Selling Methods, Public Information, and Oversubscription in IPOs: Evidence from Taiwan

Yenshan Hsu
Department of Finance
National Chengchi University
Taipei, Taiwan, ROC
Email: ysshiu@nccu.edu.tw
Tel: 886-2-29387508

and

Cheng-Yi Shiu
Department of Finance
National Central University
Taoyuan, Taiwan, ROC
Email: cshiu@ncu.edu.tw
Tel: 886-3-4227151 ext. 66268

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Abstract

This paper examines the relationship between public information and oversubscription in Taiwanese IPOs. We analyze to what extent public information affects investors' demand for shares in fixed-price offerings and in discriminatory auctions. We find that for fixed-price offerings, investors either overwhelmingly subscribe to new issues or avoid them, but to a lesser degree. Both market index returns and industry factor have a positive and significant influence on investors' demand for shares and on initial returns. These results are consistent with the suggestion that it takes more underpricing to be sure of attracting investors when market returns are high or if there are numerous of firms in the same industry competing for fund. We also find that there are variations in the number of bidders for a discriminatory auction, indicating that herding is more likely to occur in fixed-price offerings than in IPO auctions. We suggest that both selling methods and investor characteristics could be important factors relevant to herding in IPO markets.

Key words: IPOs; public information; oversubscription

JEL classification: G2

1. Introduction

This paper examines the relationship between public information and oversubscription (i.e., the total demand for shares divided by total supply of shares) in Taiwanese IPOs. We analyze to what extent public information affects investors' demand for shares in pure fixed-price offerings and in hybrid auctions, where a discriminatory auction precedes the fixed-price method.

We focus primarily on five public variables: industry factor, firm size, market index returns, initial returns of contemporaneous IPOs, and oversubscription of contemporaneous IPOs. While the first four variables are motivated by previous research, as known to have an impact on underpricing, the last one is an extension of research on hot issue markets. Some researchers also view these variables as potential measures of investor sentiment.[1]

For Taiwanese pure fixed-price offerings, we find a U-shaped distribution of allocation rates (i.e., the ratio of issued shares to the total demand for shares); in other words, investors either overwhelmingly subscribe to new issues or avoid them. The distribution of allocation rates is skewed to the left, so there is a considerable difference of oversubscribed and undersubscribed issues.

This result is consistent with Chowdhry and Sherman (1996), who show that the information leakage occurring before the issue closes for bidding by investors might lead to the result of investors' realizing the offer price is too low or too high, resulting in oversubscription or undersubscription.

We show that 25% to 45% of the variation in investor oversubscription can be predicted using public information known before the subscription date. We find that both market index returns before the subscription date and the high tech dummy have a positive and significant influence on investor oversubscription and on aftermarket returns.

Our results are consistent with Sherman (2005), who suggests that if undersubscription is costly, then the issuer/underwriter should price offerings below the expected value as insurance against failure. The risk of failure will depend on market conditions through the opportunity cost of evaluating and investing in the IPO, so it takes more underpricing to be reasonably sure of attracting investors when market returns are high.

Next, we find that the distribution of allocation rates of IPO auctions exhibits a reverse

[1] First, behavioral theories posit that investors put too much weight on recent market results and trends. Market conditions will therefore have an impact on investors' demand for IPO shares. Second, individual investors in the IPO market tend to be swayed by fads, and small IPOs are more likely to be owned by individual investors. Finally, Ljungqvist, Nanda, and Singh (2001) argue that some investors

U-shaped distribution, in striking contrast to the U-shaped distribution we see in fixed-price offerings. This striking difference indicates that herding is more likely to occur in fixed-price offerings than in IPO auctions.

We interpret the evidence as suggesting that investor characteristics are relevant to herding in IPO markets, for participants in our fixed-price offerings are exclusively individual investors, who are relatively homogeneous and uninformed, while participants in auctions include both institutional investors and individual investors who are relatively diverse. Some of these investors have better information, making herding less likely.

Finally, for follow-on fixed-price offers of hybrid offerings, we see that public information also accounts for the lion's share of the variations in later investor subscriptions. This provides evidence that public information has a stronger influence on investor subscriptions to IPOs than private information when it is incorporated into investor auction bids.

Several studies (for example, Hanley and Wilhelm (1995), Cornelli and Goldreich (2001), Jenkinson and Jones (2004), and Boehmer and Fishe (2004)) have examined the issue of IPO allocations in bookbuilding settings. However, not many authors have empirically examined IPO oversubscription either in fixed-price offerings or in IPO auctions. The only exception, to our knowledge, is Amihud et al. (2003), who document evidence of information cascades in Israeli IPOs, including 37 fixed-price offerings and 245 uniform-price auctions. In contrast, this paper examines oversubscription and its relationship to public information in fixed-price offerings and in hybrid auctions, and hence contributes to our understanding of investors' demand for shares in various IPO selling procedures.

The rest of this paper is organized as follows. Section 2 reviews the relevant literature. Section 3 introduces the IPO selling procedures in Taiwan. In Section 4 we show data and summary statistics. In Section 5 we present the preliminary results on investors' demand for shares. Section 6 examines the relation between public information and investors' demand for shares. Section 7 investigates the relation between information released from auctions and herding among investors in follow-on fixed-price offerings. Section 8 concludes.

2. Literature Review

Welch (1992) models the effect of information cascades on fixed-price selling procedures with sequential moves, assuming that investors are differently informed but more informed than issuers, that investors attempt to evaluate the interest of other investors, and that later investors,

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might be irrationally exuberant about the prospects of IPOs in a particular industry.

having observed the actions of earlier investors, will make the same choices as to staying out of the market or subscribing, regardless of their private information. Hence, pricing an issue just a little too high or too low will give the issuer too high a probability of complete failure or complete success; in other words, investors will either subscribe overwhelmingly to shares or largely ignore them.

Amihud, Hauser, and Kirsh (2003) examine the allocation rate (i.e., the ratio of issued shares to the total demand for shares) of 282 Israeli IPOs, 39 sold through a fixed-price method and 245 through an auction. They find a U-shaped distribution of allocation rates; in other words, investors either overwhelmingly subscribe to new issues or avoid them largely; very few issues are in between. Of their 282 IPOs, 142 IPOs have an allocation rate of lower than 5% and 73 have an allocation rate of over 95%. They conclude that this pattern is consistent with the implication of Welch's (1992) model of information cascades in IPOs.

Chowdhry and Sherman (1996) argue that when the offer price of a fixed-price offering is set many days before the issue closes for bidding by investors, relevant price information, both public and private, leaks and becomes public knowledge before investors have finished bidding for shares. As a result, after the information leakage, investors sometimes realize that the offer price is too low, and then the phenomenon of extremely high levels of oversubscription will occur; and there are instances when investors realize that the offer price is too high, and the issue fails. An implication of their model, similar to that of Welch's (1992) model, is that it is more likely either that extremely high levels of oversubscription will be or that the issuer is not able to sell all shares in the initial offering. They also suggest that if the cost of not selling out all IPO shares sufficiently high for the firm, the offer price should be set low to reduce the risk of failure.

Benveniste and Busaba (1997), adopting the market structure developed in Welch (1992), argue that the fixed-price method uniquely offers the potential to exploit this market structure by pricing the issue low enough to lure early investors and generate a buying frenzy. They also examine the results of using an underwriter to sell the issue through bookbuilding to the same investors, and they show that the underwriter, by collecting and publicizing investor information, could diffuse any possibility of a cascade. Benveniste and Busaba also show that pricing an issue off a book may result in an offer price below that which creates a cascade in a fixed-price offering.

Sherman (2005) models both discriminatory and uniform-price auctions in an environment where the number of bidders and the accuracy of their information are endogenous. She argues that in practice there are many potential bidders in an auction, all of whom have alternatives and are not forced to bid. In equilibrium, the number of bidders that enter the auction will adjust so that bidders get a sufficient return, on average. If they did not expect to get at least as good a return, on average, then they would abstain, leading to variations in the number of bidders for a discriminatory auction.

Sherman (2005) also argues that potential auction bidder will decide whether or not to devote time and effort to evaluating an IPO. Since the primary cost of evaluating is the opportunity cost of their time, their decision is based partly on what returns they could expect to get from the secondary market or from other IPOs. To draw in a minimum number of investors to enter a discriminatory auction, issuers hence have to offer a sufficiently high average return, relative to alternatives. Therefore, for discriminatory auctions Sherman (2005) predicts partial adjustment to recent returns on both the market and other IPOs.

3. IPO Selling Procedures in Taiwan

Since December 1995, Taiwanese issuers have been able to adopt either a pure fixed-price method or a sequential hybrid procedure, where a discriminatory auction precedes the fixed-price method, to distribute IPO shares. The pure fixed-price method is valid for distributing either primary or secondary shares, while the sequential hybrid is valid only for distributing secondary shares.

In the pure fixed-price method, underwriters and issuers look at comparable firms and set issue prices according to a pricing formula prescribed by the Security and Futures Commission in Taiwan. Order sizes offered for subscription normally range from one to three lots (1,000 shares per lot). Institutional investors are eligible to subscribing to shares of fixed-price offers, but they are generally not interested in fixed-price offers because of constraints on order size. Never has an institutional investor in our IPO sample subscribed to shares of fixed-price offers. In the event of oversubscription occurs, underwriters adopt a lottery to allocate shares. The fixed-price offer will last about one calendar week, and the IPO date is two weeks later.

In the sequential hybrid procedure, an issuer will put 50% of IPO shares in an auction, and follow this with a fixed-price open offer to distribute the remaining shares, including shares not sold out in the auction. Before the start of the discriminatory auction, the underwriter and issuer 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 offer price of follow-on fixed-price offers.[2]

[2] Prior to 2000, the maximum price range that issuing firms were allowed to set was from the minimum acceptable price to 1.5 times the price; in 2000, the factor 1.5 was adjusted to 1.3. All our IPO sample firms set their possible price ranges corresponding to the maximum price ranges.

Each eligible investor can submit one or more price/quantity bids, just as in a sealed-bid auction, up to 3% of total IPO shares, i.e., 6% of auctioned shares. The submission period normally lasts one calendar week.

On the next business day following the auction closing date, the Taiwan Securities Dealers Association will then fill orders, starting with the higher bidding prices first until all auctioned shares are distributed. Each winning bidder pays what it bids. The Association will then announce the price/quantity schedule for each individual winning bid, the identity of each winning bidder, and the offer price for the follow-on fixed-price offer.

The pricing rule for follow-on fixed-price offers is as follows: First, if there is oversubscription with an auction clearing price above the maximum price of the initial price range, the underwriter will then take the maximum price as the offer price for the follow-on fixed-price offering. Second, if there is oversubscription with an auction clearing price within the initial price range, the underwriter will first eliminate the winning bids with bidding prices above the initial price range, and then set the offer price at the quantity-weighted price calculated using the winning bids within the initial price range. Finally, if there is undersubscription, the underwriter will set the auction base price as the offer price for the follow-on fixed-price offering. We provide numerical examples of how the pricing rule operates in these three cases in the appendix.

The underwriter will conduct the follow-on fixed-price offer about three calendar weeks after the announcement of the auction results. The selling procedure is the same as in the pure fixed-price method.

Figure 1 depicts the timing of the sequential hybrid selling procedure.

Place Figure 1 about here

4. Data and Summary Statistics

We analyze 311 IPOs, 234 pure fixed-price offers and 77 hybrid offers, during the period from January 1996 through June 2000. This is the number of IPOs after excluding closed-end mutual funds and Taiwan Depository Receipts. We acquire the sample data through the Taiwan Securities Dealers Association.

Table 1 shows the distribution of our pure fixed-price and hybrid IPOs by year within our study period. Of the 234 pure fixed-price offers, 61 issues initially began trading on the Taiwan Stock Exchange and 173 issues on the over-the-counter market. Of the 77 hybrids, 44 initially began trading on the Taiwan Stock Exchange and 33 on the OTC market. In contrast to IPOs in Israel, fixed-price methods remain dominant for distributing IPO shares in Taiwan, although issuing firms can choose the auction process. Moreover, Israeli IPO auctions distribute all of the IPO shares, while Taiwanese IPO auctions are only one part (the first stage) of a sequential hybrid selling procedure to distribute 50% of IPO shares. The fixed-price methods (the second stage) distribute the remaining shares. Of the 234 pure fixed-price issues, 97 IPOs represent high-tech firms, while 137 issues are traditional firms. Of the 77 sequential hybrids, 41 issues are high-tech firms, while 36 issues are traditional firms. More firms of either type of firm are inclined to adopt the pure fixed-price procedure.

Place Table 1 about here

Table 2 presents the descriptive statistics for both samples of pure fixed-price IPOs (Panel A) and sequential hybrids (Panel B) by year. Of the 234 pure fixed-price offers, 27 issues are with an allocation rate (that is, the total supply divided by total demand) of greater than 0.95; most of them cluster in the year of 1996 and of 1999. On the other hand, 131 issues are with an allocation rate of less than 0.05; and most of them cluster in the year of 1999 and of 2000. Of the 77 follow-on fixed-price offers, 65 issues are with an allocation rate of less than 0.05, while only one issue is with an allocation rate of greater than 0.95.

Place Table 2 about here

We also see that larger issues are more apt to be distributed through the hybrid procedure, while smaller issues tend to be distributed through the fixed-price procedure. The average IPO proceeds in hybrid offerings are 1,073 million NT dollars, versus 433 million in pure fixed-price offerings.[3] A higher percentage of equity is also sold in hybrids rather than in pure fixed-price offerings. Pure fixed-price issuers have lower sales in the year preceding the IPO than do hybrids. On the other hand, the average age (that is, the number of years from the inception of a firm to its IPO year) is higher for pure fixed-price issues than that for hybrid issues.

The mean initial returns, benchmarked to the Taiwan Stock Exchange value-weighted index, are 21.64% and 22.72% for pure fixed-price offerings and sequential hybrids, respectively.[4]

[3] During the sample period, the exchange rate ranges from about 27 NT$ to 35 NT$/1 US$.

[4] The return data are retrieved from the data bank of the Taiwan Economic Journal; the stock markets in Taiwan impose a daily price limit of 7% on securities traded in the markets; a security's price may therefore continue to hit the limit several days after the listing. The initial return reported here is the cumulative market-adjusted return

5. Investors' Demand for Shares

5.1. Preliminary results

To examine investors' demand for shares on our sample IPOs, we follow Amihud et al. (2003) to plot histograms of the allocation rates for pure fixed-price offerings, Taiwanese discriminatory auctions, and follow-on fixed-price offerings.

Figure 2 is a histogram of the allocation rates for the 234 pure fixed-price offerings. The distribution pattern reveals that of 234 IPOs, 130 have an allocation rate of lower than 5%; in other words, investors subscribe aggressively to shares of these issues. Another 37 IPOs have an allocation rate falling between 5% and 15%; most investors also subscribe aggressively to shares of these issues, but to less of a degree. At the other end of the scale, 27 IPOs have an allocation rate of higher than 95%; in these cases, most investors stay away.

Place Figure 2 about here

The distribution of allocation rates with only a few issues in between is similar to the finding of Amihud et al. (2003). The results might be consistent with the implication of Welch's (1992) model of information cascades. They, however, are also consistent with the prediction of Chowdhry and Sherman's (1996) model of information leakage.

Panel A of Figure 3 is a histogram of allocation rates for the 77 discriminatory auctions. The distribution reveals that of 77 auctions, none of them has an allocation rate of lower than 5%; in other words, investors do not subscribe aggressively to shares of Taiwanese discriminatory auctions. At the other end of the scale, two IPOs have an allocation rate of higher than 95%; in these two cases, most investors stay away. The other 75 IPOs (that is, most of our sample auctions) have an allocation rate falling between 5% and 95%.

The distribution surprisingly exhibits an almost reverse U-shaped distribution, in striking contrast to the U-shaped distribution of allocation rates we have observed in pure fixed-price offerings. The results are consistent with Sherman (2005), who predicts that there will be variations in the number of bidders for a discriminatory auction.

Place Figure 3 about here

Panel B of Figure 3 is a histogram of allocation rates for the 77 follow-on fixed-price

until the day the limit is not hit.

offerings. Of 77 offerings, 65 have an allocation rate of lower than 5%, and only one offering has an allocation rate of higher than 95%.[5] This indicates that auctions create information spillover for follow-on fixed-price offerings, suggesting that underwriters and issuing firms can induce the possibility of herding by gathering investor information in an auction and releasing it to the later, potential investors of follow-on fixed-price offering. The distribution of allocation rates for these follow-on fixed-price offerings is consistent with the implication of Benveniste and Busaba's (1997) argument of information spillovers.

5.2. Discussion

Given that there is a drastic difference in the distribution of allocation rates between fixed-price offerings and discriminatory auctions, we discuss its possible implications below.

The distribution of allocation rates for Taiwanese pure fixed-price offerings is consistent not only with the implication of Welch's (1992) model of information cascades, but with the prediction of Chowdhry and Sherman's (1996) model of information leakage also. As Taiwanese pure fixed-price offerings are not sold out with a sequential selling method, and their offering prices are set roughly three weeks before the issues close for bidding by investors, we interpret our evidence as support of Chowdhry and Sherman's model of information leakage.

The distribution of allocation rates for discriminatory auctions exhibits an almost reverse U-shaped distribution, in striking contrast to the U-shaped distribution of allocation rates we have observed in pure fixed-price offerings. The evidence suggests that herding is more likely to occur in fixed-price offerings than in auctions.

Three possible reasons could explain this phenomenon. First, selling methods could be an important explanation for the presence of herding in IPOs. In discriminatory auctions, the winning bidders pay what they bid, and because the uninformed do not have any information advantage, they might not participate in the IPO market so as to avoid the "winner's curse." In fixed-price offerings, all winning bidders pay the same offer price, reducing the threat of the winner's curse, and they become more aggressive in subscribing to IPO shares. Our evidence is consistent with Chowdhry and Sherman (1996), who present a theoretical model on the relationship between oversubscription and selling methods and conclude that extreme levels of oversubscription are more likely to occur in fixed-price offerings. The evidence is also consistent with Benveniste and Busaba (1997), who argue that in the fixed-price method issuers

[5] The failed issue is Mirle Automation. Investors avoided the first-stage auction for this issue. According to the explicit pricing rule, the issuer must take the initial base price in the auction as the offer price for the follow-on fixed-price offering. The inability by Mirle Automation to price the issue below the initial base price led to the

can price the issue low enough to lure early investors and hence to generate herding.

Second, investor characteristics could be another important factor relevant to herding in IPO markets. Participants in our fixed-price offerings are exclusively individual investors, who are relatively homogeneous and uninformed and are more subject to fads according to Lee, Shleifer, and Thaler (1991). In contrast, participants in discriminatory auctions are relatively diverse, including both institutional and individual investors. The former has better information than the latter, making herding unlikely to occur.

Finally, a third explanation of why investors avoid Taiwanese auctions is a longer delay between the auction and the IPO date than between the fixed-price offering and the IPO date. Investors therefore expose themselves to more market risk in auctions than in fixed-price offerings, and they are likely to abstain from auctions.

The distribution of allocation rates for follow-on fixed-price offerings reveals that investors aggressively subscribe to shares of these offerings. As we can observe from numerical examples of pricing rule for follow-on fixed-price offerings in the appendix, Taiwanese sequential selling procedure is designed so that, for the IPOs that are in highest demand in the auction, the fixed price will be strictly below the clearing price in the auction. Fixed price investors are able to free ride off of auction investor information, because they are allowed to observe demand in the auction, as well as other public information. Thus, investors would aggressively subscribe to shares of follow-on fixed-price offerings unless it is widely believed that the auction price is far above the appropriate level.

6. Public Information and Oversubscription

Given that our results on pure fixed-price offerings are consistent with the predictions of Chowdhry and Sherman's (1996) model of information leakage, we might ask to what extent public information affects investors' demand for shares.

6.1. Public information variables

We examine three types of public information: firm characteristics, stock market conditions, and demand/pricing of other contemporaneous IPOs in our sample period. For firm characteristics we include *Ln_sale*, which is equal to the natural logarithm of the yearly sales prior to the IPO year, to proxy for the size of a firm, and *Hi_tech*, which is a dummy variable equal to 1 if the firm is a high-tech firm, and 0 otherwise.

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failure of its follow-on fixed-price offering.

We follow Derrien and Womack (2003) to construct a series of market index returns to capture stock market conditions. For each individual offering, we construct a three-month weighted market index return variable as a weighted average of the buy-and-hold returns of the Taiwan Stock Exchange value-weighted index in the three months before the subscription's beginning date. The weights are three for the most recent month, two for the next, and one for the third month before the subscription's beginning date. We then divide this weighted sum by six to get a weighted monthly market return.

We next examine the oversubscription of and the initial return of other contemporaneous IPOs. Similarly, we construct a three-month weighted variable of oversubscription, defined as the total demand of shares divided by total supply of shares. For each individual offering, we first calculate the monthly (arithmetic) average oversubscription of other contemporaneous IPOs for each of the three months before the subscription's beginning date. A three-month weighted oversubscription variable is then constructed as a weighted average of the calculated monthly oversubscriptions in the three months before the subscription's beginning date. The weights are three for the most recent month, two for the next, and one for the third month before the subscription beginning date. We also divide the weighted sum to get a weighted monthly oversubscription.

Similarly, for each individual offering we construct a three-month weighted initial return variable, which is the weighted average of monthly arithmetic initial returns of other contemporaneous IPOs in the three months before the subscription's beginning date.

Table 3 presents the summary statistics for the public information variables. The mean market index return before the subscription period is 2.64% for pure fixed-price offerings and 0.46% for follow-on fixed-price offerings. This considerable difference (and a higher standard deviation for the hybrid offerings) indicates that the added time for conducting follow-on fixed-price offerings might impose additional market risks on issuers adopting the hybrid method.

Place Table 3 about here

The mean oversubscription of other contemporaneous IPOs is 58.57 for pure fixed-price offerings and 81.12 for follow-on fixed-price offerings. The follow-on fixed-price offerings on average attract more investor subscriptions than the pure ones. Finally, the mean initial return of other contemporaneous IPOs is 18.30% for pure fixed-price offerings and 19.03% for follow-on ones, not very different.

6.2. Public information and investors' demand for shares

We use three variables to measure the extent to which public information affects investors' demand for shares: *Ln_os*, *Ir_cipo*, and *Mkt_rtn*. *Ln_os* is the natural logarithm of the oversubscription of other contemporaneous IPOs; *Ir_cipo* is the initial return of other contemporaneous IPOs; and *Mkt_rtn* is the market index return prior to the subscription period. We also include the firm characteristic variables: *Ln_sale* and *Hi_tech*. *Ln_sale* is the natural logarithm of the yearly sales preceding the IPO year, and *Hi_tech* is a dummy variable equal to 1 if the firm is a high-tech firm, and 0 otherwise.

Table 4 shows results of the analysis that relates investors' oversubscription (actually the logarithm of oversubscription) of pure fixed-price offerings to the public information variables. Regression 1 in Table 4 shows that the coefficient of *Mkt_rtn* is positive and very significantly different from zero. The regression has an adjusted R-squared of over 20%, indicating that the market index return variable has a very strong influence on investors' decision to subscribe to IPO shares.

Place Table 4 about here

In Regression 2 we observe a similar result for the oversubscription variable (*Ln_os*); the coefficient of *Ln_os* is positive and significant, but to a lesser degree. This regression has an adjusted R-squared of over 17%.

Regression 3, combining the market returns variable and the oversubscription variable, shows that any one of them still has a very strong influence on investors' demand for shares.

Regression 4 also shows a similar result for the initial return variable (*Ir_cipo*). The coefficient of *Ir_cipo* is positive and significant. The adjusted R-squared is 16.98%.[6]

The evidence suggests that any one of the three public information variables (*Mkt_rtn*, *Ln_os*, and *Ir_cipo*) has a strong influence on investor decisions to subscribe to IPO shares. In Regression 5 we hence simultaneously regress the three public information variables on investor oversubscription. The result shows that the market index return variable has the strongest influence, but the initial return variable becomes insignificant, suggesting that the market index return variable and the oversubscription variable account for the effect of the initial return variable on investor demand for shares.

[6] In these regressions, we model the interplay of the information variables on investors' oversubscription as multiplicative rather than additive.

In Regression 6 we add the firm characteristic variables, size and industry. The coefficient of industry dummy is positive and significant, while the coefficient of the size variable is negative, but insignificant. These results are similar to the findings of Cornelli and Goldreich (2003), who report that oversubscription is significantly higher for a high-tech firm, and oversubscription is not significantly related to the size of a firm.

Our results overall reveal that the public information variables together account for greater than 47% of the variation of investor subscription. This immediately presents a conjecture that public information is the primary driver of herding.

To examine this conjecture, we first separate allocation rates into two parts: the fitted allocation rates and the residual allocation rates. We then use the fitted values and the residuals derived from the regressions in Table 4 to capture the portion of oversubscription explained by public information and the portion after adjusting for publicly available information.

Table 5 presents the summary statistics for the fitted and residual allocation rates (i.e., the reciprocal of oversubscriptions) for the Table 4 regressions. The results show that the mean allocation rate based on public information ranges from 0.07 to 0.12, while the mean allocation rate after adjusting for publicly available information ranges from 3.70 to 8.00. The evidence suggests that public information indeed induces a lot of investors to subscribe to IPO shares.

Place Table 5 about here

To provide further evidence on this, in Panel A of Figure 4 we plot the histogram of 234 fitted allocation rates according to Regression 5 in Table 4. Of the 234 IPOs, 108 have a fitted allocation rate of lower than 5%; in other words, public information has a very strong influence on the oversubscription of these issues. Of the 234 IPOs, 76 have a fitted allocation rate falling between 5% and 15%; public information also has a strong impact on the oversubscription of these issues, but to a lesser degree. Finally, all 234 IPOs have a fitted allocation rate of lower than 45%, reflecting that public information indeed plays a very important role in investors' decisions to subscribe to IPO shares. Results from the other regressions in Table 4 show a similar distribution pattern of fitted allocation rates.

Place Figure 4 about here

Panel B of Figure 4 is a histogram of residual allocation rates according to Regression 5 in Table 4. The distribution pattern of residual allocation rates is very different from the pattern of fitted allocation rates. Of the 234 IPOs, 96 have an allocation rate of higher than 95%, while only four IPOs have an allocation rate of lower than 5%. Results from the other regressions in Table 4 show a similar distribution pattern of residual allocation rates.

6.3. Discussion

Regression 6 of Table 4 shows that both variables of market index return and industry factor have a very strong influence on investors' demand for shares of pure fixed-price offerings. Chowdhry and Sherman (1996) argue that if undersubscription is costly, then the issuer/underwriter should deliberately price offerings below the expected value as insurance against failure. The risk of failure will depend on market conditions through the opportunity cost of evaluating and investing in the IPO, and it takes more underpricing to be reasonably sure of attracting investors when market returns are high. This explains why the variable of market index return has a positive and significant effect on oversubscription.

Similarly, as for the industry effect, if high tech stocks were doing well in general during that time, then those that had expertise evaluating high tech stocks have a higher opportunity cost than those that are only familiar with traditional industries. High tech firms hence have to underprice their issues much more to be reasonably sure of attracting investors, and this explains why industry factor also has a positive and significant effect on investors' demand for shares. On the other hand, if there are a greater number of high tech firms (more than two fifths of our sample IPOs are from high tech firms) competing for a fixed pool of fund, then they also have to underprice their issues much more.

Panel B of Figure 4 shows that after adjusting for publicly available information, there are some variations in the residual allocation rates. This indicates that issuers need to adjust for publicly-available information such as market demand and industry factor, in order to reduce the risk of failure. The residual allocation rates show that there is a substantial variation in individual demand for specific offerings, and thus, if the issuer/underwriter set the offering price at the best unbiased estimate of the expected value, there would be substantial risk of failure. The issuer/underwriter cannot perfectly adjust for the private information of investors. Thus, the only way to offset this risk and thus make it likely that the offering will succeed is to adjust for opportunity costs in order to offer a sufficiently high average return, relative to alternatives, to draw in at least a minimum number of investors, regardless of private signals.

6.4. Public information and underpricing

We argue that to reduce the risk of failure the underwriter has to underprice much more for those issues either placed in a hot market or from an industry doing well during the IPO. This implies that these two public variables, market index returns and industry factor, will also have a positive and significant effect on initial returns. We investigate the relationship between public information variables and initial returns.

As in Table 4, we use four public variables. First, we use two firm characteristic variables, the size of a firm (*Ln_sale*) and the industry factor (*Hi_tech*). Second, we use the market index return variable (*Mkt_rtn*) to reflect recent secondary market conditions. Finally, we use the initial return variable (*Ir_cipo*) to reflect recent IPO market conditions. We calculate these public information variables as of the IPO date (instead of the earlier subscription date as before) to account for the impact of public information on initial returns.

The result that relates the initial return to these four public variables is as follows (t-statistics in parentheses):

$$\text{Initial Return}_i = \underset{(1.48)}{36.5328} + \underset{(6.43)}{22.3752}\, \mathit{Hi\_tech}_i - \underset{(-1.51)}{2.5561}\, \mathit{Ln\_sale}_i + \underset{(6.66)}{2.0711}\, \mathit{Mkt\_rtn}_i + \underset{(2.66)}{0.2969}\, \mathit{Ir\_cipo}_i$$

Adjusted $R^2 = 0.3934$

The results show that any one of the two public variables, market index returns and industry factor, indeed has a very strong influence on initial returns. The variable of initial returns of contemporaneous IPOs also has a positive and significant effect on initial returns, but to a lesser degree, while the effect of *Ln_sale* on initial returns is not significant.

7. Herding in Follow-on Fixed-Price Offerings

Given that public information accounts for the lion’s share of investor demand for shares in pure fixed-price offerings, we might ask whether the incorporated public information in auctions also has a strong influence on the herding among investors in follow-on fixed-price offerings.

To answer this question, we conduct a simple test on follow-on fixed-price offerings.

7.1. Publicized information from the auction

Prior to the conduction of follow-on fixed-price offers, the Taiwan Securities Dealer Association releases some information collected from the auction to the public. The information usually includes the quantity-weighted average bidding price for winning bids, the auction clearing price, the open offer price, the demand schedule of winning bids, the identity of winning bidders, the overall oversubscription ratio, the number of bids, and the number of shares (or dollar amount) allocated as well as the bidding price of each winning bid.

The publicized information includes not only public information available prior to the auction period, but also auction bidders' private information; later investors hence evaluate the released information and decide whether to subscribe to shares of follow-on fixed-price offerings.

We abstract some information variables from the released information as follows. First, we use the price-relevant information from investors' bids. Following the spirit of Cornelli and Goldreich (2003), we normalize the quantity-weighted bidding price for winning bids relative to the possible price range of follow-on fixed-price offering.

Formally, the normalized quantity-weighted bidding price (henceforth NQWP) for winning bids is equal to (Pw – Pmin)/(Pmax – Pmin); Pw is the quantity-weighted bidding prices for winning bids; and Pmax and Pmin are, respectively, the maximum and minimum of the initial price range set by the underwriter.[7] The normalized bidding price is above one when the quantity-weighted bidding price is above the maximum of the initial price range.

This normalization procedure adjusts for the price range. The difference between the quantity-weighted bidding price and the minimum price is large when the range is narrow, but small when the range is broad. When the NQWP is high, information reveals that the issuer sets a lower minimum price as insurance, so later investors will aggressively subscribe to shares.

Second, we abstract the quantity-relevant information from investor bids. We capture the quantity-relevant information with the measure of oversubscription (actually the logarithms of oversubscription) as well as the number of bids (also the logarithms of the number of bids). Particularly, we focus on oversubscription corresponding to all bids, measured at a price equal to the lowest bidding price.

Table 6 reports the summary statistics for NQWP, oversubscription from the auction, and number of bids. On average, the NQWP for winning bids is 1.56 (the median is 1.28), reflecting that the initial price range specified by underwriters is relatively low compared to the market's pre-auction expectation of the issue value.

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[7] The average Pmax and Pmin difference for our hybrid auctions is set at NT$22 while the median of the difference

Place Table 6 about here

The mean oversubscription is 3.94 (the median is 3.30), with a range of between 17.20 and 0.39. This fact reflects that some auctions have a very successful result while a few fail. The mean number of bids is 987 (the median is 645), with a range between 5,406 and 39.

7.2. Publicized information and herding

We next analyze the fixed-price subscription following the auction for 77 hybrid IPOs in detail. The released information incorporates not only the public information that was generated before the auction period, but also the investor private information revealed in auctions. To investigate the effect of the incorporated public information on investors' demand for shares, we first abstract the element of public information from investor bids in auctions. As in Table 3, we use the market index return variable (*Mkt_rtn*) and the initial return variable (*Ir_cipo*) to reflect the market conditions, but we here calculate these two public information variables as of the auction's beginning date. We also use the industry factor (*Hi_tech*) and the size of a firm (*Ln_sale*) to capture information on firm characteristics.

We regress the NQWP, the natural logarithm of oversubscription (*Ln_os*), and the natural logarithm of number of bids (*Ln_nob*) on the public information variables: the market index return prior to the auction period, the initial return of other contemporaneous IPOs, the high-tech dummy, and the size of a firm.

Table 7 presents the regression results, showing that investors indeed incorporate public information into their bids. Regression 1 indicates that both *Ir_cipo* and *Hi_tech* have a positive and significant impact on investors' bidding prices of winning bids, suggesting that participants offer higher prices in hot issue markets and for high-tech firms; *Ln_sale* has a negative and significant impact on investors' bidding prices, suggesting that investors submit lower bids for larger firms.

Place Table 7 about here

Regression 2 in Table 7 shows that the initial return variable has a very strong influence on the oversubscription of auctions. What is contrary to our expectation is that neither the market index return nor the high-tech dummy has a significant impact on investor oversubscription at

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is NT$17.

auctions. This result is contrary to our earlier finding on investors' oversubscription of pure fixed-price offerings that the market index return and the high-tech dummy have a positive and significant impact (Reg6, Table 4). In other words, the fixed-price offerings and auctions reflect a different relationship between oversubscription and public information.

We posit that the insignificance of the market index return variable and of the high-tech dummy might be attributable to the participation of institutional investors and large individual investors in IPO auctions. Aggarwal, Prabhala, and Puri (2002) show that institutional investors have better information than retail investors, while Lee, Taylor, and Walter (1999) provide evidence that large investors have better information than small investors. Better-informed investors are in a better position at auction than uninformed investors, and they will definitely condition subscriptions on their private information. The fact that institutional investors and large investors have an active role in Taiwanese IPO auctions presumably dilutes the influence of uninformed investors, resulting in an insignificant relationship between market index returns and oversubscription of auctions.

Another reason for the insignificant relationship between the market return and oversubscription of an auction is that in an auction the price is not set ahead of time, and the market return therefore may be less important. On the contrary, in a fixed-price offering the price is already set, and changes in the market return will therefore have influenced investors' subscriptions.

Regression 3 in Table 7 shows that both *Mkt_rtn* and *Ir_cipo* have a positive and significant impact on the number of bids; this result is somewhat different from what is reported in Regression 2, where only *Ir_cipo* is significantly related to oversubscription. The underlying reason for the difference is that an oversubscription in auctions is equivalent to the quantity-weighted number of bids, where institutional bids and large bids are assigned a greater weight as they demand more shares. In the case of the number of bids, each individual bid is assigned an equal weight, and institutional investors and large investors are hence dominated by retail investors and small investors, who condition their subscriptions on the market index returns, resulting in a significant relation between number of bids and market index returns.

We use the fitted values and the residuals from regressions in Table 7 to capture the incorporated public information and the embedded private information, respectively. In Table 8 we present the results of an analysis that relates the oversubscription of follow-on fixed-price offers to NQWP, *Ln_os*, and *Ln_nob*.

Place Table 8 about here

Regression 1 in Table 8 shows that coefficients for the variables of *Ln_os* (t-statistic = 3.02), NQWP (t-statistic = 2.70), and *Ln_nob* (t-statistic = 3.41) are all positive and very significantly different from zero. This regression has an adjusted R-squared of over 59%, indicating that information released from the auction indeed has a very strong influence on investor demand for shares of follow-on fixed-price offerings.

In order to verify whether public information has a stronger influence than does the embedded private information on investors' demand for shares of follow-on fixed-price offerings, we regress the oversubscription on the fitted values of and on the residuals of NQWP, *Ln_os*, and *Ln_nob*, respectively. Regression 2 relates the oversubscription of follow-on fixed-price offerings to the fitted values; this regression has an adjusted R-squared of over 40%, but none of the coefficients have t-values exceeding 2.0, suggesting an apparent collinearity.

Because the fitted values of *Ln_os* and of *Ln_nob* are highly correlated, we exclude the fitted values of *Ln_nob* and rerun the regression. Regression 3 shows the results; this regression has an adjusted R-squared of over 41%, and the coefficient of the fitted *Ln_os* is significant, but the coefficient of NQWP is not. The results suggest that when later investors subscribe to shares of subsequent offerings, they condition their purchase decisions more on earlier investor actions than on the revealed value of IPO shares.

Regression 4 relates the oversubscription of follow-on fixed-price offerings to the residuals of NQWP, *Ln_os*, and *Ln_nob*; this regression has an adjusted R-squared of above 19%, and there also is an apparent collinearity. We hence rerun the regression by excluding the residuals of *Ln_nob*. Regression 5, similar to Regression 3, shows that the coefficient of residual oversubscription is significant, but the coefficient of NQWP is not. This regression has an adjusted R-squared of 17.26%, suggesting that public information predicts much more of the variation of investors' demand for shares than does private information.

8. Conclusion

Our examination of investors' demand for shares in IPOs indicates that for Taiwanese pure fixed-price offerings the distribution of allocation rates exhibits a U-shaped distribution, as predicted by Chowdhry and Sherman (1996). As a result of the information leakage occurring before investors have finished bidding for shares, they sometimes realize that the offer price is too low or too high, leading to oversubscription or undersubscription.

Further evidence indicates that industry factor and market index returns have a very strong influence on investors' demand for shares and on initial returns. These results are consistent with the predictions of costly information production in Sherman (2005), who argues that the issuer/underwriter should price offerings below the expected value to reduce the risk of failure. The risk of failure will depend on market conditions through the opportunity cost of evaluating and investing in the IPO, so it takes more underpricing to be reasonably sure of attracting investors when market returns are high.

Our results of investors' demand for shares in discriminatory auctions reveal that there are variations in the number of bidders, indicating that herding is unlikely to occur in discriminatory auctions. We propose three explanations, IPO selling methods, investor characteristics, and institutional details of IPO method, of why herding is much less likely to occur in discriminatory auctions than in fixed-price offerings.

Finally, the distribution of allocation rates on follow-on fixed-price offerings suggests that information spills over from auctions to follow-on fixed-price offers. We also find that public information that is incorporated into earlier investor bids has a stronger influence on later investor demand for shares of follow-on fixed-price offers than does the private information that is incorporated into investors' bids.

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Appendix: Pricing rule for follow-on fixed-price offerings

Suppose an issuing firm puts 10,000 IPO shares at the auction with an initial price range of $20 to $30. The issuer will set the offer price for the follow-on fixed-price offering following one of three procedures.

Case 1: Oversubscription and auction clearing price above the initial price range

The Taiwan Securities Dealers Association collects investors' bids and compiles a demand schedule:

Bidder	Shares bid	Bid price
A	4,000	$40
B	6,000	35
C	6,000	31
D	8,000	28
E	8,000	24
F	9,000	22

The Association will fill orders submitted from bidders A and B, who together absorb the 10,000 auctioned shares. As the clearing price, $35 in this case, is above the initial price range, the issuer will take the maximum price of the initial price range, $30 in this case, as the offer price in the follow-on fixed-price offer.

Case 2: Oversubscription and auction clearing price within the initial price range

The Taiwan Securities Dealers Association collects investors' bids and compiles a demand schedule:

Bidder	Shares bid	Bid price
A	2,000	$34
B	2,000	31
C	3,000	28
D	3,000	26
E	4,000	22
F	5,000	20

The Association will fill orders submitted from bidders A, B, C, and D, who together absorb the 10,000 auctioned shares. As the clearing price, $26 in this case, is within the initial price range, the issuer will set the offer price of the follow-on fixed-price offer at the quantity-weighted price calculated from the winning bids with bidding prices within the initial price range, i.e., bids from C and D. In this case, the offer price is set at \$27 (\$28 × 3,000 shares/6,000 shares ＋ \$26 × 3,000 shares/6,000 shares).

Case 3: Undersubscription

The Taiwan Securities Dealers Association collects investors' bids and compiles a demand schedule:

Bidder	Shares bid	Bid price
A	1,000	\$26
B	1,000	24
C	2,000	22
D	2,000	20
E	-	-
F	-	-

Since the total number of shares wanted is less than the number of auctioned shares, the Association will fill all investors' orders, and the issuer will set the auction base price, \$20 in this case, as the offer price of the follow-on fixed-price offer.

Figure 1: Timing of hybrid selling procedure

Step 1: The minimum price and initial price range are chosen
Step 2: Investors submit price/quantity bids
Step 3: Discriminatory allocation to investors
Step 4: Set the open offer price within the initial price range
Step 5: Investors submit subscriptions to open offer
Step 6: Open offer allocation by lottery
Step 7: Shares traded on Exchange

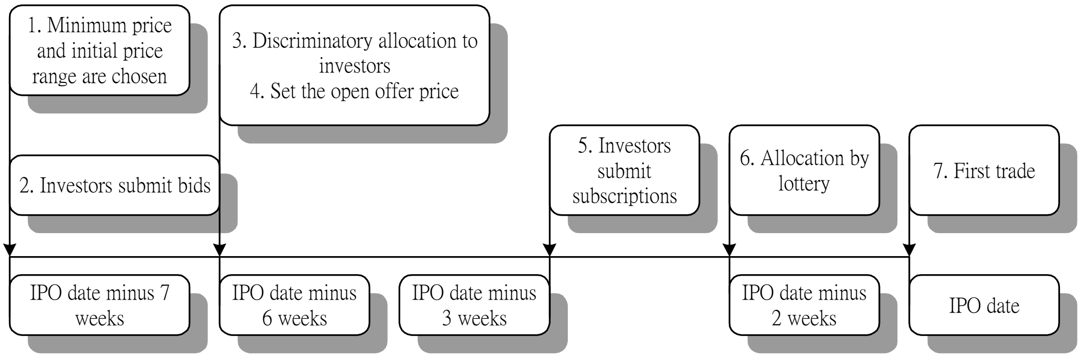
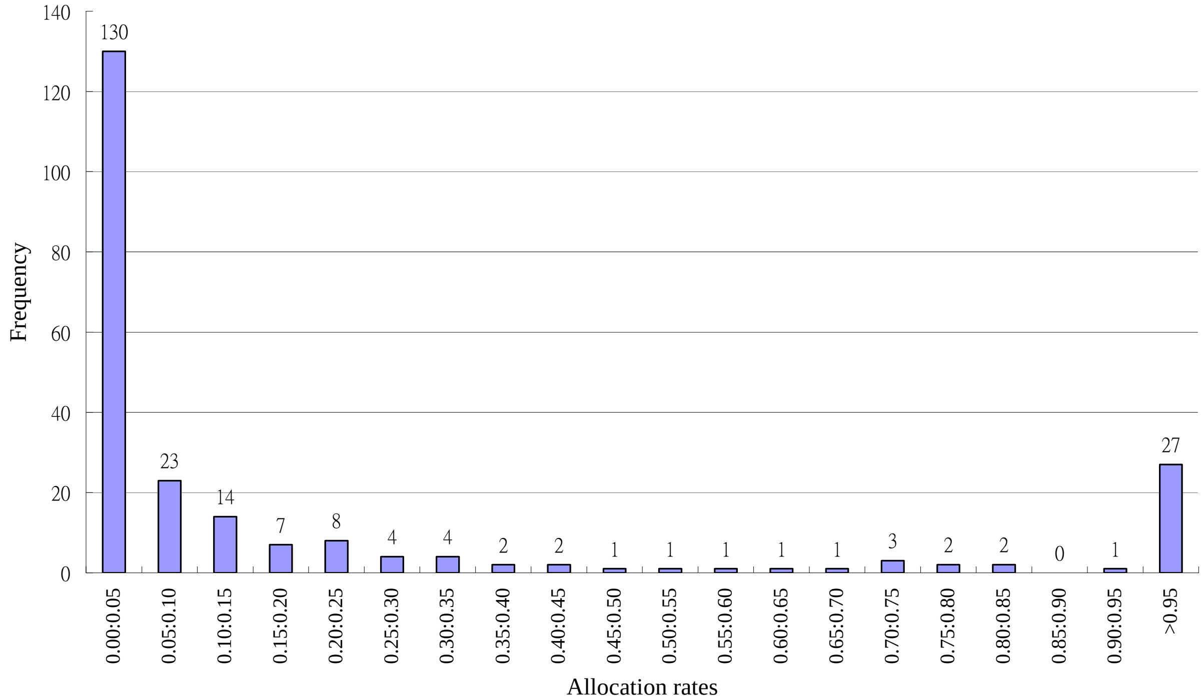


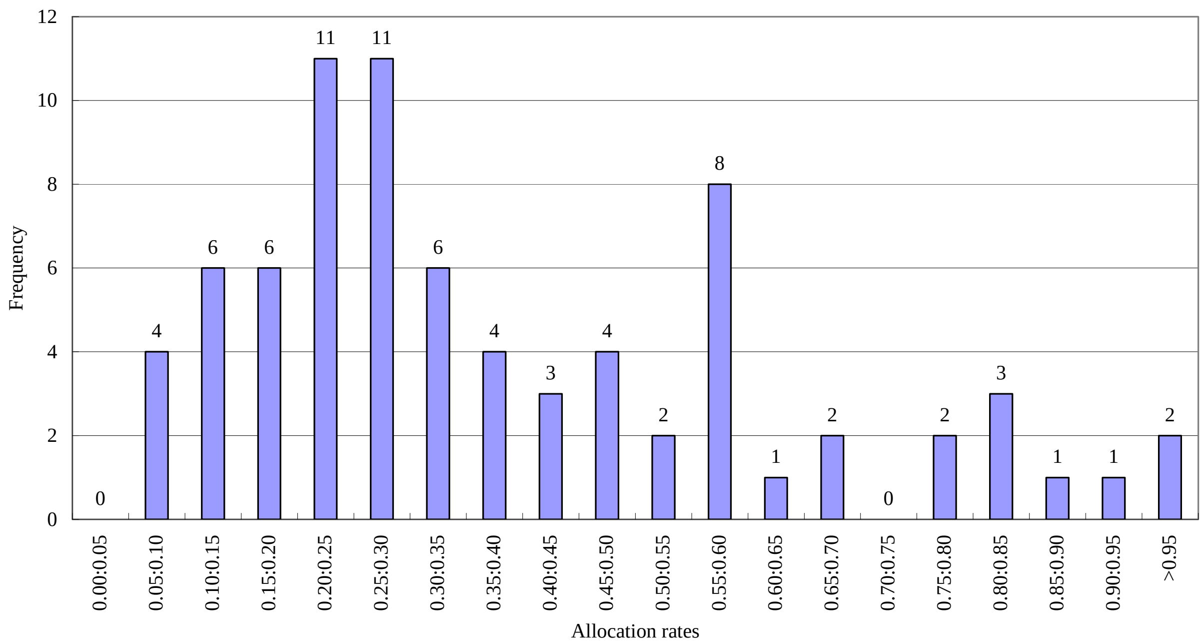
Figure 2: Distribution of allocation rates for 234 pure fixed-price offerings



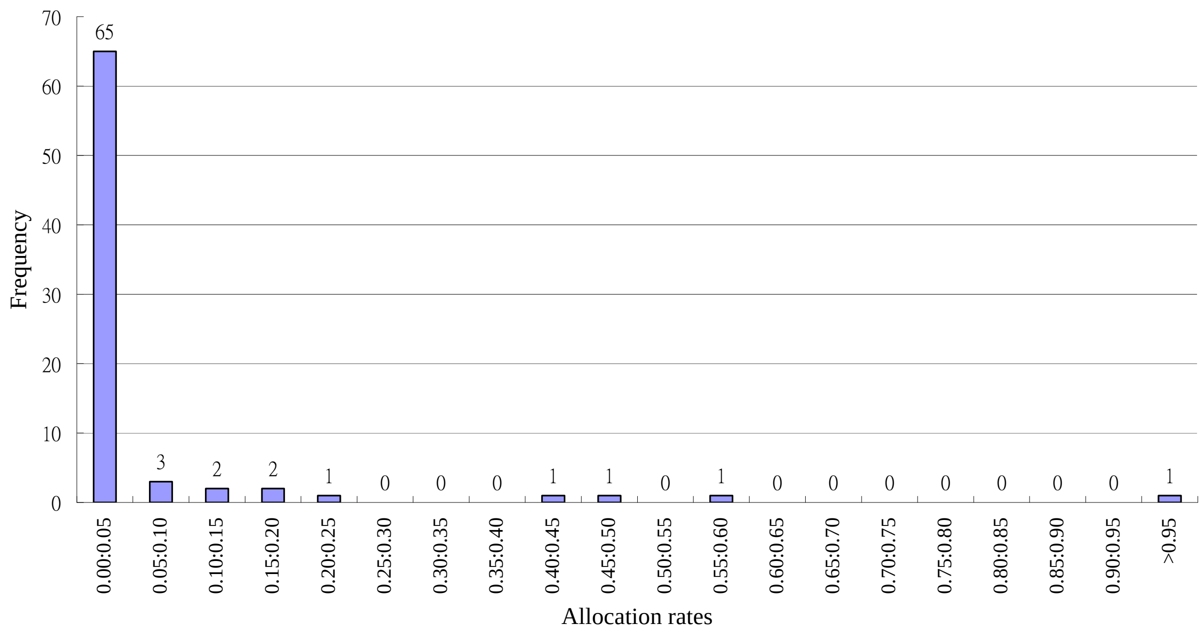
The histogram shows the allocation rates to investors calculated as the ratio of issued shares to the total demand for shares at the pure fixed-price offerings. The average is 0.4656.

Figure 3: Distribution of allocation rates for 77 IPO auctions

A. Discriminatory auctions

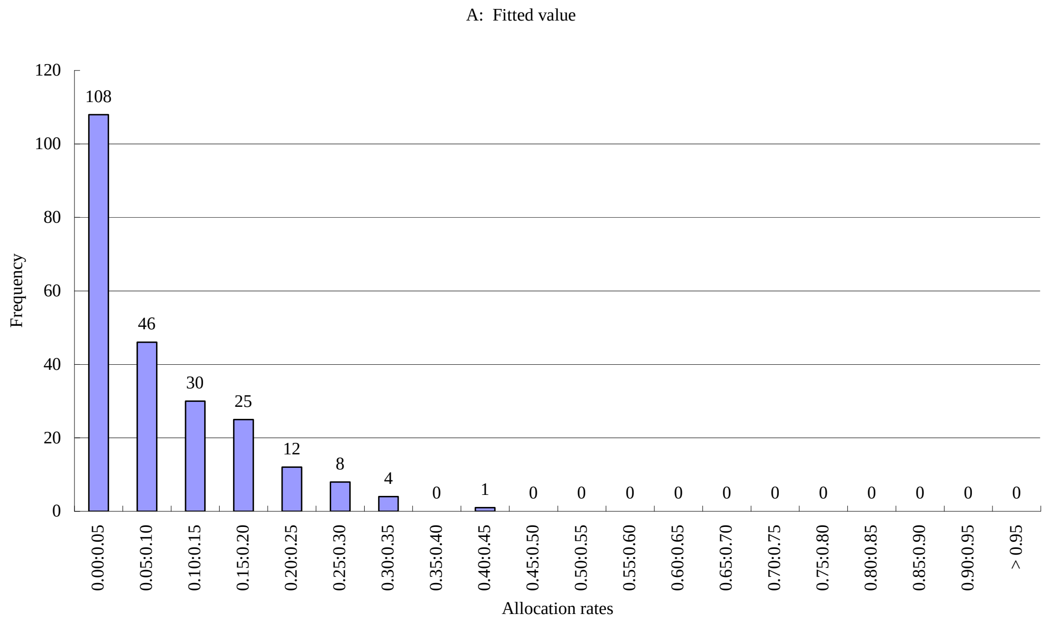


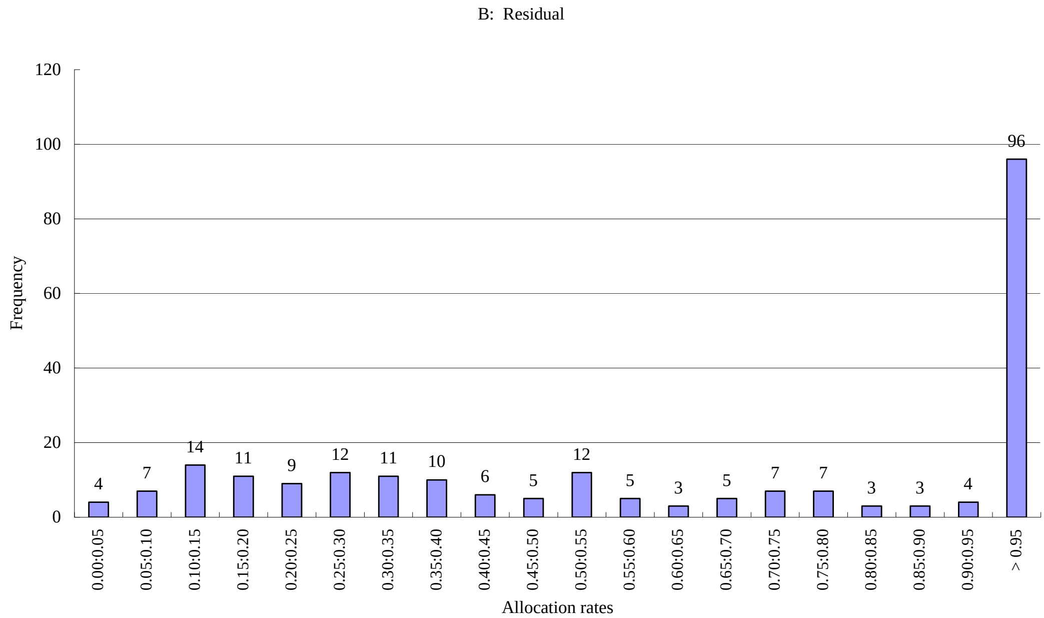
B. Follow-on fixed-price offerings



The first histogram shows the allocation rates calculated as the ratio of issued shares to total demand for shares of 77 discriminatory auctions. The average allocation rate is 0.4056. The second histogram shows the allocation at the follow-on fixed-price offerings. The average is 0.0758.

Figure 4: Distribution of fitted and of the residual allocation rates for 234 pure fixed-price offerings





The first histogram shows the distribution of the fitted allocation rates for 234 pure fixed-price IPOs and the second shows the distribution of the residual allocation rates. The fitted values and residuals are from Reg5 of Table 4.

Table 1
Number of IPOs categorized by year, offer type, exchange, and industry

IPOs with closed-end funds and Taiwan Depository Receipts have been excluded. We collect the original sample from the database of the Taiwan Securities Dealers Association. 311 sample companies went public during the sample period from January 1996 through June 2000. TSE represents the Taiwan Stock Exchange and OTC represents the over-the-counter market.

Year	Total Number of IPOs	Pure Fixed-price Offers					Hybrid Offers				
		Exchange		Industry		Total	Exchange		Industry		Total
		TSE	OTC	High-tech	Traditional		TSE	OTC	High-tech	Traditional	
1996	65	31	28	24	35	59	5	1	1	5	6
1997	35	4	8	1	11	12	16	7	7	16	23
1998	53	9	21	9	21	30	13	10	15	8	23
1999	111	11	81	41	51	92	8	11	12	7	19
2000	47	6	35	22	19	41	2	4	6	0	6
Total	311	61	173	97	137	234	44	33	41	36	77

Table 2
Summary statistics for 311 IPOs by year

The allocation rate is the total supply of shares divided by total demand of shares. Because of the 7 percent daily limit imposed on the price movements of securities traded in Taiwanese stock markets, security prices may continue to hit the limit many days following the listing day. Therefore, the initial returns are the cumulative returns until the day on which the limit is not hit. Sales are based on financial statements of the year preceding the IPO. Age is the number of years from the year of inception of the firm to the IPO year. During the sample period, the exchange rate ranges from about 27 to 35 NT$/US$.

Panel A: Pure Fixed-price Offers

Year	Number of IPOs by Allocation Rate			Total Number of IPOs	Initial Return Mean [Median] (%)	IPO Proceeds Mean [Median] (NT$ millions)	Fraction of Equity Sold Mean [Median] (%)	Issue Price Mean [Median] (NT$)	Sales Mean [Median] (NT$ billions)	Age Mean [Median] (years)
	Greater than 0.95	Less than 0.05	Between 0.95 and 0.05							
1996	8	29	22	59	21.60 [14.28]	640.20 [260.93]	16.24 [10.20]	29.55 [25.00]	4.96 [1.90]	16.81 [13.50]
1997	0	12	0	12	55.14 [69.34]	532.36 [136.97]	13.32 [5.81]	28.88 [25.00]	6.15 [1.60]	23.95 [19.08]
1998	2	12	16	30	3.91 [-1.96]	879.87 [267.54]	25.18 [7.50]	34.32 [32.25]	4.38 [1.86]	18.19 [13.45]
1999	17	44	31	92	14.98 [5.35]	224.92 [136.57]	7.09 [4.15]	35.37 [29.00]	2.13 [1.28]	18.66 [16.37]
2000	0	34	7	41	39.78 [31.37]	248.14 [171.30]	5.44 [3.79]	46.34 [36.00]	2.52 [1.01]	16.75 [16.67]
Total	27	131	76	234	21.64 [12.30]	433.43 [165.26]	11.75 [5.00]	35.36 [28.50]	3.41 [1.38]	18.07 [15.23]

Table 2 (continued)

Panel B: Hybrid Offers

Year	Number of IPOs by Allocation Rate (followed-on fixed-price offers)			Total Number of IPOs	Initial Return Mean [Median] (%)	IPO Proceeds Mean [Median] (NT$ millions)	Fraction of Equity Sold Mean [Median] (%)	Issue Price Mean [Median] (NT$)	Sales Mean [Median] (NT$ billions)	Age Mean [Median] (years)
	Greater than 0.95	Less than 0.05	Between 0.95 and 0.05							
1996	0	4	2	6	36.23 [29.89]	1,482.87 [871.57]	26.88 [19.68]	46.46 [44.25]	4.98 [1.70]	24.57 [23.34]
1997	0	22	1	23	22.71 [20.07]	1,258.13 [783.36]	19.97 [15.31]	54.94 [51.00]	6.58 [2.13]	19.53 [18.52]
1998	0	22	1	23	12.77 [12.52]	921.14 [573.70]	13.23 [11.10]	68.13 [54.00]	2.82 [1.65]	14.15 [12.41]
1999	1	11	7	19	13.40 [6.74]	1,051.44 [448.15]	12.25 [7.47]	73.79 [40.01]	5.16 [1.73]	16.00 [15.88]
2000	0	6	0	6	76.88 [72.33]	607.77 [621.70]	8.40 [7.78]	75.27 [70.80]	2.69 [2.58]	11.32 [6.37]
Total	1	65	11	77	22.72 [13.41]	1,073.30 [680.40]	15.69 [11.68]	64.46 [51.00]	4.68 [1.81]	16.80 [14.70]

Table 3
Descriptive statistics for public information variables on 311 IPOs

Ln_sale, a variable proxy for firm size, is the natural logarithm of the yearly sales preceding the IPO year. *Hi_tech* is a dummy variable equal to 1 if the firm is a high technology firm. *Market index return variable*, which captures market conditions, is constructed as a three-month weighted average of the buy-and-hold returns of the Taiwan Stock Exchange index with weights of 3 for the most recent month, 2 for the next month, and 1 for the third month before the subscription beginning date. *Oversubscription variable*, which measures the demand of other contemporaneous IPOs, is constructed as a three-month weighted average of the monthly average oversubscription of other contemporaneous IPOs for each of the three months before the subscription beginning date. *Initial return variable*, which measures the pricing of other contemporaneous IPOs, is constructed as a three-month weighted average of the arithmetic average initial return of other contemporaneous IPOs for each of the three months before the subscription beginning date.

		Pure Fixed-Price Offerings	Follow-on Fixed-Price Offerings	Mean Differences (t-statistic)
Ln_sale	Mean	14.2585	14.6580	-0.3995
	Std. dev.	1.0797	1.0004	(-2.96)*
	Median	14.1363	14.4068	
Hi_tech	Total number	97	41	
	Percent (%)	41.45	53.25	11.79
				(-1.79)
Market index return variable (%)	Mean	2.6393	0.4583	2.1811
	Std. dev.	5.8674	6.6674	(2.55)*
	Median	1.9400	0.2117	
Oversubscription variable	Mean	58.5732	81.1222	-22.5491
	Std. dev.	45.2803	69.6433	(-2.65)*
	Median	37.8084	62.2305	
Initial return variable (%)	Mean	18.3041	19.0311	-0.7270
	Std. dev.	16.9012	18.0738	(-0.31)
	Median	15.0223	16.1059	

* Significant at the 5% level.

Table 4
Oversubscription for 234 pure fixed-price offerings

This table presents regression coefficients (and White's (1980) heteroskedasticity-adjusted t-statistics in parentheses) for various model specifications on 234 pure fixed-price offerings. The dependent variable in these regressions is the natural logarithm of the open offer oversubscription. *Mkt_rtn* is the *market index return*, which is constructed as a three-month weighted average of the buy-and-hold returns of the Taiwan Stock Exchange index with weights of 3 for the most recent month, 2 for the next month, and 1 for the third month before the subscription beginning date. *Ln_os* is the natural logarithm of the *oversubscription variable*, which is constructed as a three-month weighted average of the monthly average oversubscription of other contemporaneous IPOs for each of the three months before the subscription beginning date. *Ir_cipo* is the *initial return variable*, constructed as a three-month weighted average of the arithmetic average initial return of other contemporaneous IPOs for each of the three months before the subscription beginning date. *Hi_tech* is a dummy variable equal to 1 if the firm is a high technology firm. *Ln_sale*, a variable proxy for firm size, is the natural logarithm of the yearly sales preceding the IPO year.

Dependent Variable	*Ln(oversubscription)*					
	Reg1	Reg2	Reg3	Reg4	Reg5	Reg6
Intercept	2.4653 (18.04)*	-0.9805 (-1.77)	0.0978 (0.18)	1.9705 (10.78)*	0.0895 (0.13)	2.5806 (1.84)
Mkt_rtn	0.1555 (9.11)*		0.1135 (6.08)*		0.1138 (5.26)*	0.0932 (4.66)*
Ln_os		1.0273 (7.20)*	0.6603 (4.25)*		0.6636 (3.06)*	0.3617 (1.90)
Ir_cipo				0.0495 (7.32)*	-0.0003 (-0.02)	0.0148 (1.65)
Hi_tech						1.8673 (10.16)*
Ln_sale						-0.1650 (-1.80)
Adjusted R-squared	20.32%	17.38%	25.84%	16.98%	25.52%	47.29%

* Significant at the 5% level.

Table 5
Descriptive statistics for fitted allocation rates and residual allocation rates

The fitted and residual oversubscriptions in Table 4 are transformed into fitted and the residual allocation rates in this table. The fitted values in Reg1 through Reg6 are the fitted allocation rates equivalent to 1/oversubscription, where the oversubscription is the antilogarithm of fitted *ln(oversubscription)* in Reg1 to Reg6 of Table 4, and the residuals in Reg1 to Reg6 are the residual allocation rates equivalent to 1/(residual oversubscription), where the residual oversubscription is the antilogarithm of residuals in Reg1 to Reg6 of Table 4.

Item		Mean	Std Dev	Median	Max.	Min.
Reg1	Fitted value	0.0800	0.0661	0.0629	0.4153	0.0057
	Residual	6.6456	23.2168	0.7644	231.3768	0.0125
Reg2	Fitted value	0.0786	0.0623	0.0639	0.2486	0.0116
	Residual	7.9651	28.9667	0.5995	299.3985	0.0582
Reg3	Fitted value	0.0879	0.0783	0.0588	0.4074	0.0054
	Residual	7.2056	29.0235	0.7255	306.6873	0.0394
Reg4	Fitted value	0.0736	0.0448	0.0663	0.1832	0.0066
	Residual	7.1399	24.0855	0.7373	268.8248	0.0232
Reg5	Fitted value	0.0880	0.0784	0.0590	0.4080	0.0054
	Residual	7.2080	29.0366	0.7265	306.6567	0.0394
Reg6	Fitted value	0.1232	0.1411	0.0640	0.7103	0.0019
	Residual	3.7304	12.3069	0.8452	135.9143	0.0166

Table 6
Summary statistics for publicized information variables

The sample is 77 hybrid IPOs from January 1996 through June 2000 offered on the Taiwan Stock Exchange (44) and over-the-counter (33). NQWP (winning bids) is the normalized quantity-weighted bidding price for winning bids, which is equal to (Pw – Pmin)/(Pmax – Pmin), where Pw is the quantity-weighted bidding price for winning bids, and Pmax and Pmin are, respectively, the maximum and the minimum of the initial price range announced by the underwriter. Oversubscription in auctions is given by total demand/supply of shares, where demand is measured at the lowest bidding price.

Item	Mean	Std Dev	Maximum	Minimum	Median
NQWP (winning bids)	1.56	1.20	7.87	0.11	1.28
Oversubscription (auction)	3.94	2.98	17.20	0.39	3.30
Number of bids (auction)	987.09	1,120.08	5,406	39	645

Table 7
Public information and investor bids for 77 IPO auctions

This table reports coefficients (and White's (1980) heteroskedasticity-adjusted t-statistics in parentheses) for regressions related to the effect of market index returns, initial returns, industry and firms' sales on investors' bidding prices, the over-subscription, and the number of bids. *NQWP* (winning bids) is the quantity-weighted bidding price for winning bids normalized to the price range. *Ln_os* is the logarithm of total demand/supply of shares, where demand is measured at the lowest bidding price. *Ln_nob* is the natural logarithm of the number of bids. *Mkt_rtn* is the market index return prior to the auction period. *Ir_cipo* is the initial return of other contemporaneous IPOs prior to the auction period. *Hi_tech* is a dummy set to one for issuers in a high-tech industry. *Ln_sale* is the logarithm of annual sales.

Dependent Variable	*NQWP* (winning bids)	*Ln_os*	*Ln_nob*
Independent Variable	Reg1	Reg2	Reg3
Intercept	3.67 (2.55)*	-0.24 (-0.22)	0.62 (0.41)
Mkt_rtn	0.02 (0.63)	-0.01 (-0.98)	0.06 (2.64)*
Ir_cipo	0.03 (3.78)*	0.02 (5.22)*	0.02 (2.38)*
Hi_tech	0.78 (3.33)*	0.14 (0.95)	0.31 (1.48)
Ln_sale	-0.22 (-2.16)*	0.06 (0.80)	0.35 (3.36)*
Adjusted R-squared	31.21%	24.54%	35.92%
N	77	77	77

* Significant at the 5% level.

Table 8
Regression analyses of oversubscription to publicized information: 77 follow-on fixed-price offerings

The dependent variable is the natural logarithm of oversubscription in follow-on fixed-price offerings. *Ln_os* is the natural logarithm of the oversubscription in auctions, which is given by total demand/supply of shares, where demand is measured at the lowest bidding price. *NQWP* is the normalized quantity-weighted bidding price for winning bids, which is equal to (Pw – Pmin)/(Pmax – Pmin), where Pw is the quantity-weighted bidding price for winning bids and Pmax and Pmin are, respectively, the maximum and the minimum of the initial price range announced by the underwriter. *Ln_nob* is the natural logarithm of the number of bids in auctions. Fitted values and residuals are derived from regressions of Table 7. In parentheses are White's (1980) heteroskedasticity-adjusted t-statistics.

Dependent Variable	*Ln[Oversubscription (follow-on fixed-price offerings)]*				
	Reg1	Reg2	Reg3	Reg4	Reg5
Intercept	0.1847 (0.25)	0.1582 (0.10)	0.9500 (1.59)	4.0289 (30.09)*	4.0289 (29.52)*
Ln_os	0.6202 (3.02)*				
Fitted value		2.3168 (2.00)*	2.7682 (3.11)*		
Residual				0.5027 (1.38)	0.9397 (3.86)*
NQWP	0.3317 (2.70)*				
Fitted value		0.0139 (0.04)	-0.0499 (-0.14)		
Residual				0.1580 (0.86)	0.1182 (0.66)
Ln_nob	0.4125 (3.41)*				
Fitted value		0.1901 (0.55)			
Residual				0.4035 (1.65)	
Adjusted R-squared	59.38%	40.74%	41.11%	19.28%	17.26%

* Significant at the 5% level.