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Public Information, IPO Price Formation, and Long-run Returns: Japanese Evidence

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We use a sample of JASDAQ IPOs to study the effects of public information on offer price formation, initial returns, and long-run returns. Underwriters begin reporting anticipated offer prices of Japanese IPOs at an earlier point than in the US. The observable portion of the price formation process begins with an original price that is established before the roadshow, continues through establishment of the filing range, and concludes with the offer price. Neither price adjustment--from the original price to the midpoint of the range, or from the midpoint to the offer price--fully reflects public information from as long as four months before the IPO. As in the US, price adjustments are asymmetric. Prices adjust more fully in response to negative than to positive public information. It appears that adjustments are limited by an implicit agreement between the issuer and the underwriter that originates before marketing of the offer begins. The agreement reflects an expectation that the offer price will be based on the relative market values of public companies up to four months before the IPO. We find that one-year aftermarket returns are significantly lower when initial returns are high. Initial returns under-adjust relative to public information that is revealed before the IPO and the under-adjustment is substantially reversed in the aftermarket. The evidence connects the implicit contracting theory with the argument that offer prices are based partly on expected value at the time of early price discussions. As a result, it can explain episodes of substantial underpricing that are sustained over periods of several months. The paper also documents that over-allotment options affect price formation by enabling issuers to select significantly narrower filing ranges and to price more fully, so that initial returns are lower.

Keywords: IPO price formation; partial adjustment; underpricing; public information; long-run returns; over-allotment options

JEL classification: **G24; G32; G14, G28**

Public Information, IPO Price Formation, and Long-run Returns: Japanese Evidence

In the US, initial public offering ("IPO") offer price formation begins with a "beauty contest" or "bake-off" where investment banks compete for the role of lead underwriter. The selected underwriter is responsible for conducting due diligence, organizing the syndicate, preparing the prospectus, and pre-selling the issue via a roadshow. Before the roadshow begins, the underwriter produces a preliminary prospectus that generally includes a filing range. The filing range is the first public indication of the anticipated offer price. Just prior to the IPO, the underwriter sets the offer price. Typically, as shown by Hanley (1993) and others, the price is set at a level so that the expected initial return is positive, although realized underpricing percentages vary considerably.

Recent literature establishes that IPO offer prices in the US do not fully reflect public information that is known at the time of the offering. Bradley and Jordan (2002) and Lowry and Schwert (2004) find that initial returns are significantly related to the initial returns of recent IPOs. Loughran and Ritter (2002), Lowry and Schwert (2004), and some earlier studies, find that initial returns are positively related to market-wide stock price increases before the IPO. Additionally, Lowry and Schwert find that even the filing range does not fully reflect public information. They question whether, at some earlier point, such as during the bake off, the underwriter and the issuer implicitly agree on the initial filing range, and agree to limit adjustments of the range or the offer price in response to subsequent market movements. If so, this understanding could give rise to the pattern of partial adjustment first reported by Hanley (1993) and, depending on the considerations that affect the negotiated offer price, to sustained episodes of unusually high initial returns.

The notion that price adjustments are limited by prior implicit agreements, combined with the occurrence of sustained episodes of substantial overpricing, begs the question of what considerations drive the terms of the agreement. According to Ritter (2003), early discussions focus on offer prices that are implied by the market values of publicly traded shares of other firms that are comparable. In this vein, Derrien (2005), and Pumanandam and Swaminathan (2004), among others, find that offer prices reflect considerations of value relative to other publicly traded shares ("relative value").[1] As originally hypothesized

[1] Derrien refers to "long-run intrinsic value," which implies value based on full information and an asset pricing model. Purnanandam and Swaminathan refer to "fair value," which has specific legalistic meanings when used by the Securities and Exchange Commission, the Accounting Standards Board, and the Appraisal Institute. We follow Galev, Goetzmann , and Rouwenhorst (1999)

by Miller (1977), these studies suggest that early investors in IPOs tend to be overly optimistic. Using different approaches, Derrien and Pumanandam and Swaminathan show that share prices immediately after IPOs are too high compared to relative value, resulting in long-run underperformance. Pricing based on relative value is an implication of the certification role of the underwriter as hypothesized by Booth and Smith (1986) based on reputational capital, and Tinic (1988) based on exposure to litigation risk.

If early discussions between the issuer and the underwriter restrain price adjustments in response to public information, then the consistency of offer prices with relative value can only hold on average. Even compared to the first aftermarket price, some IPOs can be overpriced *ex ante*. If the over- or underpricing is partly based on public information, it should not be hard for investors to spot the IPOs that are likely to be overpriced and those that are likely to yield high initial returns. Benvineste and Spindt (1989) argue that average underpricing serves multiple functions, including that allocations of underpriced shares can be used to compensate investors for occasionally buying shares that are overpriced. Jenkinson, Morrison, and Wilhelm (2006) hypothesize that when the filing range acts as a binding constraint on the offer price, the maximum of the range can be used to encourage investors to engage in acquiring information about the value of the issue (Sherman and Titman, 2002) or to disclose private information about their demand (Benveniste and Spindt, 1989).

Loughran and Ritter (2002) note that any pattern of partial adjustment allocates risk between the issuer and the underwriter, and that investors who buy IPO shares also are parties to the allocation. Information-based theories, such as some of the hypotheses discussed above can explain partial adjustment relative to private information even in an environment where no party is motivated by a desire to allocate risk. However, no hypothesis other than one based on an intentional allocation of risk seems able to account for partial adjustment in response to public information, and particularly public information that arrives before any information about the offer price is released to the market.

In this study, we use a sample of Japanese IPOs to study IPO offer price formation and how public information that was known at various points in the process bears on the initial and long-run returns. Institutional features of the JASDAQ IPO market enable us to study price formation beginning from an

in using the term, "relative value," to mean value based on comparison to other similar assets, without regard to the underlying asset pricing model or legal definition.

earlier stage than is possible in the US. We also are able to use other features of the JASDAQ market to shed new light on the role of the filing range in price formation, and to test how the introduction of over-allotment and Green-Shoe options influences price formation.

As conjectured by Lowry and Schwert (2004), our evidence suggests that price adjustments are limited by an implicit agreement between the issuer and the underwriter. As observed by Bradley and Jordan (2002), Loughran and Ritter (2002), and Lowry and Schwert, we find that underpricing is greater following market run-ups in the months before the IPO. More specifically, under-adjustment relative to the initial return is more than offset by under-performance in the year after the IPO. We find that under-adjustment in response to public information extends throughout the price formation process. Further, as hypothesized by Loughran and Ritter (2002) in their discussion of "leaning against the wind" of IPO investor over-optimism, long-run returns of JASDAQ IPOs are negatively related to initial returns. Complementary to the findings of Derrien (2005), and Pumanandam and Swaminathan (2004), we find that long-run returns are lower when initial returns are high relative to public information available before the offering. Thus, our evidence connects the implicit contracting hypothesis to the argument that offer prices are based on relative value and that sustained periods of high initial returns can arise from episodes when IPO investors are overly optimistic relative to the market values of established, publicly traded firms.

Consistent with US evidence, JASDAQ IPO price adjustments in response to public information are asymmetric. Offer price adjustments are stronger in response to negative information than to positive information. In our sample, the differential response can be traced largely to the constraining effects of the filing range on price adjustments. This result, which cannot be studied as directly in the US because of differences in conventions with respect to setting and adjusting the filing range, supports the hypothesis of Jenkinson, Morrison, and Wilhelm (2006).

Finally, we are able to examine the effects of the introduction of over-allotment and Green Shoe options on aspects of issue pricing. Consistent with the hypotheses of Benveniste, Busaba, and Wilhelm (1996) and Chowdhry and Nanda (1996), our evidence indicates that the options enable issuers to select significantly narrower filing ranges and to price the IPOs more fully, so that initial returns are lower.

I. Institutional Background on IPO Price Formation

Compared to the US, the equity market in Japan enables a more complete investigation of IPO offer price formation. As shown in Figure 1, IPOs in Japan are first described in a Preliminary Prospectus that includes an original price that is determined before the pre-marketing effort begins. The filing range is introduced about ten market days later in a First Revised Prospectus that is circulated while the roadshow is in progress. The offer price is announced about seven market days after that in a Second Revised Prospectus, typically about eight market days before the offer. Because the public portion of the pricing process begins with a preliminary prospectus and is updated during the roadshow, we are able to examine more completely the extent to which public information is incorporated in the original price and in the subsequent filing range.

A. Filing Range

In the US, the role of the filing range in the IPO price formation process is unclear. By convention, overwhelmingly IPOs in the US are brought to market with filing ranges of two dollars. See, for example, Hanley (1993) and Jenkinson, et al. (2006).[2] By informal policy of the US Securities and Exchange Commission (SEC), the final offer price can deviate from the filing range by as much as about 20 percent below the minimum or above the maximum. However, because the SEC permits issuers to amend the filing range as little as one day before the offer is sold, the range that is first reported in a preliminary prospectus is not necessarily a good indicator of the final offer price.[3] Although, in the US, the filing range does not establish binding constraints on the offer price, the partial adjustment evidence of Hanley (1993) suggests that it does have a limiting effect.

The equity capital market of Japan offers a useful contrast. The filing range in the First Revised Prospectus establishes binding constraints on the offer price.[4] Unlike in the US, there is no common practice with regard to the size of the filing range of Japanese IPOs. Figure 2 shows time series data on filing ranges of JASDAQ IPOs from September 30, 1997 through the end of 2003. The figure includes both yen-valued

[2] To document the US practice, we collected data on venture-backed IPOs from Thompson Financial. For 611 IPOs from October 1997 through October 2003, 93.9 percent had filing ranges of two dollars. In that sample, 8.4 percent were offered at prices that were more than 20 percent below the minimum implied by the original filing range and 23.9 percent were offered at more than 20 percent above the maximum. Thus, it is unclear whether, in the US, the initial filing range conveys useful information to investors.

[3] Bradley and Jordan (2002) examine the U.S. practice of amending the filing range. In their sample, 37 percent of issuers amended the filing range.

[4] Kaneko and Pettway (2003) report that the practice of not setting the offer price outside the range is due to "administrative guidance" from the Ministry of Finance, which views the range as an implicit promise to investors. The parties can change the filing range by issuing an amended First Revised Prospectus, but such changes are rare. In our sample, only eight IPOs (1.6 percent) revised the range. All did so within six days of issuing the original First Revised Prospectus and all revisions were at least 11 days before the IPO and at least four days before issuing the Second Revised Prospectus. If the First Revised Prospectus in amended, our analysis is based on filing range data from the final First Revised Prospectus.

ranges and natural logs of ranges. Around the end of 2001, a change in the Japanese Commercial Code led issuers to alter the typical IPO share price.[5] The effect of the change is apparent in Figure 2. Before the change, the most commonly selected range, 100 yen, was selected for only 16.8 percent of the IPOs. After the change, the most common range declined to 50 yen and was selected for 14.6 percent of the IPOs. Also, as shown in Figure 2, measuring filing range as the natural log of the maximum over the minimum, there is considerable variation of the selected ranges across IPOs, but the effect of the JASDAQ rule change is less apparent.[6]

Because the range is binding on the offer price, it can be costly for the issuer to agree to a maximum price that it perceives to be too low. Conversely, because the underwriter is committed to purchase the offer from the firm, it can be costly to agree to a minimum price that is too high. Because the choice of filing range is unconstrained, issuers and underwriters can avoid the potential for the range to limit the offer price by selecting a very broad range. However, as Jenkinson, et al. (2006) hypothesize in their study of European IPOs, in cases where the range constrains the offer price, an underwriter and issuer can use a narrow range to encourage investors to acquire information about the value of the issue. Below we test their hypothesis. We also examine how the filing range is related to the fee charged by the underwriter, and whether the narrowness of the range has an impact on how fully an IPO is priced.

B. Over-allotment and Green Shoe Options

In contrast to the US, where over-allotment options and Green Show options are common, such options have been allowed in Japan only since February 2002. Over-allotment options enable the underwriter to reduce exposure to flipping by allotting more shares than are specified in the offer. Effectively, the underwriter uses over-allotment options to hedge against a price decline after the IPO by taking a short position in the stock. Green Shoe options enable the underwriter to fill excess orders with additional shares rather than by repurchasing the shares in the market. In most cases, over-allotment and Green Shoe options are used in tandem so that the underwriter can fill orders either by covering a short position or by issuing

[5] Before the end of 2001, some issues were offered at very high share prices, with number of shares comprising a trading unit selected by the issuer. After 2001, the number of shares comprising a trading unit was determined by code as a function of the share price. For descriptive purposes, we standardize all prices to trading units of 1000 shares. In the period before the end of 2001, we do this on the basis of stated value (i.e., similar to par value) per share. Kaneko and Pettway (2003) report mean share prices that are not standardized and therefore show much higher prices than we report in Table 1.

[6] While by this measure the range is significantly lower after the end of 2001, we attribute the lower range to Japan's introduction of over-allotment and Green Shoe options, which occurred around the same time.

additional shares. If the underwriter covers its short position by repurchasing shares at below the offer price, its gain on shorting is offset by its cost, including reputational harm, of selling additional shares. If it covers the short by exercising the Green Shoe option, it gains the underwriting fees on the additional shares.

Benveniste, Busaba, and Wilhelm (1996) hypothesize that stabilization is a put option that substitutes for greater underpricing by rewarding investors for revealing private information. Chowdhry and Nanda (1996) hypothesize that stabilization reduces winners curse. Both imply that stabilizations results in less underpricing. Aggarwal (2002) and Ellis, Michaely, and O'Hara (2000) find that cold issues are over-allocated and Ellis, et al. estimate that stabilization is not very costly to underwriters. Lewellen (2006) finds: (1) that stabilization creates price rigidity below the offer price; (2) is not more prevalent when information asymmetries are high; and (3) is more commonly used by major underwriters. Fishe (2001) hypothesizes that underwriters choose offer price, and over-allotment options and aftermarket support levels to maximize their profits, including profits on aftermarket trading. Because our IPO sample spans the introduction of over-allotment and Green Shoe options, we can use this "natural experiment" to evaluate recent theories that suggest that options give rise to narrower filing ranges and more fully priced issues.

II. Data

Book building was introduced in Japan on September 1, 1997 as an alternative to its existing hybrid auction method. The first book-built IPO occurred on September 30.[7] From then through the end of 2003, 487 firms used Japan's book-building method to go public on the JASDAQ. Table 1 contains definitions and sample statistics for the main variables used in this analysis. The table also contains comparison statistics for the subsample of 358 IPOs before over-allotment and Green Shoe options were permitted (the pre-over-allotment period) and the subsample of 129 IPOs during the period when the options were permitted (the over-allotment period).

Throughout the analysis, all price adjustments, returns, and the filing range are measured in natural logs and all returns are buy-and-hold returns. Thus, we measure *Initial Price Adjustment* as the natural log of the buy-and-hold return from the original price to the midpoint of the range. *Offer Price Adjustment* (offer price/midpoint of the filing range), *Initial Return* (first after-market price/offer price), *One-year After Market*

[7] Book building was quickly adopted in preference to the traditional hybrid auction method. The only subsequent auction-method IPO occurred on October 7, 1997.

Return (the one-year later after-market price/first aftermarket price), and *Filing Range* (maximum of range/minimum of range) also are measured in analogous ways, as are the JASDAQ return, various run-up values, and *Underwriter Fee*.[8] In their examination of European IPOs, Jenkinson, et al. (2006) find that the midpoint of the filing range is a negatively biased predictor of the offer price. Our result in Table 1 is similar. Mean *Offer* P*rice Adjustment* of 0.051 is significantly positive (t-value = 14.3). However, mean *Offer Price Adjustment* is partly offset by mean *Initial Price Adjustment* of -0.021, which is significantly negative (t-value = -2.6). The standard deviation statistics in the table indicate that there is substantial cross-sectional variation in both *Initial Price Adjustment* and *Offer Price Adjustment*.

Based on tests of differences in means and on Wilcoxon rank sum tests, firms during the over-allotment period were younger and issue sizes (without option exercise) were smaller than during the pre-over-allotment period. Initial price adjustments, which are unobservable for US IPOs, are more negative and the filing ranges are narrower during the over-allotment option period. Long-run (one-year) after-market returns are negative in the pre-over-allotment period, corresponding to lower long-run changes in the JASDAQ Index. Underwriter fees are higher during the over-allotment period and underwriter market share is lower.

Anticipating our empirical analysis, the mean value of *Total Return* in our sample is 0.205, comprising an *Initial Return* of 0.255 and a *One-year Aftermarket Return* of -0.050. During the same period, the mean *One-year JASDAQ Return* was 0.294. So, on net, the mean positive *Total Price Adjustment* of 0.030 and JASDAQ-adjusted *Total Return* of -0.089 transferred wealth from investors to issuers. This result, however, is sensitive to outliers. The median *Total Price Adjustment* of 0.018, combined with the median *Total Return* of 0.117, less the median *One-year JASDAQ Return* of -0.096, implies a median net transfer to investors of 0.195, which is close to the 15 percent target relative value discount that commonly is referred to by practitioners.

In Table 2, we focus on the subsample of IPOs from the over-allotment period. Forty-three of the 130 IPOs during this period included over-allotment and Green Shoe options. Consistent with the expectation that these options reduce issue price uncertainty, IPOs with options have less-negative initial

[8] All JASDAQ IPOs through 1999 and most of them after 1999 were traded in the aftermarket by Dutch auction at the same price for all shares traded on any given day. After 1999, there has been a gradual trend toward continuous trading using a market-maker system similar to that of the US over-the-counter market.

price adjustments, narrower filing ranges, and lower initial returns. Inclusion of options is more common after run-ups in the JASDAQ index and for larger IPOs underwritten by high-market-share underwriters. The latter result supports Lewellen (2006), who studies US IPOs and finds that stabilization activities are more common for IPOs underwritten by larger underwriters. Although not shown in the table, short-coverage is more likely to occur when *Initial Return* is low (mean = -0.0095), whereas Green Shoe options are more likely to be exercised when *Initial Return* is high (mean = 0.2011).

In subsequent empirical analysis, we estimated models pooling all of the data and separate models for the pre-over-allotment period and the over-allotment period. Results for the pre-over-allotment period were similar to those based on the entire sample. Results based on the over-allotment period also were similar, but were less stable due to the smaller number of observations. Accordingly, in the empirical analysis, we report only the results for the full sample and we use binary variables to measure the effects of including over-allotment and Green Shoe options.

III. The Japanese IPO Price Formation Process and the IPO Sample

Table 3 provides information on the distribution of *Initial Price Adjustment*, *Offer Price Adjustment*, and *Initial Return*. While the mean initial price adjustment in Table 1 is near zero, there is considerable variation. In Table 3, 15.6 percent of the initial price adjustments are positive enough so that the minimum of the filing range is above the original price, and 20.7 percent of the initial price adjustments are negative enough so that the maximum of the range is below the original price. Thus, the original price does not prevent selecting filing ranges that are strictly either above or below the original price.

Table 1 shows that the mean offer price adjustment from the midpoint of the filing range is significantly positive. However, Table 3 shows that the adjustment is importantly constrained by both the maximum and the minimum of the range. Over two-thirds of the IPOs are offered at the maximum and another 8.6 percent are offered at the minimum. Not shown in the table, IPOs offered at the maximum are significantly more likely to be followed by positive initial returns and those offered at the minimum are significantly more likely to be followed by negative initial returns. Of the IPOs offered at the minimum, 43 percent have negative or zero initial returns and the mean is negative 2.0 percent. Thus, if investors were able to participate selectively in IPOs, they could avoid negative expected initial returns by not participating in

IPOs priced at the minimum of the range. While the mean initial return in the IPO sample is over 25 percent, over 15 percent of the IPOs have negative initial returns. Only five of the 74 IPOs with negative initial returns included over-allotment options, where the underwriter could mitigate losses by implicitly shorting the offering. For the others, the underwriter could bear the initial losses directly, or could bear reputational costs with investors. Benveniste and Spindt (1989) and others suggest that underwriters shift these costs to investors by using allocations of underpriced shares partly to compensate investors for participating in overpriced offerings.

The correlation statistics in Table 3 suggest that partial adjustment occurs both from the filing range to the offer price (as in the US) and from the original price to the filing range. Thus, it appears that in Japan, a price that is introduced prior to roadshow discussions with potential investors still restrains price adjustments. This result is preliminary evidence that that price adjustments are affected by an implicit contract between the issuer and the underwriter.

While our evidence generally is consistent with Jenkinson, et al. (2006), the earlier price indication in the Japanese data enables us to examine a variation of their hypothesis. Building on Benveniste and Spindt (1989) and Sherman and Titman (2002), Jenkinson, et al. argue that a commitment to price stickiness encourages informed investors to engage in information production and to reveal their true demand. For European IPOs, they attribute price stickiness relative to the range to information generated from investors before the range is set. As supporting evidence, they note that European IPOs rarely are offered at above the maximum of the filing range. Given that the roadshow in Japan starts after the original price is set and before the range is set, their argument implies that the maximum of the range should rarely be set above the original price. However, we find that the maximum is above the original price for over 60 percent of the IPOs. Further, the price increase is not trivial. The average increase from the original price to the maximum of the range is 17.3 percent. Thus, in Japan, it does not appear that the practice of routinely adjusting the maximum relative to the original price provides investors with incentives to acquire or disclose private information until after the range is established. As shown below, we nonetheless find offer price stickiness relative to the original price, which is set before any discussion with investors. We interpret the stickiness as evidence that price adjustments in Japan are restrained by early discussions between the issuer and the underwriter.

IV. Empirical Analysis of IPO Price Formation

To examine the effects of implicit contracting, the filing range, and over-allotment options on IPO price formation and initial returns, we estimate a recursive system that includes simultaneous and censored regression models. To test whether price adjustments also may be affected by concerns that demand for the IPO may reflect investor over-optimism, we also examine the relationships between price adjustments and long-run returns over the 12-months after the IPO. Results are reported in Table 4. Because the data for each observation are from overlapping periods, statistical significance levels may be overstated by OLS regression. To address this in the OLS models we report clustered robust standard errors where the clusters are calendar quarters. Significance levels based on clustered standard errors are not materially different from the standard errors that are generated without clustering or heteroskedasticity correction.

A. Initial Price Adjustment and Filing Range

By setting of the filing range in the First Revised Prospectus, the underwriter simultaneously determines the initial price adjustment. In Panel (a) of Table 4 we report three-stage-least-squares (3SLS) and ordinary least squares (OLS) estimates of models of *Initial Price Adjustment* and *Filing Range*. In the 3SLS model, *Initial Price Adjustment* and *Filing Range* are determined simultaneously. In the OLS models, we include the same set of explanatory variables for each equation. Most of the variables in the *Initial Price Adjustment* equation (i.e., *Filing Range*, market run-up variables, *Offer Size*, *Underwriter Fee*, and the over-allotment variables) would have been known to investors when the Preliminary Prospectus was issued. *Underwriter Market Share* is based on IPOs during the sample period. Because the market shares during the sample period are similar to those in earlier periods, we interpret market share as if it were known.

In the *Filing Range* equation, we add variables that are intended to reflect uncertainty about the value of the offer and only use a combined measure of market run-up over the eighty days ending on market day -20. We use the number of IPOs in the prior three months as an indicator of the extent of information the underwriter would have had about market conditions before the IPO. *Standard Deviation of JASDAQ-Adjusted Returns* is measured over the 12 months after the IPO, and is not observable at the time the range is set. We assume that this *ex post* measure of non-market risk is correlated with the *ex ante* estimate the underwriter

would have had. Because, except for the coefficients on the endogenous variables, the simultaneous and OLS results in Panel (a) of Table 4 are similar to the 3SLS results, we focus discussion on the 3SLS results.

A.1. Initial Price Adjustment

In the initial price adjustment model, the adjustment is negatively related to *Filing Range*. This indicates that the parties tend to set high initial prices on the IPOs that are subject to the greatest uncertainty about value, or in situations where the issuer and the underwriter may disagree about value and may place more reliance on the roadshow as the basis for ultimate pricing. The coefficients on the four 20-market-day intervals of market run-up ending 20 market days before the IPO all are positive, less than one, and decreasing in magnitude as time before the IPO increases. Because all but the last few days of this information normally is known when the Preliminary Prospectus is published, it is apparent that the original price does not fully reflect public information. We infer, as proposed by Lowry and Schwert (2004) that earlier discussions between the underwriter and the issuer contribute to stickiness of the original price even in response to market-wide changes in value. Whereas Lowry and Schwert conclude that the market is "almost efficient" with respect to prior public information, our result, even at this early stage, is closer to that of Bradley and Jordan (2002), who find that about 35 percent of the variance in initial returns is explained by prior public information. Along similar lines, we find that stickiness in setting the original price is economically important. In the simultaneous equations estimate, the standard deviation of *Initial Price Adjustment* due to prior changes in the JASDAQ Index is 7.6 percent, or 18.8 percent of the variance of initial price adjustments.

Initial Price Adjustment is positively related to *Underwriter Fee*. Given that the mean adjustment is negative 2.1 percent and the standard deviation of the marginal effect of the fee is 1.2 percent, the coefficient on *Underwriter Fee* suggests that higher fees are associated with greater resistance to reducing the filing range relative to the price reported in the Preliminary Prospectus.

Initial Price Adjustment also is significantly more negative during the over-allotment period. During much of the over-allotment period, changes in the JASDAQ Index would have implied positive initial price adjustments, whereas the actual adjustments tended to be negative. The evidence suggests that over-

allotment and Green Shoe options may cause issuers to be less concerned about increasing the offer price in response to positive market-wide information, preferring, instead to issue more shares.

Although we explain 28 percent of the variance in *Initial Price Adjustment* with information that would have been available to investors at the time, we cannot explain the remaining 72 percent. The reasoning of Jenkinson, et al. (2006), coupled with the 17.4 percent standard deviation of initial price adjustments, suggests that the original price provides little incentive to investors to acquire or disclose information during the period before the filing range is established. On the other hand, the evidence that prices do not adjust fully, even in response to negative market-wide information supports the implicit contracting hypothesis.

A.2. Filing Range

In the filing range model, we allow for different magnitudes of effects of positive and negative initial price adjustments by including *Absolute Value of Initial Price Adjustment.*[9] The combined effect of the two variables is similar for the simultaneous and OLS models. Positive price adjustments are associated with narrower filing ranges than are negative adjustments. When the underwriter is confronted with negative information that leads to a negative initial price adjustment, the underwriter also selects a wider filing range.

In a more detailed examination of 253 IPOs with downward initial price adjustments, Table 3 shows that 93 IPOs (36.8 percent of those with negative initial price adjustments) lowered the range to a point where the maximum was equal to the original price. The 101 that set the maximum of the range below the original price tended to set it much lower. The most positive (non-log) discount of the maximum relative to the original price for this group is 5.39 percent and the average is a maximum that is discounted of 24.1 percent relative to the original price. The concentration of offers where the maximum equals the original price seems consistent with implicit contracting, where the underwriter is attempting not to offer the shares below the original price. Four factors can contribute to the relatively large downward adjustments of the maximum when the maximum is below the original price. First, some underwriters may over-claim about market value in the early discussions in order to get the business, and then try to lower the price expectation after the issuer is committed to the relationship. Second, the issuer may have over-claimed in early

[9] In OLS and censored regression models, including the absolute value of a variable has an equivalent effect to interacting the variable with one when the price adjustment is positive, and zero otherwise, which, because the results are easier to interpret, is the approach we use elsewhere in Table 4. However, in the simultaneous equations estimates, the interaction approach produces unstable results.

discussions and the underwriter may have discovered negative information through due diligence efforts. Third, as the range is set after the roadshow has begun, the underwriter may have received negative information about the issuer from institutional investors. Fourth, the parties may have encountered unexpected negative news about the firm.

In a similar vein, run-up over the 80-market-days ending 20 days before the IPO is negatively related to *Filing Range*. It appears that faced with negative market-wide changes before the IPO, underwriters select wider (and lower) filing ranges.

To our knowledge, no previous study has examined the determinants of the filing range. Jenkinson, et al. (2006) suggest that this is because in the US the range is affected mainly by convention and interpretation of regulations and because of the common practice of amending the range. Hanley (1993) examines the ranges of US IPOs and finds little variation among categories of price adjustment and the width of the filing range in dollar or percentage terms. She does find that wider range is associated with greater absolute changes in offer prices.

Limited ability to amend the range in Japan makes the choice more important, partly because of risk allocation and partly because of the commitment value identified by Jenkinson, et al. (2006). Risk allocation argues for a broader range when value is most uncertain. *Firm Age*, *Offer Size*, and amount of IPO activity prior to the offering (*Number of IPOs in Prior Three Months*) are factors that should contribute to greater confidence in the offer price. As presented in Panel (a) of Table 4, all of these variables are associated with a narrowing of the filing range. A higher underwriter fee also is associated with a narrower range. The higher fee could be compensation for bearing additional risk of overpricing or compensation for more effort to determine the offer price through more intensive due diligence and/or a more extensive roadshow. Value uncertainty, as reflected by *Standard Deviation of Abnormal Returns,* also is associated with a wider range. The availability of over-allotment and Green Shoe options reduces price uncertainty and underwriting risk. Consistent with expectations, availability of these options is associated with a narrower range.

B. Offer Price Adjustment

In Panel (b) of Table 4, we compare the results of estimating the Offer Price Adjustment model by censored maximum likelihood regression and OLS. As shown in Table 3, *Offer Price Adjustment* is censored

from above or below for 76.4 percent of the observations. Focusing on the censored regression results, we find no significant relationship between *Offer Price Adjustment* and *Initial Price Adjustment*. In the spirit of Loughran and Ritter (2002) and Lowry and Schwert (2004), we allow for differential effects of positive and negative initial price adjustments by including the interaction of *Initial Price Adjustment* with a binary variable that equals one if the adjustment is positive. Although the variable, *Positive Values of Original Price Adjustment*, is not significantly related to *Offer Price Adjustment*, other information that is public at the time the offer price is set clearly does matter. Because price adjustments relative to the filing range midpoint predominantly are positive, adjustments tend to be larger the larger is the range. Although Loughran and Ritter and Lowry and Schwert examine the adjustment from filing range to offer price, they both focus on the midpoint and do not test whether the range affects the size of the adjustment. Given the widespread US practice of setting the range at $2, this is not surprising. However, if in the US, the range limits the offer price adjustments similarly to the way that Jenkinson, et al. (2006) contend that it does in Europe, then high underpricing in the US may be due to the limiting effect of the almost-uniform $2 range.

Following Lowry and Schwert (2004), we also allow for differential effects of positive and negative market run-ups over the 20 days before the offer. Within the range, based on the censored results, the coefficients of 0.89 on *Run-up -20 to 0* and -0.84 on *Positive Values of Run-up -20 to 0* suggest that the offer price adjusts almost fully in response to negative changes in the JASDAQ Index over the interval, but essentially not at all in response to positive changes. The data description in Table 3 suggests the explanation for this result. It shows that filing range midpoints are negatively biased relative to the offer price, enough so that over two-thirds of the IPOs are issued at the maximum of the range. With the constraint being binding on so many IPOs, there is essentially no way for offer price adjustments to reflect positive market-wide news once the range is set. The evidence is fully consistent with the hypothesis of Jenkinson, et al. (2006). In some cases, inability to adjust the range upward based on run-up just before the offer would result in leaving considerable money on the table. Particularly during 1999, a number of IPOs had log-normal values of *Run-up -20 to 0* values in excess of 20 percent.

Within the filing range, adjustments in response to JASDAQ changes over the 20-market-day intervals ending 20, 40, and 60 market days before the IPO also are high. We tested for asymmetric price

responses to positive and negative JASDAQ changes over these intervals and found no significant effects. Accordingly, we report only the symmetric effects. As with the original price, we find that the filing range does not fully reflect public information about prior market returns. Our results are similar to the findings of Lowry and Schwert (2004), except that again the effects are economically significant, particularly based on the coefficients from the censored regression, where the estimation biases due to censoring are removed. In the censored regression, the standard deviation of the effects of all market run-up variables on *Offer Price Adjustment* is 14.2 percent. In the OLS regression, the standard deviation of the run-up effects is a much smaller 3.3 percent. The latter figure is similar to the OLS result that Lowry and Schwert obtain for US data.

Underwriter Market Share is positively related to *Offer Price Adjustment*, indicating that underwriters with high market shares are more conservative in setting the filing range. This result complements the finding of Logue, et al. (2002) that high-quality investment banks are more likely to adjust prices upward during the IPO process. The findings point to the importance of underwriter reputation in the early discussions with the issuer. Consistent with the earlier results, that *Filing Range* is narrower when *Underwriter Fee* is high, a higher fee is associated with lower *Offer Price Adjustment*. We find no significant relationship of O*ffer Price Adjustment* to the availability or use of over-allotment options, though both coefficients are negative.

Because of censoring, OLS is expected to produce coefficients that are biased toward zero. Results in Panel (b) confirm this expectation. Most of the coefficients in the OLS model are lower than in the censored model, though the t-values are similar. The most obvious differences relate to previously discussed responses of *Offer Price Adjustment* to changes in the JASDAQ Index. Based on the OLS results, it appears, as it does in the US, that offer prices adjust only partially to changes in public information. In reality, the censored regression results demonstrate that within the bounds of the filing range, the adjustment is approximately full, except for the adjustments to positive values of *Run-up -20 to 0*.

Figure 3 illustrates the difference between the predicted adjustments based on the OLS and censored models. While the OLS predictions track the actual price adjustments, predictions from the censored model track expected adjustments as if the filing range were not a constraint. In the figure, we also plot *Initial Return*. The initial returns are large compared to *Offer Price Adjustment*. However, if, but for the filing range constraint, the adjustment to public information is full, then the predictions from the censored regression should

approximately track *Initial Return*. Figure 4 confirms this expectation. Particularly for the period of about one year, from early 1999 though early 2000, removal of the filing range constraints, holding all else constant, would have generated IPO prices that were more than twice as high as the selected offer prices and still would have resulted in initial returns that were predominantly positive.

This result has important implications for interpreting partial adjustment of US IPOs, where the absence of specific, rigorously enforced constraints and the ability to amend the filing range cloud the analysis. Our evidence shows that the sustained period of extreme underpricing, as well as shorter episodes, was highly predictable based on public information from up to four months before the IPO, which approximately spans the period over which most IPO negotiations are reported to be conducted.[10] The evidence that pricing depends on prior market run-up over this interval supports a variant of the implicit contracting hypothesis where early discussions are important determinants of offer prices. The fact that prior market run-up is not reflected in either the filing range or the offer price indicates that the commitment explanation of Jenkinson, et al. (2006) is not sufficient to explain the observed levels of underpricing, and particularly cannot explain sustained periods of extreme underpricing.

C. Initial Returns

In Panel (c) of Table 4, we report OLS results of the relationship of public information to the *Initial Return*. We use the same variables as we did to examine the price formation process, and explicitly include *Initial Price Adjustment* and *Offer Price Adjustment*. To allow for difference in relationships of *Initial Return* to the price adjustments, we include variables for positive values of the price adjustment variables. Consistent with the US evidence of partial adjustment, *Initial Return* is positively related to *Offer Price Adjustment*. Like studies based on US data, we find that offer prices adjust more fully to negative than to positive information. As a result, initial returns are positively related to offer price adjustments when the adjustments are positive. For negative offer price adjustments, we cannot reject the hypothesis that the adjustment is full, so that the expected initial return is constant when offer prices are adjusted down.

We also find a significant positive relationship of *Initial Return* to *Initial Price Adjustment* when the adjustment is positive (t-value = 3.25). The relationship is lower when the adjustment is negative, but the

[10] We also tested whether the price adjustment was affected by JASDAQ run-up over the -100 to -80 window. The coefficient was not significantly different from zero and was dropped from the analysis.

difference is only marginally significant.[11] This finding that partial adjustment extends to a period before the start of the underwriter's pre-selling effort is further evidence that early price discussions between the underwriter and the issuer contribute to an implicit contract that limits the magnitude of price adjustments after the Preliminary Prospectus.

Figure 4 is a plot of the combined partial effects of both price adjustments on *Initial Return*. The positive partial adjustment and negative nearly full adjustment phenomenon is readily apparent. Edelen and Kadlec (2002) hypothesize that asymmetric price adjustment is an artifact that is due to withdrawal of IPOs when prices decline and when the expected cost of holding out for a better price is high. They argue that issuers are more likely to proceed with an IPO when price change would be positive. While some amount of cancellation is likely in response to price declines, the pattern of price adjustments in Figure 4 does not point to cancellation being the full explanation for the asymmetric results. In particular, the figure shows there are a large number of IPOs with negative combined price adjustments but nonetheless have positive partial effects of the adjustments. Further, unless the number of cancellations is very large, the number of near-zero and positive partial effects when the combined price adjustment is very negative does not appear to be explainable as an extension of a truncated linear relationship on the positive side of the figure.

The coefficients on the run-up variables indicate that initial returns are affected by public information about the JASDAQ Index. This result is consistent with US evidence and with earlier discussion that the OLS model of *Offer Price Adjustment* understates the adjustment within the filing range. We tried splitting *Run-up -20 to 0* into positive and negative changes as in Panel (b), but the interacted coefficient was near zero and not significant. Instead, the constraining effect of the filing range maximum on the offer price appears to strengthen the relationship between *Initial Return* and the *Positive Values of Offer Price Adjustment*.

Availability of over-allotment and Green Shoe options does not significantly affect *Initial Return*. However, consistent with Lewellen (2006), providing for over-allotment and Green Shoe options does result in significantly lower initial returns. This, again, suggests that underwriters can use the options to reduce price uncertainty and respond to a potentially high initial return by increasing supply.

D. Long-run Returns

[11] Table 4 shows the positive interaction, whereas the significance levels reported in this paragraph of the text are based on respecifying the regressions so that the interaction is on negative values of *Initial Price Adjustment*.

Practitioners, along with Loughran and Ritter (2002), Derrien (2005) and others, propose that underwriters may increase the extent of underpricing if they perceive that the market is overheated or that demand for an issuer's shares is excessive. Pricing based on relative value, leaning against the wind, and similar hypotheses imply a negative correlation between initial returns and long-run returns. As reported by Loughran and Ritter (2002), the US evidence on this point provides mixed support.

In panel (d) of Table 4 we present a model of the *One-year Aftermarket Return*. The results allow for distinguishing between pricing based on relative value and other hypotheses of underpricing, such as the prospect theory argument of Loughran and Ritter (2002) and the agency cost explanation of Ritter and Welch (2002). While *One-year JASDAQ Return* is the most important explanatory variable, the fact that its coefficient is significantly less than one suggests that the first aftermarket prices may be too high relative to long-run value. Table 1 shows that, whereas the mean JASDAQ return was 0.29 over the 12 months, the mean aftermarket IPO return was negative 0.050. However, the JASDAQ Index was quite volatile over the sample period and included one six-month episode of logged one-year holding-period returns in excess of 200 percent. Thus, the difference in means is affected by a few very positive outliers of the JASDAQ. The difference in median returns between the JASDAQ and the IPO issues is much smaller, only .037.

The most important other factors affecting the long-run return are the initial returns and the price adjustments. As with the other models in Table 4, we allow for the effects of positive and negative adjustments to be different. The exposition is clearest in chronological order. First, the effect of *Initial Price Adjustment* is negative but near zero for downward adjustments (that is, a positive coefficient of 0.1557 is applied to a negative initial price adjustment such as -0.10, so that the one-year aftermarket return is expected to be lower by 0.0156) and also negative for positive adjustments (a combined coefficient of (0.1557 -0.7574 = -0.6017) is applied to a positive initial price adjustment such as 0.10, so that the one-year aftermarket return is expected to be lower by 0.0602), with the difference between the positive and negative coefficients being statistically significant at the 0.10 level (t-value = 1.70). The evidence indicates that revision in either direction is associated with lower expected long-run returns. The results suggest that initial price adjustments reflect improvements in pricing accuracy relative to long-run value. The result is consistent with Jenkinson, et

al. (2006), Benveniste and Spindt (1989), Sherman and Titman (2002) and other hypotheses concerning the potential for the roadshow to improve pricing accuracy.

Second, the effect of O*ffer Price Adjustment* is strictly negative and significantly stronger for negative than for positive adjustments. Thus, downward adjustments have the partial effect of increasing long-run returns (the negative coefficient times a negative offer price adjustment), whereas the effect of upward adjustments is close to zero because the positive and negative coefficients almost cancel. The near-zero relationship for issues with upward adjustments indicates that upward adjustments are not significantly related to long-run returns. The significant negative coefficient when offer prices are adjusted down seems most consistent with a concern to address potential overpricing.

Third, the effect of initial returns on long-run returns is also strictly negative, but only significant when initial returns are positive. The relationship is near zero when the initial return is negative. The result augments the evidence presented in Figure 4 that downward offer price adjustments are essentially full, and upward offer price adjustments are partial. This additional evidence indicates that the downward adjustments also are consistent with long-run value, and that the partial nature of upward adjustments is affected by concern about investor over-optimism.

One reason for partial adjustments of the filing range and the offer price is to compensate for over-optimism among investors. To assess this hypothesis, Table 5 provides descriptive data and statistical tests of the relationships between price adjustments and initial and long-run returns. As background, the correlation between one-year returns and initial returns is -.29 and is highly significant. Both *Initial Price Adjustment* and O*ffer Price Adjustment* are positively related to *Initial Return* but negatively related to *One-year Aftermarket Return*, but both are more highly correlated with *Initial Return.* To assess pricing based on relative value, we show how the price adjustments relate to T*otal Return*. Compared to either the initial or the one-year return, the relationships of price adjustments to *Total Return* are weaker. Ultimately, although the IPOs with the greatest price adjustments have the most positive initial returns, they have the lowest total returns. While the correlation between *Total Adjustment* and *Total Return* is statistically significant, it is low in terms of economic significance. Our evidence suggests that even though the price adjustments are partial, when measured

against the initial returns, the under-adjustment relative to the initial return is more than offset by under-performance in the year after the IPO.

V. Conclusion

We examine the pricing of 487 book-built JASDAQ IPOs and analyze the price formation process extending back to preliminary pricing that occurs after the beauty contest but before the roadshow. We examine the determinants of price adjustments from the original price to the filing range and from the filing range to the offer price, as well as how initial returns and long-run returns relate to the price adjustments. We find that the IPO prices in our sample are under-adjusted relative to public information that extends back to at least four months before the offer. We also find that, controlling for other factors, the IPOs with the highest initial returns have the lowest returns over the year after the IPO.

Our evidence supports the hypothesis that offer price under-adjustment arises from an implicit contract between the issuer and the underwriter that extends to the time when preliminary discussions about pricing are likely to have commenced. In Japan, adjustment of the offer price is constrained by the maximum and minimum prices of the filing range, but because Japan does not regulate the range, it appears that the range is affected by earlier price discussions. We study the determinants of the width of the filing range and find that the range is wider for riskier IPOs. Because the filing range constraint is often binding on the upside, for the offer price cannot fully adjust to positive market-wide news once the range is set. In some cases, this constraint results in leaving considerable money on the table. US institutions with respect to pricing outside the range are less exacting so that the effect of the range on partial price adjustment is not clear. However, the Japanese evidence suggests that implicit contracting to limit price adjustments in response to public information could partly account for short episodes of high underpricing in the US. Implicit contracting is not mutually exclusive with other hypotheses. The prospect-theory-based argument of Loughran and Ritter (2002), for example, can account for partial adjustment after the filing range is set, but unless the issuer's anchoring bias extends back to the early price discussions, it cannot account for the failure of offer prices to incorporate information from before the filing range was established.

Sustained periods of very high underpricing, such as during the US high-tech rally, require a different explanation, one that addresses the question of why underwriters do not set higher filing ranges during

periods when other recent IPOs are generating very high initial returns. Preliminary discussions with the underwriter normally start a few months before the IPO, and appear to result in implicit contracts that include pricing based on the relative values of established public firms around the time of the beauty contest. Implicit contracting based on relative value can result in long episodes of unusually high underpricing. Some other explanations for persistent underpricing in the US such as spinning and directed stock programs, as described by Ritter and Welch (2002), appeal to agency costs as a reason issuers would agree in advance to IPO prices that they know are too low. However, agency-cost-based hypotheses do not suggest that high initial returns can predict long-run returns. US evidence on the negative relationship between initial returns and long-run returns, while generally consistent with our findings, is less clear and more strongly supports agency-cost-based explanations.

The tension that exists between pricing based on relative value and implicit contracting dictates, that certification of the consistency of the offer price with relative value can only hold on average and that some IPOs can be predictably overpriced. As hypothesized by Benveniste and Spindt (1989), and others, the underwriter's control over allocations is necessary if underpricing is to be used to compensate investors for buying overpriced IPO shares. In our analysis, the commitment not to price above the maximum of the range can function as a device to assure average underpricing, whether allocations are used to compensate investors for producing and/or revealing their private information or not.

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Table 1

Descriptive Statistics for the IPO Sample and Bivariate Tests for Differences between Two Subsamples: IPOs from the Pre-Over-allotment Period and IPOs from the Over-allotment Period

The sample includes all 487 IPOs on JASDAQ from the beginning of the book-building regime on September 30, 1997, through the end of 2003. The sample includes 358 issues from the period through January 31, 2002, when over-allotment and Green Shoe options were not permitted (the Pre-over-allotment Period), and 129 issues from the period beginning February 1, 2002, when over-allotment and Green Shoe options were permitted (the Over-allotment Period). Varable definitions are provided in the first column of the table. All returns and price adjustments are measured in natural logs. Returns over time are measured as natural logs of buy-and-hold returns.

	Full Sample				Pre-Over-allotment Period		Over-allotment Period					
	Mean	Median	Standard Deviation	Skewness	Mean	Median	Mean	Median	t-stat	p-value	Wilcoxon z-stat	p-value
Initial Price Adjustment (Ln of (Midpoint/Original Price))	-0.021	-0.024	0.174	0.025	-0.003	0.000	-0.070	-0.060	5.13	0.00	4.71	0.00
Offer Price Adjustment (Ln (Offer Price/Midpoint of Range))	0.051	0.066	0.078	-0.861	0.052	0.069	0.048	0.064	0.52	0.61	2.16	0.03
Total Price Adjustment (Initial Adjustment plus Offer Price Adjustment	0.030	0.018	0.200	-0.018	0.049	0.051	-0.022	0.000	4.51	0.00	3.93	0.00
Initial Return (Ln (Market Price/Offer Price))	0.255	0.134	0.417	1.404	0.268	0.140	0.218	0.122	1.33	0.19	0.77	0.44
One-year Aftermarket Return (Ln of price ratio)	-0.050	-0.059	0.905	0.173	-0.146	-0.128	0.215	0.204	-3.89	0.00	-3.93	0.00
Total Return (Initial Return plus One-year Aftermarket Return)	0.205	0.117	0.878	0.477	0.122	0.049	0.433	0.373	-3.49	0.00	-3.60	0.00
Filing Range (Ln (Maximum/Minimum))	0.203	0.182	0.096	1.799	0.217	0.200	0.162	0.147	6.83	0.00	6.41	0.00
Run-up -20 to 0 (Ln of price ratio)	-0.001	-0.010	0.102	0.077	-0.001	-0.011	-0.002	-0.009	0.18	0.86	-0.54	0.59
Run-up -40 to -20 (Ln of price ratio)	-0.003	-0.147	0.094	0.679	-0.002	-0.021	-0.006	-0.004	0.48	0.63	-0.30	0.77
Run-up -60 to -40 (Ln of price ratio)	0.006	-0.012	0.102	0.784	0.001	-0.021	0.021	0.007	-2.23	0.03	-3.34	0.00
Run-up -80 to -60 (Ln of price ratio)	0.003	-0.012	0.103	0.288	-0.003	-0.018	0.020	0.013	-2.85	0.00	-3.53	0.00
Run-up -100 to -80 (Ln of price ratio)	0.000	-0.011	0.090	0.955	0.002	-0.014	-0.003	-0.008	0.66	0.51	-0.76	0.45
One-year Aftermarket Return (Ln of price ratio)	-0.050	-0.059	0.905	0.173	-0.146	-0.128	0.215	0.204	-3.89	0.00	-3.93	0.00
Standard Deviation of JASDAQ-Adjusted Returns (Ln returns)	0.258	0.188	0.224	2.454	0.256	0.182	0.262	0.196	-0.36	0.72	1.89	0.06
One-year JASDAQ Return (Ln of price ratio)	0.294	-0.096	0.818	1.564	0.209	-0.147	0.528	0.489	-4.95	0.00	-8.30	0.00
Firm Age (Ln of years)	2.963	3.099	0.748	-0.753	3.000	3.150	2.860	2.990	1.75	0.08	1.74	0.08
Offer Size (Ln of million yen)	13.933	13.876	1.120	0.711	14.010	13.920	13.710	13.650	2.17	0.01	2.34	0.02
Number of IPOs in Prior Three Months	19.384	19.000	7.148	-0.006	20.588	21.000	16.077	16.000	7.63	0.00	6.83	0.00
Underwriter Market Share (fraction of IPOs)	0.159	0.195	0.111	-0.619	0.170	0.220	0.128	0.195	3.58	0.00	3.21	0.00
Underwriter Fee (Ln (Fee/Offer Price))	0.058	0.058	0.005	0.207	0.057	0.058	0.061	0.058	-9.60	0.00	-8.62	0.00
Over-allotment Period (equals one during period allowed)	0.267	0.000	0.443	1.054								
Over-allotment Option (equals one if provided for in the Prospectus)	0.088	0.000	0.284	2.902			0.331	0.000				
Over-allotment Exercise (equals one if short covered)	0.037	0.000	0.189	4.909			0.138	0.347				
Green Shoe Option Exercise (equals one if exercised)	0.078	0.000	0.268	3.146			0.292	0.457				

Table 2

Descriptive Statistics for IPOs from the Over-Allotment Period and Bivariate Tests for Differences between Two Subsamples: IPOs that Provide for Over-allotment and Green Shoe Options and and IPOs that Do Not

The sample includes 130 IPOs on JASDAQ from February 1, 2002, when over-allotment options were permitted, through the end of 2003. The sample includes 87 issues that did not include over-allotment and Green Shoe options and 43 issues that included over-allotment and Green Shoe options. Varable definitions are provided in the first column of the table. All returns and price adjustments are measured in natural logs. Returns over time are measured as natural logs of buy-and-hold returns.

	Without Over-Allotment and Green Shoe Options		With Over-Allotment and Green Shoe Options					
	Mean	Standard Deviation	Mean	Standard Deviation	t-stat	p-value	F-stat	p-value
Initial Price Adjustment (Ln of (Midpoint/Original Price))	-0.082	0.101	-0.046	0.081	-2.23	0.03	-1.74	0.08
Offer Price Adjustment (Ln (Offer Price/Midpoint of Range))	0.050	0.063	0.043	0.047	0.71	0.48	1.36	0.17
Total Price Adjustment (Initial Adjustment plus Offer Price Adjustment)	-0.032	0.129	-0.002	0.109	-1.36	0.17	-1.14	0.25
Initial Return (Ln (Market Price/Offer Price))	0.244	0.362	0.168	0.266	1.35	0.18	0.10	0.33
One-year Aftermarket Return (Ln of price ratio)	0.138	0.970	0.369	0.772	-1.47	0.14	-1.57	0.12
Total Return (Initial Return plus One-year Aftermarket Return)	0.382	0.910	0.537	0.794	-1.00	0.32	-1.39	0.16
Filing Range (Ln (Maximum/Minimum))	0.174	0.075	0.138	0.045	3.43	0.00	2.66	0.01
Run-up -20 to 0 (Ln of price ratio)	-0.007	0.061	0.007	0.067	-1.17	0.25	-1.09	0.28
Run-up -40 to -20 (Ln of price ratio)	-0.003	0.067	-0.012	0.086	0.60	0.55	0.39	0.70
Run-up -60 to -40 (Ln of price ratio)	0.004	0.062	0.054	0.093	-3.13	0.00	-2.81	0.01
Run-up -80 to -60 (Ln of price ratio)	0.013	0.058	0.033	0.061	-1.73	0.09	-1.79	0.07
Run-up -100 to -80 (Ln of price ratio)	-0.009	0.051	0.010	0.050	-2.03	0.05	-2.05	0.04
One-year JASDAQ Return (Ln of price ratio)	0.471	0.518	0.643	0.446	-1.96	0.05	-1.62	0.11
Standard Deviation of Abnormal Returns (Ln returns)	0.272	0.236	0.249	0.160	0.66	0.51	-0.67	0.50
Firm Age (Ln of years)	2.788	0.764	3.014	0.774	-1.58	0.12	-1.86	0.06
Offer Size (Ln of million yen)	13.541	1.009	14.065	0.929	-2.94	0.00	-3.36	0.00
Number of IPOs in Prior Three Months	16.678	16.000	14.860	15.000	2.01	0.05	1.35	0.18
Underwriter Market Share (fraction of IPOs)	0.090	0.112	0.205	0.088	-6.41	0.00	-5.45	0.00
Underwriter Fee (Ln (Fee/Offer Price))	0.061	0.003	0.062	0.005	-2.08	0.04	-2.11	0.03
Standard Deviation of JASDAQ-Adjusted Returns (Ln returns)	0.272	0.236	0.249	0.160	0.66	0.51	-0.67	0.50
Over-allotment Exercise (equals one if covering short)			0.042	0.499				
Green Shoe Option Exercise (equals one if exercised)			0.884	0.324				

Table 3

Descriptive Data on Price Formation of Japanese IPOs

The original price is reported in the Preliminary Prospectus. The filing range is reported in the First Revised Prospectus. The final offer price is announced in the Second Revised Prospectus. The sample includes all 487 JASDAQ IPOs from the start of Japan's book-building regime in October 1997 through the end of 2003.

Initial Price Adjustment	**Number of IPOs**	**Percent of IPOs**
Minimum of Range > Original Price	76	15.6%
Minimum of Range = Original Price	44	9.0%
Minimum < Original < Maximum	173	35.5%
Maximum of Range = Original Price	93	19.1%
Maximum of Range < Original Price	101	20.7%
	487	

Offer Price Adjustment	**Number of IPOs**	**Percent of IPOs**
Offer Price = Maximum of Range	330	67.8%
Minimum < Offer < Maximum	115	23.6%
Offer Price = Minimum of Range	42	8.6%
	487	

Initial Return	**Number of IPOs**	**Percent of IPOs**
Number Positive	388	79.7%
Number Zero	25	5.1%
Number Negative	74	15.2%
	487	

Correlations	**Coefficient**	**p-value**
Ln(Midpoint/Original) with Ln(Offer/Midpoint)	0.1241	0.006***
Ln(Offer/Midpoint) with Ln(Initial Return)	0.2869	0.000***
Ln(Midpoint/Original) with Ln(Initial Return)	0.3072	0.000***

Table 4

Estimates of Price Adjustments, Filing Range, Initial Return, and Long-run Return

The table reports (a) 3SLS and OLS estimates of models of the price change from the Preliminary Prospectus to the midpoint of the filing range; (b) Censored maximum likelihood and OLS estimates of models of the price adjustment from the midpoint of the filing range in the First Revised Prospectus to the offer price in the Second Revised Prospectus. The price change is censored from above and below because the offer price cannot be above the maximum or below the minimum of the filing range; (c) OLS estimates of models of the initial return from offer price to the first aftermarket price; (d) the one-year return from the first aftermarket price to the price one year later. Estimates are based on all 487 IPOs from the October 1997 start of Japan's book-building regime through the end of 2003. All returns and price adjustments are measured as natural logs of buy-and-hold returns. t-values of OLS regressions are based on clustered, robust estimators, where the data are assumed to be clustered by calendar quarter. One-tailed significance levels are as follow: * = .10, ** = .05, and *** = .01.

	Panel (a)				**Panel (b)**				**Panel (c)**		**Panel (d)**	
	Initial Price Adjustment **(Price Change from Original Price to Midpoint of Filing Range)**				***Offer Price Adjustment*** **(Price Change from Midpoint of Range to Offer Price)**				***Initial Return*** **(Price Change from Offer Price to First Closing**		***One-year Aftermarket Return***	
	3SLS		**OLS**		**Censored Model**		**OLS**		**OLS**		**OLS**	
	Coefficient	**t-value**	**Coefficient**	**t-value**	**Coefficient**	**t-value**	**Coefficient**	**t-value**	**Coefficient**	**t-value**	**Coefficient**	**t-value**
Initial Price Adjustment (Ln(Midpoint/Original Price))					-0.0368	-0.36	-0.0132	-0.35	0.2042	1.25	0.1557	0.50
Positive Values of Initial Price Adjustment					0.1335	0.63	-0.0124	-0.31	0.3415	1.40*	-0.7574	-1.70*
Offer Price Adjustment (Ln(Offer Price/Midpoint))									-0.4523	-0.91	-3.3708	-3.54***
Positive Values of Offer Price Adjustment									2.4085	3.32***	3.0396	1.96**
Initial Return (Ln(First Market Price/Offer Price))											-0.0638	-0.27
Positive Values of Initial Return											-0.5035	-1.65*
Filing Range (Ln(Maximum/Minimum))	-0.3427	-1.42*	-0.2023	-2.21**	0.1230	1.05	0.2539	5.29***	-0.4594	-2.32**		
Run-up -20 to 0 (Ln(P(0)/P(-20)))					0.8892	4.02***	0.2363	2.18**	1.1978	3.97***		
Positive Values of Run-up -20 to 0					-0.8400	-2.10**	-0.1850	-1.33*				
Run-up -40 to -20 (Ln of price ratio)	0.5279	6.70***	0.5563	6.14***	0.9630	6.14***	0.2082	3.88***	0.4554	2.83***		
Run-up -60 to -40 (Ln of price ratio)	0.3557	5.13***	0.3550	3.89***	0.6646	5.20***	0.1599	3.14***	0.3294	1.52*		
Run-up -80 to -60 (Ln of price ratio)	0.2162	3.19***	0.2266	2.66***	0.3259	2.44***	0.0458	1.06	0.4467	2.11**		
Run-up -100 to -80 (Ln of price ratio)	0.1445	1.91**	0.1383	1.37*								
One-year JASDAQ Return (Ln of price ratio)											0.5179	7.06***
Offer Size (Ln of million yen)	0.0081	1.23	0.0089	1.24	0.0509	4.69***	0.0168	2.61***	-0.0270	-1.46*		
Underwriter Market Share (fraction of IPOs)	0.0032	0.05	0.0151	0.19	-0.3141	-2.93***	-0.0740	-2.44**	-0.0083	-0.06	0.0977	0.40
Underwriter Fee (Ln(Fee/Offer Price))	2.5516	1.35*	3.1252	1.43*	13.9149	5.05***	4.2721	2.53***	-2.6443	-0.88	15.5766	1.32*
Over-allotment Period (= 1 during period allowed)	-0.1019	-4.75***	-0.0967	-3.66***	-0.0348	-1.02	-0.0084	-0.67	0.0120	0.24	0.0672	0.40
Over-allotment Option (= 1 if provided for in Prospectus)	-0.0042	-0.15	-0.0016	-0.11	-0.0339	-0.67	-0.0133	-1.12	-0.1009	-2.04**	0.0626	0.48
Constant	-0.1874	-0.98	-0.2626	-1.39*	-1.2469	-5.08***	-0.4606	-2.55***	0.7311	2.16**	-0.9692	-1.36*
Adj R^2 or Pseudo R^2	0.280		0.285		0.413		0.283		0.301		0.350	

	Filing Range			
	3SLS		**OLS**	
	Coefficient	**t-value**	**Coefficient**	**t-value**
Initial Price Adjustment (Ln (Midpoint/Original Price))	-0.1306	-1.49*	-0.0699	-1.90**
Absolute Value of Initial Price Adjustment	0.1631	4.51***	0.1484	3.27***
Run-up -100 to -20 (Ln of price ratio)	-0.0293	-1.47*	-0.0390	-3.07***
Firm Age (Ln of years)	-0.0107	-2.11**	-0.0110	-1.53*
Offer Size (Ln of million yen)	-0.0059	-1.43*	-0.0067	-1.19
Number of IPOs In Prior Three Months	-0.0016	-2.63***	-0.0018	-1.95**
Start of Data Series (Control for first 3 Months)	0.0004	1.36*	0.0006	2.26**
Underwriter Market Share (fraction of IPOs)	-0.0628	-1.67**	-0.0678	-1.62*
Underwriter Fee (Ln (Fee/Offer Price))	-2.7633	-2.60***	-2.8139	-2.74***
Standard Deviation of Abnormal Returns (Ln returns)	0.0310	1.63*	0.0374	2.72***
Over-allotment Period (= 1 during period allowed)	-0.0521	-3.58***	-0.0490	-5.05***
Over-allotment Option (= 1 if provided for in Prospectus)	-0.0088	-0.53	-0.0095	-0.72
Constant	0.4995	5.04***	0.5206	3.99***
Adj R^2	0.235		0.244	

Table 5

Relationship of Price Adjustments to Initial and Long-Run Returns

The table shows comparisons of mean and median *Initial Return*, *One-year Aftermarket Return,* and *Total Return* for high, medium, and low price adjustments. *Total Return* is *Inital Return* plus *One-year Aftermarket Return*. *Total Adjustment* is *Initial Price Adjustment* plus *Offer Price Adjustment*. Based on a sample of 487 JASDQ IPOs from September 30, 1997 through 2003. All data are measured in natural logs of buy-and-hold returns.

	Initial Adjustment	Adjustment	Initial Return	Aftermarket Return	Total Return
Mean	<-.05	-0.168	0.138	0.033	0.172
		-0.005	0.239	0.097	0.336
	>=.05	0.182	0.447	-0.337	0.110
	Pearson Correlation		.31***	-.19***	-.08*
Median	<-.05	-0.143	0.063	0.000	0.143
		0.000	0.138	0.013	0.181
	>=.05	0.154	0.302	-0.359	0.000
	Spearman Rank Correlation		.30***	-.17***	-.08*
	Offer Price Adjustment				
Mean	<-.0	-0.083	0.014	0.388	0.402
		0.061	0.304	-0.158	0.146
	>=.10	0.132	0.328	-0.137	0.191
	Pearson Correlation		.29***	-.20***	-.12***
Median	<-.0	-0.080	0.033	0.216	0.244
		0.065	0.178	-0.130	0.090
	>=.10	0.123	0.201	-0.175	0.131
	Spearman Rank Correlation		.28***	-.23***	.17***
	Total Adjustment				
Mean	<-.10	-0.238	0.025	0.277	0.402
		0.009	0.217	-0.011	0.146
	>=.10	0.248	0.473	-0.337	0.191
	Pearson Correlation		.38***	-.24***	-.12***
Median	<-.10	-0.201	0.033	0.203	0.244
		0.000	0.120	-0.011	0.090
	>=.10	0.223	0.325	-0.359	0.131
	Spearman Rank Correlation		.39***	-.25***	-.14***

Figure 1

The Japanese Book-builiding Process for Initial Public Offerings on JASDAQ

Since September 30, 1997, JASDAQ IPOs have been issued by book-building In the Japanese book-building process, an original price is reported in a Preliminary Prospectus that normally is circulated about 25 market days before the IPO. The filing range is reported in a First Revised Prospectus that normally is circulated about 15 market days before the IPO. The final offer price is announced in a Second Revised Prospectus that is circulated a few days before the IPO. The issue is presold in a roadshow that begins after the Preliminary Prospectus is issued and ends before the Second Revised Prospectus is issued.

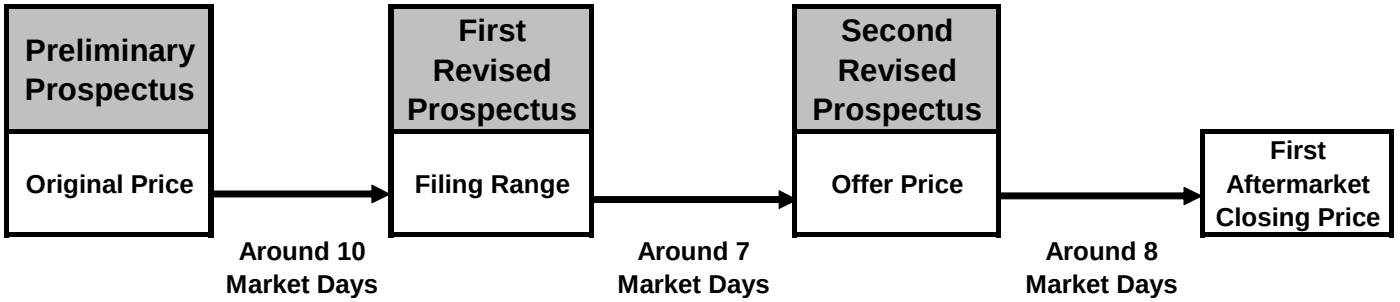

Figure 2

Filing Range in Yen per Share and in Natural Logs

for 487 JASDAQ IPOs from Septembar 30, 1997 through December 31, 2003

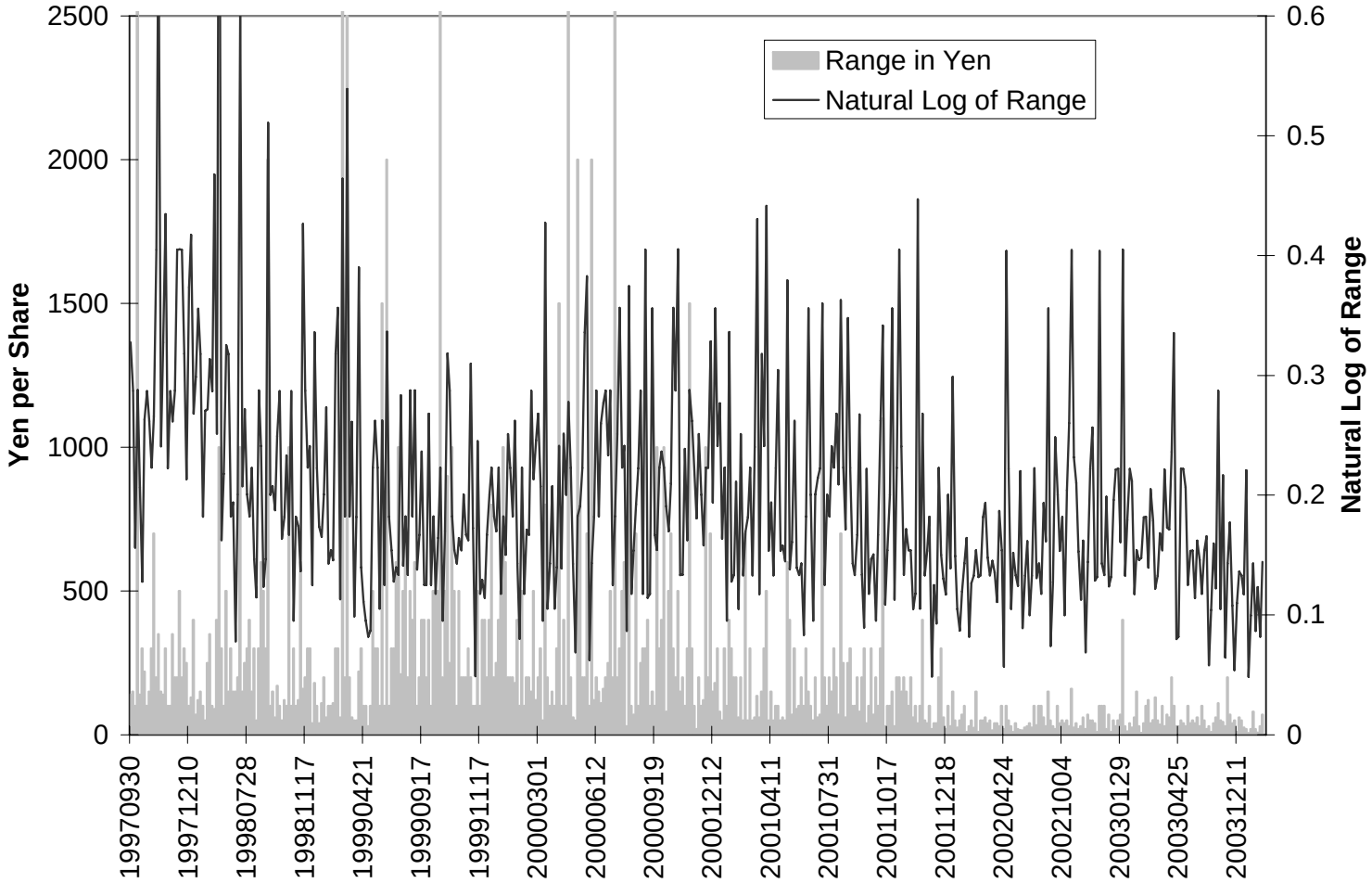

Figure 3

Actual and Predicted Price Adjustments and Initial Returns

OLS v. Censored Predictions for 487 JASDAQ IPOs from October 1997 through December 2003

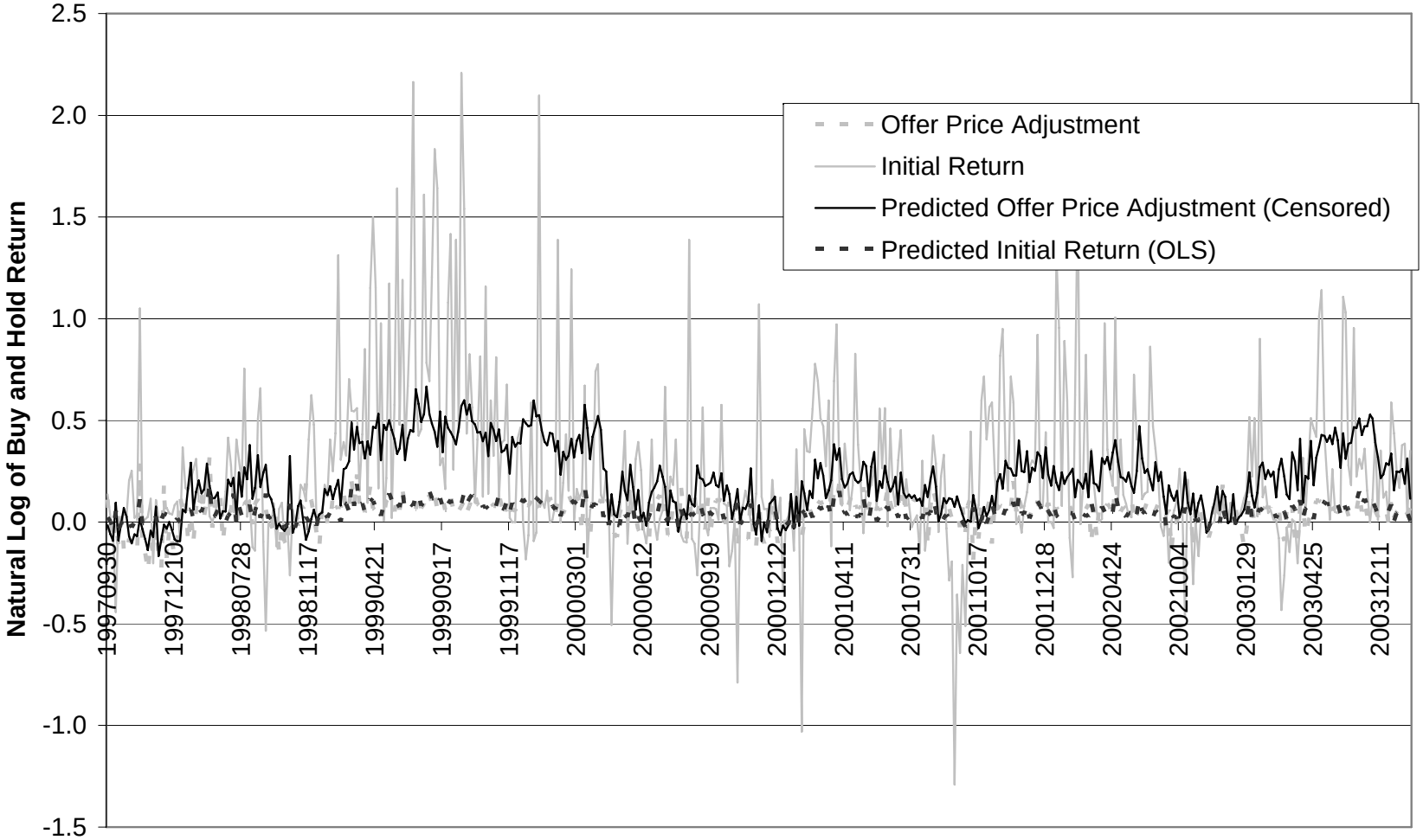

Figure 4

Partial Relationship of Initial Return to Total Price Adjustment from Original Price to Offer Price

Predictions for 487 JASDAQ IPOs from October 1997 through 2003