

# The Impacts of Japanese Price-Competitive IPO Auctions versus the U.S. Underwriter-Priced IPOs

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# The Impacts of Japanese Price-Competitive IPO Auctions versus the U.S. Underwriter-Priced IPOs

## Abstract

Many researchers suggest that investment bankers underprice IPOs. However, from 1989 to 1996, all Japanese IPOs were auctioned, reducing the role of underwriters. Initial returns of Japanese price-competitive IPOs are not found lower than underwriter-priced U.S. IPOs. Issue size, firm size, general market movements, insider sales levels, and underwriter quality are not highly related to initial returns under price-competitive auctions. However, there appears to be a strong partial adjustment phenomenon. Thus, price-competitive auctions did not result in significantly lower initial returns, but did reduce the impacts of many traditional variables found to significantly affect initial returns in U.S. underwriter-priced IPOs.

In the U.S., IPOs are priced by investment bankers after gaining knowledge of potential interest from investors.<sup>1</sup> Most empirical studies of U.S. IPOs find strong evidence of underpricing and significant initial returns.<sup>2</sup> Many studies suggest that either the issuing firm or the investment banker underprices the issue. Signaling models by Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989) propose that the issuing firm underprices IPOs to signal its quality so that the firm can subsequently issue seasoned equity at a higher price than would be the case without the underpricing signal. Most of the empirical research studies of U.S. IPOs suggest that the investment banker underprices the issue. In adverse selection (or winner's curse) models, the underwriter underprices IPOs to induce uninformed investors to purchase IPO shares [Rock (1986) and Beatty and Ritter (1986)]. In principal-agent models, the issuing firm lets the underwriter underprice IPOs to compensate itself for the use of its superior information about investor demand [Baron (1982), and Muscarella and Vetsuypens (1989)]. In information-gathering marketing models, the underwriter uses underpricing and rationing as devices to entice selected investors in a "road show" to truthfully reveal their information [Benveniste and Spindt (1989)].

However, in Japan, price discriminatory auctions are used to price IPOs; thus,

primary price-setting activities are removed from both the underwriter and the management of the firm.<sup>3</sup> Beginning April 1, 1989, a price discriminatory auction of a portion of all Japanese IPO shares issued has been required. The exclusive use of auctions continued until September 1997 when book building was also allowed.<sup>4</sup> Since this paper wants to focus exclusively on auction-priced IPOs, the analysis is over the period when only auctions were allowed. The offer price for the unauctioned shares is set as a function of the weighted average of successful bids in the auction. Thus, Japan provides an interesting laboratory to test the importance of the underwriter and/or the firm in the underpricing process. Since Michaely and Shaw (1994) and Spiess and Pettway (1997) cast doubts about the importance of the firm in underpricing, we focus on the role of the underwriter. However, our tests apply equally to both the underpricing of IPOs by underwriters and by the firm.

Since the role of the underwriter in Japanese auctions is uniquely different from their role in the U.S. allocation system, we wish to study the impact of this difference upon the pricing of IPOs. This paper compares the initial return levels on Japanese price-competitive IPO auctions with those of comparable U.S. underwriter-priced IPOs. Additionally, we measure the relationships of the initial returns from auctions versus variables that have been found to explain U.S. underwriter-priced initial returns, such as: issue size, firm size, insider sales, market movements, underwriter quality, and partial adjustment phenomenon. Analysis finds that the auction system does not produce initial returns that are highly related individually to issue size, firm size, insider sales levels, market movements, or underwriter quality. However, similar to U.S. IPO studies, initial returns are received by investors who participate in the auction and/or allocation, not the investors on the first day of trading, as the open-offer price returns are similar to close-offer price returns. It is found that Japanese auctioned IPOs have a strong partial adjustment phenomenon relating the pre-offer price movements with the initial returns. Japanese price-competitive auctions result in significant underpricing

and do not produce lower initial return levels than U.S. underwriter-priced IPOs. Thus, investors in a price-competitive auction also underprice IPOs similar to underwriters.

## **1. Data and Research Design**

After April 1, 1989, a price discriminatory auction was required on a portion of all Japanese IPO shares. Investors could bid and purchase some of the IPO shares and the winning bids then determined the offer price of the unauctioned shares that were subsequently offered by the underwriters.<sup>5</sup> For our comparison, data was gathered over the exclusive auction period from April 1, 1989 through September 30, 1996. We include all firm commitment type IPOs that were listed on either the first or second sections of the Tokyo Stock Exchange (TSE). We omit all IPOs listed on Japanese regional exchanges, IPOs registered in the OTC market in Japan, and all privatizations of public companies as these issues have different returns from TSE listed IPOs.<sup>6</sup> The resulting Japanese data will be most similar to U.S. IPOs. Seventy-eight IPOs satisfy the screening criteria.

## **2. Testable Hypotheses**

The most popular models used in the U.S. to explain underpricing (signaling, adverse selection, principal-agent, and information-gathering marketing models), emphasize the importance of the underwriter in the pricing process. However, in Japan the underwriter has a much smaller pricing role in the auction system. Therefore, a major hypothesis for testing is that the price-competitive auction process in Japan results in lower initial return levels compared to those for underwriter-priced IPOs in the U.S.

Further, Barry and Jennings (1993) in a study of U.S. IPOs find that investors on the first day of trading receive a normal daily return very close to zero, on average, much lower than the average initial return level. We hypothesize that a similar result in Japan will indicate that only the participant in the auction or allocation will receive the initial return.

Many U.S. IPO studies find that the initial returns are inversely related to the size of the firm and directly related to the percentage of insider sales at the offering (Ritter 1984 and Ibbotson, Sindelar, and Ritter 1994 and Habib and Ljungqvist 2001). We will determine if these common findings from U.S. IPO studies apply to Japanese auctions. The partial adjustment phenomenon, that has been found to exist in U.S. IPOs (Hanley 1993), will be measured to determine if it also occurs in Japanese auctioned IPOs. We also measure the relationship of the initial returns with the market movements over the test period to determine the impact of “hot” and “cold” markets upon the level of underpricing and the number of IPOs sold [Ibbotson and Jaffe (1975), Ritter (1984), Ibbotson, Sindelar, and Ritter (1988)]. In the U.S., the quality of the underwriter is a significant inverse function of initial returns or underpricing levels [Carter and Manaster (1990) and Carter, Dark, and Singh (1998)]. We will test if the quality of the underwriter in Japanese auctioned IPOs reduces initial returns as has been found in U.S. underwriter-priced IPOs.

### **3. Results**

#### *3.1. Descriptive Statistics of Japanese Auctioned IPOs*

During the auction period from April 1, 1989 through September 30, 1996, a population of 78 IPOs were made that met the financial requirements to be traded on the first or second section of the TSE.<sup>7</sup> The data in Table 1 provide descriptive statistics of these companies and issues. First, the issue size averaged 18,217 million yen or about 151.8 million U.S. dollars. However, the range and the standard deviation are quite large. Note that the minimum dollar value of 7.7 million is quite above the lower-bound cutoff used in many U.S. studies. The size of the primary offer in share terms averaged 3,951 thousand shares and the range was from 21,100 thousand to only 2 thousand shares. Secondary shares averaged 23% of the total shares sold. The percent of the primary and secondary shares that were auctioned averaged 45.98%.

In order to test the partial adjustment phenomenon described by Ibbotson,

Sindelar, and Ritter (1994) and Hanley (1993), we measure the average movement of the offer price determined after the auction with the pre-offer formula price. A ratio was made for each issue.<sup>8</sup> The 1.085 average for the ratio of offer price/pre-offer formula price indicates that the price-discriminatory auction process causes the final offer prices to be set 8.5% above the pre-offer formula price established by the underwriter and known to potential bidders prior to the share auction. Notice that the offer prices have a very large range and, thus, its mean, mode, and median prices are quite different. Finally, the capital sizes, defined as the book value of capital stock, of Japanese issuing companies is provided before and after the sale to allow a test of the impact of firm size upon underpricing levels under the auction process.

### *3.2. Structural Conditions of the Auction System during the Study Period*

On April 1, 1989, all Japanese IPOs were made subject to a price discriminatory auction on a portion of the shares sold (initially between 25% and 50% of the total number of IPO shares depending on a precise formula) and the weighted average price of successful bids was set as the offer price of the unauctioned shares that were allocated by the underwriter. Initially, the upper limit on bid prices was set at 30% higher than the lower limit. The lower limit was set equal to the pre-offer formula price that was based upon a weighted average of prices of similar companies based upon relative income and asset sizes. These conditions were used until April 1, 1992 when there were three changes in the structure: (1) fifty percent or more of the sum of primary and secondary shares must be auctioned, (2) the upper limit on bids was abolished, and (3) the lower limit of bids was reduced by 15%. Shortly thereafter, December 28, 1992, the underwriter was allowed to discount the average price from the auction to reflect the popularity of the auction, the term-risk, and the prospect of market demand. See Pettway and Kaneko (1996) for more details on these structural changes.

Since other researchers have found that structural changes in the IPO system have had an impact upon initial returns levels, we tested to determine if these changes

resulted in significant differences in returns. Both parametric and nonparametric tests of differences between mean initial return levels in the three distinct time periods were made. The results clearly indicate that the initial returns are not significantly affected by these structural changes.<sup>9</sup> Thus, the data was pooled into one period of analysis. However, we have presented data in Table 2 divided into annual periods as well as the overall period to provide the reader with knowledge of the results of the auction process over time.

### *3.3. Initial Return Levels, Market Movements, and Daily Returns*

The data in Table 2 provide the number of issues, the percent of the initial returns that are non-negative, the mean initial returns, and their standard deviation for each year of the study period as well as the overall period from 4/1/89 through 9/30/96. Of the 78 issues, over 75% were non-negative and this was generally true in each year with the exception of 1991 when 42.86% of the issues had non-negative initial returns. The initial returns ranged from a high of 88.7% to a -23.38% and all yearly averages were positive. Only 18 of the 78 issues had negative initial returns. The standard deviations provide evidence about the dispersion of the returns in each year and for the study period and will be used in the subsequent comparison with U.S. initial return levels.

The data in the column headed “% change in TOPIX by year” is the annual returns of all stocks listed on the TSE by year. It is clear that during the time period of study there were some different movements in the returns of all stocks. Remember that TSE peaked in December 1989 and generally declined subsequently. After the peak, there were some positive returns during 1993, 1994, and 1996; however, on average the TSE market had a negative return of 2.10% over the study period.

The next column in Table 2 contains the annual average values of the returns of these IPOs from open to close on the first day of trading. The traditional measure of initial return is from the offer price to the closing price of the first day of trading and these are found in Table 1. However, we also measured the return from open to close on

the first day of trading in order to determine if there was any significant difference between the traditional definition of initial return and the return from the offer price to the opening price on the first day of trading. We find that the return on the first day of trading is 0.02% on average. This indicates that the significant underpricing accrues only to the original investor who purchased the IPO at the offer price, not subsequent investors who purchased the share on the market after trading began. This is similar to the findings by Barry and Jennings (1993) for U.S. IPOs.<sup>10</sup>

The daily returns for the first four days of trading found in the next to last column in Table 2 are not statistically different from zero or from each other. We conclude from this analysis of the first four days of returns that there appears to be no underlying trend in these returns. This suggests that the closing price on the first day of trading is a fair estimate of the firm's worth as subsequent daily returns are also insignificantly different from zero and there is no trend in the observations.

#### *3.4. Comparison of Japanese IPO Short-Term Returns with U.S. IPO Short-Term Returns*

In order to compare these Japanese short-term returns that result from the auction and the firm commitment underwriting of the unauctioned shares, several studies of U.S. IPO returns are examined. The spirit of the comparison between TSE listed Japanese IPOs and U.S. IPOs is to offer only an initial, not a detailed comparison, as has been provided by many survey articles such as Smith (1986), Loughran, Ritter and Rydqvist (1994), and many others. The purpose is to provide a general comparison of initial return levels and trading day returns from the Japanese IPOs made under the auction system versus the initial return levels and trading day returns found in general studies of U.S. IPOs over approximately the same calendar time period.

The data in Table 3 provide a comparison of these levels of return, the source of the returns, the sample sizes, and the standard deviations of the mean returns. For the Japanese data found in Table 2, the initial return level is 11.95% during the study period

and is repeated in the first row of Table 3.<sup>11</sup>

Barry and Jennings (1993), BJ, analyze 175 U.S. IPOs made between December 1988 and December 1990, and report the average initial return as 8.69%. Even though this initial return appears lower than the 11.95% for Japanese auctions, no cross-sectional standard deviation of these 175 returns is provided to permit a test for a statistical difference.<sup>12</sup> It is clear, however, that the Japanese initial returns are not lower than those reported by BJ.

BJ also report the two average returns (0.87% open-to-close on day 1 and -0.08% from close-to-close on day 2). The daily average for these two days is 0.40% with a standard deviation of 4.95%. By comparison, the daily average of the first four days of returns in Japan is -0.13% with a standard deviation of 4.39%. Yet, there is no significant difference between these average daily returns since the t-value is only 1.22.

Bhabra and Pettway (2003), BP, analyze 398 IPOs from January 1987 through December 1991, and report the average initial returns are 10.03%. Since the standard deviation is provided, we find that there is no statistical difference from the Japanese initial returns. BP also report that the average of the first four days of trading after each IPO was 0.06% which is not statistically different from the values for the Japanese IPOs.

Carter, Dark and Singh (1998), CDS, study 2,292 IPOs from January 1979 through the end of 1991 and find that the initial return level is 8.15%. The standard deviation of the Japanese IPOs returns of 21.47% is similar to those of U.S. IPOs returns in the CDS paper at 17.41%. Comparing the Japanese initial return level of 11.95% to that of CDS, we find that the t-value is -1.88 which is significant at the 0.05 level. These results indicate that the Japanese initial returns are significantly higher, not lower, than U.S. returns from the CDS study. Further, CDS provide the returns of the first four days from their study of 2,292 IPOs and the average return is 0.11% which is not statistically different from those daily returns in Japan.

The study by Ibbotson, Sindelar, and Ritter (1994), ISR, is given three separate entries in Table 3 and represents three different parts of their research as each is over a different study period. The first observation is from the original Table 1 (1994) which covers the period January 1960 through December 1992. The second line is from January 1960 through December 1996, an update of their Table 1. The third line is from data provided by J. Ritter, which matched the beginning date and ending dates of the Japanese auction data period, April 1, 1989 - September 30, 1996. The original ISR average of 10,626 IPOs and the 2/19/97 revision have an average initial return of 15.26% and 15.80% respectively. Since earlier U.S. IPOs tend to have higher initial return levels as shown by ISR, it is not surprising that their 15% initial return over this period is slightly higher than the Japanese 11.95%. We do not, however, have the standard deviation of these returns to statistically test for differences.

The attempt to match the 4/1/89 beginning and ending points of the Japanese auctions from the ISR data was developed over the period 4/1/89 to 9/30/96. The average initial returns for the 2,883 U.S. IPOs had an initial return equal to 14.32% and a standard deviation of 21.48%. The test between the Japanese and U.S. sample initial returns is statistically insignificant. Thus, the Japanese auction process has not resulted in a significantly lower initial return.

Spiess and Pettway (1997) examine 172 IPOs that made subsequent seasoned equity offerings during the period January 1987 through December 1991 and find that the initial returns of the IPOs average 10.94%.<sup>13</sup> We find that there is no statistical difference between the initial return levels from their study and those in Japan.

In summary, for the Japanese firm commitment IPOs made during the auction period, April 1, 1989 through September 30, 1996, the traditional offer-to-close initial returns are statistically higher than U.S. initial returns in one study, but not statistically different in three U.S. studies. Thus, the Japanese auction system does not produce a significantly lower initial return level with its price-discriminatory auctions and reduced

role of underwriters.

We did not find that the returns of the first four days of trading in Japan are significantly different from comparable daily average returns reported in three U.S. studies. Thus, it appears that whether there is an underwriter heavily involved in the process as in the U.S. or playing a much reduced role as in Japan, both markets for IPOs after the first day exhibit similar levels of daily returns without any noticeable trend for four days.

### *3.5. Impacts of Issuer Size, Insider Sales, Market Timing, and Partial Price Adjustment Phenomenon*

It has been found in many U.S. IPO studies that the initial return levels are an inverse function of the offer size and a direct function of the percentage of the issues sold by insiders or secondary shares (Ritter 1984 and Ibbotson, Sindelar and Ritter 1994, and Habib and Ljungqvist 2001). Additionally, both Benveniste and Spindt (1989) and Ibbotson, Sindelar, and Ritter (1994) suggest and provide reasons why initial return levels are a positive function of the price adjustment from the pre-offer period to the offer price. Hanley (1993) finds very strong evidence of the partial adjustment phenomenon in U.S. IPOs. We test these U.S. confirmed hypotheses with the Japanese auction data initially using independent regression models to avoid any potential multicollinearity problem. The results are presented in Table 4.

The first model compares the initial returns with the firm's issue size. The results have the expected sign, but the p-value indicates that the coefficient is insignificant when measured as a single independent variable. Also firm size was defined as the book value of capital stock of each firm determined from the balance sheet information immediately before the IPO issue. The investors would have this information and could rely on it to develop their bids. These values are provided both in yen and in dollars in Table 1. This definition of firm size resulted in the expected sign but a lower level of significance than issue size; therefore, it was not reported in Table 4. The

results indicate that the initial returns of these auctioned IPOs are not significantly related individually to either issue size or firm size.

The second model presented in Table 4 tests the results from many U.S. IPO studies where there is an inverse relation between insider sales of shares and initial return levels. The regression coefficient is not significant at conventional levels.

The next model measures the relationship between the initial returns and market movements. The results from model 3 indicate no significant relationship between the annual return on the TOPIX, a broad market measure as defined in Table 2, and the initial returns of the IPOs made in that same year. The model was also run with a one-year lag and a one-year advance of the change in the market as the independent variable with no noticeable change in explanatory power.

The next two models (4 & 5) measure the partial adjustment phenomenon. Hanley (1993) found a very significant positive relation between final offer prices that exceed the initial pricing developed by underwriters from a “road show,” provided in the firm’s prospectus, and the initial return levels. Thus, when there was an increase in demand for a new issue, the offer price was increased, but only partly, and these issues had the highest initial returns. Her results are consistent with the suggestions of Benveniste and Spindt (1989). We test to determine if there is a partial price adjustment phenomenon operating in Japanese auctions, even with a reduced role of the underwriter in price setting.

The mechanics of the auction require that the underwriter determine a pre-offer formula price for the shares. This was described in detail in an earlier section. During the period April 1, 1989 through March 31, 1992, the pre-offer formula price was set as the lower limit for bids during the auction and the upper limit of bids was set at 30% above the lower limit. From April 1, 1992 to the present, the lower limit was set at 85% of the pre-offer formula price and the upper limit was abolished. To test the partial adjustment phenomenon we constructed a ratio of the final offer price from the auction

divided by the pre-offer formula price. When this ratio is above 1.0 for an issue, the final offer price was revised upward from the pre-offer formula price. If it was below 1.0, then the price declined. During the auction period the ranges in this ratio were from 0.85 to 1.656 with a mean value of 1.085 as presented in Table 1. Thus, there was an 8.5% average price adjustment.

Model 4 in Table 4 provides the regression equation results for the overall period and finds a positive relation between the ratio and initial returns. The relation is significant at the 0.026 level. These results are consistent with a partial adjustment phenomenon, even without the price setting by an underwriter. In Japan over the entire study period, the higher the adjustment of the final offer price to the pre-offer price, the higher will be the initial return levels. However, during the period April 1, 1989 to March 31, 1992, the distribution of the ratio was truncated as the pre-offer formula price was set at the lower limit of the auction prices and investors could not bid more than the upper limit, 30% higher than the pre-offer formula price. Thus, during this period, investors could not totally adjust their average bids up to the “intrinsic” value because of the upper limit.

Because of these limitations on bid prices, we also ran the model on the data from April 1, 1992 through the end of our data, when the pre-offer formula price was not the lower limit and when bid prices were freer to move about the pre-offer formula price. More important, the upper limit was abolished on April 1, 1992 allowing bids to be made at any level above the pre-offer formula price. Model 5 also finds a significant positive relation between the partial adjustment ratio and the level of initial returns at the 0.021 level. Thus, it has been found that in Japanese auctions there is also a partial adjustment phenomenon even with the fundamental price being set by a public auction, not an underwriter. Even with a price discriminatory auction process, especially since 4/1/92, investors do not totally adjust their average bids up to the “intrinsic” value of the shares. Higher initial returns are positively and significantly related for the firms that

have the highest upward price adjustment above the pre-offer formula price.

Models 6 & 7 are full models containing all independent variables. The p-value for the partial adjustment process during the shorter period is significant at the 0.0021 level. In model 7 for the full time period, the partial adjustment process is very significant at the 0.0001 level and is clearly the most dominant variable. Issue size and % insider sales do provide additional significant explanatory power.

This is very interesting as in U.S. IPOs it has been suggested by many researchers that this partial adjustment phenomenon is one that is controlled and established by underwriters as they gain information during the “road show.” However, in Japan the underwriter has no role in the price discriminatory auction after they provide a pre-offer formula price for the issue which is similar to the price range provided in U.S. IPO prospectuses. Also, there are no “road shows” in Japan. Thus, the partial adjustment phenomenon appears not to be related to the underwriter’s ability to control the price, but perhaps due to the demand for the issue which is more than anticipated in those issues which are adjusted upward in price between the pre-offer and the bid periods.<sup>14</sup>

### *3.6. Impact of Lead Underwriter Quality upon Initial Returns*

In a world with asymmetric information, investors may value signals of issue quality in IPOs. In U.S. IPOs, Carter and Manaster (1990), Carter, Dark, and Singh (1998), and others have found that underwriter quality is a valuable signal of investment quality and risk. The higher the quality of the underwriter, the lower is the initial return. We investigate whether Japanese underwriters provide the same type of investment quality signal during the auction period.

Since tombstone advertisements of underwritten issues are not employed in Japan and the U.S. in a similar fashion, Carter and Manaster's measures of underwriter quality could not be determined for Japanese underwriters. However, Michaely and Shaw (1994), MS, used rankings of U.S. underwriter quality based upon their capital positions and found them to be highly correlated (.86) with Carter and Manaster measures.

Following MS, we have used the level of equity capital (defined as the sum of capital stock, legal reserve, and surplus) as a proxy for underwriter quality. Of the 78 IPOs in this study, a lead underwriter could be clearly identified for all issues.<sup>15</sup> In Japan, the four largest underwriters, Nomura, Daiwa, Nikko, and Yamaichi, dominate the market for new issues. Nomura's capital position was the largest in all periods of this study and, therefore, Nomura was given the highest quality ranking. Actually, the "BIG 4" underwriters had capital levels that were much more similar to each other than to those of the non-BIG 4 underwriters employed in IPOs in this study.<sup>16</sup>

To test the impacts of lead underwriter quality upon initial returns, regression analysis was employed. The first model displayed in Table V tests the unique value of Nomura underwriting compared to the other underwriters in terms of initial returns. The measurement is via a 0/1 dummy variable, NMR, that was coded 1 if the lead underwriter was Nomura and 0 if another underwriter was the syndicate head. The second model used the 0/1 dummy variable, BIG 4, to show the impact of any of the BIG 4 underwriters upon initial returns. The third model employed the dummy variable, BIG 3, to compare the relative impact of non-Nomura major underwriters versus other underwriters. The analysis is presented for the overall auction period.

Note that the analyses do not yield the expected negative relations at conventional levels of significance. In model 3, BIG 3 does have the expected sign, however it is insignificant. It is apparent that during the period when auctions were employed in Japan, the differential underwriter quality signal was not related to the level of initial returns. This result is quite different from the studies of underwriter quality and initial returns using U.S. IPO data. In Japan, since the auction-pricing scheme requires market information to play a strong part in establishing the offer price, underwriter quality does not appear to be an important signal of quality and risk of the selling firm that is related to the level of the underpricing.

## 4. Summary and Conclusions

Many researchers suggest that investment bankers underprice IPOs. However, in Japan, all IPOs since April 1, 1989, are subject to a price-discriminatory auction process that removes both the underwriter and the firm from the primary price-setting activities. Thus, these Japanese IPOs provide an interesting laboratory to test the importance of the underwriter versus an auction process in influencing the initial return levels. We focus on six main areas where the results from U.S. underwriter-priced IPOs are compared with the auction-priced Japanese IPOs: initial returns, early daily returns, and impacts of issue size, insider sales, market movements, and partial adjustment phenomenon.

If the underwriter is the main source of the underpricing, then a price-discriminatory auction by investors should price IPOs with significantly lower levels of initial returns than underwriter-priced U.S. IPOs. We find that the initial return to investors for all IPOs listed on the Tokyo Stock Exchange between April 1, 1989 and September 30, 1996 average 11.95% with 76.92% of these values are nonnegative. These auctioned IPOs do not produce a significantly lower initial return than those typically found in U.S. IPOs. Thus, the analysis of our laboratory experiment suggests that underpricing is not completely attributed to the pricing actions of underwriters as IPOs that are priced by investors in a price-discriminatory auction pricing process are similarly underpriced.

However, underwriter quality is not related significantly to the initial return levels of the auctioned IPOs. This finding is in direct contrast to the results of most studies of U.S. IPOs. The substitution of a price-competitive auction pricing process for an underwriter-pricing process has resulted in the reduced importance of the underwriter quality in explaining the variation in initial return levels.

Several variables are important in both Japanese and U.S. IPOs: initial returns accrue to investors at the offer price, issue size, and the partial adjustment phenomenon.

Just as in U.S. IPOs there appears to be no significant return on the first day of trading indicating that the initial return of Japanese IPOs accrues to the purchaser of the issue at the offer price, not to the buyer on the first day of trading. More important, the partial adjustment phenomenon found in U.S. IPOs was found to be similarly positive and significant for these Japanese IPOs. In fact, this was found to be the most significant independent variable in explaining variation in auctioned initial returns levels.

In summary, the comparison of Japanese price-discriminatory IPO auctions with U.S. underwriter-priced IPOs finds auctions do not remove underpricing from IPOs, or eliminate a partial adjustment phenomenon, or produce lower initial return levels. The use of auctions does appear to reduce the impacts of many traditional variables found to affect initial return levels in U.S. IPOs. Thus, underpricing is not completely attributed to the actions of the underwriter wanting to assure the full sales of the issue at favorable prices to their investment clients. Investors in a price-discriminatory auction also underprice IPOs.

## Notes

1. The U.S. investment banker price setting activities are often called “book building” as they use various methods such as “road shows” and direct solicitations to obtain indications of interests at various potential offer prices. See Benveniste and Spindt (1989), Benveniste and Wilhelm (1990), Spatt and Srivastava (1991), Hanley (1993), and Hanley and Wilhelm (1995).
2. The number of U.S. IPO studies is large. Some of these papers are found in the references that are particularly relevant to this study. For an excellent survey, see: Ibbotson, Sindelar, and Ritter (1994).
3. There are several noteworthy studies of Japanese IPOs. See Hebner and Hiraki (1993), Pettway and Kaneko (1996), Dewenter, Novaes, and Pettway (2001) and Kaneko and Pettway (2003). Loughran, Ritter and Rydqvist (1994) report that as of the date of their study only Japan, Belgium, Chile, France, and Portugal employ an auction process on more than 50% of the shares offered in the IPO. A study of French IPOs by Biais and Faugeron-Crouzet (1998) compares book building methods and fixed price selling methods and finds that auctions are superior to fixed price selling methods. Also, they find that French auctions and book building methods lead to the same prices and allocations. We also wish to compare auction-priced IPOs versus underwriter-priced IPOs. To keep the comparison among IPO issuing firms of similar size, we select Japanese IPOs listed on either the first or second section of the Tokyo Stock Exchange to compare with the results of US IPOs studies. This will allow a comparison of the IPOs on the two largest and most similar capital markets in the world.
4. From 4/1/89 until 4/1/92 the required auction percentage of the total number of IPO shares (primary and secondary shares) was at least 25% and at most 50% depending upon a precise formula. After 4/1/92, the requirement was set at 50% or more of the total number of IPO shares. See Pettway and Kaneko (1996). A test of the impact of the change in the proportions of issue auctioned, found insignificant differences in initial return levels in the two periods.

Since this study wishes to concentrate only on auction-priced IPOs, the period April 1, 1989 through September 30, 1996 was selected. Note this data period omits all IPOs auctions made from October 1, 1996 to September 1, 1997 when book building was allowed as an addition to auctions. The purpose of stopping short of the beginning date of book building is to omit all auctions that were made when their pricing could be affected by the discussion of allowing book building that was under active discussion during that period. Again the purpose of this study is to focus exclusively upon auction-priced IPOs in Japan.
5. The following are the distinguishing characteristics of the Japanese IPO auctions. First, in Japanese IPOs, the underwriters of the issues have already been

determined prior to the offer and there is a contract between the firm and the underwriter that is most similar to the “firm commitment” type of underwriting in the U.S. Second, many informed investors may not participate in the auction. Issuing company employees and their families are excluded, the ten largest shareholders of the issuing company cannot submit bids. Employees of securities companies are also excluded. Further, companies that have existing capital (equity and debt) ownership in the issuing firm cannot participate. Third, the maximum number of shares that can be purchased by a single investor or account is 5,000 shares (furthermore, the individual upper limit is usually within a range of 1,000 to 2,000 shares). The offer price of the unauctioned shares is based upon the weighted average of successful bids. After the price has been determined based upon the auction price, the underwriters are free to offer the remainder of the issues at their discretion. However, no shares may be sold to investors described in the second characteristic above which means that the investors in the allocation cannot be different from those in the auction. The maximum shares sold to an individual or an institutional investor is 5,000 shares (usually the individual upper limit is voluntarily set within a range of 1,000 to 2,000 shares). Since a normal “round lot” trading size on the Tokyo Stock Exchange is 1,000 shares, the number of shares that may be received by any one investor is quite small when compared to the allocation system employed in the U.S. The Japanese IPO system appears to try to distribute the IPO issue widely among investors.

6. See Hamao, Packer, and Ritter (1998).
7. It may appear that 78 is not a large sample, but this not a sample. It is a population of all IPOs listed on the 1<sup>st</sup> and 2<sup>nd</sup> section of the Tokyo Stock Exchange (TSE) during the period. Again we wish to compare IPOs on the two largest capital markets in the world; therefore, we can not add the Japanese OTC IPOs to this groups as they have significantly different listing requirements. Further, a comparison of the 11.95% initial returns of these 78 TSE IPOs from 89-96 with the 15.7% average of Japanese OTC issues from 1989-1995 in Hamao, Packer and Ritter (1998) suggests that the OTC issues have higher initial returns than the TSE IPOs as one might expect. Additionally, since the TSE peaked in December 1998 and has been more or less in decline ever since, the number of IPO issues in Japan has been very low. Thus, it is unlikely that the number of observations can be increased significantly and maintain the desired comparison. Further, concentrating on 1<sup>st</sup> and 2<sup>nd</sup> section TSE listed IPOs rather than on the Japanese OTC allows an interesting comparison of our results by Biais and Faugeron-Crouzet (1998). They analyze 92 “Second Marche” (somewhat similar to the 2<sup>nd</sup> section of the TSE) French IPO auctions made between 1983 and 1996 and find underpricing of 13%. This is higher than the averages in the U.S. and somewhat similar to the 11.95% in Japan.
8. In calculating the pre-offer formula price, the lead underwriter selects some (usually three) companies that are already listed and very similar to the company going

public. The pre-offer formula price is determined by applying the following formula called “comparable companies method”:  $P_A * 1/2[(NI_0/NIA) + (NA_0/NA_A)]$ , where  $P_A$  is the average stock price of the similar companies,  $NI_0$  is the net income per share of the company going public,  $NIA$  is the average net income per share of the similar companies,  $NA_0$  is the net asset per share of the company going public, and  $NA_A$  is the average net asset per share of the similar companies. This pre-offer formula price is calculated to determine the lower and upper limits on bid prices at the auction. Since the lower limit on bid prices is published by the *TSE Daily Report* four trading days prior to the auction, investors can easily know the pre-offer formula price before submitting their bids in the auction.

9. Both parametric and nonparametric tests were used to determine if the three periods (period 1: 4/1/89 - 3/31/92; period 2: 4/1/92 - 12/27/92; period 3. 12/2892 - 9/30/96) showed any significantly different patterns in the initial returns. The average initial return during period 1 was 11.664% with 31 observations. The second period was very short, less than a year, and only had 4 observations. The third period average initial return was 13.178% with 43 observations. The combined full period had an initial return of 11.953% with 78 observations. The initial return for each of the three periods was first tested separately and in various combinations; however, none of the tests found any significant difference between the initial return levels using either parametric and nonparametric tests. Using a parametric t-test of differences in the initial returns in these independent periods, the resulting p-values were high, ranging from 0.7738 to 0.2509. Using the nonparametric Kruskal-Wallis test of all independent combinations of these period initial returns were all found insignificant different with p-values ranging from 0.49522 to 0.3288. Thus, both parametric and nonparametric tests find that the initial returns in the three periods were insignificantly different from each other, clearly indicating that the periods may be pooled for further analysis.

However, Hamao, Packer, and Ritter, (1998), HPR, found the average initial return of OTC listed Japanese IPOs during period 1 (4/1/89 - 3/31/92) was 19.8% compared to 11.66% for the TSE listed IPOs included in this study. During the over-all period (8904 - 9512), they found the initial return average of OTC listed IPOs was 15.7% compared to 11.95% for TSE listed IPOs here. It appears that OTC issues in Japan have higher initial returns than those listed on the TSE for a comparable period. These differences could be related to the impact of smaller firms that are listed on the OTC versus those in this study of TSE listed larger and more frequently traded firms.

10. Two different definitions of initial returns are measured: (1) the traditional offer to close of the first day of trading, and (2) the offer to open of the first day of trading. For the 78 IPOs during the auction period, the traditional initial return to the close of the first day is 11.95% while the offer to open return is 11.92%. These are not statistically different. Thus, all of the traditionally defined initial return was earned by investors in the IPO at the offer price when the market trading began on the first day. The investors who purchase the shares on the first day of trading,

received an insignificant daily return of 0.02% over the study period.

11. Since the initial returns from U.S. studies are the returns that would be obtained by investors in the underwriter allocation from the offer price, we measured the initial returns of the Japanese IPOs in a similar manner from the offer price to the investor in the allocation. Thus, the comparisons found in Table 3 are all for fixed commitment type of underwriting and the initial returns are measured from the offer price to allocated investors to the closing price of the first day of trading.
12. Many U.S. studies do not provide details of the standard deviations of the reported initial returns. Thus, this study primarily focuses on those studies which report the standard deviations of the average returns as they are the only comparisons that can be made statistically. Note three of the studies do not provide the standard deviations in the referenced paper; however, the authors were contacted personally and they provided the standard deviation values that are reported for the Bhabra and Pettway (2003), Carter, Dark, and Singh (1998), Ibbotson, Sindelar, Ritter (1994), and Spiess and Pettway (1997). We are indebted to these authors for providing the standard deviations to allow our comparison with Japanese data.
13. It might be argued by some that those IPO selected because they have a subsequent seasoned equity offering as in the Spiess and Pettway study would have lower than average initial returns. However, this is not necessarily the case among the sample of U.S. IPO return studies cited in Table 3. In fact, the general studies of Barry and Jennings (1993), Bhabra and Pettway (2003), and Carter, Dark and Singh (1998) have lower initial returns than reported in the Spiess and Pettway (1997) study. Only the study by Ibbotson, Sindelar, and Ritter (1994) has higher returns. The main point is that a comparison of the initial returns from Japanese auctioned IPOs does not have a statistically significant difference from the initial returns found in the Spiess and Pettway study. Thus, we think that this study should remain in the comparison as it is a published study of IPO initial returns and does not appear to exhibit any outward signs of sample selection bias.
14. It is very interesting that Biais and Faugeron-Crouzet (1998) in their study of French IPO auctions also found evidence of a partial price adjustment phenomenon. They find an average price adjustment of 17.36% in France compared to 8.5% in Japan reported in Table 1. Further, they find that a regression between the initial returns and the partial adjustment ratio is also positive and significant. A similar regression and results for Japanese IPOs are found in models 4, 5, 6, and 7 of Table 4. Thus, both Japanese and French IPOs that use an auction to price IPOs have partial-price adjustments just as do U.S. IPOs sold and priced by underwriter.
15. The numbers of issues for each lead underwriter were as follows: Nomura 28, Nikko 17, Yamaichi 15, Daiwa 14, non-BIG 4 underwriters 4.
16. To illustrate these differences in capital levels, each of the capital levels of the seven

underwriters employed in this study are presented in millions of yen for the period ending September 30, 1996. Nomura (1,251,910), Daiwa (926,817), Nikko (789,216), Yamaichi (613,262), Kokusai (227,371), Kankaku (89,046). The average capital level for the BIG 4 was 895,301 million yen while the average of the smaller non-BIG 4 companies was 158,210 million yen. Since Nomura is the largest, but the other BIG 4 are also quite large compared to the non-BIG 4 underwriters, this analysis compares initial returns versus underwriter quality measured by capital sizes in three categories: NMR (Nomura), BIG 4 (Nomura, Daiwa, Nikko, Yamaichi), BIG 3 (Daiwa, Nikko, Yamaichi), and non-BIG 4 (Kankaku, Kokusai).

**Table 1.**

**Descriptive Statistics:  
of 78 Japanese IPO Sales During the Auction Period  
April 1, 1989 - September 30, 1996**

| Measures   | Values  | Standard Deviations | Maximum Value | Minimum Value |
|--|---------|---------------------|---------------|---------------|
| Mean Value of Total Shares Offered (millions of Yen <sup>1</sup> ) | 18,217  | 27,259              | 172,341       | 923           |
| Mean Value of Total Shares Offered (millions of                    | 151.8   | 227.2               | 1,436.2       | 7.7           |
| Mean Number of Primary Shares Offered (1,000 shs)                  | 3,951   | 3,598               | 21,100        | 2             |
| Mean Number of Secondary Shares Offered (1,000 shs)                | 1,174   | 1,439               | 6,000         | 0             |
| Mean Percentage of Secondary Shares of Total Offered               | 23.01%  | 22.12%              | 70.15%        | 0.00%         |
| Mean Number of Shares Auctioned (1,000 shs)                        | 1,121   | 1,412               | 8,000         | 2             |
| Mean Percentage of Auctioned/Total Shares                          | 45.98%  | 8.69%               | 62.50%        | 25.00%        |
| Mean Ratio of Offer Price/Pre-Offer Formula Price <sup>3</sup>     | 1.0850  | 0.0197              | 1.6560        | 0.8500        |
| Mean Offer Price (Yen)   | 216,631 | 1,057,163           | 7,270,000     | 415           |
| Mode Offer Price (Yen)   | 4,970   |                     |               |               |
| Median Offer Price (Yen)   | 2,295   |                     |               |               |
| Mean Market Value of IPO Sale (Issue Size, millions of             | 17,926  | 2,979               | 159,800       | 880           |
| Mean Market Value of IPO Sale (Issue Size, millions of             | 149.4   | 24.8                | 1,331.7       | 7.3           |
| Mean Capital Stock Value Before Sale (millions of Yen)             | 2,672   | 3,231               | 24,379        | 446           |
| Mean Capital Stock Value Before Sale (millions of                  | 22.3    | 26.9                | 203.2         | 3.7           |
| Mean Capital Stock Value After Sale (millions of Yen)              | 8,212   | 9,760               | 59,324        | 1,170         |
| Mean Capital Stock Value After Sale (millions of                   | 68.4    | 81.3                | 494.4         | 9.8           |

<sup>1</sup> The value of total shares offered = [(auctioned shares \* average of accepted bids) + (unauctioned shares \* offer price)].

<sup>2</sup> The above values in millions of Yen were converted to million dollars using 120 Yen = 1 dollar, which was the average exchange rate during the study period.

<sup>3</sup> The pre-offer formula price is defined in footnote 8. This ratio means that the average offer price was adjusted upward by 8.5% above the pre-offer formula price. This ratio for each IPO is used to test for the significance of the "partial adjustment phenomenon."

**Table 2.**

**Distribution of 78 IPO Sales and Initial Returns During the Auction Period  
April 1, 1989 - September 30, 1996**

| Year   | Number of Issues | Mean Initial Return | Standard Deviation of IR | Percent Non-Negative | % Change in TOPIX by year | Day 1 Return (Close-Open) | Mean Day Return Days (1-4) | Standard Deviation of Days Return |
|--|------------------|---------------------|--------------------------|----------------------|---------------------------|---------------------------|----------------------------|-----------------------------------|
| 1989   | 8                | 7.18%               | 6.31%                    | 100.00%              | 20.49%                    | -1.99%                    | 0.39%                      | 4.76%                             |
| 1990   | 16               | 17.64%              | 27.72%                   | 75.00%               | -15.11%                   | 0.40%                     | -0.71%                     | 6.33%                             |
| 1991   | 7                | 3.13%               | 29.80%                   | 42.86%               | -15.52%                   | 1.32%                     | 0.70%                      | 4.70%                             |
| 1992   | 4                | 1.03%               | 14.36%                   | 75.00%               | -25.95%                   | 3.49%                     | 0.49%                      | 3.26%                             |
| 1993   | 10               | 20.75%              | 21.98%                   | 90.00%               | 11.70%                    | 0.42%                     | 0.08%                      | 3.92%                             |
| 1994   | 10               | 13.82%              | 25.20%                   | 70.00%               | 4.94%                     | -0.59%                    | -0.54%                     | 3.98%                             |
| 1995   | 14               | 12.04%              | 19.74%                   | 78.57%               | -13.67%                   | -0.40%                    | -0.16%                     | 2.83%                             |
| 1996   | 9                | 5.82%               | 11.93%                   | 77.78%               | 16.30%                    | -0.56%                    | 0.23%                      | 3.00%                             |
| <b>Overall Mean values:<br/>04/1/89 - 09/30/96</b> |                  |                     |                          |                      |                           |                           |                            |                                   |
|  | 78               | 11.95%              | 21.89%                   | 76.92%               | -2.10%                    | 0.02%                     | -0.13%                     | 4.39%                             |
| Maximum Initial                                    |                  | 88.70%              |                          |                      | 20.49%                    | 3.49%                     | 19.42%                     |                                   |
| Minimum Initial                                    |                  | -23.38%             |                          |                      | -25.95%                   | -1.99%                    | -20.32%                    |                                   |

**Definitions:**

- Initial Return      Percentage change from offer price to closing price on the first day of trading.
- % Non-Negative      Percentage of returns that were 0.0% or positive divided by all IPOs.
- % Change in TOPIX      The yearly percentage change in the Tokyo Stock Exchange (TSE) Stock Price Index which measures the total market value of all stocks listed on the TSE from year to year.
- Day 1 Return      The change in price from the open to close on the first day of trading.
- Mean Day Return      The average return of each day's prices over the first four days of trading. The first day's return was measured from open to close, the next three days' return were measured individually from close of previous day to the close of the current day. These four values were averaged.

Table 3.

## Comparison of Initial Returns and Daily Returns

|  | Number of IPOs | Study Period      | Initial Return (Close-Offer) | Standard Deviation | Trading Day Returns <sup>a</sup> | Standard Deviation <sup>b</sup> |
|--|----------------|-------------------|------------------------------|--------------------|----------------------------------|---------------------------------|
| Current Study of Japanese IPOs<br><b>FC</b>                | 78             | 4/1/89 - 9/30/96  | 11.95%                       | 21.89%             | -0.13%                           | 4.39%                           |
| Barry & Jennings (1993) <b>FC</b>                          | 175            | 12/88 - 12/90     | 8.69%                        |                    | 0.40%                            | 4.95%                           |
| t-value of difference of US Japanese                       |                |                   |                              |                    | 1.22                             |                                 |
| Bhabra & Pettway (2003) <sup>c</sup> <b>FC</b>             | 398            | 1/87 - 12/91      | 10.03%                       | 14.53%             | 0.06%                            | 4.10%                           |
| t-value of difference of US Japanese                       |                |                   | -0.97                        |                    | -0.59                            |                                 |
| Carter, Dark, & Singh (1998) <sup>c</sup> <b>FC</b>        | 2,292          | 1/1/79 - 12/31/91 | 8.15%                        | 17.41%             | 0.11%                            | 3.45%                           |
| t-value of difference of US Japanese                       |                |                   | -1.88*                       |                    | 1.19                             |                                 |
| Ibbotson, Sindelar, & Ritter (1994) <sup>d</sup> <b>FC</b> | 10,626         | 1/60-12/92        | 15.26%                       |                    |                                  |                                 |
| Ibbotson, Sindelar, & Ritter (1994) <sup>e</sup> <b>FC</b> | 13,308         | 1/60 - 12/96      | 15.80%                       |                    |                                  |                                 |
| Ibbotson, Sindelar, & Ritter (1994) <sup>f</sup> <b>FC</b> | 2,883          | 4/89-9/96         | 14.32%                       | 21.48%             |                                  |                                 |
| t-value of difference of US Japanese                       |                |                   | 0.96                         |                    |                                  |                                 |
| Spiess & Pettway (1997) <sup>c</sup> <b>FC</b>             | 172            | 1/87 - 12/91      | 10.94%                       | 14.29%             |                                  |                                 |
| t-value of difference of US Japanese                       |                |                   | -0.43                        |                    |                                  |                                 |

<sup>a</sup> The average daily returns (Japanese, BP, and CDS studies = first four days. BJ = first two days).

<sup>b</sup> The standard deviation reported is the average of those reported for the trading day returns

<sup>c</sup> Provided specific data from their study to match the Japanese data format.

<sup>d</sup> From original Table 1, ISR (1994), *Journal of Applied Corporate Finance*, 66-74.

<sup>e</sup> Firm commitments from 2/19/97 revision of the original Table 1 in the 1994 paper.

<sup>f</sup> Data provided by J. Ritter of non-unit firm commitment offerings beginning April 1, 1989 through 9/30/96, which is similar to the Japanese auction period used in this study (i.e., beginning with 4/1/89).

**FC** Firm commitment type of underwriting of IPOs.

\* Significantly different (US average - Japanese average) at .05 level

**Table 4.**  
**Relations between Initial Returns, Firm Size, % Insider Sales, Market Movements, and the Partial Adjustment Phenomenon**  
**During the Auction Period, 04/01/89 - 09/30/96**

Regression Models:

1.  $IR_j = a_j + b_j \text{LogIPOV}_j$
2.  $IR_j = a_j + b_j \%IS_j$
3.  $IR_j = a_j + b_j \%CTOPIX_j$
4.  $IR_j = a_j + b_j \text{OP/POFP}_j$  (Full sample, N=78)
5.  $IR_j = a_j + b_j \text{OP/POFP}_j$  (04/01/92 - 09/30/96, N=47)

The first value in each cell for each independent variable is the regression coefficient. The second is the p-value of that coefficient.

| Model                   | Model 1           | Model 2          | Model 3          | Model 4           | Model 5*          | Model 6*          | Model 7           |
|-------------------------|-------------------|------------------|------------------|-------------------|-------------------|-------------------|-------------------|
| Intercept               | 0.3158<br>0.1471  | 0.0874<br>0.0169 | 0.1197<br>0.0000 | -0.1837<br>0.1811 | -0.2202<br>0.1357 | -0.0870<br>0.7270 | -0.1674<br>0.4185 |
| LogIPOV <sub>j</sub>    | -0.0493<br>0.3623 |                  |                  |                   |                   | -0.1602<br>0.0442 | -0.1916<br>0.0027 |
| % Insider Sales         |                   | 0.1399<br>0.2172 |                  |                   |                   | 0.2134<br>0.1073  | 0.2164<br>0.0471  |
| % Change in TOPIX       |                   |                  | 0.0080<br>0.9618 |                   |                   | 0.0420<br>0.8363  | 0.1076<br>0.4826  |
| OP/POFP                 |                   |                  |                  | 0.2795<br>0.0264  | 0.3397<br>0.0205  | 0.5754<br>0.0021  | 0.6152<br>0.0001  |
| Adjusted R <sup>2</sup> | -0.0021           | 0.0071           | -0.0131          | 0.0508            | 0.0939            | 0.1539            | 0.1697            |
| F-Value                 | 0.8400            | 1.5486           | 0.0023           | 5.1250            | 5.7673            | 3.0910            | 4.9350            |

\* Models 5 and 6 are regressed with samples of the period of 04/01/92 to 09/30/96.

Definitions:

- $IR_j$  = Initial return [(Closing price-offer price)/offer price] of IPO<sub>j</sub>.  
 $IPOV_j$  = The size of the offer =(shares sold \* offer price) for firm j.  
 $\%IS_j$  = Insider Sales (secondary shares) as % of total shares sold.  
 $\%CTOPIX_j$  = The annual % change in the TOPIX for the current year.  
 $OP/POFP_j$  = The offer price/pre-offer formula price for each firm j. If the ratio is above 1.0, then there was an upward movement between the initial suggested price and the final offer price, and, thus, a partial adjustment in the offer price.

Table 5.

Relations between Initial Returns and Underwriter Quality  
During the Auction Period, 04/01/89 - 09/30/96

Regression Models:

1.  $IR_j = a_j + b_j NMR_j$
2.  $IR_j = a_j + b_j BIG\ 4_j$
3.  $IR_j = a_j + b_j BIG\ 3_j$

| Model | Period  | $a_j$  | $b_j$  | t-value | p-value |
|-------|---------|--------|--------|---------|---------|
| 1     | Overall | 11.83% | 0.35%  | 0.067   | 0.947   |
| 2     | Overall | 6.22%  | 6.04%  | 0.535   | 0.594   |
| 3     | Overall | 12.18% | -0.35% | -0.067  | 0.947   |

Definitions:

- $IR_j$  = Initial return [(Closing price-offer price)/offer price] of IPO<sub>j</sub>  
 $NMR$  = 0/1 dummy variable coded as 1 if Nomura was lead underwriter, N=28  
 $BIG\ 4$  = 0/1 dummy variable coded as 1 if either Nomura, Daiwa, Yamaichi, or Nikko was lead underwriter, N= 74.  
 $Big\ 3$  = 0/1 dummy variable coded if other than Nomura in the BIG 4 was lead underwriter, N = 46 as all non-BIG 4 observations were omitted.

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