

Why Does Book Building Drive Out Auction Methods of IPO Issuance? Evidence from Japan

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We examine Japan's 1997 introduction of book building as an alternative to a previously required hybrid auction method. Despite higher cost for some issuers, all issuers in Japan now select book building. Book building enables more accurate valuation of firms, but gains from accurate valuation are partly redistributive. Thus book building can drive auction-method offerings from the market even if it yields no aggregate benefit. Compared to the auction regime, book building reduces issue costs for large issuers. Auctioning is less costly for small issuers, but appears to foreclose some small firms from issuing. The aggregate costs of book building and auctioning are similar.

In the United States, Japan, and other countries, initial public offerings (*IPOs*) are marketed and priced by a negotiation method that includes book building. In regimes where firms can select between book building and auctioning, issuers overwhelmingly select book building. Sherman (2002), for example, in a study of 44 countries, finds no instance of issuers regularly using an auction method unless regulation prevents or restricts using book building.¹

Assuming, for the purpose of our analysis, that firms seek to maximize net issue proceeds from an IPO, they may select book building in preference to auctioning for a combination of two reasons. First, the total issue cost of book building (including fees and underpricing) may be less

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¹ Sherman (2001) provides a comprehensive multicountry survey of IPO offering regulations.

than the total issue cost of auctioning. Second, even if issue cost is higher, book building also may result in higher aftermarket value.

If book building is a more efficient way to provide information to IPO investors, it may result in less underpricing than auctioning. As book building centralizes information production and provides more information than can Japan's auctioning procedure, investors may incur lower information costs and accept lower initial returns. Book building may also result in more accurate aftermarket pricing. Accurate pricing can have two effects. First, it can reduce information costs in the months after the offering, which savings would yield higher aftermarket value. Second, more accurate pricing could cause some nonissuers that would have been undervalued in an auction regime to go forward with issues in a regime where book building is permitted.

Understanding why issuers select book building when an auction method is available is important. If, for each firm, the total issue cost of book building is lower and book building is more informative, then book building dominates the auction method as a low-cost way of informing investors. If book building is more expensive, even for some issuers, then the advantage of book building is less clear. Issuers select book building on the basis of their private benefits. However, as we discuss below, some of the benefits are redistributive across issuers. In a regime where both methods are available, every issuer may select book building even though collectively they would prefer an auction regime.

Opportunities to study the effects of book building's introduction on issue cost and the decision to go public are rare. We examine, as a market experiment, Japan's 1997 introduction of book building as an alternative to a discriminatory auction method that had been required since 1989. Japan's auction method was a hybrid method, where approximately half of the total offer (the "auction tranche") was sold by discriminatory auction. The remaining shares (the "public offer tranche") were sold in a public offer at a price below the weighted average successful bid from the auction. Within one month after its introduction, all issuers in Japan were selecting book building, though auctioning still is available as a choice. We find that the shift occurred despite book building's higher total issue cost for most issuers and higher fees for all issuers. Thus the savings of issue cost cannot explain the shift of all issuers to book building. Instead, it is necessary to consider the effect of book building's availability on net issue proceeds.

For IPOs, direct comparison of net proceeds by book building and auctioning is not feasible. Instead, we study total issue cost, underpricing, and issuer characteristics to draw inferences about differences in expected net proceeds between regimes where book building is permitted and regimes where it is not. If, as we find, availability of book building causes some firms to incur higher issue cost, but auctioning causes some firms not

to issue, then these effects must be weighed against each other and against book building's advantages.

With respect to total issue cost, we find evidence of a scale effect. For large issues (by large, well-established firms) by our estimates, book building is less costly than auctioning. For small issues (by small and young firms), auctioning is less costly. However, it is not possible to measure the costs of nonissuance in the auction regime. This factor is economically important, as our evidence indicates that a material fraction of small firms opted not to issue in the auction regime. Such firms may have foregone attractive investments, as a result. We exploit the finding that large issues can be achieved at lower cost by book building to examine the extreme case of whether, even if auctioning did not cause nonissuance by any firm, *aggregate* total issue cost in our sample of Japanese IPOs would be lower by book building.

If nonissuance causes a firm to forego attractive investments or to raise capital by a more expensive means, an important concern for any country is whether an observable cost advantage of auctioning is sufficient to overcome unobservable losses compared to when book building is available. Considering our sample of issues from 1995 through 1999, based solely on observable issue costs, a majority of firms would have had lower costs if book building were not available; the simple average cost advantage of auctioning is 5.58% of aftermarket value. However, although book building is more costly for small issues, it is less costly for large issues. Consequently, weighting by issue size, the aggregate costs of book building and auctioning in our sample are approximately equal. The cost comparisons represent a lower bound on the net benefit of book building, as they do not reflect auction-method opportunity losses associated with nonissuance or benefits of more accurate IPO valuation by book building. The net advantage of book building to a country is sensitive to the characteristics of prospective issuing firms in the market. In Japan, book building appears to have no *aggregate* cost disadvantage relative to Japan's hybrid auction method, and has the additional benefits associated with more accurate pricing.

In addition to its economic significance for Japan, the world's second largest equity capital market, the evidence is relevant to the United States, where experimentation is occurring in the opposite direction (toward auction), and to countries that are considering which offering methods to permit.² Further, the study is relevant to the choice between negotiated and competitive bid offerings and to understanding the general absence of best efforts offerings in the United States. In competitive bid offerings

² W R Hambrecht & Co. introduced its "OpenIPO" electronic underwriting service in 1999. Bids are treated as indications of interest, and shares are sold at a single price. Investors base their bids on a prospectus that includes a filing-range estimate of closing value. To date, only a handful of firms have gone public using the OpenIPO process. See www.hambrecht.com.

(used most commonly for public debt issues), the underwriter's role in pricing is limited in much the same way that it is in auctions.³ In best efforts offerings, as in auction offerings, the underwriter is distanced from making a credible representation about value. Instead, the issuer sets the price and investors determine the quantities they will buy.

In Section 1 we relate the choice between auction and book-building regimes to the trade-off between underinvestment in projects and overinvestment in information. In Section 2 we discuss our assumption that underpricing is a cost of information production. Section 3 contains descriptions of the salient features of Japan's hybrid auction and book-building methods. We describe the data in Section 4 and present the empirical analysis in Section 5. Section 6 contains discussion of our findings and some policy considerations.

1. Information Production and Offering Method

Firms may have private information about the value of their existing assets and investment opportunities. If managers act in the interest of passive investors, Myers and Majluf (1984) demonstrate that adverse selection can result. High-quality firms may refrain from issuing. Investors therefore infer from a firm's announced intent to issue that the firm is low quality and revise their valuations accordingly. If high-quality nonissuing firms forego attractive investments, Myers and Majluf describe the aggregate result as underinvestment.⁴

Discriminatory auction methods of IPO pricing, where each successful bidder pays their own bid price, conform closely to the Myers and Majluf assumptions. While specifics vary, a common feature is that discriminatory auctions have no obvious low-cost mechanism that enables issuers to convey private knowledge to the market. Further, even if some investors have private information about issuers, discriminatory auctions generally cannot reward them adequately for revealing what they know. Rather, to benefit from the auction, participants must bid prices that are below their reservation values.⁵

³ Prospective underwriters compete by bidding net interest cost. In a study of the choice of method, Smith (1987) finds that for risky debt issues, and during volatile interest rate periods, negotiated offering results in lower net interest cost. Competitive bidding also sometimes is used for "bought deals" of seasoned equity, where the underwriter purchases the equity and assumes the risk of changes in market value until the shares can be resold.

⁴ Underinvestment is only one potential consequence of underproduction of information. Others can include resource allocation errors based on inaccurate aftermarket valuation, inefficient efforts to produce information in the aftermarket, reduced liquidity, and uncertain issue proceeds.

⁵ Sherman (2002) summarizes the literature on auction methods and observes that underpricing is a natural result of either discriminatory or single-price auctions. Sherman also notes that, in comparisons that appear in the literature, auctions generally result in less underpricing.

Some auction methods limit the ability of investors to use existing informational advantages or to invest in information that could create an advantage. Japan's auction method, for example, does not permit bidding by insiders and severely limits the number of shares any party can bid to acquire. The apparent objective of the restrictions is to create an environment where bidders can presume they are symmetrically uninformed.⁶

By centralizing production of information about an issuer, book building addresses underinvestment. Although information published in an auction prospectus can be identical to that in a book-building prospectus, for our purpose, an essential distinction between methods is the centrality, in book building but not in a pure auctioning, of the underwriter's role in establishing the price at which the shares are sold.⁷ It is not fundamental to our analysis whether this pricing is based on due diligence or efforts to induce investors to generate information or reveal what they already know. The critical difference is that with book building the underwriter makes a credible representation of value, whereas with a pure auction no such representation is made.

However, book building increases the potential for issuers and underwriters to produce information for *redistributive* gain at the expense of other issuers. Hirshleifer (1971) demonstrates that communities of individuals with identical preferences do not, as a whole, benefit from producing information that contributes only to exchange. He concludes that pursuit of private benefits can lead to overproduction, even when information also has productive value. In an examination of financial markets, Fama and Laffer (1971) conclude that either competitive or monopolistic production of information for trading can result in overproduction. They observe that regulations that prevent firms from producing information for trading can be value enhancing. However, they note that this also may induce outsiders to produce information that the firm could have produced more cheaply, a concern that Japan's auction rules address.⁸

In our empirical analysis of total issue cost and selection of book building, we assume that the underwriter's effort level devoted to pricing in a book-built IPO is a choice variable. In effect, the issuer chooses from a schedule of fees and corresponding effort levels. Depending on issue

⁶ Biais and Faugeron-Crouzet (2002) show that discounting the auction price relative to the bids can induce investors to reveal private information in a manner similar to what preferential allocations of underpriced shares can do under book building. In Japan's discriminatory auction method, however, auction shares are sold to each winning bidder at the bidder's bid and informed investors are systematically excluded from bidding.

⁷ Under Japan's auction method, the underwriter also guarantees sale of remaining shares in a public offer tranche that is priced at a discount from the weighted average auction price.

⁸ In a recent study, Barzel, Habib, and Johnsen (2001) examine syndication and show that underpricing, rather than being a payment for producing or revealing information, can be a rent for agreeing to remain uninformed.

characteristics, firm characteristics, and the underwriter's reputation and validation technology, the schedule maps into prices the underwriter is willing to certify. Underpricing arises for two interrelated reasons. First, to protect against litigation or reputational damage, the underwriter's cost of mispricing is skewed in favor of underpricing. Second, the underwriter trades off information discovery effort against residual underpricing. If there are scale economies to the underwriter's functions related to pricing, small firms with small issues will select greater expected underpricing. We assume that the market understands the underwriter's incentive to underprice and how effort levels and targeted underpricing depend on observable characteristics of the issue, firm, and underwriter.⁹

Because the underwriter can vary effort level and offer price continuously, the savings of issue costs that auctioning may offer also may be achievable by a book-built IPO, particularly if little or no effort is devoted to certifying a price above the expected auction price.¹⁰ In this case, other advantages of book building may be sufficient to produce the commonly observed result that, when both methods are available, all issuers select book building.¹¹

Because some of the gains from permitting book building may be relative (issuers that would be undervalued by auction gain at the expense of those that would be overvalued), and because prohibiting book building may result in underinvestment, one cannot rely on "the market test" to conclude that a regime where book building is permitted is preferred to a regime where it is not. Instead, the central question is how issuers in a regime where book building is permitted would have fared in a regime where it was not, and how issuers in a regime where only auctioning is permitted would have fared if book building had been permitted.

⁹ Models of IPO signaling rely on issuer choices of offering methods or terms as signals. In Leland and Pyle (1977), ownership retention signals expected cash flows and risk. Thakor (1982) provides a model of debt insurance that parallels our reasoning. In that model, an issuer's credit quality is revealed by the payment to a third-party insurer.

¹⁰ Heinkel and Schwartz (1986) were the first to model the offering method choice as a signal. In their model, issuers select among three methods based on the effort they want underwriters to commit to producing information and how optimistic they are about value. Maksimovic and Pichler (1999) consider the choice between IPO and private placement. They argue that public issues may be underpriced if producing information is costly and conclude that small issuers may be better off by selling without generating much presale information. Our consideration of policy distinguishes this study from most studies of offering method choice. A noteworthy exception is Sherman (1999), who develops a model of shelf registration as a mechanism that limits due diligence. Sherman's model can account for several stylized facts related to seasoned equity offers, including that the market reacts more negatively to shelf offer announcements and that riskier firms tend to avoid shelf registration. Smith (1987) makes a similar argument and presents consistent evidence for debt issuers' choices to use competitive bid versus negotiation.

¹¹ The underlying adverse selection reasoning may appear to imply that some firms would continue to issue by auction. This is not necessarily true for two additional reasons that are present in our analysis. First, the firms that would issue by auction may, instead, elect not to issue. As such firms were simply free riding in the auction regime, we do not investigate this nonissuance as a cost of book building. Second, book building is not always more costly.

2. Underpricing as a Component of Total Issue Cost

In making inferences about possible overproduction of information, we use underpricing as an estimate of a portion of dissipative issue costs, along with underwriter fees. This assumption is reasonable for both book-built and auctioned IPOs as long as prospective investors are symmetrically informed, or if the number of investors with superior knowledge is not material to decisions of how much to invest in information. The assumption is most plausible for auctioned IPOs, especially when auction rules exclude informed investors.

The nature of underpricing of book-built IPOs is less clear. If underpricing is a rent to informed investors for revealing what they know, then total issue cost is partly a wealth transfer. Rock (1986), Benveniste and Spindt (1989), and Benveniste and Wilhelm (1990) are among the studies that model underpricing in this way.¹² Alternatively, if underpricing is compensation for producing information, then including underpricing as part of issue cost is correct. Sherman (2002) models underpricing as compensation to investors for producing information about aftermarket value.¹³ Finally, underpricing can substitute for due diligence and certification costs that underwriters otherwise would incur. Booth and Smith (1986), for example, develop a model whereby an issuer can increase expected net proceeds by engaging an underwriter who has invested in reputation. The underwriter's fee includes a quasi-rent that compensates for the prior investment in reputation.¹⁴ In certification models, underpricing may be either a wealth transfer or compensation, depending on, among other things, to whom the underpriced shares are allocated and what provisions exist for the underwriter to recapture the underpricing gains.¹⁵

Because the measured costs of book-built IPOs may overstate dissipative costs, our treatment of the costs as dissipative is another factor that biases our results in favor of auctions. We address this through interpretation of the results.

¹² For related empirical evidence, see Cornelli and Goldreich (2001). See also, Sherman (2000).

¹³ In contrast to Sherman, we assume firms have private knowledge about their quality and that each desires to maximize expected net proceeds. Concern about pricing accuracy is beyond the scope of our empirical analysis, but contributes to the advantage of book building.

¹⁴ Tinic (1988) offers a similar model where litigation risk is the certification mechanism. Hughes and Thakor (1992) formalize the model. Chemmanur and Fulghieri (1994) develop a dynamic model where reputation is associated with less underpricing but larger fees.

¹⁵ The Benveniste and Spindt model, for example, is necessarily a certification model where the underwriter's fee compensates for certification and underpricing is a rent to informed investors. See Benveniste, Busaba, and Wilhelm (1996) for discussion of the underwriter's certification role in the context of Benveniste and Spindt.

3. Japan's IPO Pricing Experiments

Empirical studies of underpricing and issue cost are of three types. The first includes studies of cross-sectional patterns within a regime where institutional features of the market are constant. The second includes international comparison studies where institutional features are different across countries. The third is focused on market experiments where, within a country, the regime has changed. Market responses to regime changes can yield different information than the other two approaches, and inferences of causality can be more compelling. We take our evidence from Japan's 1997 introduction of book building, a well-documented experiment in a capital market with a high level of IPO activity.

3.1 The fixed (formula) pricing regime

Before April 1989, IPO issuers in Japan were required to employ a fixed-price offering method. The underwriter determined the offer price by a mathematical formula specified by the Japan Association of Securities Dealers (*JASD*) and the stock exchanges. The formula was applied to the prices and financial data of a small selection of public companies that the underwriter identified as comparable. The offer price was computed as the equal-weighted average of the relative earnings, dividends, and net assets of the public companies, multiplied by average share price.¹⁶ The formula did not prevent systematic underpricing. Pettway and Kaneko (1996) document average initial returns of 62.1% during the period for a sample of 110 IPOs on the Tokyo Stock Exchange. During this period the underwriter controlled allocations of oversubscribed IPOs. For conducting the offering, the underwriter received a commission of approximately 3.5%.¹⁷

3.2 The auction regime

In 1989, following a political scandal related to underpricing, Japan abandoned fixed pricing and implemented a formal tender process to determine the offer price.¹⁸ Under the new hybrid auction procedure, the issuer designated a substantial portion of the issue (the auction

¹⁶ The required formula is documented in the report of Shoken Torihiki Shingikai (Securities and Exchange Council) (1989). The council is advisory to the Japan Ministry of Finance. The council proposes and recommends institutional changes for Japanese stock markets. The 1989 report addresses the shift to auction method.

¹⁷ Fees were fixed informally among underwriters at 3.5% plus two yen, paid from gross proceeds. According to Nomura Securities, fees were reduced by agreement to 3.1% plus two yen after January 1990. The percentage was not a requirement, but a common practice. After November 1994, the practice broke down and slightly higher fees of 3.3% to 3.5% sometimes were charged. Until the 1997 change, regular meetings were held among top executives of the big four underwriters. The meetings, called *Yonsha Kai* (*Yonsha* means four companies, and *Kai* means meeting) addressed matters of importance to the industry. *Yonsha Kai* is now abolished.

¹⁸ Jenkinson and Ljungqvist (1996) report that Japan's prime minister was forced to resign in April 1989, following revelation that Recruit Company had attempted to buy political influence by selling off its Cosmos subsidiary in an IPO and directing allocations of greatly underpriced shares to public officials.

tranche) to be offered directly via discriminatory auction. During our study period, 50% of the shares were required to be offered by auction. The auction failed if less than 25% of total shares were ordered.¹⁹ A preliminary prospectus was available before the auction, but contained no information on pricing. Shares allocated to the auction tranche were offered using a “first-revised” prospectus. This prospectus specified a minimum price below which bids would not be considered. The minimum was based on a formula, similar to the earlier approach.²⁰ During our study period the minimum permissible bid was 85% of formula value. At the close of the auction, shares were allocated to highest bidders first, until the entire allocation was distributed or the minimum was reached.

Japanese regulations precluded insider participation in the auction. Also, by significantly limiting the maximum number of shares any participant could bid to acquire, the regulations discouraged institutional participation. Generally a participant could bid to acquire no more than 5,000 shares (five round lots). At the average offer price in our sample, the maximum corresponds to about 10 million yen, or about \$100,000. Under these restrictions, incentives of investors to produce information about value appear to have been very limited. Institutional investors generally did not participate in the IPO market during the auction regime.²¹

A few days after the auction a formal underwritten offering of the remaining shares (the public offer tranche) would take place, using a “second-revised” prospectus and an public offer price set by the underwriter. The maximum price the underwriter could set was the weighted average price of the successful bids. The minimum could not be less than the minimum permissible bid. Kerins, Kutsuna, and Smith (2003) provide an empirical model of the price adjustment of the public offer tranche of Japan’s auction method IPOs compared to the minimum bid and are able to explain virtually the entire adjustment using published demand-related information from the auction.

As a practical matter, the public offer price is constrained by the need to induce investors to bid in the auction.²² The prospect of acquiring more shares or shares at below the public offer price encouraged bidding. Excessive free riding on price discovery was prevented (and institutional

¹⁹ See the report of Shoken Torihiki Shingikai (Securities and Exchange Council) (1995).

²⁰ Under the auction method, the preliminary prospectus was available about 10 days before the minimum permissible bid price was determined. The first revised prospectus became available on the day after the minimum was determined. Three or four days later, a one-day auction occurred.

²¹ Based on a study of 110 JASDAQ IPOs in 1996, Tamura (1997) reports that institutions purchased 11.7% of auction tranche shares and 13.7% of public offer tranche shares. Individuals purchased the remaining shares. For 17 book-built IPOs by Nomura during the first quarter of 2002, an average of 15.4% of the shares were sold to institutions in Japan.

²² See the report of Shoken Torihiki Shingikai (1995). In addition, before 2002, underwriters in Japan could not use overallocation options or oversell as ways of ensuring the success of an offering or to offset pricing errors.

participation was effectively discouraged) by limiting acquisition of public offer tranche shares. An investor could acquire no more than 5,000 shares in the public offering (a total of 10,000 by both approaches) and could participate in no more than four public offerings per year. By excluding insiders and significantly limiting the number of shares each purchaser could bid to acquire, Japan's auction mechanism limited incentives to devote resources to valuation and prevented insiders and other informed investors from directly affecting offer prices.

Under Japan's auction method, the underwriter's role in IPO pricing necessarily is limited. Prospective investors bid on the basis of information in the prospectus. While the underwriter can engage in due diligence to verify statements in the prospectus, the prospectus is an incomplete snapshot of the issuer's position and track record. Without damaging their prospects, issuers cannot fully disclose intellectual property, strategic plans, or other proprietary information that could benefit rivals. In addition, as Pettway and Kaneko establish for the fixed-price regime, the formula-based minimum permissible bid in the prospectus is not very informative about the underwriter's assessment of value. Furthermore, the informal agreement among underwriters, during the auction regime, to restrict fees to a low percentage constrained the information production efforts underwriters might otherwise have elected to make.²³

Until late 1997, this auction procedure was the sole method permitted for determining the IPO offer price. From the start of 1995 until introduction of book building, 321 JASDAQ firms used the auction method to go public. In Table 1 we summarize information related to the auction process for these IPOs. Overwhelmingly issuers set the size of the auction tranche at the 50% regulatory minimum. While our database does not include failed offerings, the sample evidence suggests that failure was rare or nonexistent. The auction tranches of all but three issues in our sample were fully subscribed or oversubscribed by auction bids. The lowest of the three that were not fully subscribed was still 80% subscribed, well above the minimum necessary to prevent failure of the auction.

As documented in the table, the minimum price provided little guidance to investors. In 87.5% of the cases the minimum is below the minimum successful bid. Minimum successful bids average 46.4% higher than the minimum price and are as much as 516.2% higher. The median is 21.7% higher. Compared to average successful bids, the differences are even larger.

In the table we also document the practice of discounting the price of the public offer tranche relative to the weighted average successful bid. As an indication of the underwriter's disengagement from pricing, 40.1% of the public offers are priced at exactly the minimum successful bid. In some

²³ See footnote 17.

Table 1
Descriptive statistics on tranche size, underpricing, and discounting for 321 hybrid auction method JASDAQ IPOs (January 1995–September 1997)

	Mean	Std. Dev.	Median	Minimum	Maximum	Other Comments
Size of auction tranche						
Auction tranche to total issue	50.6%	1.7%	50.0%	50.0%	60.0%	81.3% (261 obs.) have a 50% auction tranche
Shares bid for to shares offered by auction	4.46	2.61	3.90	0.80	20.80	0.9% (3 obs.) have ratios less than 1.0
Minimum price discounting						
Min. successful bid to min. price	146.4%	64.6%	121.1%	100.0%	616.2%	12.5% (40 obs.) have min. bid equal to min. price
Wtd. avg. successful bid to min. price	153.3%	68.3%	121.7%	100.0%	644.3%	0.3% (1 obs.) have wtd. avg. bid equal to min. price
Public offer price discounting						
Min. successful bid to wtd. avg. successful bid	95.7%	2.3%	96.1%	86.7%	100.0%	0.3% (1 obs.) have min. successful bid equal to wtd. avg. successful bid
Public offer price to wtd. average successful bid	92.9%	4.4%	93.4%	81.9%	100.0%	0.3% (1 obs.) have offer price equal to wtd. avg. successful bid
Public offer price to min. successful bid	97.1%	4.3%	99.3%	85.3%	107.8%	40.1% (129 obs.) have offer price equal to min. successful bid
						8.4% (27 obs) have offer price above min. successful bid

Japan required use of a hybrid auction method during this period. At least 50% of the total issue (the “auction tranche”) was required to be offered by discriminatory auction. The minimum acceptable bid (the “minimum price”) was computed by application of a formula and was stated in the prospectus for the auction. Remaining shares (the “public offer tranche”) were sold in a firm commitment offering, usually at a discounted price (the “public offer price”) from the weighted average successful bid price.

cases where the public offer price does not equal the minimum successful bid, the public offer price appears simply to reflect rounding.

3.3 The book-building regime

When Japan introduced book building in September 1997, it did not formally abandon its hybrid auction method, and still has not done so. Instead, it authorized book building as an alternative.²⁴ Under book building, the underwriter seeks indications of interest, primarily from institutional investors. The underwriter determines the offer price in light of due diligence and evidence of demand derived through premarketing.²⁵ Under Japan's book-building method the offer price need not be linked to the values of comparable firms.

In contrast to the earlier change to auctioning, the 1997 regime change was not driven by scandal or other crisis. Various rationales were offered for the change. Among them: underwriters needed more pricing discretion; the auction method's discriminatory pricing structure discouraged bidding, making it difficult to assess demand and limiting offer size; and, due to low institutional involvement, pricing was more heavily affected by market conditions than by fundamental value.²⁶ As an overlying consideration, introduction of book building was one aspect of Japan's "big bang" financial institution reforms. Japan was seeking ways to promote access to capital markets for earlier-stage and riskier companies.²⁷

3.4 Empirical implications

Because offer prices are constrained by auction results where investors have limited information compared to issuers, Japan's auction method can give rise to the Myers and Majluf underinvestment problem, a separating equilibrium where high-quality firms neither issue nor invest. However, pooling with all firms issuing is also possible and is more likely in market segments where bidder valuation errors from restricting information production are likely to be small.²⁸ Empirically this suggests that

²⁴ Beginning on September 1, firms could elect book building. Because of the time required to complete an offering, the first book-built IPO occurred on September 29. Based on Japanese regulation of offering procedures and discussion with practitioners, the auction method is still available, but issuers do not select auction.

²⁵ In Japan, the underwriter sets a minimum and maximum price. Institutional investors submit nonbinding price and quantity indications. The underwriter, in selecting the final offer price, can accept the quantity indications above the price and sells any remaining shares to the public.

²⁶ These concerns are documented in the report of Shoken Torihiki Shingikai (1995) and by Nomura Securities.

²⁷ In July 1995, a second over-the-counter (OTC) market was established to encourage early stage and high-technology companies to seek equity. Book building was introduced experimentally in this market. In September 1997, it was extended to all IPOs. Despite the initiative, only three young high-technology companies registered on the second market between mid-1995 and 1998. The second market now has been absorbed into JASDAQ. See the report of Shoken Torihiki Shingikai (1995) and Kutsuna, Cowling, and Westhead (2000).

²⁸ Giammarino and Lewis (1988) and Cadsby, Frank, and Maksimovic (1990) identify three possible equilibria: pooling, sorting, and semipooling. They examine the conditions under which each attains.

pooling is more likely among large and well-established firms and separating is more likely among small firms and firms with limited track records.

To base the comparison of book building and auction strictly on differences in observed issue cost, it must be possible to assume that all firms that would issue by book building also would issue by auction and that aftermarket value would be the same by either method. If so, then differences in issue cost would map directly into differences in net proceeds. However, as pooling is less likely among small and risky firms, the assumption is not valid. Consequently our comparisons are biased in favor of the auction method, particularly for such firms.

If, as our evidence suggests, under Japan's auction method, some high-quality small and risky firms refrain from issuing, then aftermarket prices of small and risky issuers by auction will reflect their expected low quality. If pooling is more likely among large and well-established firms, then aftermarket prices will reflect their expected average quality. Thus, for small and risky firms, our analysis of issue cost underestimates the impact of the auction method on net proceeds. Had pooling occurred, aftermarket prices of low-quality firms (those that did issue) would have been higher, resulting in higher average net proceeds. For the firms that did issue, the unobservable difference in aftermarket value is part of the true total issue cost of the auction method. In addition, we cannot measure the value of lost opportunities due to underinvestment.

With book building, the underwriter is at the heart of offer pricing. The underwriter can use the filing range to reflect the value implications of private information derived from due diligence and through its long-term relationship with the issuer. High-quality firms select book building if the increase in aftermarket price due to being recognized as high quality is greater than the per share cost of any additional expenditure on underwriter effort. In addition, compared to Japan's discriminatory auction, the underwriter in a book-built offering may use underpricing and allocations to extract and aggregate information from informed investors.

In the analysis of the cost of book-built IPOs, assuming that all firms issue, observed aftermarket prices should reflect average firm quality. Thus, in contrast to the auction regime, we are able to measure the full cost of book building. Consequently estimates of cost difference between book building and auctioning are upper-bound estimates of the advantage of auctioning. Because auction method costs are underestimated and some book-building costs may not be dissipative, if book building is estimated to be less costly, then book building is preferred. However, if auction is estimated to be less costly, then the balance between the two depends on the underinvestment opportunity loss, any real benefits of more accurate valuation, and benefits associated with the possibility that book building affords greater certainty of proceeds.

4. Data

To study the regime change, we use a sample of 484 IPOs by companies that listed on the primary JASDAQ market or one of the JASDAQ OTC markets during the five-year period from 1995 through 1999.²⁹ In addition to the 321 auctioned IPOs discussed previously, the sample includes 163 book-built IPOs.³⁰ We focus on JASDAQ instead of the Tokyo Stock Exchange (*TSE*) because JASDAQ is the primary market for IPOs in Japan. Only 59 IPOs occurred on the TSE during the same five-year period. IPOs on the TSE generally are by older and substantially larger firms. As the rules regarding offering methods are the same, our evidence suggests that the TSE data would more strongly favor book building.

We obtain financial data and issue data from the Research Group for Disclosure database (1996–2000). Firm data include sales revenue, equity book value, shares outstanding, firm age, and number of employees for the year before the offering. Issue data include the offer date, number of shares issued, amount raised, offer price, first aftermarket price, and other offering details. Toyo Keizai Inc. provides daily stock price data for JASDAQ companies. We use the daily JASDAQ index as a measure of overall market performance.

4.1 Issue cost

In Table 2 we contrast fees, underpricing, and total issue cost (fees plus underpricing) for book-built and auctioned IPOs. For the hybrid auction regime, we define the “offer price” as the share-weighted average of (1) the weighted average successful bid price in the auction tranche, and (2) the public offer price in the public offer tranche. Most firms on JASDAQ use a Dutch system of trading where all trades for a day occur at the same time, at the intersection of supply and demand. We measure the first aftermarket price as the settlement price on the first day of market trading.

Studies of fees and underpricing generally express both as percentages of offer price (so underpricing is measured as an initial return). In panel A we follow this convention. However, this standardization has undesirable statistical properties. Because initial returns are highly skewed, the measure heavily weights outliers that turn out to be severely underpriced. Also, total issue cost conceptually is better measured as a transaction cost; that is, the percentage reduction from market value to net proceeds. In panel B we address the skewness problem by expressing total issue cost as a percent of first aftermarket price. The measure is consistent with our discussion, which

²⁹ The sample excludes four registrations of firms that were delisted from JASDAQ and three registrations on the second division of the OTC. Departures are due mainly to merger and acquisition.

³⁰ While the switch to book building quickly became universal, two firms used the auction method in the first month after Japan authorized book building. We include them in the auction sample.

Table 2

Underwriting fees, initial returns, and total issue cost of JASDAQ IPOs (January 1995–December 1999 and selected subperiods)

	Obs.	Mean	Median	Std. Dev.	Skewness	Mean <i>t</i> -value	Variance <i>P</i> -value
Panel A							
Underwriting fees/offer price							
Entire sample	484	4.07%	3.36%	1.18%	0.85		
All auction method	321	3.26%	3.24%	15.00%	0.53	60.96	0.0%
All book building	163	5.66%	5.77%	0.49%	0.22		
Auction method post-1995	185	3.30%	3.28%	17.00%	0.21	41.53	0.0%
Book building pre-1999	90	5.52%	5.51%	0.50%	0.46		
Initial return/offer price							
Entire sample	484	28.57%	5.71%	84.64%	5.77		
All auction method	321	7.12%	3.77%	14.80%	1.71	6.01	0.0%
All book building	163	70.81%	20.00%	134.97%	3.31		
Auction method post-1995	185	5.93%	3.67%	15.19%	1.44	3.04	0.0%
Book building pre-1999	90	19.45%	9.19%	40.84%	3.65		
Total cost/offer price							
Entire sample	484	32.64%	9.27%	85.06%	5.73		
All auction method	321	10.38%	7.03%	14.77%	1.72	6.23	0.0%
All book building	163	76.47%	26.00%	135.01%	3.30		
Auction method post-1995	185	9.23%	7.00%	15.15%	1.44	3.67	0.0%
Book building pre-1999	90	24.98%	14.92%	40.87%	3.64		
Panel B							
Underwriting fees/aftermarket price							
Entire sample	484	3.50%	3.23%	1.15%	1.21		
All auction method	321	3.10%	3.13%	0.45%	0.55	9.34	0.0%
All book building	163	4.30%	4.67%	1.61%	−0.17		
Auction method post-1995	185	3.18%	3.17%	50.00%	0.66	13.39	0.0%
Book building pre-1999	90	4.95%	4.90%	1.20%	0.47		
Initial return/aftermarket price							
Entire sample	484	11.36%	5.40%	21.02%	1.14		
All auction method	321	5.07%	3.64%	11.92%	−0.22	8.01	0.0%
All book building	163	23.75%	16.67%	28.35%	0.27		
Auction method post-1995	185	3.82%	3.54%	13.00%	−0.54	2.74	0.0%
Book building pre-1999	90	10.35%	8.41%	20.66%	−0.34		
Total cost/aftermarket price							
Entire sample	484	14.86%	8.75%	20.42%	1.16		
All auction method	321	8.17%	6.78%	11.49%	−0.20	9.05	0.0%
All book building	163	28.04%	21.67%	26.80%	0.26		
Auction method post-1995	185	7.00%	6.75%	12.53%	−0.53	3.67	0.0%
Book building pre-1999	90	15.30%	13.64%	19.56%	−0.35		

Underwriting fees (f), initial return (r), and total issue cost ($f + r$) for entire IPO sample, all auction method IPOs, all book building IPOs, and selected subsample: In panel A, costs are expressed as percentages of IPO gross proceeds. In panel B, costs are expressed as percentages of the first aftermarket value of the offered shares. Auction method “offer price” is computed as the weighed average gross proceeds per share from the auction tranche and the public offer tranche. Mean t -values are based on the hypothesis that sample means are equal between the auction method and book building samples and between the auction method and book building subsamples. The t tests are constructed assuming unequal variances. Variance P -values are based on F tests of the hypothesis of equal variances between samples or subsamples.

is focused on incurring issue costs to affect the aftermarket price, and yields distributions that more closely approximate normality.

Table 2 suggests that Japan’s shift to book building led to much higher initial returns (70.81% versus 7.12%) and correspondingly higher total

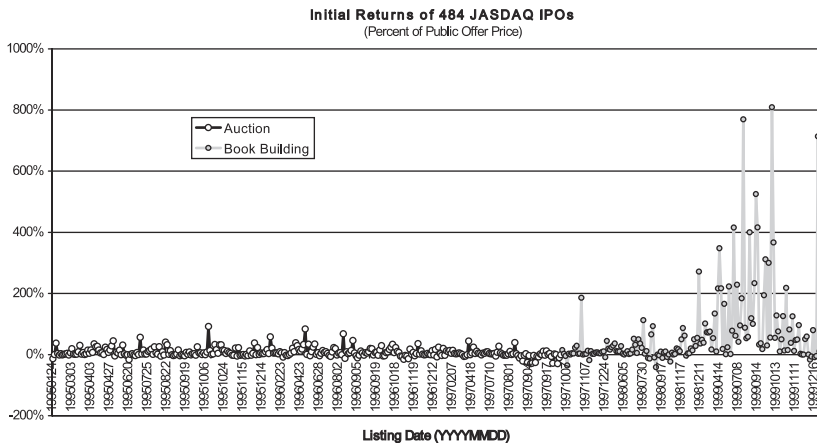


Figure 1
Initial returns of 484 JASDAQ IPOs (percent of public offer price)

issue cost. Measured against aftermarket price, total issue cost of book-built IPOs averages 28.04%, compared to 8.17% for auctioned IPOs. However, the entire difference cannot be ascribed to book building. Figure 1 illustrates that, although book building was introduced in late September 1997, there is no readily discernable change in the typical level of underpricing until 1999.

To address the inference from Figure 1, that 1999 is a fundamentally different period, we base our analysis primarily on a subsample that excludes 1999.³¹ In a similar vein, because the IPO market may have changed for reasons unrelated to introduction of book building, we exclude 1995 data from the subsample. The resulting three-year window, from 1996 through 1998, is a period of relatively stable capital market conditions and is short enough to implicitly control for many factors other than the regime change. Thus, in Table 2, we also report and test differences between post-1995 auctioned IPOs and pre-1999 book-built IPOs. The difference in mean total issue cost between these groups, though considerably smaller, is still highly significant. Much of the 8.30% difference in total issue cost is traced to the difference in fees. However, the 6.53% difference in initial returns remains significant.

³¹ Also, during 1999 the investment community of Japan was anticipating the opening of additional capital markets. *MOTHERS* (*Market Of The High-growth and Emerging Stocks*) opened in November 1999 and *NASDAQ Japan* opened in 2000. Thus during 1999, the listing environment was changing, whereas 1996 through 1998 was a more stable environment in terms of regulatory standards. *MOTHERS* had two IPOs in 1999, 27 in 2000, and has had fewer in more recent years. *NASDAQ Japan* opened in 2000, with 35 IPOs. In December 2002, *NASDAQ* withdrew from Japan and the *Osaka Securities Exchange* renamed the market *Hercules*.

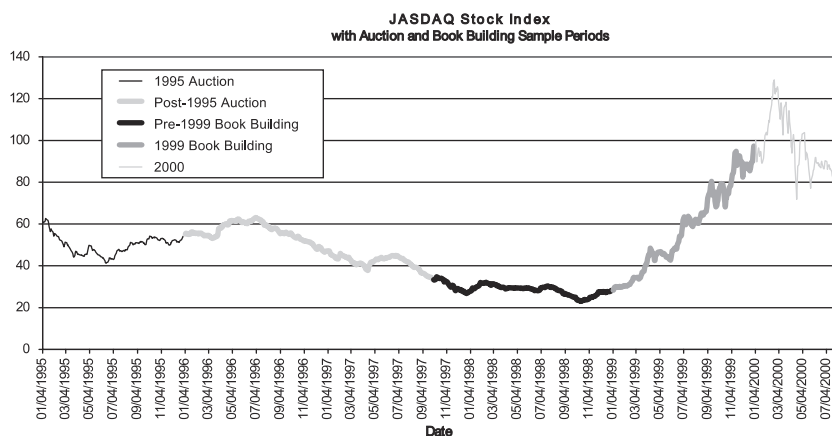


Figure 2
JASDAQ stock index (with auction and book-building sample periods)

4.2 Capital market uncertainty

Whether by auctioning or book building, the offering process includes specification of a minimum bid price or a filing range that is established on the basis of market conditions several weeks before the offering. During market runups, differences between minimums or ranges and aftermarket prices are likely to increase.³² Following market declines, offers are more likely to be canceled. Following runups, offers may go forward, but offer prices are unlikely to be adjusted fully.³³ Hence underpricing can increase.

Market runup partially explains the 1999 increase in underpricing. Figure 2 shows the JASDAQ index over the study interval. During the auction regime and through 1998, the index generally fluctuates between 40 and 60 and the overall direction of movement is negative. Both factors tend to limit underpricing. However, during 1999, the index increases by more than 300%. The rapid percentage increases correspond to the high initial returns in Figure 1.

In panel A of Table 3, we report two measures of market runup. The first is the percent increase in the JASDAQ index over the 40 market days before the IPO. We use this as an indication of the unexpected change in

³² Derrien and Womack (2003) study auctioning and book building in France and find evidence that during hot markets, auctioning is associated with less underpricing than book building. They attribute the result to the auction method's ability to incorporate more information about recent market performance into the offer price. Timing and other aspects of the French auction process are different from the Japanese process. Because auctioned and book-built IPOs are not concurrent in Japan, we cannot assess whether their findings would apply in a similar way.

³³ For book-built IPOs in the United States, Hanley (1993) documents that offer prices adjust only partially to demand that is higher or lower than the filing range in the preliminary prospectus. Kerins, Kutsuna, and Smith (2003) document partial adjustment in Japan's auction regime, relative to the minimum bid price in the first revised prospectus.

Table 3
Descriptive statistics for sample of 484 JASDAQ IPOs (January 1995–December 1999)

	Entire sample (1)	All auction (2)	All book building (3)	Post-1995 auction (4)	Pre-1999 book building (5)	1999 book building (6)	Test (2 = 3)	Test (4 = 5)	Test (5 = 6)
Panel A: Capital market uncertainty									
JASDAQ market Runup (day –40 to day –1)									
Mean	–0.23%	–3.76%	6.72%	–5.71%	–3.99%	19.92%	7.81****	1.36	14.55****
Median	–2.40%	–4.89%	5.46%	–6.50%	–4.77%	19.76%	6.91****	0.59	9.65****
JASDAQ market runup (day –100 to day –40)									
Mean	2.59%	–0.99%	9.64%	–0.30%	–9.98%	33.81%	5.18****	8.29***	21.74****
Median	–0.29%	–1.86%	1.42%	0.81%	–8.72%	36.63%	3.07****	7.02***	10.92****
Panel B: Issuer size and track record									
Age of issuing firm (years)									
Mean	28.26	30.00	24.84	28.26	24.49	25.26	3.94****	2.26**	0.35
Median	26.60	29.90	23.30	26.35	23.71	23.04	4.08****	2.24**	0.13
Number of employees									
Mean	434.44	464.95	374.34	456.18	369.89	379.84	1.97**	1.61	0.13
Median	288.00	318.00	236.00	314.00	218.00	241.00	3.42****	2.25**	0.65
Equity book value (millions of yen)									
Mean	832.43	953.19	594.62	970.63	622.13	560.70	3.68****	2.26**	0.75
Median	563.50	607.00	448.00	574.50	497.00	384.00	5.43****	2.08**	1.68*
Sales revenue (millions of yen)									
Mean	17,687	18,607	15,873	18,379	16,882	14,630	1.61	0.59	0.97
Median	11,698	12,176	10,245	10,965	10,495	10,031	1.80*	0.32	0.34

Premoney value at issue price (millions of yen)

Mean	18,482	18,461	18,526	21,451	13,495	24,728	t-value	0.01	1.09	1.31
Median	8,863	9,774	5,786	9,687	3,671	9,374	Z-value	4.99***	5.81***	4.51***

Panel C: Underwriter and venture capitalist certification or market power

Underwriter market share										
Mean	20.34%	19.09%	22.79%	19.30%	22.21%	23.51%	t-value	3.63***	2.03*	0.80
Median	17.40%	17.40%	25.80%	17.40%	25.80%	25.80%	Z-value	6.17***	3.92***	0.39
Venture capital backing (binary)										
Mean	58.47%	50.16%	74.85%	52.72%	70.00%	80.82%	t-value	5.60***	2.83***	1.61
Median	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	Z-value	5.20***	2.72***	1.58

Panel D: Other endogenous variables: issue size and proceeds allocation

Gross proceeds of offering (millions of yen)										
Mean	2,853.69	2,841.67	2,877.35	3,006.23	2,025.48	3,927.60	t-value	0.08	1.78*	2.25**
Median	1,656.50	1,867.00	1,254.00	1,943.00	746.25	2,040.00	Z-value	4.63***	6.03***	4.81***
New shares/shares outstanding										
Mean	19.36%	18.60%	20.85%	18.82%	20.58%	21.18%	t-value	4.65***	2.67***	0.68
Median	18.40%	18.10%	19.79%	18.06%	19.09%	20.16%	Z-value	4.70***	2.53**	1.09

Data are for IPOs during the entire period and various subperiods. Significance tests of differences in means (*t*-values) and medians (Mann-Whitney *U*-test *Z*-values) are reported for the following groups: (1) auction method IPOs versus book-building method IPOs after 1995 versus book-building method IPOs before 1999, and (3) book-building method IPOs before 1999 versus 1999. Calendar year 1999 was a period of rapid market runup and high market volatility. Panel A contains data for the JASDAQ market. Panel B contains company-specific data related to issuer size and track record. Panel C contains data on underwriter and venture capitalist involvement. Panel D contains data on other endogenously determined offering characteristics. Company data are from the IPO prospectus and proxy statements. Asterisks indicate significance at 10%, 5% and 1% levels in two-tailed tests.

the market from around the time of the decision to offer until the time of the IPO.³⁴ The second measure is the percent increase from 100 market days before the IPO until 40 market days before. We use the latter measure as an indication of market performance preceding the decision to offer. The table demonstrates that 1999 was a period of unusually rapid runup and that the post-1995 auction IPOs and pre-1999 book-built IPOs had similar market changes in the 40 days before the offering.

4.3 Issuer track record

Underwriters and investors are likely to have more difficulty estimating the market values of very young and small issuers. Hence underpricing and total issue cost may be larger percentages of gross proceeds.³⁵ Panel B compares the track records of issuers in our sample. Firm age, number of employees, equity book value, and sales revenue all are higher for auctioned than for book-built IPOs. Premoney valuation is an estimate of preissue market value and is calculated based on the offer price. Median values are smaller for book-built IPOs, even though 1999 increases in market prices contribute to higher values.

The above differences suggest that book building reduces informational asymmetry and underinvestment by smaller and younger firms. Our evidence provides no support for an alternative (nonmutually exclusive) “hot market” view that the increased percentage of small and young issuers was caused by market runup during 1999. The evidence suggests that the higher average issue cost reported in Table 2 for book building is associated with the higher proportion of IPOs by small and young issuers.

4.4 Underwriter market share and venture capitalist certification or market power

Panel C shows that the average underwriter market share of IPOs was higher during book building than earlier. Thus the industry became more concentrated. However, the regime change did not cause the increase. Rather it is due to the failure of Yamaichi, the underwriter with the fourth highest share during the auction regime, and the concomitant increases in shares of the top three remaining underwriters: Nomura, Nikko, and Daiwa.³⁶ The cumulative share of the remaining 12 underwriters remained constant at 19% to 20%.

³⁴ Our use of day -40 as the approximate date of the decision to offer is based on judgment and general practice, as we have no specific data for the IPOs in our sample.

³⁵ Beatty and Ritter (1986) find a positive relation between ex ante uncertainty about value and underpricing.

³⁶ Kutsuna (1997) documents that underwriting in Japan is concentrated among a small number of large companies. In our sample, the big four firms underwrote about 80% of auction IPOs: Nomura 32.7%, Daiwa 17.4%, Nikko 17.4%, and Yamaichi 13.1%. After introduction of book building and the failure of Yamaichi, shares of the big three increased: Nomura 33.1%, Nikko 25.8%, and Daiwa 20.9%.

Panel C also documents that the percent of offers with venture capital backing is higher during book building than during auctioning. This suggests that the change to book building increased capital-market access for issuers that normally would attract venture capital. While the percent with venture capital backing is highest in 1999, pre-1999 book-built IPOs are also significantly more likely than auction IPOs to be venture capital backed.³⁷

4.5 Offer size

In panel D we examine relationships between pricing method and offer size. Consistent with the implication of underinvestment, that removing the auction method constraints gave small issuers enhanced access to the capital markets, capital raised is lower under book building, but issue size relative to shares outstanding is significantly higher. This is true, particularly for the three-year subsample, which is not distorted by the 1999 runup. The evidence implies that book building affords greater flexibility — small issues appear to be more possible under book building, as are issues that are large relative to firm size.

5. Empirical Analysis

5.1 The decision to issue

The hypothesis that the auction method results in underinvestment implies that high-quality small and risky firms are less likely to issue in the auction regime than when book building is available. Consistent with the hypothesis, Table 3 documents that auctioning issuers are older and larger than book-building issuers. While it is not possible to identify firms that did not issue but would have if book building were available, descriptive data can be used to draw an inference about the number of firms that elected not to issue.

Table 4 presents results of four different estimates of the size of the nonissuer population during the auction regime. The estimates are based on three assumptions. First, we assume that with regard to firm age or employment, the distribution of potential issuers is the same during auction as during book building. Second, we assume that all prospective issuers elect to issue if book building is available. Third, we assume that for the largest or oldest two quintiles of the population of prospective issuers, unobservable aspects of firm quality are sufficiently unimportant that all firms that would issue by book building also would do so by auctioning.

³⁷ Loughran and Ritter (2003) document a secular increase in venture capital-backed IPO activity in the United States. Allowing for secular drift, we tested for a structural shift in our data, related to the hypothesis that venture capital backing is higher when book building is used. The coefficient is marginally significant (at the 10% level), and indicates that book building accounts for an increase of about 12 percentage points in the probability of an issue being venture capital backed.

In panel A we report estimates of the numbers of auction-regime non-issuers on the basis of firm age. We derive the estimates first on the basis of the entire book-building sample, and second on the pre-1999 subsample. When the subsample is used, we scale the results to estimate the number of nonissuers during the full auction sample period. Estimates in panel B are based on the same methodology, but use data on the number of employees. Our estimates of the number of nonissuers during the auction regime range from 102 to 145. Given that 163 auction IPOs occurred, the estimates imply that a substantial fraction of potential issuers did not issue.³⁸ All ranked differences between actual and expected numbers are highly significant.

Consistent with book building improving pricing accuracy, we find evidence that some overvalued firms may have rushed to complete offerings before introduction of book building. For this to be a rational tactic, auction bidders must not fully understand how book building would affect pricing accuracy. Though the numbers are too small for rigorous testing, the amount of IPO activity in September 1997, just before the regime change, was unusually high. In 1997 there were 25 offerings in September, compared to 12 in October. In 1996, both months had 16. For August and September combined, 1996 and 1997 are similar at 30 and 33 respectively. The pricing evidence also suggests that the firms trying to complete offerings before introduction of book building tended to be overvalued. Of the 24 overpriced public offer tranches of auction IPOs in our sample, 12 occurred in September 1997, 48.0% of the September offerings. Except for September 1997, only 4.1% of auction offerings were overpriced. Furthermore, average overpricing of the public offer tranche for the 12 in September 1997 was 22.9%, compared to 7.5% for the other 12.³⁹

5.2 The underwriter's role and the structure of issue costs

The agreement, during Japan's auction regime, to fix fees per share as a percent of public offer price per share helps explain why the auction method could discourage or impede potential issuers. If some of the costs of marketing the issue are fixed, then the low percentage fee could prevent small firms from offering.

If the underwriter's pricing role in auction IPOs is different than in book building, the differences should affect the structure of issue costs. First, if the underwriter performs more extensive due diligence, premarketing, and value certification for book-built than for auctioned IPOs,

³⁸ Although Table 4 implies that the activity level was higher under book building than would have been expected under auction, the overall rate of IPO activity was lower during book building. Practitioners in Japan attribute the decline to the worsening overall level of stock market prices.

³⁹ The minimum successful bids of overpriced IPOs in September generally were at the minimum price. The ratios of shares bid for to shares offered were also low. Public offer tranche discounts from the weighted average successful bid were small and sometimes constrained by the minimum price.

then firm characteristics should affect fees of book-built IPOs to a greater extent. Second, underwriters with established reputations should be more able to charge higher fees for book-built IPOs.⁴⁰ Third, corresponding to the inability of such underwriters to charge higher fees for auction IPOs, they may be able to reduce their costs by underpricing more. Because the auction method limits the underwriter's ability to select the level of underpricing and because we compute weighted average underpricing across both tranches of the IPO, it is unclear whether systematic underpricing in relation to underwriter reputation will be more or less under book building. Fourth, if there are scale economies of underwriting, then percentage fees or underpricing should decrease with increases in issue size. Fifth, if investors use the offer price along with information on the firm, the issue, and the underwriter to infer aftermarket value in book-built IPOs, then these factors should affect underpricing. Finally, fees and underpricing should be substitute components of total issue cost.

In Table 5 we examine the determinants of underwriter fees and underpricing.⁴¹ We specify the total fee per share as a percent of gross proceeds per share, so the measure is not affected by underpricing. The fee models are fully interacted for differences between auctioning and book building, and include variables related to issuer track record, issue size, and underwriter market share. In the underpricing models, we standardize by first aftermarket price. Except for runup over the 40 days before the IPO, the underpricing models also are fully interacted with regime. We restrict the runup coefficient to be the same in both regimes because limited cross-sectional variation during the auction regime precludes an accurate estimate based solely on auction data. For underpricing, we test for differences related to track record, issue size, and underwriter market share. We also include fees standardized by offer price. Model structures are consistent with a paradigm where fee is determined first, and intended underpricing is established second, based on fee. By including runup, we allow unanticipated changes in the market to affect underpricing.

Results conform to expectations. Except for the intercept of 3.5%, the models do not explain auction fees. Conversely, for book building, issuer track record variables and underwriter market share both are significant. While we anticipated that, for book building, firm age would be negatively

⁴⁰ Underwriters with larger market shares may earn superior returns on effort for several reasons: First, they may have superior ability to place issues. Second, they may be more credible as certifiers. Third, underwriters with low shares may sacrifice short-run profitability to develop reputations. These factors all imply that underwriters with larger shares are able to earn higher fees. In addition, Carter and Manaster (1990) indicate that U.S. underwriter reputation is positively related to issuer quality. Such a relationship could lead to a negative association between underpricing and underwriter share. Carter, Dark, and Singh (1998) find that IPOs managed by more prestigious underwriters are less underpriced.

⁴¹ The empirical models in Tables 5 and 6 are parsimonious, while allowing for testing of the various hypothesized relationships. Adding more indicators of issuer age or track record does not materially affect the models' overall explanatory power and does not materially alter the findings in the remainder of the article.

Table 5

Regression results for underwriter fees and underpricing (full 1995–1999 sample and 1996–1998 subsample)

Independent variables	Underwriter fees/issue price (percent)		Underpricing/aftermarket price (percent)	
	Full sample	Subsample	Full sample	Subsample
Intercept	3.45268 <i>59.60***</i>	3.50072 <i>45.26***</i>	6.24608 <i>0.68</i>	12.92362 <i>1.32</i>
Market runup day –40 to day –1 (percent)			0.82729 <i>12.96***</i>	0.84682 <i>9.23***</i>
Age of issuing firm	–0.00154 <i>1.13</i>	–0.00088 <i>0.46</i>	–0.04084 <i>0.57</i>	–0.04980 <i>0.64</i>
Sales revenue (billions)	–0.00026 <i>0.24</i>	–0.00030 <i>0.22</i>		
Issue size (billions)	–0.00661 <i>1.16</i>	–0.00702 <i>0.96</i>	–0.27100 <i>1.22</i>	–0.08940 <i>0.44</i>
Underwriter market share (percent)	0.00019 <i>0.12</i>	–0.00052 <i>0.25</i>	0.17027 <i>1.97**</i>	0.12960 <i>1.44</i>
BB*intercept	1.98924 <i>21.32***</i>	1.88407 <i>14.86***</i>	28.75568 <i>4.09***</i>	26.76458 <i>3.66***</i>
BB*age of issuing firm	0.00493 <i>2.18**</i>	0.00381 <i>1.14</i>	–0.54038 <i>4.64***</i>	–0.53260 <i>4.01***</i>
BB*sales revenue (billions)	–0.00639 <i>2.99***</i>	–0.00511 <i>1.85*</i>		
BB*issue size (billions)	0.00383 <i>0.48</i>	0.00770 <i>0.62</i>	–0.55500 <i>1.63</i>	–2.32800 <i>5.57***</i>
BB*underwriter market share (percent)	0.01069 <i>3.89***</i>	0.00763 <i>2.14***</i>	–0.22417 <i>1.49</i>	–0.07477 <i>0.49</i>
Underwriter fee (percent)			0.20159 <i>0.08</i>	–1.47981 <i>0.57</i>
Adj. R^2	0.93	0.92	0.43	0.38

Underwriter fee is expressed as a percent of issue price. Underpricing is expressed as a percent of first aftermarket price. Full sample estimates are based on 484 JASDAQ IPOs. Subsample estimates are based on 274 IPOs. Interactions with book building are designated as “BB”variablename.” Coefficient t -values are in italics. Asterisks indicate significance at the 10%, 5%, and 1% levels in two-tailed tests.

related to fee, the positive relationship is more than offset by a significant reduction in underpricing. Older firms pay more, but in return are much less underpriced. We find a similar pattern for issue size, where nonsignificant fee coefficients for book-built IPOs are paired with negative underpricing coefficients.

With respect to underwriter market share (our measure of reputation), for auction IPOs there is no significant relation to fee, but the relation to underpricing is positive. Underwriters with high market shares underprice more. For book-built IPOs, these results reverse. The relation between market share and fee is positive and significant, whereas the coefficient on market share in the underpricing regressions reverses the positive coefficient for auction IPOs.

The reversal is evidence that fees and underpricing are substitute components of total issue cost. Fee is not significant in explaining underpricing, but because of the ways the models are specified, the lack of a relationship is consistent with substitution. In the underpricing models, fee is standardized by offer price. If it were standardized by aftermarket

price, the (negative) substitution effect would be almost deterministic. All else being equal, increased underpricing reduces the fee as a percent of aftermarket price. For the two not to function as substitutes, underwriters would need to charge higher percentage fees when they anticipated higher underpricing. As, based on Table 5, they do not appear to do so, higher underpricing reduces fee, when fee is measured against aftermarket price.⁴²

5.3 Total issue cost and issue size

Assuming that all firms issue and try to maximize net proceeds per share, and that aftermarket prices are unbiased measures of value, why would an issuer select book building if it leads to higher total issue cost? Underinvestment implies that the shift is a response to adverse selection. Book building prevents low-quality firms from pooling with high-quality firms. Also, reliance on book building may indicate that firms are not concerned solely with expected net proceeds.⁴³

To compare auctioning and book building at the firm level, we model total issue cost by auctioning and by book building. We use the model to estimate and compare the hypothetical total issue cost that each issuer would have realized had it issued in the other regime.

The customary approach of comparing expected cost under different issuance methods is with a simultaneous equation system that controls for choice selectivity. However, in this case, self-selection does not bias our estimates of expected total issue cost. Issuers during the auction regime could not select book building and issuers during the book-building regime did not select auction. The only caveat is that in the transition month between regimes, a small number of firms appear to have implicitly chosen by timing their offerings.⁴⁴

However, choice of method, given regime, leaves open the possibility that issuers may prefer one regime over the other, and the question of which regime is expected to maximize the aggregate value of investment opportunities after all issue costs. The underinvestment problem implies that, during the auction regime, there also may be a self-selection censoring effect with respect to the decision to go public. While this is a more serious problem, no existing method enables us to control formally for censoring when the population of nonissuers is unknown. Instead, we recognize the direction of the bias and factor it into our interpretation of results.

⁴² The coefficient on underwriter fee, when it is standardized by aftermarket price, is negative and highly significant. Habib and Ljungqvist (2001) make a similar argument for substitutability of fees and underpricing.

⁴³ Sherman (2002), for example, shows that book building may reduce the risk for the issuer and allow the issuer to control the trade-off between underpricing and information gathering. Her models demonstrate that book building can be used to either increase or decrease spending on information acquisition, relative to a discriminatory auction.

⁴⁴ The two auctioned issues during the first month of book building appear to be carryovers from auction processes that began before book building was permitted.

While the IPO pricing regime is expected to affect issue cost, prospective issuers can respond by adjusting issue size. The data in Table 3 demonstrate that auction IPOs are larger in absolute terms, but smaller as a fraction of outstanding shares. This raises the prospect that total issue cost and issue size are determined simultaneously. We tested this by estimating a simultaneous system for percent issue cost and absolute issue size. However, the exogenous variable coefficients were not significantly or materially different from ordinary least squares (OLS) results and the endogenous variable coefficients were not significant. The findings suggest that the pricing regimes affect the characteristics of issuers and the sizes of offerings, but that firms do not select issue size to affect issue cost. Correspondingly, after controlling for firm characteristics, issue cost as a percent of aftermarket price bears little relation to issue size.

In the first two numerical columns of Table 6 we report models of total issue cost. We select variables for inclusion in the models based on the literature, as discussed above. As in Table 5, we restrict the coefficient on *runup* in the JASDAQ index to be the same over the entire period. But for this exception, the models are fully interacted with the regime indicator variable.

Results are consistent with earlier discussion. Our interpretations, in some cases, draw on the Wald tests of restrictions reported at the foot of the table. Issue cost is significantly greater after periods of *runup*, suggesting that offer prices do not adjust fully to changes in the market. Issuer age, sales revenue, and equity book value are not significantly related to the total cost of auctioned IPOs. The incremental coefficients of these variables for book-built IPOs are negative and generally significant. Results indicate that the percentage cost of book building is less for large issuers with established track records.

Expanding on discussion of Table 5, during the auction regime, underwriters with larger market shares are associated with higher total issue cost, but the relation substantially disappears in the book-building regime. For high-market-share underwriters, the lower underpricing in Table 5 offsets higher fees. The empirical relationship of total issue cost to venture capital backing in Table 6 suggests a certification or monitoring role for venture capital.⁴⁵ Particularly for the three-year subsample, book-built IPOs with venture capital backing have lower issue cost.

⁴⁵ Megginson and Weiss (1991) argue that venture capitalists provide certification. Barry *et al.* (1990) suggest that monitoring is the source of value creation. Packer (1996) finds that, in Japan, either bank shareholding or investment through a venture capital subsidiary is associated with lower underpricing. Kutsuna, Cowling, and Westhead (2000) focus on changes in venture capital holdings after IPOs of Japanese firms. They find that companies in which venture capital firms sell equity stakes after flotation underperform companies in which venture capitalists do not invest or where they maintain equity stakes. Kutsuna, Okamura, and Cowling (2002) find that venture capital ownership is significantly related to post-IPO operating performance. Lin and Smith (1998) find that venture capital-backed firms go public with less well-established track records than other issuers. Thus venture capital-backing could be associated with higher levels of underpricing. Loughran and Ritter (2003) find that venture capital-backed offerings are associated with higher initial returns for both U.S. and Japanese firms.

Table 6
Regression results for total cost and issue size (full 1995–1999 sample and 1996–1998 subsample)

Independent variables	Coef.	Total cost/aftermarket price (percent)		Issue size (million yen)	
		Full sample	Subsample	Full sample	Subsample
Intercept	c1	8.058 <i>2.52**</i>	10.844 <i>2.90***</i>	1643.72 <i>4.00***</i>	2170.85 <i>4.11***</i>
Market runup –40 to –1 (percent)	c2	0.734 <i>12.48***</i>	0.821 <i>8.94***</i>		
Market runup –100 to –40 (percent)	c3			16.43 <i>2.86***</i>	16.19 <i>1.15</i>
Age of issuing firm	c4	–0.015 <i>0.22</i>	–0.047 <i>0.60</i>	–33.11 <i>3.48***</i>	–45.83 <i>3.59***</i>
Sales revenue (billions)	c5	0.012 <i>0.26</i>	0.007 <i>0.15</i>	37.48 <i>4.96***</i>	42.43 <i>4.44***</i>
Equity book value (billions)	c6	–0.641 <i>1.04</i>	–0.256 <i>0.44</i>	318.55 <i>3.04***</i>	179.98 <i>1.61*</i>
Value of outstanding shares (billions)	c7			4.03 <i>12.46***</i>	3.87 <i>10.74***</i>
Underwriter market share	c8	0.151 <i>1.89*</i>	0.122 <i>1.37</i>	24.19 <i>2.15**</i>	18.12 <i>1.25</i>
Venture capital backing	c9	1.647 <i>0.94</i>	–0.089 <i>0.04</i>		
BB*intercept	c10	33.041 <i>6.22***</i>	27.236 <i>4.37***</i>	–1544.36 <i>2.28**</i>	–2001.94 <i>2.14**</i>
BB*age of issuing firm	c11	–0.376 <i>3.37***</i>	–0.313 <i>2.27**</i>	5.09 <i>0.31</i>	18.26 <i>0.79</i>
BB*sales revenue (billions)	c12	–0.408 <i>3.85***</i>	–0.360 <i>3.28***</i>	2.38 <i>0.15</i>	–41.03 <i>1.93*</i>
BB*equity book value (billions)	c13	–3.506 <i>1.24</i>	–1.164 <i>0.33</i>	156.93 <i>0.38</i>	1179.93 <i>2.05**</i>
BB*value of outstanding shares (billions)	c14			3.68 <i>7.46***</i>	3.78 <i>5.06***</i>
BB*underwriter market share	c15	–0.150 <i>1.08</i>	–0.032 <i>0.21</i>	13.91 <i>0.72</i>	14.57 <i>0.59</i>
BB*venture capital backing	c16	–1.047 <i>0.32</i>	–8.237 <i>2.25**</i>		
Adj. R^2		0.48	0.36	0.77	0.79
Wald test results (F -test P -values)					
c4 + c11 = 0		<i>0.000</i>	<i>0.002</i>	<i>0.029</i>	<i>0.152</i>
c5 + c12 = 0		<i>0.000</i>	<i>0.000</i>	<i>0.005</i>	<i>0.941</i>
c6 + c13 = 0		<i>0.133</i>	<i>0.679</i>	<i>0.238</i>	<i>0.017</i>
c7 + c14 = 0				<i>0.000</i>	<i>0.000</i>
c8 + c15 = 0		<i>0.989</i>	<i>0.467</i>	<i>0.017</i>	<i>0.105</i>
c9 + c16 = 0		<i>0.827</i>	<i>0.007</i>		
c4 = c5 = c6 = c9 = 0		<i>0.667</i>	<i>0.971</i>		
c11 = c12 = c13 = c16 = 0		<i>0.000</i>	<i>0.000</i>		
c4 = c5 = c6 = c8 = 0				<i>0.000</i>	<i>0.000</i>
c11 = c12 = c13 = c15 = 0				<i>0.925</i>	<i>0.214</i>

Full sample estimates are based on 484 JASDAQ IPOs. Subsample results are based on 274 IPOs. Interactions with book building are designated as “BB*variablename.” Coefficient t -values are in italics. Asterisks indicate significance at the 10 %, 5 % and 1 % levels in two-tailed tests. Wald tests of hypotheses that cumulative coefficients for book-building samples are significantly different from zero and of hypotheses that book-building models are significantly different from auction period models.

In the last two columns of Table 6, we report findings for issue size. Because issue size is a function of price and firms may attempt to issue more shares after runups, we include a measure of recent market runup. We assume that the decision to offer is made about 40 market days before

the offering and measure runup over 60 market days prior to that. In addition to measures of firm track record and underwriter market share, we allow for the possibility that the market is more receptive to an offering that represents a small fraction of outstanding shares.

The Table 6 results for issue size are a contrast with those for total cost. First, the interacted intercept coefficient for book-built IPOs nullifies the positive intercept for auctioned IPOs. Second, firm track record measures are positively and significantly related to the issue size of auctioned IPOs. In most cases, incremental coefficients for book-built IPOs are not significant. The exceptions, in the three-year subsample, are that the auction coefficient on sales revenue is reversed and the book-building coefficient on equity book value is significantly positive. Results are related to skewness of the offering distribution in the book-building subsample. More than in other periods, the data include many small IPOs and a few large ones. Preoffer firm value is positively related to issue size of auctioned IPOs, as expected. The incremental coefficients suggest that book building also enables issuers to increase offer size.⁴⁶

5.4 Economic significance of the regime change

To assess the potential for book building to result in overinvestment in information, we use the Table 6 models to estimate expected total issue cost of each issuer for the IPO pricing method actually used and for the same offer by the alternative method. As we cannot correct for bias due to underinvestment, all results in Tables 7 through 9 are biased in favor of auction.

5.4.1 Differences in equal-weighted average total issue cost. Table 7 contains a summary of the equal-weighted results. The results are similar in each of the three sets of comparisons in the table. We focus discussion on the estimates derived when the model for the three-year subsample is used to estimate expected total issue cost for that subsample. For IPOs priced by auction, we estimate that mean and median expected total issue cost would have been higher under book building. Ignoring bias due to underinvestment, the mean cost advantage of auctioning is 5.68% of the first aftermarket price. For IPOs priced by book building, the mean cost

⁴⁶ Consistent with the incentive of high-quality firms to mitigate uncertainty, if investment can be staged, a firm can seek minimum funding initially and wait for undervaluation to be resolved. Grinblatt and Hwang (1989) model underpricing as a quality signal, where quality depends on both expected cash flows and uncertainty. High-quality firms issue initially at low prices and use seasoned offerings to complete the capital-raising effort. Low-quality firms that attempt to imitate high-quality firms run the risk of being discovered before the seasoned offering can be completed. Welch (1989), in a related model, explores the conditions under which high-quality firms signal by underpricing and limiting IPO size. Allen and Faulhaber (1987) develop a similar model. These signaling equilibria imply that seasoned offerings shortly after IPOs are more likely in the auction regime. Although 38 IPOs in our sample were followed by seasoned offerings within one year, we found no significant differences related to regime.

Table 7
In- and out-of-sample estimates of expected total issue cost and total issue cost differentials

	Auction method sample			Book-building sample		
	Mean	Std. Dev.	Median	Mean	Std. Dev.	Median
Total issue cost estimates and differentials						
Full sample model applied to full sample data						
Actual issue cost	8.17%	11.49%	6.78%	28.04%	26.80%	21.67%
Expected actual issue cost	10.90%	2.14%	11.60%	23.16%	9.96%	25.04%
Expected alternative issue cost	18.34%	14.60%	20.32%	12.22%	1.86%	12.60%
Cost differential in favor of auction (actual v. expected alternative)	10.17%		13.54%	15.82%		9.07%
Cost differential in favor of auction (expected v. expected alternative)	7.44%		8.72%	10.94%		12.44%
Subsample model applied to full sample data						
Actual issue cost	8.17%	11.49%	6.78%	28.04%	26.80%	21.67%
Expected actual issue cost	11.56%	1.56%	11.39%	18.54%	8.95%	19.99%
Expected alternative issue cost	16.85%	10.39%	18.67%	12.39%	1.49%	12.70%
Cost differential in favor of auction (actual v. expected alternative)	8.68%		11.89%	15.65%	8.97%	
Cost differential in favor of auction (expected v. expected alternative)	5.29%		7.28%	6.15%		7.29%
Subsample model applied to subsample data						
Actual issue cost	7.00%	12.53%	6.75%	15.30%	19.56%	13.64%
Expected actual issue cost	11.64%	1.63%	11.49%	18.54%	8.73%	20.37%
Expected alternative issue cost	17.32%	11.50%	19.54%	12.25%	1.53%	12.66%
Cost differential in favor of auction (actual v. expected alternative)	10.32%		12.79%	3.05%		0.98%
Cost differential in favor of auction (expected v. expected alternative)	5.68%		8.05%	6.29%		7.71%
Classification results						
Sample used in model estimation	Full	Subsample	Subsample	Full	Subsample	Subsample
Sample on which classifications are based	Full	Full	Subsample	Full	Full	Subsample
Auction issues where auction appears to be lower cost	269	261	152	83.80%	81.31%	82.61%
Auction issues where book building appears to be lower cost	52	60	32	16.20%	18.69%	17.39%
Book building issues where book building appears to be lower cost	22	33	16	13.50%	20.25%	17.78%
Book building issues where auction appears to be lower cost.	141	130	74	86.50%	79.75%	82.22%

Regression models from Table 6 are used to generate predicted values of total issue cost for IPOs by the pricing method actually used and estimates of hypothetical total issue cost under the alternative pricing method. Expected differentials in total issue cost are computed against actual and predicted total issue cost. Cost differentials reflect cost advantages of auction method pricing, ignoring any effect of pricing method on aftermarket price. Classification results are determined based on comparisons of predicted values from the regression models.

advantage of auctioning is 6.29%. The estimates are similar when the three-year and five-year models are used to price IPOs in the full sample.

Based on the classifications reported at the bottom of Table 7, pricing by auction is projected to result in lower total cost for 226 of the 274 IPOs in the subsample, or 82.5%. Ignoring bias due to underinvestment, both auctioned and book-built issues include more IPOs that are projected to have lower total cost by auction.

While, on a cost basis, most issuers in our sample appear to fare better with auction, the apparent cost advantage must be weighed against the unobservable opportunity losses from underinvestment. If underinvestment is negligible, then the evidence in the table is an unbiased estimate of the (equal-weighted) percentage cost advantage of auction, suggesting that pricing by auctioning reduces mean total issue cost in our sample by an average of about 6.0% of the first aftermarket price. Taking underinvestment into account, this is an upper bound estimate of the advantage of auctioning.

5.4.2 Apparent beneficiaries of auctioning and book building. In Table 8 we classify issuers as apparent beneficiaries of auctioning or book building. Classifications are based on the model estimated from the three-year subsample. Because of small sample sizes in some groups, we construct the table based on the full sample. Results based on the full sample model and on only the subsample data are similar. The top half of the table pertains to auction IPOs and compares issuers expected to achieve apparently lower cost using auctions against issuers expected to achieve lower cost using book building. Based on the statistical estimates, firms that apparently benefit from auctioning are younger and smaller than firms that benefit from book building. However, auction beneficiaries are less likely to be venture capital backed. While average issue size of auction beneficiaries is smaller, relative issue size is larger. The lower portion of the table provides the same comparisons for book-built IPOs and yields similar results.

Comparisons of the characteristics of apparent auction beneficiaries support our concern that underinvestment biases downward the estimates of expected total issue cost by auction. While the relative cost evidence suggests that younger and smaller issuers can achieve lower cost with auctions, the smallest and youngest firms are, for the most part, absent as issuers during the auction regime. If their absence is due to underinvestment, then the estimates of auction method total cost are negatively biased, particularly for the small and young issuers. Our conclusion is that the auction method functions as a capital market barrier for small, young, and risky issuers.

5.4.3 Differences in aggregate total issue cost. Because the cost advantage of book building is greatest for large issuers, comparisons of

Table 8
Comparisons of expected issue cost and issuer characteristics for subsamples of auction method and book-building IPOs

Auction method IPOs	Apparent beneficiaries of auction method (<i>N</i> = 261)			Apparent beneficiaries of book building (<i>N</i> = 60)		
	Mean	Std. Dev.	Median	Mean	Std. Dev.	Median
Estimated advantage of auction method	8.53%	4.54%	8.45%	-8.81%	14.24%	-4.53%
Expected actual issue cost	11.74%	1.53%	11.51%	10.80%	1.50%	10.70%
Expected alternative issue cost	20.26%	4.96%	20.58%	1.98%	14.15%	5.65%
Actual issue cost	7.98%	12.08%	6.44%	8.99%	8.52%	7.93%
<i>Issuer characteristics</i>						
Age of issuing firm	27.6	11.9	26.6	40.6	12.6	44.5
Number of employees	378.4	333.1	287.0	841.5	832.4	533.5
Equity book value	722.7	491.0	575.0	1956.0	3383.7	981.0
Sales revenue	12970	9043	10444	43131	39000	33886
Underwriter market share	19.4%	10.9%	17.4%	17.9%	10.1%	17.4%
Venture capital backing	47.9%	50.1%	0.0%	60.0%	49.4%	100.0%
Shares offered	1134.7	467.6	1000.0	1614.7	960.4	1350.0
Gross proceeds of offering	2471.8	2224.5	1756.8	4452.8	8260.8	2242.9
New shares/shares outstanding	19.1%	3.8%	18.4%	16.50%	3.10%	16.60%
Apparent beneficiaries of auction (<i>N</i> = 130)						
Book-building IPOs	Apparent beneficiaries of auction (<i>N</i> = 130)			Apparent beneficiaries of book building (<i>N</i> = 33)		
	Mean	Std. Dev.	Median	Mean	Std. Dev.	Median
Estimated advantage of auction method	9.48%	5.21%	9.13%	-6.95%	6.36%	-5.35%
Expected actual issue cost	21.94%	5.66%	21.77%	5.18%	6.74%	6.95%
Expected alternative issue cost	12.46%	1.57%	12.83%	12.12%	1.13%	11.78%
Actual issue cost	31.10%	25.16%	23.61%	16.00%	29.96%	16.08%
<i>Issuer characteristics</i>						
Age of issuing firm	21.7	11.7	21.0	37.1	15.1	39.1
Number of employees	276.1	279.2	194.0	761.3	773.9	553.0
Equity book value	491.0	333.0	416.0	1003.0	796.1	754.0
Sales revenue	10672	7954	8257	36364	18541	36494
Underwriter market share	22.2%	11.3%	25.8%	25.0%	6.7%	25.8%
Venture capital backing	70.8%	45.7%	100.0%	90.9%	29.2%	100.0%
Shares offered	1129.7	523.3	1000.0	1840.0	1298.6	1400.0
Gross proceeds of offering	2026.7	3352.6	1010.0	6228.4	8773.0	2415.0
New shares/shares outstanding	21.7%	5.5%	20.7%	17.4%	4.6%	17.6%

Observations are grouped according to whether auction method or book building is expected to result in lower total issue cost. The table reports mean and median issuer characteristics within groups. Asterisks indicate significance at 10%, 5%, and 1% levels in two-tailed tests.

equal-weighted average percentage cost advantages do not reveal whether, in aggregate, auctioning or book building is lower cost. To address this, in the upper portion of Table 9 we report absolute measures of total cost in the same manner as the percentage comparisons in Table 7. All estimates in Table 9 are based on the issue cost model from the three-year subsample. Results for the full sample model are similar. Based on the issues that did occur during the study period, the aggregate total issue cost of book building and apparent aggregate total issue cost of auctioning are similar. When we apply the model just to the subsample, book building appears to be slightly less costly. However, when we apply the model to the full sample, auctioning appears to be slightly less costly.

To illustrate, focusing on the subsample, we estimate that the expected aggregate issue cost of the auction method is 69.4 billion yen for IPOs actually priced by auction and 25.7 billion yen for those actually priced by book building. The expected total is thus 95.0 billion yen, or 346.9 million yen per IPO. The comparable aggregate total cost estimate for book building is 69.4 billion yen, or 253.4 million yen per IPO. Thus we estimate that the aggregate additional cost to JASDAQ issuers of relying on the auction method from 1996 through September 1997 was 25.6 billion yen. Again, this does not reflect the negative value of opportunity losses from underinvestment in the auction regime. Applying the same analysis to the entire sample, we estimate that reliance on book building from late 1997 through 1999 cost issuers an aggregate of 26.4 billion yen. This estimate is subject to the same bias in favor of auctioning.

In the lower portion of Table 9 we compute issue-size-weighted average percentage costs and cost differentials. For the three-year subsample, we estimate that the overall cost disadvantage of the auction method is 3.27%. This compares to an apparent advantage of about 6.0% on an equal-weighted basis. For the full sample, auctioning appears to have a cost advantage of 1.43% on an issue-size-weighted average basis. However, this estimate is based partly on extrapolation of the three-year model to predict issue costs for the entire five-year sample. Furthermore, none of the cost estimates of auctioning in Table 9 account for the reduction in total issue cost by auctioning that appears to have resulted from the fee-fixing agreement. Setting fees aside, the Table 9 results suggest that aggregate underpricing would have been lower under book building on the basis of either the full sample or the subsample.

Though narrowly construed, our cost evidence is neutral, the estimates fully reflect costs of information production, but do not correct for bias due to underinvestment. Hence the arguments for book building turn on its ability (which our evidence supports) to reduce underinvestment and on the other benefits of more accurate pricing. Though small issuers might benefit from restricting all issuers to use auction, the aggregate total issue

Table 9
In- and out-of-sample estimates of aggregate and value-weighted average total issue cost and total issue cost differentials

	Auction method sample					Book-building sample					Entire sample	
	Mean	Std. Dev.	Median	Sum		Mean	Std. Dev.	Median	Sum		Sum	Mean
Yen-valued and aggregate total issue cost estimates and differentials												
Subsample model applied to full sample data												
Aftermarket value of issue	3023		2050	970494	5431	13108		1651	885246			
Actual issue cost (million yen)	273	4354	106	87472	2714	10029		264	442380			
Expected actual issue cost (million yen)	358	551	221	114784	1049	3012		258	171025	Auction	231030	477
Expected alternative issue cost (million yen)	269	528	302	86466	713	1819		197	116246	Book bldg.	257490	532
Cost differential in favor of auction (act. v. expctd. alt.)	-3	2480	196	-1006	2001			67	326135	Differential	26461	55
Cost differential in favor of auction (expd. v. expd. alt.)	-88		81	-28318	336			61	54779			
Subsample model applied to subsample data												
Aftermarket value of issue	3172	5102	2120	583655	2209	3580		866	198774			
Actual issue cost	263	599	96	48326	294	1843		80	26419			
Expected actual issue cost	377	610	236	69371	396	895		131	35595	Auction	95038	347
Expected alternative issue cost	184	3234	291	33845	285	494		108	25667	Book bldg.	69440	253
Cost differential in favor of auction (act. v. expctd. alt.)	-79		195	-14481	-8			28	-751	Differential	-25598	-93
Cost differential in favor of auction (expd. v. expd. alt.)	-193		55	-35526	-110			-23	-9928			
Value-weighted average total issue cost estimates and differentials												
Subsample model applied to full sample data												
Actual issue cost (percentage)	9.0%	12.7%	5.2%		50.0%	76.5%		16.0%		Auction	12.45%	
Expected actual issue cost (percentage)	11.8%	12.1%	10.8%		19.3%	23.0%		15.6%		Book bldg.	13.88%	
Expected alternative issue cost (percentage)	8.9%	57.0%	14.7%		13.1%	13.9%		12.0%		Differential	1.43%	
Cost differential in favor of auction (act. v. expctd. alt.)	-0.1%		9.5%		36.8%	4.0%		3.7%				
Cost differential in favor of auction (expd. v. expd. alt.)	-2.9%		3.9%		6.2%							
Subsample model applied to subsample data												
Actual issue cost (percentage)	8.3%	11.7%	4.5%		13.3%	51.5%		9.3%		Auction	12.15%	
Expected actual issue cost (percentage)	11.9%	12.0%	11.1%		17.9%	25.0%		15.1%		Book bldg.	8.87%	
Expected alternative issue cost (percentage)	5.8%	63.4%	13.7%		12.9%	13.8%		12.5%		Differential	-3.27%	
Cost differential in favor of auction (act. v. expctd. alt.)	-2.5%		9.2%		-0.4%	3.2%		3.2%				
Cost differential in favor of auction (expd. v. expd. alt.)	-6.1%		2.6%		-5.0%	-2.6%						

Regression models from Table 6 are used to generate predicted values of total issue cost for IPOs by the pricing method actually used and estimates of hypothetical total issue cost under the alternative pricing method. Percentage estimates from the regression analysis are converted to Yen based on the aftermarket Yen value of the offering. Expected differentials in total issue cost are computed against actual and predicted total issue cost. Cost differentials reflect cost advantages of auction method pricing, ignoring any effect of pricing method on aftermarket price. Classification results are determined based on comparisons of predicted values from the regression models.

cost comparisons, in conjunction with the other benefits of book building, are more than offsetting.

6. Discussion

Japan's introduction of book building in 1997, as an alternative to its existing auction IPO method, is a market experiment that we use to examine the choice of regime as a policy question. We find evidence that Japan's auction method resulted in adverse selection. Under the auction method, high-quality issuers had limited ability to distinguish themselves from low-quality issuers. As a result, it appears that some high-quality firms elected not to issue.

When book building was introduced as an alternative, all issuers quickly switched to book building. By placing the underwriter in a more central role in determining IPO prices, book building addresses the underinvestment problem. However, book building also can lead to overinvestment in information about the relative values of issuers. When both offering methods are available, and firms differ in unobservable quality, book building can drive out auctioning even if book building increases aggregate total issue cost and does not reduce aggregate underinvestment by enough to offset the higher cost. Therefore the policy decision to permit book building cannot be based only on the revealed preferences of issuers. Instead, the impact on aggregate total issue cost, the magnitude of the underinvestment problem, and the benefits of more accurate pricing all are relevant to the regime choice.

Using a sample of IPOs by Japanese firms, we document that average total issue cost, measured as a percentage of aftermarket price, was significantly higher in the book-building regime than in the earlier hybrid auction regime. This result, however, does not compare the expected costs of auctioning and book building for particular firms. It also does not account for the possibility that, if only auctioning is available, some high-quality firms may underinvest. Based on models of expected total issue cost, we find that small and risky firms, as a group, incur higher costs with book building, but larger and better-established issuers realize cost savings.

To test for overinvestment in information, we estimate and compare, for each IPO in the sample, expected total issue cost by auctioning and by book building. Weighting the observations equally, the estimates indicate that average percentage total issue costs, if all IPOs in our sample were by auction, is less than if all were by book building. However, when results are weighted by issue size, the estimated aggregate costs of auctioning and book building are similar. This outcome favors book building for two reasons. First, auction method estimates do not reflect opportunity costs related to underinvestment. Second, issue cost estimates ignore other benefits of the more accurate pricing that book building affords.

The findings raise several policy issues: Given that, in Japan, the expected aggregate issue cost of book building is similar to that of auctioning and that book building reduces underinvestment and results in more accurate pricing, is it possible to generalize that equity capital markets are enhanced by permitting book building? Is there still a role for Japan-style auctions, the new auction experiments being tried in the United States, or other methods such as best efforts and competitive bidding that limit information production? Our evidence suggests that the answer depends partly on the mix of potential issuers. Offering regimes, such as Japan's book-building regime, that promote information production appear to be better in markets where desired issue sizes are large and where small issuers are heterogeneous, hard to value, and prone to underinvest if they cannot be valued accurately. Offering regimes, such as Japan's hybrid auction regime, that inhibit information production by issuers and investors may be better in markets where desired issue sizes are small, but prospective issuers are easy to value accurately with public information.

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