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Why are IPOs underpriced? Evidence from Japan's hybrid auction-method offerings ☆

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Abstract

We document discretionary underpricing and partial adjustment of IPO prices in the public offer tranche of Japan's hybrid auction regime, in which investor information differences are not important, there are no roadshows, preferential allocations are negligible, institutional investing is low, and the public offer tranche cannot fail. The magnitude and variation of underpricing in our sample, which spans relatively hot and cold markets, are similar to those reported for US IPOs. The evidence is most consistent with underpricing arising from an implicit contract to allocate risk related to initial mispricing where, in exchange for guaranteeing a minimum price, the underwriter participates indirectly in upside performance. The results raise important questions about interpretations of IPO underpricing in the US.

JEL classification: G15; G24; G28

Keywords: IPO; Public offering; Book building; Underpricing; Partial adjustment

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1. Introduction

From April 1989 until September 1997 (the "auction regime"), firms going public in Japan were required to use a hybrid auction process where a substantial portion of the issue (the "auction tranche") was offered via a discriminatory auction. Remaining shares (the "public offer tranche") were sold a few days later by firm commitment at a fixed price. Under Japan Association of Securities Dealers (JASD) regulations, the number of shares any investor could buy in either tranche was severely limited; investors who were likely to have private information were precluded from participating in the auction; roadshows were not held; and the underwriter was prohibited from providing information to prospective investors beyond what was contained in the prospectus. Nonetheless, the public offer tranche routinely was underpriced.

Using a dataset of 321 Japanese IPOs from 1995 through 1997, we find average underpricing and a pattern of intentional "partial adjustment" that is similar to that of US IPOs. That is, compared to the reservation price or "minimum bid" for the auction, adjustment of the offer price for the public offer tranche was a deliberate choice by the underwriter and a positive function of excess auction demand at the minimum bid. Because initial returns of the public offer tranche are positively related to the price adjustment, the adjustment is only partial.

Kaneko and Pettway (2003) also document partial adjustment during Japan's auction regime. They hypothesize, but are unable to test, that partial adjustment arises from JASD-imposed restrictions on purchase quantities, which caused auction bids to understate demand. Using a different data source, we are able to test their hypothesis. While we find supportive evidence, we find more importantly that underpricing and partial adjustment are discretionary and intentional and that aggregate underpricing is much greater than would arise from the JASD restrictions alone.

The finding that partial adjustment is discretionary raises important questions about interpretations of underpricing of book-built IPOs in the US. Several well-established hypotheses about underpricing of book-built IPOs are based on information asymmetry or information production. Hanley (1993), for example, interprets partial adjustment as evidence that underpricing compensates investors for revealing private information. However, in Japan's auction regime, the pattern is similar to that in the US.

We consider a range of competing, non-mutually-exclusive, information-related hypotheses for underpricing and partial adjustment. These include explanations of short-run underpricing based on the stream of research originating with Benveniste and Spindt (1989) and more recent hypotheses of underpricing to address long-run performance (e.g., Derrien, 2005; Purnanandam and Swaminathan, 2004). We find that none of these can explain underpricing and partial adjustment in the auction regime. Thus, while any number of the information-related hypotheses are *sufficient* to generate partial adjustment, our evidence establishes that none is *necessary*.

The magnitude and variation of underpricing in our sample, which spans relatively hot and relatively cold markets, are similar to those reported for US IPOs. To determine whether issuers anticipate the extent of underpricing, we examine how underpricing relates to the occurrence of seasoned equity offerings ("SEOs") in the year following the IPO. Inconsistent with the Welch (1989) signaling hypothesis, the SEO data provide no evidence that issuers anticipate initial or long-run returns. To determine whether underpricing compensates for investor over-optimism, we examine long-run returns. While discounting

is greater after market run-ups, the run-ups do not predict more-negative market returns or market-adjusted performance. Thus, the evidence does not support the hypothesis that underpricing compensates for over-optimism.

The Japanese evidence cannot reject the hypothesis that underpricing arises from an implicit contract concerning allocation of risk related to mispricing (e.g., Lowry and Schwert, 2004; Loughran and Ritter, 2002). However, because the public offer tranche cannot fail, we can reject risk allocation hypotheses that are based on potential failure of the offer (e.g., Edelen and Kadlec, 2005). We cannot reject arguments based on prospect theory (Loughran and Ritter, 2002).

2. Japan's hybrid auction process

Japan implemented its hybrid auction procedure in 1989. The method was introduced in response to a scandal involving "spinning" of underpriced shares, which resulted in the resignation of Japan's Prime Minister. Popular press articles indicate that regulators hoped that the new method would reduce underpricing, increase liquidity, and give investors more equitable access to IPO shares.[1] During the period of our study, JASDAQ (Japan's automated quotation system, analogous to NASDAQ) rules required that the minimum offer size be the greater of 500,000 shares or 250,000 shares plus 12.5% of pre-issue outstanding shares. (Financial firms with large numbers of shares outstanding were exempt from this requirement.) At least 50% of the shares were required to be offered in the auction, and the auction failed if investors bid for less than 25% of total shares offered. Overwhelmingly, issuers set the auction tranche at the 50% minimum.[2]

Under the auction-regime procedure, a "preliminary prospectus" was published about 13 trading days before the auction. This prospectus contained no information on pricing. About eight trading days later, the shares allocated to the auction tranche were offered using a "first-revised prospectus." This prospectus specified a reservation price below which bids would not be accepted. This minimum bid was determined by a required formula that the underwriter applied to the market prices and financial data of a small selection of companies that the underwriter had identified as "comparable."[3] Auction-regime regulations were consistent during the period of our study in requiring that the

[1] Beierlein and Kato (2007), Hamao, Packer, and Ritter (2000), Kutsuna and Smith (2004), Pettway and Kaneko (1996), Kaneko and Pettway (2003), and the report of Shoken Torihiki Shingikai (Securities and Exchange Council) (1989) provide details on Japan's IPO market and review the events that led to adoption of the auction method.

[2] While our database does not include failed offerings, the evidence suggests that failure was rare or nonexistent. No successful auction is followed by failure of the public offer. Requirements of the procedure are documented in the report of Shoken Torihiki Shingikai (Securities and Exchange Council) (1995).

[3] The ability to select the comparables afforded the underwriter some control over the minimum bid. Nomura Securities describes its process as: (1) selecting 10 to 20 candidate companies based on factors such as industry, sales, and profitability; (2) paring the list to five or six using more detailed analysis; (3) examining the pricing implications of all combinations; and (4) selecting two to four of those depending on stock market conditions and factors related to comparability. Occasionally, reports in the popular press attribute high price adjustments to the underwriter's selection of comparables that produce a low value. In one case involving an IPO of a funeral home, a price adjustment of 184% was attributed to use of three comparables, one each from restaurants, hotels, and manufacture of packing materials.

minimum bid be set at 85% of the market value estimated using the formula.[4] Four or five trading days after the first-revised prospectus was circulated, a one-day discriminatory auction occurred. Shares were allocated to the highest bidders first (with each bidder paying their bid price) until the allocation was distributed or the minimum bid was reached. About four trading days later, the underwritten offering of the remaining shares took place, using a "second-revised prospectus" and an offer price set by the underwriter. The weighted-average successful bid ("WASB") from the auction was the highest price the underwriter could set for the public offer, and the minimum bid was the lowest.[5] The underwriter was required to disclose the reasons for a discount from the WASB in the prospectus and to submit the reasons to the Ministry of Finance. We reviewed a sample of disclosures and found them to be pro forma in nature, referring to high bid volumes, most frequent successful bid, and dispersion of successful bids.

The auction regulations were designed to achieve broad participation by small and uninformed investors. Employees of the issuer, the ten largest shareholders, employees of securities companies, and companies that owned the issuer's equity or debt were precluded from bidding. Under the regulations, a participant could bid to acquire no more than five units (normally 5,000 shares), which, at the average price, corresponds to about 10 million yen or $100,000. For most IPOs in our sample, the underwriter restricted the maximum allocation from the auction even further, usually to 1,000 shares. Also, an investor could acquire no more than 5,000 shares in the public offer (a combined maximum of 10,000 or less) and could participate in no more than four public offers per year. Subject to these constraints and the constraint that directed shares could not be reserved for sale to management, the underwriter was free to allocate shares from the public offer at its discretion.[6]

While the regulations and underwriter-imposed restrictions on bidding encouraged participation by small investors, they also limited incentives to develop information on issues, impeded price discovery, and discouraged institutional participation. Consequently, institutional investors generally did not participate in the IPO market.[7] In the popular press, underwriters expressed concern that bidders were provided with no information other than the prospectus, that prospectus information was not sufficient for making

[4]The formula is documented in the report of Shoken Torihiki Shingikai (1989). Pettway and Kaneko (1996) establish that the formula-based minimum bid required minimal information collection effort and was not very informative about the underwriter's assessment of value. Kaneko and Pettway (2003) describe the formula in greater detail. They argue that purchase quantity restrictions and participation restrictions prevented the auction from accurately revealing demand. Beckman, Garner, Marshall, and Okamura (2001) and Hamao, Packer, and Ritter (2000) provide additional discussion of the formula.

[5]The description in this paragraph is from various subsections of Detailed Rules Relating to the Regulations Concerning Registration of, and Publication of Prices of, Over-The-Counter Trading Securities, Article 4. Article 4.(3) provides that the minimum bid be set at 85% of the formula price. Article 4. (10) provides that the offer price not exceed the weighted average successful auction bid. Article 4.(10) indicates that underwriter must set the offer price based on the WASB, but can adjust the price in reference with market condition and auction results. The ability to discount the offer price relative to the WASB was introduced in December 1992 in response to difficulties in placing public-offer-tranche shares. See the report of Shoken Torihiki Shingikai (1995).

[6]These provisions are described in Detailed Rules Relating to the Regulations Concerning Registration of, and Publication of Prices of, Over-The-Counter Trading Securities, Article 4. Kaneko and Pettway (2003) state that a bidder usually is limited to purchasing 1,000 shares. In our sample, 4.1% of the issues accepted bids up to 5,000 shares, compared to 64.2% that accepted bids up to 1,000 shares.

[7]Based on a study of 110 JASDAQ IPOs in 1996, Tamura (1997) reports that institutions purchased only 11.7% of auction shares and only 13.7% of public offer shares.

a well-founded bid, and that the auction process could produce excessively high bids relative to "fair value."

The underwriter's role in developing information necessarily was limited. An agreement among underwriters to restrict fees to an artificially low percentage could have discouraged their information-production efforts.[8] For the auction, the first-revised prospectus included the minimum bid and information on the issuer's track record. For the public offer, the second-revised prospectus provided information on the auction results, including the number and size of bids, the WASB, the weighted average bid, and the minimum successful bid. Further, during the auction regime, underwriters were prohibited from using over-allotment options to assure the successful sale of the public offer tranche or to offset pricing errors, and could not use Green Shoe options to adjust the size of the tranche.

3. Literature review

The Japanese Ministry of Finance has been kind to academic researchers interested in studying the effects of different IPO processes. Before introduction of the auction method in 1989, all IPOs in Japan were sold in fixed price offerings based on a formula price. Pettway and Kaneko (1996) find that initial returns of fixed price offerings on the Tokyo Stock Exchange during this period averaged 62.1%. For the first six years of the auction regime, they report average initial returns of 12.7%, which is similar to our estimate of 11.5%. Kaneko and Pettway (2003) compare the auction regime and the book-building regime (initiated on September 1, 1997) and find that initial returns of OTC auction IPOs averaged 11.4%, whereas in the book-building regime, the average was 47.6%. Kutsuna and Smith (2004) also find that average initial returns of book-built JASDAQ IPOs are higher than of auction IPOs and provide an economic rationale to explain why, as long as some issuers benefit from book-building, book-building can drive out auction-method IPOs even if aggregate benefits are negative. More recently, Japan has continued to experiment with offering rules. Over-allotment options were not permitted on JASDAQ until February 2002, and short sales were first permitted around the same time. Kutsuna, Kiholm Smith, and Smith (2006) examine the IPO price formation process in Japan and the effects of introducing over-allotment options.[9]

Because discretionary price discounting in the auction regime arises under conditions much different from US book building, the Japanese evidence provides a new perspective on underpricing and partial adjustment. As the underpricing literature is voluminous, we concentrate on theories that have implications related to partial adjustment and where the Japanese evidence can shed light on underpricing in the US. With regard to the auction-regime evidence, the more prominent hypotheses fall into two categories: (1) those that are not supported by evidence from the auction regime and (2) those that auction-regime evidence cannot refute.

[8]During the sample period, fees were fixed informally at 3.1% of gross proceeds plus two yen, although actual fees often deviated from the formula and slightly higher fees sometimes were charged.

[9]See also, Hamao, Packer, and Ritter (2000) for the effect of venture-capital backing on initial and long-run returns for Japanese IPOs, and Sherman (2005) and Ritter (2003) for international trends and comparisons of auction methods.

3.1. Hypotheses not supported by auction-regime evidence

Information revelation and information acquisition: Discretionary discounting and partial adjustment in the auction regime cannot be explained by the Benveniste and Spindt (1989) hypothesis and related literature, which suggests that shares are underpriced, and preferential allocations are given, to reward investors for revealing information. Although discriminatory price auctions provide incentives for bidders to gather information, the auction regime's severe constraints on the number of shares a bidder can purchase undercut the incentives for bidders to acquire information or reveal their true demand. Also, except for giving investors small preferential allocations of public-offer-tranche shares up to four times per year, no mechanism enables the underwriter to reward bidders for revealing their private values. Moreover, with no roadshow, there is no way to collect information from public-offer-tranche investors. Nor, for similar reasons, can the evidence be explained by the Sherman and Titman (2002) hypothesis that underpricing compensates investors for the cost of acquiring information.[10]

Cascades: Welch (1992) hypothesizes that setting the offer price (or minimum bid) too high can cause sequential bidders to ignore their private information and result in failed offerings. Japan's auction process, however, aggregates demand information and works against cascades. In principle, if the minimum bid is set too high, the auction could fail, but failure appears to be nonexistent during our sample period. Only three IPOs received less than one bid per auctioned share, and the lowest subscription ratio was 0.83. An auction would not fail unless this ratio were below 0.50; rather, the size of the public offer tranche would be increased. If the auction was successful, the public offer could not fail because the underwriter had committed to completing the public offer tranche if the auction-tranche offering was completed.

Signaling: Welch (1989) and others hypothesize that high-quality issuers underprice to signal value as a precursor to an SEO at a higher price. While subsequent studies in the US provide little support for the hypothesis, it remains plausible for underpricing of the public offer tranche. Accordingly, we examine IPO aftermarket performance and SEOs after the IPO. Our findings are inconsistent with signaling. Rather, the evidence suggests that issuers undertake SEOs after increases in market value that they do not anticipate.

Pricing based on long-run value: Several hypotheses imply that underpricing can vary because the underwriter bases the offer price on long-run value. When it appears that the market is overheated or when a specific issue appears to be overvalued, the underwriter may discount the offer price more. Loughran and Ritter (2002) conjecture that underwriters may "lean against the wind" of investor over-optimism. Their hypothesis implies that initial returns and long-run returns should be negatively correlated, due to either firm-specific or marketwide effects. Similarly, Derrien (2005) argues that partial adjustment arises because underwriters compensate for overly optimistic demand for an issuer's shares. Purnanandam and Swaminathan (2004) apply a series of price-to-value multiples to comparable firms, and conclude that IPOs are overpriced at offer and that the

[10]Under Japanese regulations, auction results are provided free to all investors. Technically, information acquisition is not precluded, as the Sherman and Titman model assumes that the underwriter can use discounting and allocations to achieve whatever level of information acquisition is desired. However, without the ability to make large discriminatory allocations, the mechanism must work through discounting. In the auction regime, very large discounts could discourage auction bidders and cause the auction to fail.

most overpriced IPOs provide the lowest long-run risk-adjusted returns. In subsequent analysis, we examine long-run returns after the IPO. We find no significant support for the hypotheses that offer prices are discounted to compensate for over-optimism in terms of issue-specific or marketwide over-optimism.

3.2. Hypotheses not refuted by auction-regime evidence

Agency theory: Loughran and Ritter (2004) propose that average underpricing in the US in recent years may have increased because managers benefit more from implicit side-payments, i.e., "spinning," by the underwriter. Such side-payments, particularly in the context of severe underpricing, could include allocations of underpriced "directed" shares to managers, and quid pro quo arrangements whereby managers are allocated underpriced shares of other IPOs. If so, managers can prefer underpriced offerings. In the auction regime, prohibitions on issuing-firm employees participating in the auction, purchase quantity restrictions, and restrictions on the frequency of participation in the public offer tranche all work against high average underpricing. As high average underpricing was not common during our sample period, our evidence does not contradict this explanation for high average underpricing in the US.

Prospect theory: Loughran and Ritter (2002) and Lowry and Schwert (2004), among others, find that initial returns are state contingent in that underpricing is greater when the offer price is increased relative to the filing range. They find that initial returns are predictable based on public information that is known when the offer price is being set. Further, both studies find that even the filing range does not fully reflect public information and that the responses of the offer prices to positive and negative marketwide changes are asymmetric. Loughran and Ritter develop the argument from prospect theory that issuers may view the opportunity costs of gains and losses differently, relative to expected proceeds. They suggest that the asymmetry is consistent with prospect theory because issuers do not bargain as hard in the face of positive surprises.

Loughran and Ritter (2002) recognize that under the prospect theory argument the extent of average underpricing depends on competitive forbearance. Forbearance is particularly plausible in Japan, with its history of governmentally engineered and enforced cartels. Moreover, with only four high-prestige underwriters during our sample period (Daiwa, Nikko, Nomura, and Yamaichi), tacitly collusive arrangements could be easier to achieve than in the US. However, we find that the patterns of partial adjustment for low-market-share underwriters are similar to those of industry leaders. Thus, it is not clear whether prospect theory can account for partial adjustment or the extent of average underpricing in the auction regime.

Risk allocation: Loughran and Ritter (2002) identify risk allocation as a possible reason for partial adjustment.[11] Under the risk allocation hypothesis, underpricing reduces direct issue costs, protects the underwriter's reputation with investors, and enables the underwriter to indirectly compensate investors for participating in overpriced IPOs. As such, underpricing is part of an effort to maximize expected net proceeds. Partial

[11]It is not difficult to envision a model where the issuer's marginal value of investment capital is a positive function of unexpected good macroeconomic news (an improved investment opportunity set or a reduction in cost of capital), in which case, the issuer might want to raise more in good states, and might even want to cancel the IPO in bad states.

adjustment is an arrangement for sharing gains and losses, where the underwriter realizes the gains through its relationships with investors or its ability to attract future business. The extent of average underpricing is a result of bargaining over the minimum bid and how the gains will be shared if the minimum bid turns out to be too low relative to market demand. The essence of the hypothesis is that underpricing and partial adjustment reflect a long-term implicit contract between the issuer and the underwriter to allocate IPO pricing gains and losses. As repeat participants, underwriters can contribute to the efficiency of the IPO market in several ways. First, they can substitute underpricing for higher direct issue costs. Second, by sharing gains from the underpriced issues, they can develop relationships with investors who are willing to share losses when issues are overpriced. Third, by distributing shares of underpriced issues to prospective customers, they may be able to provide their underwriting services for lower fees.

The case for risk allocation is perhaps stronger in the auction regime than in the US. Among other considerations, the financial hedging instruments that might be alternatives are less available in Japan. Short sales and trading of options on JASDAQ-listed firms were not permitted until April 2004. Also, while the direct impact of underpricing accrues to investors, the direct impact of the loss on overpriced IPOs is borne by the underwriter. In our sample, the underwriters' aggregate yen-valued cost of overpriced IPOs was 3.95 billion yen, or 12.95% of fees. In contrast, aggregate underpricing of underpriced IPOs represents 50.84 billion yen, or 166.55% of fees. While we cannot observe the underwriters' allocation practices, subject to the above-mentioned limitations, the underwriter is free to allocate underpriced shares with an expectation of reciprocity when an issue is overpriced.

One specific theory of risk allocation that is not supported by our evidence is advanced in Edelen and Kadlec (2005). In their optimal tradeoff model, an issuer in an "up" market must weigh the benefit of holding out for better terms against the opportunity cost of deal failure. As the public-offer-tranche issues in our sample could not fail, their model cannot account for partial adjustment in the auction regime.

4. Data and evidence of discretionary underpricing and partial adjustment

4.1. Data sources

Book building was authorized as an alternative to hybrid auctions beginning on September 1, 1997. The first book-built IPO occurred on September 30, and the last auction-method IPO occurred on October 7. For our sample of 321 auction-method IPOs during the last portion of the auction regime, we obtain issue and financial data from the Research Group for Disclosure database (1996–1998). Issue data include offer date, shares issued, amount raised, offer price, first market price, and other offering details, including bidding statistics of the auction. We use the beginning of 1995 as the starting date because earlier bidding information is not available from Disclosure. Toyo Keizai Inc. provides daily stock price data. We use the daily JASDAQ Index provided by Nikkei NEEDS Financial Quest as a measure of market performance.

Table 1 contains definitions and descriptive statistics for the more important variables in the analysis. Because under the regulations the offer price could not be set above the WASB, we define *Maximum adjustment* as *WASB*/*Minimum bid*—1. (Italicized items denote variable names that are used in the tables and in the discussion.) We define *Price adjustment* as *Offer price*/*Minimum bid*—1. Correspondingly, we use *Price discount*

Table 1
Descriptive statistics

Summary statistics for all 321 auction-method IPOs on JASDAQ from January 1, 1995 through October 7, 1997. Variable definitions and units of measurement are shown in parentheses next to the variable name. Financial data including offer date, shares issued, amount raised, offer price for the public offer tranche, first market price, and offering details including bidding results and statistics are from the Research Group for Disclosure database (1996–1998). Daily stock prices are from Toyo Keizai Inc. JASDAQ Index data are from Nikkei NEEDS Financial Quest.

	Mean	Median	Std Dev	Skewness
Issuer characteristics				
Age of issuer (years)	30.00	29.90	13.04	0.20
Sales (millions of yen)	18607.5	12176.0	22035.5	5.11
Operating profit (millions of yen)	1499.5	718.0	6752.7	14.40
Net income (millions of yen)	694.3	341.0	2957.9	14.12
Issue characteristics				
Shares offered (thousands, in both tranches)	1224.4	1000.0	618.8	2.91
Offer price (“OP”) (yen per share)	2080.6	1650.0	1656.0	2.69
First market price (“MP”) (first closing price in yen per share)	2329.4	1800.0	1920.3	2.83
Auction tranche shares / Total offered	0.5059	0.5000	0.0173	3.45
Shares offered to outstanding	0.1860	0.1810	0.0381	1.54
Primary shares offered / Total offered	0.5962	0.5454	0.1804	0.91
Offer size (millions of yen)	2842.1	1867.0	4147.4	7.08
Gross proceeds at minimum bid (millions of yen)	1926.2	1320.0	2773.0	8.34
Underwriter market share (percent of IPOs in the sample)	19.08	17.40	10.81	−0.02
Auction tranche results				
Minimum bid (“MinBid”) (yen per share)	1447.4	1310.0	1867.0	2.33
Wtd. avg. successful bid (“WASB”) (yen per share)	2267.7	1727.0	1867.0	2.79
Minimum successful bid (“MSB”) (yen per share)	2163.3	1650.0	1768.4	2.78
Subscription ratio (shares bid for/auction shares)	4.4661	3.8800	2.6218	1.98
Homogeneity (MSB/WASB)	0.9567	0.9610	0.0230	−0.77
Public offer tranche pricing				
Maximum adjustment (WASB/MinBid)	1.5329	1.2795	0.6827	2.82
Price adjustment (OP/MinBid)	1.4044	1.1935	0.5631	2.91
First market price/Minimum bid	1.5937	1.3000	0.7789	2.79
First market price/WASB	1.0329	1.0039	0.1381	1.60
First market price/Minimum successful bid	1.0807	1.0479	0.1500	1.57
Price discount (OP/WASB)	0.9289	0.9343	0.0443	−0.40
Price to sales (OP/Sales per share)	1.2074	0.7900	1.4554	6.10
Price to operating profit (OP/Operating profit per share)	14.6585	12.4100	8.7704	2.75
Price to net income (OP/Net income per share)	31.3390	25.9000	19.1473	2.63
Issue cost				
Underwriter fee (Underwriter fee/OP)	0.0339	0.0340	0.0014	0.80
Fee to market (Underwriter fee/MP)	0.0310	0.0313	0.0045	0.54
Initial return (MP/OP - 1)	0.1150	0.0714	0.1645	1.69
Nondiscretionary initial return ((MP-WASB)/OP)	0.0329	0.0039	0.1381	1.60
Discretionary initial return (WASB/OP - 1)	0.0822	0.0708	0.0563	0.68
Underpricing (1 - OP/MP)	0.0859	0.0666	0.1225	−0.30
Total issue cost to market (Fee to market + Underpricing)	0.1169	0.0980	0.1183	−0.29
Market conditions before IPO				
Run-up (−40, −14) (buy-and-hold return) (pre-auction window)	−0.0188	−0.0326	0.0701	0.10
Run-up (−13, −8) (buy-and-hold return) (auction window)	−0.0098	−0.0120	0.0269	0.99

Table 1 (*continued*)

	Mean	Median	Std Dev	Skewness
Run-up (−7, −1) (buy-and-hold return) (post-auction window)	−0.0105	−0.0140	0.0286	0.48
Run-up (−40, −8) (buy-and-hold return)	−0.0280	−0.0361	0.0804	0.12
Aftermarket performance				
SEO (Seasoned equity offer within nine months of IPO)	8.10%	0.00%	27.32%	3.07

(i.e., *Offer price*/*WASB*) to measure the discretionary discount. We measure *Initial return* based on the first freely trading closing price, as (*First market price*/*Offer price*–1). Because the distribution of initial returns is skewed, we base some of our analysis on *Underpricing*, measured as (1 – *Offer price*/*First market price*). In lieu of indications of interest, we use *Subscription ratio* (i.e., the number of shares bid for per share auctioned).

4.2. Evidence of discretionary partial adjustment

Kaneko and Pettway (2003) find that partial adjustment and market movement prior to the offer date are the most significant determinants of the initial returns on Japanese IPOs in the auction regime. They suggest that partial adjustment in the regime results from the strict restrictions on auction entry, bid prices, and order volume that prevent the auction prices from fully reflecting market demand. If so, the Japanese evidence would be of little relevance to understanding underpricing in the US. However, Table 2 demonstrates that auction-regime underpricing includes an important discretionary component. The table presents *Price adjustment, Initial return*, and other statistics grouped by *Subscription ratio.* In our sample, 7.5% of the IPOs had negative initial returns and 11.5% had initial returns of zero. For issues with non-positive initial returns, the underwriter would have incurred costs to support the market or would have acted, in effect, as the writer of a put option at the offer price.[12]

Panel A demonstrates that the monotonic relation between *Price adjustment* and *Initial return* arises from two sources. First, the *Non-discretionary initial return* column confirms the mechanical relationship hypothesized by Kaneko and Pettway (2003). More importantly, *Initial return* is monotonically related to *Price discount*, a discretionary choice of the underwriter. Apparently, the non-discretionary initial return that arises from the purchase quantity constraint and yields a mean initial return of 3.60% of the offer price (a median of 0.40%) is not sufficient for the underwriter. Relative to the offer price, the mean discretionary initial return is 7.90% (median of 7.04%). Together, they constitute the 11.50% mean initial return.

Because the public offer tranche could not be priced below the minimum bid, the discretionary component sometimes is constrained. Panel A provides information on the percentages of issues for which the constraint on the minimum offer price may have been binding. However, when we delete the 38 observations where the offer prices were equal to the minimum bid, the aforementioned monotonic relations persist and are of similar

[12]The option to over-allot shares and cover the resulting short position by repurchasing, which can lower the underwriter's cost of supporting the market in the US, was not available in the hybrid auction regime.

magnitudes to those in the table. The panel also shows a tendency for the public offer tranche to be priced at the minimum successful bid, as it was for 40.19% of the observations. The relations in Panel A persist and are more apparent in the medians, where results are not skewed by outliers.[13]

Panel A illustrates that *Initial return* is positively related to the JASDAQ Index run-up in the 40 trading days before the IPO, consistent with what would be expected if underwriters were attempting to lean against the wind. However, there is no clear relation between *Initial return* or the JASDAQ Index run-up and either the post-IPO 12-month JASDAQ return or the 12-month JASDAQ-adjusted return. Thus, the tendency of offer prices not to take full account of prior market run-ups does not appear to be related to actual overheating of the market.

Panel B shows IPO activity and market returns by calendar quarter. With the IPOs aggregated by quarter, when there is positive overall market performance, the mean subscription ratios, price adjustments, and initial returns are higher, and offer prices are discounted more. There is no apparent relation between overall market performance and the intensity of new issue activity, possibly reflecting the long lag time in Japan between deciding to go public and consummating the offering. Inconsistent with effective leaning against the wind, there is no apparent relation between post-IPO 12-month JASDAQ and JASDAQ-adjusted aftermarket returns and either *Price discount* or *Initial return*.

Fig. 1 shows non-discretionary and discretionary initial returns sorted by price adjustment. The figure reveals that the non-discretionary component is highly volatile and only weakly related to the price adjustment. The potential for WASB to be well above the first market price (i.e., large negative non-discretionary returns) appears to have a positive but weak relation to the price adjustment. The potential for WASB to be well below the first aftermarket price appears to increase with the price adjustment. Overall, the data indicate that WASB is not an accurate predictor of the first market price, and can frequently be off by more than 20% in either direction. In contrast, the potential for the offer price to be more heavily discounted relative to WASB (i.e., the discretionary initial return) increases with the price adjustment. The correspondence between spikes of non-discretionary and discretionary initial returns in the figure suggests that rather than mitigating the initial return surprises that derive from the auction, the discretionary initial returns increase the variance of initial returns. This is borne out by the summary statistics in Table 1. Fig. 1 and the summary data in Table 2 suggest that the larger the price adjustment, the larger are both components of the initial return. The net result is that the issuer and investors share in the gain associated with the price increase from the minimum bid, and as noted elsewhere, the underwriter benefits indirectly from the price increase.

4.3. Japan's auction-method analog to the filing range

For a firm-commitment offering in the US, the preliminary prospectus usually specifies a filing range defined by a minimum and maximum anticipated offer price. By convention, the midpoint of the range is used as an indication of the expected offer price. Hanley (1993) segregates IPOs into those with offer prices below, within, and above their filing ranges and finds partial adjustment, in that the issues with the most positive adjustments are the most

[13]An expanded version of Table 1, including medians and standard deviations, is available from the authors.

Table 2
Price adjustment, initial return, and JASDAQ market-adjusted return by subscription ratio and listing quarter

Panel A shows means by *Subscription ratio* for all 321 IPOs on JASDAQ from January 1, 1995 through October 7, 1997. Panel B shows means for selected variables by listing quarter from 1995Q1 through 1997Q3. *Subscription ratio* is the ratio of bids to shares offered in the auction tranche. *WASB* is the *Weighted-average successful bid* from the auction tranche. *Price adjustment* is *Offer price*/*Minimum bid* − 1. *Maximum adjustment* is *WASB*/*Minimum bid*—1. *Minimum bid* is determined by a required formula, based on the values of comparable public firms. By regulation, *Minimum bid* and *WASB* are, respectively, the minimum and maximum offer price for the public offer tranche. *Price discount* is *Offer price*/*WASB*. *Initial return*, based on the first freely trading closing price, is *First market price*/*Offer price* − *1*, and is the sum of the non-discretionary portion of the initial return (*First market price—WASB*)/*Offer price* and the discretionary portion of the initial return *WASB*/*Offer price* − 1.

Panel A			Price adjustment			Initial return				Pricing		Run-up and long-run returns		
	Number of obs.	Subscription ratio	Max adjustment (%)	Price adjustment (%)	Discretionary price discount (%)	Total initial return (%)	Non-discretionary initial return (%)	Discretionary initial return (%)	Positive initial returns (%)	Offer price equal min. bid (%)	Offer price equal min. succ. bid (%)	Run-up days −40 thru −1 (%)	Post-IPO 12-month JASDAQ return (%)	12-month JASDAQ adjusted return (%)
All observations	321	4.47	53.29	40.44	92.89	11.50	3.60	7.90	81.00	11.84	40.19	−3.76	−12.08	−1.84
Subscription ratio ⩽ 1	3	0.93	0.29	0.00	99.71	−10.14	−10.43	0.29	0.00	100.00	100.00	−16.09	−6.23	4.57
1 < Subscription ratio ⩽2	37	1.59	3.41	1.14	97.87	−0.97	−3.19	2.22	43.24	70.27	75.68	−11.08	−17.58	1.12
2 < Subscription ratio ⩽3	61	2.58	16.47	9.95	94.72	7.55	1.86	5.69	78.69	13.11	65.57	−6.21	−10.38	−4.09
3 < Subscription ratio ⩽4	61	3.38	37.98	28.37	93.83	9.59	2.88	6.72	81.97	1.64	49.18	−3.09	−11.93	8.02
4 < Subscription ratio ⩽5	61	4.58	66.54	50.18	91.02	13.57	3.47	10.10	85.25	0.00	31.15	−3.11	−19.78	−3.38
5 < Subscription ratio ⩽7	58	5.94	84.26	66.69	91.34	16.32	6.64	9.69	93.10	0.00	15.52	−0.26	−10.22	−5.51
7 < Subscription ratio ⩽10	29	8.14	107.96	83.58	88.89	22.79	10.12	12.67	100.00	0.00	0.00	0.86	−6.87	−10.05
10 < Subscription ratio	11	13.48	143.71	113.41	87.99	25.16	11.39	13.78	100.00	0.00	0.00	−0.14	13.61	−1.94

Panel B

Listing quarter	Number of obs.	Ending JASDAQ index	JASDAQ return for quarter (%)	Subscription ratio	Price adjustment (%)	Price discount (%)	Initial return (%)	Post-IPO 12-month JASDAQ ret. (%)	12-month adjusted return (%)
1995Q1	24	46.85	−23.0	3.82	21.46	95.98	7.81	10.00	6.30
1995Q2	29	43.47	−7.2	6.10	27.25	94.45	13.92	36.75	−19.32
1995Q3	38	52.91	21.7	5.02	41.48	92.04	12.57	18.61	2.54
1995Q4	46	54.14	2.3	4.61	29.82	93.36	14.21	−1.94	4.96
1996Q1	14	57.85	6.9	6.53	64.63	90.39	13.71	−21.04	7.37
1996Q2	18	62.70	8.4	6.54	84.83	87.56	28.97	−29.75	−22.47
1996Q3	38	55.75	−11.1	3.98	62.49	90.23	14.26	−33.49	−1.19
1996Q4	40	47.08	−15.6	3.98	65.23	91.83	11.24	−40.01	−0.36
1997Q1	11	41.14	−12.6	3.87	25.00	94.32	9.43	−28.70	−6.45
1997Q2	17	44.82	8.9	3.62	24.73	93.79	10.14	−29.77	−15.58
1997Q3	46	33.59	−25.1	3.01	13.39	95.85	−0.25	−27.78	4.84

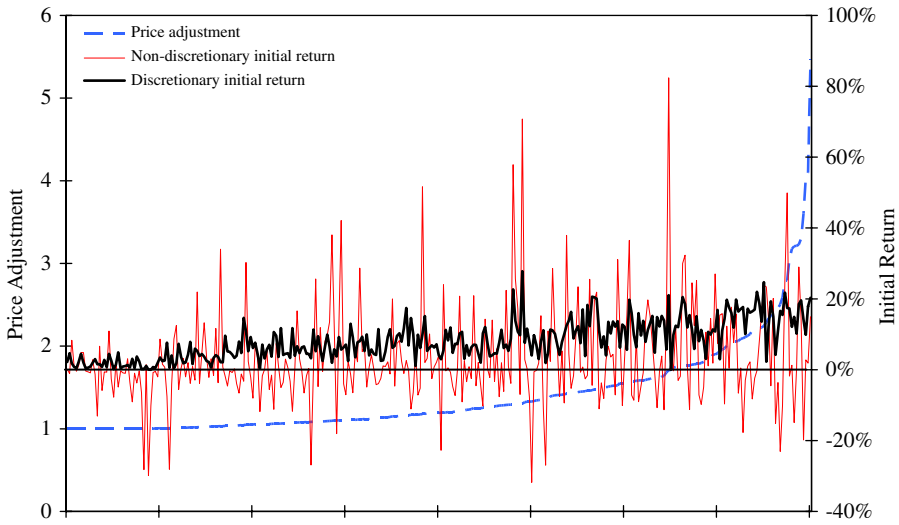

Fig. 1. Non-discretionary and discretionary components of initial returns sorted by price adjustment for all hybrid auction method IPOs on JASDAQ from January 1, 1995, through October 7, 1997

underpriced. Loughran and Ritter (2002) and Ritter and Welch (2002) find similar relations between price adjustments and initial returns.

To provide a simple way of comparing the Japan evidence of partial adjustment to the US evidence, we infer the auction-regime formula price from the requirement in effect during our sample period that the minimum bid be set at 85% of the formula price. We use the implied formula price in a similar way to how the US studies use the filing-range midpoint. We distinguish between IPOs with unexpectedly positive and negative price adjustments. IPOs where the offer price is more than 15% above the minimum bid are more likely to have been undervalued by application of the formula. We refer to them as the "high-adjustment subsample" (181 observations). IPOs where the offer price is equal to or less than 15% above the minimum bid are more likely to have been overvalued and are referred to as the "low-adjustment subsample" (140 observations).

4.4. *Money left on the table*

Viable explanations of underpricing must account for the willingness of issuers to accept net proceeds that sometimes are much lower than appear to be necessary. Loughran and Ritter (2002) refer to the dollar-valued capital gain from the offer price to the first market closing price multiplied by the number of shares issued as the "money left on the table." In Table 3, for both tranches, money left on the table is the yen-valued capital gain from the tranche offer price to the first closing market price multiplied by the number of shares offered in the tranche. We use the WASB as the auction-tranche offer price. The money left on the table in the auction tranche is non-discretionary because the WASB is determined by auction demand. The money left on the table for the public offer tranche depends on the public offer price that the underwriter chooses.

As Table 3 shows, the yen-weighted gain of the auction tranche is small. The WASB, though market determined, generally is below the first market price. Based on the WASB,

Table 3
Price adjustments and the aggregate value of initial returns

Mean [median] yen value of initial capital gain grouped by *Price adjustment*, for all 321 auction-method IPOs on JASDAQ from January 1, 1995 through October 7, 1997. *Price adjustment* is *Offer price*/*Minimum bid*. The high-adjustment subsample is IPOs with price adjustments greater than 15% (*Offer price*/*Minimum bid* >1.15), and the low-adjustment subsample is IPOs with price adjustments equal to or less than 15% (*Offer price*/*Minimum bid* $\leqslant 1.15$). Gross proceeds of the auction tranche is *Weighted-average successful bid* $\times$ Auction-tranche shares offered. Gross proceeds of the public offer tranche is *Offer price* $\times$ Public-offer-tranche shares offered. Money left on the table is (First market value of shares offered) – (Gross proceeds in the tranche). *Auction underpricing* is (Money left on the table in the tranche)/(First market value of shares offered in the tranche). *Public offer underpricing* is (Money left on the table in the tranche)/(First market value of shares offered in the tranche). Statistical tests are parametric differences in means and [nonparametric] Wilcoxon rank sum tests between subsamples. Two-tailed significance levels are shown at the .01 (***) level.

	All IPOs	Low-adjustment subsample	High-adjustment subsample	*t*-value [*z*-value]
Number of issues	321	140	181	
Auction tranche				
Gross proceeds (million yen)	1493.6	1003.4	1872.8	3.86***
	[980.4]	[673.6]	[1212.4]	[6.64***]
Money left on the table (million yen)	35.2	−0.3	62.7	2.64***
	[3.2]	[−3.5]	[14.0]	[2.67***]
Auction underpricing (percentage weighted by first market value)	2.30% [0.33%]	−0.03% [−0.52%]	3.24% [1.14%]	
Public offer tranche				
Gross proceeds (million yen)	1348.4	943.5	1661.7	3.34***
	[884.0]	[636.4]	[1044.0]	[5.95***]
Money left on the table (million yen)	146.1	41.8	226.7	6.89***
	[57.6]	[22.5]	[139.5]	[8.22***]
Public offer underpricing (percentage weighted by first market value)	9.78% [6.12%]	4.24% [3.41%]	12.00% [11.79%]	

the average auction tranche generates 35.2 million yen (about $350,000) less in gross proceeds than the market value of the tranche. Corresponding *Auction underpricing*, defined as the cumulative money left on the table divided by the cumulative first market value of the auction tranche, is 2.30% of the first aftermarket value of the tranche. The difference between the offer price of the public offer tranche and the market value of the tranche is more economically significant, averaging 146.1 million yen (about $1.5 million). *Public offer underpricing*, defined as the cumulative money left on the table divided by the cumulative first market value of the public offer tranche, represents 9.78% of the market value of the tranche. Thus, discretionary discounting is responsible for most of the aggregate value left on the table.

In Table 3, we also report how the money left on the table is related to the price adjustment. For the low-adjustment subsample, money left on the table in the public offer tranche averages 4.24% of yen-weighted market value, and for the high-adjustment subsample it averages 12.00%. Except for the difference in size between the public offer tranche and the US IPOs from 1990–1998 studied by Loughran and Ritter, our results are strikingly similar. In their sample, money left on the table represents 11.8% of market value on a value-weighted basis, and ranges from 3.2% for offers priced below the filing

range to 19.7% for offers priced above. That such different offering procedures yield similar results suggests that explanations for underpricing patterns are likely to derive from aspects of the procedures that are similar.[14]

5. Empirical analysis

The various hypotheses about the causes of underpricing and partial adjustment point to a series of key questions that are usefully examined with the auction-regime evidence: (1) Are the magnitudes of price adjustments predictable on the basis of ex ante public information and, if so, how does the predictability relate to the various hypotheses? (2) Are initial returns, long-run returns, and the occurrences of SEOs predictable on the basis of discretionary price adjustments? (3) Do selling shareholders anticipate underpricing and do issuers use underpricing to signal value? (4) Do underwriters underprice more when an issue is likely to be overvalued relative to its long-run value?

5.1. The correlates of price adjustment

As a first step toward addressing these questions, Table 4 compares the high- and low-adjustment subsamples on several dimensions. We use the comparisons to assess whether price adjustments are predictable and whether they are predictive of price discounting, underpricing, and SEOs.

Ex ante determinants of price adjustment: Table 4 shows that price adjustments are higher when bids received are high relative to the previously established minimum bid, and we know from Table 2 that large price adjustments also foreshadow greater initial returns. If issuers perceive that the minimum is low, the signaling hypothesis predicts *Shares offered* and *Shares offered to outstanding* to be low. If selling shareholders perceive that the minimum is low, the signaling hypothesis predicts *Primary shares offered/Total offered* to be high. The lack of significance for these factors does not support the signaling hypothesis. Rather, it suggests that issuers and selling shareholders do not anticipate the realized price adjustments. Instead, the evidence suggests that the offer prices for older, more established firms are set closer to the minimum bids. Because the minimum bid constrains the offer price, other things the same, the underwriter assumes more risk of overpricing by setting a higher minimum bid. Thus, for issues that are harder to value, the higher price adjustments reflect an allocation of risk between the issuer and the underwriter. The specific allocation of risk can be affected by a variety of factors, including certification (e.g., Booth and Smith, 1986) and litigation avoidance (Tinic, 1988), though litigation is rare in Japan. To the extent that high-market-share underwriters develop minimum bids on the basis of low-valued comparables, Table 4 shows that their IPOs are significantly more likely to have high price adjustments. Their reliance on low-valued comparables relative to other underwriters is consistent with the suggestion of

[14]Because the assumption of independence across observations may be violated for some variables, we also evaluated tests of statistical significance for differences in means and ordinary least squares (OLS) regression coefficients using clustered robust estimators. We assumed the data to be clustered by quarter, and found no material differences in significance levels. Tables 3, 4, 5 and 7 report standard *t*-values and significance levels for differences in means, and Tables 6 and 8 report clustered robust test statistics and significance levels for the OLS regression coefficients.

Table 4
Ex ante determinants of price adjustment

Mean [median] statistics for all 321 auction-regime IPOs on JASDAQ from January 1, 1995 through October 7, 1997. *Price adjustment* is *Offer price/Minimum bid*. The high-adjustment subsample is IPOs with price adjustments greater than 15% (*Offer price/Minimum bid* >1.15), and the low-adjustment subsample is IPOs with price adjustments equal to or less than 15% (*Offer price/Minimum bid* $\leqslant 1.15$). Run-up intervals are expressed in trading days. Statistical tests are parametric differences in means and [nonparametric] Wilcoxon rank sum tests between subsamples. Two-tailed significance levels are shown at the .01 (***), .05 (**), and .10 (*) levels.

	Low-adjustment subsample (*Offer price/ minimum bid*) $\leqslant 1.15$	High-adjustment subsample (*Offer price/ minimum bid*) >1.15	*t*-value [*z*-value]
Number of issues	140	181	
Price adjustment (Offer price/minimum bid)	1.046	1.681	NA
	[1.035]	[1.497]	NA
Offering characteristics			
Shares offered (thousands)	1209	1236	0.39
	[1012.0]	[1000.0]	[0.32]
Minimum bid (yen)	1356.0	1518.2	1.73*
	[1320.0]	[1290.0]	[1.49]
Shares offered to outstanding	18.29%	18.83%	1.31
	[17.94%]	[18.25%]	[1.41]
Primary shares offered/Total offered	58.99%	60.11%	0.55
	[52.51%]	[55.00%]	[0.72]
Issue characteristics			
Age of issuer (years)	33.3	27.4	4.15***
	[33.5]	[25.3]	[3.96***]
Underwriter characteristic			
Underwriter market share (of the IPO market)	16.75%	20.45%	2.99***
	[17.4%]	[17.4%]	[3.16***]
Market conditions			
Run-up (−40, −14) (buy-and-hold return)	−5.00%	0.52%	7.59***
	[−6.36%]	[2.28%]	[7.06***]
Run-up (−13, −8) (buy-and-hold return)	−1.50%	−0.57%	3.11***
	[−2.10%]	[−0.66%]	[3.80***]
Run-up (−7, −1) (buy-and-hold return)	−1.13%	−0.99%	0.44
	[−1.72%]	[−0.87%]	[1.51]

Loughran and Ritter (2002), related to their prospect theory hypothesis, that established underwriters have bargaining power that is not entirely competed away.

To examine the relations of marketwide information to price adjustments, we use the JASDAQ Index over three intervals. Based on the normal timing of the offering sequence, the JASDAQ Index run-up over trading days −7 through −1, where day 0 is the offer date, measures marketwide changes after the auction and before the public offer. Run-up over trading days −13 through −8 measures marketwide changes after the first-revised prospectus through completion of the auction. Run-up over trading days −40 through −14 measures marketwide changes over a period that covers the shortest reasonable time from

the first meeting between the underwriter and the issuer until circulation of the first-revised prospectus.

Price adjustments are significantly related to marketwide run-up before the first-revised prospectus and from then through completion of the auction, but not to run-up after the auction. The significant difference for trading days −40 through −14 implies that the minimum bid, which typically is set at about day −5, is not fully adjusted for marketwide changes over the prior 26 trading days. Specifically, when the offer price is at least 15% above the minimum bid, the average market return during trading days −40 to −14 is 0.52%, whereas when the offer price is no more than 15% above the minimum bid, the average market return is −5.00%. Consistent with the risk allocation hypothesis, it appears that following market declines, underwriters sometimes knowingly determine minimums that are likely to result in overpriced IPOs.

In discussing their similar finding for book-built IPOs, Lowry and Schwert (2004) suggest that price rigidity can arise from an implicit contract that occurred during the beauty contest, when the issuer was selecting the underwriter. The explanation that seems likely to account for the auction-regime result is that the pricing formula, which is based on a backward-looking appraisal-like process, impedes reducing the minimum bid. Despite differences on the surface, the two explanations are related. US underwriters base their valuation discussions with issuing firms partly on data for comparable firms and issuing firms may anchor on the implied valuations.

The significant difference in JASDAQ performance between trading days −13 and −8 is easier to understand. With the minimum bid already determined, upward adjustment of the offer price is likely to be less following a marketwide price decline. The absence of a similar result for trading days −7 through −1 raises the question of why marketwide performance shortly before the offer does not significantly affect the price adjustment.

Predictability of underpricing: Several of the previously discussed theories imply predictable relations between price adjustments and underpricing, long-run returns, and SEOs. In the first panel of Table 5, we use the two subsamples to examine these relations. We find that the price adjustment is predictably related to *Underpricing*. The high-adjustment subsample has significantly higher ratios of *First market price* to *Minimum bid*, *WASB*, and *Minimum successful bid*. On average, *WASB* is close to being an unbiased predictor of the market price. However, the average of each of the ratios and the percentage of observations where each of the ratios is greater than one are higher for the high-adjustment subsample than for the low-adjustment subsample.

Because the auction process does not involve soliciting demand information from public-offer-tranche investors, and because the public offer tranche does not fail, this predictability cannot be explained by hypotheses related to information revelation, information acquisition, or cascades. Occurrences of high average initial returns are consistent with prospect theory and with a form of risk allocation where, in exchange for shielding issuers from the losses and costs of overpricing, the underwriter realizes some of the gains from underpricing through its relationships with investors and its ability to attract future business. As the issuer does not share losses if an issue is overpriced or the minimum bid is set too high, the findings that 30.7% of the low-adjustment sample have non-positive initial returns and that 18.6% have first market prices that are less than or equal to the minimum bid are additional evidence of risk allocation.

Predictability of long-run returns: If high initial returns anticipate lower marketwide or firm-specific long-run performance, they could reflect an effort by underwriters to price on

Table 5
Predictability of underpricing, long-run returns, and SEOs

Mean [median] statistics for all 321 IPOs on JASDAQ from January 1, 1995 through October 7, 1997. *Price adjustment* is *Offer price/Minimum bid*. The high-adjustment subsample is IPOs with price adjustments greater than 15% (*Offer price/Minimum bid* >1.15), and the low-adjustment subsample is IPOs with price adjustments equal to or less than 15% (*Offer price/Minimum bid* $\leqslant 1.15$). Statistical tests are parametric differences in means and [nonparametric] Wilcoxon rank sum tests between subsamples. Two-tailed significance levels are shown at the .01 (***), .05 (**), and .10 (*) levels.

	Low- adjustment subsample	High-adjustment subsample	*t*-value [*z*-value]
Number of issues	140	181	
Initial returns, underpricing, and first market price compared to bid			
Underpricing (1 – (Offer price/First market price))	3.87%	12.24%	6.57***
	[3.48%]	[11.50%]	[7.01***]
Observations with Initial returns and Underpricing >0.0	69.3%	90.1%	4.61***
First market price/Minimum bid	1.102	1.976	13.48***
	[1.080]	[1.713]	[14.18***]
Observations with First market price/Minimum bid >1.0	81.4%	98.9%	5.15***
First market price/WASB	1.008	1.052	3.06***
	[0.996]	[1.018]	[2.25**]
Observations with First market price/WASB >1.0	47.1%	58.0%	1.94*
First market price/Minimum successful bid	1.048	1.106	3.68***
	[1.033]	[1.069]	[3.33***]
Observations with First market price/Minimum successful bid >1.0	68.6%	76.8%	1.63
Offer-price-to-value measures			
Offer price/1000 yen of sales per share	0.732	1.575	5.97***
	[0.585]	[1.100]	[6.08***]
Offer price/1000 yen of operating profit per share	10.25	18.07	9.79***
	[10.00]	[15.50]	[9.69***]
Offer price/1000 yen of net income per share	22.03	38.54	9.31***
	[20.45]	[33.57]	[9.39***]
JASDAQ-adjusted returns and seasoned equity offers			
12-month post-IPO JASDAQ index return	−11.77%	−12.33%	0.20
	[−26.55%]	[−23.71%]	[0.56]
12-month JASDAQ-adjusted aftermarket return	−0.13%	−0.30%	0.73
	[−3.48%]	[−13.19%]	[1.98**]
Seasoned offer within 12 months (percent of IPOs)	4.29%	11.05%	−2.33**
	[0.0%]	[0.0%]	[−2.20**]

the basis of long-run value. In the lower panels of Table 5, we consider the possibility that the underwriter discounts the offer prices of highly demanded IPOs to offset investor over-optimism. As an aspect of the analysis, we report ratios of the offer price to sales, operating profit, and net income. These price-to-value ratios are similar to those used by Purnanandam and Swaminathan (2004) to assess over-optimism. Mean and median differences all are substantial and statistically significant, with the high-adjustment subsample having higher ratios. Thus, it appears that underwriters increase underpricing when they think bidders are overly optimistic.

To assess the effectiveness of apparent efforts to price based on long-run value, Table 5 shows both the JASDAQ Index return for the year after the IPO and the one-year JASDAQ-adjusted return. The mean and median JASDAQ Index returns are almost equal between the two subsamples, suggesting that larger discounts are not a response to marketwide overheating. There also is no material difference in the mean JASDAQ-adjusted returns over this interval. However, consistent with pricing based on long-run value, the median JASDAQ-adjusted return of the high-adjustment group is significantly lower than that of the low-adjustment group. As it is not clear how quickly over-optimism should be resolved in the market, we also examined differences (not reported) for intervals of one month, two years, and three years after the IPO. At one month and two years, the results were similar to those reported for one year; at three years, the long-run returns of the low-adjustment subsample were significantly more negative than those of the high-adjustment sample, the opposite of what would be predicted by effective pricing based on long-run value.

We also considered the related hypothesis that underpricing is greater for riskier issues, in terms of long-run performance.[15] For this, we compared the within-group cross-sectional standard deviations of long-run aftermarket returns. While the high-adjustment subsample had a higher standard deviation over one year (p-value = 0.00), the result was reversed for two and three years. Thus, differences in uncertainty do not account for the observed patterns of discretionary underpricing.

Predictability of SEOs: As implied by the signaling hypothesis, occurrences of SEOs within a year after the IPO are higher among the high-adjustment (high initial return) subsample. However, the result in Table 5 cannot distinguish between underpricing as an intentional signal and the alternative hypothesis that SEOs are responses to unexpectedly positive aftermarket performance. Furthermore, as indicated by the middle panel, the high-adjustment subsample tends to have higher price-to-value multiples at the offer price and thus issuers might be more inclined to do an SEO anyway.

5.2. Empirical determinants of offer prices and underpricing

While the above evidence demonstrates a predictive relation between price adjustments and underpricing, it does not enable us to distinguish among plausible hypotheses for the relation. To test some of these hypotheses, we estimate cross-sectional models of *Price adjustment*, *Price discount*, and *Underpricing*. All three are functions of the offer price. Because the underwriter may take account of the expected first market price in setting the offer price, we use the first market price as an estimate of the underwriter's expectation. In Table 6, although *Price adjustment*, *Price discount*, and *Underpricing* are determined simultaneously, the equations all are identified through functional form restrictions and ordinary least squares (OLS) is used. In the *Price adjustment* and *Price discount* models, we include a scaled measure of the initial return, (*First market price* − *Offer price*)/*Minimum bid*. In the *Underpricing* model, we include a scaled measure of the discretionary discount, (*WASB* − *Offer price*)/*First market price*. The scale factors do not materially affect significance levels, but aid interpretation.

Independent variables include three exogenous measures of excess demand at the minimum bid and of uncertainty: *Subscription ratio*, *Maximum adjustment*, and

[15]This possibility was suggested to us by Ann Sherman, based on Sherman (2005).

Table 6
Determinants of offer price adjustment, offer price discount, and underpricing

Ordinary least squares regression estimates of *Price adjustment, Price discount,* and *Underpricing* for all 321 hybrid auction-method IPOs on JASDAQ from January 1, 1995 through October 7, 1997. *Price adjustment* is *Offer price/Minimum bid. Price discount* is *Offer price/WASB. Underpricing* is 1—*Offer price/First market price.* Absolute *t*-values of OLS regressions are based on clustered, robust estimators, where the data are assumed to be clustered by calendar quarter. Two-tailed significance levels are shown at the .01 (***), .05 (**), and .10 (*) levels.

	Price adjustment (offer price/ minimum bid)	Price discount (offer price/ WASB)	Underpricing (1-offer price/ first market price)
Intercept	−0.175	0.503	1.806
	(1.92)	(4.63)***	(3.95)***
Initial return (First market price-Offer price)/Minimum bid	−0.001	0.001	
	(0.06)	(0.08)	
Discretionary discount (WASB-Offer price)/First market price			−0.498
			(4.01)***
Subscription ratio (bids/auction shares)	−0.003	−0.005	0.017
	(1.95)*	(3.18)***	(3.42)***
Maximum adjustment (WASB/Min. bid)	0.828	−0.025	0.032
	(88.81)***	(3.31)***	(2.55)***
Homogeneity (Minimum successful bid/ WASB)	0.525	0.627	−1.664
	(7.27)***	(12.47)***	(9.53)***
Age of issuer (in ln(years))	−0.028	−0.007	0.023
	(1.87)*	(1.08)	(0.86)
Gross proceeds at minimum bid (ln(Shares offered × Min. bid))	0.015	0.005	−0.056
	(0.99)	(0.55)	(2.46)***
Primary shares offered/Total offered	0.023	0.012	0.015
	(1.42)	(1.11)	(0.48)
Auction tranche shares/Total offered	0.097	0.014	0.518
	(0.43)	(0.14)	(1.38)
Underwriter market share (decimal)	0.018	0.000	0.124
	(0.72)	(0.03)	(2.91)**
Underwriter fee (%)	−0.088	−0.043	−0.056
	(8.95)***	(4.89)***	(0.87)
Offer price/1000 yen of sales per share		−2.113	
		(2.01)*	
Offer price/1000 yen of operating profit per share		0.516	
		(0.78)	
Offer price/1000 yen of net income per share		−0.257	
		(1.06)	
Run-up (−7, −1) (buy-and hold return)			0.948
			(3.97)***
Run-up (−13, −8) (buy-and-hold return)	−0.076		
	(0.64)		
Run-up (−40, −8) (buy-and-hold return)		−0.072	0.029
		(4.22)***	(0.24)
Run-up (−40, −14) (buy-and-hold return)	−0.053		
	(1.81)		
Adjusted R^2	0.994	0.648	0.353

Homogeneity. Homogeneity (the ratio of the minimum successful bid to the WASB) is an indicator of demand elasticity. For firm and issue characteristics, we include the natural log of *Age of issuer*, the natural log of *Gross proceeds at minimum bid*, *Primary shares offered/Total offered*, *Auction tranche shares/Total offered*, *Underwriter market share*, and *Underwriter fee*. To assess whether, in setting the price, the underwriter compensates for over-optimism, we include offer price to value ratios relative to sales, operating profit, and net income. We use the run-up in the JASDAQ index to assess the effects of market performance.

Adjustment of the offer price: In Table 6, the adjusted R^2 (99.4%) of the *Price adjustment* equation indicates that by using information from the auction we come close to estimating a variant of the formula underwriters used to determine the price adjustment. For the most part, the adjustment is based on demand information from the auction that is available to the underwriter prior to setting the offer price and to public-offer investors via the second-revised prospectus.

Maximum adjustment is, by far, the most important factor explaining *Price adjustment*. The coefficient, which also is significantly different from 1.0 ($t = 18.4$), indicates that the adjustment is about 82.8% of the maximum adjustment.[16] If the WASB is an estimate of market value, as implied by the evidence in Table 5, then a coefficient less than 1.0 is evidence of partial adjustment. Although *Price adjustment* is highly correlated with the initial return, measured as *(Market price– Offer price)/Minimum bid* (rho = 0.57), there is no significant evidence that, after controlling for WASB and other factors, the underwriter also uses the expected market price to determine the price adjustment. To test whether other results in the model are due to nonlinearity of the relation between *Price adjustment* and *Maximum adjustment*, we estimated the model (not reported) with the square of *Maximum adjustment*: all other coefficients retained significance, the squared term was not statistically significant ($p = 0.23$) and had a non-intuitive positive sign, and the adjusted R^2 was not increased.

Also consistent with partial adjustment, and with the rationales underwriters provide for discounting offer prices, is the fact that price adjustments decrease with increases in subscription ratios. Although the coefficient indicates that the underwriter discounts more in response to a large amount of bidding, economic significance is low. The difference between the 5.79 average subscription ratio of the high-adjustment subsample and the 2.75 average of the low-adjustment subsample, though large, implies a reduction of only 1.1% in the price adjustment. Also consistent with partial adjustment, but of limited economic significance, when *Homogeneity* is greater (demand is more elastic), the offer price is closer to *WASB*. Homogeneity is 0.011 lower for the high-adjustment subsample, implying in a negative relative effect for the subsample of 0.6%. The evidence of partial adjustment is consistent with prospect theory and risk allocation.

[16]In an OLS regression of Price adjustment on only *Maximum adjustment*, the coefficient on *Maximum adjustment* is 0.821, the intercept is 0.145, and the Adjusted R^2 is .992. Aussenegg, Pichler, and Stomper (2006), in a study of German IPO pricing in the presence of a when-issued market, find a similar result: in a regression to explain the percentage revision of the offer price relative to the filing range, the coefficient on the price adjustment from the midpoint of the range to the ending when-issued price is 0.815 and is highly significant. The when-issued market is analogous in many respects to the auction tranche. They also find no informational role for book building in the presence of when-issued trading. Their finding, like ours, indicates that partial adjustment occurs even in the absence of information acquisition through book building.

The literature offers no predictions of how firm characteristics affect price adjustments. The negative coefficient on *Age of issuer* indicates that offer prices of established firms are set closer to minimum bids.

We find no significant evidence that issuers or selling shareholders anticipate price adjustments, which does not support the signaling hypothesis. To exclude the influence of the adjustment on offer size, we measure offer size as *Gross proceeds at minimum bid*. Though not significantly related to *Price adjustment*, the positive sign implies that issuers do not limit the issue size when they perceive that the minimum bid is low and could lead to a large price adjustment. Conversely, the coefficient on *Primary shares offered/Total shares* may imply that insiders refrain from selling when they perceive the minimum bid to be low. Though these results approach significance, further examination (presented below) does not support the signaling hypothesis.

The equation allows for *Underwriter fee* and *Underwriter market share* to be determinants of pricing. We find that *Price adjustment* does not depend significantly on *Underwriter market share*. The coefficient on *Underwriter fee* is negative and significant, suggesting that, for a larger fee, the underwriter will set a higher minimum bid.[17] If so, the issuer is trading off a higher fee for less underpricing. The result may be due to risk allocation. To explore this, we expressed fees as percentages of the minimum bid. The resulting mean fee for the low-adjustment subsample was 1.22 percentage points higher than for the high-adjustment subsample. Given the Table 5 result that 30.7% of low-adjustment IPOs have non-positive initial returns, compared to 9.9% for the high-adjustment subsample, the difference is in a range that might be demanded by the underwriter as an "insurance premium" against the minimum bid being too high under the risk allocation hypothesis.

To control for unexpected marketwide value changes, we use *Run-up (−40, −14)* and *Run-up (−13, −8)*. The first window captures the effects of using backward-looking formula pricing to establish the minimum bid. The second covers the period from the first-revised prospectus through the auction. Consistent with pricing based on long-run value, prospect theory, and/or risk allocation, the negative and non-significant coefficients on these variables imply that underwriters do not adjust offer prices based on changes in the JASDAQ Index before the offer. The negative signs are not surprising. If the underwriter believes auction bidders are too optimistic and that the optimism is associated with a marketwide run-up, then the coefficients should be negative.

Offer price discounting: Table 6 shows that, after controlling for the other factors, *Price discount* is not significantly related to the initial return. Instead, discounting is explained by variables that indicate high excess demand at the minimum bid (*Subscription ratio*, *Maximum adjustment*, and *Homogeneity*). The result is consistent with the rationales that commonly are provided in the second-revised prospectus, and with the implication from prospect theory that issuers are content to discount more when the offer price is well above the minimum bid. It also is consistent with risk allocation and with pricing based on long-run value.

[17]Given the small variation in fees, as reported in Table 1, and the informal fee-fixing agreement, it is surprising that *Underwriter fee* is significantly related to *Price adjustment* and *Price discount*. On inspection, it appears that, over the period of the study, there was some jockeying among underwriters with respect to market positioning. Daiwa, for example, tended to quote slightly lower fees than the others during the early part of the sample period, and higher fees later, whereas Nomura did the opposite.

Issuer and issue characteristics are not significantly related to discounting. Nor do high-market-share underwriters discount more, as might be expected if they were exercising market power. We do find that higher fees are related to lower offer prices relative to the maximum. Although the economic significance is low, the sign is consistent with risk allocation where, in exchange for a higher fee, the underwriter sets a higher minimum, ex ante, but does not adjust the offer price as much when auction demand turns out to be high.

We find no significant support for the idea that the offer price is discounted to offset unusually high price-to-value multiples relative to other firms. This is inconsistent with the view that prices are set on the basis of long-run value. The combined partial effect of the three price-to-value measures is that the high-adjustment subsample is discounted 0.19 percentage points less than the low-adjustment subsample is, the opposite of what would be expected if discounting were a response to concern about overvaluation relative to the longrun.

Finally, the offer price is discounted significantly more following a marketwide run-up before the public offer (*Run-up* (*−40, −8*)). Because *Price discount* is affected by information that is available from the auction, we estimate the relation over the combined (−40, −8) pre-issuance window from the approximate date of underwriter selection until completion of the auction. The partial effect of public information about the market is consistent with prospect theory and with the notion of leaning against the wind.

Underpricing: If the underwriter uses information from the auction to discount the offer price, then the information also can affect underpricing. To test whether, controlling for information from the auction, underpricing is predictably related to discounting, we include a measure of the discretionary discount. The estimated relation is negative, significant, and economically material. Discounting by one yen yields a 0.498 yen decrease in *Underpricing*. Consistent with pricing based on long-run value, the negative partial effect suggests that discounting is greater when the WASB would result in little underpricing.

Underpricing is significantly higher the higher is *Subscription ratio*. It also is significantly higher the higher is *Maximum adjustment*. When demand is elastic, as indicated by *Homogeneity*, issues are priced more fully. Collectively, these four variables (including the discretionary discount) account for 6.96% greater underpricing for the high-adjustment subsample, compared to a total difference between subsamples of 8.37%. The result is consistent with there being more underpricing when the underwriter is concerned that the bidding results reflect undue optimism about the first market price or about long-run value. It also is consistent with prospect theory and risk allocation.

Underpricing is negatively related to *Gross proceeds at minimum bid*, suggestive of a scale effect. Also, there is more underpricing for IPOs taken public by high-market-share underwriters. The evidence suggests that high-market-share underwriters can extract higher effective compensation through underpricing. Possibly, reputation signals quality, resulting in higher first market prices, which is partly offset by greater underpricing.[18]

Many authors document that initial returns in the US are positively related to market returns before the IPO. As with the US results, we find that *Underpricing* is positively related to *Run-up (−7, −1)*. The coefficient indicates that a 1% increase in the JASDAQ

[18]During the period of our study, four major underwriters (Daiwa, Nikko, Nomura, and Yamaichi) were responsible for 80.7% of the IPOs (56, 56, 105, and 42 IPOs, respectively) and ten non-major underwriters were responsible for the remaining 19.3% (62 IPOs).

Index yields approximately a 1% increase in *Underpricing*. Thus, underwriters appear not to revise offer prices in response to marketwide changes over the days before the IPO. In contrast, *Underpricing* is not related to run-up from around the time of the beauty contest until completion of the auction, *Run-up (−40, −8)*. The evidence, combined with the *Price discount* result, suggests that IPO investors perceive that market run-up already is reflected in the offer price. The combined results suggest that underwriters discount the offer price because they perceive over-optimism in the auction results.

5.3. Underpricing as a quality signal

The signaling hypothesis indicates that harder-to-value firms are more likely to undertake small IPOs, and follow them with SEOs once value is established in the market. The hypothesis presumes that high-quality issuers recognize they are undervalued by the market. Consequently, SEOs after IPOs should be more likely when firms deliberately underprice and when IPOs are small.

Because the model in Table 6 explains virtually all of the variation in price adjustments, our partial adjustment evidence is inconsistent with the hypothesis that auction-regime issuers underprice to signal quality. With the adjustment being determined almost fully by observable information, high levels of underpricing cannot function as quality signals.

To test the hypothesis more directly, Table 7 presents statistics for subsamples determined by whether the IPO issuer had a follow-on SEO within one year. Issuers with and without SEOs have similar proportions of *Shares offered to outstanding* and are about as likely to issue the regulatory minimum number of shares. SEO issuers have higher median *Gross proceeds at minimum bid*. These comparisons suggest that SEO issuers do not limit IPO size in anticipation of an SEO. *Primary shares offered/Total offered* is higher for the SEO subsample, but because of the more-than-offsetting difference in *Gross proceeds at minimum bid*, even at the minimum bid, secondary sellers would have generated more proceeds in their IPO sales than they would when issuers do not follow with SEOs. This evidence suggests that informed issuers are not holding back, waiting for an SEO. Because the signaling hypothesis implies that the IPOs of signaling firms should be small, we also computed the Table 7 statistics for the subsamples of SEO and non-SEO issuers that offered the minimum number of IPO shares required by JASDAQ, with similar results but somewhat lower significance levels.

Issuers that subsequently conduct SEOs have significantly higher maximum adjustments in their IPOs, indicating that, with regard to minimum bids, these issuers are relatively undervalued by the underwriter. However, contrary to the signaling hypothesis, price discounts and initial returns are similar between the groups. Finally, the SEO subsample has significantly more positive aftermarket performance. This information on aftermarket returns would have been available to most of the firms that issue within one year. Thus, rather than supporting the hypothesis that high-quality issuers underprice to signal quality, the results suggest that SEOs occur following unexpected increases in value after the offering. The results are similar to findings of Jegadeesh, Weinstein, and Welch (1993).

5.4. Determinants of long-run market-adjusted returns

If underpricing compensates for over-optimism, then greater discounting should predict more negative aftermarket performance. In Table 8, we report the results of OLS

Table 7
Descriptive statistics by seasoned offer

Mean [median] statistics for all 321 hybrid auction-method IPOs on JASDAQ from January 1, 1995 through October 7, 1997. Statistical tests are of differences in means [medians] between subsamples that do and do not offer a seasoned offer within one year of the IPO. Statistical tests are parametric differences in means and [nonparametric] Wilcoxon rank sum tests between subsamples. Two-tailed significance levels are shown at the .01 (***), .05 (**), and .10 (*) levels.

	Seasoned offer within one year	No seasoned offer within one year	*t*-value [*z*-value]
Number of issues	26	295	
Offering characteristics			
Shares offered to outstanding	18.32%	18.62%	0.37
	[17.27%]	[18.18%]	[0.82]
Offer proceeds (billion yen)	5040.9	2648.3	−1.67
	[2682.9]	[1756.8]	[−3.43***]
Gross proceeds at minimum bid (billion yen)	3372.2	1798.8	−1.23
	[1988.8]	[1278.5]	[−2.99***]
Primary shares offered/total offered	65.27%	59.12%	−1.63
	[59.37%]	[53.33%]	[−1.78*]
Percent of IPOs at minimum size	53.85%	56.95%	0.30
Auction data			
Maximum adjustment (WASB/Min. bid)	1.774	1.512	−1.80*
	[1.696]	[1.265]	[−2.44***]
Price discount (offer price/WASB)	0.921	0.930	1.18
	[0.920]	[0.936]	[1.34]
Returns			
Initial return (Market price/Offer price − 1)	10.18%	11.62%	0.47
	[7.92%]	[7.06%]	[0.87]
Three-month JASDAQ-adjusted returns	21.04%	−1.94%	−3.29***
	[17.27%]	[−4.76%]	[−4.01***]
Nine-month JASDAQ-adjusted returns	42.34%	−1.78%	−2.92***
	[25.33%]	[−7.48%]	[−4.14***]

regressions of three- and 12-month JASDAQ-adjusted returns on price discounts and other variables. As explanatory variables, we include a decomposition of the initial return into its non-discretionary and discretionary components. If underwriters set offer prices to counter over-optimism that results in the first aftermarket price being too high relative to long-run value, and if the discount fully offsets over-optimism, then *Discretionary initial return*, in particular, should have a coefficient around minus one. The models also include variables related to possible underwriter market power and other variables that could be related to over-optimism. Because the results, while weak, are stronger for the three-month window, we focus the discussion there.

Inconsistent with the leaning-against-the-wind hypothesis, the coefficient on *Discretionary discount* is not statistically significant and is too small, relative to the minus-one coefficient needed to offset the positive initial return. Extending the window to 12 months (or to two or three years) does not alter this conclusion.

Table 8
Long-run market-adjusted returns

Ordinary least squares regressions of three-month and 12-month JASDAQ-adjusted aftermarket returns without the initial return. Models are for all 321 hybrid auction-method IPOs on JASDAQ from January 1, 1995 through October 7, 1997. *Non-discretionary initial return* is *(Market price-WASB)/Offer price* and *Discretionary initial return* is *(WASB-Offer price)/Offer price*. Absolute *t*-values of OLS regressions are based on clustered, robust estimators, where the data are assumed to be clustered by calendar quarter. Two-tailed significance levels of absolute *t*-values are shown at the .05 (**) and .10 (*) levels.

	Three-month adjusted aftermarket return	Twelve-month adjusted aftermarket return
Intercept	0.395	0.399
	(1.26)	(0.63)
Non-discretionary initial return	−0.212	−0.124
	(1.46)	(0.52)
Discretionary initial return	−0.220	0.246
	(0.84)	(0.47)
Underwriter market share (decimal)	0.258	0.381
	(1.81)	(2.79)**
Underwriter fees (%)	−0.134	−0.137
	(1.54)	(0.77)
Offer price/1000 yen of sales per share	−23.32	−20.664
	(1.96)*	(1.09)
Offer price/1000 yen of operating profit per share	−6.891	−1.710
	(1.68)	(0.17)
Offer price/1000 yen of net income per share	3.948	0.134
	(2.46)**	(0.03)
Run-up (−7, −1) (cumulative decimal return)	−0.115	−0.250
	(0.17)	(0.33)
Run-up (−40, −8) (cumulative decimal return)	−0.192	−0.166
	(1.47)	(0.41)
Adjusted R^2	0.029	0.025

The coefficient on *Market share* is positive in both models, suggesting that issues underwritten by high-market-share underwriters are relatively underpriced and that investors do not anticipate the aftermarket price gains relative to JASDAQ. A 20% increase in market share implies about a 5% increase in the market-adjusted return over three months and 7% over 12 months. The result is consistent with certification by high-market-share underwriters that is not fully recognized by investors, and with the exercise of market power by high-market-share underwriters.

Two of the three price-to-value ratios are marginally significant over the three-month window, but the signs are mixed due to collinearity. To assess whether underwriters underprice more to offset over-optimism reflected in high price-to-value ratios, we compared the marginal effects for the high- and low-adjustment subsamples. Results are inconsistent with the hypothesis, as the partial effect for the high-adjustment subsample is about 0.5% more positive than that of the low-adjustment subsample.

Finally, aftermarket returns are not significantly related to the JASDAQ run-up before the IPO. The lack of significance implies that the run-up does not predict aftermarket performance.

6. Summary and conclusion

From April 1989 until September 1997, firms going public in Japan were required to use a hybrid auction process in which a substantial portion of the issue was offered via a discriminatory auction. Remaining shares were sold a few days later by firm commitment at a fixed price. We examine the auction-regime data in the light of a broad range of competing but non-mutually-exclusive hypotheses. We find that the price of the public offer tranche is intentionally adjusted only partially in response to information from the auction tranche. We conclude that the evidence of partial adjustment is most consistent with prospect theory and risk allocation explanations of partial adjustment in a market where underwriters are repeat participants and pricing terms are influenced by regulation and informal agreements.

Evidence from Japan's auction-method offerings raises important questions about interpretations of IPO underpricing in the US. In a regime where information differences among investors are not important, roadshows are not held, preferential allocations to any investor are negligible, and institutional investing is low, we find the following: (1) Inconsistent with the view that partial adjustment rewards investors for disclosing or investing in information, the public offer tranche exhibits partial adjustment and underpricing that are similar to those of book-built IPOs in the US. (2) Inconsistent with the signaling hypothesis, IPO issuers that undertake SEOs within one year do so in response to high aftermarket returns that were not anticipated. (3) Also inconsistent with signaling, existing shareholders do not appear to anticipate those issues that are more likely to be discounted relative to value in the auction. (4) There is no significant support for the hypothesis that underwriters effectively lean against the wind with respect to marketwide over-optimism or issuer-specific overvaluation. (5) From among the various hypotheses, we are left with the possibilities that underpricing and partial adjustment reflect prospect theory and/or an implicit contract to share the risk of over- or underpricing.

The risk allocation hypothesis holds that underpricing and partial adjustment reflect a long-term implicit contract between issuers and the underwriter to allocate IPO pricing gains and losses as part of an effort to maximize expected net proceeds. Because underwriters are repeat participants in the IPO market, they can contribute to IPO market efficiency by substituting underpricing for higher direct issue costs, sharing gains from underpriced issues with investors who are willing to share losses from overpriced issues, and distributing shares of underpriced issues to prospective customers. Under the risk allocation hypothesis, partial adjustment is an arrangement for sharing gains and losses, where the underwriter realizes the gains through its relationships with investors or its ability to attract future business. This view is supported by the fact that no issuer received net proceeds below the minimum bid net of fees, and that 11.8% of the IPOs were offered at the minimum, and 37.9% of these had negative initial returns.

Our evidence does not support some hypotheses of how mispricing risk is allocated. In particular, it does not support the view that issuers seek certain proceeds with underwriters bearing the entire risk of mispricing. Nor, because the public offer tranche cannot fail if the auction tranche succeeds, does it support the hypothesis of Edelen and Kadlec (2005) that issuers trade off the expected benefit of holding out for a better price against the opportunity cost of deal failure. Rather, the evidence fits models where issuers regard over- and underpricing asymmetrically. It is not difficult to develop efficiency-based arguments

as to why, for example, an issuer's declining marginal ability to employ offer proceeds could give rise to an asymmetric gain-and-loss function.

Both risk allocation and prospect theory are state-contingent explanations for partial adjustment in that underpricing is greater when the offer price is unexpectedly high. Either theory can be consistent with any level of average underpricing. Under risk allocation, average underpricing arises because the issuer bears no downside loss when the minimum bid is too high, but shares in the upside gain when the minimum bid is too low. Under prospect theory, the underwriter prefers indirect compensation resulting from underpricing to explicit fee-based compensation. In the face of positive surprises leading to unexpectedly high offer prices, issuers do not negotiate as aggressively for the ex post gains relative to their efforts to avoid ex post losses associated with negative surprises. Although risk allocation and prospect theory have different underlying drivers and make different assumptions about the rationality of issuers, they yield similar empirical predictions. In the case of Japan, consistent with risk association, the sometimes-binding effects of restrictions on reducing the offer price below the minimum bid can be observed directly, whereas something less formal would have to explain the allocation of risk of US IPOs. However, risk allocation in Japan's auction regime is not easily reconciled with the occurrence of IPOs that have very high non-discretionary initial returns that are augmented by large discretionary initial returns. As some issues in our sample are seriously underpriced, our evidence also is consistent with the prospect theory argument that underpricing sometimes goes beyond what would be expected solely based on risk allocation.

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