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Issue Cost and Method of IPO Underwriting: Japan's Change from Auction Method Pricing to Book Building

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Abstract

In 1997, Japan introduced book building an alternative to an auction method of IPO pricing that had been required since 1989. Shortly after its authorization, all IPOs in Japan were priced by book building. The shift occurred despite economic arguments and evidence suggesting that the auction method reduced underpricing. We attribute the shift to creation of an information-based pooling equilibrium where low quality firms that benefit from the imposed auction regime lose the benefit if high quality firms are free to select book building. We examine the effects of the regime change on total issue cost and characteristics of IPO firms. We find that, on average, total issue cost during the auction period would have been similar under book building, but that the regimes have differential effects. For large well-established issuers, book building reduced total issue cost. Small issuers had lower cost under the auction method, but high-quality small firms appear to have been foreclosed from issuing. Ignoring the effect of pricing method on underinvestment, our estimates of the simple average cost advantage of the auction method range from 6.9 percent of aftermarket value to –1.8 percent. Because, from a cost standpoint, book building benefits large issuers, the value-weighted effect of the book building method is unambiguously positive, averaging 136 million Yen per issuer in our sample, or 3.5 percent of aftermarket value. In aggregate, we estimate that reliance on the auction method from 1995 through late 1997 cost JASDAQ issuers 61 billion Yen more than book building would have cost. This estimate does not include any additional costs associated with underinvestment.

Issue Cost and Method of IPO Underwriting: Japan's Change from Auction Method Pricing to Book Building[1]

In the US, Japan, and many other countries, firm-commitment initial public offerings ("IPOs") are marketed and priced by a negotiation process that includes book building. The underwriter "builds the book" by soliciting non-binding indications of interest from investors and uses the information, along with information derived through its due diligence on the issuer, to negotiate the offering size and the offering price. Following convention, we refer to this type of negotiated offering as "book building."

Book building is widely believed to be an expensive process compared to alternatives such as auctions. Though direct evidence of relative issue cost is rare, it seems paradoxical that, when the choice is available, issuers generally select book building. Why not, for example, allow the market to determine the price directly by auctioning shares to the highest bidders? Or why not allow the market to determine offering size by setting the price and selling as many share as the market demands through a best efforts offering?

Issue costs include fees paid to underwriters and underpricing. Systematic underpricing when book building is used is well documented in the US and internationally.[2] Proponents of using auctions to determine IPO prices argue that auctions can reduce fees and reduce or eliminate underpricing. Underpricing may reflect inefficiency of the capital raising process, possibly due to the oligopolistic and closely-knit structure of the underwriting market.[3] Alternatively, it may be an efficient aspect of the process. Economic arguments consistent with

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[2] Loughran, Ritter, and Rydqvist (1994), and Jenkinson and Ljungqvist (1996) review underpricing in the US, Europe, Pacific-Basin, and Latin America.

[3] See, e.g., Baron and Holstrom (1980). This conjecture is particularly plausible in Japan, where there are few large underwriters and informal agreements on pricing and other aspects of the offering are openly sought.

efficiency are diverse and complex, with ramifications for the abilities of firms of differing quality to access the public capital markets.[4]

One defense of book building is the argument that by selecting it over the alternatives, issuers are expressing their preferences. Ostensibly, cost differences between book building and other approaches are not sufficient to outweigh the benefits investors perceive. Among the benefits, book building may: result in higher net proceeds, enable smaller and riskier firms to access public equity markets, enable issuers to raise larger amounts of capital, provide liquidity for early investors, place shares with preferred types of investors, and encourage underwriters to provide important aftermarket services.

We demonstrate, however, that, even in a competitive market for IPO underwriting, overwhelming selection of book building by is not incontrovertible evidence of issuer preference. The core assumption of our argument is that issuers (small and risky issuers, in particular) differ in quality in ways that are known to the issuers but not observable by investors. When issuers are constrained to use an auction method, investors determine bid prices or quantities based on observable characteristics of the issuer and the offering. Depending on the degree of investor uncertainty, the result can be a pooling equilibrium, in which all prospective issuers proceed with public offerings, or a separating equilibrium, in which only low quality firms issue.[5] This is, essentially, the Myers and Majluf (1984) underinvestment problem.

Book building, in addition to being means of gauging market demand, is a mechanism issuers can use to signal quality. With a fixed cost of producing the signal, equilibrium can result where high quality firms (compared to value as perceived by the market) select book building and a relatively homogeneous group of lower quality firms select auction. Allowing for

[4] See, e.g., Benveniste and Spindt (1989), Booth and Smith (1986), and Tinic (1988).

more realistic flexibility of the book building procedure, issuers may select book building to reduce but not eliminate investor uncertainty. In this case, all firms with attractive investment opportunities may issue and select book building.[6]

In this equilibrium, firms are sorted by quality. High quality firms obtain better terms than if all firms were required to issue via auction, and low quality firms obtain worse terms. Whether, in aggregate, book building is superior to auctioning depends on the aggregate additional cost of using book building, compared against the aggregate value of the underinvestment problem that its availability resolves.

While we cannot measure the net benefits of book building directly, a recent market experiment in Japan enables us to examine the relative issue costs of book building and auction IPOs and to study how issuers responded to the introduction of book building. In 1997, Japan changed from relying on an auction process to determine IPO pricing a regime where issuers are permitted to select either pricing method. In response, the Japan IPO market changed quickly to one hundred percent book building, even though the auction method remains available officially.

We use this dramatic shift to examine how the change affected issue cost, issue size, and the decision to go public. In comparison to Japan's auction method of IPO pricing, we find that for many large issuers, book building is actually less expensive. The cost advantage is separate from any benefits issuers may realize with regard to offer price or other aspects of the offering. For other issuers, we find that the cost disadvantage of book building is small, and within the bounds of what high-quality issuers reasonably could realize by using book building to signal quality. To examine the potential for the auction method to result in underinvestment, we use

[5] A mixed equilibrium is also possible, in which low quality firms issue and some, but not all, high quality firms forego issuing. See Giammarino and Lewis (1988). The refinement is not critical to our analysis.

population characteristics of issuers during the book-building period to estimate the likelihood of high-quality firms withdrawing from the IPO market during the auction regime. Our evidence suggests that imposed reliance on auctioning is an economically significant impediment to raising equity capital by such firms. Finally, consistent with our hypothesis that book building helps resolve informational asymmetry, we find that offering characteristics are affected by availability of book building. We examine, specifically, the choice of offering size. While size and cost are both endogenous, we find little evidence of econometric simultaneity.

Evidence related to the change in Japan is relevant to the US, where experimentation is occurring in the opposite direction, moving from book building to an auction method somewhat similar to the method used in Japan before 1997.[7] The study also is relevant to the choice between negotiated offerings and competitive bid offerings and to understanding the general absence of best efforts offerings. Japan's auction method has parallels to competitive bid offering in the US (used most commonly for public utility debt issues), in that the market determines the offering price and the underwriter's role in pricing is limited.[8] Best efforts offering is essentially another form of auction, where the issuer sets the price and investors determine the quantities they will buy. The underwriter does not guarantee offering proceeds and is not obligated to support the market after the offering.

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[6] If book building underwriters can achieve a comparable level of market demand information at a comparable cost to the cost of auctioning, low quality firms may notionally select book building, but without an economically meaningful difference from auctioning.

[7] W R Hambrecht & Co. introduced its "OpenIPO" electronic underwriting service in 1999. Bids are treated as non-binding indications of interest, and shares are sold at the lowest winning bid price. Investors base their bids on a preliminary prospectus that includes a filing range estimate of the closing value the underwriter expects in the offering. Hambrecht's stated objectives are to provide more equitable distribution of shares to bidders and to reduce or eliminate underpricing. See www.hambrecht.com.

[8] Prospective underwriters compete by bidding the net interest cost. Issuers generally accept the bid with the lowest net interest cost. In a study of the choice between competitive and negotiated offering, Smith (1987) finds that for risky debt issues, and during periods of volatile interest rate, competitive bidding results in higher net interest cost than negotiated offering.

I. Japan's IPO Pricing Experiments

The formula pricing regime: The 1997 change is the second major change of IPO pricing regimes in Japan's recent past. Before April 1989, IPO prices were determined by the underwriter in consultation with the issuer, using a procedure specified by the Japan Securities Dealers Association ("JSDA") and the stock exchanges.[9] The underwriter determined the offering price by applying a mathematical formula to the market prices and financial data of a small selection of public companies that the underwriter had identified as comparable.[10] The offering price was computed as the equal-weighted average of the relative earnings, dividends, and net assets of public companies, multiplied by their average price.[11] The underwriter purchased the shares from the issuer at the computed price and re-offered them to the market at the same price. For conducting the offering, the underwriter received a commission of approximately 3.5 percent.[12]

Though it was designed to do so, the pricing formula did not prevent systematic underpricing. Pettway and Kaneko (1996) document average initial returns of 62.1 percent for a sample of 110 IPOs on the Tokyo Stock Exchange. Apparently, underwriters were able to bias offering prices by selecting comparable firms with low market values, or limiting offering size.

The auction regime: In 1989, a political scandal related to underpricing led to the first change of IPO pricing regimes. Jenkinson and Ljungqvist (1996) report that Japan's prime

[9] See the report of Shoken Torihiki Shingikai (Securities and Exchange Council) (1989). The Securities and Exchange Council is the advisory council for the Japan Ministry of Finance. The council proposes and recommends institutional change of Japanese stock markets. The 1989 report addresses the shift to auction method.

[10] The underwriter might compute several alternatives, based on different groups of comparable firms, and negotiate the ultimate selection with the issuer.

[11] For documentation of the required formula, see the report of Shoken Torihiki Shingikai (1989).

[12] In this period, fees were fixed informally among underwriters at 3.5% plus 2 yen. These fees were paid from gross proceeds. According to the Nomura Securities, fees were reduced by agreement to 3.1% plus two Yen after January 1990. The percentage was not an explicit rule, but was a common practice. Until the 1997 change, regular meetings were held among top executive of the big four underwriters. The meetings, called "Yonsha Kai" (Yonsha

minister was forced to resign in April 1989, following public revelation that Recruit Company had attempted to buy political influence by selling off its Cosmos subsidiary in an IPO, and directing allocations of the greatly underpriced shares to public officials.

In the same month, Japan abandoned the formula that had enabled IPO underpricing to occur and implemented a formal tender process to determine the offer price. Under the new auction procedure, the issuer designates a substantial portion of the issue to be offered directly via auction.[13] A preliminary prospectus is available before the auction, but contains no information on intended pricing. Shares allocated for tender are offered using a first revised prospectus.[14] This prospectus specifies a range of acceptable bids, where the lower limit is determined by formula in a manner similar to the prior approach. Until April 1992, the minimum acceptable bid was determined by application of the formula, and the maximum was 130 percent of the minimum.[15]

At the close of the auction, shares are allocated to highest bidders first, until either the entire allocation is distributed or the minimum bid value is reached. This is a discriminatory auction where each bidder pays her own bid price.[16] A few days after the auction, a formal offering of the remaining shares takes place, using a final prospectus. Until April 1992, the

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means four companies. Kai means meeting) addressed matters of importance to the industry. Adjustments to practice were based on the meetings. Yonsha Kai is now abolished.

[13] Initially, 25 to 50 percent of total offered shares were required to be offered via auction. After April 1992, the percent of shares required to be offered was increased to 50. If less than 25 percent of the offered shares are ordered, the auction fails. Otherwise, all non-auctioned shares are sold via a formal offering. See the report of Shoken Torihiki Shingikai (Securities and Exchange Council) (1995).

[14] Under the auction process, the preliminary prospectus is available about 11 days before the bid range is determined. The first revised prospectus becomes available on the day after the minimum bid price is determined. Three days later, a one-day auction occurs.

[15] See the report of Shoken Torihiki Shingikai (Securities and Exchange Council) (1995).

[16] Japanese regulations preclude insider participation in the auction and, by significantly limiting the maximum number of shares any single participant can bid to acquire, discourage participation by large institutions.

offering price was set at the weighted average price of successful bids.[17] The prospect of acquiring shares at below the offering price encourages bidding in the auction.

With two modifications, this auction procedure was the sole method for determining the IPO offer price until September 1997. First, beginning in April 1992, Japan removed the upper limit on bids and reduced the lower limit to 85 percent of formula value.[18] Second, in December 1992, the requirement that shares in the offering be sold at the weighted average bid price was removed.[19] Underwriters and issuers were then freer to negotiate discounts.[20]

Particularly for the period before December 1992, Japan's auction method appears to have the potential to eliminate underpricing. If, on average, investors could correctly estimate the aftermarket values of IPO shares, then underpricing might be eliminated. However, if underwriters had sufficient control over the range of acceptable bids, offerings priced by auction still could be intentionally underpriced.[21] Using a sample of 37 Tokyo Stock Exchange IPOs from the first four years of the auction regime, Pettway and Kaneko find that offerings were still underpriced by an average of 12.0 percent. While underpricing persisted, they conclude that the change to auction significantly reduced initial returns and that public policy choices have the potential to limit underpricing.[22]

The book-building regime: Our study begins where the Pettway and Kaneko study ends. We examine the September 1997 introduction of book building. At that time, Japan did not

[17] See the report of Shoken Torihiki Shingikai (Securities and Exchange Council) (1995).
[18] The primary effect is to widen the range of acceptable bids. Pettway and Kaneko find no statistically significant impact of the change on average underpricing.
[19] The report of Shoken Torihiki Shingikai (Securities and Exchange Council) (1995).
[20] Based on prospectuses of IPO firms and an interview with Nomura Securities, before September 1997, underwriters generally acted as commission brokers. While they continued to purchase and resell the offering shares, they charged an explicit fee in exchange for their services related to placing the issue with investors.
[21] If demand is not perfectly elastic, some amount of intentional underpricing in the auction appears to be necessary to generate a price that would be accepted by investors in the subsequent IPO.
[22] While Pettway and Kaneko test for differences in levels of underpricing in the different regimes, they do not test for a structural break at the time of the change.

formally abandon the auction method, and still has not done so. Instead, it introduced the alternative of allowing issuers and underwriters to determine offer prices by negotiation, in a manner similar to US book building. Book building quickly dominated as the method of choice.

Under book building, the underwriter seeks indications of interest, primarily from institutional investors. The underwriter and the issuer determine the offering price by negotiation, in light of the underwriter's due diligence and evidence on demand derived through pre-marketing efforts. Under Japan's book-building method, there is no requirement that offer price be linked by formula to the values of comparable firms.

In contrast to the earlier change, 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 for underwriters to assess demand and limiting offering size; and due to low institutional involvement, pricing in the auctions was more heavily affected by market conditions than by fundamental value.[23] In addition, Japan recognized the apparent success of the US IPO market, where book building is the standard pricing method. As an overlying consideration, Japan was recovering from its economic collapse, and was seeking to promote access to capital markets for earlier-stage and riskier companies.[24]

[23] The report of Shoken Torihiki Shingikai (Securities and Exchange Council) (1995) and the interview from Nomura Securities documents these concerns.

[24] In July 1995, a second over-the-counter (OTC) market was established in Japan to encourage early stage and high-technology companies to seek external equity capital. This initiative sought to encourage more young high-technology companies to register on the JASDAQ market. The book-building method was introduced experimentally in this new market. In September 1997, it was extended to all IPOs on JASDAQ. Despite the initiative, only three young high-technology companies registered on the second OTC market between mid-1995 and 1998. The second market has now been absorbed into JASDAQ. See the report of Shoken Torihiki Shingikai (Securities and Exchange Council) (1995) and Kutsuna, Cowling, and Westhead (2000).

II. The Economics of IPO Pricing

Auction method: Under Japan's auction method, the underwriter's role in IPO pricing is extremely limited. Prospective investors bid prices and quantities on the basis of information in the prospectus. This information necessarily is a limited snapshot of the issuer's position and track record. Issuers cannot fully disclose intellectual property, strategic plans, or other proprietary information that could benefit rivals. Nor do issuers or underwriters intentionally make forward-looking statements upon which investors may later claim to have relied.[25] In addition, the prospectus that is used during the auction process in Japan contains a very broad range of acceptable bid prices, and, consequently, is not very informative about the underwriter's assessment of value. In addition, by excluding insiders and limiting each purchaser to bid for a maximum of 5,000 shares Japan' auction mechanism limits investor incentives to devote resources to valuation and prevents insiders and other informed investors from directly affect offering prices.

In the public offering that follows the auction, the underwriter pricing latitude is constrained by the auction results. The offering price cannot exceed the weighted average auction price, and cannot be significantly lower than the weighted average without jeopardizing the auction. A practice of materially discounting the offer price could threaten the integrity of the auction, as those wishing to acquire shares would have incentives to submit lowball bids or wait for the IPO.

If the auction process were truly measuring demand, who would be left to buy the shares in the IPO? With the price established on the basis of the auction, prospective investors in the IPO include bidders who valued the issue more highly than the offer price, bidders who want

more shares but are constrained by the auction limits, investors who are interested in the issue but want to free ride on the auction valuation, and investors who are advised in some way by the underwriter that the offering is attractively priced. Thus, while the auction guarantees that any investor can receive some of the shares, it does not prevent the underwriter from favoring preferred customers if the remaining shares are underpriced in the IPO.

Because issue prices are based on auctions where investors can have very limited information compared to issuers, Japan's auction process can give rise to the Myers and Majluf (1984) underinvestment problem, particularly for small high-risk firms. In their model, existing shareholders may desire to issue either because the firm has valuable investment opportunities or because they believe the market would overvalue the firm's existing assets. In a slight restatement, suppose firms that, to outside investors, appear to be identical, in fact vary in the quality of their existing assets. We designate the value of existing assets of the i_{th} firm as A_i, where $i = H$ (high) or L (low) quality. Whereas investors know only the probability distribution of prospective issuer types and firm values conditional on type, issuers know the firm's type. Firm *i* has the opportunity to undertake a new investment with NPV_i by investing *E*, but has no financial slack. To pursue the investment, the firm must raise *E* in the form of new equity. The value of the firm, if it and invests, is, therefore, $V_i = A_i + E + NPV_i$.

Because we are interested, partly, in the difference in total issue cost between auction and book building, we define *E* from the perspective of investors, as the aftermarket value of equity that would be issued to fund the investment. Correspondingly, we define NPV_i as net of all auction-method issue costs. Thus, we treat measurable issue costs, including underwriter fees

[25] This is true in the US, even following the 1995 Private Investor Securities Litigation Reform Act. The Act formally protects issuers and underwriters from liability for non-fraudulent forward looking statements, but still leave open the prospect of litigation over arguably fraudulent or misleading statements.

and underpricing, as a reduction in NPV_i. Consistent with Myers and Majluf, we assume that issuers are attempting to maximize the value of existing shares and that the IPO market is competitive. Accordingly, IPO investors require an ownership share, *s*, of each issuing firm such that $s = E / \sum_i (p_i V_i)$. Where p_i is the probability that an issuer is of type *i*.

Consider a group of observably identical firms, which differ in the unobservable quality. Assuming that each seeks to raise *E* to fund new investment, a necessary condition for pooling to occur is that $E/(p_H V_H + p_L V_L) < (E + NPV_H)/V_H$. In this expression, $E/(p_H V_H + p_L V_L)$ is the fraction, *s**, of post-issue equity that investors would require if they were to assume that all firms issue, and $(E + NPV_H)/V_H$ is the fraction of post-issue value that is attributable to the new investment of high quality firms. The condition holds because, equivalently, $(1 - s^*)V_H > A_H$. Existing owners of type *H* firms are better off by issuing than not issuing, even though some of the positive net present value is share with new investors. Existing owners of type *L* firms will naturally go along, as, ultimately, they are the beneficiaries of the wealth transfer from type *H* firms.[26] In this case, because all firms issue, the underinvestment problem does not arise.

If the above condition is reversed, $E/(p_H V_H + p_L V_L) > (E + NPV_H)/V_H$, then investors who assumed that both firm types issue would demand a fraction of type *H* equity that would cause such firms to forego issuing. Because firms that elected to issue would be revealed as type *L*, investors would demand E/V_L as their share of post-issue equity, and high quality firms would underinvest.

To facilitate discussion of our empirical analysis, we define the aftermarket price of an offering as the reciprocal of the share of equity new investors acquire. Thus, $P_L = V_L / E$ in the

equilibrium where only type L firms issue, and $P^* = (p_H V_H + p_L V_L)/E$ in the pooling equilibrium. The issue price benefit of pooling to type L firms is $P^* - P_L$.

The above discussion implies that a pooling equilibrium is more likely when E is small, compared to V_H, NPV_H is large, V_L is not much lower than V_H, and p_L is low. Empirically, we believe this implies that pooling is more likely among groups of large and well-established firms than among small and risky firms with limited track records. If, under Japan's auction method of IPO pricing, high quality firms are unable to distinguish themselves from low quality, except by foregoing issuance, the aftermarket prices of small and risky issuers will be more like P_L and those of large and well-established issuers will be more like P^*. If, as we infer from some of our evidence, underinvestment is more prevalent among small and risky firms, then our empirical analysis will tend to underestimate the true expected total issue cost for such firms. Had pooling occurred, the aftermarket prices of lower quality firms, those that did issue, would have been higher, resulting (based on the actual offering terms) in more underpricing and higher total issue cost. In addition, we cannot measure of the value of lost opportunities due to underinvestment. Thus, our empirical analysis is potentially biased in favor of the auction method.

Book building: With book building, offer price and issue size are results of negotiation between the issuer and the underwriter. While the explicit information content of the prospectus is the same as in the auction prospectus, the underwriter is at the heart of issue pricing. In contrast to the formula-based broad price range that is supplied to bidders in the auction, the filing range in the book-building preliminary prospectus is a representation about value as perceived by the underwriter. The underwriter can use the filing range to reflect the value implications of private information assessed in the due diligence process or through its long-term

[26] Giammarino and Lewis (1988) and Cadsby, Frank, and Maksimovic (1990) identify three possible equilibria:

relationship with the issuer.[27] In addition, the underwriter can use the book-building road show to convey its assessment to investors and to infer the valuations of institutional investors, who are likely to be better informed than the small bidders in a Japan-style auction.[28]

Because institutional investors are long-term clients, the underwriter can be expected to support its value representations in a variety of ways. Price stabilization enables investors to exit without loss, informal ex post settling up arrangements and intentional underpricing can compensate repeat customers for holding shares that decline in value after the offering, and litigation can protect investors against incorrect information or inadequate due diligence.[29]

Because its due diligence, book building, and value certification services can positively influence the market's valuation of high quality issuers, total issue cost can justifiable be higher than under auction. The higher cost can be in the form of a higher fee, or greater underpricing, as underpricing can reduce the underwriter's cost of formal due diligence and marketing and can protect the underwriter from ex post costs of price stabilization, settling up, and litigation.

Suppose that by incurring an additional cost of *C*, a firm under the auction method can use book building to reveal its type to the underwriter. The underwriter, in turn, reflects this information in the offer price and uses it to build the book. By incurring *C*, a high quality firm can reduce the fraction of equity it must issue to fund its investment opportunity to $s_H = E/V_H$, and can be valued in the aftermarket at price, $P_H = V_H / E$.

Compared to the separating equilibrium under the auction method, where type *H* firms do not issue, these firms will select book building if the additional cost is less than the share of

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pooling, sorting, and semipooling. They examine the conditions under which each attains.

[27] Booth and Smith (1986) and Benveniste and Spindt (1989) offer different but complementary discussions of the underwriter's role in information production and offer price certification.

[28] Rock (1986) discusses the role of underpricing as a mechanism for involving informed investors in IPOs, Benvineste and Spindt (1989) characterize underpricing as compensation to such investors for revealing their information.

value retained by existing investors minus the total value of existing assets, $C < (1-s_H)V_H - A_H$. This condition is satisfied if $C < NPV_H$, where NPV_H is already net of all auction-method issue costs. In the resulting equilibrium, type *H* firms issue and choose book building. Type *L* firms continue to issue by auction method and to be recognized as type *L*. Thus, for firm groupings where imposition of the auction method results in separation, introduction of book building, if it is selected, is unambiguously welfare enhancing. The extra issue cost is incurred to overcome the underinvestment problem.

If the auction equilibrium is a pool, however, the welfare effect is negative. Compared to the equilibrium, where all firms issue, type *H* firms select book building if the additional cost is less than the existing investors' share of the market value gain:

$$C < (1-s_H)V_H - (1-s^*)(p_H V_H + p_L V_L),$$

or, equivalently,

$$C < (1-p_H)(A_H + NPV_H) - p_L(A_L + NPV_L).$$

The condition is more likely to be satisfied if differences in publicly unobservable value are large and the probability that a firm is type *H* is low. In terms of issue prices, high quality firms will select book building if the increase in aftermarket price is greater than the per share cost of the additional expenditure. In this case, the welfare effect is negative and equal to the increase in issue cost. High quality firms gain by incurring *C* to reveal their type, but there is no underinvestment. The gain is only a wealth transfer from type *L* firms, as their type is revealed.

The theoretical model is highly stylized. Even though high quality firms can benefit by distinguishing themselves, they have no means of doing so, except for not issuing or incurring *C* as a fixed amount. This is because firms are of only two types, the required amount of equity

[29] See Tinic (1988).

financing is fixed, and quality revelation is complete. In reality, firms are of varying quality, underwriters can make partial assessments of quality, and issuers can vary offering size.

Suppose the distribution of unobservable quality levels is continuous and that the extent of due diligence and book-building effort affects the precision of the underwriter's estimate of quality. If so, higher quality firms will purchase underwriter effort up to the point where the marginal gain equals marginal cost. Because the underwriter must make its representations of value credible to investors and because its costs of book building are positive, issuers face a trade-off between direct issue cost paid to the underwriter and the cost of underpricing. If, as is reasonable to expect, the underwriter's efforts are subject to scale economies, then underpricing will be greater for small issues by firms with limited track records. High quality firms also can attempt to distinguish themselves by limiting offering size.

In this more realistic context, the equilibrium may result in some lower quality firms selecting auction or in all firms selecting book building. If book-building underwriters can vary effort levels to achieve market valuations comparable to those under auction, and can do so for comparable cost, book building can displace auction, even for low quality issuers. With book building, the underinvestment problem is eliminated for any firm where the share of NPV retained by existing owners is more than the additional issue cost.

However, for the reasons discussed earlier, universal selection of book building and mitigation of the underinvestment problem does not guarantee that issuers prefer the book-building regime or that book building is value enhancing in aggregate. Because high quality issuers are apt to select book building if it is available, the decision to authorize use of book building is a question of public policy. In the empirical analysis of the cost of book-building IPOs, if all firms issue, the observed aftermarket prices are, on average, analogous to P^* in the

earlier discussion.[30] Thus, in contrast to the auction regime, we are able to measure the full cost of book building. Because estimates of auction method costs do not reflect opportunity losses associated with underinvestment, comparisons of total issue cost estimates are not fully informative about relative net benefit of auction and book building. Because auction method costs are underestimated, if book building is estimated to be less costly than auction, then book building is preferred. However, if auction is estimated to be less costly, then the balance between the two approaches depends on the underinvestment cost in the auction regime. The value of book building increases with the seriousness of the underinvestment problem.

III. Data

To study the impact of the September 1997 regime change, we use a sample of 484 IPOs by companies that listed on the primary JASDAQ market or one of the JSDA OTC markets during the five-year period from 1995 through 1999.[31] The sample includes 321 auction and 163 book-building IPOs.[32] We focus on JASDAQ instead of the Tokyo Stock Exchange because JASDAQ is the primary market for IPOs in Japan. Only 59 IPOs occurred on the Tokyo Stock Exchange during the same five-year period.

We obtain detailed financial data and issue data for the firms from the Research Group for Disclosure database (1996-2000). Firm data include sales revenue, net equity, shares outstanding, firm age, and number of employees for the year before the offering. Issue data include the offering date, number of shares issued, amount raised, issue price, first aftermarket price, and other offering details. We extract data on investor ownership from the top 10 Shareholders List in the prospectus of each company.

[30] Individual firms may be valued between P_L and P_H, based on dimensions of quality that are unobservable to us.
[31] The sample excludes four registrations of firms that were delisted from JASDAQ due to their inability to continue to satisfy listing requirements, and 3 registrations on the second division of the OTC.

Toyo Keizai Inc. provides daily stock price data and stock split adjustment factors for the JASDAQ and stock exchange-listed companies. However, data for the companies that leave the market are not included. In our sample, there are six such companies. Departures are due mainly to mergers and acquisitions. We use the JASDAQ Index as a measure of overall market performance. JSDA provides JASDAQ Index data on a daily basis.

Issue cost: Our primary analytical focus is on total issue cost, which we define as the sum of underwriter fees and underpricing. In Table 1, we contrast underwriter fees, initial returns, and total issue cost for book-building and auction-method IPOs. Studies of issue costs and underpricing generally standardize by offer price. In Panel (a) of the table we follow this convention. However, this standardization has several drawbacks. Econometrically, it heavily weights outlier issues that turn out to be severely underpriced. Conceptually, issue cost is better measured as the percentage difference between market value and net proceeds. Accordingly, in Panel (b) we standardize by first aftermarket price. The transformation is consistent with our earlier theoretical discussion of issue cost and yields distributions that more closely approximate normality. In our empirical analysis of total issue cost, we standardize by first aftermarket price.

Our results comparing all auction IPOs with all book building IPOs are consistent with the findings of Pettway and Kaneko, who examine Japan's earlier change from formula pricing to auction method, in that initial returns and total issue cost are significantly lower during the auction period. Presented in this summary fashion, the results appear to suggest that the shift to book building has led to greater underpricing and higher total issue cost. Measured against aftermarket price, total issue cost of book building IPOs averages 27.28 percent, compared to 11.39 percent for auction IPOs. However, the entire increase cannot be ascribed to book

[32] We classify the two firms that used the auction method in the month after Japan authorized book building as auction-method issuers.

building. Figure 1 illustrates that the statistical comparisons in Table 1 are misleading. Although book building was introduced in September 1997, there is no discernable change in the typical level of underpricing until the end of 1998.

To address the inference from Figure 1, that 1999 is a fundamentally different period in the market from the previous years, we sometimes base our analysis on data excluding 1999. In a similar vein, to address a possible concern that, over the five-year study period, the IPO market may have changed for reasons unrelated to the introduction of book building, we sometimes base our analysis on data excluding 1996. The resulting three-year window, from 1996 through 1998, is a period of relatively stable capital market conditions and is short enough to control for many factors other than the regime change. Thus, in Table 1, we also report and test differences between post-1995 auction IPOs and pre-1999 book-building IPOs. The difference in total issue cost between these groups, though smaller, is still highly significant.

Capital market uncertainty: Capital market uncertainty is a possible reason for increased issue cost during the latter part of the book-building period. Whether by auction or book building, the offering process includes specification of a bid or filing price range. The range is established based on market analysis and information, during a period that begins several weeks before the offering.[33] During periods of high uncertainty or market volatility, deviations between pricing ranges and after market values are likely to increase. After market declines, offerings are more likely to be cancelled because demand is not sufficient in the initial

[33] Derrien and Womack (2000) study auction and book building processes in France and find evidence that the French-style auction is associated with less underpricing and less uncertainty of underpricing. They attribute the results to the auction method's ability to incorporate more information about recent market performance into the offer price. Important timing aspects of the French auction process are different from the Japanese process. Because auction method and book building IPOs are not concurrent in Japan, we are unable to assess whether their findings would also apply to Japan.

price range. After market runups, offerings may go forward, but offer prices are unlikely to be adjusted fully. In such cases, underpricing can increase. [34]

Market runup is a partial explanation for the increase in underpricing in 1999. Figure 2 shows the JASDAQ Index over the study interval. During the auction period, the Index generally fluctuates between 40 and 60 and the overall direction of movement is negative. Both factors tend to limit observed underpricing. The negative drift persists through the first half of the book-building period. However, during 1999, the Index increases by more than 300 percent. This period of rapid percentage increases corresponds to the high initial returns in figure 1.

In Panel (a) of Table 2, we report two measures of market runup. The first is the percentage increase in the JASDAQ Index over the 40 market days before the IPO. We use this as an indication of the unexpected change in the market from around the time the offering decision is made until the time of the IPO. The second measure is the percentage increase in the JASDAQ Index from 100 market days before until 40 market days before the IPO. We use this measure as an indication of the change in the market leading up to the approximate date of the offering decision.[35] The measure allows for the possibility that market performance may influence the offering size. The table shows percentage changes in the JASDAQ Index and total issue cost for the IPO groupings we study. The data and related statistical tests demonstrate that 1999 was a period of unusually rapid runup and that the post −1995 auction IPOs and pre-9999 book building IPOs had similar market changes in the 40 days before the offering.

Issuer track record: Underpricing and total issue cost may be larger for issuers with less well-established bases for valuation. Underwriters are likely to have more difficulty estimating

[34] Hanley (1993) documents that offering prices only partially adjust to demand that is higher or lower than the filing range in the preliminary prospectus.

[35] 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.

the market values of younger and smaller issuers.[36] Panel (b) compares the track records of issuers during the various periods of the study. Firm age, number of employees, equity book value, and sales revenue all are higher for auction period issuers than for book-building issuers. The pattern is similar but significance levels are lower when the comparisons are limited to the 1996-1998 three-year interval. Premoney valuation is an estimate of the pre-issue market value of existing equity and is calculated based on the issue price. Median values are smaller for book-building samples, even thought increases in market prices during 1999 contribute to higher values for issuers in that year.

Results in the table are consistent with the view that book building helps reduce the informational asymmetry that leads to underinvestment in the auction period. Our evidence provides no support for a (non-mutually exclusive) alternative view that the increased percentage of small and young issuers was caused by the rapid market runup that occurred during 1999. The evidence in Panel (b) suggests that higher average total issue cost during the book-building period is associated with the higher proportion of IPOs by smaller and younger issuers.

Underwriter and venture capitalist certification or market power: Panel (c) of the table shows that the average underwriter market share of IPOs was higher during book building than earlier. Thus, the industry became more concentrated.[37] However, the entire increase is due to the failure of Yamaichi, the underwriter with the fourth highest share during the auction period, and the concomitant increases in shares of the top three remaining underwriters: Nomura, Nikko,

[36] Beatty and Ritter (1986) provide empirical evidence of a positive relation between the ex ante uncertainty about an IPO firm's value and the level of underpricing.

[37] Kutsuna (1997) documents that underwriting in Japan is concentrated among a small number of large securities companies, in contrast to the US and UK. The market share of IPOs of the top 15 underwriters is around 50% in the US in contrast to 100% in Japan. In our sample, the big 4 securities firms underwrote about 80% of the auction IPOs: Nomura 32.7%, Daiwa 17.4%, Nikko 17.4%, and Yamaichi 13.1%. After the introduction of book building and the failure of Yamaichi, shares of the big 3 increased: Nomura 33.1%, Nikko 25.8%, and Daiwa 20.9%.

and Daiwa. The cumulative share of the remaining 12 underwriters remained constant at 19 to 20 percent. Thus, it does not appear that the regime change caused the concentration increase.

In Table 2, we also report information on venture capital backing. Panel (c) documents that the percentage of offerings with venture capital backing is significantly higher during book building than during auction. This is consistent with the view that the change to book building increased capital-market access for issuers that normally would attract venture capital. While the percentage of IPOs with venture capital backing is highest in 1999, the pre-1999 book-building IPOs are also significantly more likely to be venture capital backed than auction IPOs.

Other endogenous variables: Issue scale and allocation of proceeds: In Panel (d), we test for a relationship between pricing method and two different measures of offering size. Consistent with the view that removal of the auction-method constraints led to enhanced access to the capital markets by small issuers, the median amount of capital raised is significantly smaller under book building, but issue size relative to shares outstanding is significantly larger. This is true, particularly for the three-year subsample. The other comparisons of absolute amounts are distorted by the 1999 market runup. Both differences are in the direction of greater flexibility for issuers. Smaller issues appear to be more possible under book building, as are issues that are large relative to issuer size. The results are consistent with the view that book building help to address the underinvestment problem for small and risky issuers.

IV. Empirical Analysis

The decision to issue: Table 2 documents that auction issuers are older and larger than book building issuers. This pattern is consistent with the view that high-quality firms sometimes do not issue by the auction process because they are unable to reveal their true quality to

investors.[38] While it is not possible to identify firms that did not issue in the auction regime but would have if book building were available, we, nonetheless, can use descriptive data on issuers to develop a rough estimate of the number of firms that elected not to issue.

Table 3 presents the results of four different estimates of the size of the non-issuer population during the auction regime. The estimates are generated based on three assumptions. First, we assume that with regard to a descriptive firm attribute, such as age or employment, the distribution of potential issuers is the same during the auction regime as during book building. Second, we assume that book building enables IPOs to be priced on the basis of the firm's true quality and 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 true populations of prospective issuers, unobservable aspects of firm quality are sufficiently unimportant that all firms that would issue by book building would also do so by auction.

In Panel (a), we report estimates of the numbers of auction-period non-issuers on the basis of firm age distributions. We derive these estimates first on the basis of all five years of IPO data, and second on the basis of the three-year subsample. When the subsample is used, we scale the estimate of non-issuers up to produce an estimate of the number of non-issuers during our full auction period. The estimates in Panel (b) are based on the same methodology, but using distribution data on number of employees. Our estimates of the number of non-issuers during the auction regime range from 102 to 145. Given that 163 auction-method IPOs occurred the estimates imply that a substantial fraction of potential issuers did not do so under the auction regime.

The Underwriter's Role and the Structure of Issue Costs: The previously noted informal agreement, during Japan's auction regime, to fix underwriting fees as a percentage of gross

[38] While we

proceeds helps explain why the auction method could discourage a large fraction of potential issuers. The fee was fixed at well below the average fee during book building. If the underwriter's costs of marketing the issue are partly fixed in absolute terms, then fixing the percentage fee could discourage or impede small firms from offering.

If the underwriter's issue pricing role in the auction process is different fundamentally than in book building, the differences should affect the structure of issue cost. First, if the underwriter performs more important due diligence, pre-marketing, price support, and value certification functions for book building IPOs than for auction IPOs, then firm characteristics should affect underwriter fees and/or underpricing of book building IPOs to a greater extent than of auction IPOs. Second, underwriters with established reputations should be more able to charge higher fees for book-building IPOs.[39] Third, corresponding to the inability of such underwriters to charge higher fees for auction IPOs, they may be able to reduce their direct underwriting costs by underpricing more. Because ability to underprice is limited by the pricing constraints of the auction process, 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 fees or underpricing should decrease with increases in issue size. Finally, fees and underpricing should be substitute components of total issue cost.

[39] Underwriters with larger market shares may be able to earn superior returns on their efforts for any of several reasons: First, an underwriter with larger share may have superior ability to place an issue. Second, an underwriter with large market share may be more credible as a certifier of value. Third, underwriters with low shares may compete more aggressively for business, sacrificing short-run profitability to develop reputational capital. These factors all imply that underwriters with larger market shares are able to earn higher fees. Conversely, an underwriter with reputational capital should be able to price a high quality offering more fully. Booth and Smith (1986) and Carow (1999) analyzed the relation between underwriter reputation and level of compensation. They documented that more prestigious underwriters charge higher spreads and attribute the differential to a return on investment in reputational capital. Additionally, evidence from the US (Carter and Manaster, 1990) indicates that underwriter reputation is positively related to issuer quality. Such a relationship could lead to a negative association between underpricing and underwriter market share. Carter, Dark, and Singh (1998) find that IPOs managed by more prestigious underwriters are associated with less underpricing.

We examine the determinants of underwriter fees and underpricing in Table 4.[40] We report results for both the full sample and the three-year subsample. In the underwriter fee models, we specify the fee as a percent of issue price, so the measure is not affected by underpricing. The fee models are fully interacted for differences between auction and book building IPOs, and include variables related to issuer track record, issue size, and underwriter market share. In the underpricing models, we standardize underpricing by first aftermarket price. Except for market runup over the 40 days before the IPO, the underpricing models are also fully interacted with respect to pricing regime. We restrict the runup coefficient to be the same in both regimes because of the limited cross-sectional volatility of underpricing during the auction regime. For underpricing, we again test for differences related to issuer track record, underwriter market share, and issue size. We also include underwriter fees (standardized by issue price) as a possible explanatory variable. The model structures in Table 4 are consistent with a paradigm where underwriter fee is determined first, and intended underpricing is established second, based on the fee. By including market runup, we allow for actual underpricing to be affected by unanticipated changes in the market.

Results in Table 4 conform to expectations. Except for the intercept of about 3.5 percent, we have virtually no ability to explain underwriter fees of auction IPOs. Conversely, for book building IPOs, issuer track record variables and underwriter market share both are significant. While we anticipated that firm age would be negatively related to underwriter fees for book building, it appears that the significant positive relationship is more than offset by a substantial reduction in underpricing for older firms. Older firms pay somewhat more to the underwriter, but, in return, are substantially less underpriced. We find a similar pattern with regard to issue

[40] In Tables 4 and 5, we report model specifications that are parsimonious, while allowing for testing of various hypothesized relationships. Adding more indicators of issuer age or track record does not materially affect the

size, where the non-significant fee coefficients for book building IPOs are paired with significant negative underpricing coefficients.

With respect to underwriter market share, our measure of reputation, for auction IPOs share there is no significant relation to fees, but the relation to underpricing is significantly positive. Underwrites with high market shares underprice more. For book-building 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 essentially reverses the positive coefficient for auction IPOs. The reversal is indirect evidence that fees and underpricing are substitute components of total issue cost. The more direct measure, underwriter fee, is not significantly related to underpricing. This result, however, is consistent with substitution. In the underpricing models, underwriter fee is standardized by offer price. When it is standardized by aftermarket price, the substitution effect becomes almost automatic. If, as in the auction regime, fee is fixed as a percent of issue price, then increased underpricing reduces the fee as a percent of aftermarket price. For the two not to function as substitutes in true measures of total issue cost, underwriters would need to charge higher percentage fees when they anticipated underpricing to be high. As, based on the Table 4 results, they do not appear to do so, higher underpricing effectively reduces the underwriter's fee, when fee is measured against aftermarket price.[41]

Total issue cost and issue size: The difference between the regimes in average total issue cost, as shown in table 1, suggests a paradox. Why would issuers uniformly select book building if it leads to higher fees and greater underpricing? The table seems to imply that the regime change is harmful to issuers and, therefore, that election of book building may not be voluntary on the part of at least some issuers. Conceivably, the shift occurred because high quality issuers

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models' overall explanatory power and does not materially alter our findings in the remainder of the paper.

[41] The coefficient on underwriter fee, when it is standardized by aftermarket price, is negative and highly significant.

can benefit from the more central role of the underwriter in issue pricing under book building. In addition, the differences in Tables 1 and 4 suggest that underwriters may benefit from higher fees and reduced effort-related costs that can result from greater underpricing.

To examine the impact of the regime change, we model expected total issue cost for issuers by auction and by book building. We use the model to estimate the hypothetical of total issue cost that issuers would have realized had they used (or been able to use) the other offering method.

The customary approach of comparing expected cost under different issuance methods is to employ a simultaneous equation system to control for choice selectivity. However, in this case, self-selection between approaches does not bias the estimates. Issuers during the auction period were not able to select book building and, as virtually all issuers during the later regime selected book building, there is no self-selection bias among either group of issuers. This still leaves open, however, the question of which regime is expected to maximize the aggregate net present value of investment opportunities after all issue costs, which is the focus of our analysis.

The underinvestment problem implies that there also may be a self-selection censoring effect with respect to the decision to go public, particularly during the auction regime. While we are unable to control formally for censoring, we recognize the direction of the potential bias on our estimates of expected issue cost and factor it into our interpretation of results.

While the IPO pricing regime is expected to affect issue cost directly, prospective issuers can respond to the regime change by adjusting issue size. The data summarized in Table 2 demonstrate that the mean and median sizes of auction IPOs are significantly larger in absolute terms, but smaller as a fraction of outstanding shares. This raises the prospect that, in an econometric sense, total issue cost and issue size are simultaneously determined. We tested this

possibility by estimating a simultaneous system for percentage issue cost and absolute issue size. However, the exogenous variable coefficients were not significantly different from ordinary least squares results and the endogenous variable coefficients were not statistically significant. The findings suggest that the pricing regime affects the characteristics of issuing firms and the sizes of offerings they select, but that issue size is not selected to affect total issue cost. Correspondingly, after controlling for issuer characteristics, total issue cost as a percent of first aftermarket price bears little relation to absolute issue size.

In the first two numerical columns of table 5, we present the ordinary least squares empirical models of total issue cost. We select variables for inclusion in the models based on the financial economics literature, as discussed above. To control for the effects of unanticipated market run-up on measured issue cost, we include the runup in the JASDAQ Index, measured over the 40 market days before the offering. Because the auction period is one of relatively little change in market values, compared to the book-building period, the strength of the relationship is difficult to gauge in the auction period. Consequently, we restrict the coefficient on market run-up to be constant over the entire sample period. But for this exception, the total issue cost models are fully interacted with the binary book-building period indicator variable. Thus, we base our estimates of expected total issue cost of auction IPOs on the coefficient estimates excluding the book-building variable, and its interactions with other variables. We base our estimates of expected total issue cost of book-building IPOs on the complete models.

Results in Table 5 are consistent with earlier discussion. Our interpretations, in some cases, draw on the Wald tests of restrictions reported at the bottom of the table. Issue cost is significantly greater after periods of rapid runup, suggesting that offer prices do not adjust quickly or fully to overall changes in the market. Issuer age, sales revenue, and book value of

equity are not significantly related to the total cost of auction IPOs. The incremental coefficients of these variables for book-building IPOs all are significantly negative. Results are consistent with the view that, using book building, issuers with established track records face lower costs of going public than do other issuers.

Expanding on discussion of Table 4, our results in Table 5 indicate that during the auction period, underwriters with larger market shares are associated with higher levels of total issue cost and that the relation essentially disappears in the book-building period. For high-market-share underwriters, lower underpricing offsets the higher fees reported in Table 4. Market share is the only variable for which a statistically significant coefficient on the incremental relation in the book-building sample has the opposite sign of a significant primary relationship in the auction sample. The empirical relationship of total issue cost to venture-capital backing, in Table 5 suggests a certification or monitoring role for venture capitalists.[42] Particularly for the three-year subsample, book-building IPOs with venture capital backing have lower total issue cost. The result suggests that venture capital backing can substitute, to some extent, for an issuer's track record, as venture capitalists tend to associate with younger and smaller issuers.

In the last two columns of Table 5, we report our findings for issue size. Because issue size is a function of price and because issuers may attempt to time offerings by issuing more

[42] Megginson and Weiss (1991) argue that venture capitalists provide certification. Barry, Muscarella, Peavy, and Vetsuypens (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 sold equity stakes after flotation under-perform companies in which venture capitalists did not invest or maintain equity stakes. Kutsuna and Okamura (1999) examine the association between venture capital ownership and operating performance of JASDAQ companies after IPOs. They find that the level of VC ownership after IPO is statistically related to 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. Hamao, Packer, and Ritter (1999) find that venture-capital backed offerings are associated with higher initial returns for both US and Japanese firms.

shares after a market runup, 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 will be more receptive to an offering that represents a small fraction of outstanding shares. The effect of relative size on market receptivity is implied by investor concern with the issuer's incentive to sell when the market is likely to overvalue the shares. To test for this, we include a measure of pre-offering firm value, which we compute as the product of issue price and shares outstanding before the offering.

The Table 5 results for issue size are a contrast with those for total cost. First, the interacted intercept coefficient for book-building IPOs nullifies the positive intercept for auction IPOs. Second, firm track record measures are positively and significantly related to the issue size of auction IPOs. In most cases, incremental coefficients for book-building IPOs are not significant. The exceptions, in the three-year subsample model, are that the auction IPO coefficient on sales revenue is reversed and the book-building coefficient on equity book value is significantly positive. On inspection, it appears that this result is 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 very large ones. Pre-offering firm value is positively related to the issue size of auction IPOs, as expected, and the incremental book-building coefficients are also positive. The incremental coefficients suggest that book building enables issuers to increase offering size, consistent with the view that book building helps address investor concerns with overvaluation and that firms respond by selling more shares.[43]

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[43] Consistent with the incentive of high quality firms to mitigate uncertainty, if investment can be staged, a firm could seek minimum funding initially and wait for the market's undervaluation to be resolved. Assuming that quality differences would be discernible to investors a short time after the offering, Allen and Faulhaber (1989)

Economic significance of the regime change: While the models in Table 5 demonstrate that the pricing regimes are significantly different from each other along a number of dimensions, they provide no evidence of the economic significance of the differences. To evaluate economic significance the model predictions must be applied to a population of issuers and expected cost differences of the two approaches must be measured. We use the models and our sample of IPOs to derive statistics on expected total issue cost for the IPO pricing method actually used in each IPO and of the hypothetical expected cost of the same offering by the

develop the argument that relatively high quality firms can use to use offer size as a quality signal. The cost to low quality firms of imitating the issue size decisions of high quality issuers is that they lose the opportunity to benefit from the wealth transfer that occurs in any residual pooling equilibrium. This type of signaling equilibrium implies that IPO sizes of high quality firms are more likely to be small and that such firms are more likely to make seasoned offerings shortly after the IPO. It also implies that seasoned offerings shortly after IPOs are more likely in the auction regime. Although 42 of the IPOs in our sample were followed by seasoned offerings within one year, we found no significant differences related to regime. Firms that make follow-on seasoned offerings are slightly younger than their cohort groups, but the differences are not statistically significant. Compared to cohorts, there are no significant differences in offering size as a percent of shares outstanding.

alternative method. In doing so, we are treating the actual issuers as a sample from the population of potential issuers.

Our approach is subject to the previously mentioned limitations: that high quality firms that elect not to issue in the auction regime are excluded; that estimates of total cost for auction method are biased downward as a result; and that the predictions of total cost are only point estimates such that statistical tests of differences are not possible.

Table 6 contains a summary of the equal-weighted results. While the table contains three sets of comparisons, the results are similar in each. We focus discussion on results when the issue cost model for the three-year subsample is used to estimate expected total issue cost for the entire five-year sample of IPOs. The table indicates that, for IPOs actually priced by auction, mean and median expected total cost are estimated to have been slightly higher under book building. Based on means, the expected cost advantage of pricing by auction is 1.15 percent of first aftermarket price. Based on medians, it is 1.66 percent. For IPOs actually priced by book building, mean and median differences in expected total cost suggest that book building is less expensive. The computed cost advantages of book building are 1.35 percent based on means and 1.25 percent based on medians. These estimates are similar when the model is used to price only IPOs in the three-year subsample. The issue price model estimated on the full five-year sample generates results that suggest more of a cost advantage for the auction method.

Based on classifications of individual IPOs, as reported at the bottom of Table 6, pricing by auction is projected to result in lower total cost for 321 of the 484 IPOs, or 66.2 percent of the sample. In terms of numbers of IPOs, both auction and book-building samples include more IPOs that are projected to have lower total cost by auction. In conjunction with average cost

differences, this indicates the percentage benefits of auction when auction is favored are generally smaller than those of book building when book building is favored.

Based on Table 6 results, expected total issue costs of pricing by book building are similar to those of pricing by auction. While on a cost basis, most firms in our sample appear to fare better under the auction, the apparent cost advantage must be weighed against the potentially large but unobservable opportunity losses from underinvestment. If we assume that underinvestment is negligible, then the evidence in the table suggest that, at most, pricing by auction reduces mean total issue cost by an estimated 6.43 percent of the first aftermarket price for the IPOs in our sample, at worst, it increases mean total cost by an estimated 1.35 percent.

In Table 7, we classify issuers as apparent beneficiaries of auction or book building. Classification are based on the model estimated from the three-year subsample but the table is constructed based on comparisons of expected issue cost for the entire IPO sample. The top half of the table pertains to auction method IPOs and compares those expected to achieve lower cost using auction against those expected to achieve lower cost using book building. Based on the statistical estimates, the expected beneficiaries of pricing by auction are younger and smaller than expected beneficiaries of book building. However, they are less likely to be venture capital backed, and while average issue size of auction beneficiaries is smaller, but not significantly so, relative issue size is larger. The lower portion of the table provides the same comparisons for the sample of book-building IPOs and yields similar results.

Comparisons of the characteristics of auction beneficiaries from among the auction and book-building IPO groups support our concern that underinvestment may bias the estimates of expected total issue cost by the auction. While the relative cost evidence suggests that younger and smaller issuers can achieve lower cost with auction, 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 that are apparent beneficiaries of pricing by auction.

Our conclusion from this evidence is not that book building disadvantages small issuers. Instead, the evidence, taken as a whole, suggests that the auction method of IPO pricing functions as a capital market barrier for small, young, and risky issuers. While the statistical model implies that they might have lower total issue cost under the auction method, the true effect may be to foreclose such firms from the market, all together.

Because our estimates of relative cost advantage are correlated with issue size, comparisons of percentage cost advantages do not reveal whether, in aggregate, auction or book building is lower cost. To address this, in the upper portion of Table 8 we report absolute measures of total cost in the same manner as the percentage comparisons in Table 6. All estimates in Table 8 are based on the issue cost model from the three-year subsample. To illustrate, focusing on the full sample, we estimate that the expected aggregate issue cost of the auction method is 134.1 billion Yen for IPOs actually priced by auction and 286.9 billion Yen for those actually priced by book building. The expected total is, thus, 421.1 billion Yen, or 870 million Yen per IPO. The comparable aggregate total cost estimate for book building is 355.5 billion Yen, or 735 million Yen per IPO. Thus, we estimate that reliance on the auction method of pricing from 1995 through September 1997 cost JASDAQ issuers an aggregate of 65.6 billion Yen. This does not include the value of opportunity losses that may have resulted from underinvestment in the auction period.

In the lower portion of Table 8, we compute issue-size-weighted average costs and cost differential. The percentage mean total issue cost favors book building in both the auction

sample and the book building sample. We estimate that the overall cost disadvantage of pricing by auction method is 3.52 percent. This compares to 1.35 percent in the equal-weighted calculations and, again, is separate from any opportunity losses that have resulted from underinvestment.

V. Discussion

Japan's auction method of IPO pricing is a procedure where high quality issuers are unable to distinguish themselves from low quality issuers. We identify conditions under which this causes high quality firms to forego equity IPOs, giving rise to potential underinvestment. Book building is a negotiated offering process that can result in higher total issue cost but enables high quality issuers to distinguish themselves. We demonstrate that if book building and auction are both available, and firms differ sufficiently in unobservable quality, some, and potentially all, will select book building, even if doing so results in higher average total issue cost and does not reduce underinvestment by enough to offset the higher cost. This aspect of our analysis is particularly relevant for small and risky issuers, where information asymmetry problems are more likely to be material to an issuer's choice. The analysis implies that the policy decision to permit book building as an alternative to auction cannot be based on the observed choices of issuers. Instead, it must be based on estimates of the aggregate relative total issue cost of book building and auction approaches to IPO pricing and the likely magnitude of the underinvestment problem if high quality issuers cannot distinguish themselves.

For a sample of IPOs by Japanese firms, we document that average total issue cost, measured as a percent of aftermarket price, is significantly higher for book building than for auction IPOs. This result, however, does not compare the expected cost of auction and book building procedures for any particular firm. It also does not account for the possibility that, with

only auction available, some high quality firms may decide not to issue and may forego attractive investment opportunities. After providing evidence that Japan's auction regime may have resulted in underinvestment, we estimate an empirical model of the expected total cost of issuing by auction method and by book building. Although underinvestment may bias our analysis in favor of the auction approach, we, nonetheless, compare estimates of the expected costs of issuing by the two approaches. Weighting the observations equally, our results indicate that the total issue costs of auction and book building are similar, conceivably favoring either approach by a slight amount. However, when the results are weighted by issue size, they indicate an aggregate cost advantage for book building that is separate from any possible gain of reduced underinvestment.

The statistical model suggests that small and risky firm incur higher costs with book building, whereas larger and better-established issuers, for whom information problems are less of a concern, realize a cost advantage. The adverse impact of the auction method on large and well-established issuers is consistent with the general view that the pre-marketing efforts of the underwriter can increase market demand for shares of the issuing firm. Our finding that issue size is greater as a percent of pre-issue firm size is consistent with this view of the benefit of book building for large issuers. Although the auction process appears to reduce issue cost for smaller and risky firms that issue some small and risky firms appear to have been effectively foreclosed from the capital market by the auction requirement. If so, then our estimates of the cost advantage of auction for small and risky issuers are overstated.

Given our finding that, in Japan, the expected aggregate cost of the book building process is lower than of the auction process, is it possible to generalize that equity capital markets should permit book building and is there still a role for auction procedures like in Japan, or like best

efforts offerings or the new auction experiments being tried in the US? While we have no definitive answer, it is useful to consider large and small issuers separately. Our evidence suggests that large and well-established issuers are likely to favor book building because of the scale economies associated with the process and because of book building's capability of marketing large offerings. Only when information asymmetry concerns are very low, as in very low risk debt issues, does it appear that investor demand is sufficiently elastic to induce large issuers to select auction mechanisms. For small issuers, the choice between an auction process and book building appears to depend on the balance between the higher percentage cost of book building and the value to high quality issuers of distinguishing themselves. If value differences are substantial, high quality small issuers will select book building. Whether this is advantageous in aggregate for small and high-risk issuers depends on the extent to which book building mitigates underinvestment. If mitigation is minimal, then issuers, as a group, may prefer some form of imposed auctioning. In environments where both alternatives are available, some form of auctioning is likely to appeal only to small issuers of readily ascertainable quality. However, if underwriters can reduce direct costs of book building for small firms and can rely more on intentional underpricing, then even these firms may select book building.

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Table 1

Underwriting Fees, Initial Returns, and Total Issue Cost of 484 JASDAQ January 1995-December 1999 and Selected Subperiods

Underwriting Fees (a), Initial Return (b), and Total Issue Cost (a+b) for entire IPO sample, all Auction Method IPOs, all Book Building IPOs, and selected subsamples: 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. Mean P-values are based on t tests of 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.

Panel (a)	**Obs.**	**Mean**	**Median**	**Std. Dev.**	**Skewness**	**Mean P-value**	**Variance P-value**
Underwriting Fees/Offer Price							
Entire Sample	484	4.15%	3.50%	1.12%	0.86		
All Auction Method	321	3.39%	3.40%	0.14%	0.80	*0.0%*	*0.0%*
All Book Building	163	5.66%	5.77%	0.49%	0.22		
Auction Method post-1995	185	3.44%	3.50%	0.14%	0.70	*0.0%*	*0.0%*
Book Building pre-1999	90	5.52%	5.51%	0.50%	0.45		
Initial Return/Offer Price							
Entire Sample	484	31.48%	9.98%	84.13%	5.76		
All Auction Method	321	11.50%	7.14%	16.45%	1.69	*0.0%*	*0.0%*
All Book Building	163	70.81%	20.00%	134.97%	3.28		
Auction Method post-1995	185	10.67%	7.14%	17.16%	1.42	*5.4%*	*0.0%*
Book Building pre-1999	90	19.45%	9.19%	40.83%	20.31		
Total Cost/Offer Price							
Entire Sample	484	35.63%	13.47%	84.51%	5.73		
All Auction Method	321	14.89%	10.49%	16.45%	1.70	*0.0%*	*0.0%*
All Book Building	163	76.47%	26.00%	135.01%	3.27		
Auction Method post-1995	185	14.11%	10.64%	17.15%	1.43	*1.8%*	*0.0%*
Book Building pre-1999	90	24.98%	14.93%	40.87%	3.58		
Panel (b)	**Obs.**	**Mean**	**Median**	**Std. Dev.**	**Skewness**	**Mean P value**	**Variance P value**
Underwriting Fees/Aftermarket Price							
Entire Sample	484	3.04%	2.88%	1.47%	1.96		
All Auction Method	321	2.79%	2.83%	0.77%	1.49	*0.0%*	*0.0%*
All Book Building	163	3.53%	3.60%	2.21%	0.99		
Auction Method post-1995	185	2.90%	2.85%	0.89%	1.60	*0.0%*	*0.0%*
Book Building pre-1999	90	4.42%	4.51%	2.01%	1.78		
Initial Return/Aftermarket Price							
Entire Sample	484	13.70%	9.07%	20.51%	0.99		
All Auction Method	321	8.59%	6.67%	12.25%	-0.30	*0.0%*	*0.0%*
All Book Building	163	23.75%	16.67%	28.35%	0.27		
Auction Method post-1995	185	7.67%	6.67%	13.51%	-0.62	*26.6%*	*0.0%*
Book Building pre-1999	90	10.35%	8.81%	20.66%	-0.33		
Total Cost/Aftermarket Price							
Entire Sample	484	16.74%	11.87%	19.37%	1.12		
All Auction Method	321	11.39%	9.49%	11.50%	-0.22	*0.0%*	*0.0%*
All Book Building	163	27.28%	20.63%	26.23%	0.35		
Auction Method post-1995	185	10.56%	9.62%	12.64%	-0.55	*5.8%*	*0.0%*
Book Building pre-1999	90	14.77%	12.98%	18.75%	-0.18		

Table 2

Descriptive Statistics for Sample of 484 JASDAQ IPOs January 1995-December 1999

Data are for IPOs during the entire period and various sub periods. 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, (2) auction method IPOs after 1995 versus book building method IPOs before 1999, and (3) book building method IPOs before 1999, versus during 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 the underwriter and on venture capitalist involvement. Panel (d) contains data on other endogenously determined offering characteristics. Company data are from the IPO prospectus and proxy statements. Astrisks indicate significance at 10 percent, 5 percent and 1 percent levels in one-tail tests.

	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%	t-value	*7.81****	*1.36*	*14.55****
Median	-2.40%	-4.89%	5.46%	-6.50%	-4.77%	19.76%	Z-value	*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%	t-value	*5.18****	*8.29****	*21.74****
Median	-0.29%	-1.86%	1.42%	0.81%	-8.72%	36.63%	Z-value	*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	t-value	*3.94****	*2.26***	*0.35*
Median	26.60	29.90	23.30	26.35	23.71	23.04	Z-value	*4.08****	*2.24***	*0.13*
Number of Employees										
Mean	434.44	464.95	374.34	456.18	369.89	379.84	t-value	*1.97***	*1.61*	*0.13*
Median	288.00	318.00	236.00	314.00	218.00	241.00	Z-value	*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	t-value	*3.68****	*2.26***	*0.75*
Median	563.50	607.00	448.00	574.50	497.00	384.00	Z-value	*5.43****	*2.08***	*1.68**
Sales Revenue (millions of Yen)										
Mean	17,687	18,607	15,873	18,379	16,882	14,630	t-value	*1.61*	*0.59*	*0.97*
Median	11,698	12,176	10,245	10,965	10,495	10,031	Z-value	*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 Scale and Proceeds Allocation										
Gross Proceeds of Offering (millions of Yen)										
Mean	2,818.49	2,841.11	2,773.95	3,005.92	1,960.84	3,776.40	t-value	*0.15*	*1.93**	*2.24***
Median	1,646.50	1,867.00	1,221.00	1,943.00	732.00	2,025.00	Z-value	*4.88****	*6.10****	*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*

Table 3

Estimates of Number of Non-Issuers During Auction Period

ıre derived based on the assumptions that (1) distributions of issuer firm ages or numbers of employees during the auction method d have been the same as the actual distributions during the book building period, and (2) that issue decision of firms in the highest two ployee quintiles during the auction period are not affected by the requirement to use the auction method to price the offering. Estimates are based on firm age for the entire period and for the period from 1996 through 1998. Estimates in Panel (b) are based on numbers of The "Actual Minus Expected" column is an estimate of the reduction in IPOs due to the auction method requirement. Estimates in the Full Sample" column are constructed by scaling up the actual number of auction method IPOs from 184 to 321, and are included to mparisons of estimates based on the full period and the 1996 through 1998 period.

Projections Based on Distributions of Firm Age

Using Data for the Entire Sample Period

es of ing	Book Building IPOs	Actual Auction IPOs	Expected Auction IPOs	Actual Minus Expected
.09 years	33	24	94	-70
.06 years	32	51	92	-41
.06 years	33	60	94	-34
.11 years	32	77	92	-15
years	33	109	94	15
	163	321	466	**-145**

Using Data from 1996 though 1998

Age Quintiles of Book Building IPOs	Book Building IPOs	Actual Auction IPOs	Expected Auction IPOs	Actual Minus Expected	Implied for Full Sample
0.00 to 13.05 years	18	26	49	-23	-39
13.06 to 18.40 years	18	22	49	-27	-46
18.40 to 25.40 years	18	39	49	-10	-17
25.41 to 35.10 years	18	41	49	-8	-13
Over 35.10 years	18	56	49	8	13
Totals	90	184	243	**-59**	**-102**

Projections Based on Number of Employees

Using Data for the Entire Sample Period

nt f Book Os	Book Building IPOs	Actual Auction IPOs	Expected Auction IPOs	Actual Minus Expected
employe	33	30	92	-62
employe	32	54	90	-36
employe	33	55	92	-37
employe	32	93	90	3
mployees	33	89	92	-3
	163	321	456	**-135**

Using Data from 1996 though 1998

Employment Quintiles of Book Building IPOs	Book Building IPOs	Actual Auction IPOs	Expected Auction IPOs	Actual Minus Expected	Implied for Full Sample
0 to 120 employe	18	20	52	-32	-56
121 to 169 employe	18	26	52	-26	-45
170 to 273 employe	18	34	52	-18	-31
274 to 618 employe	18	72	52	20	35
Over 618 employees	18	32	52	-20	-35
Totals	90	184	260	**-76**	**-133**

Table 4

Regression Results for Underwriter Fees and Underpricin
Full 1995-1999 Sample and 1996-1998 Subsampl

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 results are based on 274 IPOs. Coefficient t-values are in italics. Astrisks indicate significance at 10 percent, 5 percent and 1 percent levels in one-tail tests.

	Underwriter Fees/ Issue Price (percent)		Underpricing/ Aftermarket Price (percent)	
Independent Variables	**Full Sample**	**Subsample**	**Full Sample**	**Subsample**
Intercept	3.45268 *59.60****	3.50072 *45.26****	11.11260 *3.52****	12.35900 *3.61****
Market Runup day -40 to day -1 (percent)			0.85728 *13.42****	0.91320 *9.91****
Age of Issuing Firm	-0.00154 *1.13*	-0.00088 *0.46*	-0.07110 *1.00*	-0.07340 *0.94*
Sales Revenue (billions)	-0.00026 *0.24*	-0.00030 *0.22*		
Issue Size (billions)	-0.00661 *1.16*	-0.00702 *0.96*	-0.25000 *1.13*	-0.06980 *0.35*
Underwriter Market Share (percent)	0.00019 *0.12*	-0.00052 *0.25*	0.18657 *2.17***	0.14590 *1.62*
BB*Intercept	1.98924 *21.32****	1.88407 *14.86****	19.60140 *1.27*	25.59700 *1.59*
BB*Age of Issuing Firm	0.00493 *2.18***	0.00381 *1.14*	-0.51500 *4.45****	-0.51890 *3.91****
BB*Sales Revenue (billions)	-0.00639 *2.99****	-0.00511 *1.85**		
BB*Issue Size (billions)	0.00383 *0.48*	0.00770 *0.62*	-0.58000 *1.71*	-2.33000 *5.55****
BB*Underwriter Market Share (percent)	0.01069 *3.89****	0.00763 *2.14****	-0.24980 *1.66**	-0.09750 *0.63*
Underwriter Fee (percent)			0.98800 *0.36*	-1.05550 *0.37*
Adj R^2	0.93	0.91	0.39	0.37

Full 1995-1999 Sample and 1996-1998 Subsampl

Full sample estimates are based on 484 JASDAQ IPOs. Subsample results are based on 274 IPOs. Coefficient t-values are in italics. Astrisks indicate significance at 10 percent, 5 percent and 1 percent levels in one-tail 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.

		Total Cost/ Aftermarket Price (percent)		Issue Size (million Yen)	
Independent Variables	**Coef.**	**Full Sample**	**Subsample**	**Full Sample**	**Subsample**
Intercept	c1	11.553	14.305	1643.72	2170.85
		*3.73***	*3.97***	*4.00***	*4.11***
Market Runup -40 to -1 (percent)	c2	0.751	0.857		
		*13.17***	*9.675***		
Market Runup -100 to -40 (percent)	c3			16.43	16.19
				*2.86***	*1.15*
Age of Issuing Firm	c4	-0.037	-0.059	-33.11	-45.83
		0.56	*0.78*	*3.48***	*3.59***
Sales Revenue (billions)	c5	0.004	0.001	37.48	42.43
		0.08	*0.02*	*4.96***	*4.44***
Equity Book Value (billions)	c6	-0.607	-0.262	318.55	179.98
		1.01	*0.47*	*3.04***	*1.61**
Value of Outstanding Shares (billions)	c7			4.03	3.87
				*12.46***	*10.74***
Underwriter Market Share	c8	0.161	0.135	24.19	18.12
		*2.07***	*1.57*	*2.15***	*1.25*
Venture Capital Backing	c9	2.424	0.951		
		1.43	*0.49*		
BB*Intercept	c10	28.723	23.301	-1544.36	-2001.94
		*5.57***	*3.864***	*2.28***	*2.14***
BB*Age of Issuing Firm	c11	-0.363	-0.315	5.09	18.26
		*3.35***	*2.36***	*0.31*	*0.79*
BB*Sales Revenue (billions)	c12	-0.373	-0.326	2.38	-41.03
		*3.62***	*3.08***	*0.15*	*1.93**
BB*Equity Book Value (billions)	c13	-3.550	-1.100	156.93	1179.93
		1.29	*0.33*	*0.38*	*2.05***
BB*Value of Outstanding Shares (billions)	c14			3.68	3.78
				*7.46***	*5.06***
BB*Underwriter Market Share	c15	-0.167	-0.056	13.91	14.57
		1.25	*0.38*	*0.72*	*0.59*
BB*Venture Capital Backing	c16	-1.898	-9.041		
		0.60	*2.57***		
Adj R^2		0.44	0.33	0.77	0.79
Wald Test Results (F test P-values)					
c4+c11=0		*0.000*	*0.001*	*0.029*	*0.152*
c5+c12=0		*0.000*	*0.001*	*0.005*	*0.941*
c6+c13=0		*0.121*	*0.680*	*0.238*	*0.017*
c7+c14=0				*0.000*	*0.000*
c8+c15=0		*0.951*	*0.509*	*0.017*	*0.105*
c9+c16=0		*0.844*	*0.006*		
c4=c5=c6=c9=0		*0.349*	*0.830*		
c11=c12=c13=c16=0		*0.000*	*0.000*		
c4=c5=c6=c8=0				*0.000*	*0.000*
c11=c12=c13=c15=0				*0.925*	*0.214*

Table 6

In- and Out-of-Sample Estimates of Expected Total Issue Cost and Total Issue Cost Differentials

Regression models from Table 5 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.

Total Issue Cost Estimates and Differentials

	Auction Method Sample			Book Building Sample		
	Mean	**Std. Dev.**	**Median**	**Mean**	**Std. Dev.**	**Median**
Full Sample Model applied to Full Sample Data						
Actual Issue Cost	11.39%	11.50%	9.49%	27.28%	26.24%	20.63%
Expected Actual Issue Cost	11.39%	7.18%	11.40%	27.28%	15.42%	27.29%
Expected Alternative Issue Cost	14.73%	15.63%	17.38%	20.85%	12.33%	20.38%
Cost Differential in Favor of Auction (Actual v. Expected Alternative)	3.34%		7.89%	6.43%		0.25%
Cost Differential in Favor of Auction (Expected v. Expected Alternative)	3.34%		5.98%	6.43%		6.91%
Subsample Model applied to Full Sample Data						
Actual Issue Cost	11.39%	11.50%	9.49%	27.28%	26.24%	20.63%
Expected Actual Issue Cost	12.10%	7.92%	12.07%	23.83%	15.71%	22.66%
Expected Alternative Issue Cost	13.25%	12.64%	13.73%	25.18%	13.91%	23.91%
Cost Differential in Favor of Auction (Actual v. Expected Alternative)	1.86%		4.24%	2.10%		-3.28%
Cost Differential in Favor of Auction (Expected v. Expected Alternative)	1.15%		1.66%	-1.35%		-1.25%
Subsample Model applied to Subsample Data						
Actual Issue Cost	10.58%	12.68%	9.69%	14.77%	18.75%	12.98%
Expected Actual Issue Cost	10.58%	6.81%	10.40%	14.77%	11.89%	13.62%
Expected Alternative Issue Cost	12.09%	13.09%	12.98%	15.86%	9.60%	15.39%
Cost Differential in Favor of Auction (Actual v. Expected Alternative)	1.51%		3.29%	-1.09%		-2.41%
Cost Differential in Favor of Auction (Expected v. Expected Alternative)	1.51%		2.58%	-1.09%		-1.77%

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	243	211	124	75.70%	65.73%	67.39%
Auction issues where Book Building appears to be lower cost	78	110	60	24.30%	34.27%	32.61%
Book Building issues where book building appears to be lower cost	37	77	41	22.70%	47.24%	45.56%
Book Building issues where Auction appears to be lower cost.	126	86	49	77.30%	52.76%	54.44%

Table 6

In- and Out-of-Sample Estimates of Expected Total Issue Cost and Total Issue Cost Differentials

Regression models from Table 5 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.

Total Issue Cost Estimates and Differentials

	Auction Method Sample			Book Building Sample		
	Mean	**Std. Dev.**	**Median**	**Mean**	**Std. Dev.**	**Median**
Full Sample Model applied to Full Sample Data						
Actual Issue Cost	11.39%	11.50%	9.49%	27.28%	26.24%	20.63%
Expected Actual Issue Cost	11.39%	7.18%	11.40%	27.28%	15.42%	27.29%
Expected Alternative Issue Cost	14.73%	15.63%	17.38%	20.85%	12.33%	20.38%
Cost Differential in Favor of Auction (Actual v. Expected Alternative)	3.34%		7.89%	6.43%		0.25%
Cost Differential in Favor of Auction (Expected v. Expected Alternative)	3.34%		5.98%	6.43%		6.91%
Subsample Model applied to Full Sample Data						
Actual Issue Cost	11.39%	11.50%	9.49%	27.28%	26.24%	20.63%
Expected Actual Issue Cost	12.10%	7.92%	12.07%	23.83%	15.71%	22.66%
Expected Alternative Issue Cost	13.25%	12.64%	13.73%	25.18%	13.91%	23.91%
Cost Differential in Favor of Auction (Actual v. Expected Alternative)	1.86%		4.24%	2.10%		-3.28%
Cost Differential in Favor of Auction (Expected v. Expected Alternative)	1.15%		1.66%	-1.35%		-1.25%
Subsample Model applied to Subsample Data						
Actual Issue Cost	10.58%	12.68%	9.69%	14.77%	18.75%	12.98%
Expected Actual Issue Cost	10.58%	6.81%	10.40%	14.77%	11.89%	13.62%
Expected Alternative Issue Cost	12.09%	13.09%	12.98%	15.86%	9.60%	15.39%
Cost Differential in Favor of Auction (Actual v. Expected Alternative)	1.51%		3.29%	-1.09%		-2.41%
Cost Differential in Favor of Auction (Expected v. Expected Alternative)	1.51%		2.58%	-1.09%		-1.77%

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	243	211	124	75.70%	65.73%	67.39%
Auction issues where Book Building appears to be lower cost	78	110	60	24.30%	34.27%	32.61%
Book Building issues where book building appears to be lower cost	37	77	41	22.70%	47.24%	45.56%
Book Building issues where Auction appears to be lower cost.	126	86	49	77.30%	52.76%	54.44%

Table 7

Comparisons of Expected Issue Cost and Issuer Characteristics for Subsamples of Auction Method and Book Building IPOs

Observations are grouped according to wheter auction method or book building is expected to result in lower total issue cost. The table reports mean and median issuer characterstics within the groups. Astrisks indicate differences in means are significant at 10 percent, 5 percent and 1 percent levels in one-tail tests.

Auction Method IPOs	**Apparent Beneficiaries of Auction Method (N=211)**			**Apparent Beneficiaries of Book Building (N=110)**			**t value**
	Mean	**Std. Dev.**	**Median**	**Mean**	**Std. Dev.**	**Median**	
Estimated Advantage of Auction Method	5.73%	3.71%	5.22%	-7.63%	10.71%	-4.41%	
Expected Actual Issue Cost	12.66%	7.90%	12.47%	11.03%	7.89%	10.72%	*1.75**
Expected Alternative Issue Cost	18.39%	8.19%	18.01%	3.39%	13.80%	6.23%	*10.47****
Actual Issue Cost	11.84%	11.67%	9.49%	10.51%	11.16%	9.59%	*1.00*
Issuer Characteristics							
Age of Issuing Firm	25.51	11.54	24.80	38.60	11.38	39.70	*9.73****
Number of Employees	367.0	318.1	280.0	652.8	697.6	412.5	*4.08****
Equity Book Value	702.9	466.9	579.0	1433.2	2584.5	727.5	*2.94****
Sales Revenue	12081	8110	9841	31127	32530	23678	*6.04****
Underwriter Market Share	18.98%	11.17%	17.40%	19.29%	10.06%	17.40%	*0.25*
Venture Capital Backing	41.71%	49.42%	0.00%	66.36%	47.46%	100.00%	*4.36****
Gross Proceeds of Offering	2572.4	2314.4	1870.0	3356.5	6306.4	1860.5	*1.26*
New Shares/Shares Outstanding	18.99%	3.54%	18.32%	17.84%	4.19%	17.54%	*2.47***

Book Building IPOs	**Apparent Beneficiaries of Book Building (N=77)**			**Apparent Beneficiaries of Auction (N=86)**			**t value**
	Mean	**Std. Dev.**	**Median**	**Mean**	**Std. Dev.**	**Median**	
Estimated Advantage of Auction Method	-9.11%	7.26%	-7.49%	5.60%	4.49%	4.95%	
Expected Actual Issue Cost	18.02%	14.27%	17.24%	29.03%	15.17%	28.89%	*4.78****
Expected Alternative Issue Cost	27.13%	13.48%	26.93%	23.43%	14.14%	21.95%	*1.71**
Actual Issue Cost	22.14%	24.73%	18.98%	31.87%	26.83%	23.63%	*2.41***
Issuer Characteristics							
Age of Issuing Firm	34.04	13.00	33.80	16.59	8.46	16.07	*10.03****
Number of Employees	524.0	572.0	407.0	240.0	292.3	168.5	*3.93****
Equity Book Value	759.0	597.6	570.0	447.5	349.8	342.0	*4.00****
Sales Revenue	23290	17722	18531	9233	7388	7159	*6.48****
Underwriter Market Share	24.02%	9.59%	25.80%	21.69%	11.27%	25.80%	*1.42*
Venture Capital Backing	87.01%	33.84%	100.00%	63.95%	48.30%	100.00%	*3,56****
Gross Proceeds of Offering	3414.0	6032.0	1464.0	2200.8	3789.5	915.5	*1.52*
New Shares/Shares Outstanding	19.84%	5.18%	19.06%	21.75%	5.78%	20.66%	*2.23***

Table 8

In- and Out-of-Sample Estimates of Aggregate and Value-Weighted Average Total Issue Cost and Total Issue Cost Differentials

Regression models from Table 5 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.

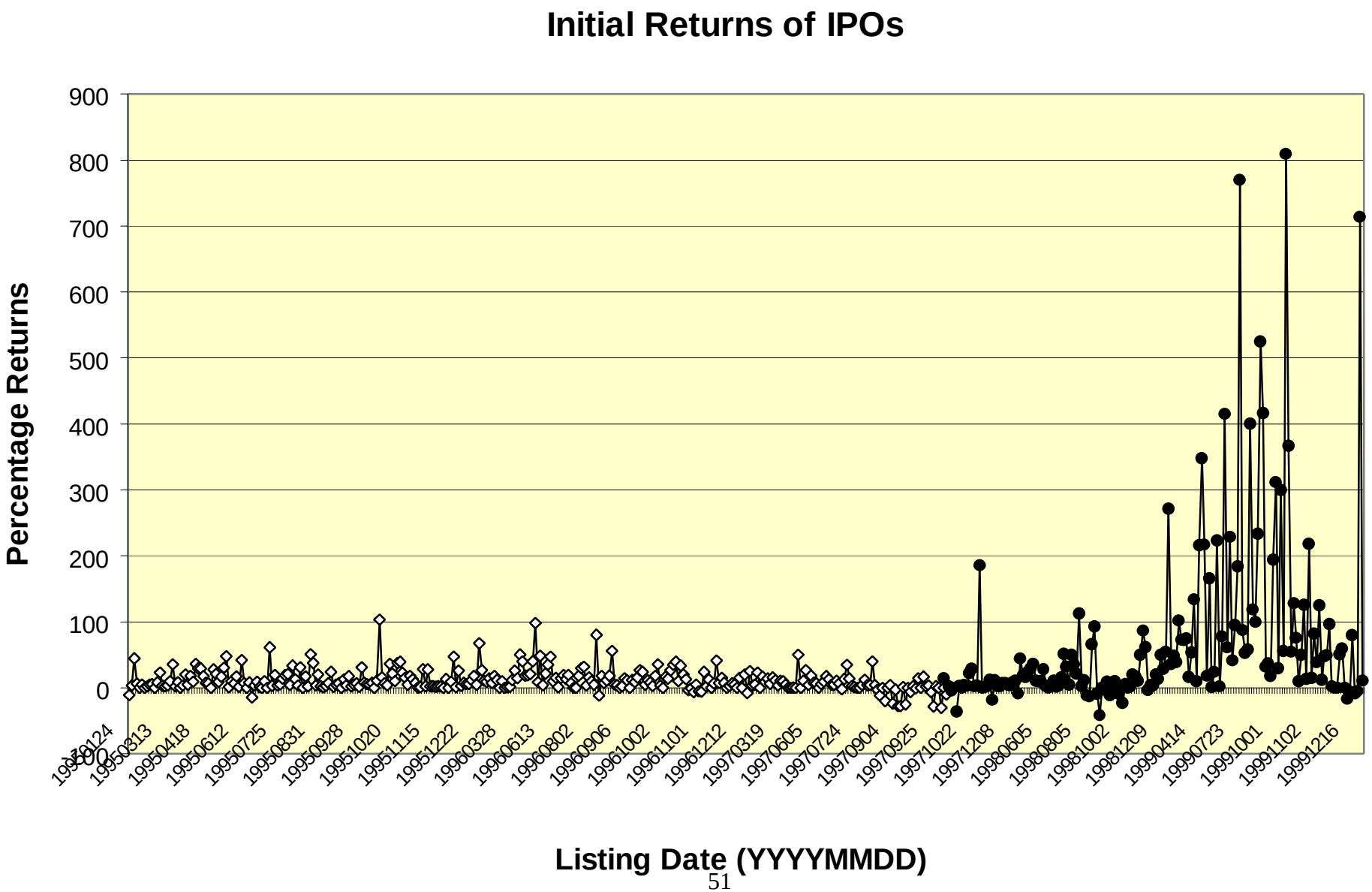
Yen-Valued and Aggregate Total Issue Cost Estimates and Differentials

	Auction Method Sample				Book Building Sample				Entire Sample	
	Mean	Std. Dev.	Median	Sum	Mean	Std. Dev.	Median	Sum	Sum	Mean
Subsample Model applied to Full Sample Data										
Aftermarket Value of Issue	3154.2	4474.6	2116.4	1012495.4	5208.7	12439.1	1612.0	849010.1		
Actual Issue Cost (million Yen)	397.5	655.1	177.3	127609.4	2549.6	9383.3	244.2	415579.6		
Expected Actual Issue Cost (million Yen)	417.9	680.6	224.5	134144.4	1732.6	5559.0	298.7	282407.6	**Auction**	421089.6	870.0
Expected Alternative Issue Cost (million Yen)	227.7	2531.2	239.6	73080.3	1760.4	5364.2	425.5	286945.2	**Book Building**	355487.9	734.5
Cost Differential in Favor of Auction (Actual v. Expected Alternativ	-169.8		62.3	-54529.1	789.2		-181.3	128634.4			
Cost Differential in Favor of Auction (Expected v. Expected Altern	-190.2		15.1	-61064.1	-27.8		-126.8	-4537.6	**Differential**	-65601.7	-135.5
Subsample Model applied to Subsample Data										
Aftermarket Value of Issue	3318.4	5205.3	2253.6	610583.9	2135.4	3444.3	862.0	192187.2		
Actual Issue Cost	403.3	689.2	163.9	74200.8	280.8	1684.1	72.8	25271.6		
Expected Actual Issue Cost	363.4	546.6	188.4	66860.5	309.4	838.4	95.0	27846.7	**Auction**	97428.0	355.6
Expected Alternative Issue Cost	75.5	3290.4	189.3	13886.5	339.6	566.2	117.6	30567.5	**Book Building**	41733.2	152.3
Cost Differential in Favor of Auction (Actual v. Expected Alternativ	-327.8		25.4	-60314.3	58.8		44.8	5295.9			
Cost Differential in Favor of Auction (Expected v. Expected Altern	-287.9		0.9	-52974.0	30.2		22.6	2720.8	**Differential**	-55694.8	-203.3

Value-Weighted Average Total Issue Cost Estimates and Differentials

	Auction Method Sample				Book Building Sample				Entire Sample
	Mean	Std. Dev.	Median		Mean	Std. Dev.	Median	Sum	Mean
Subsample Model applied to Full Sample Data									
Actual Issue Cost (percentage)	12.60%	14.64%	8.38%		48.95%	75.43%	15.15%		
Expected Actual Issue Cost (percentage)	13.25%	15.21%	10.61%		33.26%	44.69%	18.53%		**Auction** 22.62%
Expected Alternative Issue Cost (percentage)	7.22%	56.57%	11.32%		33.80%	43.12%	26.40%		**Book Building** 19.10%
Cost Differential in Favor of Auction (Actual v. Expected Alternativ	-5.38%		2.94%		15.15%		-11.25%		
Cost Differential in Favor of Auction (Expected v. Expected Altern	-6.03%		0.71%		-0.54%		-7.87%		**Differential** -3.52%
Subsample Model applied to Subsample Data									
Actual Issue Cost (percentage)	12.15%	13.24%	7.27%		13.15%	48.90%	8.45%		
Expected Actual Issue Cost (percentage)	10.95%	10.50%	8.36%		14.49%	24.34%	11.02%		**Auction** 12.14%
Expected Alternative Issue Cost (percentage)	2.27%	63.21%	8.40%		15.91%	16.44%	13.64%		**Book Building** 5.20%
Cost Differential in Favor of Auction (Actual v. Expected Alternativ	-9.88%		1.13%		2.76%		5.19%		
Cost Differential in Favor of Auction (Expected v. Expected Altern	-8.68%		0.04%		1.42%		2.62%		**Differential** -6.94%

Figure 1


Initial Returns of IPOs
Percentage Returns
900
800
700
600
500
400
300
200
100
0
-100
19950124
19950313
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19950612
19950725
19950831
19950928
19951020
19951115
19951222
19960328
19960613
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19970319
19970605
19970724
19970904
19970925
19971022
19971208
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19981002
19981209
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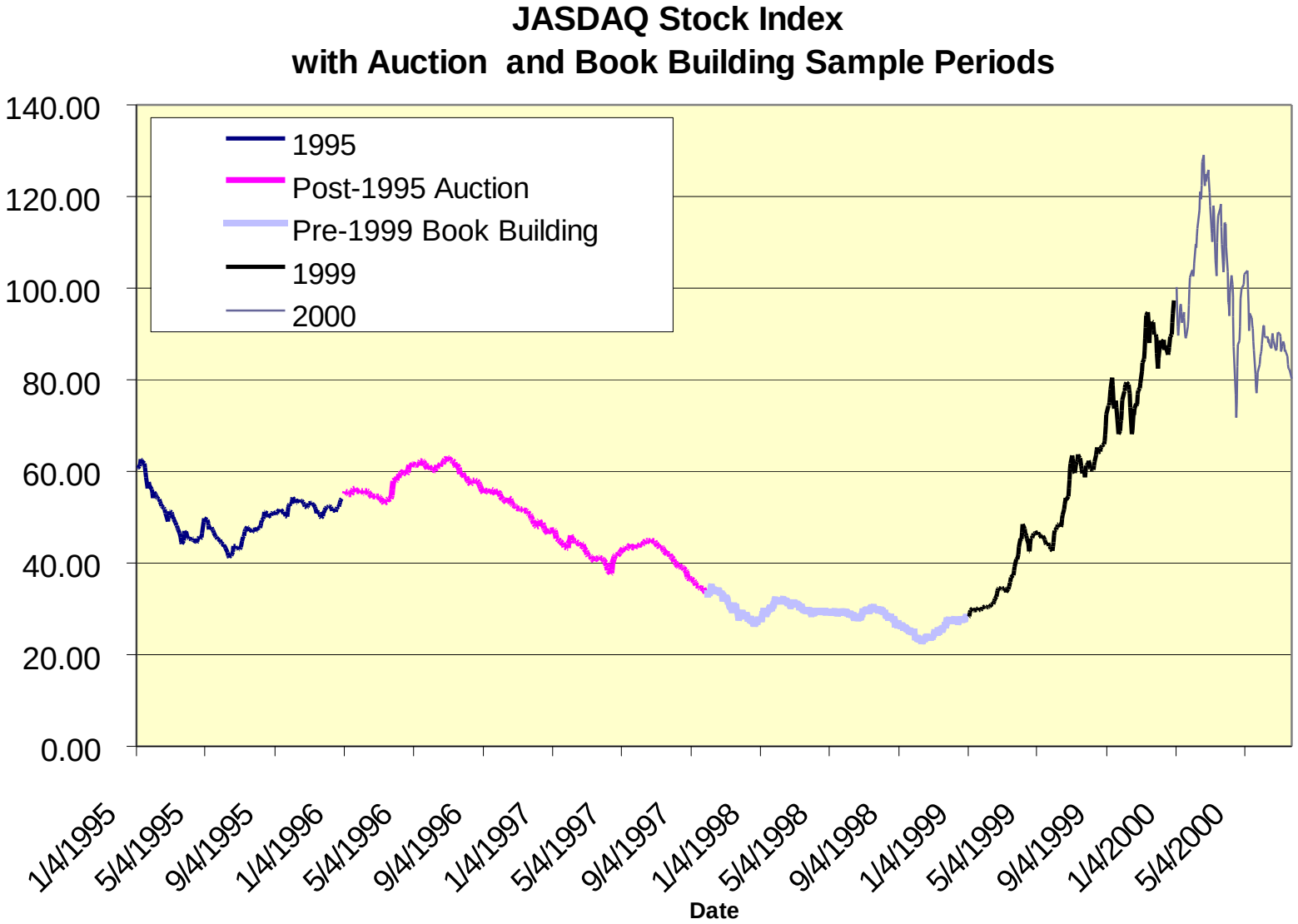
19990723
19991001
19991102
19991216
Listing Date (YYYYMMDD)

Figure 2


JASDAQ Stock Index
with Auction and Book Building Sample Periods
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
1995
Post-1995 Auction
Pre-1999 Book Building
1999
2000
1/4/1995
5/4/1995
9/4/1995
1/4/1996
5/4/1996
9/4/1996
1/4/1997
5/4/1997
9/4/1997
1/4/1998
5/4/1998
9/4/1998
1/4/1999
5/4/1999
9/4/1999
1/4/2000
5/4/2000
Date