# 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 that have higher 10-day underpricing. Our results therefore suggest that auctioned IPOs could be an effective alternative to traditional bookbuilding.

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## 1. Introduction

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, 2008). 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 has 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

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

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.

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) 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 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]

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[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, Jirnyi and and Sherman (2009) 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

Our detailed bidding data from the universe of WR Hambrecht 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 auctioned IPOs in the U.S. 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 the price discovery process. Second, compared to bookbuilding, auctioned IPOs are decentralized, leaving less room for the underwriter to actively promote the IPO, hence creating a risk of unexpectedly low participation. We examine these two issues empirically and conclude that these concerns are largely unwarranted.

We do 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

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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.

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

of evidence of some free-riding by retail investors, WR Hambrecht's IPO auction mechanism is successful at eliciting pricing 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 is marketed – suggesting that participation is largely predictable.

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 larger when the clearing price was affected by high bids (and therefore likely to contain "froth"), when there was less investor consensus in the demand curve, and when a larger fraction of the large institutional bids was at prices below the clearing price.

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 known 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 – defined as initial allocants selling shares within one month of the IPO – 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.

When we extend the time horizon to examine whether initial allocants still report holding six months after the IPO, we no longer find a difference between cold vs. hot deals, and initial allocants in auctioned IPO seem to hold their shares somewhat longer than in bookbuilt IPOs studied by Ritter and Zhang (2007).

Interestingly, while the allocation of shares in WR Hambrecht 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 2 describes the OpenIPO mechanism used in WR Hambrecht auctioned IPOs. Section 3 presents the data. Section 4 reports summary statistics of our sample. Sections 5 to 10 report our results on bidding, investor participation, the elasticity of the demand curves, pricing, flipping, and investor returns. Section 11 concludes.

## 2. 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 institutional investors, similar to the familiar bookbuilding approach.[4] 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 auction closes, which immediately precedes 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.[5] 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 the chosen price.[6] When there is excess demand at the price chosen for the IPO, investors receive shares on a pro rata basis.[7]

[4] Retail investors have access to an electronic version from a website.

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

[6] 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.

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.

## 3. 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:

- 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.

[7] 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 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.[8] 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 names of retail investors are not included.

- 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.[9] 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 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.

## 4. 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

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

auctioned IPO were $107 million, compared to $188 million for the entire U.S. IPO population in the same period. [10] 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%.[11]

[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 total 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 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

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

[11] The spreads on Interactive Brokers Group (1.9%) and Morningstar (2%) were the lowest gross spreads on any U.S. domestic operating company IPOs in the last thirty years.

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 from retail investors and 152 from institutions. The total number of bids per deal 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 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 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). Japanese auctions were also dominated by retail investors, partly due to government-induced rules that severely constrained the ability of institutions to participate (see Pettway, Thosar, and Walker, 2008, and Kaneko and Pettway, 2005).

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% below the demand-weighted average institutional bid price, 19% below the average retail bid price, and discounted by 4.5% relative to the auction clearing price.[12] 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 (71%) and 2000 (56%). 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%.[13] When we drop this observation, the average first day return decreases to 0.6%. First-day turnover is 72% on average, compared to 116% for the entire universe of U.S. IPOs in 1999-2007. Similar to U.S. IPOs in general, first-day turnover was much higher in 1999-2000 (141% vs. 149% for U.S. IPOs) than in 2001-2007 (54% vs. 84%

[12] We use the actual number of shares sold in the IPO to compute the clearing price.

[13] 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.

for U.S. IPOs). Three- and twelve-month Nasdaq-adjusted returns are slightly negative on average (-2.0% and -2.7%, respectively), and exhibit very large variance.[14] This is similar to the results of many studies of long-term post-IPO performance in and outside the United States.

**5. 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 bidding for a large quantity of shares, such as institutions, the incentive to free ride is tempered by the concern that their bid might inflate the auction clearing price. Thus, IPO investors in auctions face a dilemma. 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 issuing firm has to refile with the SEC if changes in price or quantity will alter realized proceeds by more than 20% relative to the indicated proceeds in the initial prospectus. Hence, an

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

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.]

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 modeling 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 base rate probability of a retail investor bidding high is 6%, vs. 2% for an institutional investor.

Institutional investors bidding for larger amounts are *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 90$^{th}$ percentile institutional bid represents about five percent of total demand and is about ten times the size of the 50$^{th}$ percentile institutional bid. Thus, the median institutional bidder is unlikely to affect the IPO price – but the largest ($90^{th}$ percentile) institutional bidders are quite 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[15] and that bullish retail investor sentiment translates into both paying higher prices and bidding for larger quantities.

The probability that institutions submit high bids also increases by about fifteen percentage points when the deal has been repriced with an increased price range (twelve percentage points for retail investors). 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-unit increase in the *Deal Rank* variable is associated with a one percentage point decrease in the probability of a high bid for both institutional and retail investors. There are several interpretations for this finding. Perhaps

[15] Dorn (2007).

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 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 relatively 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 find 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.

## 6. Investor participation

If too few investors decide to acquire information and participate in the offering, the set 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 suggest this conclusion 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.

A potential problem with these views is that due to the ample discretion given to the underwriter in share allocation and pricing, bookbuilding lends itself well to “quid pro quo” arrangements. For example, Nimalendran, Ritter and Zhang (2007) and Reuter (2006) find that bookbuilding underwriters allocate underpriced IPOs in return for soft dollars. Such practices remove the incentive for investors to acquire information. In their studies of the order book in bookbuilt IPOs, Cornelli and Goldreich (2003) and Jenkinson and Jones (2004) find that a large fraction of indications of interest are not price sensitive, suggesting that investors do not acquire or provide information. Jenkinson and Jones’ (2009) survey of IPO pricing and allocation finds that institutional investors do not believe that their bidding behavior will affect IPO allocation in bookbuilding, casting doubt on the information production theories of bookbuilding.

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. For example we would expect more interest from institutions in the large Morningstar IPO than for small deals such as Briazz. 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 nine percentage points in institutional oversubscription and two 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. The smallest deals in our sample may also have failed to generate institutional interest because they were so small that they did not allow institutions to meet their investment capitalization requirements. 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 models. This implies 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. The small number of repeat players may indicate that fewer "quid pro quo" arrangements exist in auctioned IPOs compared to bookbuilt IPOs.

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.[16] Kaustia and Knüpfer (2007) find 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* and *Lowered Price Dummy*, two indicator variables equal to one if the price range was raised or lowered, respectively, during the IPO process, because a change in the price range may influence an investor's participation decision.

[Insert Table 4 about here.]

[16] 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.

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 10-day underpricing (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 auction 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.

## 7. The elasticity of the demand curves

The elasticity of the demand curve measures the degree of consensus among investors about their valuation of the IPO. Like others before us, [17] 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. To the extent that the lead underwriter provides guidance to institutional investors regarding the likely offering price, the elasticities may be overestimated. But this problem would not affect auctioned more than bookbuilt IPOs.

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

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

[Insert Table 5 about here.]

Table 5 reports the median elasticity across our 19 deals using alternative measures of elasticity. Our calculated 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 third row of Table 5 shows that overall elasticity is almost perfectly correlated with institutional elasticity. The correlation of retail demand elasticity with overall elasticity is much weaker (fourth row). The contribution of institutional investors to the information content of the demand curve overwhelms any "noise" introduced by retail investors into the bidding process. In the bottom row of Table 5, we report the correlation between demand elasticity and institutional participation, measured as dollar institutional demand divided by total dollar demand. The correlation between institutional participation and demand elasticity is positive for all measures of elasticity, and statistically significant for seven of them. This confirms that higher institutional participation is associated with greater information production.

## 8. Pricing

The spirit of the auction process is to "let the market speak" in setting the IPO price. 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 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 6 about here.]

Table 6 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. Issuers might also choose to discount the IPO in order for large institutions that submitted bids below the clearing price to receive shares. From the issuer's perspective, having a large institution in its ownership may be beneficial (Stoughton and Zechner, 1998), and an institution is more likely to be a firm's shareholder in the long run if it is already a firm's shareholder right after the IPO (Zhang, 2004). From WR Hambrecht's perspective, allocating shares to institutions that bid slightly below the clearing price may have improved these institutions' perception of the auction mechanism and therefore, increased their probability of participating in future auctioned deals.

[Insert Table 7 about here.]

In Table 7 we test these three possibilities in Tobit regressions where the dependent variable is the IPO discount. Fixing the explanatory variables at their means, the baseline probability of a discount is 31%. A one standard deviation increase in the variable *Effect of High Bids on Clearing Price* (defined as the change in clearing price when high bids are excluded divided by the clearing price) is associated with a 67 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 34 percentage point fall in the probability of a discount and a one percentage point reduction in the expected discount. To test for the possibility that discounting the deal allows large institutions to receive shares, we use the variable *Fraction of large institutional bids below clearing price*, equal to the number of institutional bids in [clearing price – 20%, clearing price + 20%] and in the largest bid size decile with prices below the clearing price, divided by the number of institutional bids in [clearing price – 20%, clearing price + 20%] and in the largest bid size decile. On average, 40% of large institutional bids are below the clearing price in discounted deals, vs. 12% in other deals. In Table 7, a one standard deviation increase in *Fraction of large institutional bids below clearing price* is associated with an 85 percentage point increase in the probability of a discount and a 2.5 percentage point increase in the expected discount. This finding is consistent with the idea that issuers are willing to leave money on the table in order for large institutions to receive shares. Another potential interpretation is that large institutional orders are very informative and that a high concentration of these orders below the clearing price indicates that the clearing price is too high. Table 7 also shows that a discount was also more likely in later deals. In summary, IPO auction issuers were more comfortable "letting the market speak" when high bids did not influence the clearing price, when the demand curve contained more information, and when most of the large institutional bids were above the clearing price.

A related question concerning the design of the auctions used by WR Hambrecht is why, in case of oversubscription, rationing applies to all bids at or above the IPO price instead of just bids at the IPO price. We see two potential explanations to this rule. The first is relationship-based: if the issuer is willing to leave money on the table in order for large institutions who bid below the clearing price to receive shares, it certainly does not want these institutions to be penalized by rationing. The second explanation is information-based: bids at the clearing price are more informative than bids at a much higher price. Therefore, if the goal of the auction mechanism is to reward investors who provide information, it should not penalize investors who submit pivotal bids.

**9. 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 investors flip 27.6% of the shares they receive in the month following the offering. Retail investors flip 26.5% of their shares in the same period. 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 and retail investors flip on average 26% and

24% of their shares respectively. Since we measure flipping over one month after the IPO (rather than Aggarwal's (2003) two days) our flipping numbers are upwardly biased relative to hers.

[Insert Table 8 about here.]

Is there a link between investor flipping and 10-day underpricing? 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 8, Panel A reports the average flipping ratio of institutional and retail investors depending on 10-day underpricing. 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% of their shares when 10-day underpricing is negative, and 19.7% when 10-day underpricing is 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 10-day underpricing is positive.[18] 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? If allocations in underpriced bookbuilt IPOs are sought by, and given to, rent-seekers rather than buy-and-hold investors, we would expect a high level of flipping in hot bookbuilt IPOs. We also surmise that the discretion underwriters enjoy in bookbuilt IPOs allows them to punish investors 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

[18] 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.

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 8, 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.

Consistent with the univariate evidence in Panel A, Panel B of Table 8 shows that investors flip less when 10-day underpricing 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.

Flip report data covers holdings for up to 30 days after the IPO. To get a sense of the longer-run propensity of initial allocants to sell the shares they received in auctioned IPOs, we turn to data from the Spectrum 1 & 2 database, which contains fund holdings data. We monitor the holdings of initial allocants for six months after the IPO. While we gain on the time horizon dimension, we lose observations, since foreign funds and hedge funds are not included in Spectrum. We find that out of an average of 15 initial allocants present on Spectrum, about five still report holdings in the IPO six months later. The numbers are essentially identical for hot and cold deals. The proportion of initial allocants that are still shareholders after six months (5/15= one third) is somewhat higher than that reported by Ritter and Zhang (2007) for a sample of bookbuilt IPOs. They find that out of an average of 80 initial allocants included in Spectrum, on average 18 still report holdings after six months. Subject to the imprecision of Spectrum data, extending the time horizon of our examination of flipping thus has two effects: (1) the difference between cold vs. hot IPOs vanishes, and (2) auctioned IPOs appear to be somewhat less flipped than bookbuilt IPOs in the first six months.

## 10. 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 higher 10-day underpricing. If we ignore the outlier 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% for institutions vs. -5.0% for retail investors. 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.[19]

## 11. Conclusion

We study 19 auctioned IPOs that used WR Hambrecht's OpenIPO auction mechanism between 1999 and 2007. Overall, we find convincing evidence that this mechanism allows the underwriter and the issuer to extract valuable pricing information from investors' bids. Bids submitted at high prices indeed suggest that some investors (predominantly retail investors, 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, especially from institutions, is quite elastic, suggesting that institutional investors produce information and reveal it in the bidding process. The pricing flexibility offered by the mechanism

[19] This result is consistent with the findings of Lin, Lee, and Liu (2007) and Chiang, Qian and Sherman (2008) for Taiwanese auctioned IPOs, and Field and Lowry (2007), who find that U.S. IPOs with high levels of institutional ownership outperfrom those with low levels of institutional ownership.

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 flipping is about as prevalent in auctions as in bookbuilt deals. However, unlike in bookbuilding, in the first month after the IPO investors tend to flip their shares more in cold deals (i.e., deals with low 10-day underpricing) perhaps because the absence of allocation discrimination prevents issuers from penalizing past flippers. Over a longer horizon, investors appear to hold equally to cold vs. hot auctioned IPOs, and somewhat more than in bookbuilt IPOs. Finally, we find that institutional investors, who provide more information, are somewhat rewarded by obtaining larger shares of the deals with higher 10-day underpricing.

A potential concern with our results might be that our sample only consists of 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. Lowry, Officer and Schwert (2008) find that older firms are more likely to use auctions. Older firms are better-known, have an existing customer base, and this might explain in part why the demand curves for auctioned IPOs are very elastic.

Subject to these caveats, our results suggest that auctions are an effective alternative to traditional bookbuilding. One might wonder why despite their advantages (low costs and efficient pricing), auctioned IPOs failed to gain a significant market share in the U.S. in recent years. A possible explanation is that WR Hambrecht is not a bulge-bracket underwriter, and bulge-bracket underwriters have increased their market share in the last decade (Loughran and Ritter, 2004). WR Hambrecht has therefore been competing against underwriters with increasing market power that have been reluctant to give up the traditional IPO mechanism, perhaps for fear of losing the benefits they gain from the “quid pro quo” relationship with investors inherent in bookbuilding.

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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. *1-day turnover* is the first-day trading volume from CRSP divided by the number of shares issued (excluding the overallotment option). *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. 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 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 | Averages for U.S. IPOs in 1999-2007 |
|---|---|---|---|---|---|---|
| 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 | 38.2% |
| 1-day turnover | 72.4% | 55.7% | 16.8% | 227.0% | 19 | 116.4% |
| 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. *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). *Deal Rank* is the rank among WR Hambrecht auctioned IPOs (1 for the first IPO, etc.). *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 (resp., count) explanatory variables we report the change in the probability of a high bid as the dummy variable goes from zero to one (resp., increases by one unit). 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) |
| 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 increases by 1 unit | |
| Deal Rank | -0.013*** | -0.011*** |
| | (0.00) | (0.00) |
| | 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. *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. *Deal Rank* is the rank among WR Hambrecht auctioned IPOs (1 for the first IPO, etc.). *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 (resp., count) explanatory variables we report the change in the probability of participation as the dummy variable goes from zero to one (resp., increases by one unit). 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 | | | | | |
| 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 variable increases by one unit | | | | | |
| Deal Rank | -0.005*** | -0.005*** | -0.012*** | -0.005*** | -0.011*** | -0.011** |
| | (0.00) | (0.01) | (0.00) | (0.01) | (0.00) | (0.02) |
| | 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) |
| Baseline probability of participation | 7% | 7% | 8% | 7% | 8% | 7% |
| 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 median elasticities, ratios of institutional to retail elasticity, Spearman rank correlations between different elasticity measures and between institutional elasticity and the percentage of institutional demand (dollar institutional demand divided by total dollar demand). The *p*-values appear below 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***<br>(0.00) | 0.98***<br>(0.00) | 0.99***<br>(0.00) | 0.98***<br>(0.00) | 0.99***<br>(0.00) | 0.99***<br>(0.00) | 0.99***<br>(0.00) | 0.98***<br>(0.00) | 0.96***<br>(0.00) |
| Correlation of overall elasticity with retail elasticity | 0.56***<br>(0.01) | 0.54**<br>(0.02) | 0.56***<br>(0.01) | 0.54**<br>(0.02) | 0.48**<br>(0.04) | 0.48**<br>(0.04) | 0.71***<br>(0.00) | 0.87***<br>(0.00) | 0.29<br>(0.23) |
| Correlation of elasticity with the percentage of institutional demand | 0.43*<br>(0.07) | 0.44*<br>(0.06) | 0.43*<br>(0.07) | 0.57***<br>(0.01) | 0.37<br>(0.12) | 0.23<br>(0.34) | 0.43*<br>(0.06) | 0.45**<br>(0.05) | 0.45**<br>(0.05) |

**Table 6**
**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 7**
**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. *Elasticity* is the relative change in quantity of shares demanded when the price rises 10 cents from the clearing price. *Fraction of large institutional bids below clearing price* is the number of institutional bids in [clearing price – 20%, clearing price + 20%] and in the largest size decile with prices below the clearing price, divided by the number of institutional bids in [clearing price – 20%, clearing price + 20%] and in the largest size decile. *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 | 0.67** | 2.0%*** |
| | (0.02) | (0.00) |
| Elasticity | -0.34* | -1.0%* |
| | (0.07) | (0.06) |
| Fraction of large institutional bids below clearing price | 0.85** | 2.5%*** |
| | (0.04) | (0.01) |
| Log(Proceeds) | -0.40 | 11.0% |
| | (0.41) | (0.38) |
| Deal Rank | 0.53* | 1.6%** |
| | (0.07) | (0.03) |
| Baseline probability of a discount | 31% | -- |
| N | 19 | |

**Table 8**
**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: 10-day underpricing 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%.

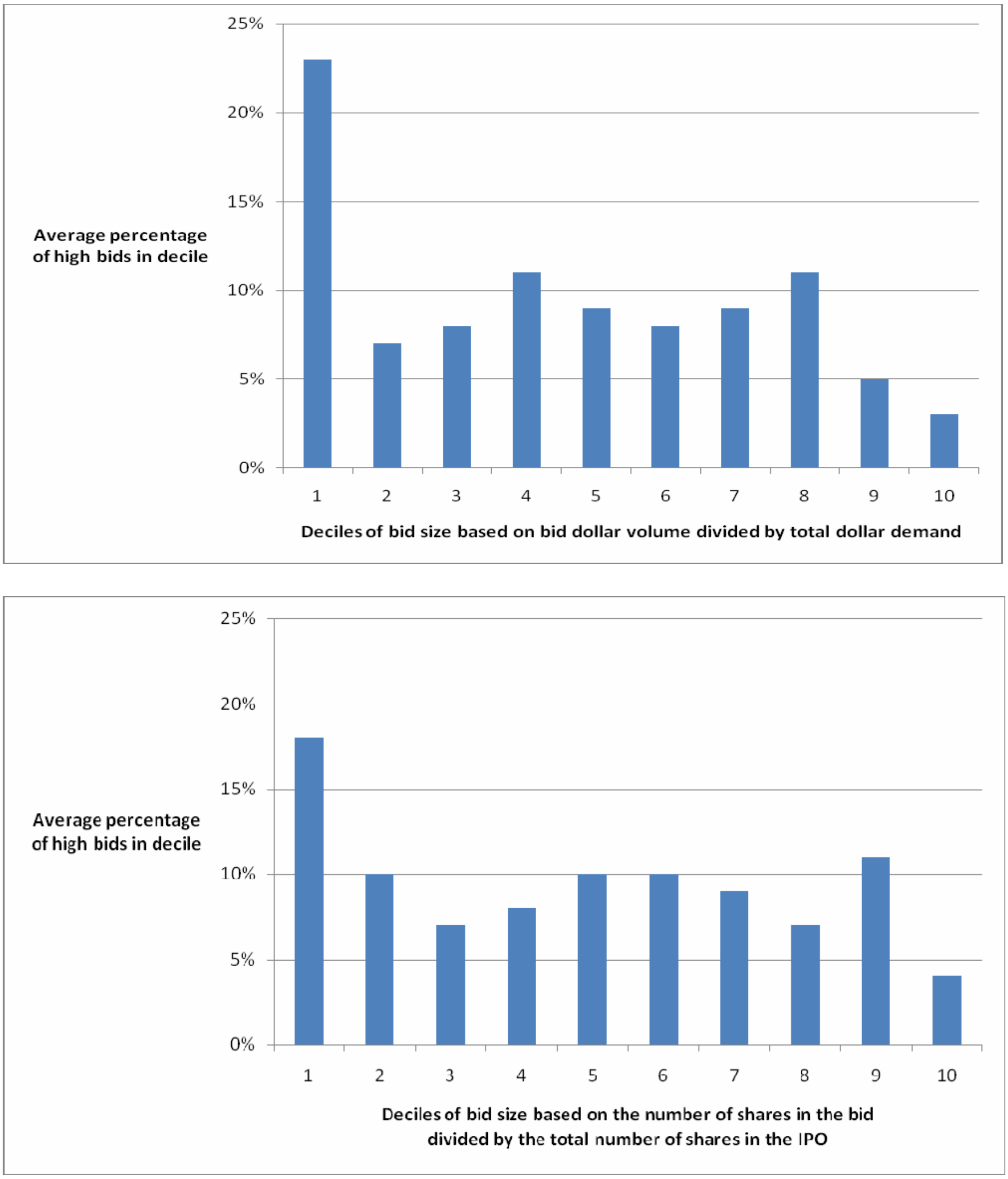

**Figure 2**
**Demand curve for one of the auctioned IPOs in our sample.**

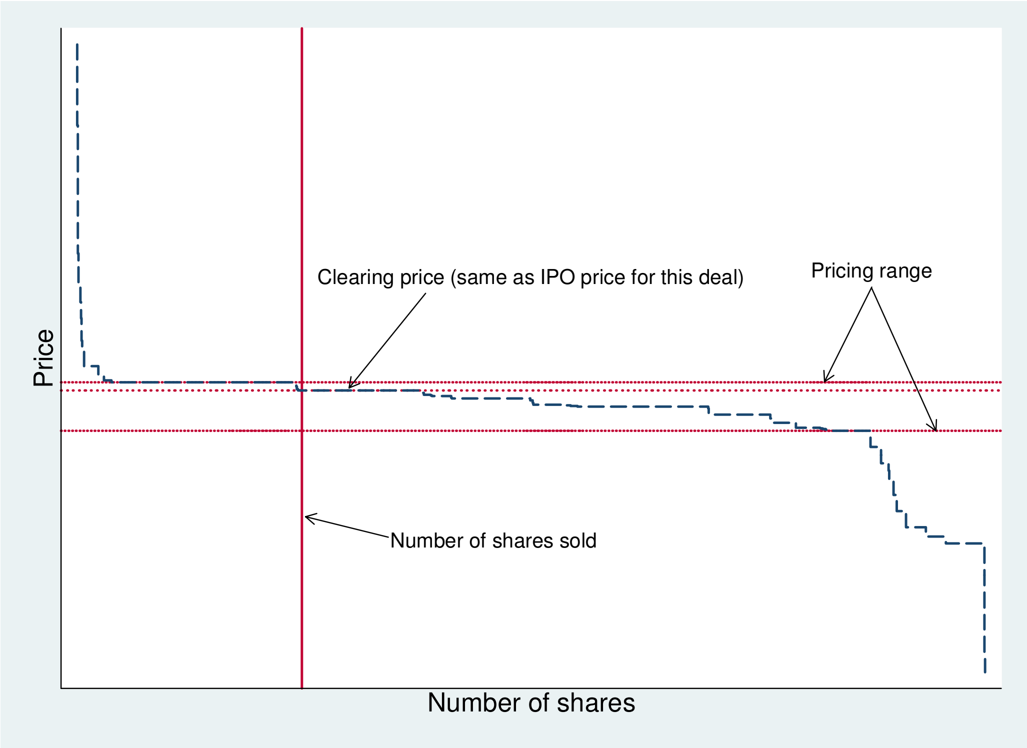

**Figure 3**
**Underpricing and fraction of the shares received by institutional investors**

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).