return performance of bidders in IPO auctions. Panel A of Table 3 present the total investment capital of bidders for different types of investors and in different groups. The average total investment capital is NT$9.4 million, with the figure ranging from NT$6.3 million for bidders in Group 1, to NT$32.8 million for those in Group 4. This pattern is quite normal, since frequent bidders require more capital to bid in more auctions.

<Table 3 is inserted about here>

Panel B presents the average investment capital per auction for different types of bidders and in different groups. Bidders submit an average of NT$3.71 million in each auction; institutional investors submit NT$16.16 million, which is significantly higher than the average of NT$2.89 million submitted by individual investors, thereby indicating that in terms of investment capital, institutional investors are big players. The difference between the investment capital of male and female investors was

insignificant.

Interestingly, in each auction, infrequent bidders have larger investment capital than frequent bidders; the mean investment capital is NT$4.3 million for Group 1, and NT$1.7 million for Group 4, a significant difference of NT$2.6 million. The difference between Groups 1 and 4 is also significant for all types of investors.

Details of the return performance of all bidders in IPO auctions are presented in Table 4, with Panel A reporting the gross return performance, Panel B reporting the net return performance, and Panel C reporting the adjusted net return performance. The average bidders earn gross returns of 7.52 percent, net returns of 7.01 percent, and adjusted net returns of 8.32 percent. The aggregate bidders earn gross returns of 8.38 percent, net returns of 7.98 percent, and adjusted net returns of 11.16 percent.

<Table 4 is inserted about here>

We find that for all three of the return performance measures, the returns for institutional investors are significantly higher than those for individual investors; for example, the average institutional investor has a gross return of 9.84 percent, whereas the average individual investor has a gross return of 7.37 percent, a difference of 2.47 percent (*t*-statistic = 2.20). This result suggests that institutional investors are better informed, or more sophisticated, than individual investors, a finding which is consistent with a recent study reporting considerable losses in the aggregate portfolios of individual investors in the Taiwan stock market (Barber et al., 2008).

The 'overconfidence' hypothesis suggests that the performance of frequent bidders will be inferior to that of infrequent bidders. We find that the average bidders in Group 1 have gross returns of 8.29 percent from their IPO auctions, whereas bidders in Group 4 have gross returns of only 4.43 percent, a difference which is both statistically and economically significant. Similarly, the aggregate bidders in Group 1 have gross returns of 10.46 percent, whilst those in Group 4 have gross returns of 4.93

percent, a difference of 5.53 percent.

We also find that frequent bidders under-perform infrequent bidders for all types of investors (including both of institutional investors and individual investors, and male and female investors). For example, the gross returns for the average institutional (individual) investors in Group 1 are 11.13 (8.11) percent, while those for institutional (individual) investors in Group 4 are 4.76 (4.42) percent. The gross returns in Group 1 for the average male (female) investor are 8.08 (8.16) percent, whilst the gross returns in Group 4 are 4.42 percent for both male and female investors.

The results reported in Table 4 indicate that frequent bidders have inferior performance, and we believe that such poor performance is attributable to overconfidence which subsequently led to bidders actively participating in IPO auctions and actively engaging in bidding. We are, however, unable to rule out other explanations. Firstly, as reported in Table 2, the success rate for Group 1 is much higher than those for Groups 2, 3 and 4. Failed bids mean a zero gross return, and a slightly negative net return, which dampens the overall performance of both average and aggregate returns. It is therefore necessary to check whether the higher success rate for Group 1 resulted in better performance for this group.

Secondly, the descriptive statistics in Table 3 report that the investment capital per auction for Group 1 is significantly higher than that for Group 4, suggesting that investors in Group 1 are large investors.[11] Thirdly, a rational reason for poor performance amongst frequent bidders is the perverse incentives of brokerage firms, who generally make money if they encourage investors to participate actively and bid more in IPO auctions.

In order to investigate whether such poor performance is related to

[11] Lee et al. (1999) present evidence to show that large investors have a clear information advantage over small investors.

overconfidence or other reasons, we carried out a number of additional checks for robustness; these include: (i) a repeat of the analysis following deletion of the unsuccessful bids in each group; (ii) the application of a multivariate analysis to control for other factors, including the size of the investment capital for each bidder; and (iii) analysis of the structure of brokerage firms employed by frequent and infrequent bidders; if the inferior performance of frequent bidders is related to the perverse incentives of brokerage firms, this would suggest that frequent bidders tend to concentrate themselves in certain brokerage firms, whilst infrequent bidders dealt with other brokerage firms.

4.1 The Performance of Successful Bids

We begin by repeating the analysis in Table 3, deleting all of the unsuccessful bids from the four groups; the results are reported in Table 5.[12] When counting only the successful bids, infrequent bidders still outperform frequent bidders. The adjusted net returns for the average bidders in Group 1 are 11.83 percent and 9.73 percent for Group 4, a difference of 2.10 percent with a *t*-statistic of 2.99.

The differences in the adjusted net returns between Groups 1 and 4 are also significant for all types of investors (with the exception of female investors); for example, the adjusted net returns for the average institutional (individual) investors in Group 1 are 18.06 (11.45) percent, and 12.15 (9.63) percent in Group 4, with the differences in the return performance between the two groups all being significant. Although the extent of the differences of the returns between frequent and infrequent bidders is mitigated by the adoption of successful bids only, such differences are still economically and statistically significant.

<Table 5 is inserted about here>

[12] In the interests of parsimony, only the adjusted net returns for successful bids are reported in Table 5; the results of the gross and net returns are, however, qualitatively similar.

4.2 Regression Analysis of Returns

In order to estimate the relationship between bidding frequency and performance, we regress the return performance of the bidders on several independent variables. The variables are as follows: three bidder dummies (*G*_1, *G*_2 and *G*_3 for the respective bidders in Group 1, 2 and 3); the amount of investment capital per auction (*Ln_cap*, the logarithm of capital); investor type (*Type*, a dummy variable which is set as 1 for institutional investors; otherwise zero); gender (*Gender*, a dummy which is set as 1 if the individual is male; otherwise zero), and multiple bids (*Multi_bid*, a dummy which is set as 1 if the bidder had submitted at least one multiple bid in auction; otherwise zero).

The overconfidence theory predicts that frequent bidders will have inferior performance; thus, if the bidders in Groups 1-3 do perform better than bidders in Group 4, the signs of the coefficients on *G*_1, *G*_2 and *G*_3 are expected to be positive. For the controlling variables, the literature suggests that large investors, institutional investors and investors with multiple bids will be more informed or sophisticated than their counterparts; moreover, female investors are less prone to overconfidence than male investors. Therefore, the signs on *Ln_cap*, *Type*, *Gender* and *Multi_bid* are expected to be positive. The regression results are reported in Table 6.

<Table 6 is inserted about here>

The first regression in Table 6 examines the adjusted net returns of all bidders, whilst the second and third regressions investigate the respective returns for individual and institutional investors. The regression reported in Table 6 suggests that, irrespective of whether the analysis is of all bidders, institutional investor or individual investors, infrequent bidders have better performance than frequent bidders.

The signs on *G*_1 are significantly positive for all bidders (2.377; *t*-statistic = 5.28) and individual investors (2.437; *t*-statistic = 5.26), and insignificantly positive for

institutional investors. This suggests that the returns for infrequent bidders are 2.377 percent higher than the returns for frequent bidders. The signs on *G*_2 and *G*_3 are positive, but insignificant, and smaller than the signs on *G*_1.

In the first regression, the sign on *Type* is 2.815 (*t*-statistic = 2.65), indicating that institutional investors have higher returns than individual investors. This provides support for the general finding within the literature that institutional investors are better informed than individual investors. However, in the second regression, the sign on *Gender* is –0.424, which is insignificantly different from zero, suggesting that female investors do not perform better than male investors; this is contrary to the findings of the prior studies. The sign on *Multi_bid* is significantly negative in all three of the regressions, indicating that investors who submit multiple bids at auction have inferior returns to those investors who submit only one bid; this also contradicts the literature which argues that investors placing multiple bids are more informed.

The specification results reported in Table 6 are consistent with the earlier results, that bidders in Group 1 have better return performance than those in Group 4. More importantly, infrequent bidders still outperform frequent bidders, even after controlling for other factors.

4.3 Brokerage Firm Structure

It may be argued that frequent bidders are encouraged by their brokerage firms to participate actively in IPO auctions, since the brokerage firms will make money if their clients do so. Frequent bidding behavior is related to the rational model rather than to overconfidence; therefore, we examine whether such perverse incentives can explain the differences in the number of auctions in which frequent and infrequent bidders take part by examining the structure of the brokerage firms they employed based upon a total of 51 brokerage firms employed by investors in the 77 IPO auctions.

Firstly, we examine the brokerage firms employed by the 357 frequent bidders and find that there is no steady business relationship between these bidders and the firms: only 11 of the frequent bidders submitted their bids through three brokerage firms (or less), whilst most frequent bidders employed eight to ten firms.[13] Secondly, we analyze the structure of the brokerage firms employed by frequent and infrequent bidders, and find that the brokerage firms most commonly employed by frequent bidders are also the ones regularly used by infrequent bidders. The most commonly used brokerage firm accounts for 33 percent of frequent bidders and 27 percent of infrequent bidders. Furthermore, the correlation between the percentages for frequent and infrequent bidders is 0.98, suggesting that there are no differences in the structure of brokerage firms used by either frequent or infrequent bidders.

These results provide no indication that frequent bidders may be concentrating their business in specific brokerage firms or that the structure of brokerage firms employed by frequent and infrequent bidders are different, thereby demolishing the perverse incentives hypothesis.

4.4 Discussion

Our results show that frequent bidders have inferior return performance in IPO auctions, with the returns for Group 1 (infrequent bidders) outperforming those for Group 4 (frequent bidders). Furthermore, the superior performance of infrequent bidders persists for institutional and individual investors, of either gender, even after controlling for other factors. Having also examined the perverse incentives hypothesis, we can find no evidence providing support for this alternative rational explanation. Our results are thus consistent with the overconfidence hypothesis; frequent bidders

[13] Of the 357 frequent bidders, two maintain their auction business with two brokerage firms, nine are with three brokerage firms, 72 are with four to five firms, 101 are with six to seven firms, 128 are with eight to ten firms, 42 are with 11 to 14 firms, and three carry out their auction business with 15 or more brokerage firms. The statistics show that the frequent bidders do not concentrate their bids in specific brokerage firms.

are overconfident and believe that they have superior information when they actually do not. They bid more in IPO auctions, and as a result, have inferior return performance.

In the following sections, we begin by decomposing the adjusted abnormal returns to examine the reasons for the inferior performance of frequent bidders, and then go on to analyze the dynamic changes in return performance of frequent bidders to explore why they become so overconfident.

5. Decomposition of Investment Performance

Our main aim in this section is to gain an understanding of why the returns earned by frequent bidders in IPO auctions are lower than those of infrequent bidders. We hypothesize that the difference in the returns is attributable to bidding behavior and stock selection ability. Since IPO auctions are discriminatory, the winners must pay the price that they bid; if a bidder bids too aggressively, he will pay too dearly for his trophies, and this will lower his investment returns from the IPO auctions. We refer to this tendency towards overpayment as the bidder's 'bidding behavior', from which we calculate his bidding performance.

Stock selection ability also influences the return performance of bidders. Some bidders carefully select IPOs and make a healthy profit on the auctions, whereas others do not. We refer to this profitability as the bidder's 'stock selection ability, from which we calculate his stock selection performance. The calculation of the investment return decomposition is in accordance with Equation (9); the results of the decomposition are reported in Table 7.

<Table 7 is inserted about here>

Details on the bidding performance of investors are presented in Panel A, from which we find that bidders in Group 1 have the best bidding performance; for example,

the returns for aggregate bidders are: Group 1 (0.06 percent); Group 2 (0.0 percent); and Group 3 (0.22 percent), whilst bidders in Group 4 have the lowest return (–0.22 percent). The difference of 0.28 percent between Group 1 and 4 is significantly different from zero. Infrequent bidders are found to have better bidding performance than frequent bidders, with the evidence suggesting that overconfident investors tend to bid too aggressively in the IPO auctions.

Frequent investors in IPO auctions are found to have paid, on average, 0.28 percent more than infrequent investors, such that infrequent bidders enjoyed superior bidding performance to frequent bidders, with such superior performance coming mainly from individual investors (0.45 percent). Nevertheless, within institutions, infrequent bidders are not found to have any better bidding performance than frequent bidders. We should note that although the difference is statistically significant for individual investors, the variation in bidding performance across the four groups is quite small.

The stock selection performance results are presented in Panel B of Table 7, from which we again find that infrequent bidders have better stock selection performance than frequent bidders. The returns for aggregate bidders are: Group 1 (16.37 percent), Group 2 (16.26 percent) and Group 3 (13.53 percent), whilst there is a decline in the returns for Group 4, to 11.63 percent. The superior performance of infrequent bidders is again revealed for all types of investors (including institutional investors and individual investors of either gender).

Interestingly, while the aggregate return for institutional investors is 19.72 percent, this is only 13.51 percent for individual investors; a difference of 6.21 percent with a *t*-statistic of 11.05. Our finding of institutional investors having better stock selection performance seems to reflect the fact that institutional investors are better informed than individual investors, which is consistent with the finding of Michaely and Shaw

(1994). Female investors also revealed better stock selection performance than male investors, with a difference of 2.95 percent, which is significantly different from zero at the traditional level.

In their empirical findings, Barber and Odean (2000) argued that portfolio selection did not explain the inferior investment performance of those households which traded frequently; however, the investment decision in our analysis differs from that of Barber and Odean (2000). In their framework, portfolio selection is simultaneously determined by investors; that is, investors could hold many stocks at the same time. In our analysis, the bidding decision is sequential; with the announcement of the auction, bidders evaluate the IPO and decide whether or not to bid.

Our empirical findings suggest that frequent bidders may overestimate the future prospects of IPO firms, or underestimate the risk of investment in such firms, or both, leading to an improper increase in the feasible sets of positive NPV. Our results indicate that stock selection performance can explain the differences in the return performance of frequent bidders and infrequent bidders, which is inconsistent with the finding of Barber and Odean (2000).

6. Dynamic Changes in Investment Performance for Frequent Bidders

In this section, we investigate why frequent bidders become overconfident. The self-attribution bias model of Gervais and Odean (2001) posits that investors tend to take too much credit for their own success, causing them to become overconfident; the model also predicts that overconfident bidders will have had successes in their first few bids, which leads to the gradual development of their overconfidence. Experienced bidders who have become overconfident will exhibit greater optimism for the prospects of IPO firms, which will lead to such overconfident investors being more likely to bid again, thereby exhibiting their greater optimism by aggressively

bidding on IPO firms. Their future bids, which are driven by overconfidence, will result in inferior performance.

Focusing on the 357 frequent bidders, we examine the dynamic changes in their investment performance from first-order bids to high-order bids. Since frequent bidders are defined in this study as those bidding in 13 (or more) auctions, we group the auctions of each frequent bidder into four orders: (i) first to fourth order auctions; (ii) fifth to eighth order auctions; (iii) ninth to twelfth order auctions; and (iv) thirteenth or higher order auctions. Details of the dynamic changes in return performance are presented in Table 8.

<Table 8 is inserted about here>

For frequent bidders, the average returns on the first to fourth order auctions are high, with gross returns of 12.99 percent, net returns of 12.51 percent and adjusted net returns of 11.68 percent. Referring back to the return performance of bidders from the four groups (Table 4), bidders in Group 1, who are defined as investors bidding in 1-4 auctions, have gross returns of 8.29 percent, net returns of 7.76 percent and adjusted net returns of 9.23 percent.

A comparison of return performance in the first four auctions of frequent bidders vis-à-vis infrequent bidders, seems to indicate that frequent bidders are quite successful; however, such success is reversed in subsequent auctions. In the fifth to eighth order auctions, the gross return decreases to 5.50 percent; in the ninth to twelfth order auctions, the gross return declines further to 2.31 percent; and in the thirteenth or higher order auctions, gross return is very poor, at –0.35 percent. The net and adjusted net returns also reveal similar patterns.

Our evidence is consistent with the self-attribution bias hypothesis proposed by Gervais and Odean (2001). We find that frequent bidders are successful in their first few bids, but that they gradually develop some level of overconfidence. Overconfident

bidders exhibit greater optimism for the prospects of IPO firms, causing them to bid in more IPO auctions and to bid more aggressively on IPO firms. Their future bids, which are driven by overconfidence, result in inferior performance.

7. Conclusions

We have analyzed the investment returns of 6,993 investors in 77 discriminatory auctions which took place in the Taiwan stock market between January 1996 and April 2000. The average infrequent bidders earn a gross return (adjusted net return) of 8.29 percent (9.23 percent), whilst the returns for the average frequent bidder are only 4.43 percent (4.95 percent). The differences in the returns between infrequent bidders and frequent bidders are statistically and economically significant, with the inferior performance of frequent bidders being pervasive, not only for individual investors, but also for institutional investors.

We have also explored the reasons for the underperformance of frequent bidders using the multivariate model, and examined the structure of brokerage firms used by frequent and infrequent bidders; however, the robustness checks do not provide any evidence in support of the alternative rational models. Our results are consistent with the theory on the prediction of overconfidence (Odean, 1998) that frequent bidders will under-perform infrequent bidders. Overconfident bidders actively participating in the IPO auctions overestimate the value of their private information, causing them to bid too aggressively, and consequently, to earn below-average returns.

We further decompose the investment returns of investors into bidding performance and stock selection performance, with our evidence showing that for frequent bidders, performance is inferior to that of infrequent bidders in both aspects. This implies that overconfidence causes frequent bidders to bid too aggressively, with such overly aggressive bidding leading to paying more to secure the auctioned IPO

shares, and thereby lowering their investment performance. Frequent bidders also have inferior stock selection performance, implying that they overestimate the future cash flow of the IPO firms, or underestimate the risk of investment in these firms, or both. Their over-optimism improperly increases the feasible sets of positive NPV, leading to erroneous bids at some auctions. This finding is consistent with the Miller (1977) model, that the most optimistic investors are always the losers.

We have also found that institutional investors have better stock selection performance than individual investors, indicating that the former are better informed than the latter. This finding is similar to that of Barber et al. (2008), who report that individual investors in the Taiwan stock market suffer a 3.8 percent loss, whilst institutional investors earn a 1.5 percent net return, and is consistent with the findings of Michaely and Shaw (1994) that institutional investors target more resources towards the gathering of corporate information which individual investors cannot easily access. Our results also confirm the assumption of institutional investors being better informed under the practice of new shares allocation in IPO bookbuilding selling mechanism (Aggarwal et al., 2002; Cornelli and Goldreich, 2003).

Finally, we have focused on 357 frequent bidders to analyze the dynamic changes in their investment performance from first-order bids to high-order bids. In their first few bids, frequent bidders are found to earn higher returns than infrequent bidders; however, such successes lead to a rise in confidence levels amongst these bidders, causing them to bid in more IPO auctions and to bid more aggressively, thereby leading to underperformance in their subsequent IPO auctions. Our results are consistent with the predictions of the self-attribution bias model proposed by Gervais and Odean (2001). Taken as a whole, our empirical study provides evidence to show that overconfidence, augmented by self-attribution bias, plays an important role in explaining the differences in investment performance between infrequent bidders and

frequent bidders in the primary market.

References

Aggarwal, Reena, Nagpurnanand R. Prabhala, and Manju Puri, 2002. Institutional allocation in initial public offerings: Empirical evidence. Journal of Finance 57, 1421-1442.

Baker, Malcolm, Richard Ruback, and Jeffrey Wurgler, 2006. Behavioral corporate finance: A survey. In: Espen Eckbo (ed.), The Handbook of Corporate Finance: Empirical Corporate Finance. Elsevier/North Holland, New York, NY.

Barber, Brad M., Yi-Tsung Lee, Yu-Jane Liu, and Terrance Odean, 2008. Just how much do individual investors lose by trading? Review of Financial Studies (forthcoming).

Barber, Brad M., and Terrance Odean, 2000. Trading is hazardous to your wealth: The common stock investment performance of individual investors. Journal of Finance 55, 773-806.

Barber, Brad M., and Terrance Odean, 2001. Boys will be boys: Gender, overconfidence, and common stock investment. The Quarterly Journal of Economics 116, 261-292.

Barber, Brad M., and Terrance Odean, 2002. Online investors: Do the slow die first? Review of Financial Studies 15, 455-487.

Bloomfield, Robert J., Robert Libby, and Mark W. Nelson, 1999. Confidence and the welfare of less-informed investors. Accounting, Organizations, and Society 24, 623-647.

Cornelli, Francesca, and David Goldreich, 2003. Bookbuilding: How Informative is the Order Book? Journal of Finance 58, 1415-44.

Daniel, Kent, David Hirshleifer, and Avanidhar Subrahmanyam, 1998. Investor psychology and security market under- and over-reactions. Journal of Finance 53, 1839-1886.

Doukas, John A., and Dimitris Petmezas, 2007. Acquisitions, overconfident managers and self-attribution bias. European Financial Management 13, 531-577.

Gervais, Simon, and Terrance Odean, 2001. Learning to be overconfident. Review of Financial Studies 14, 1-27.

Grossman, Sanford J., and Joseph E. Stiglitz, 1980. On the impossibility of informationally efficient markets. American Economic Review 70, 393-408.

Hilary, Gilles, and Lior Menzly. 2006. Does past success lead analysts to become overconfident? Management Science 52, 489-500.

Hirshleifer, David, 2001. Investor psychology and asset pricing. Journal of Finance 56, 1533-1597.

Kahneman, Daniel, and Amos Tversky, 2000. Choices, values, and frames. Cambridge University Press, Cambridge, U.K.

Lee, Philip J., Stephen L. Taylor, and Terry S. Walter, 1999. IPO underpricing explanations: Implications from investor application and allocation schedules. Journal of Financial and Quantitative Analysis 34, 425-444.

Lichtenstein Sarah, Baruch Fischhoff, and Lawrence D. Phillips, 1982. Calibration of probabilities: the state of the art to 1980, in: Daniel Kahneman, Paul Slovic, and Amos Tversky, (eds.), Judgment under uncertainty: heuristics and biases. Cambridge University Press /Cambridge, U.K. pp. 306-334.

Lin, Ji-Chai, Yi-Tsung, and Yu-Jane Liu, 2007. IPO auctions and private information. Journal of Banking and Finance 31, 1483-1500.

Malmendier, Ulrike, and Geoffrey Tate, 2008. Who makes acquisitions? CEO overconfidence and the market's reaction. Journal of Financial Economics (forthcoming).

Michaely, Roni, and Wayne H. Shaw, 1994. The pricing of initial public offerings: Tests of the adverse selection and signaling theories. Review of Financial Studies 7, 279-319.

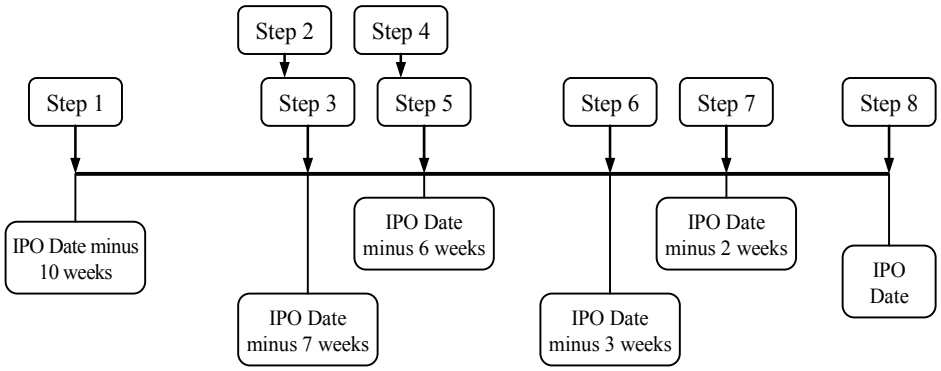
Miller, Edward M., 1977. Risk, uncertainty, and divergence of opinion. Journal of Finance 32, 1151-1168.

Odean, Terrance, 1998. Volume, volatility, price, and profit when all traders are above average. Journal of Finance 53, 1887-1934.

Odean, Terrance, 1999. Do investors trade too much? American Economics Review 89, 1279-1298.

Sherman, Ann, 2005. Global Trends in IPO Methods: Bookbuilding vs. Auctions with Endogenous Entry. Journal of Financial Economics 78, 615-649.

Figure 1 Timing of the sequential hybrid auction selling procedure



Key:

Step 1: Issuers select the selling method
Step 2: Selection of the minimum price and initial price range
Step 3: Investors submit price/quantity bids
Step 4: Discriminatory allocation to investors
Step 5: The fixed-price offer price is set within the initial price range
Step 6: Investors submit subscriptions to the fixed-price offer
Step 7: Fixed-price offer allocation by lottery
Step 8: Shares traded on the exchange

Table 1 Descriptive statistics of IPO auctions

The sample comprises of 77 IPO auctions which took place between January 1996 and April 2000, with Panel A providing the descriptive statistics of the application data (all bids), and Panel B reporting the allocation data (successful bids).

	Mean	Std. Dev.	Median	Max.	Min.
Panel A: Application data (All bids)					
No. of investors	704.48	764.52	464	3699	36
Institutions	31.74	33.52	24	198	0
Individuals	672.74	742.77	432	3582	36
Male	410.88	453.11	265	2155	20
Female	261.86	291.38	160	1436	16
No. of bids	987.09	1120.08	645	5406	39
Institutions	57.32	64.98	42	342	0
Individuals	929.77	1072.91	599	5180	39
Male	579.70	669.28	397	3199	22
Female	350.06	405.96	218	1985	17
No. of lots submitted	29,613	35,351	18,389	207,594	944
Institutions	7,575	10,823	4,184	62,954	0
Individuals	22,039	25,771	14,632	144,640	797
Male	13,810	16,580	8,908	90,584	575
Female	8,229	9,309	5,466	54,056	222
Panel B: Allocation data (Successful bids)					
No. of investors	155.36	125.52	116	621	17
Institutions	9.27	10.73	6	69	0
Individuals	146.09	120.06	111	616	16
Male	90.08	75.10	70	374	8
Female	56.01	46.05	40	242	6
No. of bids	200.62	172.16	141	826	17
Institutions	14.23	16.72	8	92	0
Individuals	186.39	162.80	130	820	16
Male	116.94	103.72	85	507	8
Female	69.45	60.34	49	313	6
No. of lots submitted	7,975.65	7,031.02	5,840	38,788	944
Institutions	1,890.90	2,867.05	710	15,577	0
Individuals	6,084.75	5,229.20	4,876	27,283	797
Male	3,753.09	3,269.92	3,008	16,267	575
Female	2,331.66	2,154.99	1,788	11,339	173

Table 2 Summary statistics of bidder groups, by auction frequency

The sample comprises of 6,693 bidders in 77 IPO auctions which took place between January 1996 and April 2000, which was then divided into four groups; Group 1: bidders participating in one to four auctions; Group 2: bidders participating in five to eight auctions; Group 3 bidders participating in nine to twelve auctions; and Group 4 bidders participating in thirteen or more auction.

Variables	No. of Auctions				Total
	1-4 (Group 1)	5-8 (Group 2)	9-12 (Group 3)	≥13 (Group 4)	
Institutional bidders (a)	296	99	21	14	430
Individual bidders (b)	4,869	967	384	343	6,563
Male	2,611	629	254	253	3,747
Female	2,258	338	130	90	2,816
Total No. of bidders (a + b)	5,165	1,066	405	357	6,993
Mean No. of auctions	1.79	6.15	10.2	19.69	3.86
Mean No. of successful bids	1.37	2.71	4.87	9.91	2.21
Successful bid rate (%)	76.5	44.1	47.7	50.3	57.3

Table 3 Summary statistics of the investment capital of bidder groups

The sample comprises of 6,693 bidders in 77 IPO auctions which took place between January 1996 and April 2000; this was then divided into four groups; Group 1: bidders participating in one to four auctions; Group 2: bidders participating in five to eight auctions; Group 3 bidders participating in nine to twelve auctions; and Group 4 bidders participating in thirteen or more auction.

Variables	No. of Auctions 1-4 (Group 1)		5-8 (Group 2)		9-12 (Group 3)		≥13 (Group 4)		Total		Difference between Groups 1 and 4	
	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.
Mean Capital (NT$ million) [a]	6.27		13.91		16.88		32.80		9.40		−26.53	−8.80
Institutions	29.61		60.32		105.01		147.50		44.20		−117.89	−6.29
Individuals	4.85		9.16		12.06		28.12		7.12		−23.27	−8.41
Male	4.89		8.89		13.34		29.25		7.78		−24.36	−7.11
Female	4.81		9.66		9.57		24.93		6.25		−20.13	−4.65
Differences: Institutions – Individuals	24.76	14.51	51.16	11.34	92.95	5.11	119.38	6.33	37.08	16.14		
Differences: Male – Female	0.08	0.24	−0.76	−0.61	3.77	1.53	4.32	0.78	1.52	3.38		
Mean capital per auction (NT$ million) [b]	4.32		2.23		1.66		1.71		3.71		2.60	11.96
Institutions	19.15		9.51		10.38		8.63		16.16		10.52	6.34
Individuals	3.41		1.48		1.18		1.43		2.89		1.98	10.52
Male	3.34		1.41		1.31		1.47		2.75		1.87	7.78
Female	3.50		1.61		0.93		1.32		3.08		2.18	7.68
Differences: Institutions – Individuals	15.74	11.87	8.03	12.01	9.20	5.17	7.20	7.07	13.27	13.90		
Differences: Male – Female	−0.16	−0.58	−0.19	−0.92	0.38	1.63	0.15	0.57	−0.33	−1.58		

[a] Mean capital is the total dollar amount of investment by a bidder on IPO auctions.

[b] Mean capital per auction is the averaged dollar amount of capital for each auction, calculated by the dollar amount of investment divided by the number of auctions submitted by a bidder.

Table 4 Return performance of IPO auction bidders

The sample comprises of 6,693 bidders in 77 IPO auctions which took place between January 1996 and April 2000; this was then divided into four groups; Group 1: bidders participating in one to four auctions; Group 2: bidders participating in five to eight auctions; Group 3 bidders participating in nine to twelve auctions; and Group 4 bidders participating in thirteen or more auction.

Variables	No. of Auctions 1-4 (Group 1)		5-8 (Group 2)		9-12 (Group 3)		≥13 (Group 4)		Total		Difference between Groups 1 and 4	
	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.
Panel A: Gross Return Performance [a]												
Return for average bidders (%)	8.29		5.73		5.21		4.43		7.52		3.86	8.94
Institutions	11.13		6.87		9.11		4.76		9.84		6.37	2.92
Individuals	8.11		5.61		4.99		4.42		7.37		3.70	8.41
Male	8.08		5.28		4.85		4.42		7.14		3.66	6.51
Female	8.16		6.24		5.28		4.42		7.68		3.74	5.47
Differences: Institutions – Individuals	3.02	1.96	1.26	0.87	4.12	1.67	0.34	0.21	2.47	2.20		
Differences: Male – Female	−0.08	−0.13	−0.95	−1.37	−0.43	−0.52	0.00	−0.01	−0.53	−1.08		
Return for aggregate bidders (%)	10.46		6.86		7.71		4.93		8.38		5.53	8.89
Institutions	13.02		8.48		10.13		4.51		10.33		8.51	2.39
Individuals	9.51		5.77		6.56		5.02		7.58		4.49	7.81
Male	9.20		5.09		6.08		4.70		6.91		4.51	6.76
Female	9.88		6.94		7.86		6.08		8.71		3.80	3.28
Differences: Institutions – Individuals	3.50	4.75	2.71	3.16	3.57	3.14	−0.51	−0.66	2.75	5.66		
Differences: Male – Female	−0.68	−1.07	−1.86	−2.27	−1.78	−1.74	−1.38	−1.90	−1.80	−4.14		

Notes:

[a] Gross return performance is the gross profit earned by the bidder in IPO auctions divided by the dollar amount of investment in IPO auctions.

Table 4 (Contd.)

Variables	No. of Auctions 1-4 (Group 1)		5-8 (Group 2)		9-12 (Group 3)		≥13 (Group 4)		Total		Difference between Groups 1 and 4	
	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.
Panel B: Net Return Performance [b]												
Return for average bidders (%)	7.76		5.28		4.76		3.99		7.01		3.76	8.75
Institutions	10.72		6.58		8.78		4.50		9.47		6.22	2.87
Individuals	7.58		5.15		4.54		3.97		6.85		3.60	8.22
Male	7.54		4.81		4.41		3.97		6.63		3.58	6.39
Female	7.61		5.79		4.81		3.99		7.15		3.62	5.32
Differences: Institutions – Individuals	3.14	2.05	1.43	1.00	4.24	1.72	0.52	0.33	2.62	2.34		
Differences: Male – Female	−0.07	−0.11	−0.98	−1.41	−0.40	−0.48	−0.03	−0.04	−0.52	−1.05		
Return for aggregate bidders (%)	10.02		6.52		7.34		4.58		7.98		5.44	8.78
Institutions	12.60		8.18		9.80		4.24		9.98		8.36	2.36
Individuals	9.07		5.40		6.18		4.65		7.18		4.41	7.71
Male	8.76		4.72		5.71		4.33		6.51		4.43	6.67
Female	9.43		6.56		7.45		5.72		8.28		3.71	3.22
Differences: Institutions – Individuals	3.53	4.81	2.78	3.25	3.62	3.20	−0.41	−0.53	2.80	5.80		
Differences: Male – Female	−0.67	−1.05	−1.85	−2.27	−1.74	−1.71	−1.38	−1.91	−1.78	−4.10		

Notes:

[b] Net return performance is the net profit (gross profit less deductions for transaction tax, commission and submission fees) divided by investment.

Table 4 (Contd.)

Variables	No. of Auctions 1-4 (Group 1)		5-8 (Group 2)		9-12 (Group 3)		≥13 (Group 4)		Total		Difference between Groups 1 and 4	
	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.
Panel C: Adjusted Net Return Performance [c]												
Return for average bidders (%)	9.23		6.13		5.44		4.95		8.32		4.28	10.45
Institutions	14.86		10.56		9.32		6.24		13.32		8.62	4.54
Individuals	8.89		5.68		5.22		4.90		8.00		3.99	9.54
Male	8.67		5.25		5.29		4.81		7.61		3.86	7.30
Female	9.15		6.49		5.09		5.13		8.51		4.02	5.81
Differences: Institutions – Individuals	5.97	4.33	4.88	3.87	4.10	1.90	1.34	0.98	5.32	5.29		
Differences: Male – Female	−0.48	−0.82	−1.25	−1.88	0.20	0.26	−0.32	−0.49	−0.91	−1.98		
Return for aggregate bidders (%)	13.78		10.42		8.77		6.24		11.16		7.54	13.19
Institutions	16.48		12.67		10.00		6.49		13.45		9.99	3.17
Individuals	12.78		8.91		8.18		6.18		10.23		6.60	12.26
Male	11.77		7.88		7.95		5.85		9.07		5.91	9.50
Female	13.97		10.67		8.81		7.27		12.14		6.70	6.20
Differences: Institutions – Individuals	3.70	5.48	3.76	5.02	1.83	1.83	0.31	0.41	3.22	7.23		
Differences: Male – Female	−2.20	−3.72	−2.80	−3.80	−0.86	−0.92	−1.41	−1.94	−3.06	−7.52		

Notes:

[c] Adjusted net return performance is the net return deflated by the value-weighted market return in the corresponding period.

Table 5 Adjusted net return performance for successful bids, by bidder groups *

The sample comprises of 6,693 bidders in 77 IPO auctions which took place between January 1996 and April 2000; this was then divided into four groups; Group 1: bidders participating in one to four auctions; Group 2: bidders participating in five to eight auctions; Group 3 bidders participating in nine to twelve auctions; and Group 4 bidders participating in thirteen or more auction. Only successful bids are considered in the calculation of investment performance.

Variables	No. of Auctions 1-4 (Group 1)		5-8 (Group 2)		9-12 (Group 3)		≥13 (Group 4)		Total		Difference between Groups 1 and 4	
	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.
Return for average bidders (%)	11.83		12.48		11.15		9.73		11.79		2.10	2.99
Institutions	18.06		19.17		18.66		12.15		18.15		5.92	2.16
Individuals	11.45		11.80		10.74		9.63		11.37		1.82	2.52
Male	11.50		11.28		11.22		9.43		11.30		2.07	2.27
Female	11.41		12.77		9.81		10.22		11.46		1.19	1.06
Differences: Institutions – Individuals	6.61	4.22	7.37	3.19	7.92	1.65	2.51	1.06	6.78	5.54		
Differences: Male – Female	0.09	0.13	−1.49	−1.11	1.42	0.91	−0.79	−0.63	−0.15	−0.27		
Return for aggregate bidders (%)	16.37		16.34		13.62		10.07		15.17		6.30	8.68
Institutions	20.69		21.67		15.92		12.30		19.73		8.39	1.95
Individuals	14.88		13.24		12.57		9.68		13.50		5.20	7.75
Male	13.93		11.77		12.35		9.10		12.32		4.83	6.16
Female	15.97		15.72		13.16		11.65		15.33		4.32	3.18
Differences: Institutions – Individuals	5.80	7.52	8.43	7.08	3.35	1.99	2.62	2.02	6.23	11.03		
Differences: Male – Female	−2.04	−3.11	−3.95	−3.69	−0.81	−0.60	−2.55	−2.25	−3.01	−6.18		

Table 6 Regression analysis of abnormal returns, by types of bidders

The dependent variable is the abnormal return of each bidder. *Ln_cap* is the logarithm of the average amount of capital across bids submitted by the bidder; *Group*1, *Group*2 and *Group*3 are dummies which are equal to 1 if bidders are respectively assigned to Group 1 (one to four auctions), Group 2 (five to eight auctions) or Group 3 (nine to twelve), otherwise zero; *Type* is an indicator which is set as 1 if the bidder is an institution, and zero if the bidder is an individual. *Gender* is a dummy variable which is equal to 1 if the bidder is a male; *Multi_bid* is an indicator which is set as 1 if the bidder makes at least one multiple bid at auction, otherwise zero. The *t*-stats are White (1980) heteroskedasticity adjusted t-statistics.

Variables [b]	All Bidders		Individual Bidders		Institutional Bidders	
	Mean	*t*-stat.[c]	Mean	*t*-stat.[c]	Mean	*t*-stat.[c]
Intercept	−10.748	−4.61	−9.562	−3.98	−38.530	−2.31
Ln_cap	1.298	7.54	1.211	6.95	3.455	3.16
*Group*1	2.377	5.28	2.437	5.26	2.901	1.59
*Group*2	0.565	1.29	0.550	1.24	2.410	1.30
*Group*3	0.371	0.80	0.313	0.67	1.745	0.72
Type	2.815	2.65	–	–	–	–
Gender	–	–	−0.424	−0.93	–	–
Multi_bid	−2.273	−5.15	−1.712	−3.86	−10.137	−4.36
Adj-R^2	0.023		0.016		0.077	
Total No.	6,993		6,553		430	

Notes:
[a]

Table 7 Decomposition of adjusted net return performance results, by bidder groups*

The sample comprises of 6,693 bidders in 77 IPO auctions which took place between January 1996 and April 2000; this was then divided into four groups; Group 1: bidders participating in one to four auctions; Group 2: bidders participating in five to eight auctions; Group 3 bidders participating in nine to twelve auctions; and Group 4 bidders participating in thirteen or more auction. The adjusted net return is the net return deflated by the value-weighted market return in the corresponding period. Only successful bids are considered in the calculation of investment performance, which is then decomposed as bidding and stock selection performance.

Variables	No. of Auctions 1-4 (Group 1)		5-8 (Group 2)		9-12 (Group 3)		≥13 (Group 4)		Total		Difference between Groups 1 and 4	
	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.
Panel A: Bidding Performance for Successful Bids												
Return for average bidders (%)	−0.08		−0.56		−0.76		−0.66		−0.22		0.57	3.77
Institutions	0.56		0.12		−0.49		0.70		0.41		−0.14	−0.32
Individuals	−0.12		−0.63		−0.78		−0.71		−0.27		0.59	3.76
Male	−0.12		−0.74		−0.75		−0.88		−0.32		0.75	3.91
Female	−0.12		−0.42		−0.83		−0.24		−0.19		0.12	0.49
Differences: Institutions – Individuals	0.68	3.30	0.75	2.45	0.29	0.50	1.42	3.41	0.68	4.20		
Differences: Male – Female	0.00	−0.03	−0.32	−1.20	0.07	0.19	−0.63	−2.13	−0.13	−1.28		
Return for aggregate bidders (%)	0.06		0.00		0.02		−0.22		0.00		0.28	3.14
Institutions	−0.04		0.06		0.07		0.52		0.04		−0.56	−1.21
Individuals	0.09		−0.04		−0.01		−0.35		−0.02		0.45	5.06
Male	0.03		0.04		−0.01		−0.32		−0.05		0.36	3.45
Female	0.16		−0.18		0.02		−0.46		0.04		0.62	3.47
Differences: Institutions – Individuals	−0.14	−1.47	0.10	0.63	0.08	0.38	0.87	3.05	0.06	0.87		
Differences: Male – Female	−0.13	−1.58	0.22	1.38	−0.03	−0.14	0.14	0.53	−0.09	−1.34		

Table 7 (Contd.)

Variables	No. of Auctions 1-4 (Group 1)		5-8 (Group 2)		9-12 (Group 3)		≥13 (Group 4)		Total		Difference between Groups 1 and 4	
	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.	Mean	*t*-stat.
Panel B: Stock selection performance for successful bids												
Return for average bidders (%)	11.90		12.99		11.93		10.37		11.99		1.52	2.32
Institutions	17.52		18.93		19.32		11.28		17.73		6.24	2.43
Individuals	11.56		12.39		11.52		10.34		11.61		1.22	1.80
Male	11.60		11.98		11.98		10.30		11.60		1.30	1.51
Female	11.50		13.13		10.63		10.43		11.62		1.08	1.03
Differences: Institutions – Individuals	5.96	3.79	6.54	2.97	7.80	1.63	0.94	0.44	6.12	5.01		
Differences: Male – Female	0.10	0.15	−1.15	−0.91	1.34	0.91	−0.12	−0.10	−0.02	−0.04		
Return for aggregate bidders (%)	16.37		16.26		13.53		10.25		15.17		6.12	8.38
Institutions	20.92		21.41		15.75		11.63		19.72		9.30	2.11
Individuals	14.80		13.25		12.52		10.01		13.51		4.79	7.17
Male	13.89		11.70		12.28		9.41		12.35		4.48	5.79
Female	15.83		15.87		13.13		12.05		15.30		3.79	2.78
Differences: Institutions – Individuals	6.13	7.87	8.16	7.16	3.24	2.00	1.62	1.35	6.21	11.05		
Differences: Male – Female	−1.94	−2.96	−4.18	−4.00	−0.85	−0.66	−2.63	−2.50	−2.95	−6.11		

Table 8 Dynamic changes in return performance for frequent bidders

The sample comprises of 357 frequent bidders, who are defined as investors submitting bids in at least 13 of the 77 IPO auctions in Taiwan between January 1996 and April 2000. Bidding order is based on the number of auctions in which the bidder participated in the previous IPO auctions; for example, 5th bidding order indicates that the bidder had subscribed to 4 auctions prior to the current bid. Gross return is the gross profit earned by the bidder in IPO auctions divided by the dollar amount of investment in IPO auctions. Net return is the net profit which is gross profit less deductions for transaction tax, commission and submission fees, divided by investment. Adjusted net return is the net return deflated by the value-weighted market return in the corresponding period. The differences and corresponding *t*-statistics are based upon the matched samples.

Bidding Order	Gross Return		Net Return		Adjusted Net Return	
	%	t-stat.	%	t-stat.	%	t-stat.
1st~4th	12.99		12.51		11.68	
5th~8th	5.50		5.05		5.50	
9th~12th	2.31		1.88		3.18	
13th~	−0.35		−0.75		0.24	
Differences: (1st~4th)–(13th~)	13.34	14.87	13.25	14.86	11.44	14.00