IPO 折價與訊息的代理變數
IPO Underpricing and Information Proxy: A Note

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摘 要

本文以臺灣IPO市場的競價拍賣為樣本，探討投資人的身分類別(機構投資人、散戶)以及申購金額(大戶、小戶)兩種資訊代理變數的解釋能力。結果發現，申購金額大小是較好的資訊代理變數。本文也分別以申購以及分配的資料，來檢定兩種資訊不對稱的代理變數對於新股上市初期報酬的解釋程度。實證結果顯示，無論在申購的資料，或是分配的資料，申購金額大小的差異比投資人之身分別有較好的解釋能力，此外，在解釋新股上市初期報酬的能力上，申購資料較分配資料有較強的解釋力。

Abstract

This paper compares the capability of investor's type (institutional vs. individual investors) and of application value (large vs. small investors) to proxy for the information asymmetry among investors in IPOs. The results show that application value is a better information proxy than investor's type. We also examine the relative merit of investor's type and application value as an information proxy in explaining the initial profit in both application and allocation schedules. Empirical results show that application value has a stronger explanative power than investor's type in both application and allocation schedules. Moreover, application schedule has a stronger explanative power than allocation schedule in explaining initial profits.

關鍵字：初次公開上市、訊息的代理變數、上市初期報酬
Keywords: IPOs; Information proxy; Initial profits.

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1. Introduction

The initial underpricing in initial public offerings (IPOs) is an international popular phenomenon[1], and information asymmetry among investors is an important determinant of underpricing in IPOs.[2] Rock (1986) modeled the concept of the winner's curse to the new-issue market by incorporating information asymmetry between two groups of investors, informed and uninformed groups. Traditionally, institutional investors are assumed to be better informed than individual investors (Hanley and Wilhelm (1995)). However, if information of investor's type is not available, the usual situation in IPOs, large investors with large application values are assumed to be better informed than small investors (Koh and Walter (1989)).

Field (1997) indicates that institutional investors may be better informed about IPO value by examining post-issue institutional holdings, while Lee, Taylor, and Walter (1999) present the direct evidence that large investors have an information advantage over small investors for Singaporean IPOs. Lee et al. are unable to verify if application value is a better information proxy than investor's type as investor's types are not available to them.

This paper tests whether investor's type or application value is a better information proxy using a unique Taiwanese IPO auction dataset containing both investor's types and application values. Before 1995 December, investors in Taiwan could acquire IPO shares via the fixed-price mechanism. Since the size of the order that an investor could subscribe was normally limited to within one to five lots (1,000 shares per lot), institutional investors are not interested in acquiring IPO shares. Beginning in 1996, issuing firms and underwriters could alternatively use a two-stage hybrid mechanism, combining auction and fixed-price, to distribute shares with 50% of the shares to be auctioned followed by a fixed-price offer for the remaining shares.

Under the auction mechanism, the underwriter and issuer announce the number of shares to be auctioned, the minimum acceptable price (i.e., base price) and the possible price range for the subsequent open offer price.[3] Both institutional and individual investors can subscribe shares with any bidding price above or equal to the base price set by the issuing firm. The size

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[1] Please refer to Loughran, Ritter and Rydqvist (1994) and Ritter (1998). For the underpricing evidence in Taiwan, please refer to Lin (1995) and Chen (1997).

[2] Other theories including investors sentiment and signaling hypotheses have been advanced for the initial underpricing phenomenon. In general, these theories are not mutually exclusive. The focus of this paper is not to distinguish these theories.

[3] Before December 1999, the range is from the base price to 1.5 times of it. After December 1999, the range is 1.3 times of the base price instead of 1.5 times.

of an order could be up to 3% of the entire new issue.

If over-subscription occurred, the allocation would be based solely on the bidding prices submitted by investors. Orders with higher bidding prices would be filled first until all of the new shares were completely allocated. Lottery is employed to fill orders with the same bidding price. If undersubscription occurs, the unsold shares are lumped with the remaining 50% of shares originally designated for the subsequent open offer. Since the auction is a discriminatory one, each winning bidder pays what he bids.

The subsequent open offer is conducted about three calendar weeks later after the auction. The price in open offer is determined as follows: if bidding prices for all winning bids in the auction are above the maximum price of initial price range, the offer price is set at the maximum price. On the other hand, if it is not the case, winning bids with bidding prices greater than the maximum price are first eliminated and the offer price is set at the quantity-weighted price calculated with the remained winning bids with bidding prices less than the maximum price. The two-stage hybrid selling procedure in Taiwan IPO market is shown in Figure 1.

Drawing on application data and allocation data from a sample of 75 IPOs issued through the auction allocation during the period 1996 – 2000, we found that both investor's type and application value are good information proxies. However, application value is better than investor's type. Besides, our empirical results lend supports to the winner's curse hypothesis proposed by Rock (1986). The rest of this paper is organized as follows. Section 2 describes the data and methodology. Empirical results are reported in Section 3. The final section concludes this paper with a summary.

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 Exchanges

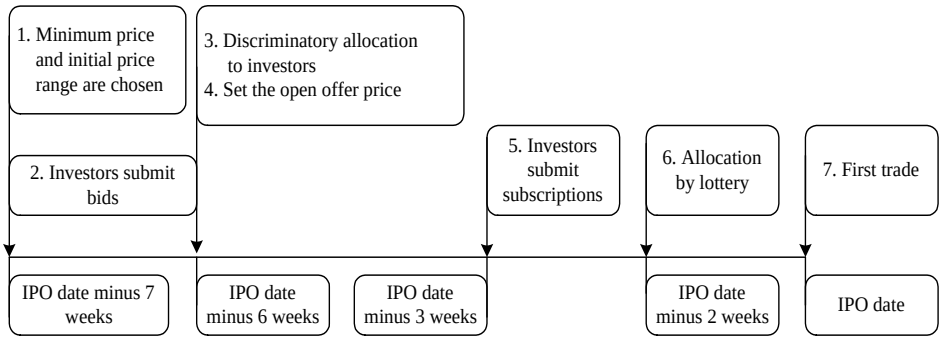


Figure 1 Timing of the Hybrid Selling Procedure

2. Data and methodology

1. Data

Our original sample consisted of 77 new issues during the sample period from January 1996 to April 2000.[4] We acquired the sample data through the Chinese Securities Association. Of the 77-issue samples, 45 issues were traded on the Taiwan Stock Exchange while 32 issues were traded on the OTC market. The data set contains information on individual bidding for each issue, including the identity of investors (institutional or individual investors), bidding sizes and bidding prices. Whether an order was filled or not was also indicated in this data set. Orders were filled according to bidding prices submitted from investors until all shares were completely allocated.[5]

The original sample includes two utility companies. These two utility IPOs were excluded from the original sample because utility firms are regulated and foreign institutional investors are not allowed to participate in the IPO auction. Hereafter the analyses are based solely on the 75 IPOs.

[4] These 77 IPOs are distributed as follows: 6 in 1996, 23 in 1997, 23 in 1998, 19 in 1999, and 6 in 2000.
[5] If two or more investors have the same bidding price, the lottery will be used to set the filling priority among these investors.

Table 1 reports summary statistics for the application and allocation of the 75 IPOs. The number of lots put up at auction, ranging from 38,788 to 1,362, averaged 8,000, while the total subscription number from the investors averaged 30,024, which is roughly 3.75 times the average number put up at auction. The results reported in Table 1 show that the total number of shares subscribed by individual investors was about 3 times that by institutional investors. This reflects the fact that individual investors participate actively and repeatedly in IPOs.[6]

Table 1 Summary statistics for 75 Taiwanese IPOs at auction during the sample period [a]: Investor's identity

	Mean	Std. Dev.	Maximum	Minimum	Median
Lots at auction	8,000	6,943	38,788	1,362	5,840
Total bidding lots [b]	30,024	35,892	210,141	944	18,389
Individual	22,392	26,021	144,640	797	14,680
Institutional	7,633	11,093	65,501	0	4,184
Average number of lots per bidding	35.97	20.65	115.83	10.26	31.69
Individual	29.86	19.11	110.54	7.17	25.94
Institutional	125.20	72.89	332.49	7.50	109.45
Lot-weighted average bidding price [c] (NT$)	72.95	60.24	434.12	17.79	52.45
Individual	72.91	60.05	432.81	17.87	52.08
Institutional	74.01	61.07	436.02	16.83	52.12

cont.

	Mean	Std. Dev.	Maximum	Minimum	Median
Average dollar value per bidding (NT$M)	2.171	1.257	7.756	0.258	2.202
Individual	1.726	0.922	5.337	0.221	1.589
Institutional	7.921	5.215	27.207	0.225	7.357
Fractions of shares allocated [d]					
Individual	80.90%	17.46%	100%	28.49%	86.02%
Institutional	19.10%	17.46%	71.51%	0%	13.98%

[6] Although individual investors are more active in IPOs, institutional investors play an important role in IPOs at auction. Of the 75 new issues at auction, two were under-subscribed in which no institutional investors participated.

Average size of successful applications (lots)	50.73	35.81	193.73	11.60	37.17
Individual	44.76	36.22	205.22	8.16	31.78
Institutional	125.32	80.29	414.76	25.00	105.17
Lot-weighted average price of successful applications (NT$)	79.67	65.43	457.01	19.09	55.48
Individual	79.71	65.39	456.65	19.09	56.17
Institutional	85.06	67.25	457.65	21.00	58.75
Average dollar value of successful applications (NT$M)	3.612	3.679	26.866	0.258	2.707
Individual	3.120	3.631	28.465	0.221	2.088
Institutional	9.228	6.443	27.863	0.704	7.139
Allocation percentage within each class					
Individual	0.4507	0.2544	1	0.0747	0.3584
Institutional	0.3508	0.2986	1	0	0.2478

a. These 75sample IPOs were brought to market at auction during the period January 1996 to April 2000.

b. Of 75 IPOs, institutional investors did not submit any bids for 2 IPOs.

c. The lot-weighted average bidding price is the sum of the bidding prices weighted by their respective order sizes for all applications.

d. Of 75 IPOs, institutional investors received no allocations for 8 IPOs.

Moreover, individual investors also account for a lion's share of allocated shares. The statistics reported in Table 1 indicate that the average individual allocation (80.9%) is around 4 times the institutional allocation (19.1%).[7] Although the institutional investors, on average, accounted for approximately one quarter of the applications, these allocation results reveal that institutional investors, compared to individual investors, are allocated relatively fewer shares than they apply for. However, the average number of lots allocated to each institutional investor is 125, which is 2.8 times that allocated to each individual investor.

Furthermore, the weighted average price of received allocations were NT$85.06 and NT$79.71 respectively, for institutional and individual inves-

[7] Besides the two under-subscribed IPOs, institutional investors received no allocation in six over-subscribed IPOs.

tors. These results suggest that institutional investors, in contrast to individual investors, are more aggressive in IPO bidding, as they might possess more information concerning a firm's value. The average dollar value for successful institutional investors is around NT$9 million, far exceeding the NT$3 million from individual investors. Finally, the fractions of shares allocated to the individual and institutional class within each class were 45% and 35%, respectively.

To make our results comparable to those reported in Lee, Taylor, and Walter (1999), we followed them to categorize investors into four classes, namely small, medium/small, medium, and large investors, based on the value of the stock applications. Small investors are defined as those who apply for up to NT$500,000 stock value in each issue. Medium/small investors apply for stock in the range of NT$500,001 to NT$2,000,000. Medium investors apply for stock in the range of NT$2,000,001 to NT$8,000,000 and large investors apply for stock valued greater than NT$8,000,000.

Table 2 reports summary statistics for the application and allocation of the 75 IPOs for these four categories of investors. Table 2 indicates that large investors, on average, account for approximately half of the application, though they are allocated only 42%. These results together with the results in Table 1 indicate that a lot of large investors are individual investors since individual investors account for approximately 75% the application and 81% the allocation. The large investors have the largest weighted average bidding price, while the small investors have the smallest bidding price. These results also suggest that the large investors possess more information than other investors and they are more aggressive in IPO biddings. Finally, fractions of shares allocated to each class of investors are respectively 32%, 37%, 42%, and 39% for small, medium/small, medium, and large investors.

Table 2 Summary statistics for 75 Taiwanese IPOs at auction during the sample period [a]: Application value

	Mean	Std. Dev.	Maximum	Minimum	Median
Total bidding lots	30,024	35,892	210,141	944	18,389
Small	2,344	3,699	17,745	62	1,042
Medium/small	5,757	7,913	42,387	235	3,289
Medium	8,854	9,442	54,116	147	5,774
Large[b]	15,269	17,649	107,166	100	9,380
Average number of lots per	35.97	20.65	115.83	10.26	31.69

bidding					
Small	5.36	2.68	12.40	1.00	5.34
Medium/small	21.44	13.14	71.36	2.73	19.11
Medium	80.18	44.95	223.53	9.09	75.29
Large	247.70	118.64	538.68	59.38	243.74
Lot-weighted average bidding price [c] (NT$)	72.95	60.24	434.12	17.79	52.45
Small	68.69	56.19	416.92	16.21	47.73
Medium/small	70.60	57.16	419.47	18.03	50.97
Medium	72.96	59.86	429.18	17.87	51.65
Large	82.25	63.21	436.01	23.40	60.07
Average dollar value per bidding (NT$M)	2.171	1.257	7.756	0.258	2.202
Small	0.262	0.057	0.431	0.141	0.257
Medium/small	1.002	0.101	1.383	0.820	0.991
Medium	3.935	0.544	6.191	2.327	3.920
Large	15.592	5.830	32.356	8.000	14.480
Fractions of shares allocated [d]					
Small	5.70%	8.36%	55.83%	0[d]	3.04%
Medium/small	17.24%	16.03%	83.48%	0	11.24%
Medium	35.08%	22.52%	99.22%	4.38%	30.38%
Large	41.98%	29.91%	94.57%	0	44.71%
Average size of successful applications (lots)	50.73	35.81	193.73	11.60	37.17
Small	5.03	3.03	20.00	1.00	4.56

cont.

	Mean	Std. Dev.	Maximum	Minimum	Median
Medium/small	19.30	11.92	62.93	2.72	16.26
Medium	72.83	41.72	222.00	9.71	65.96
Large	252.32	151.59	998.40	49.00	234.88
Lot-weighted average price of successful applications (NT$)	79.67	65.43	457.01	19.09	55.48
Small	79.44	65.49	460.15	19.00	56.87
Medium/small	80.66	66.00	458.86	19.29	56.77
Medium	79.82	65.62	458.67	18.94	55.54
Large	87.95	68.59	456.69	23.40	61.33

Average dollar value of successful applications (NT$M)	3.612	3.679	26.866	0.258	2.707
Small	0.280	0.064	0.491	0.160	0.264
Medium/small	1.045	0.154	1.628	0.799	1.027
Medium	4.022	0.732	7.328	2.167	4.061
Large	17.083	9.483	61.639	8.295	14.471
Allocation percentage within each class					
Small	31.94%	28.80%	100%	0	22.83%
Medium/small	37.04%	29.08%	100%	0	27.60%
Medium	41.44%	26.91%	100%	4.68%	34.28%
Large	39.42%	30.70%	100%	0	34.49%

a. These 75sample IPOs were brought to market at auction during the period January 1996 to April 2000.

b. Small investors were defined as those who applied for up to NT$500,000 dollars worth of shares in each issue. Medium/small investors applied for NT$500,001 to NT$2,000,000. Medium investors applied for NT$2,000,001 to NT$8,000,000 and large investors were defined as those who applied for more than NT$8,000,000 worth of stock.

c. The lot-weighted average bidding price is the sum of bidding prices weighted by their respective order sizes for all applications.

d. Of 75 IPOs, small investors received no allocation for 2 IPOs. Medium/small investors received no allocation for any IPO. Large investors received no allocation for 13 IPOs.

2. Methodology

This study investigated whether investor's type or application value is a better information proxy using a unique Taiwanese IPO auction dataset. The Taiwan stock markets institute a price limit, a popular mechanism among Asian countries, to dampen market volatility.[8] The price limit mechanism complicates the calculation of initial returns. This is the case because if the closing price hits the limit on the first trading date, the initial return might be overestimated if the lower limit is hit or underestimated if the upper limit is hit. To cope with this issue, if the closing price hits the limit on the first trading date, the initial return is calculated over an initial listing period (i.e. honey-moon period) beginning from the first trading date to the trading date that the limit is not hit.

[8] Currently, the individual stock price is allowed to move up or down 7% relative to the closing price on the preceding trading date in the Taiwan stock markets.

The average time length between the offering date and the first trading date is approximately two months. When an investor submits a bid for shares in a new issue in Taiwan, 30% of the bidding dollar value of the shares applied for must be paid. Auction results are normally revealed ten days after the offering date. Unsuccessful applicants get their application monies refunded while successful applicants are requested to make payments on the remaining 70% of the share dollar value bid. It is approximately ten days between this payment date and the first trading date.[9]

First, we calculated the returns over the initial listing period. Then we adjusted returns for the market movement to account for the market risk during the initial listing period. Next, we accounted for the opportunity cost of the capital tied up in applications over the period between the offering date and the first trading date. The application fee, NT$500 per application, was also deducted in the calculation. Finally, we also accounted for the transaction costs for selling shares in the aftermarket. Transaction costs, which account for 0.4425% of the transaction value, include brokerage commissions (0.1425%) and a transaction tax (0.3%). In sum, the initial excess return for a successful investor in a particular issue is calculated as follows:

$$r_i^S = \left[\frac{P_H(1-TC) \times Q_{i,B} - F}{P_{i,B} \times Q_{i,B}} - 1 \right] - \left[\frac{Index_H}{Index_L} - 1 \right] - \frac{D_1}{365} \times 0.3 \times R_f - \frac{D_2}{365} \times R_f \quad (1)$$

r_i^S is the initial excess return for a successful investor. $P_{i,B}$ is the bidding price and $Q_{i,B}$ is the number of shares submitted by investor i in a particular issue. P_H is the closing price on the last trading day of the initial listing period. TC is the transaction cost. F is the application fee, NT$500 per application. $Index_H$ and $Index_L$ are the closing value of the Taiwan Stock Exchange (TSE) Value-Weighted Index on the last trading date of the initial listing period and the closing value on the last submitting date. R_f is the risk-free return over the period from application to listing for a particular issue. D_1 is the number of days between the application date and payment date. D_2 is the number of days between the payment date and the last trading date of the initial listing period. In equation (1), the first term denotes

[9] The exact number of days spanning the payment date and the first trading date can be retrieved from the prospectus. Therefore, these data will be employed to account for the opportunity cost of the capital tied up in applications.

returns after transaction costs for winning bidders; the second term denotes the market return from the last submitting date to the last trading date of initial listing period; and the third and fourth terms are the tied-up costs.

On the other hand, the initial excess return for an investment failure is calculated as follows:

$$r_i^F = \left[\frac{P_{i,B} \times Q_{i,B} - F}{P_{i,B} \times Q_{i,B}} - 1 \right] - \frac{10}{365} \times 0.3 \times R_f \quad (2)$$

r_i^F is the return for an investment failure in a particular issue. $P_{i,B}$ and $Q_{i,B}$ are again the bidding price and the number of shares submitted by investor i in a particular issue. F is the application fee, NT$500 per application. R_f is the risk-free return over the period from application to listing for a particular issue. In equation (2), the first term denotes the loss as a percentage of application value for failed investors, and the second one is the cost of capital tied-up.

The excess return for a particular class of investors (institutional investors or individual investors; large to small investors) with N successful investors and M failed investors in IPO j is calculated as follows:

$$r_j^{ID} = \frac{\sum_{i=1}^{N} r_i^S \times P_{i,B} \times Q_{i,B} + \sum_{i=1}^{M} r_i^F \times P_{i,B} \times Q_{i,B}}{\sum_{i=1}^{N+M} P_{i,B} \times Q_{i,B}} \quad (3)$$

Accordingly, the annualized initial excess return for a particular class of investors in IPO j is as follows:

$$AR_j^{ID} = r_j^{ID} \times \frac{365}{D_1 + D_2} \quad (4)$$

3. Empirical results

1. Information proxy and initial excess returns

We studied the initial returns for both informed investors and uninformed investors. Figure 2 presents the scatter diagram for the initial excess return and the difference in allocation proportions between institutional investors and individual investors for each of the 75 issues. The scatter diagram in Figure 2 reveals a positive relationship between the initial returns and the differences in allocation proportions between institutional investors and individual investors for the 75 IPOs. In other words, in those more relatively underpriced IPOs, institutional investors as a whole received relatively more shares put up at auction than individual investors. On the contrary, in those relatively overpriced IPOs, institutional investors as a whole received less shares put up at auction. These results provide evidence supporting that institutional investors had better information concerning the "true value" of IPO shares because the institutional investors respond to greater expected underpricing by expanding applications.

Table 3 reports initial excess returns on 75 IPOs for both institutional and individual investors. The value-weighted initial excess returns, after accounting for transaction costs, costs of capital tied-up, and allocation proportions, are 25.34% and 16.38% respectively for institutional investors and individual investors. Tests on whether these initial returns were greater than zero yield significant results and institutional investors achieved a higher average return than individual investors.

Figure 3 plots the difference in allocation proportions between large value investors and small value investors. It reveals again a positive relationship between the differences in allocation proportions and the initial returns. That is, the differences in allocations associated with the more underpriced IPOs are greater than those associated with the overpriced IPOs. Moreover, the magnitude of the differences is greater than that based upon the investor's identity.

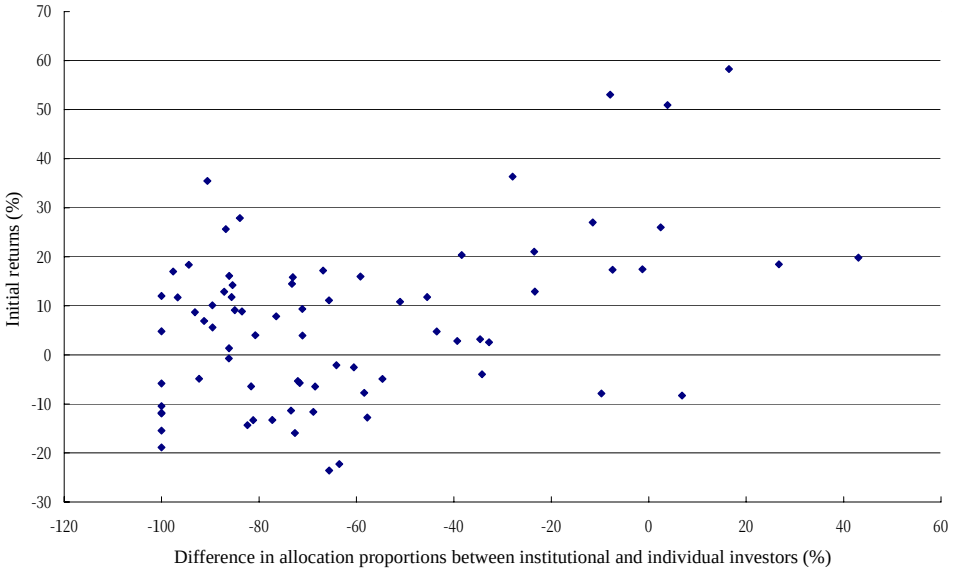


Figure 2 Differences in allocation proportions between institutional and individual investors for 75 IPOs at auction during the period of January 1996 to April 2000

Table 3 Initial excess return on 75 IPOs for institutional and individual investors

The annualized initial excess return for a particular class of investors in IPO j is as follows:

$$AR_j^{ID} = r_j^{ID} \times \frac{365}{D_1 + D_2}$$

where

$$r_j^{ID} = \frac{\sum_{i=1}^{N} r_i^S \times P_{i,B} \times Q_{i,B} + \sum_{i=1}^{M} r_i^F \times P_{i,B} \times Q_{i,B}}{\sum_{i=1}^{N+M} P_{i,B} \times Q_{i,B}}$$

$$r_i^S = \left[\frac{P_H (1 - TC) \times Q_{i,B} - F}{P_{i,B} \times Q_{i,B}} - 1 \right] - \left[\frac{Index_H}{Index_L} - 1 \right] - \frac{D_1}{365} \times 0.3 \times R_f - \frac{D_2}{365} \times R_f$$

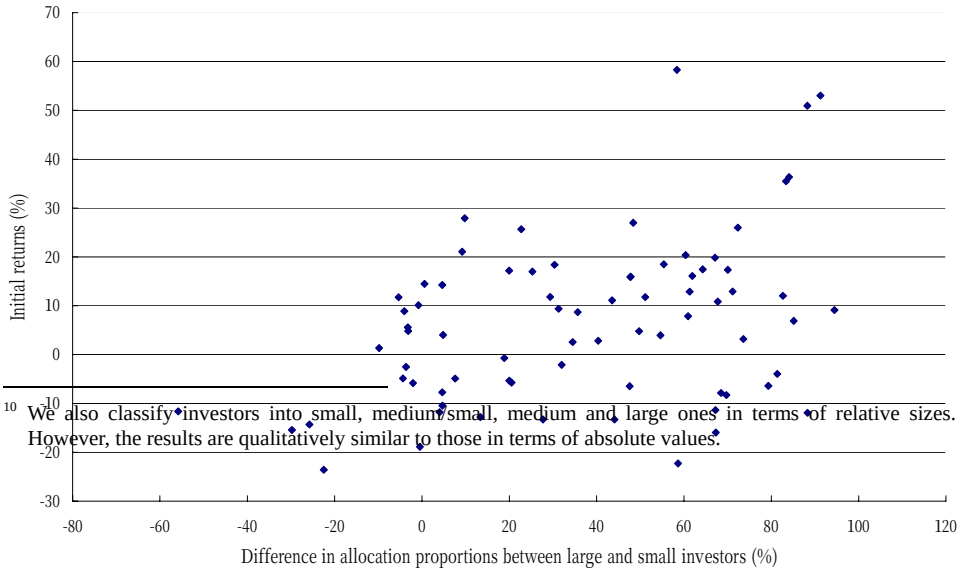
$$r_i^F = \left[\frac{P_{i,B} \times Q_{i,B} - F}{P_{i,B} \times Q_{i,B}} - 1 \right] - \frac{10}{365} \times 0.3 \times R_f$$

r_j^{ID} is the return for a particular class of investors (institutional investors or individual investors; large to small investors) with N successful investors and M failed investors for IPO j. r_i^S is the initial return for a successful investor and r_i^F is the return for a failed investor for a particular issue. $P_{i,B}$ is the bidding price submitted by investor i for a particular issue. P_H is the closing price on the last trading day of the initial listing period. $Q_{i,B}$ is number of shares applied for by investor i. R_f is the risk-free return over the period from application to listing for a particular issue. $Index_H$ is the closing value for the Taiwan Stock

Exchange (TSE) Value-Weighted Index on the last trading date of the initial listing period. $Index_L$ is the closing value for the TSE Value -Weighted Index on the last submitting date. F is the application fee, NT$500 per application. TC is the transaction cost. D_1 is the number of days between the application date and payment date. D_2 is the number of days between the payment date and the last trading date of the initial listing period.

	Initial excess return		
Identity	Value-weighted mean	t-statistics	Number of sample
Individual	16.3778%	3.97	75
Institutional	25.3402%	4.36	73

Table 4 reports initial excess returns for large value, medium value, medium/small value and small value investors. The value-weighted initial excess returns are 4.32%, 6.60%, 13.20%, and 26.97% respectively for small, medium/small, medium, and large value investors. The initial excess return ascends as the value of the application increases. The t-statistic associated with small value investors' initial excess return is 1.66, which is not significantly different from zero at the 5% level. On the other hand, the t-statistics associated with medium/small, medium, and large value in vestors' initial excess return are 2.40, 3.82, and 4.34, which are significantly different from zero at the 5% level. These results support that large investors had better information than small ones.[10] These results are also in line with Rock's model, predicting that weighting the returns by the probabilities of obtaining an allocation will leave the uninformed investors earning the risk-free rate.



[10] We also classify investors into small, medium/small, medium and large ones in terms of relative sizes. However, the results are qualitatively similar to those in terms of absolute values.

Figure 3 Difference in allocation proportions between large and small investors for 75 IPOs at auction during the period of January 1996 to April 2000

2. Results from the interaction effects

The results in Table 3 and Table 4 show that institutional investors have greater initial excess returns than individual investors and so do large value investors than small value investors. Hence, both institutional investors and large value investors are better informed than their counterparts. In other words, both identity and application value are good proxies for information. The issue we want to examine now is whether the identity effect is homogeneous across alternative application value classes and if the application value effect is homogeneous between individual and institutional investors. In other words, to what extent does the identity effect vary between small and large value investors and to what extent does the application value effect vary between individual and institutional investors?

The initial excess returns for application value classes pertaining to each of the two identity classes are presented in Table 5. In general the application value effect seems to be present in each of the identity classes. To see this more clearly, Figure 4 contains a scatter diagram of the initial

Table 4 Initial excess return on 75 IPOs for small, medium/small, medium and large investors

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The annualized initial excess return for a particular class of investors in IPO j is as follows:

$$AR_j^{ID} = r_j^{ID} \times \frac{365}{D_1 + D_2}$$

where $$r_j^{ID} = \frac{\sum_{i=1}^{N} r_i^S \times P_{i,B} \times Q_{i,B} + \sum_{i=1}^{M} r_i^F \times P_{i,B} \times Q_{i,B}}{\sum_{i=1}^{N+M} P_{i,B} \times Q_{i,B}}$$

$$r_i^S = \left[\frac{P_H (1 - TC) \times Q_{i,B} - F}{P_{i,B} \times Q_{i,B}} - 1 \right] - \left[\frac{Index_H}{Index_L} - 1 \right] - \frac{D_1}{365} \times 0.3 \times R_f - \frac{D_2}{365} \times R_f$$

$$r_i^F = \left[\frac{P_{i,B} \times Q_{i,B} - F}{P_{i,B} \times Q_{i,B}} - 1 \right] - \frac{10}{365} \times 0.3 \times R_f$$

r_j^{ID} is the return for a particular class of investors (institutional investors or individual investors; large to small investors) with N successful investors and M failed investors for IPO j. r_i^S is the initial return for a successful investor and r_i^F is the return for a failed investor for a particular issue. $P_{i,B}$ is the bidding price submitted by investor i for a particular issue. P_H is the closing price on the last trading day of the initial listing period. $Q_{i,B}$ is number of shares applied for by investor i. R_f is the risk-free return over the period from application to listing for a particular issue. $Index_H$ is the closing value for the Taiwan Stock Exchange (TSE) Value-Weighted Index on the last trading date of the initial listing period. $Index_L$ is the closing value for the TSE Value -Weighted Index on the last submitting date. F is the application fee, NT$500 per application. TC is the transaction cost. D_1 is the number of days between the application date and payment date. D_2 is the number of days between the payment date and the last trading date of the initial listing period.

Group	Initial excess return		
Application Value	Value-weighted mean	t-statistics	Number of sample
Small[a]	4.3197%	1.66	75
Medium/small [a]	6.6039%	2.40	75
Medium[a]	13.2040%	3.82	75
Large[a]	26.9697%	4.34	63

a. Small investors are defined as those who applied for up to NT$500,000 dollars worth of shares in each issue. Medium/small investors applied for NT$500,001 to NT$2,000,000. Medium investors applied for NT$2,000,001 to NT$8,000,000 and large investors are defined as those who applied for more than NT$8,000,000 worth of stock.

excess returns versus application value for two classes of identity investors. With both the individual and institutional investors, the large value investors experienced higher initial excess returns than their low value counterparts.

Table 5 Initial excess return on 75 Taiwanese IPOs made between 1996 and 2000: Identity investors classified by application value

The annualized initial excess return for a particular class of investors in IPO j is as follows:

$$AR_j^{ID} = r_j^{ID} \times \frac{365}{D_1 + D_2}$$

where

$$r_j^{ID} = \frac{\sum_{i=1}^{N} r_i^S \times P_{i,B} \times Q_{i,B} + \sum_{i=1}^{M} r_i^F \times P_{i,B} \times Q_{i,B}}{\sum_{i=1}^{N+M} P_{i,B} \times Q_{i,B}}$$

$$r_i^S = \left[\frac{P_H (1 - TC) \times Q_{i,B} - F}{P_{i,B} \times Q_{i,B}} - 1 \right] - \left[\frac{Index_H}{Index_L} - 1 \right] - \frac{D_1}{365} \times 0.3 \times R_f - \frac{D_2}{365} \times R_f$$

$$r_i^F = \left[\frac{P_{i,B} \times Q_{i,B} - F}{P_{i,B} \times Q_{i,B}} - 1 \right] - \frac{10}{365} \times 0.3 \times R_f$$

r_j^{ID} is the return for a particular class of investors (institutional investors or individual investors; large to small investors) with N successful investors and M failed investors for IPO j. r_i^S is the initial return for a successful investor and r_i^F is the return for a failed investor for a particular issue. $P_{i,B}$ is the bidding price submitted by investor i for a particular issue. P_H is the closing price on the last trading day of the initial listing period. $Q_{i,B}$ is number of shares applied for by investor i. R_f is the risk-free return over the period from application to listing for a particular issue. $Index_H$ is the closing value for the Taiwan Stock Exchange (TSE) Value-Weighted Index on the last trading date of the initial listing period. $Index_L$ is the closing value for the TSE Value -Weighted Index on the last submitting date. F is the application fee, NT$500 per application. TC is the transaction cost. D_1 is the number of days between the application date and payment date. D_2 is the number of days between the payment date and the last trading date of the initial listing period.

cont.

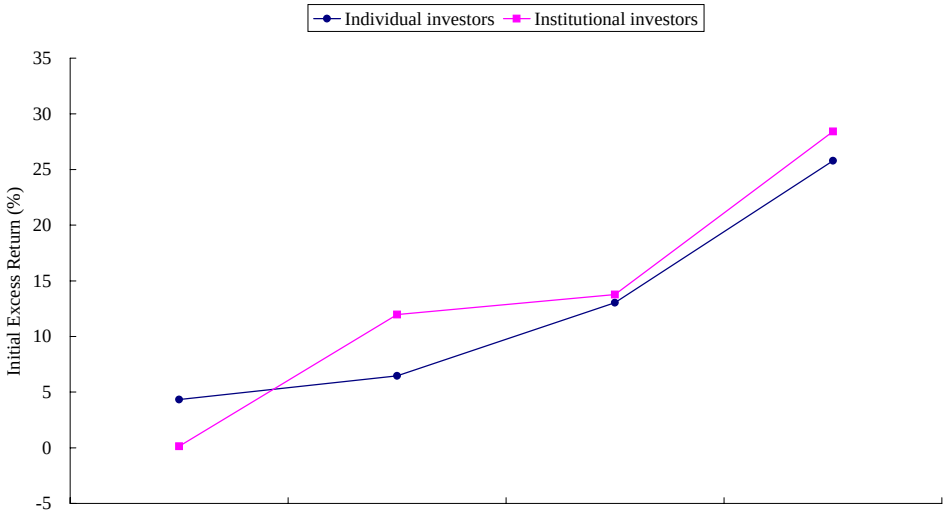
Group		Initial excess returns		
Identity Class	Application value class	Value-Weighted Mean (%)	t-statistics	Number of sample
Individual	Small[a]	4.3270	1.66	75
	Medium/small[a]	6.4662	2.39	75

	Medium[a]	13.0256	3.71	74
	Large[a]	25.7877	4.34	62
Institutional	Small	0.1430	0.03	21
	Medium/small	11.9710	2.34	65
	Medium	13.7683	3.60	65
	Large	28.4060	4.07	59

a. Small investors are defined as those who applied for up to NT$500,000 dollars worth of shares in each issue. Medium/small investors applied for NT$500,001 to NT$2,000,000. Medium investors applied for NT$2,000,001 to NT$8,000,000 and large investors are defined as those who applied for more than NT$8,000,000 worth of stock.

With small value investors, the individual investors experienced higher initial excess returns than the institutional investors did. The result is contrary to the typically assumed proposition that institutional investors are better informed about the true value of an IPO. Although the institutional investors experienced higher returns than the individual investors in large, medium/small, and small investors, the evidence does not demonstrate that the institutional investors are necessarily better informed in the absence of an observable market price.

Further evidence on this latter point is provided in Table 6, which shows the relative strength of both the identity and application value effects. Table 6 reports the differences in initial excess returns and the associated t-statistics among four classes of application value investors within each of two identity classes and between two identity classes within each of the four application value classes. The four shaded squares in the diagonal direction report the differences in initial excess returns between two identity classes of investors for four different ranges of application values.



Small investors are defined as those who applied for up to NT$500,000 dollars worth of shares in each issue. Medium/small investors apply for NT$500,001 to NT$2,000,000. Medium investors applied for NT$2,000,001 to NT$8,000,000 and large investors are defined as those who applied for more than NT$8,000,000 worth of stock.

Figure 4 Plots of average initial excess returns for individual and institutional investors by application value category for 75 IPOs.

The first shaded cell in the diagonal (INS_S-IND_S) shows the difference of excess returns between institutional investors and individual investors for small investors. The difference is –4.18%, which is not significantly different from zero. The other three shaded cells exhibit the same result. In other words, within each of the four application value classes, institutional investors do not have much more information than individual investors.

Table 6 Tests on differences of initial excess returns among a variety of investor categories classified by identity and application value

	Institutional Investors			
	Small[a]	Medium/	Medium[a]	Large[a]
	[21] [c]	Small[a] [65]	[65]	[59]

Individual Investors	Small[a] [75]	INS_S-IND_S	INS_{SM}-INS_S	INS_M-INS_S	INS_L-INS_S
		-4.18%	11.83%	13.63%	28.26%
		(-0.77)[d]	(1.26)	(1.89)*	(2.35)**
	Medium/ Small[a] [75]	IND_{SM}-IND_S	INS_{SM}-IND_{SM}	INS_M-INS_{SM}	INS_L-INS_{SM}
		2.14%	5.50%	1.80%	16.44%
		(0.57)	(0.99)	(0.28)	(1.93)*
	Medium[a] [74]	IND_M-IND_S	IND_M-IND_{SM}	INS_M-IND_M	INS_L-INS_M
		8.70%	6.56%	0.74%	14.64%
		(1.99)*	(1.48)	(0.14)	(1.89)*
	Large[a] [62]	IND_L-IND_S	IND_L-IND_{SM}	IND_L-IND_M	INS_L-IND_L
		21.46%	19.32%	12.76%	2.62%
		(3.50)**	(3.12)**	(1.91)*	(0.29)

** Significant at the 1% level.

* Significant at the 5% level.

a. Small investors are defined as those who applied for up to NT$500,000 dollars worth of shares in each issue. Medium/small investors applied for NT$500,001 to NT$2,000,000. Medium investors applied for NT$2,000,001 to NT$8,000,000 and large investors are defined as those who applied for more than NT$8,000,000 worth of stock.

b. INS_S= Institutional investors with small application values.
INS_{SM}= Institutional investors with medium/small application values.
INS_M= Institutional investors with medium application values.
INS_L= Institutional investors with large application values.
IND_S= Individual investors with small application values.
IND_{SM}= Individual investors with medium/small application values.
IND_M= Individual investors with medium application values.
IND_L= Individual investors with large application values.

c. Figures in brackets are the numbers of IPOs.

d. Numbers in parentheses are the t-values.

e. t-statistic is calculated as follows:

$$t = \frac{\overline{X}_i - \overline{X}_j}{\sqrt{s^2(\frac{1}{n_i} + \frac{1}{n_j})}}$$

where $\overline{X}_i$ and $\overline{X}_j$ are the mean of initial excess returns for sample i and j investors category, respectively; $s^2 = \frac{s_i^2(n_i - 1) + s_j^2(n_j - 1)}{n_i + n_j - 2}$ is the pooled estimate of variance; s_i^2 and s_j^2 are the sample variance for sample i and j; n_i and n_j are the sample size.

The upper off-diagonal cells in Table 6 report the differences of initial return between any two of the four application value classes among institutional investors. The far right upper off-diagonal cell (INS_L-INS_S) denotes the difference of initial excess returns between large and small investors. The difference is 28.26%, which is significant at the 1% level.

The lower off-diagonal cells in Table 6 report the differences of initial return between any two of the four application value classes among individual investors. The far left lower off-diagonal cell (IND_L-IND_S) reports the difference of initial excess returns between large and small investors for individual investors. The difference is 21.46%, which is also significant at the 1% level.

The above results reveal that large investors have much more information than small investors, but institutional investors do not have better information than individual investors. These results, in short, suggest that the application value is a better proxy for information than identity although institutional investors might be better informed than individual investors.[11]

3. Information proxy associated with application and allocation data

Based upon the internal allocation data provided by an underwriter for 38 firm commitment U.S. IPOs, Hanley and Wilhelm (1995) show that institutional investors receive approximately the same proportion of shares in both underpriced and overpriced IPOs. Furthermore, the relationship between the variation in the proportion allocated to institutional investors and the initial underpricing is positive but statistically insignificant.

To investigate whether different inferences can be drawn from the application schedule versus allocation schedule, Lee, Taylor, and Walter (1999) regressed either the application proportion or the allocation proportion for four investor categories on the associated initial profit. They found that the variation in either the application or allocation proportions for large (i.e., informed) investors was significantly positively associated with the initial profit. Moreover, the positive relationship was stronger in the applicant schedule than in the allocation schedule. Hence, they concluded that inferences based on the application proportion might be quite different from those based on the allocation proportion.

As our data contained both the application proportion and allocation proportion for both individual investors and institutional investors, this section examines whether the ability of investor's type and of application value to explain the variations in the initial underpricing differs in application and

[11] Investors were grouped into four categories according to their application values. However, investors were classified into only two categories according to their identities. Therefore, the stronger information effect in the application value might be due to the finer partition of information among the four application value classes. In order to verify this conjecture, we grouped large and medium investors into one group and medium/small and small investors into another group. The differences in excess returns between these two groups were still significantly different from zero, although somewhat weaker than those reported in Table 6.

allocation schedules.

Following Lee, Taylor, and Walter (1999), we regressed either the application proportion or the allocation proportion on the initial profit. Table 7 reports the results for twelve regressions.

The regression equation for Table 7 is as follows:

$$P_i = \alpha + \beta \cdot IP_i + \varepsilon \quad (5)$$

where i = 1,2,…, number of observation firms;

P = proportion (application or allocation) for either small, medium/small, medium, and large investors or individual and institutional investors.

IP = initial profits.

Panel A of Table 7 reports results based on the application value. These results show that the relative demand by the largest investors is associated with significantly positive initial profits, while the relative demands by the other three classes of investors are associated with significantly negative initial profits. This implies that the largest investors are much better informed than investors in the other three classes and the demand from the largest investors not only dilutes a lot of the application proportions from the other investors but also crowds out the allocation proportions for the other classes of investors.[12]

Table 7 OLS regression results for application and allocation proportions

Results for the OLS regression of application and allocation proportions for various investors classes (Panel A: based on dollar value of applications; Panel B: based on identity of investors) on initial underpricing profits, for 75 Taiwanese IPOs made between Jan. 1996 and Apr. 2000. Initial profits were determined by multiplying the underpricing by the size of the issue (issue price multiplied by the number of shares issued) and denominated in millions of

[12] Since the allocation is to four application value classes or to two investor-identity classes, the sum of α, the average allocation proportion for each class, must be 100. Since β measures the allocation adjustments among four or two classes, the allocation gained by one class of investors is at the cost of another classes of investors. Therefore, sum of β must be 0.

NT dollars. All t-statistics have been adjusted for heteroskedasticity using White's (1980) procedure.

The regression equation is as follows:

$$P_i = \alpha + \beta \cdot IP_i + \varepsilon \ ,$$

where i = 1,2,…,number of observation firms;

P = application or allocation proportion for small, medium/small, medium, large, individual, or institutional investors;

IP = initial profits.

Panel A: based on dollar value of applications

Application value class		Application Proportions		Allocation Proportions	
		Coefficient	t-Statistic	Coefficient	t-Statistic
Small[a]	Intercept	9.0405	8.19**	6.2975	5.67**
	Initial Profits	-0.0057	-3.43**	-0.0051	-2.71**
	Adjusted R^2		0.0202		0.0140
Medium	Intercept	21.1998	13.06**	18.8479	9.05**
/Small[a]	Initial Profits	-0.0102	-3.93**	-0.0132	-3.52**
	Adjusted R^2		0.0355		0.0371
Medium[a]	Intercept	36.8287	16.41**	36.6127	13.12**
	Initial Profits	-0.0177	-5.09**	-0.0200	-4.08**
	Adjusted R^2		0.0621		0.0479
cont.					
Large[a]	Intercept	32.9312	10.98**	38.2400	10.49**
	Initial Profits	0.0335	6.51**	0.0383	4.55**
	Adjusted R^2		0.1262		0.1114

Panel B: based on identity of investors					
Individual	Intercept	80.7042	45.37**	83.5659	42.49**
	Initial Profits	-0.0234	-5.41**	-0.0245	-4.37**
	Adjusted R^2	0.1582		0.1365	
Institutional	Intercept	19.2958	10.85**	16.4341	8.36**
	Initial Profits	0.0234	5.41**	0.0245	4.37**
	Adjusted R^2	0.1582		0.1365	

**Significant at 1% level.

a. Small investors are defined as those who applied for up to NT$500,000 dollars worth of shares in each issue. Medium/small investors applied for NT$500,001 to NT$2,000,000. Medium investors applied for NT$2,000,001 to NT$8,000,000 and large investors are defined as those who applied for more than NT$8,000,000 worth of stock.

Panel B of Table 7 reports results based on investor's type. These results are qualitatively similar to those in Panel A. Demand from institutional investors can significantly reduce the proportional application and allocation for individual investors. However, the relative magnitude of impact from institutional investors is smaller than that from the largest investors. These results support that application value is a better information proxy than investor's type.

4. Conclusions

It is typically assumed that institutional investors have better information about the value of an IPO. However, the information concerning investors' identity from individual applications or allocations in a particular IPO is usually not available. Researchers have customarily employed the application share value as the information proxy. In other words, investors

submitting larger application values might be better informed than other investors.

Our results revealed that either investor's type or application value is a good proxy for this information. However, the application value is a better information proxy than investor's type. In other words, the information among the largest investors is finer than the information among the institutional investors. These results suggest that caution should be taken in comparing studies based on different information proxies.

To examine whether the ability of investor's type and application value to proxy for information differs in application and allocation schedules, we generated twelve regressions in which either the application proportion or the allocation proportion was regressed on the initial profit based on these two information proxies. Empirical results show that the application value has a stronger explicative power than investor's type either in application schedule or in allocation schedule. Moreover, this explicative power is stronger for the application schedule than the allocation schedule. These results imply that the application schedule contains much more information than the allocation schedule.

Finally, the large value investors' initial excess return is positive and significant, while the small value investors' initial excess return is negative but not significant. These results imply that the discriminatory auctions are unable to completely mitigate information asymmetry. Whether the uniform-price auctions can better mitigate information asymmetry among investors deserves further studies.

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