Bidding styles of institutional investors in IPO auctions*

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Abstract

We examine the bidding behavior of institutional investors in initial public offering (IPO) auctions using a hand-collected dataset of limit bids. We find that the majority of institutional investors in our sample are "occasional bidders," who rarely get a share allocation. "Regular bidders" are in a minority but account for the bulk of the demand. They bid conservatively, and only a few of them can be classified as "well-informed bidders," who place more aggressive bids in hotter IPOs than in colder ones. Our findings suggest that "dirty" auctions that are restricted to institutional investors work as an information extraction mechanism.

JEL classification: D82; G23; G24; G32.

Keywords: IPO; Auction; Institutional investors; China.

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1 Introduction

A large body of theoretical literature that originates from the seminal works of Rock (1986) and Benveniste and Spindt (1989) recognizes the important role played by informed investors in determining the offer price in initial public offerings (IPOs). Models highlight informed investors' contribution to price discovery in both bookbuilt IPOs and IPO auctions (e.g., Sherman, 2005), and institutional investors are thought to be the archetypal informed investors (e.g., Keloharju and Torstila, 2002; Khurshed et al., 2014).

Notwithstanding the large body of theoretical work on the involvement of institutional investors in the IPO process, empirical evidence on the bidding behavior of institutional investors in IPOs is sparse. In the case of bookbuilt IPOs, the evidence is limited to a handful of studies that capitalize on unique datasets (e.g., Cornelli and Goldreich, 2001, 2003; Jenkinson et al., 2018) as institutional investor bids are "proprietary information that investment banks are loathe to reveal" (Jenkinson and Jones, 2004, p. 2309). In the case of IPO auctions, datasets can be small as the auction mechanism is much less employed than the bookbuilding mechanism (Jagannathan et al., 2015); data can be limited to aggregate demand schedules (e.g., Kandel et al., 1999); and auction rules may vary substantially across markets [e.g., Chiang et al. (2010) study discriminatory IPO auctions in Taiwan whereas Degeorge et al. (2010) examine uniform IPO auctions in the U.S.].

In this study, we make use of a large, hand-collected dataset of institutional investor bids to provide insight on the bidding behavior of institutional investors in IPO auctions. The construction of this dataset is made possible thanks to the adoption of an auction mechanism in China whereby issuers disclose the bids submitted by institutional investors. The sample includes 214 IPOs conducted between December 2010 and October 2012 by issuers whose shares were subsequently listed on ChiNext, which is a segment of the Shenzhen Stock Exchange (SZSE) launched in late 2009 and is known as "China's Nasdaq-style board." An important reason why we focus on this segment is because it attracts smaller issuers (often technology firms), and institutional investors would find it difficult to value such issuers without acquiring information. The IPOs in our sample are carried out in two stages. The

first stage is an auction that is exclusive to institutional investors. The second stage is a fixed-price offering tailored to retail investors. The fact that the auction is restricted to institutional investors means that their bidding strategies are not influenced by the presence of retail investors (cf., Chiang et al., 2010). This presents a similarity to bookbuilding, which also relies on institutional investors for price discovery. Moreover, the offer price is set below the market-clearing price in the auction (so-called "dirty" auctions). This means that there is excess demand at the offer price, which is the norm in bookbuilding as well (Cornelli and Goldreich, 2001). The main distinction between the IPO auctions we examine and bookbuilt IPOs concerns share allocations. In our sample, share allocations are decided via balloting, which is essentially a lottery mechanism, whereas underwriters exercise discretion over allocations in bookbuilt IPOs. Finally, while strike bids (quantity bids that do not specify a limit price) are allowed in bookbuilding (Cornelli and Goldreich, 2001), limit bids (limit price-quantity pairs) are obligatory in our sample, which creates an ideal environment to test whether some institutional investors strategically bid low or high.

In our empirical analysis, we make a distinction between three dimensions of bidding behavior: frequency, aggressiveness, and informativeness. With regard to bidding frequency, we refer to the institutions (the terms "institutional investors" and "institutions" are used interchangeably in the text) who place bids in a small number of IPO auctions as "occasional bidders," and to those who submit bids in a majority of IPO auctions as "regular bidders." We call the remaining institutions "selective bidders," since these institutions bid in more auctions than occasional bidders but are more selective about the auctions they enter compared to regular bidders. In terms of bidding aggressiveness, we distinguish between "conservative bidders," "neutral bidders," and "aggressive bidders" who have a tendency to bid below, within, and above the initial price range, respectively. Finally, depending on their ability to cherry-pick hot IPOs and place aggressive bids for such issues, we make a distinction between "well-informed bidders" and "less-informed bidders."

Our main findings can be summarized as follows. Strikingly, the majority of the institutions in the sample are occasional bidders. However, they account for only 2% of the total demand in a typical auction, and the vast majority never get a share allocation. Most of the

occasional bidders are recommended investors, such that they take part in auctions on the basis of a recommendation by underwriters. Regular bidders represent less than 10% of the institutions. Yet, their ongoing participation in IPO auctions is critical as they account for more than 60% of the total demand in a typical auction. They are the most conservative group of bidders and tend to bid well below the lower limit of the initial price range. Very few can be classified as well-informed bidders, while the vast majority are less-informed bidders, who are either less skilled or not skilled at all in following an informed bidding strategy. Well-informed bidders are predominantly either fund management firms or securities firms.

We also find that bidding behavior has a significant impact on the offer price, share allocations, and returns realized by institutional investors. First, the quantity-weighted average price based on institutional investor bids is positively related to demand, and the offer price is positively related to both the quantity-weighted average price, which is also the case in bookbuilding (Cornelli and Goldreich, 2003), and the ratio of informed demand to uninformed demand. This suggests that underwriters choose a higher offer price when informed demand is stronger relative to uninformed demand. Moreover, the relation is concave such that the rate of increase in the offer price goes down as the level of informed demand gets higher, which implies an underreaction of price to positive information as argued by Biais and Faugeron-Crouzet (2002) and Sherman and Titman (2002). Second, the proportion of shares well-informed bidders receive in the best-performing IPOs is more than double the proportion they receive in the worst-performing IPOs. Third, bidding informativeness is the key determinant of the average return an institutional investor realizes from its investments in IPO shares. Average returns are substantially lower when we account for the facts that (i) many institutions never get any shares despite bidding in multiple IPOs (due to the high rates of oversubscription and the use of balloting for deciding allocations), and (ii) institutions get more shares in IPOs that yield low returns than in those that yield high returns (due to the winner's curse caused by the presence of well-informed bidders). We also note that while well-informed bidders generally experience higher average returns than other bidders, there is substantial cross-sectional variation in their performance, highlighting the high risk-return characteristic of their strategy.

Our study contributes to the literature in a number of ways. We are the first to study the interplay between bidding frequency, bidding aggressiveness, and bidding informativeness and document their impact on the offer price, share allocations, and investment performance in the context of IPO auctions. While there is empirical work on bidding informativeness in IPO auctions (see, among others, Chiang et al., 2010 and Degeorge et al., 2010), the interactions of bidding informativeness with bidding frequency and bidding aggressiveness have not received attention commensurate with their importance. We also contribute to the debate on the optimal mechanism for IPOs by offering evidence that information production takes place in IPO auctions, since there are well-informed bidders in the sample, and underwriters take into consideration the strength of informed demand when setting the offer price. Therefore, our findings are consistent with models that predict that price discovery takes place in dirty auctions (Biais and Faugeron-Crouzet, 2002; Parlour and Rajan, 2005) and lend support to the view that the sequential hybrid mechanism that involves an auction exclusive to institutional investors followed by a public offer to retail investors is conducive to both information production and information extraction (Chiang et al., 2010; Jagannathan et al., 2015). Finally, our findings offer fresh insights into the heterogeneous nature of institutional investors' behaviors in IPOs (Keloharju and Torstila, 2002; Rocholl, 2009). We find that regular bidders, who represent the bulk of demand and who tend to be less-informed bidders, bid conservatively, which puts downward pressure on the offer price. Their bidding strategy is consistent with Rock's (1986) argument that the offer price should reflect a sufficient discount that ensures the continuing participation of uninformed investors (e.g., Leite, 2006).

We are aware of a few other contemporaneous studies that examine IPO auctions in China. Cao et al. (2017) focus on the impact of divergence of opinion among institutional investors on IPO returns (both initial performance and long-run performance). They document a positive (negative) link between the divergence of institutional bids and initial (long-run) returns. Chemmanur et al. (2017a), on the other hand, test the rent-seeking theory, which posits that underwriters reward institutions that are their brokerage clients by allocating them shares in hot IPOs. They find that offer prices are discounted more when the bids of commission-paying institutions are concentrated at lower parts of the demand schedule. This is interpreted as

an attempt by underwriters to help their brokerage clients get a share allocation. Gao et al. (2018) provide evidence that institutional investors anchor on the rounded endpoints of the initial price range when submitting bids. This has real economic consequences as the offer price tends to end up being higher (lower) as a result of bids that are rounded up (down).

The closest study to ours is Chemmanur et al. (2017b), who are interested in how informed institutions influence price discovery in IPO auctions. However, there are significant differences between their work and ours. First, the approach of identifying informed bidders differs completely. While they rely on various characteristics of an institution to decide whether the institution has the *potential* to produce precise information about an issue, we infer whether the institution *actually* behaves in an informed manner from its observed bids. Second, in our analysis, we take into account bidding frequency and bidding aggressiveness as well as bidding informativeness and study the implications of interactions between these three dimensions of bidding behavior. Third, while Chemmanur et al. also document the close relation between the quantity-weighted average price and the offer price, we additionally examine the determinants of the quantity-weighted average and also show that the relation between the offer price and the relative strength of informed demand is not only positive but also concave. Fourth, in terms of the average returns realized by institutions, Chemmanur et al. (2017b) focus on a single investment performance metric (profits) over a single holding period (three months). In contrast, we consider different metrics (simple average returns vs. yuan-weighted average returns) measured over various holding periods up to three years and demonstrate that average returns are significantly overstated when the winner's curse and the experience of institutions that never get shares are not taken into consideration.

The remainder of this paper is organized as follows. We discuss the related literature in Section 2 and provide an overview of the institutional background in Section 3. The data are described in Section 4 and our findings are presented in Section 5. We conclude in Section 6.

2 Related literature

There is substantial debate in the literature regarding the optimal mechanism for extracting information from investors during an IPO. One side of the debate maintains that underwriter discretion over share allocations is a vital tool for extracting information, and, thus, bookbuilding has an advantage over auctioning. Benveniste and Spindt (1989) show that it is optimal for investors to reveal their positive information truthfully when they know that they will be awarded with share allocations and that the offer price will only partially adjust to the information revealed.[1] Cornelli and Goldreich (2001) offer empirical evidence that underwriters indeed award more shares to investors who reveal information, and Cornelli and Goldreich (2003) show that underwriters make substantial use of the information in the order book when setting the offer price. In contrast, Jenkinson and Jones (2004) find that being perceived as a long-term holder of the stock rather than submitting informative bids influences share allocations, and Jenkinson and Jones (2009) offer survey evidence that investment banks favor institutional investors who are their brokerage clients when allocating shares, implying a quid pro quo between the parties. More recently, Jenkinson et al. (2018) examine bookbuilding data involving multiple investment banks. They observe substantial heterogeneity across investment banks such that while some reward informative bids, others do not, which explains the conflicting results in Cornelli and Goldreich (2001) and Jenkinson and Jones (2004). Moreover, they find that high-revenue clients enjoy disproportionately high allocations even when client fixed effects are controlled for, which is consistent with Jenkinson and Jones (2009). In a setting where shares are sold to institutional investors and retail investors in separate tranches and where reallocations between the two tranches are allowed, Bertoni and Giudici (2014) provide evidence that institutional investors are rewarded with a tranche larger than initially planned when they reveal positive information during bookbuilding. Ljungqvist and Wilhelm (2002) find that depriving underwriters of discretion over share allocations leads to smaller price revisions relative to the initial price range, which is interpreted as less information production. Similarly, Bubna and Prabhala (2011) observe that the

[1] Benveniste and Wilhelm (1990), Sherman (2000), and Sherman and Titman (2002) offer extensions of Benveniste and Spindt (1989).

lower level of underpricing associated with bookbuilt IPOs relative to fixed price IPOs is lost in the Indian market following a regulatory change that removed discretionary allocations. Sherman (2005) and Jagannathan et al. (2015) highlight two additional weaknesses of auctions relative to bookbuilding. First, uniform auctions are susceptible to free riders who do not engage in costly information acquisition but who simply place bids at very high prices in order to secure a share allocation. Second, the uncertainty over the number of investors who enter bidding makes it difficult for even sophisticated bidders to shave their bids accurately to address a winner's curse. Nonetheless, Jagannathan et al. (2015) note that these two issues can be mitigated with a sequential hybrid mechanism that involves an auction exclusive to institutional investors in the first step and a public offer for retail investors in the second step [see Schnitzlein et al. (2019) for experimental evidence]. The IPO auctions we examine employ the mechanism advocated by Jagannathan et al. (2015).

On the other side of the debate, the argument is that investors reveal information in IPO auctions despite underwriters' lack of control over share allocations. Biais and Faugeron-Crouzet (2002) study the "mise en vente" method used in France, which is essentially a dirty uniform auction like those we examine, and show that this mechanism can lead to optimal information elicitation and price discovery. Similarly, Parlour and Rajan (2005) argue that setting the offer price below the market-clearing price mitigates informed investors' fear of the winner's curse and induces them to bid more aggressively even in the absence of discretionary allocations. Moreover, Degeorge et al. (2010) show that institutional demand in IPO auctions is highly elastic (Kandel et al., 1999), which means that institutional investors reveal information in the bidding process. They also address the concerns of Sherman (2005) and Jagannathan et al. (2015) by showing that retail investors' attempt to free ride on the information generated by institutional investors does not impede price discovery and that the participation of institutional investors is largely predictable based on the size of the issue. Derrien and Womack (2003) find that the auction mechanism is associated with less underpricing and lower variance of underpricing than bookbuilding (Kutsuna and Smith, 2004; Lowry et al., 2010). Chiang et al. (2010) provide evidence that institutional investors bid in an informed manner in Taiwanese IPO auctions. They find that an unexpectedly

high number of institutional bidders (or the high bids they place) have explanatory power for IPO returns (Lin et al., 2007). They also note that because retail investors often exhibit return chasing and overbidding, their participation in auctions might cause instability in IPO outcomes. Therefore, like Jagannathan et al. (2015), they recommend an auction that is open to institutional investors only, followed by a public offer targeting retail investors.

Our findings support the view that information is produced and extracted in dirty auctions that are exclusive to institutional investors. In particular, we observe that a large number of institutional investors in the sample are able to place more aggressive bids in IPOs that generate higher returns, which is evidence of information production. Moreover, the offer price is positively related to the strength of informed demand relative to uninformed demand, which is evidence of information extraction. Although this positive relation is reported in Chemmanur et al. (2017b) as well, their method of identifying informed bidders is different. They focus on the characteristics of an institution that are expected to correlate with their ability to produce precise information about an issue. Instead, we analyze the bids submitted by the institution to decide whether or not it is an informed bidder.

A separate strand of literature highlights the informational asymmetries among institutional investors under different IPO mechanisms. Rocholl (2009), who examines allocations in European bookbuilt IPOs, finds that foreign institutional investors bid in a more informed manner than domestic institutional investors. He notes that this can be explained by a quid pro quo between domestic institutional investors and underwriters, such that underwriters reward domestic institutional investors with higher allocations in hot issues in return for support (in terms of demand) in cold issues. Keloharju and Torstila (2002), who examine a sample of Finnish IPOs in a setting where the offer price is set independently of the market response to the issuer's prospectus, find that institutional investors who are informed about an issue submit larger orders than those who are uninformed.

Our findings show that informational asymmetries among institutional investors are present in dirty auctions as well. Moreover, we document significant interactions between bidding informativeness, bidding frequency, and bidding aggressiveness. In particular, only a few regular bidders in the sample are highly skilled in following an informed bidding strategy. Instead,

they are conservative bidders, whose bids put downward pressure on the offer price. This supports Rock's (1986) argument that in the presence of a winner's curse, uninformed investors' participation in the IPO market depends on offer prices being set at a sufficient discount. It is also consistent with Leite (2006), who shows that it is optimal for less-informed investors to scale down their bids, which leads to underpricing, when investors who are involved in bookbuilding are heterogeneous with respect to their information. Finally, several researchers test and find support for Rock's (1986) prediction that allocation-weighted initial returns will be lower than equally-weighted initial returns in fixed-price offers (e.g., Koh and Walter, 1989; Levis, 1990; Keloharju, 1993; Amihud et al., 2003). We find parallel results in the case of IPO auctions. Specifically, average returns experienced by institutional investors are substantially lower when we account for the winner's curse.

3 Institutional background

Our sample period, which runs from December 2010 to October 2012, is a stable interval in the Chinese equity markets with few regulatory changes affecting IPOs. During this period, Chinese IPOs feature separate tranches for institutional investors and retail investors. The institutional offering takes place first. It is a uniform price auction where the offer price is set below the market-clearing price (often called a "dirty" auction) and where underwriters do not have discretion over share allocations, which are decided via balloting. The retail offering, on the other hand, starts after the offer price is set and is a fixed price public offer. Therefore, the IPO method can be classified as a sequential hybrid of an auction and a public offer (Jagannathan et al., 2015), whereby the auction method resembles the mise en vente method used in France (Biais and Faugeron-Crouzet, 2002), and the lottery qualification auction method described in Harstad and Bordley (1996) (see also Parlour et al., 2007).

The institutional offering comprises two stages: preliminary inquiry and subscription offering. The preliminary inquiry commences after the preliminary prospectus is published and involves a roadshow during which the issue is marketed to institutional investors. Typically, it lasts three working days, and underwriters spend one day each in Shenzhen, Shanghai, and

Beijing. A valuation report that includes an initial price range is provided to institutional investors. During the preliminary inquiry, institutional investors are referred to as "inquiry objects." Each inquiry object can bid via multiple "placement objects." For example, fund management firms can bid via multiple funds under their umbrella. Each placement object can submit up to three limit bids, which means that step bids are allowed. Thereafter, the offer price is set, taking into account the order book, valuation of comparable firms, financing requirements of the issuer, and industry and market conditions. The bids that are below the offer price are canceled, and the rest remain eligible for the subsequent subscription offering. The offer price is typically set well below the clearing price and is usually in the vicinity of the quantity-weighted average price based on institutional investor bids, which is consistent with Cornelli and Goldreich (2003). As a result, the subscription offering is always oversubscribed and rationing is necessary. As already mentioned, rationing is achieved via balloting, leaving underwriters no discretion over allocations. For most of the sample period, the shares allocated to institutional investors are subject to a lock-up period of three months. This restriction was removed with an amendment to the rules, effective May 18, 2012. Overall, 84% of the auctions in the sample were completed with the lock-up rule in place.

The retail offering is a fixed price public offer and takes place on the same day as the subscription offering for institutions. The shares are sold at the same price in both offerings.[2] Retail investors choose the amount of shares they subscribe for, which can be thought of as submitting a single quantity bid at the offer price.[3] For most of the sample period, the percentage of shares allocated to institutional investors is capped at 20%, which means that 80% of the shares are sold to retail investors.[4] Like the institutional offering, the retail offering is always oversubscribed, and, thus, allocations are again decided via balloting.

[2]This is not necessarily the case in other markets. For example, in Japan where prices can differ between the public offer and the auction, Kerins et al. (2007) find that underwriters partially adjust the price of the public offer tranche in response to information from the auction tranche.

[3]The subscription amount must be a multiple of a specified minimum amount (e.g., 500 shares). The maximum subscription amount is usually limited to 0.1% of the retail offering.

[4]This is a high percentage allocation to retail investors compared to other IPO markets. Ljungqvist and Wilhelm (2002) report that institutional investors get, on average, two-thirds of the IPO shares across the 37 countries they examine. Towards the end of the sample period, the introduction of a new rule (effective May 18, 2012) partially relaxed the 20% cap by requiring at least 50% of the shares to be reserved for the institutional offering. However, when the retail offering is heavily oversubscribed, up to 20% of the shares are still clawed back to the retail offering.

The end of the sample period coincides with the China Securities Regulatory Commission's (CSRC's) decision to temporarily shut down the IPO market.[5] There are no IPOs in China between the end of the sample period and January 2014, when the CSRC reopened the IPO market with significant changes in the going-public process. In particular, following the reopening, underwriters gained some discretion over share allocations, which is a step toward bookbuilding. Therefore, the auction method we examine has not been employed in China after the end of the sample period.

4 Data

The sample is based on 214 IPOs whose shares started trading on ChiNext between December 2010 and October 2012. We obtain the list of IPOs from the official website of the SZSE, which also provides the ticker, name, listing date, industry, offer price, number of shares offered, and proceeds. Then, we use the Securities Data Company's (SDC's) new issues database (accessed via Thomson ONE) to collect data on the issue date, foundation year, and venture capital backing. If a firm's foundation year is missing in the SDC's database, we source it from the IPO prospectus. Data on stock prices, market value of equity, and book value of equity of listed firms in China are gathered from the China Stock Market & Accounting Research (CSMAR) database (accessed via WRDS). Data on institutional investor bids are obtained from http://www.cninfo.com.cn, which is an information disclosure platform designated by the CSRC.

The main variables used in our empirical tests are defined as follows. R is the initial return, which is obtained by first calculating the percentage change between the offer price and the closing price on the first day of trading and then subtracting the percentage change in the level of the China A index (Datastream mnemonic: TOTMKCA) between the days of pricing and listing.[6] $BHAR(3m)$ is the difference between the buy-and-hold returns of the

[5] This is neither the first nor the last time the CSRC imposed an IPO moratorium in China. The CSRC's decision to suspend IPO activity is often motivated by recent poor stock market performance and a desire to make changes to rules concerning IPOs.

[6] The average time gap between the days of pricing and listing is 14 days in the sample. Thus, an adjustment of the initial return for market movements is necessary (e.g., Chan et al., 2004).

IPO firm and a matching firm during the first three months of listing. As in Ritter (2011), the matching firm is in the same decile of the market value of equity as the IPO firm and has the closest book-to-market ratio, with the restriction that the matching firm must have been listed for at least five years [see also Barber and Lyon (1997) and Jegadeesh and Karceski (2009) for the control-firm approach]. The market value of equity is equal to the closing price on the day of listing times the number of shares outstanding. Book-to-market ratio is calculated as the book value of equity (as reported in the first quarterly report after listing) divided by the market value of equity (e.g., Brav et al., 2000). $BHAR(1y)$, $BHAR(2y)$, and $BHAR(3y)$ are defined the same as $BHAR(3m)$ except that they are measured over a holding period of one, two, and three years, respectively. $Market$ is the 30-day return of the China A index on the day of pricing. N is the number of institutional investors who bid in an IPO. *Allocation* indicates the allocation rate, which is the number of shares offered divided by the number of shares subscribed for. $Coverage$ is the number of times the issue is covered at the lowest limit price. *Range* is the width of the initial price range relative to its midpoint. $P(average)$ is the quantity-weighted average price based on all bids submitted during the preliminary inquiry. Hereafter, we also use the simpler term "average price" to refer to $P(average)$. $P(offer)$ is the offer price. Both $P(average)$ and $P(offer)$ are normalized by the initial price range. *Elasticity* is the elasticity of demand. As in Cornelli and Goldreich (2003), it is measured as the percentage change from the total quantity of shares demanded at or above $P(average)$ to the total quantity of shares demanded at or above $1.01 \times P(average)$ divided by the percentage change in price (i.e., 1%). $Proceeds$ and $Sales$ are gross proceeds and sales at the time of the IPO (both in millions of yuan), respectively. Age is the difference between the years of listing and foundation. VC is a dummy variable equal to one for VC-backed IPOs.

Table 1 presents descriptive statistics for the IPOs in the sample. The median R is 16%. This implies a positive jump in the share price on the first day of trading, which is consistent with the stylized fact that IPOs yield positive initial returns on average (e.g., Loughran et al., 1994). The descriptive statistics of buy-and-hold abnormal returns suggest a poor share performance over the first three months of listing as the mean and median values of $BHAR(3m)$ are well below those of R and a subsequent recovery in performance as

indicated by higher levels of $BHAR(1y)$, $BHAR(2y)$, and $BHAR(3y)$ compared to $BHAR(3m)$. The average 30-day market return on the day of pricing is -2%. The median IPO has 45 institutional bidders and is heavily oversubscribed (low allocation rate and high coverage). *Elasticity* has an average value of 5.63, which is comparable to the figure reported in Cornelli and Goldreich (2003). The average width of the initial price range is 0.15. This is close to the figures in Cornelli and Goldreich (2003) and Jenkinson and Jones (2004). Both $P(average)$ and $P(offer)$ have a negative mean in our sample. This means that both the average price based on institutional investor bids and the offer price are typically below the lower limit of the initial price range. The mean $P(offer)$ is 0.51 in Cornelli and Goldreich (2003) and 0.61 in Jenkinson and Jones (2004), indicating that the offer price is typically set close to the midpoint of the initial price range in their samples. The typical issuer in the sample raises 589 million yuan (close to 100 million U.S. dollars) and has pre-IPO sales of 323 million yuan (approximately 50 million U.S. dollars).[7] The median issuer age is 10 years, compared to 7 years in the U.S. (Loughran and Ritter, 2004), and half of the IPOs in the sample are venture capital backed.

[Please insert Table 1 about here]

5 Empirical results

5.1 Bidding behavior

We begin our analysis by examining three different dimensions of bidding behavior: frequency, aggressiveness, and informativeness.

5.1.1 Bidding frequency

Bidding frequency captures the propensity of institutional investors to bid in IPO auctions. $Freq_i$ is defined as the number of IPO auctions in which institution i enters bidding. We refer to institutions who bid in less than 5% of the IPO auctions in the sample as "occasional

[7] 1 yuan was approximately 0.15 U.S. dollars at the start of the sample period. It slightly appreciated over time, reaching 0.16 US dollars by the end of the sample period.

bidders" and those who bid in at least half as "regular bidders." The remaining institutions are referred to as "selective bidders," since they participate in IPO auctions more often than occasional bidders but are more selective compared to regular bidders, who participate in a majority of the auctions. According to the statistics presented in Panel A of Table 2, the median institution enters bidding in eight auctions only and the majority of institutions in the sample are occasional bidders. In contrast, regular bidders constitute less than 10% of the sample.

[Please insert Table 2 about here]

5.1.2 Bidding aggressiveness

The initial price range set by the lead underwriter serves as a valuation benchmark for institutions that consider bidding in IPO auctions. Bidding aggressiveness captures whether an institution has a general tendency to bid high or low relative to (i) the initial price range and (ii) other institutions. Given that institutions can submit multiple bids in an IPO, we first calculate P_{ij}, which is institution i's quantity-weighted average bid in IPO j. Then, $Aggr_i$ is the average value of P_{ij} normalized by the initial price range of IPO j. Institutions that tend to bid below the lower limit of the initial price range ($Aggr < 0$) are classified as "conservative bidders" and those that tend to bid above the upper limit of the initial price range ($Aggr > 1$) are considered as "aggressive bidders." The remaining institutions that normally bid within the initial price range are called "neutral bidders." The majority of institutional investors in the sample are conservative bidders and $Aggr$ has a sample median of -0.18 (Panel A of Table 2). In fact, almost all of the regular bidders in the sample are conservative bidders (Panel B). Only slightly more than 10% of the institutions are classified as aggressive bidders (Panel A), 95% of whom are occasional bidders (Panel C).

We also consider an alternative measure of bidding aggressiveness: $Aggr'$ is derived in a similar manner to $Aggr$ except that rather than normalizing P_{ij} by the initial price range, we divide it by $P_j(mid)$, which is the midpoint of the initial price range in IPO j. An institution that tends to bid above the midpoint will have $Aggr' > 1$, whereas another that tends to bid

below the midpoint will have $Aggr' < 1$. $Aggr'$ has a sample median of 0.9 (Panel A of Table 2), which means that institutions tend to bid 10% below the midpoint. The corresponding figure for regular bidders, who are particularly conservative, is 0.86 (Panel B), implying a tendency to bid 14% below the midpoint.

5.1.3 Bidding informativeness

Next, we investigate institutional investors' ability to bid in an informed manner. There are two aspects to bidding informativeness. First, institutional investors prefer to avoid potential poor performers and focus their investments in IPOs that they expect to be the best performers. Second, they have to place sufficiently aggressive bids in best performers to maximize their chances of getting a share allocation. Therefore, bidding informativeness is related to (but distinct from) bidding frequency and bidding aggressiveness.

As discussed in Section 3, for most of the sample period, shares allocated to institutional investors are subject to a lock-up period of three months, which prevents them from flipping shares on the first day of trading (Aggarwal, 2003). Therefore, informed bidders are concerned about the issuer's aftermarket performance during the first three months more than they are concerned about its performance on the first day of trading. Consequently, we focus on 3-month buy-and-hold abnormal returns $BHAR(3m)$ when developing measures of bidding informativeness.

Our first measure of bidding informativeness $Info_i$ is the average value of $\frac{P_{ij}}{P_j(mid)} BHAR_j(3m)$. Note that *Info* would reduce to the arithmetic average of $BHAR(3m)$, which is 13.18% (see Panel A of Table 1), if an institution bid at the midpoint in all of the IPO auctions in the sample. From Panel A of Table 2, we know that institutions tend to bid 10% below the midpoint. Then, the value of *Info* would be in the vicinity of $0.9 \times 13.18\% = 11.86\%$ for an institution that bids approximately 10% below the midpoint in either all IPOs or some IPOs selected randomly. This is a benchmark return based on an uninformed strategy, which informed institutions would aim to beat by bidding more aggressively in IPOs that are anticipated to outperform than in those that are expected to underperform. Overall, the sample mean of *Info* would exceed 11.86% if a sufficient number of institutions were informed. How-

ever, an institution that placed bids in a few very hot (cold) IPOs would only fetch an *Info* much higher (lower) than 11.86% purely by chance. To avoid such cases, we calculate *Info* for selective bidders and regular bidders but not for occasional bidders as the median number of IPO auctions they enter is only two (Panel B of Table 2).[8] *Info* has a sample mean of 15.45% (unreported in Table 2). A two-tailed t-test rejects the null that the mean is equal to 11.86% at the 1% significance level. Therefore, on average, institutions in the sample bid in a more informed manner than prescribed by an uninformed strategy.

Our second measure of bidding informativeness *Info*$'$ captures how aggressive an institution bids in IPOs that yield high returns relative to other institutions rather than relative to the midpoint of the initial price range, which is captured by *Info*. In particular, we sort the bids in each IPO from high to low on the basis of P_{ij} and split them into quartiles. Then, we assign each institution a score of $S_{ij} \in \{1, 2, 3, 4\}$. Specifically, S_{ij} is equal to one if the bid is in the bottom quartile, two if it is in the second quartile, and so on. *Info*$'$ is the sum of $\frac{S_{ij}}{\sum S_{ij}} BHAR_j(3m)$ across the IPOs in which institution i places a bid. If an institution bid in all of the IPO auctions in the sample and always fell into the same quartile in terms of its bidding aggressiveness relative to other bidders, its *Info*$'$ would be equal to the arithmetic average of $BHAR(3m)$, which is 13.18% (see Panel A of Table 1). However, informed bidders are expected to be among the aggressive bidders in the best-performing IPOs but not in the worst-performing ones. Therefore, they would obtain values of *Info*$'$ that are higher than 13.18%. As in the case of *Info*, we do not calculate *Info*$'$ for occasional bidders who may obtain a high (low) value of *Info*$'$ despite being uninformed (informed). The sample mean of *Info*$'$ is 17.33% (unreported in Table 2). A two-tailed t-test rejects the null that the mean is equal to 13.18% at the 1% significance level. We conclude that, on average, institutions beat the benchmark return based on an uninformed strategy when bidding informativeness is measured in *Info*$'$ as well as in *Info*.

Unless an institutional investor can dramatically adjust its bidding aggressiveness across

[8] Although it is not possible to establish whether occasional bidders are informed or uninformed as they could get a high or low value of *Info* due to luck, we expect most of them will be uninformed bidders as it would be hard for them to recover the costs of information acquisition by bidding in a few IPOs only and with no guarantee of a share allocation.

the worst- and best-performing IPOs, its value of *Info* (*Info′*) starts approaching the uninformed benchmark return of 11.86% (13.18%) as it bids in more IPOs. This implies that regular bidders cannot be expected to have as high values of *Info* (*Info′*) as selective bidders, regardless of any systematic differences in the precision of information these two groups have. In order to allow for a fair comparison across institutional investors with differing levels of bidding frequency, we bootstrap distributions of *Info* and *Info′* and establish a statistical threshold of 10% (p-value of 0.10) for each value of $Freq$. The method we use follows from Brown and Kovbasyuk (2016), who statistically identify institutional investors who consistently invest in the most highly-underpriced IPOs. To simulate a value of *Info* (*Info′*) for $Freq = n$, we randomly select n observations of $\frac{P_{ij}}{P_j(mid)}$ ($\frac{S_{ij}}{\sum S_{ij}}$) and match them with randomly selected values of $BHAR_j(3m)$. The random selections are made with replacement. Overall, we generate 10,000 random values of *Info* and *Info′* for each value of $Freq$.

We depict the 10% thresholds for *Info* and *Info′* as a function of $Freq$ in Panels (a) and (b) of Figure 1, respectively. As expected, the critical thresholds decline as $Freq$ increases, and we would be biased against regular bidders if we used *Info* or *Info′* to compare them against selective bidders. Instead, we rely on $Info_{\%}$ and $Info'_{\%}$ as our measures of comparison. For an institution that bids in n IPO auctions, $Info_{\%}$ is the percentage of 10,000 random values of *Info* generated for $Freq = n$ that are below the institution's actual value of *Info*. $Info'_{\%}$ is defined the same way but is based on *Info′*. Of the 163 institutional investors who are either selective bidders or regular bidders, 30% meet the 10% threshold based on *Info* (i.e., $Info_{\%} > 90$), 34% meet the same based on *Info′* (i.e., $Info'_{\%} > 90$), and 28% based on both (i.e., $Info_{\%} > 90$ & $Info'_{\%} > 90$). In the remainder of the text, we refer to institutions that satisfy $Info_{\%} > 90$ & $Info'_{\%} > 90$ as "well-informed bidders" and call the remaining institutions (except occasional bidders for whom *Info* and *Info′* are not calculated) "less-informed bidders." According to Panel D in Table 2, the sample median of $Info_{\%}$ ($Info'_{\%}$) is 98.38 (98.13) for well-informed bidders, whereas the corresponding figure is 52.88 (55.39) for less-informed bidders. Importantly, only 6% of regular bidders are classified as well-informed bidders, whereas nearly a third of selective bidders fall into the same category (Panel B).

[Please insert Figure 1 about here]

Panel E of Table 2 reports pairwise correlations between $Freq$, $Aggr$, $Aggr'$, $Info_{\%}$, and $Info'_{\%}$. Not surprisingly, there is strong positive correlation between $Aggr$ and $Aggr'$, and between $Info_{\%}$ and $Info'_{\%}$. The remaining correlation coefficients are low (less than 0.2 in absolute value) and, except the one between $Info'_{\%}$ and $Aggr'$ (p-value = 0.03), are not statistically significant at the 5% significance level. This supports the idea that frequency, aggressiveness, and informativeness are distinct dimensions of bidding behavior.

5.2 Bidder type

In this subsection, we investigate whether bidding behavior varies across different types of bidders. There are seven types of institutional investors in the sample: fund management firms, securities firms, investment trusts, recommended investors, finance firms, insurance firms, and qualified foreign institutional investors (QFIIs).

[Please insert Table 3 about here]

As shown in Table 3, recommended investors constitute the largest category, representing 45% of the 353 institutional investors in the sample (Panel A). They are independently recommended by underwriters to take part in auctions and are expected to have long-term investment intentions. The vast majority are occasional bidders, such that the median recommended investor bids in two IPO auctions, less than 1% of all auctions in the sample (Panel B).[9] QFIIs, who constitute one of the smallest categories (Panel A), are predominantly occasional bidders as well (Panel B).[10]

In contrast to recommended investors and QFIIs, fund management firms and securities firms place bids in IPO auctions much more frequently. The median fund management firm

[9] Jenkinson and Jones (2004) provide evidence that underwriters treat investors who are expected to be long-term holders of the stock favorably when deciding share allocations in bookbuilt IPOs. In our context, underwriters could not offer such a favorable treatment to recommended investors as share allocations are decided via balloting. Yet, they could name their favored clients as recommended investors in IPOs that are expected to yield superior performance. However, the fact that the median recommended investor bids in less than 1% of the IPO auctions suggests that this is unlikely to be the case.

[10] The QFIIs in the sample are Deutsche Bank, Fortis Bank, Schroder Investment Management Limited, Stanford University, and Yale University.

(securities firm) participates in 42 (38) IPO auctions, which is 20% (18%) of all IPO auctions in the sample (Panel B). In fact, nearly a quarter of fund management firms are regular bidders, which is well above the sample average of less than 10% (Panel B).

The results in Panel A show that most types of institutional investors tend to place a single limit bid in an IPO. The exceptions to this trend are fund management firms and investment trusts, which place 2.7 bids per IPO and 2.1 bids per IPO on average, respectively. Panel A also shows that fund management firms and securities firms jointly account for 15,737 bids, which is more than 80% of all bids in the sample. Despite being the largest category of institutional investors, recommended investors only account for 5% of all bids. This is a consequence of their being occasional bidders.

In terms of bidding aggressiveness (Panel C), a large majority of fund management firms and securities firms are conservative bidders, meaning that they commonly bid below the initial price range (i.e., $Aggr < 0$). Compared to them, investment trusts and finance firms tend to bid closer to the lower limit of the range (i.e., $Aggr$ is closer to zero from below). Insurance firms and QFIIs aim for the midpoint or higher (i.e., $Aggr \geq 0.5$ or $Aggr' \geq 1$). These patterns explain why $P(average)$ is well below the lower limit of the initial price range (see Panel C of Table 1): Fund management firms and securities firms account for the bulk of the bids and a large majority of these institutions are conservative bidders.

We next examine bidder types with regard to their bidding informativeness. The median fund management firm has $Info_{\%} = 89.35$ and $Info'_{\%} = 90.78$ (Panel D), suggesting that half of the fund management firms are either above or very close to the 10% threshold we establish for each of the two bidding informativeness measures. Moreover, 39% of fund management firms meet the 10% threshold for both measures and, thus, are classified as well-informed bidders. Following fund management firms, securities firms have the highest medians for $Info_{\%}$ and $Info'_{\%}$, and 22% of them satisfy $Info_{\%} > 90$ and $Info'_{\%} > 90$. Overall, fund management firms and securities firms together account for more than 90% of all well-informed bidders in the sample.

The findings in this section paint a clear picture: On one hand, there is a large number of institutional investors (mainly recommended investors and QFIIs) who take part in IPO

auctions only once or twice. On the other hand, there are fund management firms and securities firms who enter many IPO auctions with bids below the initial price range and who account for more than 90% of well-informed bidders. In between, there are investment trusts, finance firms, and insurance firms who (i) bid more often than recommended investors and QFIIs but less often than fund management firms and securities firms, (ii) are less conservative than fund management firms and securities firms, and (iii) are unlikely to be well-informed bidders.

5.3 Average price and offer price

In this subsection, we examine the impact of bidding behavior on the average price $P(average)$ and the offer price $P(\textit{offer})$. $P(average)$ is established by the limit bids placed by institutional investors during the preliminary inquiry. In contrast, $P(\textit{offer})$ is determined by underwriters who take into account not only $P(average)$ but also a host of other factors such as industry and market conditions.

We begin our analysis by investigating the determinants of $P(average)$. We expect a positive relation between $P(average)$ and proxies of institutional investor demand for shares. Findings reported in Table 4 confirm this expectation as $P(average)$ is high when the coverage is high (model (1)), the allocation rate is low (model (2)), and the number of institutions who enter bidding is high (model (3)). In particular, the number of bidders alone explains half of the variation in $P(average)$ (model (3)), and the coverage and the allocation rate have no marginal explanatory power once the number of bidders is controlled for (model (4)). This suggests that the average price is higher in IPOs that attract more bidders.

[Please insert Table 4 about here]

Having investigated the determinants of $P(average)$, we move on to the determinants of $P(\textit{offer})$. Figure 2 presents a scatter plot of $P(\textit{offer})$ against $P(average)$. Observations are most heavily clustered in the lower left quadrant where both variables are below the midpoint of the initial price range. Moreover, a tight relation between $P(\textit{offer})$ and $P(average)$ is clearly visible. According to the model (5) in Table 4, $P(average)$ explains 93% of the cross-sectional

variation in $P(\textit{offer})$, and the estimate of the slope coefficient is 0.95. These figures are very close to those reported in Cornelli and Goldreich (2003), who run the same model on a sample of bookbuilt IPOs. The almost one-to-one relation between $P(\textit{offer})$ and $P(\textit{average})$ means that underwriters heavily rely on the average price obtained in the preliminary inquiry when setting the offer price. However, in 86% of the IPOs, they set an offer price that is higher than the average price. This is noticeable in Figure 2 as most observations lie above the 45-degree line that shows the case when $P(\textit{offer}) = P(\textit{average})$.

[Please insert Figure 2 about here]

Which factors other than $P(\textit{average})$ affect $P(\textit{offer})$? Model (6) in Table 4 shows that $P(\textit{offer})$ is related to N_i/N_o, which is the ratio of the number of well-informed bidders to the number of other bidders (i.e., less-informed bidders and occasional bidders), as well as $P(\textit{average})$. This means that, when setting the offer price, underwriters take into consideration not only the average price but also the bidding informativeness of institutional investors who determine the average price. Moreover, there is a positive, concave relation between $P(\textit{offer})$ and N_i/N_o. Therefore, the offer price is expected to increase as informed demand gets stronger, and the expected increase is larger when the initial level of informed demand is low. This makes sense as once there is a sufficient number of well-informed bidders already bidding in an auction, the entry of an additional well-informed bidder conveys little additional information. In addition, if the offer price fully adjusted to the strength of informed demand, there would not be a strong incentive for investors to engage in costly information acquisition in the first place. In fact, Biais and Faugeron-Crouzet (2002) argue that the underreaction of the offer price to demand prevents tacit collusion on low prices in dirty auctions, and Sherman and Titman (2002) show that underpricing is observed in states in which many investors reveal positive information during bookbuilding.

In model (7), alongside $P(\textit{average})$ and N_i/N_o, we consider other potential determinants of $P(\textit{offer})$ such as issuer characteristics (size, age, venture capital backing, proceeds raised), market conditions at the time when the offer price is set, and industry fixed effects. Moreover, underwriters can be expected to price issues more conservatively when opinions about

the value of shares are more diverse (i.e., when *Elasticity* is lower) and when the ex ante uncertainty is higher (i.e., when *Range* is wider) (Kandel et al., 1999; Cornelli and Goldreich, 2003). We observe that underwriters are more reluctant to push the offer price higher in larger issues (those with higher proceeds) than in smaller ones. The positive coefficient of $Market$, which is statistically significant at the 5% level, suggests that underwriters set the offer price higher when recent market returns are higher. Finally, the relation between the offer price and the width of the initial price range is significant and negative as expected.

Models (8)-(10) show that our conclusions remain robust under an alternative specification where the dependent variable is the revision from $P(average)$ to $P(offer)$. The average revision from $P(average)$ to $P(offer)$ is 6.2% (model (8)), and there is a positive, concave relation between the size of the revision and N_i/N_o (model (9)), which remains significant after adding the control variables (model (10)).

The tight relation between the average price established during the preliminary inquiry $P(average)$ and the final offer price $P(offer)$ is reported in Chemmanur et al. (2017b) as well. They find that $P(offer)$ is more sensitive to the bids of institutions who have the potential to produce more precise information. Our findings complement and extend theirs in a number of ways. First, unlike Chemmanur et al., we identify informed institutions based on their bidding patterns and show that $P(offer)$ is influenced by their bids. Second, we examine the determinants of $P(average)$ as well as $P(offer)$ and find that the former is positively related to proxies of institutional demand in general and to the number of bidders in particular. Finally, we show that the relation between the offer price and the relative strength of informed demand is not only positive but also concave.

5.4 Share allocations

Determination of the offer price marks the end of the preliminary inquiry and the start of the subscription offering. As described in Section 3, during the subscription offering, institutional investors subscribe for shares based on their qualified bids (i.e., bids that are at or above the offer price). In the case of oversubscription, which is the case for all IPO auctions in the sample, share allocations are decided via balloting. An institutional investor's chances

of receiving a share allocation depends on (i) the quantity it demanded at or above the offer price, and (ii) the total quantity demanded by all other bidders at or above the offer price. While the institutional investor has no control over (ii), it has full control over (i). Therefore, an institutional investor wishing to maximize its chances of getting shares in a particular issue could do so by demanding large quantities of shares at high prices.

We know that well-informed bidders have high values of $Info_{\%}$ and $Info'_{\%}$ (Subsection 5.1.3), which means that they place more aggressive bids in terms of quantity and/or price in hot IPOs than in cold ones. This leads to two predictions regarding the level of informed demand during the stages of preliminary inquiry and subscription offering. First, the fraction of total quantity demanded due to well-informed bidders during the preliminary inquiry must be higher in hot IPOs than in cold ones. Second, in hot IPOs, the fraction of total quantity demanded due to well-informed bidders during the subscription offering must exceed the fraction of total quantity demanded due to them during the preliminary inquiry, since their aggressive bids would have a better chance of qualifying for the subscription offering.

In what follows, we investigate the extent to which these two predictions are borne out by the data. Our findings are presented in Table 5. Institutional investors are divided into groups based on their bidding informativeness and bidding frequency. As discussed in Subsection 5.1.3, occasional bidders are not classified in terms of their bidding informativeness. Moreover, within the group of well-informed bidders, regular bidders and selective bidders are reported jointly rather than separately, since there are only two regular bidders that are well informed. Panel A shows that the group of occasional bidders, which contains more than half of all institutional investors in the sample (see Table 2), accounts for only 2% of the total demand. In contrast, the group of less-informed regular bidders, which represents less than 10% of all institutional investors in the sample (see Table 2), accounts for more than 60% of the total demand. This suggests that the success of the IPO auctions we examine relies on the continuing participation of less-informed regular bidders as their bids represent a large majority of the total quantity demanded. Finally, the group of well-informed bidders accounts for 12% of the total quantity demanded during the preliminary inquiry. There are parallels between these findings and Rock's (1986) argument that the IPO market would fail in the

absence of uninformed demand as informed demand would not be sufficient to absorb whole issues.

[Please insert Table 5 about here]

When we split IPOs into quartiles based on 3-month buy-and-hold abnormal returns, we observe a clear pattern as we move from Panel B to Panel E in Table 5: Well-informed bidders steadily increase their share of the total quantity demanded at the preliminary inquiry stage from 7.7% in the coldest issues to 16.4% in the hottest issues, which is an increase of 113%. This increase comes at the expense of less-informed bidders and occasional bidders whose total share declines from 92.3% to 83.6%. It confirms the first prediction we stated earlier in this subsection that well-informed bidders demand more shares in hot IPOs than in cold ones.

We also observe another pattern when we compare the proportions of total demand attributable to well-informed bidders across the stages of preliminary inquiry and subscription offering. In Panel E, which includes the hottest IPOs, when bids below the offer price are discarded, the proportion of total demand due to well-informed bidders jumps from 16.4% to 20.3% (p-value: 0.014). This suggests that well-informed bidders not only demand more shares but also place aggressive bids in the hottest IPOs, which is in line with the second prediction we set out earlier in this subsection.

Finally, the column titled "Share allocation" in Table 5 shows that the average percentage of shares allocated to well-informed bidders more than doubles from 9.2% in the coldest IPOs to 21.6% in the hottest IPOs, highlighting the economic impact of their informed bidding behavior. The presence of well-informed bidders imposes a winner's curse à la Rock (1986) on other bidders who win 90.8% of the shares in the coldest issues compared to 78.4% of the shares in the hottest issues.

5.5 Investment performance of institutional investors

So far, we have distinguished institutional investors in terms of bidding behavior (Subsection 5.1) and bidder type (Subsection 5.2) and have investigated the impact of bidding behavior on

the average price, offer price (Subsection 5.3), and share allocations (Subsection 5.4). Now, we analyze the investment performance of institutional investors following the allocation of shares. Given that the dataset includes share allocations at the institution level for each IPO, we are able to calculate the return an institutional investor would get from its investment in an IPO if it simply held on to its share allocation for a certain period.

We compare four groups of institutional investors, which are occasional bidders, less-informed selective bidders, less-informed regular bidders, and well-informed bidders, in terms of how their investments in IPO shares perform over three months, one year, two years, and three years. For each institution, we calculate the simple average return of the IPOs in which they receive shares. However, the simple average return is not necessarily the best measure of investment performance due to the winner's curse. For example, an institution that receives 1 million yuan worth of shares in a hot IPO with 80% return and 9 million yuan worth of shares in a cold IPO with -20% return experiences a simple average return of 30%, but the same institution incurs a loss of one million yuan ($= 80\% \times 1$ million yuan $- 20\% \times 9$ million yuan) over a total investment of 10 million yuan, implying a yuan-weighted average return of -10%. Therefore, we investigate yuan-weighted average returns as well as simple average returns. Moreover, average performance figures based only on the institutions who get shares would not reflect the typical investor experience. This is because more than half of the institutions in the sample never get shares, and ignoring their experience would lead to an overstatement of average performance. In order to address this issue, we report average performance figures based on all institutions, assuming that institutions who never receive shares experience an average performance of zero, as well as on the institutions who receive shares in at least one IPO.

Our findings are presented in Table 6. Of the 353 institutional investors in the sample, 163 receive shares in at least one of the 214 IPOs, while the remaining 190 never get a share allocation despite bidding in one or more IPOs. There is a strong link between bidding frequency and winning a share allocation at least once. All regular bidders receive shares in at least one IPO. In contrast, only 13% of occasional bidders ever get a share allocation. In general, the figures reported in Table 6 highlight the importance of considering the winner's curse and the

likelihood of never receiving shares when calculating the investment performance. For example, while the simple average $BHAR(3m)$ experienced by institutions who get shares in at least one IPO is 10.8%, the yuan-weighted average $BHAR(3m)$, which accounts for the winner's curse, is 8.7% (Panel A). Moreover, the yuan-weighted average $BHAR(3m)$ further drops to just 4%, once the experience of institutions who never get shares is taken into consideration (Panel B).

[Please insert Table 6 about here]

Well-informed bidders have the highest averages of both simple average returns and yuan-weighted average returns in both panels of Table 6. They are followed by less-informed regular bidders who generally have the second highest figures. In some cases, the difference between the average performance of well-informed bidders and less-informed regular bidders is not statistically significant at the 10% level. This is because the variability of performance around the average is high for well-informed bidders, suggesting a high degree of uncertainty with respect to their performance. In contrast, the variability of performance around the average is low for less-informed regular bidders, making their investment performance relatively easy to predict. Finally, we note that occasional bidders' average performance figures (both simple average and yuan-weighted average) drop the most compared to other groups once the experience of institutions who never get shares is accounted for (Panel B). This makes sense as an overwhelming majority of occasional bidders never get a share allocation and, thus, do not actually experience the average performance figures reported in Panel A.

We also run multivariate regressions to further explore the relation between investment performance and bidding behavior. In particular, we examine marginal explanatory powers of bidding frequency $Freq$, bidding aggressiveness $Aggr$, and bidding informativeness $Info_{\%}$ (Subsection 5.1), controlling for the bidder type (Subsection 5.2). Given that occasional bidders are not classified with respect to their bidding informativeness (Subsection 5.1.3), the sample in these cross-sectional OLS regressions is based on selective bidders and regular bidders. The dependent variable is either the simple average or yuan-weighted average return of IPOs in which an institution receives shares, whereby the return measure is one of the

following: $BHAR(3m)$, $BHAR(1y)$, $BHAR(2y)$, or $BHAR(3y)$. The results are presented in Table 7. In Panel A, institutions that never get a share allocation are excluded. In Panel B, they are included with an average performance of zero. $Info_{\%}$ has a positive coefficient that is statistically significant at the 1% level in all specifications. The coefficient of $Freq$ is generally not significant at a conventional level, except when we account for institutions that never get shares and the holding period is at least two years (Panel B). Agg has a negative coefficient in all models, but the coefficient is generally not significant in Panel B. These findings suggest that bidding informativeness is the key driver of investment performance. Moreover, once we control for the three dimensions of bidding behavior (frequency, aggressiveness, and informativeness), the bidder's type does not have much explanatory power for investment performance, except that insurance firms perform significantly worse than other types of bidders. These results remain robust if we use $Aggr'$ instead of $Aggr$ as a measure of bidding aggressiveness and/or $Info'_{\%}$ instead of $Info_{\%}$ as a measure of bidding informativeness. These robustness tests are presented in Table A1, which is in the Appendix.

[Please insert Table 7 about here]

Overall, the findings presented in this section show that bidding informativeness has a strong positive impact on investment performance. They also demonstrate that the winner's curse damages investment performance. Moreover, we observe that bidding behavior matters more than bidder type in driving investment performance. Chemmanur et al. (2017b) report that institutional investors who have potential to produce more precise information about issues exhibit stronger investment performance based on univariate tests. However, they only focus on profits, ignoring the differences across institutions in the total amount they invest in IPOs, which we show makes a big difference especially in the case of regular bidders. Furthermore, they do not consider the experience of institutions that never get a share allocation, which has a substantial influence on average performance figures as demonstrated by our findings. Finally, while Chemmanur et al. (2017b) focus on an investment period of three months only, we consider longer holding periods up to three years as well.

6 Conclusion

In this paper, we capitalize on a large, hand-collected dataset of institutional investor bids to offer new insights into the bidding patterns of institutional investors in IPO auctions. The auctions we examine are conducted in the ChiNext market. They are dirty uniform auctions exclusive to institutional investors and are followed by public offers to retail investors. Share allocations are decided via balloting in both the auctions and the public offers.

In our analysis, we focus on three dimensions of bidding behavior: frequency, aggressiveness, and informativeness. We find that the majority of institutional investors are occasional bidders who enter a few auctions only. Occasional bidders are typically investors recommended by underwriters. Their bids represent only a small fraction of the total demand, and they seldom get any shares. In contrast, regular bidders are a minority in the sample but account for more than 60% of the total demand. They tend to be conservative bidders, and only a few of them are classified as well-informed bidders. Well-informed bidders are concentrated among fund management firms and securities firms and exhibit significant skill in placing aggressive bids in hot IPOs.

Once institutional investors submit their bids, the offer price is set and the allocation of shares takes place via balloting. We find that although the offer price is closely related to the quantity-weighted average price based on institutional investor bids, the former often exceeds the latter. Furthermore, the extent of the upward revision has a positive, concave relation with the ratio of informed demand to uninformed demand. As regards share allocations, there is clear evidence of a winner's curse imposed on less-informed bidders by well-informed ones: The proportion of shares allocated to well-informed bidders in the hottest issues is more than double the proportion allocated to them in the coldest issues.

For the vast majority of IPOs in the sample, the shares allocated to institutional investors are subject to a lock-up period of three months, which means that institutional investors are particularly concerned about the issuer's aftermarket performance during the first three months. The average institutional investor who gets shares in at least one IPO experiences a simple average 3-month buy-and-hold abnormal return $BHAR(3m)$ of 11%. However, most in-

stitutional investors get more shares in the worst-performing IPOs than in the best-performing ones due to the winner's curse caused by the presence of well-informed bidders. Consequently, the average institution's yuan-weighted average $BHAR(3m)$ is 9%. Moreover, when we account for the experience of institutions who never get a share allocation, the yuan-weighted average $BHAR(3m)$ further drops to 4%. Nonetheless, there is a strong, positive relation between bidding informativeness and the average return experienced by an institutional investor up to a holding period of three years.

Taken together, our findings highlight the importance of considering bidding frequency and bidding aggressiveness alongside bidding informativeness when examining the bidding behavior of institutional investors. They provide evidence that dirty auctions exclusive to institutional investors are conducive to information production and information extraction. Finally, they reveal significant informational asymmetries among institutional investors who bid in IPOs and show that an informational advantage at the time of an IPO has a lasting effect on the average returns institutions realize on their investments in IPO shares.

Appendix

As discussed in Subsection 5.5, we present robustness tests for the relation between investment performance and bidding behavior in Table A1. These robustness tests support the findings shown in Table 7.

[Please insert Table A1 about here]

References

Aggarwal, R. (2003), 'Allocation of initial public offerings and flipping activity', *Journal of Financial Economics*, **68** (1), 111–135.

Amihud, Y., S. Hauser and A. Kirsh (2003), 'Allocations, adverse selection, and cascades in IPOs: Evidence from the Tel Aviv Stock Exchange', *Journal of Financial Economics*, **68** (1), 137–158.

Barber, B. M. and J. D. Lyon (1997), 'Detecting long-run abnormal stock returns: The empirical power and specification of test statistics', *Journal of Financial Economics*, **43** (3), 341 – 372.

Benveniste, L. M. and P. A. Spindt (1989), 'How investment bankers determine the offer price and allocation of new issues', *Journal of Financial Economics*, **24** (2), 343–361.

Benveniste, L. M. and W. J. Wilhelm (1990), 'A comparative analysis of IPO proceeds under alternative regulatory environments', *Journal of Financial Economics*, **28** (1–2), 173–207.

Bertoni, F. and G. Giudici (2014), 'The strategic reallocation of IPO shares', *Journal of Banking & Finance*, **39**, 211–222.

Biais, B. and A. M. Faugeron-Crouzet (2002), 'IPO auctions: English, Dutch, ... French, and internet', *Journal of Financial Intermediation*, **11** (1), 9–36.

Brav, A., C. Geczy and P. A. Gompers (2000), 'Is the abnormal return following equity issuances anomalous?', *Journal of Financial Economics*, **56**, pp. 209–249.

Brown, D. C. and S. Kovbasyuk (2016), 'Key investors in IPOs', *Working paper*.

Bubna, A. and N. R. Prabhala (2011), 'IPOs with and without allocation discretion: Empirical evidence', *Journal of Financial Intermediation*, **20** (4), 530–561.

Cao, J., T. Leng, B. Liu and W. Megginson (2017), 'Institutional bidding in IPO allocation: Evidence from China', *Working paper*.

Chan, K., J. Wang and K. C. J. Wei (2004), 'Underpricing and long-term performance of IPOs in China', *Journal of Corporate Finance*, **10** (3), 409–430.

Chemmanur, T. J., B. Liu and X. Tian (2017a), 'Rent seeking, brokerage commissions, and the pricing and allocation of shares in initial public offerings', *Working paper*.

Chemmanur, T. J., P. Ma, C. Wu and Q. Yu (2017b), 'Information production by institutions and information extraction by underwriters in hybrid IPO auctions', *Working paper*.

Chiang, Y.-M., Y. Qian and A. E. Sherman (2010), 'Endogenous entry and partial adjustment in IPO auctions: Are institutional investors better informed?', *Review of Financial Studies*, **23** (3), 1200–1230.

Cornelli, F. and D. Goldreich (2001), 'Bookbuilding and strategic allocation', *The Journal of Finance*, **56** (6), 2337–2369.

—— (2003), 'Bookbuilding: How informative is the order book?', *The Journal of Finance*, **58** (4), 1415–1443.

Degeorge, F., F. Derrien and K. L. Womack (2010), 'Auctioned IPOs: The US evidence', *Journal of Financial Economics*, **98** (2), 177–194.

Derrien, F. and K. L. Womack (2003), 'Auctions vs. bookbuilding and the control of underpricing in hot IPO markets', *Review of Financial Studies*, **16** (1), 31–61.

Gao, S., Q. Meng, J. Y. Chan and K. C. Chan (2018), 'Cognitive reference points, institutional investors' bid prices, and IPO pricing: Evidence from IPO auctions in China', *Journal of Financial Markets*, **38**, 124–140.

Harstad, R. M. and R. F. Bordley (1996), 'Lottery qualification auctions', in M. R. Baye (ed.), 'Auctions', volume 6 of *Advances in Applied Microeconomics*, pages 157–183, JAI Press.

Jagannathan, R., A. Jirnyi and A. G. Sherman (2015), 'Share auctions of initial public offerings: Global evidence', *Journal of Financial Intermediation*, **24** (3), 283–311.

Jegadeesh, N. and J. Karceski (2009), 'Long-run performance evaluation: Correlation and heteroskedasticity-consistent tests', *Journal of Empirical Finance*, **16** (1), 101–111.

Jenkinson, T. and H. Jones (2004), 'Bids and allocations in European IPO bookbuilding', *The Journal of Finance*, **59** (5), 2309–2338.

—— (2009), 'IPO pricing and allocation: A survey of the views of institutional investors', *Review of Financial Studies*, **22** (4), 1477–1504.

Jenkinson, T., H. Jones and F. Suntheim (2018), 'Quid pro quo? What factors influence IPO allocations to investors?', *The Journal of Finance*, **73** (5), 2303–2341.

Kandel, S., O. Sarig and A. Wohl (1999), 'The demand for stocks: An analysis of IPO auctions', *Review of Financial Studies*, **12** (2), 227–247.

Keloharju, M. (1993), 'The winner's curse, legal liability, and the long-run price performance of initial public offerings in Finland', *Journal of Financial Economics*, **34** (2), 251–277.

Keloharju, M. and S. Torstila (2002), 'The distribution of information among institutional and retail investors in IPOs', *European Financial Management*, **8** (3), 357–372.

Kerins, F., K. Kutsuna and R. Smith (2007), 'Why are IPOs underpriced? Evidence from Japan's hybrid auction-method offerings', *Journal of Financial Economics*, **85** (3), 637–666.

Khurshed, A., S. Paleari, A. Pande and S. Vismara (2014), 'Transparent bookbuilding, certification and initial public offerings', *Journal of Financial Markets*, **19**, 154–169.

Koh, F. and T. Walter (1989), 'A direct test of Rock's model of the pricing of unseasoned issues', *Journal of Financial Economics*, **23** (2), 251–272.

Kutsuna, K. and R. Smith (2004), 'Why does book building drive out auction methods of IPO issuance? Evidence from Japan', *The Review of Financial Studies*, **17** (4), 1129–1166.

Leite, T. (2006), 'Bookbuilding with heterogeneous investors', *Journal of Financial Intermediation*, **15** (2), 235–253.

Levis, M. (1990), 'The winner's curse problem, interest costs and the underpricing of initial public offerings', *The Economic Journal*, **100** (399), 76–89.

Lin, J.-C., Y.-T. Lee and Y.-J. Liu (2007), 'IPO auctions and private information', *Journal of Banking & Finance*, **31** (5), 1483–1500.

Ljungqvist, A. P. and W. J. Wilhelm (2002), 'IPO allocations: discriminatory or discretionary?', *Journal of Financial Economics*, **65** (2), 167–201.

Loughran, T. and J. R. Ritter (2004), 'Why has IPO underpricing changed over time?', *Financial Management*, **33** (3), 5–37.

Loughran, T., J. R. Ritter and K. Rydqvist (1994), 'Initial public offerings: International insights', *Pacific-Basin Finance Journal*, **2** (2-3), 165–199.

Lowry, M., M. S. Officer and G. W. Schwert (2010), 'The variability of IPO initial returns', *The Journal of Finance*, **65** (2), 425–465.

Parlour, C. A., V. Prasnikar and U. Rajan (2007), 'Compensating for the winner's curse: Experimental evidence', *Games and Economic Behavior*, **60** (2), 339–356.

Parlour, C. A. and U. Rajan (2005), 'Rationing in IPOs', *Review of Finance*, **9** (1), 33–63.

Ritter, J. R. (2011), 'Equilibrium in the initial public offerings market', *Annual Review of Financial Economics*, **3** (1), 347–374.

Rocholl, J. (2009), 'A friend in need is a friend indeed: Allocation and demand in IPO book-building', *Journal of Financial Intermediation*, **18** (2), 284–310.

Rock, K. (1986), 'Why new issues are underpriced', *Journal of Financial Economics*, **15** (1-2), 187–212.

Schnitzlein, C. R., M. Shao and A. E. Sherman (2019), 'Come on in, the water's fine! An experimental examination of hybrid IPO auctions with a public pool', *Journal of Financial Research*, **42** (1), 5–39.

Sherman, A. E. (2000), 'IPOs and long-term relationships: An advantage of book building', *The Review of Financial Studies*, **13** (3), 697–714.

—— (2005), 'Global trends in IPO methods: Book building versus auctions with endogenous entry', *Journal of Financial Economics*, **78** (3), 615–649.

Sherman, A. E. and S. Titman (2002), 'Building the IPO order book: Underpricing and participation limits with costly information', *Journal of Financial Economics*, **65** (1), 3–29.

Table 1: Descriptive statistics

The sample includes 214 IPOs listed on ChiNext between December 2010 and October 2012. R is the initial return and is adjusted for market movements between the days of pricing and listing. $BHAR(3m)$ is the difference between the buy-and-hold returns of the IPO firm and a matching firm during the first three months of listing. The matching firm is seasoned for at least five years, is in the same decile of market value of equity as the IPO firm, and has the closest book-to-market ratio to the IPO firm. $BHAR(1y)$, $BHAR(2y)$, and $BHAR(3y)$ are defined the same as $BHAR(3m)$ except that they are measured over a holding period of one, two, and three years, respectively. $Market$ is the 30-day return of the China A index on the day of pricing. N is the number of institutional investors who bid in an IPO. *Allocation* indicates the allocation rate, which is the number of shares offered divided by the number of shares subscribed for. *Coverage* is the number of times the issue is covered at the lowest limit price. *Range* is the width of the initial price range relative to its midpoint. $P(average)$ is the quantity-weighted average price based on all bids submitted during the preliminary inquiry. $P(offer)$ is the offer price. Both $P(average)$ and $P(offer)$ are normalized by the initial price range. *Elasticity* is the elasticity of demand measured from $P(average)$ to a price one percent higher. *Proceeds* and *Sales* are gross proceeds and sales at the time of the IPO (both in millions of yuan), respectively. *Age* is the difference between the years of listing and foundation. VC is a dummy variable equal to one for VC-backed IPOs.

Symbol	Brief definition	Mean	p25	Median	p75	Count
	Panel A: Returns					
R	Initial return	22.84	1.25	15.91	34.70	214
$BHAR(3m)$	3-month buy-and-hold abnormal return	13.18	−12.56	7.80	32.13	214
$BHAR(1y)$	1-year buy-and-hold abnormal return	22.70	−10.45	11.32	44.68	214
$BHAR(2y)$	2-year buy-and-hold abnormal return	53.04	−13.81	25.59	98.83	214
$BHAR(3y)$	3-year buy-and-hold abnormal return	116.41	5.79	74.76	174.25	214
$Market$	Pre-IPO market return	−2.06	−6.27	−3.03	2.13	214
	Panel B: Institutional demand					
N	Number of bidders	48.99	36.00	45.00	56.00	214
Allocation	Allocation rate	0.09	0.04	0.06	0.12	214
Coverage	Coverage at the minimum bid	45.26	26.00	39.00	56.67	214
Elasticity	Demand elasticity	5.63	1.18	2.62	5.71	214
	Panel C: Valuation					
Range	Width of the initial price range	0.15	0.12	0.15	0.18	214
$P(average)$	Average price (relative to range)	−0.61	−1.33	−0.52	0.27	214
$P(offer)$	Offer price (relative to range)	−0.26	−1.11	−0.21	0.58	214
	Panel D: Issuer characteristics					
Proceeds	Proceeds (in millions of yuan)	588.99	358.40	474.83	752.00	214
Sales	Sales (in millions of yuan)	323.22	167.23	244.31	372.95	214
Age	Age (in years)	10.25	7.00	10.00	12.00	211
VC	VC backing (dummy variable)	0.51	0.00	1.00	1.00	213

Table 2: Bidding behavior

The sample includes 353 institutions bidding in at least one of the 214 IPOs listed on ChiNext between December 2010 and October 2012. $Freq$ is the number of IPO auctions in which an institution enters bidding. Occasional bidders have $Freq < 11$, regular bidders have $Freq \geq 107$, and the rest are selective bidders. $Aggr$ is the average value of P_{ij} normalized by the initial price range of IPO j, and $Aggr'$ is the average value of P_{ij} divided by $P_j(mid)$, where P_{ij} is institution i's quantity-weighted average bid in IPO j and $P_j(mid)$ is the midpoint of the initial price range in IPO j. Conservative bidders have $Aggr < 0$, aggressive bidders have $Aggr > 1$, and the rest are neutral bidders. $Info$ is the average value of $\frac{P_{ij}}{P_j(mid)} BHAR_j(3m)$, and $Info'$ is the sum of $\frac{S_{ij}}{\sum S_{ij}} BHAR_j(3m)$, where $S_{ij} \in \{1, 2, 3, 4\}$ is the quartile (1: bottom, 4: top) in which P_{ij} falls when bids are sorted from the highest to the lowest, and $BHAR_j(3m)$ is the buy-and-hold abnormal return during the first three months of listing. $Info$ and $Info'$ are not calculated for occasional bidders. For an institution that bids in n IPO auctions, $Info_{\%}$ is the percentage of 10,000 random values of $Info$ generated for $Freq = n$ that are below the institution's actual value of $Info$. $Info'_{\%}$ is defined the same way but is based on $Info'$. Well-informed (less-informed) bidders (fail to) satisfy $Info_{\%} > 90$ & $Info'_{\%} > 90$. In Panels A to D, figures reported under the columns titled $Freq$, $Aggr$, $Aggr'$, $Info_{\%}$, and $Info'_{\%}$ are medians; the column titled "Count" gives the number of institutions; and the figures reported under the remaining columns are the number of institutions in the group that is specified by the column as a percentage of the total number of institutions reported under "Count." In Panel E, pairwise correlations are reported. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

		Bidding frequency				Bidding aggressiveness					Bidding informativeness				
	Count	$Freq$	Occasi.	Select.	Regular	$Aggr$	$Aggr'$	Conser.	Neutral	Aggres.	$Info_{\%}$	$Info'_{\%}$	Unclas.	Less in.	Well in.
Panel A: All bidders as a single group															
All bidders	353	8.00	53.82	36.83	9.35	−0.18	0.90	58.36	30.03	11.61	72.15	74.33	53.82	33.43	12.75
Panel B: Breakdown by bidding frequency															
Occasional	190	2.00	100.00	0.00	0.00	−0.09	0.91	52.63	26.84	20.53	-	-	100.00	-	-
Selective	130	34.00	0.00	100.00	0.00	−0.10	0.92	56.92	41.54	1.54	78.53	78.77	-	66.92	33.08
Regular	33	140.00	0.00	0.00	100.00	−0.50	0.86	96.97	3.03	0.00	57.54	69.15	-	93.94	6.06
Panel C: Breakdown by bidding aggressiveness															
Conservative	206	12.00	48.54	35.92	15.53	−0.60	0.85	100.00	0.00	0.00	68.75	75.34	48.54	37.86	13.59
Neutral	106	11.00	48.11	50.94	0.94	0.46	0.99	0.00	100.00	0.00	81.26	72.54	48.11	35.85	16.04
Aggressive	41	2.00	95.12	4.88	0.00	1.47	1.15	0.00	0.00	100.00	29.09	21.92	95.12	4.88	0.00
Panel D: Breakdown by bidding informativeness															
Unclassified	190	2.00	100.00	-	-	−0.09	0.91	52.63	26.84	20.53	-	-	100.00	-	-
Less informed	118	47.00	-	73.73	26.27	−0.27	0.89	66.10	32.20	1.69	52.88	55.39	-	100.00	0.00
Well informed	45	36.00	-	95.56	4.44	−0.11	0.90	62.22	37.78	0.00	98.38	98.13	-	0.00	100.00
Panel E: Pairwise correlations															
$Freq$		1.00													
$Aggr$		−0.08				1.00									
$Aggr'$		−0.10*				0.94***	1.00								
$Info_{\%}$		−0.06				−0.02	−0.04				1.00				
$Info'_{\%}$		0.08				−0.15*	−0.17**				0.94***	1.00			

Table 3: Bidder type

The sample includes 353 institutions bidding in at least one of the 214 IPOs listed on ChiNext between December 2010 and October 2012. There are seven types of bidders: fund management firms (Fund), securities firms (Secu.), investment trusts (Trust), recommended investors (Reco.), finance firms (Fina.), insurance firms (Insu.), and qualified foreign institutional investors (QFII). "Count" is the number of institutions. "Bids (disaggregate)" is the total number of bids placed across all IPOs. "Bids (aggregate)" is similar to Bids (disaggregate) except that multiple bids submitted by the same institution in an IPO is counted as a single bid. "Bids per IPO" is the mean value of the average number of bids placed by an institution in an IPO. $Freq$ is the number of IPO auctions in which an institution enters bidding. Occasional bidders have $Freq < 11$, regular bidders have $Freq \geq 107$, and the rest are selective bidders. $Aggr$ is the average value of P_{ij} normalized by the initial price range of IPO j, and $Aggr'$ is the average value of P_{ij} divided by $P_j(mid)$, where P_{ij} is institution i's quantity-weighted average bid in IPO j and $P_j(mid)$ is the midpoint of the initial price range in IPO j. Conservative bidders have $Aggr < 0$, aggressive bidders have $Aggr > 1$, and the rest are neutral bidders. $Info$ is the average value of $\frac{P_{ij}}{P_j(mid)} BHAR_j(3m)$, and $Info'$ is the sum of $\frac{S_{ij}}{\sum S_{ij}} BHAR_j(3m)$, where $S_{ij} \in \{1, 2, 3, 4\}$ is the quartile (1: bottom, 4: top) in which P_{ij} falls when bids are sorted from the highest to the lowest, and $BHAR_j(3m)$ is the buy-and-hold abnormal return during the first three months of listing. $Info$ and $Info'$ are not calculated for occasional bidders. For an institution that bids in n IPO auctions, $Info_{\%}$ is the percentage of 10,000 random values of $Info$ generated for $Freq = n$ that are below the institution's actual value of $Info$. $Info'_{\%}$ is defined the same way but is based on $Info'$. Well-informed (less-informed) bidders (fail to) satisfy $Info_{\%} > 90$ & $Info'_{\%} > 90$. In Panels B to D, medians are reported for $Freq$, $Aggr$, $Aggr'$, $Info_{\%}$, and $Info'_{\%}$ and the figures in the remaining rows are the number of institutions that fall into a group as a percentage of the total number of institutions shown in the row named "Count" in Panel A.

	Fund	Secu.	Trust	Reco.	Fina.	Insu.	QFII	All
Panel A								
Count	61	78	25	158	24	2	5	353
Bids (disaggregate)	10,251	5,486	1,506	1,021	822	41	24	19,151
Bids (aggregate)	3,846	4,185	732	928	718	40	23	10,472
Bids per IPO	2.67	1.31	2.06	1.10	1.14	1.03	1.04	1.83
Panel B: Bidding frequency								
$Freq$	42.00	38.00	12.00	2.00	12.50	20.00	2.00	8.00
Occasional	16.39	16.67	48.00	87.97	45.83	50.00	80.00	53.82
Selective	59.02	67.95	44.00	10.76	45.83	50.00	20.00	36.83
Regular	24.59	15.38	8.00	1.27	8.33	0.00	0.00	9.35
Panel C: Bidding aggressiveness								
$Aggr$	−0.22	−0.25	−0.17	−0.22	−0.01	0.67	0.80	−0.18
$Aggr'$	0.90	0.90	0.94	0.88	0.92	1.02	1.02	0.90
Conservative	70.49	64.10	52.00	55.70	50.00	0.00	0.00	58.36
Neutral	27.87	30.77	32.00	27.22	37.50	50.00	80.00	30.03
Aggressive	1.64	5.13	16.00	17.09	12.50	50.00	20.00	11.61
Panel D: Bidding informativeness								
$Info_{\%}$	89.35	73.56	60.47	37.07	54.83	16.03	25.54	72.15
$Info'_{\%}$	90.78	72.54	38.92	27.15	36.71	9.44	20.46	74.33
Unclassified	16.39	16.67	48.00	87.97	45.83	50.00	80.00	53.82
Less informed	44.26	61.54	52.00	12.03	37.50	50.00	20.00	33.43
Well informed	39.34	21.79	0.00	0.00	16.67	0.00	0.00	12.75

Table 4: Average price and offer price

The sample includes 214 IPOs listed on ChiNext between December 2010 and October 2012. All models are estimated using OLS. The dependent variable is $P(average)$ in models (1)-(4), $P(offer)$ in models (5)-(7), and the percentage change from $P(average)$ to $P(offer)$ in models (8)-(10). $P(average)$ is the quantity-weighted average price based on all bids submitted during the preliminary inquiry. $P(offer)$ is the offer price. Both $P(average)$ and $P(offer)$ are normalized by the initial price range. $Coverage$ is the number of times the issue is covered at the lowest limit price. $Allocation$ indicates the allocation rate, which is the number of shares offered divided by the number of shares subscribed for. N is the number of institutional investors who enter bidding. N_i is the number of well-informed bidders who enter bidding, and $N_o = N - N_i$. $Sales$ and $Proceeds$ are sales at the time of the IPO and gross proceeds (both in millions of yuan), respectively. Age is the difference between the years of listing and foundation. VC is a dummy variable equal to one for VC-backed IPOs. $Market$ is the 30-day return of the China A index on the day of pricing. $Elasticity$ is the elasticity of demand measured from $P(average)$ to a price one percent higher. $Range$ is the width of the initial price range relative to its midpoint. Models (7) and (10) include industry fixed effects. Robust standard errors are reported in parentheses. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\ln(1+Coverage)$	1.13***			−0.05						
	(0.15)			(0.17)						
$\ln(Allocation)$		−0.84***		−0.05						
		(0.11)		(0.16)						
$\ln(1+N)$			3.13***	3.11***						
			(0.24)	(0.30)						
$P(average)$					0.95***	0.94***	0.98***			
					(0.02)	(0.02)	(0.02)			
N_i/N_o						2.80***	2.24***		52.73***	40.59***
						(0.72)	(0.65)		(14.21)	(11.69)
$(N_i/N_o)^2$						−5.23***	−3.95***		−97.51***	−76.95***
						(1.49)	(1.26)		(30.30)	(23.65)
$\ln(Sales)$							0.03			1.41
							(0.06)			(1.02)
$\ln(1+Age)$							0.06			1.14
							(0.07)			(1.15)
VC							−0.02			−0.07
							(0.06)			(0.98)
$\ln(Proceeds)$							−0.13*			−3.19***
							(0.06)			(0.98)
$Market$							0.01**			0.22**
							(0.01)			(0.10)
$Elasticity$							−0.01			−0.10
							(0.00)			(0.07)
$Range$							−1.73***			2.41
							(0.61)			(10.24)
Constant	−4.74***	−2.90***	−12.66***	−12.54***	0.32***	0.03	0.72*	6.20***	0.69	8.40
	(0.60)	(0.32)	(0.94)	(1.01)	(0.03)	(0.07)	(0.43)	(0.49)	(1.41)	(6.81)
Observations	214	214	214	214	214	214	211	214	214	211
R-squared	0.20	0.21	0.50	0.50	0.93	0.93	0.94	0.00	0.06	0.24

Table 5: Share allocations

The sample includes 353 institutions and 214 IPOs listed on ChiNext between December 2010 and October 2012. IPOs are split into quartiles in terms of their 3-month buy-and-hold abnormal return $BHAR(3m)$, and the top quartile contains the IPOs with the highest returns. Institutions are split into three groups in terms of bidding frequency: occasional bidders (participation in less than 5% of the sample IPO auctions), selective bidders (5% to less than 50%), and regular bidders (50% or more). Selective bidders and regular bidders are divided into two groups in terms of bidding informativeness: Well-informed bidders satisfy the condition $Info_{\%} > 90$ & $Info'_{\%} > 90$, whereas less-informed bidders do not ($Info_{\%}$ and $Info'_{\%}$ are measures of bidding informativeness). Occasional bidders are unclassified with respect to their bidding informativeness. For each IPO, the quantity of shares demanded by (or allocated to) a bidder group is calculated as a percentage of the total number of shares demanded (allocated). The table reports averages of these percentages across all IPOs in Panel A and IPOs in a particular quartile of $BHAR(3m)$ in Panels B to E. The figures under the column titled "Preliminary inquiry" are based on all bids, whereas those under the column titled "Subscription offering" are based on bids that are eligible for the subscription offering (i.e., bids at or above the offer price). The last column reports p-values of Wilcoxon signed-rank tests of differences between the stages of preliminary inquiry and subscription offering.

Bidding informativeness	Bidding frequency	Preliminary inquiry	Subscription offering	Share allocation	p-value
Panel A: All IPOs					
Unclassified	Occasional	2.02	2.31	2.65	0.6736
Less informed	Selective	22.93	22.58	21.87	0.1188
	Regular	62.66	59.97	60.16	0.0550
Well informed	Selective or Regular	12.39	15.14	15.32	0.0001
Panel B: IPOs in the bottom quartile of $BHAR(3m)$					
Unclassified	Occasional	2.42	3.11	3.07	0.6285
Less informed	Selective	26.42	25.41	25.92	0.3242
	Regular	63.45	61.39	61.81	0.5846
Well informed	Selective or Regular	7.72	10.10	9.20	0.1806
Panel C: IPOs in the second quartile of $BHAR(3m)$					
Unclassified	Occasional	1.96	2.25	2.50	0.4167
Less informed	Selective	23.13	22.20	21.89	0.2071
	Regular	63.19	60.87	61.12	0.7266
Well informed	Selective or Regular	11.73	14.68	14.50	0.0367
Panel D: IPOs in the third quartile of $BHAR(3m)$					
Unclassified	Occasional	1.92	1.91	3.03	0.5152
Less informed	Selective	23.35	24.73	22.72	0.8329
	Regular	60.99	57.81	58.17	0.1618
Well informed	Selective or Regular	13.74	15.54	16.07	0.0890
Panel E: IPOs in the top quartile of $BHAR(3m)$					
Unclassified	Occasional	1.77	1.96	2.00	0.8428
Less informed	Selective	18.76	17.89	16.84	0.1579
	Regular	63.03	59.83	59.56	0.0952
Well informed	Selective or Regular	16.45	20.32	21.61	0.0137

Table 6: Investment performance of institutional investors

The sample includes 353 institutions and 214 IPOs listed on ChiNext between December 2010 and October 2012. Institutions are split into three groups in terms of bidding frequency: occasional bidders (participation in less than 5% of the sample IPO auctions), selective bidders (5% to less than 50%), and regular bidders (50% or more). Selective bidders and regular bidders are divided into two groups in terms of bidding informativeness: Well-informed bidders satisfy the condition $Info_{\%} > 90$ & $Info'_{\%} > 90$, whereas less-informed bidders do not ($Info_{\%}$ and $Info'_{\%}$ are measures of bidding informativeness). Occasional bidders are unclassified with respect to their bidding informativeness. $BHAR(3m)$ is the difference between the buy-and-hold returns of the IPO firm and a matching firm during the first three months of listing. The matching firm is seasoned for at least five years, is in the same decile of the market value of equity as the IPO firm, and has the closest book-to-market ratio to the IPO firm. $BHAR(1y)$, $BHAR(2y)$, and $BHAR(3y)$ are defined the same as $BHAR(3m)$ except that they are measured over a holding period of one, two, and three years, respectively. For each institution, we calculate both a simple average return and a yuan-weighted average return of IPOs in which the institution receives shares. For the latter, the return of an IPO is weighted by the amount the institution invests in that IPO (i.e., the offer price times the number of shares received) divided by the total amount the institution invests in all IPOs. In Panel A, institutions who never get a share allocation are excluded. In Panel B, they are included with an average performance of zero. In both panels, averages of the simple average return and yuan-weighted average return across institutions are reported. t-tests are conducted between pairs of four groups of bidders (occasional bidders, less-informed selective bidders, less-informed regular bidders, and well-informed bidders) to examine differences in averages. Superscripts 1, 2, and 3 denote that the average return of a group is higher than the average return of one, two, and three of the remaining groups at the 10% level, respectively.

Bidding informativeness	Bidding frequency	Count	Simple average				Yuan-weighted average			
			$BHAR(3m)$	$BHAR(1y)$	$BHAR(2y)$	$BHAR(3y)$	$BHAR(3m)$	$BHAR(1y)$	$BHAR(2y)$	$BHAR(3y)$
Panel A: Institutions with a share allocation in at least one IPO										
All	All	163	10.81	20.43	46.43	92.55	8.71	18.42	44.91	90.76
Unclassified	Occasional	24	10.87	18.25	42.77	75.38	10.77^{1}	18.14	42.65	74.95
Less informed	Selective	71	4.12	13.65	33.09	76.62	1.61	10.76	30.87	75.88
	Regular	31	9.80^{1}	21.05^{1}	47.59^{1}	102.79^{1}	6.39^{1}	17.75^{1}	45.03^{1}	96.48^{1}
Well informed	Selective or Regular	37	24.44^{3}	34.35^{3}	73.43^{2}	125.65^{2}	22.95^{3}	33.88^{3}	73.24^{2}	124.78^{2}
Panel B: All institutions										
All	All	353	4.99	9.43	21.44	42.73	4.02	8.51	20.74	41.91
Unclassified	Occasional	190	1.37	2.31	5.40	9.52	1.36	2.29	5.39	9.47
Less informed	Selective	87	3.36	11.14^{1}	27.01^{1}	62.53^{1}	1.31	8.78^{1}	25.19^{1}	61.93^{1}
	Regular	31	9.80^{2}	21.05^{2}	47.59^{2}	102.79^{2}	6.39^{2}	17.75^{2}	45.03^{2}	96.48^{2}
Well informed	Selective or Regular	45	20.09^{3}	28.25^{2}	60.38^{2}	103.31^{2}	18.87^{3}	27.86^{3}	60.22^{2}	102.60^{2}

Table 7: The relation between investment performance and bidding behavior

The sample includes 163 institutions bidding in at least 5% of the 214 IPOs listed on ChiNext between December 2010 and October 2012. All models are estimated using OLS. The dependent variable is an institution's average investment performance. Specifically, for each institution, we calculate both a simple average return and a yuan-weighted average return of IPOs in which the institution receives shares. For the latter, the return of an IPO is weighted by the amount the institution invests in that IPO (i.e., the offer price times the number of shares received) divided by the total amount the institution invests in all IPOs. In Panel A, institutions who never get a share allocation are excluded. In Panel B, they are included with an average performance of zero. $BHAR(3m)$ is the difference between the buy-and-hold returns of the IPO firm and a matching firm during the first three months of listing. The matching firm is seasoned for at least five years, is in the same decile of the market value of equity as the IPO firm, and has the closest book-to-market ratio to the IPO firm. $BHAR(1y)$, $BHAR(2y)$, and $BHAR(3y)$ are defined the same as $BHAR(3m)$ except that they are measured over a holding period of one, two, and three years, respectively. $Freq$ is the number of IPO auctions in which an institution enters bidding. $Aggr$ is the average value of P_{ij} normalized by the initial price range of IPO j, where P_{ij} is institution i's quantity-weighted average bid in IPO j. $Info$ is the average value of $\frac{P_{ij}}{P_j(mid)} BHAR_j(3m)$, where $P_j(mid)$ is the midpoint of the initial price range in IPO j. For an institution that bids in n IPO auctions, $Info_{\%}$ is the percentage of 10,000 random values of $Info$ generated for $Freq = n$ that are below the institution's actual value of $Info$. $Fund$, $Securities$, $Trust$, $Finance$, $Insurance$, and $QFII$ are dummy variables that control for the bidder type. Robust standard errors are reported in parentheses. ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively.

	Simple average				Yuan-weighted average			
	$BHAR(3m)$	$BHAR(1y)$	$BHAR(2y)$	$BHAR(3y)$	$BHAR(3m)$	$BHAR(1y)$	$BHAR(2y)$	$BHAR(3y)$
Panel A: Institutions with a share allocation in at least one IPO								
$Freq$	−0.04	0.01	0.02	0.17	−0.06	−0.00	−0.01	0.11
	(0.05)	(0.06)	(0.09)	(0.18)	(0.05)	(0.05)	(0.10)	(0.18)
$Aggr$	−13.10**	−12.34**	−20.05*	−20.30	−11.48**	−10.05*	−18.65	−20.62
	(5.60)	(5.55)	(11.63)	(17.64)	(5.46)	(5.56)	(11.79)	(18.10)
$Info_{\%}$	0.33***	0.45***	0.65***	0.95***	0.33***	0.46***	0.63***	0.96***
	(0.06)	(0.09)	(0.15)	(0.28)	(0.06)	(0.09)	(0.16)	(0.29)
$Fund$	−0.46	−12.77	−16.41	−41.16	−4.17	−19.65	−23.32	−50.08
	(7.26)	(15.49)	(26.64)	(47.32)	(6.99)	(16.94)	(28.27)	(50.85)
$Securities$	2.26	−12.66	−30.45	−52.09	−0.70	−18.81	−36.09	−57.90
	(8.23)	(14.90)	(25.90)	(45.52)	(7.88)	(16.19)	(27.35)	(48.96)
$Trust$	5.88	0.89	−14.54	−38.65	0.66	−9.12	−25.61	−48.94
	(9.41)	(14.62)	(24.64)	(43.02)	(8.51)	(15.04)	(25.65)	(46.25)
$Finance$	−8.42	−24.76	−38.37	−63.26	−9.58	−27.94	−43.00	−66.98
	(8.21)	(16.35)	(25.95)	(41.97)	(7.75)	(17.50)	(27.36)	(45.13)
$Insurance$	−57.49***	−44.08***	−65.72***	−114.19***	−61.40***	−49.78***	−72.61***	−119.93***
	(8.33)	(12.62)	(22.99)	(39.10)	(7.98)	(13.53)	(24.27)	(41.73)
Constant	−9.35	2.03	24.52	64.99	−7.33	5.41	31.55	73.07*
	(8.47)	(12.86)	(23.16)	(40.14)	(8.14)	(13.64)	(24.41)	(42.34)
Observations	139	139	139	139	139	139	139	139
R-squared	0.26	0.25	0.21	0.13	0.26	0.24	0.19	0.12

Table 7 - continued.

	Simple average				Yuan-weighted average			
	$BHAR(3m)$	$BHAR(1y)$	$BHAR(2y)$	$BHAR(3y)$	$BHAR(3m)$	$BHAR(1y)$	$BHAR(2y)$	$BHAR(3y)$
Panel B: All institutions								
$Freq$	0.00	0.07	0.15**	0.41***	−0.02	0.06	0.13*	0.36**
	(0.04)	(0.04)	(0.07)	(0.15)	(0.04)	(0.04)	(0.08)	(0.15)
$Aggr$	−7.74*	−6.80	−10.04	−5.84	−6.82*	−5.45	−9.15	−6.08
	(4.07)	(4.35)	(8.60)	(13.31)	(3.90)	(4.23)	(8.67)	(13.62)
$Info_{\%}$	0.30***	0.39***	0.57***	0.83***	0.29***	0.41***	0.56***	0.84***
	(0.06)	(0.08)	(0.15)	(0.27)	(0.05)	(0.09)	(0.15)	(0.28)
$Fund$	−2.03	−9.60	−7.45	−20.19	−4.69	−14.46	−12.03	−26.49
	(5.69)	(12.07)	(21.21)	(38.17)	(5.58)	(13.17)	(22.52)	(40.73)
$Securities$	−0.12	−9.98	−21.41	−32.08	−1.95	−13.98	−24.71	−35.46
	(5.79)	(10.95)	(19.10)	(34.31)	(5.61)	(11.93)	(20.27)	(36.86)
$Trust$	3.47	1.97	−7.43	−21.43	−0.39	−5.43	−15.45	−28.68
	(6.99)	(11.10)	(18.24)	(32.60)	(6.17)	(10.88)	(18.72)	(34.67)
$Finance$	−11.39*	−23.19*	−32.54	−48.89	−11.72**	−24.86*	−34.95	−50.66
	(5.77)	(12.58)	(20.04)	(32.66)	(5.53)	(13.51)	(21.14)	(34.95)
$Insurance$	−60.46***	−41.72***	−55.64***	−88.82***	−63.42***	−45.65***	−60.00***	−91.86***
	(5.69)	(8.38)	(15.53)	(27.13)	(5.45)	(8.91)	(16.41)	(28.84)
$QFII$	8.88	−0.94	−14.64	−49.05*	6.83	−4.62	−19.53	−53.61*
	(6.78)	(8.96)	(16.97)	(28.45)	(6.50)	(9.40)	(17.78)	(30.14)
Constant	−9.04	−3.40	8.01	28.87	−7.53	−1.17	12.69	34.07
	(5.83)	(8.24)	(15.50)	(27.23)	(5.62)	(8.66)	(16.31)	(28.57)
Observations	163	163	163	163	163	163	163	163
R-squared	0.22	0.21	0.17	0.12	0.21	0.19	0.15	0.11

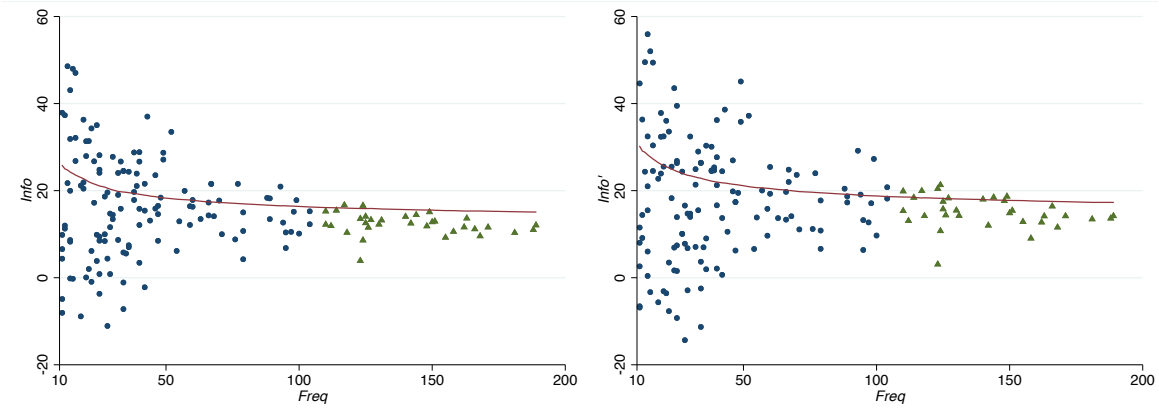
Table A1: Robustness tests for the relation between investment performance and bidding behavior

The sample includes 163 institutions bidding in at least 5% of the 214 IPOs listed on ChiNext between December 2010 and October 2012. All models are estimated using OLS. The dependent variable is an institution's average investment performance. Specifically, for each institution, we calculate both a simple average return and a yuan-weighted average return of IPOs in which the institution receives shares. For the latter, the return of an IPO is weighted by the amount the institution invests in that IPO (i.e., the offer price times the number of shares received) divided by the total amount the institution invests in all IPOs. In Panel A, institutions who never get a share allocation are excluded. In Panel B, they are included with an average performance of zero. $BHAR(3m)$ is the difference between the buy-and-hold returns of the IPO firm and a matching firm during the first three months of listing. The matching firm is seasoned for at least five years, is in the same decile of the market value of equity as the IPO firm, and has the closest book-to-market ratio to the IPO firm. $BHAR(1y)$, $BHAR(2y)$, and $BHAR(3y)$ are defined the same as $BHAR(3m)$ except that they are measured over a holding period of one, two, and three years, respectively. $Freq$ is the number of IPO auctions in which an institution enters bidding. $Aggr$ is the average value of P_{ij} normalized by the initial price range of IPO j, and $Aggr'$ is the average value of P_{ij} divided by $P_j(mid)$, where P_{ij} is institution i's quantity-weighted average bid in IPO j and $P_j(mid)$ is the midpoint of the initial price range in IPO j. $Info$ is the average value of $\frac{P_{ij}}{P_j(mid)} BHAR_j(3m)$, and $Info'$ is the sum of $\frac{S_{ij}}{\sum S_{ij}} BHAR_j(3m)$, where $S_{ij} \in \{1,2,3,4\}$ is the quartile (1: bottom, 4: top) in which P_{ij} falls when bids are sorted from the highest to the lowest. For an institution that bids in n IPO auctions, $Info_{\%}$ is the percentage of 10,000 random values of $Info$ generated for $Freq = n$ that are below the institution's actual value of $Info$. $Info'_{\%}$ is defined the same way but is based on $Info'$. All models include fixed effects for the bidder type. Robust standard errors are reported in parentheses. ***, **, and * denote significance at 1%, 5%, and 10% levels respectively.

		Simple average				Yuan-weighted average			
		$BHAR(3m)$	$BHAR(1y)$	$BHAR(2y)$	$BHAR(3y)$	$BHAR(3m)$	$BHAR(1y)$	$BHAR(2y)$	$BHAR(3y)$
Panel A: Institutions with a share allocation in at least one IPO									
Alternative specification with $Info'_{\%}$.	$Freq$	−0.07	−0.03	−0.05	0.08	−0.09*	−0.04	−0.07	0.02
		(0.05)	(0.06)	(0.10)	(0.18)	(0.05)	(0.05)	(0.10)	(0.18)
	$Aggr$	−11.45**	−10.14*	−17.43	−16.52	−9.89*	−7.81	−16.26	−17.12
		(5.64)	(5.54)	(11.54)	(17.54)	(5.49)	(5.56)	(11.68)	(17.94)
	$Info'_{\%}$	0.28***	0.38***	0.50***	0.73***	0.27***	0.39***	0.47***	0.71***
		(0.06)	(0.08)	(0.14)	(0.27)	(0.06)	(0.08)	(0.14)	(0.27)
	Constant	−6.94	5.31	31.41	75.17*	−4.79	8.97	38.79	84.40*
		(8.82)	(13.89)	(24.55)	(42.21)	(8.55)	(14.82)	(25.88)	(44.65)
	Observations	139	139	139	139	139	139	139	139
	R-squared	0.24	0.22	0.17	0.10	0.23	0.20	0.15	0.09
Alternative specification with $Aggr'$.	$Freq$	−0.05	0.00	0.02	0.18	−0.07	−0.00	−0.00	0.13
		(0.05)	(0.05)	(0.09)	(0.18)	(0.05)	(0.05)	(0.09)	(0.18)
	$Aggr'$	−113.73***	−98.71**	−146.75*	−130.90	−99.28**	−77.08*	−133.80	−128.91
		(42.42)	(40.46)	(82.55)	(135.31)	(41.52)	(40.54)	(83.95)	(138.17)
	$Info_{\%}$	0.33***	0.44***	0.65***	0.95***	0.32***	0.46***	0.63***	0.96***
		(0.06)	(0.09)	(0.15)	(0.28)	(0.06)	(0.09)	(0.16)	(0.29)
	Constant	96.05**	93.73**	161.24**	187.51	84.70**	77.11*	156.29*	193.87
		(39.60)	(41.83)	(81.50)	(139.87)	(38.82)	(42.45)	(83.18)	(143.17)
	Observations	139	139	139	139	139	139	139	139
	R-squared	0.28	0.26	0.21	0.12	0.26	0.24	0.19	0.12
Alternative specification with $Info'_{\%}$ and $Aggr'$.	$Freq$	−0.08	−0.04	−0.04	0.09	−0.10*	−0.04	−0.06	0.03
		(0.05)	(0.06)	(0.09)	(0.18)	(0.05)	(0.05)	(0.10)	(0.18)
	$Aggr'$	−101.24**	−81.55**	−126.43	−100.87	−87.25**	−59.44	−115.25	−101.16
		(42.81)	(40.59)	(81.90)	(135.15)	(41.80)	(40.71)	(83.16)	(137.28)
	$Info'_{\%}$	0.27***	0.37***	0.50***	0.73***	0.27***	0.38***	0.47***	0.71***
		(0.06)	(0.08)	(0.14)	(0.27)	(0.06)	(0.08)	(0.14)	(0.27)
	Constant	86.99**	81.13*	149.21*	169.57	76.17*	64.30	146.23*	179.15
		(41.00)	(42.86)	(82.13)	(141.26)	(40.03)	(43.45)	(83.56)	(143.76)
	Observations	139	139	139	139	139	139	139	139
	R-squared	0.25	0.22	0.17	0.10	0.23	0.20	0.15	0.09

Table A1 - continued.

		Simple average				Yuan-weighted average			
		$BHAR(3m)$	$BHAR(1y)$	$BHAR(2y)$	$BHAR(3y)$	$BHAR(3m)$	$BHAR(1y)$	$BHAR(2y)$	$BHAR(3y)$
Panel B: All institutions									
Alternative specification with $Info'_{\%}$.	$Freq$	−0.02	0.04	0.10	0.33**	−0.04	0.02	0.07	0.27*
		(0.04)	(0.04)	(0.08)	(0.15)	(0.04)	(0.04)	(0.08)	(0.15)
	$Aggr$	−6.53	−5.20	−8.05	−2.94	−5.66	−3.83	−7.29	−3.31
		(4.01)	(4.23)	(8.43)	(13.12)	(3.85)	(4.12)	(8.50)	(13.41)
	$Info'_{\%}$	0.25***	0.34***	0.45***	0.66***	0.25***	0.35***	0.43***	0.65**
		(0.06)	(0.08)	(0.13)	(0.25)	(0.05)	(0.08)	(0.14)	(0.26)
	Constant	−6.94	−0.53	13.64	37.11	−5.33	1.94	18.53	43.14
		(5.89)	(8.75)	(16.20)	(28.42)	(5.70)	(9.27)	(17.07)	(29.96)
	Observations	163	163	163	163	163	163	163	163
	R-squared	0.20	0.19	0.15	0.10	0.19	0.17	0.12	0.09
Alternative specification with $Aggr'$.	$Freq$	−0.00	0.07	0.15**	0.42***	−0.02	0.05	0.13*	0.36**
		(0.04)	(0.04)	(0.07)	(0.14)	(0.04)	(0.04)	(0.08)	(0.14)
	$Aggr'$	−68.44**	−54.34	−71.88	−27.83	−60.07**	−41.22	−63.75	−26.98
		(31.54)	(33.11)	(63.17)	(104.14)	(30.14)	(31.73)	(63.60)	(105.75)
	$Info_{\%}$	0.29***	0.39***	0.57***	0.83***	0.29***	0.40***	0.55***	0.84***
		(0.05)	(0.08)	(0.15)	(0.27)	(0.05)	(0.09)	(0.15)	(0.28)
	Constant	54.42*	47.14	75.13	55.33	48.18*	37.25	72.28	59.82
		(29.01)	(32.44)	(61.32)	(104.06)	(27.81)	(31.70)	(61.99)	(106.01)
	Observations	163	163	163	163	163	163	163	163
	R-squared	0.23	0.21	0.17	0.12	0.22	0.19	0.15	0.11
Alternative specification with $Info'_{\%}$ and $Aggr'$.	$Freq$	−0.03	0.03	0.10	0.34**	−0.05	0.02	0.08	0.28*
		(0.04)	(0.04)	(0.08)	(0.15)	(0.04)	(0.04)	(0.08)	(0.15)
	$Aggr'$	−59.25*	−41.94	−56.66	−5.31	−51.25*	−28.61	−49.57	−5.68
		(31.03)	(32.17)	(61.80)	(102.81)	(29.64)	(30.89)	(62.26)	(104.09)
	$Info'_{\%}$	0.25***	0.34***	0.45***	0.66***	0.24***	0.34***	0.43***	0.65**
		(0.06)	(0.08)	(0.13)	(0.25)	(0.05)	(0.08)	(0.14)	(0.26)
	Constant	48.04	38.50	66.54	42.47	42.23	28.61	64.87	48.91
		(29.16)	(32.10)	(60.71)	(103.96)	(27.92)	(31.41)	(61.35)	(105.56)
	Observations	163	163	163	163	163	163	163	163
	R-squared	0.21	0.19	0.14	0.10	0.19	0.17	0.12	0.09



(a) *Info* (b) *Info′*

Figure 1: Bidding informativeness (*Info* and *Info′*) against bidding frequency (*Freq*)

Each data point represents an institutional investor, with triangles showing regular bidders who bid in at least half of the IPO auctions and circles showing selective bidders who bid in at least 5% but less than half of the IPO auctions. The solid curves in Panels (a) and (b) are the top 10% thresholds based on 10,000 random values of *Info* and *Info′* generated for each level of *Freq*, respectively.

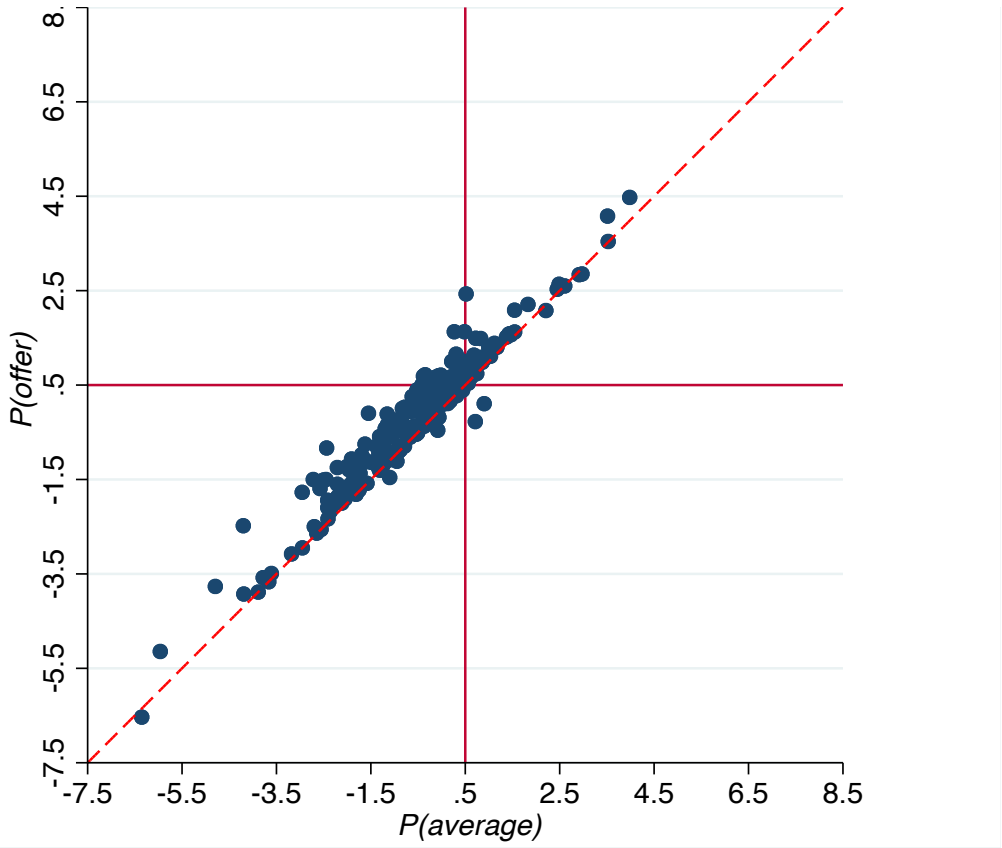


Figure 2: The offer price ($P(offer)$) against the average price based on all bids submitted during the preliminary inquiry ($P(average)$)

Each data point represents an IPO auction. The solid horizontal (vertical) line indicates the case when $P(offer)$ ($P(average)$) is equal to the midpoint of the initial price range. The dashed 45-degree line shows the case when $P(offer) = P(average)$.