Auctioned IPOs: The U.S. Evidence

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Abstract

Between 1999 and 2007, WR Hambrecht completed 19 IPOs in the U.S. using an auction mechanism. We analyze investor behavior and mechanism performance in these auctioned IPOs using detailed bidding data. The existence of some bids posted at high prices suggests that some investors (mostly retail) try to free-ride on the mechanism. But institutional demand in these auctions is very elastic, suggesting that institutional investors reveal information in the bidding process. Investor participation is largely predictable based on deal size, and demand is dominated by institutions. Flipping is equally prevalent in auctions as in bookbuilt deals – but unlike in bookbuilding, investors in auctions tend to flip their shares more in cold deals. Finally, we find that institutional investors, who provide more information, are rewarded by obtaining a larger share of the deals with higher initial returns. Our results suggest that auctioned IPOs could be an effective alternative to traditional bookbuilding.

In 1999, WR Hambrecht introduced the OpenIPO auction mechanism in the United States to compete with the bookbuilding approach, which effectively had complete control over IPO issuances before then. Between 1999 and 2007, WR Hambrecht was the lead underwriter in 19 auctioned IPOs.[1] This paper provides an analysis of investor behavior and mechanism performance in these IPOs using detailed bidding data from these auctions. We find that auctioned IPOs perform well under two important criteria: they exhibit highly elastic (i.e. informative) demand, and they attract strong and predictable participation from institutional investors. Our results suggest that auctioned IPOs could therefore be an effective alternative to traditional bookbuilding.

IPOs have been notoriously hard to price for the issuer and the underwriter as demonstrated by significant variance in first day returns (Lowry, Officer and Schwert 2006). An important aim of the IPO selling mechanism is to extract information from investors that will enable a more accurate pricing of the issue. A series of theoretical papers have analyzed the pros and cons of bookbuilding versus other IPO mechanisms. Benveniste and Spindt (1989), Benveniste and Wilhelm (1990), Spatt and Srivastava (1991), and Sherman (2000) argue that the bookbuilding mechanism, thanks to its pricing and allocation flexibility, allows underwriters to elicit truthful information revelation from informed investors. Biais and Faugeron-Crouzet (2002), and Biais, Bossaerts, Rochet (2002) take a mechanism-design approach to characterize the optimal IPO mechanism, and show that under certain assumptions, the *Mise en Vente*, a modified auction mechanism used in France, exhibits information-extraction properties similar to bookbuilding. Sherman (2005), on the other hand, suggests that with costly information acquisition, auctions can lead to sub-optimal information production and free-riding by uninformed investors.

[1] WR Hambrecht was also a co-manager in the auctioned IPOs of Google in 2004 and NetSuite in 2007, and one of the lead managers in the auctioned IPO of Rackspace in August 2008.

Because of the lack of detailed IPO bidding data available from investment bankers, few empirical papers have addressed these issues. Exceptions include Cornelli and Goldreich (2001, 2003) and Jenkinson and Jones (2004, 2007) who analyze bidding and allocation in European bookbuilt IPOs. Cornelli and Goldreich find that order books contain information that is used to price bookbuilt deals and that investors who provide information receive better allocations. Jenkinson and Jones use a different sample of bookbuilt IPOs and take a survey of institutional investors, and conclude that the information extraction role of bookbuilding is limited. Kandel, Sarig and Wohl (1999) analyze demand curves in Israeli auctioned IPOs. Liu, Wei and Liaw (2001), Lin, Lee, and Liu (2007), and Chiang, Qian, and Sherman (2008) analyze bidding in Taiwanese auctioned IPOs. Taiwanese auctioned IPOs are discriminatory: Successful bidders pay the price they bid. As such they are different from the U.S. auctioned IPOs we study in this paper: In the U.S. the Security and Exchange Commission (SEC) requires that all successful investors pay the same price (such auctions are called “non-discriminatory”).[2]

Our detailed bidding data from the universe of U.S. auctioned IPOs enable us to weigh in empirically on the bookbuilding/auction debate. There are two main potential concerns about auctioned IPOs. First, the non-discriminatory feature of U.S. auctioned IPOs potentially creates an incentive for uninformed investors to place bids at very high prices (quasi-market orders), effectively free-riding on informed investors’ information. Widespread free-riding might disrupt

[2] Other empirical studies have compared bookbuilding and auctions without using detailed bidding data. Using data from countries in which several mechanisms were available, Derrien and Womack (2003), Kaneko and Pettway (2003) and Kutsuna and Smith (2004) document lower mean underpricing and lower fees for auctioned vs. bookbuilt IPOs. Jagannathan and Sherman (2007) take a more global approach and document that virtually every country that has allowed issuers to use auctions has abandoned this mechanism. Degeorge, Derrien and Womack (2007) argue that the search for better analyst coverage may explain the willingness of issuers to choose bookbuilding over auctions, in spite of the higher fees and underpricing associated with bookbuilding. Ritter and Welch (2002) and Loughran and Ritter (2002) discuss agency problems that can arise with bookbuilding. Several studies have analyzed Treasury auctions, which are quite different from IPOs, as information extraction is not a primary concern (Back and Zender (1993), Nyborg, Rydqvist, and Sundaresan (2002), Keloharju, Nyborg and Rydqvist (2005).

the price discovery process. Second, compared to bookbuilding, auctioned IPOs are a decentralized mechanism, leaving less room for the underwriter to actively promote the IPO, hence creating a risk of unexpectedly low participation. We examine these issues empirically and conclude that these concerns are largely unwarranted.

We find some evidence of free riding: retail investors are much more likely than institutional investors to place high – presumably uninformative – bids. However, free riding by retail investors does not impede the auctioned IPO mechanism's ability to extract information from investors. We construct the demand curves for our sample of auctioned IPOs, and we argue, as others before us, that a high elasticity of the demand curve is indicative of high information content in investors' bids.[3] We find that the demand curves in our U.S. sample are on average more elastic than those estimated in previous studies of bookbuilt deals. The median elasticity of demand at the IPO price is 34.6 in our sample of auctioned IPOs. Using the same measure of demand elasticity, Cornelli and Goldreich (2003) report a median elasticity of demand of 3.6 in their sample of European bookbuilt IPOs. We also find, importantly, that the demand curve for institutional investors is much more elastic than that of retail investors. We conclude that in spite of evidence of some free-riding by retail investors, WR Hambrecht's IPO auction mechanism is successful at eliciting information from institutional investors.

We also find that auctioned IPOs attract strong participation from institutional investors: Institutions account for about 84 percent of demand in dollar value, and they receive about 87 percent of the shares offered in the IPO, on average. Moreover, the main driver of participation is the size of the deal – a characteristic that is known to all before the deal goes through – suggesting that participation is largely predictable.

[3] See for instance Kandel, Sarig and Wohl (1999).

The spirit of auctions is to allow investor bids to determine the price. But in seven out of 19 deals, the investment banker, WR Hambrecht, and the issuer chose an IPO price at a discount to the auction clearing price. We find that a discount was more likely and higher when the clearing price was affected by high bids (and therefore likely to contain “froth”) and when there was less investor consensus in the demand curve.

A desirable property of an IPO selling mechanism is its ability to place shares in “safe hands” – that is, with investors who are unlikely to resell them immediately after the offering (a practice know as “flipping”). Flipping is mostly a concern in “cold” deals – that is, deals with poor initial stock price performance – because it effectively forces the underwriter to buy back shares or possibly suffer significant price declines. We find that the amount of flipping in these auctioned IPOs is similar to that documented for U.S. bookbuilt IPOs. However, for auctioned IPOs, flipping is more prevalent in “cold” deals, in contrast to the patterns documented in U.S. bookbuilt IPOs (Aggarwal 2003). We conclude that the IPO auction mechanism has, so far, been less successful than bookbuilding at allocating shares to “safe hands.” We conjecture that it may be harder to discourage investors from flipping auctioned IPOs, perhaps because the IPO auction mechanism rules prevent the underwriter from “punishing” flippers by withdrawing allocations in future deals.

Interestingly, while the allocation of shares in IPO auctions is not discriminatory, we find that retail investors get a higher proportion of the worst performing deals. This suggests that informational free riding by retail investors potentially at the expense of institutions does not curtail institutions’ informational advantage: Institutions appear to be compensated for the information they provide in the pricing process.

In a nutshell, our results suggest that free riding happens in auctioned IPOs, but it does not wreck the mechanism. Auctioned IPOs exhibit strong and predictable institutional participation and highly elastic demand curves, indicating high information content in the bids. Institutions are compensated for the information they provide in the form of higher returns than those retail investors obtain. Our results imply that the auction IPO mechanism is an effective alternative to traditional bookbuilding.

The remainder of the paper is organized as follows. Section 1 describes the OpenIPO mechanism. Section 2 presents the data. Section 3 reports summary statistics of our sample. Sections 4 to 9 report our results on bidding, investor participation, the demand elasticity of the demand curves, pricing, flipping, and investor returns. Section 10 concludes.

1) The IPO Auction Mechanism

WR Hambrecht's OpenIPO mechanism works as follows: First, WR Hambrecht announces the number of shares to be offered to the public as well as an indicative price range, and organizes a road show in which the deal is presented to potential investors, similar to the familiar bookbuilding approach. The auction opens approximately two weeks before the scheduled IPO date. Investors can then submit price/quantity bids. Investors can submit multiple bids at tiered price levels, and bid prices can be outside the indicative price range. Bids can be cancelled or modified until the closing of the auction, which happens typically a few hours before the pricing of the deal.

When the auction closes, WR Hambrecht constructs a demand curve and calculates the clearing price, which is the highest price at which the number of shares asked for is at least equal to the number of shares offered (including shares in the overallotment option if the underwriter decides to exercise this option). WR Hambrecht then meets with the issuer to decide on the IPO price, which can be at or below the clearing price.[4] The issuer can also decide to adjust the number of shares offered to the public. Price and quantity adjustments are *de facto* limited by an SEC rule that specifies that the issuer needs to refile the IPO if the proceeds (IPO price multiplied by the number of shares offered) differ from the proceeds announced in the last pre-IPO prospectus by more than 20%. Once the price has been chosen, investors who bid at or above the IPO price receive shares at that price.[5] When there is excess demand at the price chosen for the IPO, investors receive shares on a pro rata basis.[6]

The key distinction between the auction mechanism and the traditional bookbuilding mechanism used in most U.S. initial public offerings is that the auction mechanism leaves the underwriter less discretion in share allocation. The other features of the IPOs in our sample are similar to those observed in traditional U.S. IPOs. For example, in all the IPOs in our sample the underwriter receives an overallotment option, in seventeen out of nineteen, pre-IPO shareholders have 180-day lockups, and eighteen of them are firm-commitment deals.

2) The data

For the nineteen auctioned IPOs in which WR Hambrecht was the lead underwriter between 1999 and 2007, we have the demand schedule from all investors at the time of the closing of the auction process. The data contain the following information, for each of the bids in the demand schedule:

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[4] Auctions in which the price can be set below the clearing price are sometimes called "dirty Dutch" auctions.

[5] There is only one exception to this allocation rule in the nineteen IPOs of our sample. In the Andover.net IPO, in December 1999, the IPO price was set at $18, but only investors with bids at or above $24 received shares.

[6] The allocation rule is such that investors always receive round lots. Due to this rule, in case of excess demand investors with similar price/quantity bids (in particular investors who submit small bids) can receive slightly different allocations. However, it is important to note that apart from these marginal adjustments, investors are treated equally, i.e., two investors that submit the same bid have the same *ex ante* expected allocation, whatever their identity.

- The type of broker through which the investor submitted his bids. There are typically five broker types: "WRH institutional", "WRH Middle Markets" and "WRH retail" are used for bids submitted directly to WR Hambrecht by institutional investors, middle market investors (typically small institutions), and retail investors, respectively. The "Co-Managers" label is used for bids submitted through one of the co-managers of the deal. Finally, the "Selling Group" label is used for investors who submit their bids through other brokers who participate in the deal as selling group members.

- The identity of investors. The dataset contains the name of institutional investors that place their bids through the "WRH institutional", "WRH Middle Markets", and "Co-Managers" channels in sixteen deals, which allows us to follow the bidding of institutional investors across these deals.[7] When investors bid through selling group members, they are identified with codes, so we do not know the investor's identity or type (institution or retail).

- The bids submitted by investors. For each bid, we observe the number of shares and the price of the bid, as well as the allocation received.

We obtained data on the characteristics of the IPOs from final prospectuses, and data on aftermarket prices and trading volumes from CRSP. Finally, for a sub-sample of eleven IPOs, we have access to flipping reports, which indicate whether investors who received shares in the IPO sell these shares in the month following the offering. The Depositary Trust Corp. (DTC) collects these data from all the selling group members and sends them to WR Hambrecht.[8] For institutional investors that bought their shares through WR Hambrecht and co-managers, flipping reports contain the identity of the investor and the number of shares flipped within 30 days of the

[7] This information is missing in the first three deals completed by WR Hambrecht.
[8] For a detailed description of the DTC IPO Tracking system, see Aggarwal (2003).

IPO. For retail investors who bid directly through WR Hambrecht and for all investors that bid through selling group members, flipping reports contain the aggregate amount of flipping.

3) Summary statistics

All the IPOs in our sample were listed on the Nasdaq. Over the nine sample calendar years, the annual number of auctioned IPOs varies between one and five. The average proceeds of an auctioned IPO were $107 million, compared to $188 million for the entire U.S. IPO population in the same period.[9] Similar to other IPOs, the size distribution of our sample is right-skewed, with one very large deal, Interactive Brokers Group, which raised $1,200 million in May 2007. The median age of auctioned IPOs (7 years) is similar to that of the average U.S. IPO (8 years). In bookbuilt IPOs, fees exhibit significant clustering at exactly 7% of the proceeds (Chen and Ritter 2000). In our sample of auctioned IPOs, the fees vary between 1.9% and 7%, and average 5.5%.

[Insert Table 1 about here.]

We examine the bidding of institutional and retail investors separately in many of our analyses. In our 37,570 bids, 25,856 that were submitted through the "WRH retail" channel or through a retail broker come from retail investors. Another 1,757 bids were submitted through the "WRH institutional", "WRH Middle Markets", and "Co-Managers" channels, coming from institutional investors. We were not able to assign another 9,957 bids, representing about 25% of the demand in number of bids and in dollar value, to one of these two groups of investors. We use the following rule to allocate these bids to institutions or retail investors: if the dollar value (number of shares multiplied by bid price) of the bid is more than $50,000, which corresponds to

[9] The numbers reported for U.S. bookbuilt IPOs are taken from http://bear.cba.ufl.edu/ritter/IPOs2007sorts.pdf, unless specified otherwise.

the 90th percentile of the distribution of retail bid values and the 30th percentile of the distribution of institutional bid values, we assign the bid to the institutional investors group. If the dollar value of the bid is less than $15,000, which corresponds to the 75th percentile of the distribution of retail bid values and the 10th percentile of the distribution of institutional bid values, we assign the bid to the retail investors group. Using this procedure, we have 32,353 retail bids, 2,889 institutional bids, and 2,328 bids that we cannot assign to one of the two groups of investors.

Table 1, Panel B reports summary statistics on bids. The average IPO in our sample received 1,977 individual bids, 1,702 coming from retail investors, 152 from institutions. The total number of bids is significantly larger than in Cornelli and Goldreich (2003) and Jenkinson and Jones (2004) who report averages of 411 and 205 bids per deal, respectively. However, their data must contain almost only institutional bids because bookbuilt deals are virtually closed to retail investors, while ours contain a large fraction of retail bids. Furthermore, in bookbuilt deals like in the Cornelli-Goldreich sample, a given institution typically submits only one indication of interest, frequently without specifying a price. With auctions, a given institution may submit multiple bids at different prices -- In our sample, institutions submit about 2.5 bids (at different prices) on average when they participate in an IPO.

The number of bids varies considerably across IPOs. The deal with the largest number of bids had 13,504 bids (12,857 from retail investors, 647 from institutions), while the deal with the smallest number of bids received only 75 bids (52 from retail investors, 22 from institutions, and one bid that we could not allocate to retail or institutional). In terms of bid size, the average institutional bid is about 57 times as large in dollar value as the average retail bid ($2.6 million vs. $44,700). Scaled by the size of the IPO, the average institutional bid represents approximately 0.6% of total demand, which is in line with the numbers reported in Cornelli and Goldreich (2001) and Jenkinson and Jones (2004) for bookbuilt IPOs. The median oversubscription ratio (total shares bid for relative to shares issued) is 1.82, with a range of slightly more than one to more than five. This is less than in Cornelli and Goldreich (2003), who report an average oversubscription ratio of 9.1. However, with bookbuilt IPOs, indications of interest are “soft”, and on hot deals it is common for investors to ask for many more shares than they expect to be allocated.

On average, retail investors account for 80.3% of the winning bids but receive only 13% of the shares sold in the auction, due to the smaller size of their bids. Thus, even though auctioned IPOs are open to retail investors, they are effectively dominated by institutions, like traditional bookbuilt IPOs. In that respect, U.S. auctioned IPOs differ from their Taiwanese counterparts, in which retail investors receive about 80% of the shares sold on average (Chiang, Qian and Sherman 2008).

Table 1, Panel C reports statistics on pricing and aftermarket performance of the 19 auctioned IPOs. The average IPO is priced approximately 10% below the midpoint of its price range, 9% (19%) below the demand-weighted average institutional (retail) bid price, and discounted by 4.5% relative to the auction clearing price.[10] Seven deals were discounted, and 12 were priced at their clearing price. The average first-day return is 13.8%. This is comparable to average IPO underpricing in the U.S. in 2001-2007 (12%), but significantly lower than average IPO underpricing in 1999 and 2000 (71% and 56.2%, respectively). Median underpricing, however, is close to 0. The difference between the median and the mean is due to one outlier, Andover.net, which had a first day return of 252%.[11] When we drop this observation, the average initial return decreases to 0.6%. Three- and twelve-month Nasdaq-adjusted returns are slightly

[10] We use the actual number of shares sold in the IPO to compute the clearing price.
[11] Andover.net was the first Linux operating system company to go public. Its initial public offering occurred on December 8, 1999, one day before that of its competitor, VA Linux, which used the bookbuilding method and had a 697% first-day return.

negative on average (-2.0% and -2.7%, respectively), and exhibit very large variance.[12] This is similar to the results of many studies of long-term post-IPO performance in and outside the United States.

4) Bidding and the Potential for Free-Riding

Investors who receive shares in auctioned IPOs all pay the same price regardless of their bid. This uniform-price feature gives investors an incentive to place market orders in order to free ride on the valuation homework of other investors, and to benefit from the possible underpricing of the IPO. While actual market orders are not permitted in auctioned IPOs, investors can submit quasi market orders by placing bids at very high prices. If free riding were widespread in auctioned IPOs, it might result in uninformative demand curves and mispriced shares.

For investors with large bids, such as institutions, the incentive to free ride is tempered by the concern that their bid might push up the auction clearing price. Thus, auctioned IPO investors face an ecological tradeoff. All would like to free ride on each other's information. But only retail investors can safely do so – their small bids are unlikely to move up the price. Accordingly we expect retail investors to be much more likely to place high bids than institutional investors.

The IPO issuer has to refile with the SEC if changes in price or quantity will alter realized proceeds by more than 20% relative to the initial prospectus. Hence, an investor bidding at a price that exceeds the top of the price range by more than 20% is almost certain to receive shares. Thereafter we define such bids as "high bids."

[Insert Table 2 about here.]

[12] Two firms (Andover.net and Nogatech) were delisted before the first anniversary of their IPO. Their 12-month performance is calculated at their delisting date

Table 2, Panel A confirms that retail investors are more prone to place high bids. Averaging across deals, 9.7% of bids placed by retail investors were high, vs. 6% for institutions when the percentages are computed as the number of bids (when the percentages are computed in dollar value, the percentages are 16.5% for retail vs. 6.5% for institutional bids). These percentages are quite variable across deals*,* raising the next question of which deal characteristics are associated with high bidding behavior.

Table 2, Panel B presents the results of logit regressions of the probability of placing a high bid as a function of deal and investor characteristics. The unit of observation for these regressions is a bid, and the dependent variable is an indicator variable equal to one if the bid is high (i.e., at a price that exceeds the top of the price range by more than 20%), and zero otherwise. Consistent with the univariate results, retail investors are more likely to place high bids than institutional investors. Fixing the explanatory variables at their means, the baseline probability of a retail investor bidding high is 6%, vs. 2% for an institutional investor.

Institutional investors making larger bid sizes were *less* likely to bid high: for them a one standard deviation increase in *Log(Bid Size)* is associated with about one percentage point decrease in the probability of a high bid. This finding supports the idea that institutional investors making large bids are concerned that their bids might raise the offering price.

The concern of institutional investors that their bid might increase the clearing price should be most prevalent for the largest bid sizes. In the median deal the 90th percentile institutional bid is about ten times the size of the median institutional bid and represents about five percent of total demand. Thus, the median institutional bidder is unlikely to affect the IPO price – but the largest (90th percentile) institutional bidders are likely to affect it. To check this intuition we split institutional bids into bid size deciles, and we compute the mean percentage of high bids in each decile. Figure 1 reports our results. The average percentage of high bids is significantly higher in the smallest bid size deciles which contain bids from small institutions, and as expected, it drops sharply in the highest bid size deciles.

[Insert Figure 1 about here.]

Interestingly, retail investors making larger bids are more likely to bid high: A one standard deviation increase in *Log(Bid Size)* is associated with a two percentage point increase in the probability of a high bid (Table 2, Panel B, column 2). One explanation may be that retail investors are more driven by sentiment[13] and that bullish retail investor sentiment translates into both higher prices and higher quantities.

The probability for institutions (retail investors) to submit a high bid also increases by about fifteen (twelve) percentage points when the deal has been repriced with an increased price range. This suggests that investors expect such repriced deals to perform well on the aftermarket, as is the case with bookbuilt deals, and place quasi-market orders to take advantage of this short-term performance.

We also observe a time trend. We introduce an explanatory variable named *Deal Rank*, equal to 1 for the first deal, 2 for the second deal, etc. Both institutional and retail investors were more likely to bid high in the early WR Hambrecht deals: A one standard deviation increase in the *Deal Rank* variable is associated with a seven (six) percentage point decrease in the probability of a high bid for institutional (retail) investors. There are several interpretations for this finding. Perhaps investors in the early WR Hambrecht auctions expected high levels of underpricing that are typical of bookbuilt offerings, and may have tried to obtain "bargain" shares by bidding high in early deals. This tactic may have then had less appeal as investors realized that the underpricing in IPO auctions is smaller, by design, than in bookbuilt deals. Another

[13] Dorn (2007).

possibility is that WR Hambrecht itself became more selective over time as to which investors it marketed IPOs to, and succeeded in attracting investors with more information, and more willingness to place informative bids.

It could also be that the link between *Deal Rank* and high bidding is not driven by bidders' behavior, but rather by WR Hambrecht's (and the issuer's) choice of the price range. For example, suppose that the issuer chose a low price range on a deal. That would translate mechanically into more high bids for that IPO, since we define high bids relative to the price range. One could imagine that WR Hambrecht chose excessively low price ranges in its early deals, lacking pricing experience and preferring to err on the conservative side. But if this effect explained why investors placed more high bids in early deals, we should probably also see fewer *low* bids in early deals. In fact, if we define a low bid as one placed at a price below the midpoint of the filing range, we see no correlation between *Deal Rank* and *Fraction of Low Bids in Deal*. Moreover, if the "cautious price range" explanation above were driving our results on high bids, we would think that a greater *Fraction of Low Bids in Deal* should be associated with a smaller probability of a high bid. In fact, the estimated coefficient on *Fraction of Low Bids in Deal* is positive.

Another possibility is that WR Hambrecht planned excessively narrow price ranges in some deals – mechanically driving up the number of high bids. If this were true, we would expect a positive coefficient on the *Fraction of Low Bids in Deal* in the logit regression. We find that the coefficient estimate is positive and statistically different from zero for institutions only (column 1). This suggests that institutions submit more high bids when the price range is too narrow relative to the pricing uncertainty of the deal.

We have found that free riding does occur in auctioned IPOs, mostly by retail investors placing small bids. A natural question is whether such free riding derails the auctioned IPO process, for instance by deterring the participation of informed investors, or by making the demand curves uninformative. We now turn to these issues.

5) Investor participation

If too few investors decide to acquire information and participate in the offering, the IPO price might be far from the firm's aftermarket price, and the firm may also suffer low aftermarket liquidity. Chemmanur and Liu (2006) and Sherman (2005) compare auctions vs. other IPO mechanisms and reach these conclusions from a theoretical perspective. Chemmanur and Liu (2006) argue that unlike in fixed-priced IPOs, in which the price is set before investors decide to acquire information, informational rents obtained by costly information acquisition are competed away in an auction. Sherman (2005) compares auctions with bookbuilt IPOs in which the underwriter is free to choose the IPO price and to allocate shares. This freedom theoretically allows the underwriter to reward informed investors through underpriced shares in order to induce them to acquire information. Therefore, in bookbuilt offerings, the underwriter can ensure that collectively, investors acquire the optimal amount of information. On the contrary, in auctioned IPOs, the underwriter does not control the amount of information production, which makes the outcome of the offering more uncertain.

Table 1 suggests that investor participation, measured by the overall level of oversubscription, is quite variable. We now explore the determinants of investor participation. We make a distinction between institutional and retail participation, because the willingness and ability of these two types of investors to generate information and the factors that influence their decision to participate in an IPO may differ.

If participation depends on costly information acquisition, then it should be higher when the IPO is less subject to information asymmetry, which should be the case for larger IPOs. Over time, investors may also learn about the OpenIPO process and fine tune the cost/benefit analysis of participation in auctioned IPOs, so we also include *Deal Rank*, the time rank of the deal, in our tests. Investors' willingness to participate in IPOs may also increase with stronger IPO market conditions (see Derrien (2005) and Cornelli, Goldreich and Ljungqvist (2006)) so we include a measure of market conditions in the regressions. Our *IPO Market Conditions* variable is the weighted average of the percentage of IPOs (in the entire population of U.S. IPO) that were priced above the midpoint of the price range in the 3 months preceding the IPO we are considering. The weight is 3 for the most recent month, 2 for the second-most recent month, and 1 for the third-most recent month.

[Insert Table 3 about here.]

Table 3 reports analyses of institutional and retail participation in panels A and B, respectively. The unit of observation is the deal (N=19). In both panels, investor participation is the dependent variable, and we measure it as oversubscription, using the number of shares announced in the initial filing, as well as the final number of shares announced.

The size of the deal is by far the main driver of both institutional and retail participation. The coefficient on the *Log(proceeds)* variable is statistically significant at the 1% level for institutional participation, and at the 5% level for retail participation. A 10% increase in the proceeds is associated with an increase of 16 percentage points in institutional oversubscription and three percentage points in retail oversubscription, which is economically significant compared with the average oversubscription ratio of 2.26 reported in Table 1. This finding is consistent with the hypothesis that more information is produced in larger IPOs because information is relatively less costly to acquire for larger, more visible firms. None of the other explanatory variables are consistently significant in all regressions.

Interestingly, the R^2 is quite high in all regressions (62% and 51% in institutional participation regressions, 53% and 47% in retail participation tests), and it drops dramatically (to 4% to 8%) when we exclude *Log(proceeds)* from the tests. This suggests that while participation is highly variable, it is also quite predictable using firm and IPO characteristics known before the deal, especially deal size.

In Table 4, we examine the decision to participate in auctioned IPOs at the investor level, using our ability to track institutional investors over time in the most recent sixteen deals completed by WR Hambrecht. In these tests, the unit of observation is an investor/IPO pair. For each investor/IPO pair, participation is an indicator variable equal to one if the investor decides to bid in the IPO, and zero otherwise. We identify 570 institutional investors. 402 of them participate in only one IPO, 145 in two to four IPOs, and 23 in five IPOs or more.

In these investor-level tests, we use the same set of explanatory variables as in the deal-level tests, as well as variables measuring whether the same investor participated in earlier IPOs, whether it received shares in previous deals, and how these shares performed in the aftermarket.[14] Kaustia and Knüpfer (2007) found that individual investors are more likely to participate in IPOs if past bookbuilt IPOs in which they participated had better aftermarket performance, consistent with a theory of reinforcement learning. We might observe the same effect with institutions in auctioned IPOs. Finally, we include in the list of explanatory variables *Raised Price Dummy* (respectively, *Lowered Price Dummy*), an indicator variable equal to one if the price range was

[14] These tests are limited by the fact that we cannot track investors in the very first deals and investors that placed their bids through selling group members.

raised (respectively, lowered) during the IPO process, because a change in the price range may influence an investor's participation decision.

[Insert Table 4 about here.]

Table 4 confirms that investors are more likely to participate in larger IPOs. They are also more likely to participate in the earlier auctioned IPOs. This may be because investors learned over time that the gains from being informed are not as large in auctions as in bookbuilt IPOs. Or perhaps in early deals investors expected IPOs to be priced at a discount and realized that in most cases they were not. The positive link between *IPO Market Conditions* and the probability of participation (in four out of six specifications) suggests that investors are more inclined to participate in an IPO when they expect it to be "hot".

Investor learning also seems to play a significant role in the decision to participate in an auctioned IPO. Institutional investors are more likely to participate in an auctioned IPO when they have participated in previous auctioned IPOs (specification 2), and when they have received shares in previous auctioned IPOs (specification 4). Conditional on participating in past IPOs, institutional investors are also more likely to participate when the previous IPOs in which they did participate had higher initial returns (specifications 3 and 5). The effect is significant statistically and economically. A one-standard deviation increase in the average 10-day return of past auctioned IPOs in which institutional investors participated increases their probability of participating in a given IPO by about two percentage points relative to an unconditional probability of about 8% (specification 5). Thus, past experience with the IPO mechanism, and success with it, are important ingredients in the decision of institutional investors to participate in an auctioned IPO.

This section suggests that investor participation in auctioned IPOs is primarily a function of deal size. As deal size is known to all before the IPO goes through, we interpret this finding to mean that while variable across deals, investor participation is largely predictable. Thus the fact that auctioned IPOs allow less role for the underwriter to drum up demand among investors need not be a concern.

6) The elasticity of the demand curves

The elasticity of the demand curve measures the degree of consensus among investors about the price of the IPO. Like others before us,[15] we interpret it as a measure of valuable pricing information contained in investors' bids: In a common value auction setting, if investors have access to more precise valuation information, their bids will be closer to each other. (Investors' bids might also exhibit more consensus if they herd. We consider this possibility below, and find no support for it, at least among institutional investors.)

[Insert Figure 2 about here.]

Figure 2 shows the demand curve for one of our sample IPOs. Most of the demand is within a fairly narrow price band, indicating a high elasticity. We construct several measures of elasticity as shown in Table 5, some following studies of bookbuilt IPOs, others more suited to auctioned IPOs. Liu et al. (2001) and Cornelli and Goldreich (2003) measure elasticity as the relative change in the number of shares demanded when the price is increased by 1% above the IPO price. Kandel et al. (1999) measure it as the relative quantity change when the price rises by one New Israeli Shekel. We construct similar measures, as well as elasticities computed at the

[15] Cornelli and Goldreich (2003), Kandel et al. (1999), Liu et al. (2007).

clearing price. We also compute elasticities separately for institutional and retail demand in addition to the overall elasticities. If institutional investors bring more information than retail investors into their bids, we would expect the institutional investor elasticity to be higher than the retail elasticity.

[Insert Table 5 about here.]

Table 5 reports the median elasticity across our 19 deals using alternative measures of elasticity. Demand elasticity is somewhat higher than in Kandel et al.'s (1999) study of Israeli auctioned IPOs and Liu et al.'s (2001) study of Taiwanese auctioned IPOs – the comparable elasticity measure has a median of 34.4 in our sample vs. 21 and 20 in theirs, respectively. Demand elasticity in our sample is also much higher than in Cornelli and Goldreich's (2003) study of European bookbuilt IPOs – the comparable elasticity measure has a median of 34.6 in our sample vs. 3.6 in theirs. We interpret the high elasticities in our sample as evidence that WR Hambrecht's auction system is successful at eliciting information from investors in the U.S. environment.

As the second row of Table 5 attests, the elasticity of institutional demand is markedly greater than that of retail demand, regardless of the measure of elasticity we use. The median ratio of institutional to retail elasticity is above three for most of our elasticity measures, giving credence to the notion that institutional bids are more informative than retail bids. This result is in line with the findings of Chiang, Qian and Sherman (2008) for Taiwanese auctioned IPOs.

The bottom rows of Table 5 show that overall elasticity is almost perfectly correlated with institutional elasticity. The correlation of retail demand elasticity with overall elasticity is much weaker. The contribution of institutional investors to the information content of the demand curve overwhelms any "noise" introduced by retail investors into the bidding process.

[Insert Table 6 about here.]

Table 6 provides more support for this idea, correlating institutional demand with the elasticity of the demand curve. We report correlations between institutional investor participation measures and elasticities. The pattern is clear: greater institutional participation is associated with greater elasticity. In the first row of the table, the correlation between institutional oversubscription and elasticity of demand is positive for eight out of nine measures of demand elasticity (and statistically significantly at conventional levels for five measures). In the second row of Table 6, we measure institutional participation as the percentage of institutional demand. The correlation between institutional participation and demand elasticity is positive for all measures of elasticity, and statistically significant for seven of them. These results show that higher institutional participation is associated with more information revelation not only when we consider institutional participation alone (in the first row of Table 6), but also when we measure institutional participation relative to retail participation (in the second row of Table 6). They confirm that institutional bids are informative and retail bids are not (or, at least, much less so).

We have seen in Table 3 that participation is higher in larger auctioned IPOs, and we concluded that information production is higher in larger deals. If this interpretation is correct, then demand elasticity should also be higher in larger deals. The third row of Table 6 confirms this hypothesis: The correlation between *Log(proceeds)* and elasticity is significantly positive with five (out of nine) measures of elasticity. This confirms our previous findings that more information is produced in larger deals.

So far we have interpreted greater consensus among investors as synonymous with a greater amount of information incorporated in the demand curve. An alternative view is that greater consensus results from collective investor error: Investors might all rely on the same erroneous pieces of information, i.e., they might be herding. If greater consensus among investors truly reflects a better information environment, higher demand elasticity should be associated with *less* aftermarket price variability. Under the "collective error" view, higher demand elasticity should be associated with *more* aftermarket price variability, so we next try to distinguish between these two possibilities.

[Insert Table 7 about here.]

In Table 7, we regress aftermarket variability on measures of institutional and retail demand elasticities. We measure aftermarket variability as the absolute value of the three-month adjusted stock price performance.[16] For almost all measures of elasticity, we find that higher institutional demand elasticity is associated with less aftermarket variability. This finding is consistent with the view that institutional demand contributes useful valuation information to the pricing of the IPO. By contrast, higher retail elasticity is almost always associated with higher aftermarket variability, consistent with the view that retail investors add noise to the pricing process.[17]

7) Pricing

The spirit of the IPO auction process is to "let the market speak." However, WR Hambrecht's auction process has explicitly allowed for discretion in the setting of the IPO price. We have seen that in seven IPO auctions, the IPO price reflected a discount from the clearing price, leaving 12 auctions where the auction clearing price was also the chosen IPO price. We

[16] The results are similar if we calculate aftermarket variability over different horizons.
[17] For a comparative analysis of aftermarket variability in bookbuilt vs. auctioned IPOs, see Pettway et al. (2008).

want to examine empirically what determines whether the IPO was priced at a discount to the auction clearing price.

One possibility is that WR Hambrecht and the issuer attempted to shield the IPO price from the influence of high bids, when they felt that the demand curve contained "froth." Such actions would attempt to mitigate the influence of high bids on the IPO price.

[Insert Table 8 about here.]

Table 8 suggests that high bids have much less influence on the IPO price than on the clearing price. We regress *Clearing Price Relative* (equal to the clearing price minus the midpoint of the price range, divided by the midpoint of the price range – column 1) and *IPO Price Relative* (equal to the IPO price minus the midpoint of the price range, divided by the midpoint of the price range – column 2) on the percentage of high bids and control variables. In column 1, the coefficient on *Fraction of high bids in Deal* is strongly positive and significant. In column 2, it is not statistically significant. This suggests that high bids do influence the clearing price, but not the chosen IPO price. These results are consistent with WR Hambrecht and the issuer "buffering" the IPO price from the influence of high bids.

We test the "buffering" hypothesis more directly by examining the determinants of the discount. That is, if the issuer is concerned about overpricing, we should see a more likely, and a higher discount, when the clearing price is affected by high bids. For each deal we compute what the clearing price would have been if the issuer had discarded the high bids – high bids had an impact on the clearing price in five out of 19 deals. The issuer might also be hesitant about pricing the IPO at the clearing price when the elasticity of the demand curve is low, as that would suggest disagreement among investors. We find evidence consistent with both of these intuitions.

[Insert Table 9 about here.]

In Table 9 we report the results of Tobit regressions of the IPO discount on the *Effect of High Bids on Clearing price* (defined as the change in clearing price when high bids are excluded divided by the clearing price), demand elasticity, and control variables. Fixing the explanatory variables at their means, the baseline probability of a discount is 34%. A one standard deviation increase in the variable *Effect of High Bids on Clearing Price* is associated with a 56 percentage point increase in the probability of a discount, and a two percentage point increase in the expected discount. A one standard deviation increase in *Elasticity* is associated with a 44 percentage point fall in the probability of a discount and a one percentage point reduction in the expected discount: IPO auction issuers were more comfortable "letting the market speak" when high bids did not influence the clearing price, and when the demand curve contained more information.

8) Flipping

Next, we explore the flipping behavior of auctioned IPO investors, i.e., their decision to sell the shares they received in the IPO in the month following the offering. Flipping is a serious concern for issuers and underwriters, especially in cold deals, in which it can put downward pressure on the aftermarket price. Krigman, Shaw and Womack (1999) and Aggarwal (2003) have analyzed flipping in bookbuilt IPOs, but no such evidence exists for auctions. Bankers often argue that the flexibility of the bookbuilding mechanism allows underwriters to put IPO shares in the "good hands" of long-term investors, that is, to avoid flippers. Auctions do not offer this flexibility to the underwriter, and might therefore be more subject to flipping. On the other hand, if auctions do a good job of placing the shares in the hands of investors who value them the most, then flipping should be less prevalent for IPO auctions.

We have flipping data for 390 institutional investors and 36 retail investors in 11 deals. In 323 of the 390 institutional investor observations, the investor placed its bid through WR Hambrecht and can be identified by name. In the remaining cases, investors placed their bids through selling group members, and the flipping data is aggregated at the selling group member level. On average, institutional (retail) investors flip 27.6% (26.5%) of the shares they receive in the month following the offering. These numbers are very close to those reported by Aggarwal (2003) for bookbuilt IPOs. She finds that in the two days following the offering institutional (retail) investors flip 26% (24%) of their shares on average.[18]

[Insert Table 10 about here.]

Is there a link between investor flipping and initial return? In the 11 IPOs for which we observe flipping, six had 10-day returns equal to or below zero, and five had strictly positive 10-day returns. Table 10, Panel A reports the average flipping ratio of institutional and retail investors depending on initial return. This table shows that both institutions and retail investors flip a much larger fraction of their shares in cold deals: Institutions flip on average 33.6% (19.7%) of their shares when initial return is negative (positive). For retail investors, the effect is even more pronounced. They flip more than half of their shares (52.5%) in cold deals, and only 7.9% on average when initial return is positive.[19] This result is at odds with the findings of Aggarwal (2003), who shows that in bookbuilt IPOs, flipping is significantly higher in hot deals than in cold deals.

What can explain this significant difference between auctions and bookbuilding? We surmise that the discretion underwriters enjoy in bookbuilt IPOs allows them to punish investors

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[18] Since we measure flipping over one month after the IPO (rather than Aggarwal's (2003) two days) our flipping numbers are probably upwardly biased relative to hers.

[19] In most cases, the median investor does not flip any of his shares. This is because the distribution of the flipping ratio is bi-modal: most investors flip either all their shares or no shares at all.

who flip their shares in cold deals (when flipping is presumably the most detrimental to the issuer and the underwriter) by excluding them from future offerings. In a multi-period game setting in which investors benefit from a long-term relationship with the underwriter, investors may respond to this threat by reluctantly refraining from flipping cold deals. In an auction, the underwriter cannot discriminate among investors, and therefore cannot prevent investors from flipping their shares in cold deals. There are other ways to discourage flipping. One of them is to impose penalties on syndicate members whose investors flipped their shares. The OpenIPO mechanism also allows explicitly WR Hambrecht to exclude investors from the bidding process. However, these alternative mechanisms are probably less efficient anti-flipping tools than allocation discrimination. Moreover, as a niche underwriter, WR Hambrecht's bargaining power with large institutional investors and its ability to discourage them from flipping was in this period probably relatively limited.

Investor-level flipping data for 323 institutional investors allows further analysis. If IPO auctions succeed in placing shares with the investors who value them the most, and if bids reflect private valuations, investors with high bids should flip less. We find support for this joint hypothesis in Table 10, Panel B, where we analyze flipping decisions in a multiple regression framework. We construct the variable *Institution's Average Bid Price in the IPO*, equal to the weighted average price of the bids submitted by the investor (where the weight is the number of shares in the bid) minus the midpoint of the price range. The coefficient on this variable in the regression is negative with a *p*-value of 0.04, suggesting that for institutions high price bids reflected truly high private valuations, and not just an attempt to receive share allocations.

Institutional investors also flipped more in earlier deals. Consistent with the univariate evidence in Panel A, Panel B of Table 10 shows that investors flip less when the initial return is positive. The flipping ratio decreases by about 15 percentage points when the 10-day return of the

IPO is positive (p-value 0.01). Institutional investors also tend to flip more in larger deals, and to flip less when they received more shares. Perhaps institutions decided to flip their shares when their allocation fell short of their desired holdings in the company.

9) Investor returns

We have shown that institutional investors that participate in these auctions seem to be more informed than individuals, and contribute their information in their bids. In equilibrium, institutions should earn higher returns in auctioned IPOs to compensate them for the cost of their information. We find evidence consistent with this prediction: institutions stay away from "bad" deals (those with poor aftermarket performance), and participate more in "hot" deals (those that do well in the aftermarket).

[Insert Figure 3 about here.]

Figure 3 relates 10-day underpricing to the fraction of the IPO shares allocated to institutions. The figure shows that, with the exception of one outlier, Andover.net, which appears at the top of Figure 3, institutions get a bigger share of IPOs with smaller initial returns. If we ignore the outlier, Andover.net, the correlation between these two variables is 0.53 and is significant at the 5% level. The weighted average 10-day return of institutional vs. retail investors (the weight being the fraction of the shares received by each group of investors) is 8.5% for institutions vs. 5.4% for individuals. If we ignore Andover.net, we obtain average returns of 0.7% vs. -5.0%, respectively. Overall, the fact that institutional investors obtain a bigger share of the deals with the best aftermarket performance translates into their better average returns. This is consistent with the idea that institutional investors take advantage of their superior information vis-à-vis retail investors.[20]

10) Conclusion

We study 19 auctioned IPOs that used WR Hambrecht's OpenIPO auction mechanism between 1999 and 2007. Overall, we find that this mechanism allows the underwriter and the issuer to extract information. Bids posted at high prices indeed suggest that some investors (predominantly retail and small institutions, whose impact on the clearing price is limited) try to free-ride on the mechanism. Retail bids are less informative than institutional bids, but do not seem to affect the information-extraction mechanism enough to discourage institutional investors from participating. Demand in auctioned IPOs is quite elastic, suggesting that investors produce information and reveal it in the bidding process. The pricing flexibility offered by the mechanism allows the issuer to "buffer" against such free-riding by discounting the deal relative to the clearing price when more investors submit bids at high prices. We also find that overall, flipping is about as prevalent in auctions as in bookbuilt deals. However, unlike in bookbuilding, investors tend to flip their shares more in deals with low initial returns, perhaps because the absence of allocation discrimination prevents issuers from penalizing past flippers. Finally, we find that institutional investors, who provide more information, are somewhat rewarded by obtaining larger shares of the deals with higher initial returns.

Overall, these results suggest that auctions are an effective alternative to traditional bookbuilding. A potential concern with our results might be that our sample only consists of

[20] This result is consistent with the findings of Lin, Lee, and Liu (2007) and Chiang, Qian and Sherman (2008) for Taiwanese auctioned IPOs.

successful deals. But the number of withdrawn auctioned IPOs over the 1999-2007 period – six – is in line with that reported by Dunbar and Foerster (2008) who find that 20% of IPOs were withdrawn in the 1985-2000 period in the U.S. Another concern is that issuers select their IPO mechanism, and we cannot exclude the possibility that issuing companies for which investors have more information are disproportionately represented in WR Hambrecht's IPO auctions. Our investor participation results suggest that some firms are better suited for auctioned IPOs than others, in particular large firms that are less subject to information asymmetry and that appeal naturally to large institutional investors.

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Table 1
Summary Statistics

This table reports summary statistics on the 19 deals and 37,570 individual bids in our sample.

In Panel A, *Proceeds* are equal to the IPO price multiplied by the number of shares sold, excluding overallotment shares. *Firm age* is the number of years since incorporation at IPO date.

In Panel B, *Institutional (retail) demand per bid* is the number of shares demanded multiplied by the bid price for each institutional (retail) bid. Bids at different prices from the same investor are counted as separate bids. *Oversubscription* is the number of shares demanded at all prices divided by the number of shares sold, excluding the overallotment option. *Retail allocation* is the fraction of the IPO shares received by retail investors.

In Panel C, *IPO price relative to midpoint of range* is the IPO price minus the midpoint of the price range, divided by the midpoint of the price range. *IPO price relative to average institutional (retail) price* is the IPO price minus the demand-weighted average institutional (retail) bid price, divided by the demand-weighted average institutional (retail) bid price. *Discount relative to market clearing price* is the clearing price minus the IPO price, divided by the IPO price. *Rationing* is the number of shares offered to the public divided by the number of shares investors bid for at prices equal to or above the IPO price. *1-day return* and *10-day return* are unadjusted returns over 1- and 10-day periods following the IPO, respectively. *3-month* and *12-month Nasdaq-adjusted* returns are adjusted using the return of the Nasdaq index over the same period. In panels A, B and C, the last column contains averages for samples of bookbuilt IPOs (when available). Numbers in the last columns of panels A and C come from Jay Ritter's website and are for U.S. bookbuilt IPOs. Numbers in the last column of Panel B come from Cornelli and Goldreich (2003) or Jenkinson and Jones (2004), and are for samples of European bookbuilt IPOs. The source (CG, or JJ) is in parentheses.

Panel A: Firm and IPO characteristics

		Number of auctioned IPOs in our sample	Total number of IPOs in the U.S.
IPO year	1999	3	476
	2000	1	381
	2001	2	80
	2002	1	66
	2003	2	63
	2004	1	174
	2005	5	161
	2006	2	156
	2007	2	158

	Mean	Median	Min	Max	N	Averages for the entire universe of U.S. IPOs in 1999-2007
Proceeds ($million)	107	33.6	10.5	1,200	19	188
Firm age	11.7	7	1	30	19	8
Fees	5.5%	6%	1.9%	7%	19	--

Table 1 (continued)

Panel B: Bids

	Mean	Median	Min	Max	N	Averages for samples of European bookbuilt IPOs
Number of bids per deal	1,977	1,080	75	13,504	19	411 (CG), 205 (JJ)
Number of institutional bids per deal	152	92	22	647	19	--
Number of retail bids per deal	1,702	862	52	12,857	19	--
Institutional demand per bid ($,000)	2,559	320	0.2	128,000	2,889	
Retail demand per bid ($,000)	44.7	5.1	0	48,200	32,353	
Oversubscription	2.26	1.82	1.02	5.28	19	9.1 (CG), 10 (JJ)
Fraction of winning bids	82.1%	93.0%	26.7%	98.7%	19	--
Retail allocation	13.0%	12.0%	3.5%	28.9%	19	--

Panel C: Pricing and aftermarket performance

	Mean	Median	Min	Max	N
IPO price relative to midpoint of range	-9.8%	-12.5%	-33.3%	9.1%	19
IPO price relative to average institutional price	-8.9%	-8.4%	-25.0%	8.6%	19
IPO price relative to average retail price	-18.8%	-16.9%	-59.6%	4.7%	19
Discount relative to market clearing price	4.5%	0	0	33.3%	19
Rationing	73.5%	80.9%	27.5%	100.0%	19
1-day return	13.8%	0.6%	-21.6%	252.1%	19
10-day return	8.8%	1.8%	-35.2%	167.7%	19
3-month Nasdaq-adjusted return	-2.0%	-9.5%	-61.4%	103.7%	19
12-month Nasdaq-adjusted return	-2.7%	-22.0%	-138.0%	335.0%	19

Table 2
Determinants of high bids

The sample consists of 2,889 institutional bids and 31,446 retail bids in 19 deals. We define a high bid as one made at a price that exceeds the top of the price range by more than 20%.

In row 1 of Panel A we compute the percentage of high bids by dividing the number of high bids by the number of bids in each deal. In row 2 of Panel A we compute the percentage of high bids submitted by each investor class by dividing the dollar value of high bids by the dollar value of all bids in each deal.

In Panel B, we report logit regressions. The dependent variable is a dummy variable equal to one if the bid is high and zero otherwise. *Log(Bid Size)* is the log of the number of shares for that bid. *Deal Rank* is the rank among WR Hambrecht auctioned IPOs (1 for the first IPO, etc.). *IPO Market Conditions* is the weighted average of the percentage of IPOs that were priced above the midpoint of the price range in the 3 months preceding the IPO we are considering. The weight is 3 for the most recent month, 2 for the second-most recent month, and 1 for the third-most recent month. *Log(proceeds)* is the log of the dollar size of the offering, excluding overallotment shares. *Fraction of Low Bids in Deal* is the number of low bids (priced below the midpoint of the price range) divided by the number of bids in the deal (excluding high bids). *Raised Price Dummy* is equal to one if the top of the price range was raised between the first filing and the IPO, and zero otherwise. *Lowered Price Dummy* is equal to one if the top of the price range was lowered between the first filing and the IPO, and zero otherwise. For continuous explanatory variables we report the change in the probability of a high bid associated with a one standard deviation change in the independent variable, assuming that the other variables are fixed at their sample mean. For dummy explanatory variables we report the change in the probability of a high bid as the dummy variable goes from zero to one. We report the *p*-values (calculated with clustering at the IPO level) in parentheses below the marginal effect numbers. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Panel A: Percentage of high bids for institutions vs. retail investors

		Institutions	Retail
In number of bids	Mean percentage across deals	6.0%	9.7%
	Standard deviation of percentage across deals	11.9%	10.7%
In dollar volume	Mean percentage across deals	6.5%	16.5%
	Standard deviation of percentage across deals	15.0%	18.2%

Panel B: Logit regressions

	Change in the probability of a high bid associated with a one standard deviation increase in the independent variable	
	Institutions	Retail
Log(Bid Size)	-0.014***	0.021***
	(0.00)	(0.01)
Deal Rank	-0.069***	-0.062***
	(0.00)	(0.00)
IPO Market Conditions	0.000	-0.000
	(0.87)	(0.23)
Log(proceeds)	0.039**	-0.005
	(0.01)	(0.89)
Fraction of Low Bids in Deal	0.027***	0.016
	(0.00)	(0.34)
	Change in the probability of a high bid as the explanatory variable goes from 0 to 1	
Raised Price Dummy	0.146*	0.124***
	(0.09)	(0.01)
Lowered Price Dummy	0.078	0.012
	(0.13)	(0.63)
Baseline probability of bidding high	2%	6%
Pseudo R^2	0.30	0.11
N	2,889	31,446

Table 3
Determinants of investor participation at the deal level

This table reports OLS regressions of investor participation on the following explanatory variables: *Deal Rank* is the rank among WR Hambrecht auctioned IPOs (1 for the first IPO, etc.). *IPO Market Conditions* is the weighted average of the percentage of IPOs that were priced above the midpoint of the price range in the 3 months preceding the IPO we are considering. The weight is 3 for the most recent month, 2 for the second-most recent month, and 1 for the third-most recent month. *Log(proceeds)* is the log of the dollar size of the offering, excluding overallotment shares. In Panel A, the dependent variables are two measures of institutional investor participation: Institutional oversubscription (initial filing) is the number of shares demanded by institutions (at all prices) divided by the number of shares offered by the issuer in the first IPO filing. Institutional oversubscription (final) is the number of shares demanded by institutions (at all prices) divided by the number of shares offered by the issuer in the IPO prospectus. In Panel B, the dependent variables are two measures of retail investor participation: Retail oversubscription (initial filing) is the total number of shares demanded by retail investors divided by the number of shares offered by the issuer in the first IPO filing. Retail oversubscription (final) is the total number of shares demanded by retail investors divided by the number of shares offered by the issuer in the final IPO prospectus. We report *p*-values in parentheses below the regression coefficients.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Panel A: Institutional participation

	Dependent variable	
	Institutional oversubscription (initial filing)	Institutional oversubscription (final)
Deal Rank	-0.066	-0.054
	(0.23)	(0.19)
IPO Market Conditions	0.730	0.658
	(0.34)	(0.42)
Log(proceeds)	1.566***	0.942***
	(0.01)	(0.00)
Constant	-25.034***	-14.360***
	(0.01)	(0.00)
R^2	0.62	0.51
R^2 when we replicate the tests without Log(proceeds)	*0.08*	*0.04*
N	19	19

Panel B: Retail participation

	Dependent variable	
	Retail oversubscription (initial filing)	Retail oversubscription (final)
Deal Rank	-0.021	-0.017
	(0.14)	(0.13)
IPO Market Conditions	0.393*	0.386*
	(0.07)	(0.08)
Log(proceeds)	0.330**	0.197**
	(0.03)	(0.02)
Constant	-5.459**	-3.188**
	(0.04)	(0.03)
R^2	0.53	0.47
R^2 when we replicate the tests without Log(proceeds)	*0.05*	*0.08*
N	19	19

Table 4

Determinants of the probability of institutional participation at the investor level

This table reports the results of logit regressions of institutional participation on explanatory variables. The sample consists of 9,120 investor-deal observations from 16 deals for which institutional investor-level data is available. The dependent variable is an indicator variable equal to one if the investor participated in the deal, and zero otherwise. *Deal Rank* is the rank among WR Hambrecht auctioned IPOs (1 for the first IPO, etc.). *IPO Market Conditions* is the weighted average of the percentage of IPOs that were priced above the midpoint of the price range in the 3 months preceding the IPO we are considering. The weight is 3 for the most recent month, 2 for the second-most recent month, and 1 for the third-most recent month. *Log(proceeds)* is the log of the dollar size of the offering, excluding overallotment shares. *%Past participation* is the number of previous IPO auctions in which this investor participated, divided by the number of previous IPOs for which investor participation is available. *PastUP* is the average 10-day return for the previous IPO auctions in which this investor participated. *%PastPartAlloc* is the number of previous IPO auctions in which this investor participated and received shares, divided by the number of previous IPOs for which investor participation is available. *PastUPAlloc* is the average 10-day return for the previous IPO auctions in which this investor participated and received shares. *PastUPAll* is the average 10-day return for all previous IPO auctions. *Raised Price dummy* is a dummy variable equal to one if the top of the price range was raised between the first filing and the IPO, and zero otherwise. *Lowered Price dummy* is a dummy variable equal to one if the top of the price range was lowered between the first filing and the IPO, and zero otherwise.

For continuous explanatory variables we report the change in the probability of participation associated with a one standard deviation change in the independent variable. For dummy explanatory variables we report the change in the probability of participation as the dummy variable goes from zero to one. We report the *p*-values (calculated with clustering at the IPO level) in parentheses below the marginal effect numbers. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

	(1)	(2)	(3)	(4)	(5)	(6)
	Change in probability of participation associated with a one standard deviation increase in the independent variable					
Deal Rank	-0.022***	-0.023***	-0.057***	-0.023***	-0.053***	-0.028**
	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.02)
IPO Market Conditions	0.016***	0.015***	-0.008	0.015***	0.012	0.016***
	(0.00)	(0.00)	(0.45)	(0.00)	(0.39)	(0.00)
Log(proceeds)	0.062***	0.061***	0.063***	0.061***	0.061***	0.063***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
%Past participation		0.007*				
		(0.06)				
PastUP			0.018***			
			(0.00)			
%PastPartAlloc				0.006*		
				(0.10)		
PastUPAlloc					0.017***	
					(0.00)	
PastUPAll						-0.006
						(0.41)
	Change in probability of participation as the independent dummy variable goes from zero to one					
Raised Price Dummy	0.046	0.047	-0.019	0.046	-0.025	0.046
	(0.21)	(0.21)	(0.40)	(0.21)	(0.26)	(0.18)
Lowered Price Dummy	0.020	0.017	0.060*	0.018	0.058	0.020
	(0.21)	(0.34)	(0.06)	(0.32)	(0.12)	(0.24)
Pseudo R^2	0.15	0.16	0.05	0.16	0.05	0.15
N	9,120	8,550	3,403	8,550	3,146	9,120

Table 5
Demand curve elasticities

This table reports measures of elasticity (one column per measure) for our sample of 19 auctioned IPOs. The first row of the table reports the definitions of our elasticity measures. Other rows report Spearman rank correlations between various measures of elasticity. We report the *p*-values below the correlation coefficients. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Relative change in quantity of shares demanded when:	Price goes up 1% above the IPO price (similar to Cornelli and Goldreich 2003)	Price goes up 10 cents above the IPO price	Price goes up $1 above the IPO price	Price goes from 90% to 110% of the IPO price (arc elasticity)	Price goes up 1% above the clearing price (similar to Cornelli and Goldreich 2003)	Price goes up 10 cents above the clearing price (similar to Kandel et al. 1999)	Price goes up $1 above the clearing price	Price goes from 90% to 110% of the clearing price (arc elasticity)	Price goes from the bottom to the top of the pricing range
Median	34.61	33.98	4.36	3.20	35.98	34.43	4.61	4.57	2.13
Median ratio of institutional to retail elasticity	3.77	3.77	2.76	3.05	3.73	3.76	3.13	3.05	1.82
Correlation of overall elasticity with institutional elasticity	0.97***	0.98***	0.99***	0.98***	0.99***	0.99***	0.99***	0.98***	0.96***
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Correlation of overall elasticity with retail elasticity	0.56***	0.54**	0.56***	0.54**	0.48**	0.48**	0.71***	0.87***	0.29
p-value	0.01	0.02	0.01	0.02	0.04	0.04	0.00	0.00	0.23

Table 6
Institutional participation and demand elasticities

This table reports correlations between different measures of elasticity (one column per measure) and different measures of institutional participation for our sample of 19 auctioned IPOs. The first row of the table reports the definitions of our elasticity measures. In the second row, investor participation is institutional oversubscription, the number of shares demanded by institutions at all prices divided by the number of shares sold, excluding the overallotment option. In the third row, investor participation is the dollar value of institutional demand at all prices, divided by the total dollar value of demand at all prices. In the fourth row, we report correlations between elasticity and the log of the dollar size of the offering. We report the *p*-values below the correlation coefficients. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Relative change in quantity of shares demanded when:	Price goes up 1% above the IPO price	Price goes up 10 cents above the IPO price	Price goes up $1 above the IPO price	Price goes from 90% to 110% of the IPO price (arc elasticity)	Price goes up 1% above the clearing price	Price goes up 10 cents above the clearing price	Price goes up $1 above the clearing price	Price goes from 90% to 110% of the clearing price (arc elasticity)	Price goes from the bottom to the top of the pricing range
Correlation of elasticity with institutional oversubscription	-0.122	0.137	0.762***	0.619***	0.070	0.658***	0.781***	0.716***	0.070
p-value	0.62	0.58	0.00	0.00	0.78	0.00	0.00	0.00	0.78
Correlation of elasticity with the percentage of dollar institutional demand	0.429*	0.435*	0.429*	0.573***	0.368	0.232	0.432*	0.452**	0.454**
p-value	0.07	0.06	0.07	0.01	0.12	0.34	0.06	0.05	0.05
Correlation of elasticity with the size of the deal	-0.302	-0.155	0.526**	0.448**	-0.039	0.544**	0.551***	0.550***	0.229
p-value	0.21	0.53	0.02	0.05	0.87	0.02	0.01	0.01	0.35

Table 7
Aftermarket stock price variability and demand elasticities

This table reports the results of OLS regressions of aftermarket stock price variability on measures of institutional and retail demand elasticity for the 19 auctioned IPOs in our sample using the following model:

$$\textit{Aftermarket variability}_i = \alpha_0 + \alpha_1.\textit{Log(proceeds)}_i + \alpha_2.\textit{IPO market conditions}_i + \alpha_3.\textit{institutional elasticity}_i + \alpha_4.\textit{retail elasticity}_i + e_i$$

We define aftermarket stock price variability as the absolute value of the three-month Nasdaq-adjusted stock performance relative to the offer price, in percent. Elasticities are defined in the first column. *Log(proceeds)* is the log of the dollar size of the offering, excluding overallotment shares. *IPO Market Conditions* is the weighted average of the percentage of IPOs that were priced above the midpoint of the price range in the 3 months preceding the IPO we are considering. The weight is 3 for the most recent month, 2 for the second-most recent month, and 1 for the third-most recent month. Heteroskedasticity-consistent *p*-values are in parentheses below the coefficient estimates. * p<0.10, ** p<0.05, *** p<0.01.

		Dependent variable: Aftermarket stock price variability								
Log(proceeds)		-9.02	-7.18	-9.82*	-4.34	-5.56	0.30	1.95	-1.77	-7.56
		(0.16)	(0.21)	(0.06)	(0.33)	(0.31)	(0.97)	(0.82)	(0.73)	(0.20)
IPO Market Conditions		-0.12	-0.10	-0.00	0.01	-0.10	0.02	0.12	0.08	-0.24
		(0.62)	(0.58)	(0.99)	(0.98)	(0.72)	(0.94)	(0.70)	(0.81)	(0.45)
Relative change in quantity of shares demanded when:										
Price goes up 1% above the IPO price	Institutional	-0.61***								
		(0.01)								
	Retail	0.63**								
		(0.02)								
Price goes up 10 cents above the IPO price	Institutional		-0.43**							
			(0.02)							
	Retail		0.58**							
			(0.03)							
Price goes up $1 above the IPO price	Institutional			-4.99***						
				(0.00)						
	Retail			6.31***						
				(0.00)						

Table 7 (continued)

Price goes from 90% to 110% of the IPO price (arc elasticity)	Institutional				-7.67***					
					(0.00)					
	Retail				7.04***					
					(0.00)					
Price goes up 1% above the clearing price	Institutional					-0.69**				
						(0.01)				
	Retail					0.65**				
						(0.02)				
Price goes up 10 cents above the clearing price	Institutional						-0.47**			
							(0.02)			
	Retail						0.72**			
							(0.04)			
Price goes up $1 above the clearing price	Institutional							-5.15**		
								(0.02)		
	Retail							5.43**		
								(0.01)		
Price goes from 90% to 110% of the clearing price (arc elasticity)	Institutional								-0.783**	
									(0.05)	
	Retail								6.40**	
									(0.04)	
Price goes from the bottom to the top of the pricing range	Institutional									-1.56
										(0.18)
	Retail									7.03
										(0.29)
Constant		218.13*	180.35	221.47**	134.15	162.04	47.32	19.14	91.09	178.99*
		(0.09)	(0.11)	(0.02)	(0.10)	(0.13)	(0.71)	(0.71)	(0.32)	(0.07)
R^2		0.43	0.42	0.45	0.47	0.39	0.36	0.32	0.37	0.11
N		19	19	19	19	19	19	19	19	19

Table 8
Determinants of the IPO price and the clearing price

This table reports OLS regressions of the *Clearing Price Relative* and the *IPO Price Relative* on the *Fraction of High Bids in Deal* and control variables. The dependent variable in column 1 is *Clearing Price Relative*, equal to the clearing price minus the midpoint of the price range, divided by the midpoint of the price range. The dependent variable in column 2 is *IPO Price Relative*, equal to the IPO price minus the midpoint of the price range, divided by the midpoint of the price range. *IPO Market Conditions* is the weighted average of the percentage of IPOs that were priced above the midpoint of the price range in the 3 months preceding the IPO we are considering. The weight is 3 for the most recent month, 2 for the second-most recent month, and 1 for the third-most recent month. *Log(proceeds)* is the log of the dollar size of the offering, excluding overallotment shares. *Fraction of High Bids in Deal* is the number of high bids (defined as exceeding the top of the price range by more than 20%), divided by the number of bids in the deal. *Raised Price Dummy* is a dummy variable equal to one if the top of the price range was raised between the first filing and the IPO, and zero otherwise. We report *p*-values in parentheses below the coefficient estimates.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

	Dependent variable	
	Clearing Price Relative	IPO Price Relative
IPO Market Conditions	0.287**	0.256**
	(0.02)	(0.04)
Log(proceeds)	0.066	0.048
	(0.12)	(0.32)
Raised Price Dummy	0.058	0.019
	(0.68)	(0.90)
Fraction of High Bids in Deal	0.775***	0.120
	(0.01)	(0.54)
Constant	-1.398*	-1.077
	(0.08)	(0.22)
R^2	0.71	0.39
N	19	19

Table 9
Determinants of the IPO discount

This table reports the results of a Tobit regression of the IPO discount on explanatory variables. The dependent variable is the relative discount defined as the clearing price minus the IPO price divided by the clearing price. *Effect of High Bids on Clearing Price* is the clearing price minus the clearing price when we exclude high bids (i.e., bids made at a price that exceeds the top of the price range by more than 20%), divided by the clearing price. *IPO Market Conditions* is the weighted average of the percentage of IPOs that were priced above the midpoint of the price range in the 3 months preceding the IPO we are considering. The weight is 3 for the most recent month, 2 for the second-most recent month, and 1 for the third-most recent month. *Log(proceeds)* is the log of the dollar size of the offering, excluding overallotment shares. *Deal Rank* is the rank among WR Hambrecht auctioned IPOs (1 for the first IPO, etc.). We report the marginal effects on the probability of a discount, and on the expected discount (conditional on the discount being positive). We report *p*-values in parentheses below the marginal effects. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

	Marginal effect on the probability of discount of a one standard deviation change in the explanatory variable	Marginal effect on the expected discount of a one standard deviation change in the explanatory variable
Effect of High Bids on Clearing Price	0.56**	1.8%***
	(0.03)	(0.01)
Elasticity (relative change in quantity of shares demanded when price rises 1% from the clearing price)	-0.44**	-1.4%***
	(0.02)	(0.01)
IPO Market Conditions	0.26	0.9%
	(0.32)	(0.28)
Log(Proceeds)	0.25*	0.8%*
	(0.10)	(0.09)
Deal Rank	0.29	0.9%
	(0.25)	(0.22)
N	19	

Table 10
Flipping

Panel A reports mean and median flipping ratios across investors in five IPOs with positive 10-day returns and six IPOs with 10-day returns equal to or below 0. For each investor, the flipping ratio is calculated as the number of shares flipped within a month of the IPO, divided by the number of shares received in the IPO.

Panel B reports OLS regressions of flipping ratios on explanatory variables for 323 institutional investors in 11 auctioned IPOs. For each investor, the flipping ratio is calculated as the number of shares flipped within a month of the IPO, divided by the number of shares received in the IPO. *Deal Rank* is the rank among WR Hambrecht auctioned IPOs (1 for the first IPO, etc.). *IPO Market Conditions* is the weighted average of the percentage of IPOs that were priced above the midpoint of the price range in the 3 months preceding the IPO we are considering. The weight is 3 for the most recent month, 2 for the second-most recent month, and 1 for the third-most recent month. *Log(proceeds)* is the log of the dollar size of the offering, excluding overallotment shares. *Positive 10-day Return* is an indicator variable equal to 1 if the 10-day return of the IPO is strictly positive, 0 otherwise. *Institution's Average Bid Price in the IPO* is the weighted average price of the bids submitted by the investor (the weight is the number of shares in the bid), minus the midpoint of the filing range. *Log(shares)* is the log of the number of shares received by the investor. We report *p*-values (calculated with clustering at the IPO level) in parentheses below the regression coefficients. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Panel A: Initial returns and flipping

Shares flipped as a fraction of the shares received	10-day return ≤ 0 (6 IPOs)		10-day return > 0 (5 IPOs)	
	Mean	Median	Mean	Median
Institutions	33.6%	0	19.7%	0
N	221		169	
Retail	52.5%	36%	7.8%	0
N	15		21	

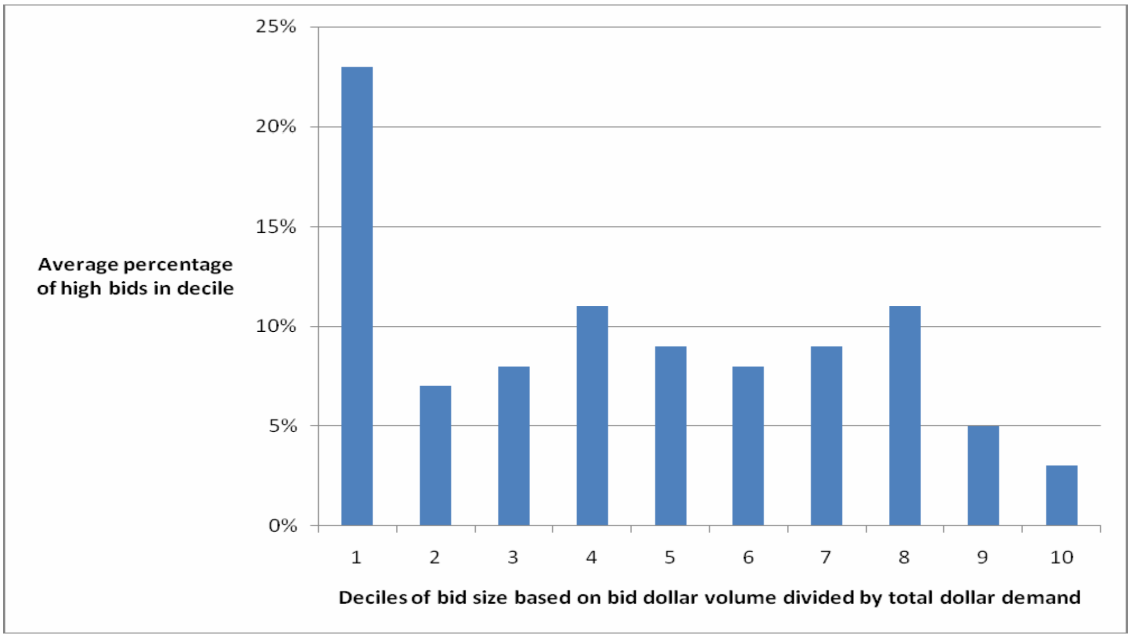
Panel B : Explaining flipping

	Dependent variable: flipping ratio
Deal Rank	-0.008
	(0.22)
IPO Market Conditions	0.399**
	(0.01)
Log(proceeds)	0.048**
	(0.03)
Positive 10-day Return	-0.155***
	(0.01)
Institution's Average Bid Price in the IPO	-0.042**
	(0.04)
Log(shares)	-0.058**
	(0.02)
Constant	-0.903
	(0.90)
R^2	0.14
N	323

Figure 1

Average percentage of high bids for institutional investors, by size of bids

We define a high bid as one made at a price that exceeds the top of the price range by more than 20%.



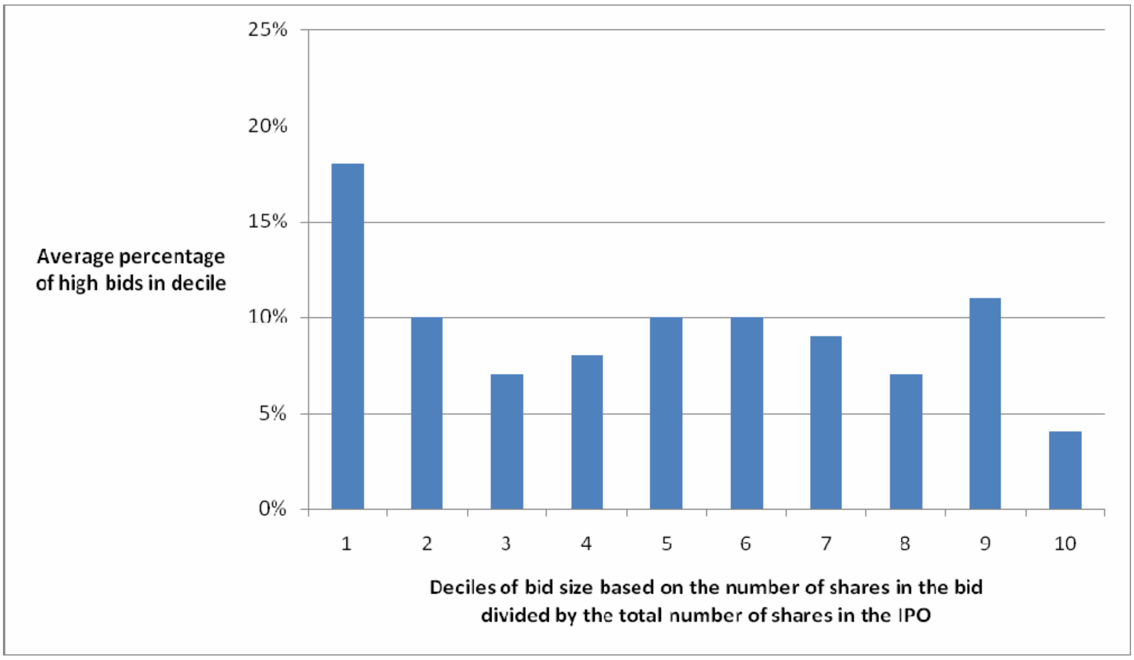


Figure 2
Demand curve for one of the auctioned IPOs in our sample.

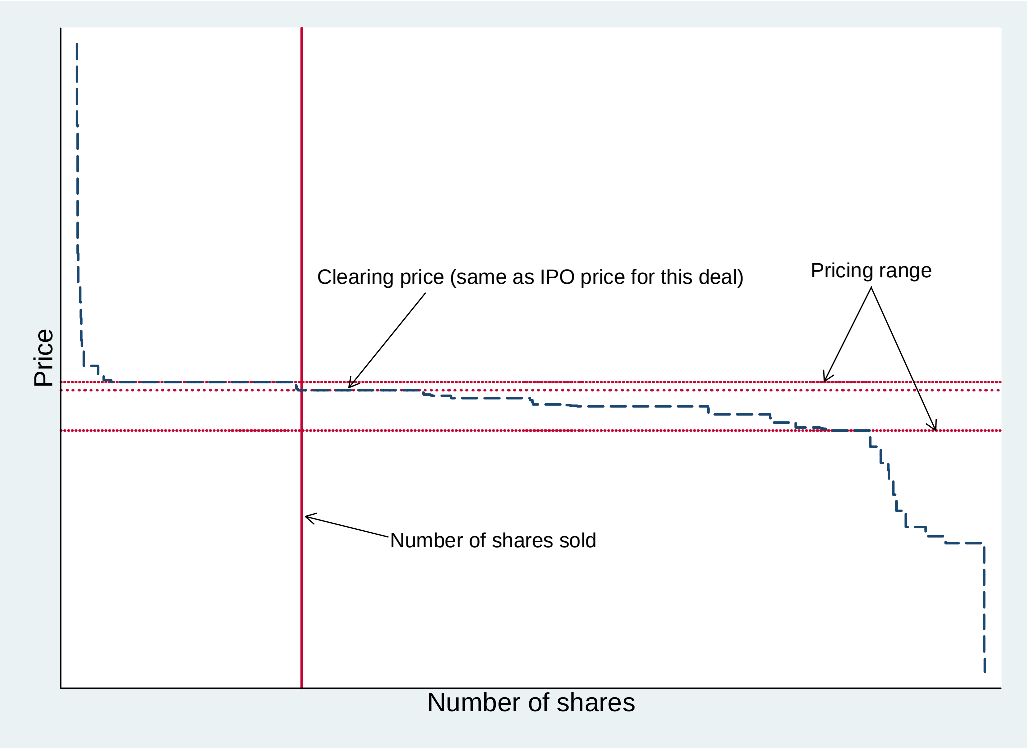


Figure 3

Underpricing and fraction of the shares received by institutional investors

For each of the nineteen IPOs in our sample, this figure shows 10-day underpricing (y-axis) as a function of the fraction of the shares received by institutional investors (x-axis).