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## Information spillover in Chinese hybrid IPO auctions

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## ABSTRACT

We examine the impact of information spillovers from contemporaneous hybrid IPO auction results on investor participation, price discovery, and event return of current IPOs. We find that the information produced by contemporaneous investors with different levels of sophistication affects the participation of institutional and retail investors in different ways. The implication is that the informativeness of contemporaneous bidding results varies based on investor sophistication. Although we find that information spillover from contemporaneous institutional investors has a positive impact on the price revision of current IPOs, the information spillover from contemporaneous retail investors has little influence on the current IPO price revision. Information spillover extends from the auction phase to IPO event and post-IPO returns. Heterogeneity analysis shows that information asymmetry, difficult-to-value companies, market volatility, and political uncertainty impact information production by institutional investors.

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## 1. Introduction

In the context of an IPO market that is dominated by a book-building mechanism, using the pricing results of contemporaneous IPOs as measures for information spillovers, extant empirical research shows evidence of contemporaries' information spillovers affecting the price-discovery process of current IPOs (e.g., [Ljungqvist and Wilhelm, 2002](#); [Benveniste et al., 2003](#); [Edelen and Kadlec, 2005](#); [Zhang, 2012](#); [Ince, 2014](#); [Bakke et al., 2017](#)). Information production is critical in the IPO market as the companies are new to the market. For example, [Chemmanur \(1993\)](#) provides a model for IPO pricing with dynamic information production. [Benveniste et al. \(2003\)](#) provide evidence of information spillovers in the production of investment banking services. This paper uses the concepts of information production and spillover as utilised in the IPO literature. Underwriters rely heavily on institutional bidders to discern information as institutional investors are better informed ([Cai et al., 2010](#)). Considerable divergence of opinion among institutional bidders may convey a significant disagreement among institutional investors, and hence the value of the IPO firm might be difficult to establish for the underwriters. The information production mechanism by institutional investors in book-building is different from the auction method and very different from the sealed bid hybrid auction method. Hence, the findings in the context of book-building do not extend to auction or sealed bid hybrid auction. We contribute to the literature by empirically examining information production and spillovers in the context of sealed bid hybrid IPO auction mechanisms. This is the primary focus of this paper.

The most popular method of IPO pricing is book-building, where the underwriter attempts to determine the price by recording and generating investor demand. Usually, institutional and retail investors are not differentiated in the price-

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setting process. One alternative IPO pricing mechanism to book-building is a hybrid sealed bid IPO auction, where institutional investors participate in the sealed bid auction, followed by a retail tranche where the retail investors can participate at a price set in the sealed bid auction (e.g., [Schnitzlein et al., 2016](#); [Chemmanur et al., 2017](#)).<sup>1,2</sup> Such hybrid auctions are used in China. An essential feature of the sealed-bid auction is that underwriters do not have the discretion to allocate shares. Instead, IPO allocations are undertaken pro-rata to all institutions placing a bid for the current IPO above the offer price set by the underwriters in the sealed-bid auctions. A criticism of sealed bid hybrid IPO auctions is that institutional investors do not produce much information regarding the true value of the IPO firm. Rather they strategically bid to obtain the desired shares. In most countries using strict sealed-bid procedures, no one knows the bids until after the closed auction. Therefore, an intriguing feature of the Chinese sealed bid auction method is the ability of the underwriter to observe the bids as they are submitted. This may create much more information which may spill over to the current and contemporaneous IPOs. Moreover, institutional bidders in China must pay for all their bids when they place orders during the auction, which is different from the requirement in developed markets. This means that the institutional bidders are serious and committed to their bids as they put up money in the bidding phase.

[Schnitzlein et al. \(2015\)](#) offer experimental and theoretical evidence that the hybrid auction method for IPOs is more efficient with the participation of institutional and retail investors. Hybrid auction method increases money raised, reduces the variability in prices, reduces pricing error, and reduces the incentive for small bidders to free ride by submitting extremely high bids, thus facilitating information production. Also, the auction's demand is more elastic than the book-building procedure ([Degeorge, Derrien, and Womack, 2010](#)). In this paper, we empirically examine whether institutional investors produce information and whether such information spills over to the current and contemporaneous IPOs. As there are sealed bids and a public tranche, we can examine the information produced by investors with different levels of sophistication.

Furthermore, behavioural theory ([Welch, 1992](#); [Bikhchandani et al., 1998](#)) implies that the participation of sophisticated investors in an IPO's price-setting tranche will generate information externalities that are valuable to unsophisticated investors who intend to engage in the follow-up-offering tranche.<sup>3</sup> In other words, IPO selling mechanisms conducted in a hybrid manner are prone to triggering cascading demand among investors with different levels of sophistication ([Derrien and Womack, 2003](#); [Ljungqvist et al., 2003](#)). In an IPO market with a transparent selling mechanism,<sup>4</sup> [Neupane and Poshakwale \(2012\)](#) and [Khurshed et al. \(2014\)](#) identify convincing evidence that the participation of institutional investors largely influences the participation of retail investors. Nevertheless, it is an outstanding empirical question as to whether the information generated by institutional investors in the current sealed-bid auction tranche can spill over and affect the participation of retail investors in the current IPO's public tranche. Thus, another objective of this empirical study is to analyse the information-spillover effects within the sealed-bid hybrid IPO auction mechanism.

The information spillover that we examine in this paper is different from what has been studied concerning price discovery in the options and the stock market. As options are based on the underlying assets (stocks), price discovery metrics used in options markets, such as Hasbrouck's (1995) information share (IS) and Gonzalo Granger's (1995) component share (CS), represent a combination of information leadership and the relative degree of noise. However, price setting and price discovery processes are different in the IPO market. The price-setting process is based on a book-building, auction, or a sealed bid hybrid auction. What is known in the context of the options market regarding price discovery is not applicable in the IPO market. Hence, we contribute to the existing literature by examining the information spillover in the Chinese sealed bid hybrid IPO auctions.

We studied 1,144 IPOs brought to market through the hybrid auction method in China between June 2006 and October 2012 and using a unique manually collected dataset of investors' bidding (subscription) information from the announcements of the hybrid auction results. There is considerable evidence of information spillovers influencing investor participation and IPO price discovery in hybrid IPO auctions. In this study, we mainly focus on two information spillovers: (1) information spillovers from the announcements of the results of contemporaneous hybrid IPO auctions; and (2) information spillovers from the sealed-bid auction tranche of current hybrid IPO auctions. We include contemporaneous-pricing spillover and secondary-market spillover variables to control for the other spillover effects reported by previous literature.

We present several interesting and novel findings. First, we find that the information produced by institutional investors for the valuation of contemporaneous auctioned IPOs, especially that generated by large institutional investors, has a positive impact on the participation (or entry) of institutional investors in the current IPO. This information-spillover effect is stronger among IPOs subject to a common valuation factor, where we conjecture that IPO firms in the same industry are more likely to share the common factor. By contrast, we find that the information about oversubscription submitted by retail investors revealed in the announcement of contemporaneous IPO public tranches has little association with the participation of institutional investors in the current IPO.

<sup>1</sup> To the best of our knowledge, the other two markets that require issuers to use auction methods for IPOs are Vietnam and Taiwan, which are smaller than China's IPO market in terms of market capitalization. In most other countries, going public by using an auction method is an option for issuers, rather than being mandatory, but, in practice, there are few issuers willing to choose auction methods voluntarily ([Jagannathan et al., 2015](#)).

<sup>2</sup> To eliminate ambiguity in the nomenclature of China's IPO selling mechanisms, see [Section 2](#).

<sup>3</sup> The terms of sophisticated investors and informed investors are used interchangeably in this paper. Likewise, the terms of unsophisticated investors and uninformed investors are also used interchangeably in this paper.

<sup>4</sup> Where investors participating in different offering tranches can observe each other's demand.

Second, we find that the reaction of retail investors to the information disclosed in the announcements of hybrid IPO auction results is quite different from that of institutional investors. In particular, the information about oversubscription submitted by retail investors in contemporaneous IPO public tranches spills over and significantly affects the entry of retail investors into the current IPO. In contrast, the information produced by contemporaneous institutional investors has little influence on the retail participation in the current IPO unless the information spills over from contemporaneous IPOs in the same industry.

Third, we find evidence that the information produced by institutional investors for contemporaneous auctioned IPOs spills over and positively influences the price revision of the current IPO. As a further consequence, the underwriters appear to incorporate such spillover information into the offer price only because it is expressed through institutional investors' current bids.

Fourth, we find that, during a sealed-bid hybrid IPO auction procedure, the information generated by institutional investors in the current auction tranche can spill over and affect the participation of retail investors in the current IPO's public tranche. This extends the evidence reported in the previous literature (e.g., Neupane and Poshakwale, 2012; Khurshed et al., 2014) and suggests that learning from the participation of institutional investors not only takes place in a transparent IPO setting (where retail investors can observe the bidding dynamics) but also exists in a sealed-bid hybrid IPO setting.

From a mechanism-design perspective, as predicted by recent studies (e.g., Jagannathan et al., 2015; Schnitzlein et al., 2016), we find that, by adding a separate public tranche, the hybrid IPO auction mechanism can effectively eliminate retail investors' bids (or subscriptions) that influence the price-setting process. Moreover, consistent with the findings of Cornelli and Goldreich (2003) and Chemmanur et al. (2017), we find that the information about oversubscription contained in institutional investors' bids is important for determining the offer price. This partially demonstrates the role of the hybrid IPO auction (the auction tranche in particular) as an information-extraction mechanism.

Finally, these information spillovers are not only significant in the auction phase, but they are also valuable at the IPO stage and post-IPO stage. We find that our measures of information spillover are significantly related to the IPO underpricing, lockup expiration returns, buy-and-hold abnormal returns till lockup and buy-and-hold abnormal returns after one year of IPO. In addition, the information production mitigates the information asymmetry on IPO underpricing and lockup expiration returns. We further analyse the heterogeneity to shed light on the mechanisms of information extractions. Finally, the results show that information asymmetry, difficult-to-value companies, market volatility, and political uncertainty impact information production by institutional investors.

The study makes four contributions to the literature and has practical implications. First, to the best of our knowledge, this is the first study that examines information-spillover effects in the context of an auction-based IPO market, which has a different information environment than the book-building-based IPO market. Next, this paper enriches the existing evidence on the determinants of investor participation in IPO auctions. Previous research details how idiosyncratic factors and market conditions mainly drive the participation of investors in IPO auctions (e.g., Derrien, 2005; Chiang et al., 2010; Degeorge et al., 2010; Neupane et al., 2014; Jagannathan et al., 2015). The results of this study demonstrate, that information spilling over from contemporaneous hybrid IPO auction results is also an essential driver of investor participation in current IPOs.

In addition, previous research shows the relevant evidence in a transparent IPO selling environment (e.g., Neupane and Poshakwale, 2012; Khurshed et al., 2014). Our analysis highlights that the information generated by institutional investors in the current sealed-bid auction tranche is still able to spill over and affect the participation of retail investors in the current IPO's public tranche. This finding also supports the hypothesis of Chowdhry and Sherman (1996), who predicts that the presence of information leakage in a sealed-bid IPO selling mechanism enables unsophisticated investors to learn from the participation of sophisticated investors. Finally, by demonstrating the role of adding a separate public tranche in preventing unsophisticated retail investors from disrupting the price-setting process, this study contributes to a small but growing amount of literature that examines the efficiency of the hybrid IPO auction mechanism with a public tranche (Cao et al., 2016; Schnitzlein et al., 2016; Chemmanur et al., 2017). These information extractions are not only critical at the auction stage, but they extend to the IPO stage and post-IPO stage. Our heterogeneity analysis shows that information asymmetry, difficult-to-value companies, market volatility, and political uncertainty impact information production by institutional investors.

The rest of this paper is organized as follows. Section 2 describes the background of the hybrid IPO auction mechanism used in China. Section 3 reviews the related literature and develops hypotheses. Section 4 reports the data collection, sample distribution, variable definitions, and methodologies. Section 5 presents the empirical analyses and results. Section 6 presents the impact of information production on IPO event returns. Section 7 provides a heterogeneity analysis. Finally, section 8 concludes.

## 2. China's hybrid IPO auction mechanism

IPO placement methods (also known as IPO selling mechanisms) in China's primary market have experienced a series of changes since the market began to formally operate in 1990 (see Ma and Faff, 2007; Gao, 2010; Su, 2018; Jia et al., 2016). Broadly speaking, the fixed-price-offering method played a dominant role in China's IPO market before 2005, in which both investors and underwriters had little force to drive the price-discovery process. Over this long period, although the CSRC

attempted to either relax or tighten its intervention on offer-price setting (or IPO price formation) many times, the rules of pricing and allocations were consistently subject to the authoritarian voice of the CSRC. Moreover, during this period, any information about investor participation (such as their identity and orders) was not made publicly available after the IPO, except for the odds of winning the subscription.<sup>5</sup>

In 2006, the CSRC promulgated the No. 37 Decree on *Administrative Measures on Securities Issuance and Underwriting*, which signifies that a hybrid IPO auction mechanism has been formally put into practice in China's primary market (Gao et al., 2017).<sup>6</sup> At the same time, the fixed-price method is no longer applicable to any IPOs in principle, unless the CSRC allows some specific candidate firms to do so. According to Ritter (2011) and Jagannathan et al. (2015), the key distinguishing feature of the IPO book-building mechanism is that the underwriter has substantial discretion in allocating the new shares, whereas the main characteristic of the auction-like mechanism is employing fair and transparent rules (that have been determined before an IPO) to allocate the new shares. Taking this into account, since the IPO selling mechanism introduced by the CSRC does not give underwriters discretion with respect to allocation, we refer to it as a hybrid IPO auction mechanism.

Fig. 1 shows the offering procedure for China's hybrid IPO auctions, where the time frame is drawn based on the offering schedules of 1,144 hybrid IPO auctions from 2006 to 2012. The hybrid IPO placement method typically consists of an auction tranche and a public tranche. In general, the auction tranche is used to solicit direct feedback from institutional investors and to set the offer price, while the public tranche is mainly reserved for retail investors and adopts a fixed-price offering.<sup>7</sup> According to the distribution rules revealed in the CSRC's (2006) Decree No. 37, if the total issue size exceeds 400 million shares, underwriters are permitted to adjust the proportion of IPO shares sold in the auction tranche from 20 % up to 50 %, relative to the total issue size.

The starting point of the hybrid IPO selling procedure is the date when a candidate issuer files its IPO schedule with the regulator and releases its preliminary prospectus (also referred to as the filing date). Shortly afterward, the underwriter will first organize roadshows and conduct marketing campaigns aimed at institutional investors.<sup>8</sup> During the roadshow sessions, the underwriter will provide institutional investors with a specific valuation report that contains an indicative price range based on the pre-market due diligence.<sup>9</sup> At the same time, through communication in the roadshow sessions, some institutional investors will reveal their preliminary indications of interest to the underwriter (also referred to as the preliminary price-enquiry stage). If the provision of such information facilitates refining the indicative price range, then the underwriter will update the indicative price range. The entire roadshow process is typically completed within 10 days and takes place across three major cities (Beijing, Shanghai, and Shenzhen).

Next, the underwriter will organize a sealed-bid, uniform-price auction for institutional investors, where the entrants can submit their orders (or bids) via an electronic tendering system.<sup>10</sup> The types of orders submitted in the sealed-bid auction can be either a "limit bid" or a "step bid". Specifically, in a limit bid, an institutional bidder needs to specify the maximum price that he/she is willing to pay for a given number of shares.<sup>11</sup> A step bid is a combination of limit bids, in which the institutional bidder can place up to three limit bids (as a step function) to form a demand schedule. Thus, the information in the order book mainly contains the quantities demanded by institutional investors and their limit prices. Institutional bidders in China are required to pay for all their bids when they place orders during the auction, which is different from the requirement in developed markets. Only when the allocation ratio has been determined after the auction can these bidders get refunds (without interest) for their preceding overpayments (i.e. the amount paid for the portion of bidders' unsuccessful bids and unallocated bids). An auction is typically closed within four days. During the sealed-bid period, only the underwriter has permission to observe the institutional bidding process (e.g., the bid time, bidder identity, bid price, and bid quantity).

Once the auction has closed, the underwriter will build an order book based on all the institutional bids and set an offer price in consultation with the issuer. At this stage, the underwriter has discretion concerning the offer-price setting. In other words, the offer price is not necessarily set at the market-clearing price (i.e., the highest price that allows new shares to be

<sup>5</sup> To confirm that there was no essential information about investor participation that was accessible through publicly available sources under the period of the fixed-price offerings, we double-checked this in the *China Securities Journal* and on the CNINFO website, which are the authoritative sources for accessing IPO information disclosure (or release) in China.

<sup>6</sup> Gao et al. (2017, p. 92) state that, although the CSRC switched from the fixed-price method to the hybrid auction mechanism in 2005, the specific auction rules were not implemented until the issue of the CSRC's No. 37 Decree in 2006. Moreover, as Chemmanur et al. (2017, p. 14) observes, "In 2005, the CSRC introduced a hybrid IPO auction mechanism... This mechanism is in use until now and the basic design has remained unchanged since then". In practice, due to the suspension of China's IPO market in 2005, there were few IPOs in that year. Therefore, our sample period starts in 2006, and it ends in 2012 due to the subsequent long-term suspension of China's IPO market.

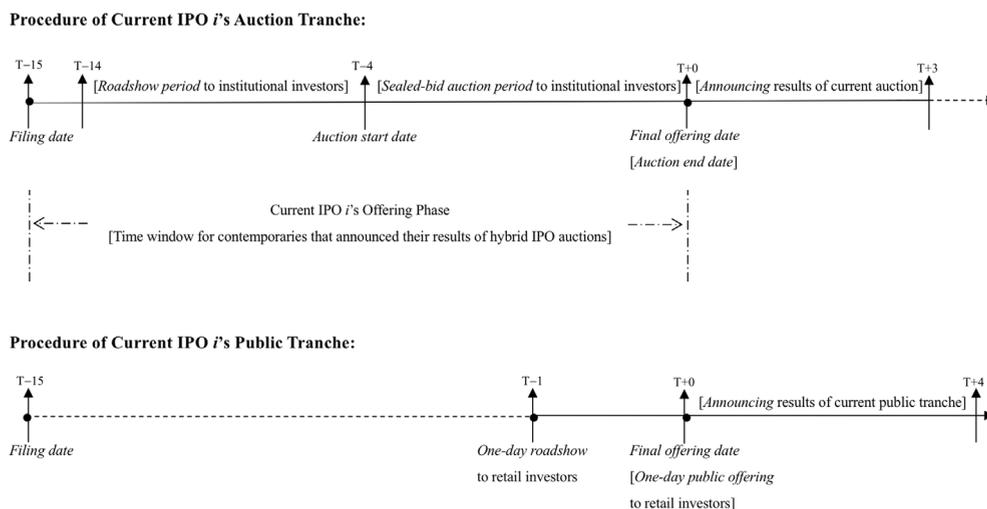
<sup>7</sup> Before 2009, if institutional investors did not engage in the current IPO's auction tranche, they were allowed to participate in the current IPO's public tranche. However, Jia et al. (2016) show that, in practice, there are few institutional investors that wish to participate in the public tranche, and more than 80% of the participants in the public tranche are retail investors.

<sup>8</sup> In this study, when we refer to institutional investors, we mean the "qualified institutional investors" that have been approved by the CSRC. In China, any institutions that want to get involved in IPO activities must be reviewed by the regulator and obtain a relevant qualification. These qualified institutional investors typically include mutual funds, securities companies, insurance companies, trust companies, etc.

<sup>9</sup> We were informed by several IPO practitioners that this specific valuation report is not allowed to be made publicly available during the institutional roadshow session. Although this report does not contain any essential disclosure beyond the IPO prospectus, the sell-side analysts from the investment bank will reveal their interpretations of the valuation of the IPO firm in detail in the report.

<sup>10</sup> Uniform-price auctions are multi-unit (sealed-bid) auctions in which all winning bidders pay the same price, while discriminatory auctions require each winning bidder to pay the price stated in his/her own bid (Jagannathan et al., 2015).

<sup>11</sup> Of note is that, according to the advice of the CSRC, the bid price submitted by institutional investors in the auction should not be able to exceed the indicative price range.



**Fig. 1.** The offering procedure of hybrid IPO auctions in China. The time frame is drawn based on the offering schedules of 1144 China's hybrid IPO auctions from 2006 to 2012. Solid lines represent the steps that take place in the relevant tranches. T + 0 represents the date of the initial public offering (IPO) or referred to as the final offering date.

sold); the underwriter is allowed to set it below the clearing price based on his/her own judgement (also known as a “dirty” IPO auction). After the price setting, the underwriter must report the offer price to the CSRC for advice and approval.

Within three days after the sealed-bid auction closes, the underwriter will determine an allocation ratio for the IPO shares among the institutional bidders and will announce the auction results or bidding results.<sup>12</sup> In most cases, there is excess demand at the offer price, and the IPO shares need to be allocated on a *pro-rata* basis among the eligible institutional orders.<sup>13,14</sup> If the limit price (or bid price) submitted by an institutional bidder is equal to or above the final offer price, then that bidder is eligible to have shares allocated to them (the number of shares this bidder actually receives is equal to the corresponding bid quantity multiplied by the uniform allocation ratio). In the case of a step bid, if the lowest bid price submitted by an institutional bidder is equal to or above the final offer price, then the eligible bid quantity ordered by this bidder is the sum of the bid quantities from each limit bid. It is worth noting that the IPO shares allocated to institutional bidders are typically locked up for three months.<sup>15</sup>

Regarding announcing the auction results, because the regulator did not require the underwriter to reveal the full institutional bidding information until November 2010,<sup>16</sup> the underwriter previously had some flexibility in deciding the contents of the announcements. In terms of the copies of the announcements that we have collected, all underwriters have revealed the share allocation, bid quantity (including multiple bids if there are any), and the identity information for each institutional bidder, while only some of them chose to reveal the information about bid prices and losing bids. After announcing these results, the offering procedure for the auction tranche comes to an end.

In a hybrid procedure, the remaining IPO shares are sold to retail investors through a fixed-price public-offer tranche. Prior to the public offering, the underwriter will organize a one-day online roadshow for potential retail investors. Then, the public tranche will take place on the last day of the auction or shortly after the auction closes.<sup>17</sup> During this one-day public offering, if any retail investors would like to engage in the public tranche, they need to place orders via an online subscription system and specify (and pay for) the number of shares they wish to buy at the fixed price given by the underwriter. Like in a sealed-bid auction, retail investors in the public tranche are also not able to observe other investors' orders. At the same time, they also cannot directly access any information about the auction trends from publicly available sources. The fixed price faced by retail investors could be either the final offer price or the upper bound of the indicative price range, depending on whether an offer price has been determined by the underwriter at the time of the public offering.

<sup>12</sup> A uniform allocation ratio is used for institutional allocations, which is typically calculated using the number of shares to be auctioned divided by the total number of shares ordered by institutional investors.

<sup>13</sup> In our sample IPOs, there are no auctioned shares that were undersubscribed.

<sup>14</sup> Since November 2010, for most auctioned IPOs, the institutional allocation is determined using lottery draws when there is excess demand.

<sup>15</sup> On 28th April 2010, the CSRC refined the No. 37 Decree (2006) to remove the three-month lock-up period.

<sup>16</sup> On 1st November 2010, the CSRC promulgated *Guiding Opinions on Further Reforming the Mechanism of Issuance of New Shares* to require that underwriters reveal the information on both the bid price and bid quantity submitted by institutional investors after the close of the auction.

<sup>17</sup> If the price-setting tranche (auction tranche) is completed prior to the public tranche, then this type of hybrid is also known as a sequential hybrid. In addition, the day the public tranche takes place is commonly referred to as the date of the IPO (or the final-offering date).

Within four days after the public tranche closes, the underwriter will allocate the IPO shares to retail investors through lottery draws (if there is excess demand in the public tranche) and announce the subscription results of the public tranche. Any retail investors who do not win in the lottery draws will get refunds (without interest) for their preceding subscription payments; for any retail investors who receive share allocations, their shares are not subject to the lock-up period. When announcing the results of the public tranche, other than the information about the total number of retail entrants and the total number of shares demanded by these retail entrants, all underwriters did not reveal the investor-specific information for retail investors.

In summary, China's hybrid IPO auctions have an investor-driven approach, which combines a price-setting tranche (a sealed-bid auction, which is only open to institutional investors) with a separate public tranche that allows retail investors to access equity offerings without specifying a price. This hybrid system is different from the auction-like mechanisms used in other markets, such as the US, France, Taiwan, Israel, and Singapore. In these markets, retail investors have not been separated from the auction tranche, which means they are able to bid alongside the institutional investors in auctions. From a mechanism-design perspective, China's hybrid auction process is close to the one proposed by [Jagannathan et al. \(2015\)](#) and [Schnitzlein et al. \(2016\)](#), who argue that such a hybrid will be able to prevent unsophisticated retail investors from affecting the IPO's price-setting process. Moreover, compared to the IPO book-building mechanism used in developed markets, China's hybrid IPO auction not only features transparent allocation rules but is also characterized by revealing part of the bidding results after the offering.

The Chinese setup is important for the following reasons to test the information spillover. The US IPO system and most of the developed markets follow book-building where the underwriter controls the allocation of IPOs through conventional book-building where the institutional investors reveal private information about the true value of IPO firms (Benveniste and Wilhelm, 1990). In contrast, in China, there is a hybrid placement method consisting of a sealed-bid auction tranche, in which only institutional investors are allowed to engage in the price-setting process, however, every-one pays the same price. Critics of this feature are concerned that institutional investors play no part in information production, instead purposefully inflating their bids to acquire an allotment of shares. Furthermore, unlike most countries, which have used strict sealed-bid procedures in which no one knew the bids until after the auction had closed, the ability of the underwriter to observe the bids as they are submitted in China IPO is an intriguing feature that may potentially create information leakage and sharing, reducing the bidders' incentive to produce information.

China's IPO auction system is also a hybrid auction as the method consists of a sealed-bid auction tranche, in which only institutional investors are allowed to engage in the price-setting process and a separate public tranche that allows retail investors to place (subscription) orders without specifying a price. [Schnitzlein et al. \(2015\)](#) offer experimental and theoretical evidence that the hybrid auction method for IPOs is a more efficient way with the participation of institutional and retail investors which increases proceeds, lower price volatility, reduces price error, and reduces the incentive for small bidders to free ride by submitting extremely high bids, thus facilitating information production. Also, the demand in auctions is more elastic compared to the book-building procedure ([DeGeorge, Derrien, and Womack \(2010\)](#)). It is unclear whether the information production is valuable in Chinese hybrid IPO auctions. We empirically address these questions as the Chinese market is characterised by those special features.

### 3. Literature review and hypothesis development

There is a growing body of literature focusing on the role of information spillovers in the context of the primary equity market. Evidence on the effects of information spillover to date has been largely documented in an environment of IPO book-building (e.g. [Ljungqvist and Wilhelm, 2002](#); [Benveniste et al., 2003](#); [Cornelli and Goldreich, 2003](#); [Ljungqvist and Wilhelm, 2003](#); [Edelen and Kadlec, 2005](#); [Dunbar and Foerster, 2008](#); [Zhang, 2012](#); [Ince, 2014](#); [Bakke et al., 2017](#)).<sup>18</sup> Nevertheless, as the contents of the spillovers can vary with the structure of the IPO selling mechanisms, the pattern of information-spillover effects is presumably different in an offering environment other than IPO book-building.

Empirical evidence on the information-spillover pattern from sophisticated investors to unsophisticated investors has been reported for an offering environment where investors are able to observe the others' actions. [Neupane and Poshakwale \(2012\)](#) analyse the investor participation and IPO pricing in the Indian market,<sup>19</sup> and suggest that uninformed retail investors tend to submit their bids at the later stage of the offering, only after learning about the demands of institutional bidders; whereas informed institutional investors appear to be less interested in the demands of other investors and participate early based on the information they possess. Furthermore, they find that the price revision is largely influenced by the oversubscriptions of retail investors who have determined the aggregate demand information from the institutional investors' bids. [Khurshed et al. \(2014\)](#) document similar learning patterns among investors in the Indian IPO market, while they provide a novel interpretation stating that institutional demand in the early stage of an offering plays an important role in the certification of

<sup>18</sup> Other empirical studies examine the information-spillover effects surrounding IPO-related corporate events. For instance, [Hsu et al. \(2010\)](#) find that companies experience negative (positive) stock-price reactions when their rivals announce the completion (withdrawal) of IPOs in their industry. [Bradley and Yuan \(2013\)](#) present the fact that information spillovers from a firm's announcements of its seasoned equity offerings of primary (secondary) shares has a positive (negative) impact on the stock price of rival firms.

<sup>19</sup> The Indian IPO market is unique in its transparent selling process (for both book-building and auction-like mechanisms), which allows investors to observe the behaviour of other investors during the bidding period.

the IPO quality, which attracts retail investors more effectively than other certification mechanisms, such as underwriter reputation and VC affiliation. In examining Taiwan's hybrid IPO auction,<sup>20</sup> Hsu and Shiu (2006) find there is a spillover effect from announcing the current auction results ahead of the public tranche, which has a strong impact on the demands of retail investors who participate in the follow-on public tranche. It is, nonetheless, far from clear whether the pattern of spillover between two investor communities (which have heterogeneity in the levels of sophistication) is still prevalent in a sealed-bid-offering setting (i.e., any investors in any tranches are not able to access the current bidding or subscription results at the time of the offering phase).

Similar to the auction structure that we examine in this paper, recent work (e.g. Schnitzlein et al., 2016; Cao et al., 2016; Chemmanur et al., 2017) focuses on the informational properties of the hybrid IPO auction (with a public tranche). Based on the experimental evidence, Schnitzlein et al. (2016) suggest that separating retail investors from the auction tranche (i.e., reducing the number of unexpected influences on the market-clearing price caused by retail investors) facilitates institutional investors participating in the auction and producing precise information about the intrinsic value of the offering. Chemmanur et al. (2017) reach similar conclusions by examining institutional investors' information production in the auction tranche of China's hybrid IPO mechanism, and they further find that the offer price (or price revision) is more sensitive to the bidding of large institutions that can produce more precise information than small institutions.

However, the aforementioned empirical studies neither examine how the information produced by contemporaneous auction participants spills over into the current auction participation and pricing nor address the issue of whether the information production by sophisticated investors in the current sealed-bid auction tranche has a spillover effect on the unsophisticated investors in the current public tranche, which are the primary focuses of this empirical study.

We consider two classes of information spilling over from the announcements of contemporaneous hybrid IPO auction results: institutional investors' bidding results as revealed in the announcement for the auction tranche, and retail investors' subscription results as revealed in the announcement for the public tranche. The institutional bidding results convey information produced by sophisticated investors for contemporaneous auctioned IPOs, which can lower the costs or uncertainty of estimating the value for IPOs that are subject to a common valuation factor. By contrast, the retail subscription results reflect the sentiment or collective mood of unsophisticated investors that is prevailing at the time of the contemporaneous offering, which is not able to produce precise information about the intrinsic value of the offerings.

In the context of China's hybrid IPO auction mechanism, only institutional investors are eligible to participate in the auction tranche, while retail investors are only allowed to engage in the fixed-price public-offer tranche. For this study, we refer to the period between an IPO firm's filing date and its final offering date as the "offering phase" of the hybrid auction, and then we assume that both types of investors will garner information during the offering phase to assess the IPO and make entry decisions. According to Sherman's (2005) information-production model, if the sophisticated investors' auction entry depends on costly information acquisition, then we anticipate that the entry of institutional investors into the auction tranche will increase as information costs or information uncertainty decreases during the offering phase. Since unsophisticated investors are susceptible to behavioural biases, and their entry or participation depends on the sentiment, the crowd, and/or market conditions (e.g. Derrien, 2005; Cornelli et al., 2006; Dorn, 2009; Chiang et al., 2010; Neupane et al., 2014), we anticipate that the entry of retail investors into the public tranche will increase with an increase in the sentiment of other investors prevailing at the time of the offering phase.

To examine how the information revealed in the announcements of contemporaneous hybrid IPO auction results exerts influence on investor participation in current IPOs, we have organized the discussions into two sets of hypotheses regarding institutional participation and retail participation. If institutional participation depends on costly information acquisition, then we expect that the information produced by institutional bidders in contemporaneous IPO auction tranches will have a positive impact on the entry of institutional investors into the current IPO; if institutional participation depends on the sentiment or collective mood that is prevailing at the time of the offering phase, then we anticipate that the information produced by retail investors in contemporaneous IPO public tranches will have a positive impact on the entry of institutional investors into the current IPO. Hence, the first set of hypotheses is as follows:

**Hypothesis 1a.** *The entry of institutional investors into the current IPO's auction tranche is positively related to information spillovers from the announcement of the results of contemporaneous IPO auction tranches.*

**Hypothesis 1b.** *The entry of institutional investors into the current IPO's auction tranche is positively related to information spillovers from the announcement of the results of contemporaneous IPO public tranches.*

<sup>20</sup> It is noteworthy that there are three remarkable differences between the Taiwan's hybrid auction and the China's hybrid auction. First, the Taiwan's hybrid mechanism requires that the public tranche will take place only after the auction results have been announced, whereas investors in the public tranche of the China's hybrid mechanism will not access the current auction trend information at the time of the offering (i.e. in China, the offering results will not be announced until the end of the entire offering process). Second, the Taiwan's auction tranche allows retail investors to participate, whereas the China's auction tranche prohibits the participation of retail investors. Third, the discriminatory auction (i.e. pay-as-bid) is adopted by the Taiwan's hybrid mechanism, whereas the "dirty" uniform-price auction is used in the China's hybrid mechanism.

If retail participation depends on costly information acquisition, then we expect that the information produced by institutional bidders in contemporaneous IPO auction tranches will have a positive impact on the entry of retail investors into the current IPO; if retail participation depends on the sentiment or collective mood that is prevailing at the time of the offering phase, then we anticipate that the information produced by retail investors in contemporaneous IPO public tranches will have a positive impact on the entry of retail investors into the current IPO. Hence, the second set of hypotheses is as follows:

**Hypothesis 2a.** *The entry of retail investors into the current IPO's public tranche is positively related to information spillovers from the announcement of the results of contemporaneous IPO auction tranches.*

**Hypothesis 2b.** *The entry of retail investors into the current IPO's public tranche is positively related to information spillovers from the announcement of the results of contemporaneous IPO public tranches.*

To investigate whether the participation of institutional investors in the current IPO's auction tranche of a sealed-bid hybrid IPO procedure can create information externalities that affect the participation of retail investors in the current IPO's public tranche, we developed the third set of hypotheses that account for different aspects of information spillovers that may exist in the sealed-bid hybrid IPO auction mechanism.

Following the prediction of [Chowdhry and Sherman \(1996\)](#), we first assume that information about the aggregate demand submitted by institutional investors in the current sealed-bid auction may enter the public domain via short-term interbank interest rates. This can happen in China's IPO market, because institutional bidders need to pay for all their bids at the time of the sealed-bid auction, and such funds will be tied up in the banking system until the end of the share allocations. In examining China's interbank market, [Porter and Xu \(2009\)](#) find that the funds tied up by the IPO event (during the offering period in particular) have a positive impact on short-term interbank interest rates. This implies that a higher level of short-term interbank interest rates during the current auction period may signal that greater aggregate demand has been submitted by institutional investors in the sealed-bid auction tranche. If retail investors perceive the level of short-term interbank interest rates during the current auction period is a signal of spillover about current institutional investors' aggregate demand, then their entry will increase in line with the interbank interest rate at the time of the current auction:

**Hypothesis 3a.** *The entry of retail investors into the current IPO's public tranche is positively related to the level of short-term interbank interest rates during the current auction period.*

Prior studies (e.g. [Chowdhry and Sherman, 1996](#); [Amihud et al., 2003](#); [Jenkinson and Jones, 2009](#); [Cao et al., 2016](#)) argue that information leakage about the participation of institutional bidders is prevalent in a sealed-bid IPO environment, where retail investors might be able to get rough information about the trend for institutional investors from various sources, such as stockbrokers, financial gurus and/or other investors.<sup>21</sup> This makes information spillovers from the auction tranche to the public tranche likely to take place in the sealed-bid hybrid IPO auction mechanism. If so, then retail investors participating in the current IPO's public tranche should react directly to institutional participation in the current IPO's auction tranche, as indicated by the evidence reported for a transparent IPO environment (e.g., [Neupane and Poshakwale, 2012](#); [Khurshed et al., 2014](#)). Hence, if information about the participation of institutional investors in the current IPO's auction tranche spills over and affects the participation of retail investors in the current IPO's public tranche, we expect that the entry of retail investors will increase with an increase in the entry of institutional investors:

**Hypothesis 3b.** *The entry of retail investors into the current IPO's public tranche is positively related to the number of institutional bidders entering the current IPO's auction tranche.*

[Derrien and Womack \(2003\)](#), and [Ljungqvist et al. \(2003\)](#) assert that a sequential hybrid IPO placement method is prone to triggering cascading demand among investors with different levels of sophistication, where unsophisticated retail investors in the public tranche can condition their demand based on leaked interest in the preceding price-setting tranche. In addition, [Chowdhry and Sherman's \(1996\)](#) model reveals that the duration of the price-setting process will determine the extent to which information about the sophisticated investors' indications of interest in the current sealed-bid environment will be learned or perceived by unsophisticated investors. Accordingly, their model implies that the level of oversubscription in a sealed-bid IPO setting will increase with an increase in the duration of the price-setting process. Hence, within China's hybrid IPO auction mechanism, if information about the participation of institutional investors in the auction tranche spills over and affects the participation of retail investors in the public tranche, we expect that the oversubscription generated by retail investors in the current public tranche will increase with an increase in the duration of the current auction tranche:

**Hypothesis 3c.** *The level of retail investors' oversubscription in the current IPO's public tranche is positively correlated with the duration of the current IPO's auction tranche.*

<sup>21</sup> For example, [Cao et al. \(2016\)](#) conjecture that, in China, underwriters who can observe the full dynamics of the auction process may leak the information about institutional participation to other clients. Given that underwriters in China also play the role of stockbrokers, they are likely to provide the information about institutional participation as a special financial service to retail clients in order to attract more retail investors to use their brokerage services.

Lastly, considering that underwriters or auctioneers have discretion regarding the offer-price setting in a uniform-price, hybrid IPO auction and they aim to set it close to the intrinsic value of the firm, they will incorporate the information that is able to improve the precision of estimating the value for the current IPO's firm into the offer price. If the information produced by institutional investors for contemporaneous auctioned IPOs is valuable to the current IPO's price discovery, then information spillovers from contemporaneous IPO auction results will have a positive impact on the current IPO's price revision. By contrast, the subscription information generated by contemporaneous retail investors in IPO public tranches is presumably less useful for estimating the value of the current IPO firm, so the underwriter will not incorporate such spillover information into the offer price.

When examining how information spillovers from the announcements of contemporaneous hybrid IPO auction results influence the price revision of current IPOs, it is also of interest to assess whether the spillover information affects the price revision directly through the underwriter's adjustment or indirectly through the current investors' reactions. Most of the existing research (e.g., Benveniste et al., 2002; Ljungqvist and Wilhelm, 2002; Benveniste et al., 2003) asserts that underwriters directly react to contemporaneous information spillovers and then update the offer prices; whereas Cornelli and Goldreich (2003) suggest that underwriters use spillover information only to the extent that it is conveyed through the current bids of institutional investors. Since China's auction-like IPO mechanism is an investor-driven approach, the interpretation of information spillovers by institutional investors should be important to underwriters in choosing an offer price. Hence, we further expect that the impact of information spillovers from contemporaneous IPO auction results on the current IPO's price revision is affected indirectly through the current bids of institutional investors. The final set of hypotheses is as follows:

**Hypothesis 4a.** *Information spillovers from contemporaneous IPO auction results have a positive impact on the current IPO's price revision.*

**Hypothesis 4b.** *Information produced by institutional investors in the current IPO's auction tranche is positively related to the price revision of the current IPO.*

Then we examine the impact of institutional bidding information on the IPO initial returns. Assuming the IPO is issued at a discount to the market-clearing price in the IPO auction, many institutions may have priced the IPO higher than the ultimate IPO offer price which is evident in the bid price they put (Chemmanur et al., 2017). Moreover, if the IPO was oversubscribed it is highly unlikely that they would receive the desired number of shares in the IPO. Such institutions might have an incentive to buy shares in the aftermarket on the first trading day (Cao et al., 2015). Hence, the number of institutions participating in the bidding process is a good indicator that they will buy the shares in the secondary market, thus reducing the underpricing. On the other hand, if the institutional investors bid aggressively and the issue price was higher than the true value of the firm, thus increasing underpricing. It is an empirical question of what mechanism dominates the underlying relationship. Hence, we propose:

**Hypothesis 5a.** *Information spillovers from current and contemporaneous IPO auction results have a positive impact on the IPO underpricing.*

Finally, we examine the impact of institutional bidding on the lockup expiration returns, the buy-and-hold return till lockup and buy-and-hold returns till one year after the IPO. During the lockup expiration period, the information asymmetry and moral hazard were mitigated to some extent as the insiders are not allowed to sell shares (Brav and Gompers, 2003). As soon as lockup expires, if the IPO is not as good as the market perceives, the insiders will sell their shares (Brau et al, 2005). Hence, if the institutional bidding was higher for an IPO, we expect that the lockup expiration return will be higher. Likewise, if the shares demanded and participation is higher by the institutional investors in an IPO, we expect that the buy and hold return till lockup expiration and one year after the IPO to be higher.

**Hypothesis 5b.** *Information spillovers from current and contemporaneous IPO auction results have a positive relationship with lockup expiration returns, buy-and-hold abnormal returns till lockup expiration and buy-and-hold abnormal returns till one year of IPO.*

## 4. Data, methodology, and descriptive statistics

### 4.1. IPO sample and data collection

The sample consists of 1,144 firms that completed A-share IPOs in China's Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE) using the sealed-bid, uniform-price, hybrid auction approach between June 2006 and October 2012. The China Security Market and Accounting Research (CSMAR) database list 1,153 A-share IPO firms during the period from 2006 to 2012, from which we excluded 7 pure fixed-price offerings and 2 firms with missing data due to the suspension of their IPOs. The sample ends in 2012 because the CSRC suspended A-share IPO activity in November 2012.

IPO market in China was heavily controlled and government took several initiatives to control the market. Such an activity is IPO market suspension in 2012. Some of the studies in the relevant literature use IPO suspension to control for endogeneity and use a difference-in-difference analysis to examine several phenomena. Through the empirical analysis, Cui and Yang (2018) find that the firms subjecting to the IPO suspension are more likely to reduce their investments in R&D than those not affected by the IPO suspension. Packer and Spiegel, 2020, examined the competitive effects of IPO using the Chinese listing suspensions. Li et al (2022) using China's suspension of IPOs, find that firms affected by the suspension show lower CSR in their listing year. The later listing after the suspension ends, the greater reduction in CSR. Our empirical design does not depend on the IPO suspension activities. Rather, we follow Schnitzlein et al., 2016; Cao et al., 2016; Chemmanur et al., 2017 who focuses on the informational properties of the hybrid IPO auction (with a public tranche).

The data concerning the announcements of hybrid IPO auction results (including the results from both the auction tranche and the public tranche) were collected from the CNINFO website, which is one of the largest IPO information-disclosure platforms in China and is a website authorized by the CSRC, SSE, and SZSE to release the latest IPO information.<sup>22</sup> For the subsequent construction of variables, from each of the announcements, we manually collected the following information:

- The specific dates of the announcements for the results of each IPO's auction tranche and public tranche.
- The number of shares bid for by each institutional investor above the final offer price (i.e., the eligible bid quantity requested by each institutional investor in the auction tranche).
- The identity information of each institutional investor who participated in the auction tranche (e.g. their name and type, such as mutual funds, securities companies, insurance companies, financial companies, trust companies, and Qualified Foreign Institutional Investors [QFII]).
- The total number of eligible institutional investors in the auction tranche, the aggregate demand (i.e. the total bid quantity) of the eligible institutional investors that have been received by underwriters in the auction tranche, and the total number of shares offered by the issuers in the auction tranche.
- The total number of retail investors in the public tranche, the aggregate demand (i.e. the total number of subscribed shares) of retail investors that have been received by the underwriters in the public tranche, and the total number of shares offered by the issuers in the public tranche.

Regarding the investor-specific information for institutional investors that we collected from the announcements, a total of 478 institutional investors participated in the sample of IPO auctions from 2006 to 2012, and a total of 126,128 bids were placed by these institutional investors. In addition, from the CNINFO website, we also obtain the schedule data for the detailed procedures of the 1,144 hybrid IPO auctions. Several specific dates, such as the filing date and the auction date shown in each of the schedules, are used to define the window of contemporaries. Moreover, we also manually collected the indicative price range (i.e., the initial filing range) for each IPO.

The other data used to construct the variables were manually collected from a variety of sources. Specifically, to measure the size of institutional investors, the registered capital of each security, insurance, financial, and trust company was collected from the National Enterprise Credit Information Publicity System (NECIPS); the investment quota of each QFII institution was obtained from the CSRC; the scale of the portfolio management of each mutual fund was collected from the Asset Management Association of China (AMAC); the annual income ranking of the IPO underwriters was obtained from the Securities Association of China (SAC), and the short-term interbank interest rate was collected from the China Foreign Exchange Trade System (CFETS).

Stock market data (including offer prices, aftermarket prices, and market indices) and financial data about IPO firms were taken from the CSMAR database. We double-checked and manually filled several missing items of financial data from IPO prospectuses. The industry classification used is the one from the CSRC's (2012) *Guidelines for Industry Classification of Listed Companies*.

#### 4.2. Sample description

Table 1 presents the distribution of the IPO sample from 2006 to 2012, in terms of the number of hybrid IPO auctions, the gross proceeds of the hybrid IPO auction, and the pattern of investor participation. The gross proceeds and investors' bid (or subscription) amounts were adjusted using China's gross domestic product (GDP) deflator (purchasing power in 2006 = 100).<sup>23</sup> Panel A of Table 1 reveals the distribution of the sample by the offering year.<sup>24</sup> As shown in this panel, the sample IPOs are unevenly distributed across the sample period, in which the number of IPOs drops to a low of 76 during the period

<sup>22</sup> On the CNINFO website, the announcement of the results of IPO auction tranches is called "Announcement of A-share IPO Pricing, Offline Bidding and Allocation Results"; the announcement of the results of IPO public tranches is called "Announcement of A-share IPO Online Fixed-price Subscription and Lottery Results".

<sup>23</sup> The China's GDP Deflator data are collected from the World Bank.

<sup>24</sup> Of note is that an issuer's offering year is different from its listing year, where the offering year is the year of the issuer completed its auctioned IPO while the listing year is the year of the issuer's IPO stock eventually listed on the stock exchange. Since this empirical charter focuses more on the participation and pricing decisions made by primary market investors and underwriters during the hybrid IPO auction process, we choose to sort the sample distribution by offering year.

**Table 1**  
Sample distribution: Hybrid IPO auctions with a public tranche, 2006–2012.

	Sample IPOs		Hybrid auction proceeds (billions of RMB)		Investor participation (Institutional investors in the auction tranche; Retail investors in the public tranche)			
	N	%	Auction tranche	Public tranche	Avg. N of Institutional bidders participating in an IPO	Institutional bidding amounts (bn RMB)	Avg. N of retail investors participating in an IPO	Retail subscription amounts (bn RMB)
<i>Panel A: By IPO year</i>								
2006	70	6.12	41.13	102.33	107.71	1,612.72	435,221.10	13,951.93
2007	117	10.23	152.30	391.15	238.04	10,676.57	754,570.46	70,848.02
2008	76	6.64	31.46	114.64	291.51	4,048.31	465,714.01	68,839.94
2009	111	9.70	92.31	192.99	197.41	7,440.21	1,038,223.81	30,905.95
2010	345	30.16	166.31	515.13	91.47	7,063.93	385,310.70	59,095.76
2011	276	24.13	100.56	343.26	33.51	1,302.23	217,646.45	27,636.24
2012	149	13.02	42.57	120.15	32.60	803.42	198,008.54	9,935.64
Total	1144	100	626.64	1779.66	110.25 <sup>a</sup>	32,947.38	431,485.30 <sup>a</sup>	281,213.49
<i>Panel B: By industry</i>								
Agriculture, Forestry, Farming & Fishery (A)	19	1.66	6.56	16.58	125.00	373.42	427,141.32	3,709.94
Mining (B)	23	2.01	73.42	210.16	203.26	4,281.38	808,587.35	24,168.31
Manufacturing (C)	829	72.47	234.78	826.65	99.27	12,852.47	386,969.89	163,918.34
Energy (D)	8	0.70	5.05	10.83	153.63	313.28	617,644.38	3,014.78
Construction (E)	36	3.15	82.44	147.73	148.78	3,894.14	833,354.78	17,319.36
Wholesale & Retail (F)	27	2.36	10.44	40.74	129.52	664.84	377,096.37	7,304.11
Transportation (G)	23	2.01	31.67	63.98	132.65	1,859.18	689,418.83	10,087.04
Lodging & Catering (H)	3	0.26	0.50	1.99	308.00	124.92	871,300.00	2,512.33
Information Technology (I)	96	8.39	17.43	67.37	97.00	1,151.54	328,501.20	15,247.80
Finance (J)	23	2.01	146.25	333.24	204.91	5,989.72	1,035,193.04	21,472.43
Real Estate (K)	10	0.87	2.44	9.60	204.50	354.42	667,345.80	4,112.23
Leasing & Commercial Services (L)	10	0.87	2.31	9.23	237.40	471.56	581,582.80	3,171.69
Scientific Research & Technical Services (M)	10	0.87	2.00	6.91	109.80	125.74	301,630.30	1,138.00
Environment & Utilities (N)	10	0.87	2.74	11.00	51.70	122.33	269,690.90	1,158.82
Social Services & Health Care (O)	3	0.26	0.70	1.96	141.67	84.85	258,466.67	283.78
Culture, Entertainment & Sport (R)	14	1.22	7.92	21.70	88.29	283.60	461,747.64	2,594.52
Total	1144	100	626.64	1779.66	110.25 <sup>a</sup>	32,947.38	431,485.30 <sup>a</sup>	281,213.49
<i>Panel C: By market</i>								
SSE & SZSE Main Markets	139	12.15	406.42	937.30	139.64	18,259.67	703,947.43	81,064.36
Small & Medium Enterprises (SME)	650	56.82	144.60	557.09	131.69	11,520.83	472,667.71	165,545.08
Growth Enterprise Market (GEM)	355	31.03	75.62	285.27	56.65	3,166.87	244,536.65	34,604.05
Total	1144	100	626.64	1779.66	110.25 <sup>a</sup>	32,947.38	431,485.30 <sup>a</sup>	281,213.49

This table presents the distribution of the IPO sample by the offering year (Panel A), the industry sector (Panel B), and the listing market (Panel C) over the sample period 2006–2012, in terms of the number of hybrid IPOs, the gross proceeds of hybrid IPO auctions, and the pattern of investor participation. The industry classification is based on CSRC's Guidelines for Industry Classification of Listed Companies (2012 Revision). The average number (N) of investors participating in an IPO is the number of investors divided by the number of IPOs in the relevant year, industry sector, and listing market. The gross proceeds and investors' bidding (or subscription) amounts are adjusted using China's GDP Deflator (Purchasing Power in 2006 = 100). 1 USD(\$\$) was approximately 6.59 RMB(¥) on 31 December 2010. <sup>a</sup> reports the sample average for investor participation.

of the financial crisis in 2008 and then this number increases to a high of 345 at the time of launching the Growth Enterprise Market (GEM) in 2010. Likewise, the annual gross proceeds of the hybrid IPO auctions fluctuate year on year over the sample period, especially the gross proceeds raised in 2010 (¥681.44 billion, which is approximately \$103.41 billion), which are higher

than in other periods and account for 28.32 % of the aggregate gross proceeds of the sample (¥2,406.30 billion, which is approximately \$365.14 billion).<sup>25</sup> Moreover, since the CSRC limits the fraction of auctioned shares to between 20 % and 50 % of the total number of IPO shares, the gross proceeds raised from IPO public tranches consistently exceed the gross proceeds raised from auction tranches over the sample period. The aggregate gross proceeds raised from the public tranche (¥1,779.66 billion, which is approximately \$270.06 billion) are around three times more than those raised from the auction tranche (¥626.64 billion, which is approximately \$95.09 billion), which indicates that Chinese issuers and underwriters have assigned a large proportion of IPO shares to retail investors who participate in the public tranche.

Panel A of Table 1 further shows the distribution of institutional and retail investors participating in hybrid IPO auctions across the sample period. As illustrated by the average number of investors participating in an IPO each year, both institutional and retail investors participated actively in hybrid IPO auctions during the three years from 2007 to 2009, and since then the average number of participants has shrunk year on year from highs of 291.51 (for institutional bidders in the auction tranche) and 1,038,223.81 (for retail investors in the public tranche) to lows of 32.60 (for institutional bidders) and 198,008.54 (for retail investors). By comparing investors' bidding amounts to the hybrid IPO auction proceeds year on year, excess demand is consistently present in both the auction and public tranches in China's IPO market.

Panel B of Table 1 breaks down the sample by industry sector. Of the 1,144 IPO firms, 829 firms are in the manufacturing sector, which accounts for 72.47 % of the sample IPO firms. Thus, it is not surprising that around half of the gross proceeds in our sample (44.11 %) were raised by the IPO firms in the manufacturing sector. Also, both the institutional bid amounts and retail subscription amounts reached highs of ¥12,852.47 billion (approximately \$1,950.30 billion) and ¥163,918.34 billion (approximately \$24,873.80 billion), respectively, in this industry sector. However, in terms of the average number of IPO participants, the institutional investors are mainly involved in the auctioned IPOs in the lodging-and-catering sector (308.00 bidders per IPO), the leasing-and-commercial-services sector (237.40 bidders per IPO) and the finance sector (204.91 bidders per IPO); the retail investors are mainly engaged in the IPOs in the finance sector (1,035,193.04 persons per IPO), the lodging-and-catering sector (871,300.00 persons per IPO) and the construction sector (833,354.78 persons per IPO).

Panel C of Table 1 reports the distribution of the sample by the listing markets. More than half of the sample IPO firms (650 firms) chose the small-and-medium-enterprises (SME) market as the venue for going public, which reflects a strong financing demand from Chinese SME firms in our sample. Although there are not many firms (139 firms) listed on the SSE's and SZSE's main markets, the gross proceeds raised in the main markets are higher than in other markets. Interestingly, in terms of investor participation, both institutional and retail investors appear to be less enthusiastic about participating in the IPO auctions in the GEM.

Lastly, since the participation of institutional and retail investors in hybrid IPO auctions varies across the sample's years, industry sectors, and listing markets, it is necessary to account for these factors in the subsequent empirical analysis by including an array of relevant indicator variables.

#### 4.3. Descriptive statistics

Table 2 presents the descriptive statistics of the main variables used in the empirical analysis. All the variable definitions are in Appendix 1. There are several interesting findings. The first finding is regarding the participation (or entry) of institutional and retail investors into current hybrid IPO auctions. Consistent with the pattern of investor participation in the auction or auction-like mechanisms in other markets (e.g., Kerins et al., 2007; Chiang et al., 2010; Degeorge et al., 2010), China's hybrid IPO auctions are also dominated by retail participation, as evidenced by the average number of retail investors (431,485.30) relative to the average number of institutional investors (110.25). In terms of the bidding (or subscription) quantity, the level of oversubscription submitted by investors (especially for retail investors in the public tranche, whose oversubscription is on average 372.73 times) in China's hybrid IPO auctions is much higher than in other markets. For example, the average oversubscription submitted by retail investors in the French IPO market is 5.97 times (Derrien, 2005); the average oversubscription in Japan's hybrid IPO auctions is 4.47 times (Kerins et al., 2007); and the average oversubscription submitted by institutional and retail investors in Taiwan's hybrid IPO auctions are 0.69 and 3.01 times, respectively (Chiang et al., 2010). The extreme level of oversubscription submitted by Chinese retail investors in the public tranche is a strong indication of their interest in the new issues, while such a strong indication of interest may be caused by information spillovers or information leakage between the two tranches within China's hybrid IPO auction mechanism. Moreover, investor participation varies considerably across IPOs, as shown by the standard deviation for both the number of investors and the level of their oversubscription. Some hybrid IPO auctions attract a very large demand from investors (equal to up to 714 times and 7,727 times the auctioned fraction of the shares for institutional and retail investors, respectively), while some of them are disregarded by these investors (with the minimum oversubscription by institutional and retail investors being 1 time and 1.53 times, respectively).

Second, the average price revision for sample IPOs is  $-1.19\%$  (with a slight variability of 1.55 %, as shown by the standard deviation), which indicates that the final offer price is, on average, set very close to the midpoint of the indicative price range provided by underwriters. This is consistent with the findings of Chemmanur et al. (2017) concerning the price revision

<sup>25</sup> 1 USD(\$ ) was approximately 6.59 RMB(¥) on 31 December 2010.

**Table 2**  
Descriptive Statistics.

Variable	N	Mean	Std. Dev.	Min.	Median	Max.
<i>Investor participation and price discovery</i>						
No. of Institutional Bidders	1,144	110.25	107.16	2.00	74.00	461.00
Institutional Oversubscription	1,144	81.76	92.51	1.00	49.03	714.00
D_Institutional Participation	546,832	0.10	0.31	0.00	0.00	1.00
No. of Retail Investors	1,140	431,485.30	459,907.32	8,482.00	308,597.50	4,470,871.00
Retail Oversubscription	1,144	372.73	716.75	1.53	155.50	7,727.00
Price Revision [%]	881	-1.19	1.55	-32.93	-3.82	53.51
Underpricing	1131	0.605	0.767	-0.263	0.365	5.381
Offer range	1144	0.520	0.398	0.000	0.609	2.175
Offer mid	1144	0.979	0.238	0.000	1.000	1.491
Lockup BHAR	1144	-0.043	0.155	-0.572	-0.044	0.469
Lockup Exp return	1131	-0.002	0.006	-0.036	-0.002	0.049
BHAR 1 Yr	1131	-0.130	0.466	-1.715	-0.138	1.406
<i>Information spillovers from contemporaries</i>						
Contem_ΔInstOversub	1,118	39.44	38.81	-0.64	27.35	195.33
Contem_ΔInstBidders	1,118	55.78	47.29	1.25	44.60	393.00
Contem_ΔInstShares [Million]	1,118	846.92	3,124.11	-9.10	223.68	55,255.80
Contem_ΔInstAggressive	1,118	17.94	80.25	-423.00	-7.44	345.00
Contem_RetailOversub	1,118	410.69	699.63	22.00	173.71	4,571.00
Contem_IR [%]	1,095	56.97	67.19	-11.05	38.99	519.51
Contem_MktRet [%]	1,144	0.00	0.75	-2.72	0.02	2.38
No. of Contemporaries	1,144	7.78	3.82	1.00	8.00	21.00
<i>Spillovers from the current (sealed-bid) auction tranche</i>						
Current_ΔInstOversub	1,144	38.64	43.19	-8.68	22.50	283.33
Current_ΔInstBidders	1,144	54.04	54.01	-19.00	36.00	393.00
Avg. Repo Rate [%]	1,144	2.89	1.34	1.20	2.64	9.51
Auction Duration [Days]	1,144	1.37	0.63	1.00	1.00	4.00
<i>Firm- and offer-specific characteristics</i>						
Proceeds [Million]	1,144	1,552.03	5,107.61	38.70	600.00	68,529.18
Firm Age [Years]	1,144	9.05	4.96	1.00	9.00	30.00
EPS [-3yr, IPO]	1,095	0.53	0.26	0.07	0.48	2.22
Leverage [-3yr, IPO]	1,144	0.51	0.17	0.04	0.52	1.03
Reputation	1,144	6.31	2.84	0.00	7.00	9.00
Non-tradable [%]	1,144	11.05	22.24	0.00	0.00	92.39
Largest Ownership [%]	1,144	38.81	15.19	0.10	37.54	88.55
D_SOE	1,144	0.15	0.36	0.00	0.00	1.00
D_Big4	1,144	0.06	0.23	0.00	0.00	1.00
D_Cross-listing	1,144	0.03	0.18	0.00	0.00	1.00
<i>Market Microstructure Characteristics</i>						
Market return	1144	0.003	0.055	-0.230	0.002	0.229
Market Volatility	1144	0.250	0.139	0.000	0.220	1.468
Market Abnormal Volume	1144	8.732	0.377	7.959	8.693	10.845
<i>Macroeconomic Controls</i>						
Policy Uncertainty Index	1144	130.979	78.440	26.000	104.000	364.000
Log GDP	1144	12.768	0.137	12.440	12.784	12.931
Gross Capital Formation	1144	45.123	2.400	39.910	46.556	46.660
Inflation	1144	5.934	2.689	-0.210	6.881	8.076
GDP growth	1144	10.326	1.747	7.864	9.651	14.231

This table reports the descriptive statistics of the main variables used in the empirical analysis, in terms of the mean, standard deviation, minimum, median, and maximum. Variable definitions are summarised in Appendix 1.

among China's hybrid IPOs, and it is also comparable to the findings of US's and Japan's IPO markets (e.g., [Hanley, 1993](#); [Benveniste et al., 2003](#); [Cook et al., 2006](#); [Kutsuna et al., 2009](#)). The average offer range and offer mid are 0.520 and 0.979.

Third, the average value of each information-spillover measure is positive, which suggests that the information production among contemporaneous IPO auctions is mainly driven by large institutional investors rather than by small ones. For example, the average *Contem\_ΔInstOversub* is 39.44 times, which indicates that, on average, the demand information (in terms of the oversubscription reflected in bids) generated by large institutional investors exceeds the demand information generated by small institutional investors for contemporaneous offerings. If large institutional investors can produce more precise information about the value of the offering than small institutional investors (e.g., [Cornelli and Goldreich, 2003](#); [Chemmanur et al., 2017](#)), then these findings imply that announcing the auction results of contemporaneous offerings is informative for evaluating current offerings. Nevertheless, there are substantial variations in those information-spillover measures across IPOs, as evidenced by the standard deviation of the spillover measures. From the minimum value, it appears that some hybrid IPO auctions even experienced negative information spillovers from contemporaries (i.e., the information production of contemporaries is dominated by small institutional investors). In addition, the average number of contemporaries that have announced the auction results during the current offering phase is 7.78 IPO firms.

For firm- and offer-specific characteristics, we find that the average and median of the sample IPO firms' ages are 9.05 and 9 years, respectively. This indicates that most of the firms that engaged in IPOs during our sample period are established firms rather than start-ups. The average EPS and leverage ratios are 0.53 and 0.51, respectively, which are comparable with the findings of Liu et al. (2013) and Jia et al. (2016) for Chinese firms' pre-IPO operating performance over a similar sample period. In addition, the average and median of the IPO underwriters' reputation measures are 6.31 and 7, respectively, which suggests that most sample IPOs are managed by reputable underwriters. This is very close to the findings of Su and Bangassa (2011) regarding the measure of Chinese underwriters' reputation, although they use underwriters' registered capital to construct a ten-tier ranking. Furthermore, we find that 37 % of the IPO firms in our sample are high-tech companies and 15 % of IPO firms are SOEs.

We used several market microstructure characteristics.<sup>26</sup> We use the market return on the day of IPO which has an average value of 0.3 %. We also use the volatility of market returns calculated over the 90 days before the IPO. The average volatility is 0.25. As a measure of market liquidity, we use the abnormal volume of trading calculated based on the prior 90 trading days.

Finally, we use several macroeconomic characteristics in our analysis.<sup>27</sup> We use the policy uncertainty index, log of GDP, gross capital formation, inflation, and GDP growth. The policy uncertainty index shows a lot of variations as the minimum was 26 and the maximum was 364. The GDP growth minimum was 7.864 % while the maximum is 14.231 %.

## 5. Empirical results

### 5.1. The effect of information spillovers on institutional participation

In this subsection, we examine how information spillovers from contemporaneous hybrid IPO auction results exert an influence on the participation of institutional investors in the current IPO's auction tranche.

Table 3 presents estimates of cross-sectional regressions that analyse the impact of contemporaneous information spillovers on the entry of institutional investors into the current IPO's auction tranche. In addition to the ordinary least squares (OLS), we use the weighted least squares (WLS) as the IPO data is unevenly distributed across time and industry. In the WLS we use three different weightings: number of IPOs per year, IPO proceeds, and IPOs per industry. The results of OLS and WLS are very similar. Column 1 shows the results from OLS. As predicted, the coefficient of *Contem\_AInstOversub* is positive and significant, which indicates that information produced by institutional investors for contemporaneous auctioned IPOs (especially that generated by large institutional investors) has a positive spillover effect on the entry of institutional investors into the current IPO auctions. The estimated coefficient of *Contem\_AInstOversub* remains positive and significant at the 1 % level. In terms of economic magnitude, if the average oversubscription difference between contemporaneous large and small institutional investors increases 10 times while holding all other variables constant, then the number of institutional bidders in the current IPO's auction tranche is expected to increase by 6.82 % ( $\approx 100 * [e^{0.0066 * 10} - 1]$ ). This finding is consistent with our Hypothesis 1a, which suggests that information spillovers from contemporaneous IPO auction results have a positive impact on the entry of institutional investors into the current IPO auction. By contrast, after controlling for other potential effects on investor participation, the estimated coefficient of *Contem\_RetailOversub* becomes insignificant in terms of both statistical and economic magnitudes, which rejects our Hypothesis 1b. This suggests that the information generated by retail investors in contemporaneous IPOs' public tranches does not have a spillover effect on the participation of institutional investors in the current IPO auction and implies that the information production by contemporaneous retail investors is not valuable for institutional investors to evaluate the current offering. Moreover, with respect to the spillover-related control variables, the institutional participation is still significantly positively related to the contemporaneous IPO pricing results (*Contem\_IR*) and has little association with the contemporaneous market conditions (*Contem\_MktRet*). The adjusted R-squared value indicates that the variables in this multivariate regression explain 70.16 % of the cross-sectional variation in the natural logarithm of the number of institutional investors entering the current IPO auction.

Column 2, 3, and 4, reports the regression results for WLS. The results are very similar to when we consider different weighting. As predicted, the coefficient of *Contem\_AInstOversub* is positive and significant, which indicates that information produced by institutional investors for contemporaneous auctioned IPOs (especially that generated by large institutional investors) has a positive spillover effect on the entry of institutional investors into current IPO auctions. The estimated coefficient of *Contem\_AInstOversub* remains positive and significant at the 1 % level. In terms of economic magnitude, if the average oversubscription difference between contemporaneous large and small institutional investors increases 10 times while holding all other variables constant, then the number of institutional bidders in the current IPO's auction tranche is expected to increase by 6.82 % to 6.92 % (depending on the weighting used in different models). This finding is consistent with our Hypothesis 1a, which suggests that information spillovers from contemporaneous IPO auction results have a positive impact on the entry of institutional investors into the current IPO auction. By contrast, after controlling for other potential effects on investor participation, the estimated coefficient of *Contem\_RetailOversub* becomes insignificant in terms of both statistical and economic magnitudes, which rejects our Hypothesis 1b. This suggests that the information generated by retail investors in contemporaneous IPOs' public tranches does not have a spillover effect on the participation of institutional investors in

<sup>26</sup> We thank the anonymous referee for suggesting to use market microstructure measures.

<sup>27</sup> We thank the anonymous referee for suggesting to use macroeconomic measures.

**Table 3**  
The effect of contemporaneous information spillovers on institutional participation.

	Dependent variable: Ln(No. of Institutional Bidders)					
	(1)	(2)	(3)	(4)	Contemporaries that are subject to a common valuation factor (i.e. they are in the same industry as the current IPO firm)	
	OLS	WLS (# of IPOs per year)	WLS (IPO Proceeds)	WLS(# IPOs per industry)	(5) OLS	(6) WLS(# IPOs per industry)
<i>Contemporaneous information-spillover measures</i>						
Contem_ΔInstOversub	0.0066*** (5.37)	0.0067*** (5.67)	0.0066*** (5.39)	0.0066*** (5.36)	0.0079*** (7.76)	0.0079*** (7.77)
Contem_RetailOversub	0.0001 (-0.22)	0.0001 (-0.21)	0.0001 (-0.24)	0.0001 (-0.22)	0.0001 (-0.02)	0.0001 (-0.02)
Contem_IR	0.1900*** (4.57)	0.1913*** (4.68)	0.1900*** (4.57)	0.1899*** (4.57)	0.1831*** (4.21)	0.1832*** (4.21)
Contem_MktRet	-4.8747* (-1.83)	-4.7093* (-1.77)	-4.8744* (-1.83)	-4.9057* (-1.84)	-5.6302* (-1.92)	-5.6103* (-1.91)
<i>Firm- and offer-specific characteristics</i>						
Ln(Proceeds)	-0.0879** (-2.18)	-0.0907** (-2.27)	-0.0877** (-2.17)	-0.0876** (-2.17)	-0.0115 (-0.25)	-0.011 (-0.24)
Ln(Firm Age)	-0.0178 (-0.58)	-0.0203 (-0.66)	-0.0181 (-0.58)	-0.0174 (-0.56)	-0.0178 (-0.52)	-0.0178 (-0.52)
EPS [-3yr, IPO]	-0.1580** (-2.26)	-0.1555** (-2.23)	-0.1582** (-2.27)	-0.1576** (-2.26)	-0.0932 (-1.21)	-0.0933 (-1.21)
Leverage [-3yr, IPO]	-0.3780*** (-3.13)	-0.3653*** (-3.04)	-0.3764*** (-3.12)	-0.3812*** (-3.16)	-0.4791*** (-3.46)	-0.4776*** (-3.44)
Reputation	0.0088 (1.36)	0.009 (1.40)	0.0087 (1.35)	0.0087 (1.36)	0.0072 (1.03)	0.0072 (1.02)
Non-tradable	0.3012 (1.77)	0.2904 (1.74)	0.3023 (1.78)	0.303 (1.78)	0.4272* (1.99)	0.4266* (1.99)
Largest Ownership	0.0579 (0.48)	0.0541 (0.45)	0.0562 (0.46)	0.0595 (0.49)	0.0562 (0.42)	0.0555 (0.41)
D_SOE	-0.1408 (-1.42)	-0.1406 (-1.44)	-0.1421 (-1.44)	-0.1414 (-1.43)	-0.2273 (-1.95)	-0.2274 (-1.95)
D_Big4	0.0412 (0.34)	0.0306 (0.26)	0.0408 (0.34)	0.0417 (0.35)	0.0417 (0.51)	0.0778 (0.51)
D_Cross-listing	-0.3266** (-2.15)	-0.3320** (-2.19)	-0.3231** (-2.13)	-0.3266** (-2.15)	-0.3675* (-1.82)	-0.3669* (-1.82)
<i>Market Microstructure characteristics</i>						
Market return	-2.5399*** (-5.83)	-2.4463*** (-5.63)	-2.5407*** (-5.84)	-2.5406*** (-5.84)	-2.3070*** (-4.83)	-2.3055*** (-4.83)
Market Volatility	1.0416*** (7.76)	1.0311*** (7.71)	1.0388*** (7.76)	1.0444*** (7.76)	1.1780*** (6.37)	1.1773*** (6.37)
Market Abnormal Volume	0.8065*** (7.72)	0.8175*** (7.90)	0.8077*** (7.74)	0.8045*** (7.70)	0.6102*** (5.57)	0.6106*** (5.57)
<i>Macroeconomic Characteristics</i>						
Policy Uncertainty Index	0.0008** (1.97)	0.0008* (1.93)	0.0008** (1.97)	0.0008** (1.97)	0.0008* (1.86)	0.0008* (1.86)
GDP growth	-0.1484*** (-4.55)	-0.1459*** (-4.51)	-0.1476*** (-4.52)	-0.1488*** (-4.56)	-0.1465*** (-3.85)	-0.1463*** (-3.85)
Inflation	0.0452*** (3.95)	0.0458*** (4.02)	0.0450*** (3.93)	0.0452*** (3.95)	0.0571*** (4.44)	0.0571*** (4.44)
Gross Cap formation	0.1628*** (5.89)	0.1599*** (5.87)	0.1626*** (5.89)	0.1627*** (5.89)	0.1706*** (5.72)	0.1704*** (5.71)
log GDP	-7.3392*** (-11.40)	-7.1821*** (-11.48)	-7.3290*** (-11.39)	-7.3502*** (-11.41)	-7.3433*** (-11.17)	-7.3331*** (-11.15)
constant	86.1018*** (11.39)	84.1581*** (11.47)	85.9612*** (11.38)	86.2638*** (11.40)	85.7849*** (10.97)	85.6466*** (10.95)
Year Indicators	Y	Y	Y	Y	Y	Y
Industry Indicators	Y	Y	Y	Y	Y	Y
Market Indicators	Y	Y	Y	Y	Y	Y
R-sqr	70.16 %	70.22 %	70.21 %	70.15 %	71.35 %	71.34 %
N	1005	1005	1005	1005	784	784

This table presents the estimates of cross-sectional regressions that analyse the impact of contemporaneous information spillovers on the entry of institutional investors into the current IPO auction. The dependent variable for each regression is the natural logarithm of the number of institutional bidders in the current IPO's auction tranche. The independent variables of interest are two information-spillover measures: *Contem\_ΔInstOversub* is the average difference in oversubscription between large and small institutional investors as revealed in the announcements of the results of contemporaneous IPO auction tranches; *Contem\_RetailOversub* is the average oversubscription of retail investors as revealed in the announcements of the results of contemporaneous IPO public tranches. Variable definitions are summarised in Appendix 1. An array of IPO year, industry, and market indicator variables are included in the regressions (4) and (6) but not reported. The last two columns present regression results that take into account of the contemporaneous offerings that are subject to a common valuation factor (i.e. they are in the same industry as the current IPO firm). Cluster (year and industry) adjusted robust *t*-statistics are reported in parenthesis. \*, \*\*, and \*\*\* denote statistical significance at the 10 %, 5 %, and 1 % levels, respectively.

the current IPO auction and implies that the information production by contemporaneous retail investors is not valuable for institutional investors to evaluate the current offering. Moreover, with respect to the spillover-related control variables, the institutional participation is still significantly positively related to the contemporaneous IPO pricing results (*Contem\_IR*) and has little association with the contemporaneous market conditions (*Contem\_MktRet*). A positive and significant coefficient estimate of *Contem\_IR* suggests that more institutional investors enter the current IPO auction when the average underpricing level of the contemporaneous offerings is higher which is consistent with [Ljungqvist and Wilhelm \(2002\)](#), and [Benveniste et al. \(2003\)](#). The adjusted *R*-squared value indicates that the variables in this multivariate regression explain 70.15%–70.22% (depending on the weighting used in different models) of the cross-sectional variation in the natural logarithm of the number of institutional investors entering the current IPO auction.

In columns (5) and (6) of [Table 3](#), we present results by considering that the contemporaneous offerings are subject to a common valuation factor (i.e., being in the same industry as the current IPO firm). [Benveniste et al. \(2003\)](#) argue that information-spillover effects should be stronger among IPO firms sharing a common valuation factor. Therefore, we expected that institutional investors might react more strongly to the spillover information from contemporaries that share a common valuation factor with the current offering.

As shown in column (5), where we use OLS, which considers an alternative definition for contemporaries, the estimated coefficient for our primary spillover variable of interest (*Contem\_AInstOversub*) remains positive and significant at the 1% level, and the adjusted *R*-squared value indicates that the spillover information explains nearly 71.34% of the cross-sectional variation in the natural logarithm of the number of institutional investors entering the current IPO auction. More importantly, in terms of the economic magnitude, if the primary spillover measure (*Contem\_AInstOversub*), which is based on the contemporaneous offerings in the same industry, increases 10 times while holding all other variables constant, then the number of institutional bidders in current IPO's auction tranche is expected to increase by 8.22% ( $\approx 100 * [e^{0.0079 * 10} - 1]$ ). When we use WLS in column 6, the results are relatively similar to OLS.

Regarding the significance of the control variables in [Table 3](#), the results show that the offering size ( $\ln(\text{Proceeds})$ ) is consistently significant in all regressions. This is in line with the findings of [Degeorge et al. \(2010\)](#) for the US market, which suggests that larger IPOs are less subject to information asymmetry and get more interest from institutional investors. However, the difference between this and our results is that [Degeorge et al. \(2010\)](#) assert that investor participation is largely predictable using the offering size since  $\ln(\text{Proceeds})$  alone can explain 40–50% of the cross-sectional variation in US IPO auction participation, whereas the outcome of our study reveals that the offering size ( $\ln(\text{Proceeds})$ ) alone only explains 0.58% of the cross-sectional variation in China's IPO auction participation.<sup>28</sup> This indicates that there is a dramatic difference between US's and China's institutional investors with respect to their auction-participation behaviour. The market microstructure and macroeconomic variables are mostly significant across the regressions which shows the importance of those variables in determining institutional participation.

In summary, our empirical findings in this subsection lend strong support to our Hypothesis 1a, which suggests that information spillovers from the announcement of contemporaneous IPO auction results have a positive impact on the institutional participation in the current IPO auction. Conversely, we did not find evidence supporting Hypothesis 1b. After controlling for other factors that affect the current institutional participation, information spillovers from the results of contemporaneous IPO public tranches have little association with the entry of institutional investors into the current IPO auction.

### 5.1.1. Robustness tests at the investor level

Unlike the previous auction-level tests used to analyse the participation of institutional investors as a group in each deal, the investor-level tests focus on the decision of each institutional investor to participate in the IPO auctions. Hence, it is of interest to assess whether information spillovers from contemporaneous hybrid IPO auction results influence the probability of institutional participation at the investor level.

In these investor-level tests, the unit of observation is an institution–IPO pair. For each institution–IPO pair, participation (or auction choice) is an indicator variable that is equal to 1 if the institutional investor decides to bid in the current IPO auction and 0 otherwise. By tracking institutional investors over time for the 1,144 IPO auctions, we identified 478 institutional investors participating in the IPO auctions from 2006 to 2012. This means the sample consists of 546,832 institution–IPO observations.<sup>29</sup> Regarding the explanatory variables, we used the same set of information-spillover variables and control variables as in the auction-level tests.

[Table 4](#) presents the results of logit regressions of institutional participation on explanatory variables, where the dependent variable is the indicator variable for the auction choice of institutional investors. Moreover, we estimated the marginal effect of each explanatory variable on the auction choice of institutional investors, where the marginal effect ( $dy/dx$ ) was evaluated at the sample means of explanatory variables and reported next to the coefficient estimates. Additionally, to take account of the potential error dependence across time within each IPO auction, as well as heteroskedasticity, the *p*-values (reported in parentheses) were adjusted using White's robust standard errors with clustering at the IPO auction level.

<sup>28</sup> The univariate regression for  $\ln(\text{Proceeds})$  is not documented in the table.

<sup>29</sup> In multivariate regressions, this sample size will be reduced due to missing values for the variables, especially when we use the alternative definition for contemporaries.

In the first two columns, corresponding to the tests at the auction level, various combinations of the information-spillover measures were introduced simultaneously into the regressions, along with the other control variables. As shown in column (1), the coefficient of *Contem\_AInstOversub* is positive and significant, which suggests that institutional investors are more likely to participate in an IPO auction when there is a higher average oversubscription difference between large and small institutional bidders spilling over from contemporaneous IPO auction results. The marginal effect shows that a 1 % increase in *Contem\_AInstOversub* at the time of the current offering phase will increase the probability of institutional investors entering the current auction tranche by 0.0005 %. By contrast, the information generated by retail investors in contemporaneous public tranches (*Contem\_RetailOversub*) does not have a significant influence on the probability of institutional investors entering the current IPO auction. Furthermore, the results show a contemporaneous pricing result (*Contem\_IR*) and contemporaneous secondary-market conditions (*Contem\_MktRet*) are insignificant. All these results are consistent with our inferences obtained from the auction-level tests, which implies that only contemporaneous information spillovers that can lower the costs or uncertainty of estimating the value for the current offering will be able to affect the auction choice of institutional investors.

We replicated the regression analysis using the alternative spillover measure. In the column (2) specification, the coefficient estimates of *Contem\_AInstBidders* is still positive and significant, which suggests that institutional investors are also more likely to participate in an IPO auction when there is a greater number of large institutional investors involved in contemporaneous offerings than the number of small institutional investors.

In the last two columns of Table 5, we present an examination of the effect of contemporaneous information spillovers on the probability of institutional participation by taking account of the contemporaneous offerings subject to a common valuation factor. As shown in these two columns, the estimated coefficients of *Contem\_AInstOversub* and *Contem\_AInstBidders* remain positive and significant at the 1 % level, which is consistent with the results drawn from unconditional contemporaries. Hence, our inferences are identical when using the alternative definition of contemporaries.

Overall, in this subsection, through the investor-level tests, we have confirmed our previous conclusion that information spillovers from the announcement of contemporaneous IPO auction results (which can reduce the valuation uncertainty) facilitate institutional investors entering the current IPO auction, whereas information produced by retail investors in contemporaneous IPOs' public tranches does not have a spillover effect on the entry decision of institutional investors.

## 5.2. The effect of information spillovers on retail participation

Since China's hybrid IPO auction mechanism separates retail investors from the auction tranche and assigns them to a public tranche, it is also of interest to know how these retail investors, as a group in the public tranche, react to the information revealed in the announcements of the contemporaneous hybrid IPO auction results. In this subsection, we conduct examinations of Hypotheses 2a and 2b, which investigate how the information produced by sophisticated and unsophisticated investors for contemporaneous hybrid IPO auctions exerts influence on the participation of retail investors in the current IPO.

Table 5 presents the estimates of the cross-sectional regressions (OLS and WLS) that were used to analyse the impact of contemporaneous information spillovers on the entry of retail investors into the current IPO's public tranche. As shown in column (1), the primary information-spillover measures based on contemporaneous institutional investors (*Contem\_AInstOversub*) and retail investors (*Contem\_RetailOversub*) were introduced simultaneously into the regression, along with all control variables. As expected, the estimated coefficient of *Contem\_RetailOversub* is positive and significant at the 1 % level, which suggests that more retail investors engage in the current IPO's public tranche when the average oversubscription submitted by contemporaneous retail investors is higher. By contrast, the information produced by contemporaneous institutional investors (*Contem\_AInstOversub*) has little association with the entry of retail investors into the current IPO. These results imply that retail investors evaluate the current offering by relying on the spillover information that reflects the collective mood or sentiment at the time of the offering phase, rather than the spillover information that can lower their valuation uncertainty. Moreover, the results identify that the average one-day initial return of all contemporaneous offerings (*Contem\_IR*) has a significantly positive influence on the current retail participation, which is evidence of the return-chasing behaviour of retail investors, which is consistent with the findings of Chiang et al. (2010) and Jagannathan et al. (2015) for other markets.<sup>30</sup>

After controlling for other factors that affect retail participation, the outcome shows that none of the alternative spillover measures (*Contem\_AInstBidders*, *Contem\_AInstShares*, and *Contem\_AInstAggressive*) are significantly related to the entry of retail investors into the current IPO's public tranche. This confirms our prior conclusion that retail investors disregard the valuation efforts made by contemporaneous institutional investors, and thereby reject our Hypothesis 2a. By contrast, the estimated coefficient of *Contem\_RetailOversub* remains positive and significant at the 1 % level in all specifications, which lends strong support to our Hypothesis 2b, in that retail participation is related to the information regarding the aggregate

<sup>30</sup> Although the spillover-related control variable *Contem\_IR* has a significant influence on both retail and institutional participation, the participants' reactions to this spillover information may result from different reasons. Specifically, as retail investors (in the public tranche) are not subject to the lock-up restriction, they are more likely to be IPO flippers (i.e. reselling their allocations immediately on the first aftermarket day). Thus, retail investors might be more inclined to see the spillover information of *Contem\_IR* as a signal of flipping activities. By contrast, as institutional investors (in the auction tranche) face the lock-up period, they are presumably long-term investors. Hence, they are more likely to learn about pricing experience from the spillover information of *Contem\_IR*.

**Table 4**

The effect of spillovers on the probability of institutional participation at the investor level.

	Dependent variable: D_Institutional Participation (== 1 if the investor participated in the auction, and == 0 otherwise)							
	(1)		(2)		Contemporaries that are subject to a common valuation factor (i.e. they are in the same industry)			
	Coef.	dy/dx	Coef.	dy/dx	(3)		(4)	
				Coef.	dy/dx	Coef.	dy/dx	
<i>Contemporaneous information-spillover measures</i>								
Contem_AlInstOversub	0.0059*** (3.12)	0.0005*** (3.25)			0.0055*** (2.66)	0.0004*** (2.74)		
Contem_AlInstBidders			0.0046*** (3.72)	0.0004*** (3.84)			0.0044*** (2.85)	0.0004*** (2.94)
Contem_AlInstShares	0.0001 (-0.20)	0.0001 (-0.20)	0.0001 (-1.77)	0.0001 (-1.74)	0.0001 (-1.73)	0.0001 (-1.70)	-0.0001*** (-3.18)	-0.0001*** (-3.13)
Contem_AlInstAggressive	-0.0006 (-0.87)	-0.0001 (-0.87)	0.0006 (0.91)	0.0001 (0.92)	0.0001 (0.14)	0.001 (0.14)	0.0008** (2.00)	0.0001** (2.02)
Contem_RetailOversub	0.001 (-0.16)	0.001 (-0.16)	-0.0001 (-0.73)	0.001 (-0.73)	0.001 (-0.44)	0.001 (-0.44)	0.001 (-0.55)	0.001 (-0.55)
Contem_MktRet	-3.2255 (-0.97)	-0.282 (-0.96)	-2.8822 (-0.92)	-0.2519 (-0.92)	-4.2445 (-1.06)	-3.441 (-1.05)	-3.4815 (-0.93)	-0.2822 (-0.93)
Contem_IR	0.1334 (1.77)	0.0117 (1.78)	0.1174 (1.65)	0.0103 (1.66)	0.1311 (1.56)	0.0106 (1.57)	0.1299 (1.60)	0.0105 (1.61)
constant	55.1455*** (3.67)		51.7269*** (3.46)		66.4833*** (4.03)		63.3665*** (3.68)	
Firm- and offer-specific characteristics	Y		Y		Y		Y	
Market Microstructure characteristics	Y		Y		Y		Y	
Macroeconomic Characteristics	Y		Y		Y		Y	
Year Indicators	Y		Y		Y		Y	
Industry Indicators	Y		Y		Y		Y	
Market Indicators	Y		Y		Y		Y	
Log likelihood	-162180		-155132		-121108		-111322	
Pseudo R <sup>2</sup>	0.0706		0.0706		0.0610		0.0620	
Observations	489,950		489,950		379,532		379,532	

This table reports the results of logit regressions of institutional participation on explanatory variables, where the dependent variable is an indicator variable equal to 1 if the investor participated in the auction and 0 otherwise. The explanatory variables of interest are information-spillover measures (e.g. the primary spillover measures, *Contem\_AlInstOversub* and *Contem\_RetailOversub*; the alternative spillover measures, *Contem\_AlInstBidders*, *Contem\_AlInstShares*, and *Contem\_AlInstAggressive*). Variable definitions are summarised in Appendix 1. An array of IPO year, industry, and market indicator variables are included but not reported. The last two columns present regression results that take into account of the contemporaneous offerings that are subject to a common valuation factor (i.e. they are in the same industry as the current IPO firm). The marginal effect (dy/dx) is evaluated at the sample means of explanatory variables and reported next to the coefficient estimates. The unit of observation is an Institution – IPO pair. *p*-values, which are in parentheses, are adjusted using White's robust standard errors with clustering at the IPO auction level. \*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively.

demand generated by contemporaneous retail investors in contemporaneous IPOs' public tranches. Nevertheless, the economic magnitude of the spillover effect produced by *Contem\_RetailOversub* is relatively small, and 10 times increase in the average oversubscription by contemporaneous retail investors leads to an increase of only 0.20% ( $\approx 100 * [e^{0.0002 * 10} - 1]$ ) for the number of retail investors in the current IPO auction. In column 2, when we use WLS the results remain similar.

To ensure that our results are robust concerning the alternative definition of contemporaries, we reran our regression analyses using information spillovers from contemporaneous offerings that are subject to a common valuation factor (i.e. they are in the same industry). As shown in the last four columns of Table 6, when retail investors are assumed to be only able to learn about the information spillovers from contemporaneous offerings in the same industry, their participation in the current IPO's public tranche is still positively and significantly related to contemporaneous retail investors' demand (*Contem\_RetailOversub*). At the same time, the relationship between the retail participation and the spillover information of *Contem\_IR* and *Contem\_MktRet* remains positive and significant at the 1% level. The reaction of retail investors to contemporaneous sentiment-related spillover information is not driven by the way we have defined contemporaries. However, interestingly, the estimated coefficients of both *Contem\_AlInstOversub* and *Contem\_AlInstBidders* became positive and significant, which suggests that retail investors are also willing to incorporate the information produced by contemporaneous institutional investors into their entry decisions when such information spills over from contemporaneous offerings that are in the same industry as the current IPO firm. All the market microstructure and macroeconomic controls are significant in these regressions, highlighting the importance of those factors in the entry decisions of retail investors.

Collectively, our empirical results obtained in this subsection lend strong support to Hypothesis 2b, which suggests that the information regarding the aggregate demand generated by contemporaneous retail investors in contemporaneous IPOs' public tranches spills over and has a positive influence on the entry of retail investors into the current IPO. By contrast, there is no strong evidence lending support to Hypothesis 2a, in that the information regarding the valuation efforts made by insti-

**Table 5**  
The effect of contemporaneous information spillovers on retail participation.

	Dependent variable: Ln(No. of Retail Investors)							
	(1)	(2)	(3)	(4)	Contemporaries that are subject to a common valuation factor (i.e. they are in the same industry as the current IPO firm)			
	OLS	WLS	OLS	WLS	(5) OLS	(6) WLS	(7) OLS	(8) WLS
<i>Contemporaneous information-spillover</i>								
Contem_InstOversub	0.0017 (0.81)	0.0024** (2.34)			0.0052*** (4.59)	0.0056*** (4.50)		
Contem_InstBidders			0.0016 (1.04)	0.0022*** (3.15)			0.0043*** (4.98)	0.0045*** (4.78)
Contem_RetailOversub	0.0002*** (3.65)	0.0002*** (3.62)	0.0002*** (3.14)	0.0002*** (3.04)	0.0002*** (3.60)	0.0002*** (3.61)	0.0002*** (3.62)	0.0002*** (3.04)
Contem_InstShares	0.0001 (1.36)	0.0001* (1.77)	0.0001 (0.91)	0.0001 (1.11)	0.0001 (-0.68)	0.0001 (-0.78)	0.0001 (-1.46)	0.0001 (-1.37)
Contem_InstAggressive	-0.0009 (-0.93)	-0.0011* (-2.13)	-0.0005 (-0.81)	-0.0006 (-1.25)	-0.0004 (-0.66)	-0.0005 (-0.78)	0.0003 (0.55)	0.0003 (0.50)
Contem_IR	0.2786*** (5.58)	0.2546*** (6.40)	0.2693*** (5.36)	0.2417*** (6.08)	0.2227*** (3.74)	0.1863*** (4.06)	0.2196*** (3.71)	0.1850*** (4.03)
Contem_MktRet	0.2015 (0.08)	-0.412 (-0.16)	0.529 (0.20)	-0.174 (-0.07)	0.0175 (0.01)	-0.7147 (-0.25)	0.8107 (0.27)	0.0561 (-0.02)
constant	58.9529*** (8.72)		56.9503*** (7.86)		52.8660*** (6.82)		49.6589*** (6.29)	
Firm- and offer-specific characteristics	Y	Y	Y	Y	Y	Y	Y	Y
Market Microstructure characteristics	Y	Y	Y	Y	Y	Y	Y	Y
Macroeconomic Characteristics	Y	Y	Y	Y	Y	Y	Y	Y
Year Indicators	Y	Y	Y	Y	Y	Y	Y	Y
Industry Indicators	Y	Y	Y	Y	Y	Y	Y	Y
Market Indicators	Y	Y	Y	Y	Y	Y	Y	Y
R-sqr	59.18 %	59.38 %	59.29 %	59.55 %	55.32 %	55.35 %	55.49 %	55.51 %
N	1002	1002	1002	1002	771	771	771	771

This table presents the estimates of cross-sectional regressions that analyse the impact of contemporaneous information spillovers on the entry of retail investors into the current IPO's public tranche. The dependent variable used for each regression is the natural logarithm of the number of retail investors in the current IPO's public tranche. The independent variables of interest are information-spillover measures (e.g., the primary spillover measures, *Contem\_RetailOversub*, and *Contem\_InstOversub*; the alternative spillover measures, *Contem\_InstBidders*, *Contem\_InstShares*, and *Contem\_InstAggressive*; the spillover-related control variables, *Contem\_IR* and *Contem\_MktRet*). Variable definitions are detailed in Subsection 2.4.3 and summarised in Appendix 1. An array of IPO year, industry, and market indicator variables are included but not reported. The last four columns present regression results that consider of the contemporaneous offerings that are subject to a common valuation factor (i.e., they are in the same industry as the current IPO firm). Cluster (year and industry) adjusted robust *t*-statistics are reported in parenthesis. \*, \*\*, and \*\*\* denote statistical significance at the 10 %, 5 %, and 1 % levels, respectively.

tutional investors in contemporaneous IPOs' auction tranches has little association with the retail participation in the current IPO, unless contemporaneous offerings are in the same industry as the current IPO firm.

### 5.3. Information spillovers within the sealed-bid hybrid IPO auction mechanism

The prior literature (e.g., Ljungqvist et al., 2003; Derrien and Womack, 2003) maintains that an IPO selling mechanism with a hybrid structure is likely to create cascading demand, where retail investors in the public tranche can condition their demand based on the indications of interest revealed in the preceding order book (or price-setting tranche). Although relevant evidence has been found by Neupane and Poshakwale (2012), and Khurshed et al. (2014) in an environment where the IPO selling process is transparent (i.e., the entire bidding process is publicly observable at the time of the offering), it is still far from clear whether the information generated by institutional investors in the current sealed-bid auction can spill over and affect the participation of retail investors in the current IPO's public tranche. Therefore, in this subsection, we will move on to investigate patterns of information spillovers between the auction tranche and the public tranche within the sealed-bid hybrid IPO auction mechanism.

According to Hypothesis 3a, if retail investors can discern the aggregate demand information of institutional investors in the current IPO's auction tranche indirectly through the level of short-term interbank interest rates at the time of the auction period, then we expected that the entry of retail investors into the current IPO's public tranche would be positively related to the level of short-term interbank interest rates during the current IPO's auction period.

Panel A of Table 6 presents the estimates of the cross-sectional regressions (OLS and WLS) that examine the impact of the trend of short-term interbank interest rates during the current IPO's auction period (as a signal for the information spillover regarding aggregate demand of institutional investors) on the retail participation in the current IPO's public tranche. Specifically, column 1 and 2 of Panel A reports the multivariate regression results that used the natural logarithm of the number of retail investors as the dependent variable used to measure the retail participation (or retail entry) in the current IPO's public

**Table 6**  
Information spillovers within the sealed-bid hybrid IPO auction mechanism.

	Panel A: Short-term interbank interest rates as a signal for the information spillover regarding aggregate demand of institutional investors				Panel B: Information spillovers from the auction tranche to the public tranche in the current sealed-bid hybrid IPO auction procedure	
	Ln (No. of Retail Investors)		Ln (Retail Oversub)		Ln (No. of Retail Investors)	
	(1) OLS	(2) WLS	(3) OLS	(4) WLS	(5) OLS	(6) WLS
<i>Information spillovers from current IPO's auction tranche</i>						
Ln(No. of Institutional Bidders)					0.1437** (2.29)	0.1944*** (3.17)
Ln(Institutional Oversubscription)					0.1218*** (2.73)	0.1104** (2.45)
Current_ΔInstBidders					0.0054*** (4.31)	0.0044*** (3.40)
Current_ΔInstOversub					0.0034*** (3.72)	0.0027*** (2.70)
<i>Information spillovers via short-term interbank interest rates</i>						
Avg. Repo Rate [auction start, end date]	-7.3564*** (-4.36)	-7.2510*** (-4.25)	-15.4915*** (-8.25)	-14.7590*** (-8.07)	-3.9820** (-2.33)	-2.9742* (-1.71)
<i>Contemporaneous information-spillover measures</i>						
Contem_ΔInstBidders	0.0024* (1.80)	0.0028*** (4.67)	0.0021 (1.66)	0.0013* (1.88)	0.0012 (0.97)	0.0015*** (2.65)
Contem_RetailOversub	0.0001 (1.81)	0.0001 (1.79)	0.0001 (1.88)	0.0002** (2.77)	0.0001* (2.31)	0.0001 (1.90)
Contem_IR	0.2367*** (4.45)	0.2026*** (5.51)	0.2679*** (5.05)	0.3050*** (6.57)	0.2136*** (4.39)	0.1478*** (4.31)
Contem_MktRet	-0.082 (-0.03)	-0.8988 (-0.36)	-1.6393 (-0.55)	-0.6239 (-0.22)	1.9702 (0.78)	0.5266 (0.23)
constant	44.8997*** (6.08)	40.4797*** (6.22)	91.6702*** (9.99)	98.4810*** (12.65)	25.9299*** (3.70)	17.8076** (2.76)
Firm- and offer-specific characteristics	Y	Y	Y	Y	Y	Y
Market Microstructure Characteristics	Y	Y	Y	Y	Y	Y
Macroeconomic Characteristics	Y	Y	Y	Y	Y	Y
Year Indicators	Y	Y	Y	Y	Y	Y
Industry Indicators	Y	Y	Y	Y	Y	Y
Market Indicators	Y	Y	Y	Y	Y	Y
Adj R-sqr	59.74 %	60.02 %	73.91 %	72.68 %	63.13 %	63.97 %
N	1003	1003	1005	1005	999	999

This table presents the estimates of cross-sectional regressions that examine the effect of information spillovers from the current IPO's auction tranche on the participation of retail investors in the current IPO's public tranche. Panel A reports the regression results that were used to examine the impact of the trend of short-term interbank interest rates during the current IPO's auction period (as a signal for the information spillover regarding aggregate demand of institutional investors) on the participation of retail investors in the current IPO's public tranche, where the explanatory variable of interest is the average 7-day interbank repo rate between the start date and end date of the current IPO's auction tranche (*Avg. Repo Rate [auction starts, ends]*). Panel B reports the regression results that were used to examine the impact of the institutional participation in the current IPO's auction tranche on the participation of retail investors in the current IPO's public tranche, where the explanatory variables of interest are the natural logarithm of the number of institutional bidders in the current IPO's auction tranche (*Ln(No. of Institutional Bidders)*), the natural logarithm of the overall level of institutional oversubscription in the current IPO's auction tranche (*Ln(Institutional Oversubscription)*), the difference between the number of large institutional bidders and the number of small institutional bidders in the current IPO's auction tranche (*Current\_ΔInstBidders*), and the oversubscription difference between large and small institutional bidders in the current IPO's auction tranche (*Current\_ΔInstOversub*). Variable definitions are summarised in Appendix 1. An array of IPO year, industry, and market indicator variables are included but not reported. Cluster (year and industry) adjusted robust *t*-statistics are reported in parenthesis. \*, \*\*, and \*\*\* denote statistical significance at the 10 %, 5 %, and 1 % levels, respectively.

tranche. Surprisingly, the results show that the number of retail investors entering the current IPO's public tranche is against the trend of short-term interbank interest rates during the current IPO's auction period, as shown by the negative and significant coefficient of the spillover variable *Avg. Repo Rate*. This result is inconsistent with Hypothesis 3a. It appears that retail investors do not perceive the level of short-term interbank interest rates as a signal of institutional aggregate demand spilling over from the current IPO's auction tranche, although their entry decisions are strongly related to the trend of short-term interbank interest rates.<sup>31</sup> Hence, our finding is in sharp contrast to the prediction of [Chowdhry and Sherman \(1996\)](#), who con-

<sup>31</sup> Assuming that if retail investors perceive the aggregate demand information of institutional investors from the trend of short-term interbank rates, then the significantly negative correlation implies that they are inclined to participate in the offerings that are less interesting to institutional investors. Obviously, this is inconsistent with cascade/herding theory. Moreover, later empirical analysis shows that retail investors are more inclined to engage in the offerings that have more institutional investors involved. Therefore, retail investors seem to not discern the level of short-term interest rates as a signal of the institutional demand spillover.

jecture that information about sophisticated investors' aggregate demand will become public knowledge and spill over into unsophisticated investors' demand via short-term interest rates if investors are required to pay for all their subscriptions at the time of the offering. Apparently, our empirical result implies that retail investors regard an increase in short-term interbank interest rates as an important signal to avoid engaging in the current IPO's public tranche. This is probably because retail investors interpret a high-interest-rate environment as an increase in their opportunity costs (or transaction costs), as demonstrated by [Fung et al. \(2004\)](#) and [Leung and Menyah \(2006\)](#), who state that IPO investors bear the opportunity cost of lost interest income on their subscription funds in a setting where the subscription funds are tied up without earning interest.<sup>32</sup>

As a robustness check, as shown in columns 3 and 4 of [Table 6](#) Panel A, we replicated the regression analysis using the natural logarithm of the overall level of retail investors' oversubscriptions in the current IPO's public tranche as the dependent variable. The estimated coefficient of the spillover variable *Avg. Repo Rate* remains negative and significant at the 1 % level, which indicates that our results are not driven by the way we have defined retail participation.

In addition to the seven-day interbank repo rate, there are two key short-term interbank interest rates in China's interbank market: the China Interbank Offer Rate (CHIBOR) and Shanghai Interbank Offer Rate (SHIBOR). We re-estimated regression specifications (1) and (2) using either *Avg. CHIBOR* or *Avg. SHIBOR* to replace the spillover variable *Avg. Repo Rate*.<sup>33</sup> There are few changes in significance and no changes in signs, which does little to affect our conclusion.

Next, given that retail investors may get rough information about institutional participation (or institutional aggregate demand) from stockbrokers, financial gurus, and/or other investors ([Chowdhry and Sherman, 1996](#); [Amihud et al., 2003](#); [Cao et al., 2016](#)), we investigated whether retail investors in a sealed-bid context react directly to the participation of institutional investors in the current IPO's auction tranche. According to Hypothesis 3b, if the information spillover from the auction tranche to the public tranche takes place within the current sealed-bid hybrid IPO auction mechanism, then we expected that the entry of retail investors into the current IPO's public tranche would be positively related to the number of institutional bidders entering the current IPO's auction tranche.

Panel B of [Table 6](#) reports the estimates of the cross-sectional regressions (OLS and WLS) that have been used to examine the impact of the participation of institutional investors in the current IPO's auction tranche on the entry of retail investors into the current IPO's public tranche, where the dependent variable is the natural logarithm of the number of retail investors ( $\ln(\text{No. of Retail Investors})$ ). Specifically, as shown in columns (3 and 4) of Panel B, the natural logarithm of the number of institutional bidders ( $\ln(\text{No. of Institutional Bidders})$ ), as our primary measure of the information spillover of the participation of institutional investors in the current IPO auction, is introduced simultaneously into the regression analysis along with the control variables.<sup>34</sup> As expected, the estimated coefficient for the  $\ln(\text{No. of Institutional Bidders})$  is positive and significant at the 5 % level, which suggests that retail investors are inclined to learn from and follow the auction participation of institutional investors, even when the relevant information is not publicly available at the time of the current offering phase. Although IPO placement in China adopts a sealed-bid hybrid selling approach, information about the participation of institutional investors in the current IPO's auction tranche still spills over and directly affects the participation of retail investors in the current IPO's public tranche. This result lends support to the argument of [Ljungqvist et al. \(2003\)](#), and [Derrien and Womack \(2003\)](#) that a hybrid IPO placement method is likely to trigger cascading demand, and it also extends the findings of [Neupane and Poshakwale \(2012\)](#), and [Khurshed et al. \(2014\)](#) to include the evidence that a pattern of learning between sophisticated investors and unsophisticated investors possibly takes place in a sealed-bid IPO selling environment. In terms of the economic magnitude, a 1 % change in the number of institutional bidders engaging in the current auction tranche results in a 0.20 % ( $\approx 100^* [1.01^{0.1944} - 1]$ ) change in the number of retail investors participating in the current public tranche, while holding all other variables constant. The adjusted *R*-squared value suggests that the variables included in the column (4) regression explain 63.01 % of the cross-sectional variation in the natural logarithm of the number of retail investors entering the current IPO.

Endogeneity may be a concern in the regressions shown in columns (3) and (4), because the explanatory variables of the  $\ln(\text{No. of Institutional Bidders})$  and  $\ln(\text{Institutional Oversubscription})$  – which were treated as dependent variables in our previous regression analyses – may be endogenously determined by other factors. Hence, before we could decide whether it was necessary to use an instrumental variable approach to mitigate endogeneity, we first had to determine if the two explanatory variables of interest are endogenous. To test for this endogeneity concern, we carried out a formal Durbin-Wu-Hausman test ([Durbin, 1954](#); [Wu, 1973](#); [Hausman, 1978](#)) on the  $\ln(\text{No. of Institutional Bidders})$  and  $\ln(\text{Institutional Oversubscription})$ . The results of the Durbin-Wu-Hausman test on both variables are insignificant (*p*-value = 0.380 and 0.171, respectively), which fails to reject the null hypothesis that the spillover variables of the  $\ln(\text{No. of Institutional Bidders})$  and  $\ln(\text{Institutional Over-$

<sup>32</sup> Like the IPO subscription rules for most Asian markets focused on by [Fung et al. \(2004\)](#), and [Leung and Menyah \(2006\)](#), China's IPO market (during our sample period) also required investors to pay all of their subscription funds at the time of the offering, and the refunds for unsuccessful subscriptions were distributed within a week, but only at face value (without interest). Given the extremely low lottery rate (1.19% on average) over our sample period, retail investors are presumably unwilling to subscribe to IPO shares when the short-term interest rate goes up, because they will face substantial opportunity costs or transaction costs while there is a very low chance of getting IPO allocations.

<sup>33</sup> The definitions of *Avg. CHIBOR* and *Avg. SHIBOR* were determined in the same way as *Avg. Repo Rate*. For brevity, the results of these additional robustness tests are not reported in the table.

<sup>34</sup> The spillover variable of the average short-term interbank rate was retained as a control variable in all regression specifications in Panel B of [Table 8](#). Since it remains negative and significant across all the regressions, the relevant conclusions are unchanged.

subscription) are exogenous concerning the  $\ln(\text{No. of Retail Investors})$ . Consequently, the regression results, as shown in columns (3) and (4), are statistically acceptable.<sup>35</sup>

Collectively, our empirical findings in this subsection demonstrate that information spillovers from the auction tranche to the public tranche exist in the sealed-bid hybrid IPO auction procedure. These findings lend support to our Hypothesis 3b, which implies that information generated by institutional investors in the current IPO auction spills over and directly affects retail investors' participation in the current IPO's public tranche. By contrast, we did not find strong evidence to support Hypothesis 3a.

### 5.3.1. Additional evidence of information spillovers within the sealed-bid hybrid IPO auction procedure

Chowdhry and Sherman (1996) argue that the time-lapse of the offering period will determine the extent to which spillover information about the aggregate demand of sophisticated investors will be learned about and screened by unsophisticated investors. If the offering period is shorter, then there is a lower probability that spillover information related to the aggregate demand of sophisticated investors will be precisely and/or widely known to unsophisticated investors. Similarly, a longer offering period will cause a higher probability of the same. Therefore, if there is information leakage in the current sealed-bid IPO selling procedure, Chowdhry and Sherman (1996) predict that the level of IPO oversubscriptions will increase with an increase in the time-lapse of the offering period. Likewise, if information spillovers from the auction tranche to the public tranche exist in China's sealed-bid hybrid IPO auction procedure, then we expected that the level of retail investors' oversubscriptions in the current IPO's public tranche would be positively related to the duration of the current IPO's auction tranche.

Table 7 presents the estimates of the cross-sectional regressions (OLS and WLS) that examine the relationship between the retail investors' participation in the current IPO's public tranche and the duration of the current IPO's auction tranche. The explanatory variable of interest is the current IPO's auction duration (*Auction Duration*), which is measured using the number of days the current IPO auction lasts. To control for other factors that influence retail investors' participation, all the variables used in our previous analysis for retail participation were introduced into the regressions.

In column (1), we used the natural logarithm of the overall level of retail investors' oversubscriptions in the current IPO's public tranche ( $\ln(\text{Retail Oversubscriptions})$ ) as the dependent variable to measure the extent of retail participation.<sup>36</sup> The estimated coefficient of *Auction Duration* is not significant, which does not suggest that retail investors will place subscription orders more aggressively in the current IPO's public tranche when the current IPO's auction tranche lasts longer. This does not provide support for our Hypothesis 3c.

In summary, not consistent with the prediction of Hypothesis 3c, the empirical results in this subsection demonstrate that the level of retail investors' oversubscriptions in the current IPO's public tranche does not increase with the duration of the current IPO's auction tranche, which provides additional evidence for the presence of information spillovers within the sealed-bid hybrid IPO auction mechanism.

### 5.4. The effect of information spillovers on IPO price discovery

In this subsection, we analyse how this spillover information exerts an influence on the current IPO's price discovery. More specifically, given that Chinese underwriters (or auctioneers) have the discretion to set the offer price for the auctioned IPOs, it is worthwhile investigating whether the spillover information affects the offer price directly through underwriters' revisions (Benveniste et al., 2003) or if it is filtered through the current bids of institutional investors (Cornelli and Goldreich, 2003). In addition, given that participation decisions made by Chinese retail investors are susceptible to behavioural biases, it is also of interest to investigate whether the hybrid IPO auction mechanism (with a separate public tranche) advocated by Jagannathan et al. (2015) and Schnitzlein et al. (2016) can effectively prevent retail participation from affecting IPO price discovery.

Table 8 presents the results of the cross-sectional regressions (OLS and WLS) that were used to analyse the impact of information spillovers from contemporaneous hybrid IPO auction results on the current IPO's price revision, as well as the relationship between the information produced by current investors and the current IPO's price discovery. As a measure of price discovery we use price revision, offer mid, and offer range. As shown in columns (1) and (2), we examine the effect of contemporaneous information spillovers on the current IPO's price discovery by regressing the normalized IPO offer price (*Price Revision*) on a set of contemporaneous information-spillover measures, while simultaneously controlling for idiosyncratic uncertainty, and IPO year-, industry- and listing-venue-related fixed effects. As expected, the estimated coefficient for *Contem\_InstOversub* is positive and significant, which suggests that the offer price of the currently auctioned IPO will be adjusted higher when the oversubscription generated by contemporaneous large institutional investors is, on average, greater than that generated by contemporaneous small institutional investors, which is consistent with our Hypothesis 4a. By contrast, as shown in column (1), the coefficient estimates of the spillover measure of *Contem\_RetailOversub* is

<sup>35</sup> We also use the instrumental variable approach with two-stage least squares regressions (2SLS) to address the potential endogeneity concerns and confirm the validity of our conclusions. We do not report these results for brevity, and they are available upon request.

<sup>36</sup> For this specification, a formal Durbin-Wu-Hausman test was carried out to address the potential endogeneity concern regarding the  $\ln(\text{Institutional Oversubscription})$ . An insignificant value of the Durbin-Wu-Hausman test ( $p\text{-value} = 0.177$ ) does not reject the null hypothesis that the  $\ln(\text{Institutional Oversubscription})$  variable is exogenous with respect to  $\ln(\text{Retail Oversubscriptions})$ .

**Table 7**  
Analysis of information spillover within the sealed-bid IPO selling procedure based on auction duration.

	Ln(Retail Oversubscriptions)		Ln(No. of Retail Investors)	
	(1) OLS	(2) WLS	(3) OLS	(4) WLS
<i>Information production by investors in current auction</i>				
Auction Duration	−0.0489 (−0.89)	−0.05 (−0.99)	0.0107 (0.22)	0.0424 (0.99)
Ln(Institutional Oversubscription)	0.3252*** (11.91)	0.3240*** (12.75)	0.1999*** (7.74)	0.2226*** (8.91)
Avg. Repo Rate [auction start, end date]	−8.6903*** (−5.03)	−8.6944*** (−4.83)	−3.1548* (−1.86)	−2.2075 (−1.27)
<i>Contemporaneous info-spillover measures</i>				
Contem_ΔInstBidders	0.0002 (0.21)	0.0002 (0.31)	0.0013 (1.08)	0.0018** (3.07)
Contem_RetailOversub	0.0001 (1.79)	0.0001* (2.16)	0.0001 (1.69)	0.0001 (1.46)
Contem_IR	0.1994*** (4.46)	0.2010*** (4.95)	0.1960*** (4.05)	0.1451*** (4.22)
Contem_MktRet	2.1337 (0.80)	2.1768 (0.83)	2.4545 (0.95)	1.3442 (0.57)
constant	64.5642*** (7.67)	64.9082*** (8.83)	26.6700*** (3.85)	19.1088** (2.92)
Firm- and offer-specific characteristics	Y	Y	Y	Y
Market Microstructure Characteristics	Y	Y	Y	Y
Macroeconomic Characteristics	Y	Y	Y	Y
Year Indicators	Y	Y	Y	Y
Industry Indicators	Y	Y	Y	Y
Market Indicators	Y	Y	Y	Y
R-sqr	77.66 %	77.60 %	62.20 %	63.01 %
N	1003	1003	1001	1001

This table presents the estimates of cross-sectional OLS regressions that examine the relationship between the retail investors' participation in the current IPO's public tranche and the duration of the current IPO's auction tranche, where the dependent variable used in the column (1) regression is the natural logarithm of the overall level of retail investors' oversubscriptions in the current IPO's public tranche ( $Ln(\text{Retail Oversubscriptions})$ ), and the dependent variable used in the column (2) regression is the natural logarithm of the number of retail investors in the current IPO's public tranche ( $Ln(\text{No. of Retail Investors})$ ). The explanatory variable of interest is the duration of the current IPO's auction tranche ( $\text{Auction Duration}$ ). Variable definitions are summarised in Appendix 1. Cluster (year and industry) adjusted robust  $t$ -statistics are reported in parenthesis. \*, \*\*, and \*\*\* denote statistical significance at the 10 %, 5 %, and 1 % levels, respectively.

insignificant, which suggests that the information produced by contemporaneous retail investors, as reflected in their oversubscriptions to contemporaneous offerings, does not have an impact on the current IPO's price discovery.

As a robustness check, not shown here, we replicated the regression analysis using information-spillover measures from contemporaneous offerings that are subject to a common valuation factor (i.e. they are in the same industry). Our results are robust concerning this alternative definition of contemporaries.

Before moving on to investigate whether the information spillover from contemporaneous IPO auction results affects the price revision directly or if it is incorporated into the offer price through the current bids of institutional investors, it was necessary to figure out how the information produced by investors in the current hybrid IPO auction is used by the underwriter for setting the offer price. As shown in column (1) of Table 8, we examined the impact of information produced by institutional investors in the current IPO's auction tranche on the price discovery, by regressing the normalized IPO offer price ( $\text{Price Revision}$ ) on the oversubscription of institutional investors ( $Ln(\text{Institutional Oversubscription})$ ) and a set of control variables. For this model specification, the estimated coefficient for  $Ln(\text{Institutional Oversubscription})$  is positive and significant at the 10 % level, which suggests that underwriters adjust the offer price higher if institutional investors reveal a stronger demand for the currently auctioned IPO via their bids. This demonstrates that the auction tranche performs the role of information extraction in the hybrid IPO selling mechanism, in which underwriters revise the offer price according to the information produced by institutional investors in the current IPO's auction tranche.

Since Chemmanur et al. (2017) find that underwriters in China's hybrid IPO auctions rely more on the information contained in the oversubscription of large institutional investors than those of small institutional investors when determining the offer price, we further distinguished the oversubscription generated by large and small institutional investors to allow for the possibility that underwriters screen the information produced by these two types of investors. Thus, as shown in column (1), we run a regression analysis using the  $\text{Current\_}\Delta\text{InstOversub}$  to account for the different information precision produced by large and small institutional investors. For this specification, the coefficient of  $\text{Current\_}\Delta\text{InstOversub}$  is positive and significant at the 1 % level, which suggests that underwriters adjust the offer price even higher if large institutional investors reveal a stronger demand than small institutional investors in the current IPO auction tranche. Collectively, the results lend support to our Hypothesis 4b.

**Table 8**

The effect of information spillover on IPO price discovery.

	Price revision		Offer Mid		Offer range	
	(1) OLS	(2) WLS	(3) OLS	(4) WLS	(5) OLS	(6) WLS
<i>Information production by investors in current auction</i>						
Ln(Institutional Oversub)	0.0182** (2.39)	0.0218*** (3.53)	0.0347*** (2.85)	0.0061 (0.67)	0.0772*** (4.95)	0.0764*** (4.87)
Ln(Retail Oversub)	-0.0032 (-0.42)	-0.0025 (-0.34)	0.0296** (2.26)	-0.0088 (-1.03)	-0.0083 (-0.47)	-0.0091 (-0.49)
<i>Contemporaneous info-spillover measures</i>						
Contem_ΔInstOversub	0.0011*** (3.38)	0.0012*** (4.80)	-0.0001 (-0.34)	-0.0001 (-0.29)	0.0009 (1.32)	0.0008 (1.36)
Contem_RetailOversub	0.0001 (-1.58)	-0.0000** (-2.14)	0.0001 (0.81)	0.0001 (1.09)	0.0001 (-0.45)	0.0001 (-0.37)
Contem_IR	0.01 (0.69)	-0.0012 (-0.10)	0.0055 (-0.39)	0.0181** (2.12)	0.0688*** (2.75)	0.0705*** (2.77)
Contem_MktRet	0.4333 (0.49)	0.2204 (0.31)	1.1911 (1.37)	0.448 (0.68)	0.9885 (0.64)	0.9493 (0.62)
constant	2.4839 (1.21)	2.0993 (1.11)	1.3388 (0.47)	0.5612 (0.30)	5.8421 (1.36)	6.0974 (1.37)
Firm- and offer-specific characteristics	Y	Y	Y	Y	Y	Y
Market Microstructure Characteristics	Y	Y	Y	Y	Y	Y
Macroeconomic Characteristics	Y	Y	Y	Y	Y	Y
Year Indicators	Y	Y	Y	Y	Y	Y
Industry Indicators	Y	Y	Y	Y	Y	Y
Market Indicators	Y	Y	Y	Y	Y	Y
Adj R-sqr	36.62 %	34.60 %	40.15 %	41.20 %	34.63 %	33.93 %
N	748	748	1004	1004	1004	1004

This table presents the results of cross-sectional OLS regressions that analyse the impact of information spillovers from contemporaneous hybrid IPO auction results on the current IPO's price revision, as well as the relationship between the information produced by current investors and the current IPO's price revision. Variable definitions are summarised in Appendix 1. An array of IPO year, industry, and market indicator variables are included but not reported. Cluster (year and industry) adjusted robust *t*-statistics are reported in parenthesis. \*, \*\*, and \*\*\* denote statistical significance at the 10 %, 5 %, and 1 % levels, respectively.

Furthermore, we examined whether the information produced by retail investors in the current IPO's public tranche has an impact on the price discovery, by regressing the normalized IPO offer price (*Price Revision*) on the oversubscription of retail investors (*Ln(Retail oversubscription)*)<sup>37</sup> and a set of control variables. The estimated coefficient of *Ln(Retail Oversubscription)* is not significant at conventional levels, which implies that underwriters do not incorporate the information produced by retail investors (i.e. the information regarding their aggregate demand) into the offer price when retail investors are separated from the IPO auction tranche.

Next, as shown in columns (3 and 4) and columns (5 and 6) of Table 8, we went back to address the issue of whether the information spillover from contemporaneous IPO auction results affects the price revision directly or if it is incorporated into the offer price through the current bids of institutional investors. We introduced measures of the information produced by both current and contemporaneous institutional investors into the regression, along with the other variables, where the dependent variable is offer mid and offer range. For the offer range, the coefficient of the information-production measure of the current institutional investors (*Ln(Institutional oversub)*) remains positive and significant at the 1 % level, but the coefficient of the information-spillover measure of contemporaneous institutional investors (*Contem\_ΔInstOversub*) becomes insignificant. When we use Offer mid, the results are similar. Thus, the underwriters use the information spillover from contemporaneous IPO auction results only to the extent that it is conveyed through the reaction of the current institutional investors. This conclusion is broadly consistent with the findings of Cornelli and Goldreich (2003), who document that the underwriters incorporate the information spillover from monthly IPO activities into the offer price only after observing the reaction of institutional investors in the current book-building process to such information.

As a robustness check, we replicated the preceding regression analysis by accounting for contemporaneous offerings subject to a common valuation factor (i.e. they are in the same industry). Evidently, the estimated coefficient for the information-spillover measure of *Contem\_ΔInstOversub* remains insignificant after introducing the information-production measure of *Current\_ΔInstOversub* into the regression.<sup>38</sup>

Following Cornelli and Goldreich's (2003) approach, we further checked the robustness of our conclusion. Specifically, we first obtained the residuals from column (1) regression, which are the components of the IPO price revision that are not due to the information conveyed through the current bids of institutional investors. If information spillovers from contempora-

<sup>37</sup> (*Ln(Retail oversubscription)*) could be endogenously determined. We use 2SLS to address endogeneity problem. These results are not reported for the sake of brevity and available upon request.

<sup>38</sup> Those results are not reported to save space.

neous IPO auction results are incorporated directly into the offer price by underwriters, then we would expect to see a statistically significant relationship between these residuals and the information-spillover measures. By regressing these residuals on the contemporaneous information-spillover measures, the results identify that none of the coefficient estimates of the spillover measures is significant at conventional levels.<sup>39</sup> This confirms our conclusion that the spillover information affects the IPO price revision only as it is filtered through the current bids of institutional investors.

Again, we replicated the preceding analysis using the information spillovers from contemporaneous offerings that are subject to a common valuation factor. Likewise, we used the residuals from column (1) regression as the dependent variable to capture the portion of the price revision that is not explained by the bidding information of current institutional investors. The results show that there is no statistically significant relationship between these residuals and the contemporaneous information-spillover measures. Thus, our conclusion is not driven by the alternative definition of contemporaries.

To summarize, although the results demonstrate that the information revealed in the announcements of contemporaneous IPO auction results (i.e., the information produced by contemporaneous institutional investors) spills over and affects the price-setting process in the current IPO auction, it arrives through the current bids of institutional investors and not directly via underwriters. According to [Cornelli and Goldreich \(2003\)](#), a possible interpretation of this empirical finding is that underwriters must see the reaction of the current institutional bidders to the spillover information to assess its significance. Furthermore, in agreement with the suggestion of [Jagannathan et al. \(2015\)](#) and [Schnitzlein et al. \(2016\)](#) regarding the design approach for the optimal IPO auction mechanism, we concur that the hybrid IPO auction structure, which is created by adding a separate public tranche, can efficiently prevent the participation of unsophisticated retail investors from disrupting the price-setting process and facilitate the information production of institutional investors.

## 6. The impact of information spillover on IPO event returns<sup>40</sup>

So far, we have examined the information production by current and contemporaneous institutional and retail participation. We do not observe any price information or market reaction during the auction procedure in the hybrid auction mechanisms. Thus, it is not possible to examine the impact of information spillover on any returns during the auction. However, as soon as the company starts trading there are a few important events that we can examine. In this section, we examine such IPO events. We examine IPO underpricing, lockup expiration returns, Buy-and-hold abnormal returns till lockup expiration, and buy-and-hold abnormal returns till one year after the IPO. Prior research has demonstrated that IPO underpricing ([Rock, 1986](#); [Benveniste and Spindt, 1989](#)) and imposing lockup clauses on insiders reduce asymmetric information ([Brau et al., 2005](#)). Hence, we analyse these two events as robustness checks of our results.

In equations 1 and 2, [Table 9](#), we examine the impact of information spillovers on IPO underpricing. Column 1 reports the results from OLS and column 2 reports the results from WLS. We did not find that  $\ln(\text{institutional oversub})$  or  $\ln(\text{Retail oversub})$  is significant in these specifications. We find that  $\text{Contem\_AInstOversub}$  is highly significant and positive. We also find that contemporaneous IPO pricing results ( $\text{Contem\_IR}$ ) and contemporaneous market conditions ( $\text{Contem\_MktRet}$ ) are highly significant and positive. In terms of economic significance, the contemporary market return has the largest impact followed by contemporary underpricing followed by  $\text{Contem\_AInstOversub}$ . In summary, our findings show that demand information supplied by big institutions has a stronger predictive value for IPO initial returns than demand information provided by smaller institutions as measured by  $\text{Contem\_AInstOversub}$ . The results support hypothesis 5a.

We find support for the notion that, that the sensitivity of IPO initial returns to the information contained in IPO oversubscription ratios of institutions and retail investors that can produce less precise information. However, the contemporaneous information production by the difference in large and small institutional investors is more sensitive to IPO underpricing.

The next event we analyse is the lockup expiration return. During the lockup period as the insiders cannot sell their shares the share price is relatively stable. However, when the lockup expires, the information asymmetry is reduced to a great extent as the insiders sell shares. In general, the lockup expiration date returns are negative and often average a 2% drop in returns.

In equations 3 and 4, [Table 9](#), we examine the impact of information spillovers on lockup expiration returns. Column 3 reports the results from OLS and column 4 reports the results from WLS. We find that  $\ln(\text{institutional oversub})$  is significant and positive in these specifications and  $\ln(\text{Retail oversub})$  is negative and significant. However, the magnitude of the coefficients is very small. We find that  $\text{Contem\_AInstOversub}$  and  $\text{Contem\_RetailOversub}$  are highly significant and positive in OLS (equation 3). We also find that contemporaneous IPO pricing results ( $\text{Contem\_IR}$ ) and contemporaneous market conditions ( $\text{Contem\_MktRet}$ ) are not significant. In terms of economic significance, the  $\ln(\text{institutional oversub})$  has the largest impact on lockup expiration returns. In sum, we find that the current institutional oversubscription, contemporary institutional changes among large and small institutions, and contemporary retail oversubscription have a positive impact on the lockup expiration returns. Information produced by the institution and retail investors has a positive impact on the lockup expiration returns.

<sup>39</sup> Using the residuals from either the column (4) or (6) regression as dependent variable led to identical results.

<sup>40</sup> We thank an anonymous referee for suggesting the analysis of various IPO event returns.

**Table 9**

The effect of information spillover on IPO event returns.

	IR		Lockup exp return		BHARtilllockup		BHAR 1YR	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	WLS	OLS	WLS	OLS	WLS	OLS	WLS
<i>Information production by investors in current auction</i>								
Ln(Institutional Oversub)	-0.029*	-0.019	0.0017***	0.0013***	0.0415***	0.0350***	0.1271***	0.1083***
	(-1.84)	(-1.49)	(5.11)	(7.08)	(5.35)	(6.98)	(5.36)	(7.10)
Ln(Retail Oversub)	0.0056	0.0081	-0.0005	-0.0009***	-0.0083	-0.0188**	-0.0266	-0.0580***
	(0.24)	(0.52)	(-1.29)	(-3.83)	(-1.12)	(-3.05)	(-1.19)	(-3.10)
<i>Contemporaneous info-spillover measures</i>								
Contem_ΔInstOversub	0.0029***	0.0021***	0.0001**	0.0001	0.0010***	0.0005**	0.0029***	0.0017**
	(3.32)	(3.66)	(2.46)	(1.59)	(3.41)	(2.30)	(3.43)	(2.46)
Contem_RetailOversub	0.0001	0.001	0.0000**	0.0000**	0.0000**	0.0000**	0.0001**	0.0001***
	(-0.21)	(1.11)	(2.41)	(3.02)	(2.48)	(2.98)	(2.42)	(2.87)
Contem_IR	0.1857***	0.1786***	0.0007*	0.0001	0.0203**	0.0099	0.0584**	0.026
	(5.11)	(6.19)	(1.79)	(0.21)	(2.38)	(0.89)	(2.28)	(0.78)
Contem_MktRet	6.7385***	6.5305***	0.0166	0.0291	0.4802	0.5766	1.5307	1.9072
	(3.55)	(4.31)	(0.58)	(1.25)	(0.73)	(0.98)	(0.78)	(1.07)
constant	-21.9604***	-16.8647***	-0.5176***	-0.2085***	-13.4208***	-6.8715***	-41.0707***	-22.0231***
	(-3.27)	(-3.38)	(-4.69)	(-2.65)	(-5.46)	(-3.60)	(-5.50)	(-3.81)
Firm- and offer-specific characteristics	Y	Y	Y	Y	Y	Y	Y	Y
Market Microstructure Characteristics	Y	Y	Y	Y	Y	Y	Y	Y
Macroeconomic Characteristics	Y	Y	Y	Y	Y	Y	Y	Y
Year Indicators	Y	Y	Y	Y	Y	Y	Y	Y
Industry Indicators	Y	Y	Y	Y	Y	Y	Y	Y
Market Indicators	Y	Y	Y	Y	Y	Y	Y	Y
R-sqr	76.58 %	73.45 %	23.38 %	15.05 %	27.39 %	16.79 %	27.50 %	17.12 %
N	994	994	994	994	1004	1004	994	994

This table presents the results of cross-sectional OLS regressions that analyse the impact of information spillover from contemporaneous hybrid IPO auction results on the current IPO's price revision, as well as the relationship between the information produced by current investors and the current IPO's price revision. Variable definitions are summarised in Appendix 1. An array of IPO year, industry, and market indicator variables are included but not reported. Cluster (year and industry) adjusted robust *t*-statistics are reported in parenthesis. \*, \*\*, and \*\*\* denote statistical significance at the 10 %, 5 %, and 1 % levels, respectively.

We also examine the buy-and-hold abnormal returns till the lockup expiration. In equations 5 and 6, Table 9, we examine the impact of information spillovers on buy-and-hold returns till lockup expiration. Column 5 reports the results from OLS and column 6 reports the results from WLS. We find that *Ln(institutional oversub)* is significant and positive in these specifications and *Ln(Retail oversub)* is negative and significant. We find that *Contem\_ΔInstOversub* and *Contem\_RetailOversub* are highly significant and positive. We also find that contemporaneous IPO pricing results (*Contem\_IR*) are significant and positive in the OLS specification (equation 5). However, contemporaneous market conditions (*Contem\_MktRet*) are not significant. In terms of economic significance, the *Ln(institutional oversub)* has the largest impact on BHAR till lockup expiration. In sum, we find that the current institutional oversubscription, contemporary institutional changes among large and small institutions, and contemporary retail oversubscription have a positive impact on the lockup expiration returns. Information produced by the institution and retail investors has a positive impact on the BHAR till lockup expirations.

Finally, we examine the buy-and-hold abnormal return and the impact of information production by institutional and retail investors. In equations 7 and 8, Table 9, we examine the impact of information spillovers on buy-and-hold returns after one year of IPO. Column 7 reports the results from OLS and column 8 reports the results from WLS. We find that *Ln(institutional oversub)* is significant and positive in these specifications and *Ln(Retail oversub)* is negative and significant only in Column 8 (WLS). We find that *Contem\_ΔInstOversub* and *Contem\_RetailOversub* are highly significant and positive. We also find that contemporaneous IPO pricing results (*Contem\_IR*) are significant and positive in the OLS specification (equation 7). However, contemporaneous market conditions (*Contem\_MktRet*) are not significant. In terms of economic significance, the *Ln(institutional oversub)* has the largest impact on BHAR. In sum, we find that the current institutional oversubscription, contemporary institutional changes among large and small institutions, and contemporary retail oversubscription have a positive impact on the BHAR. Information produced by the institution and retail investors has a positive impact on the BHAR. Overall, the results in this section support hypothesis 5b.

All in all, in this section we find evidence that the information produced by the current and contemporaneous institutional and retail investors is valuable for different IPO event returns, even after one year of the IPO.

## 7. Heterogeneity analysis

### 7.1. The underlying mechanisms of contemporaneous information spillovers on institutional participation

In this section, we partition our sample into subsamples to analyse the heterogeneity of our results to shed light on the underlying mechanisms of information spillover on institutional participation. We partition our sample IPOs by size, tech and others, high/low market volatility and high/low political uncertainty. First, we divide the sample IPOs by size. As the size is a measure of information asymmetry, we divide the IPOs by size. Larger IPOs are defined as IPOs which are greater than the median size and the smaller IPOs are lower than the median size. For both samples, *Contem\_AInstOversub* and contemporaneous IPO pricing results (*Contem\_IR*) are significant and positive. However, the magnitude of the coefficients is different. If the average oversubscription difference between contemporaneous large and small institutional investors increases 10 times, while holding all other variables constant, then the number of institutional bidders in the current IPO's auction tranche is expected to increase by 8.00 % for the larger IPOs, while the number is 6.28 % for smaller IPOs. The (*Contem\_IR*) coefficient is 0.2855 for larger IPOs and 0.1220 for smaller IPOs. The results show that in larger IPOs where information asymmetry is smaller the information production by oversubscription difference between contemporaneous large and small institutional investors has more impact on institutional participation (see Table 10).

Then we divide the IPOs by high tech and others. As high-tech companies are difficult to value hence, we partition the sample by high tech and others. The oversubscription difference between contemporaneous large and small institutional investors (*Contem\_AInstOversub*) is not significant in the high tech sample, however, the coefficient is highly significant in the other sample. This shows that for the companies that are difficult to value *Contem\_AInstOversub* does not produce much information. Contemporaneous IPO pricing results (*Contem\_IR*) are significant and positive in both samples. However, the magnitude of the coefficient is slightly higher in the high-tech sub-sample (see Table 10).

Next, we divide the sample by high market volatility and low market volatility. When market volatility is high then the information production might be less precise and valuable. The oversubscription difference between contemporaneous large and small institutional investors (*Contem\_AInstOversub*) is significant in both samples, but the magnitude of the coefficients is very different. If the average oversubscription difference between contemporaneous large and small institutional investors increases 10 times, while holding all other variables constant, then the number of institutional bidders in the current IPO's

**Table 10**  
The Underlying mechanisms of contemporaneous information spillovers on institutional participation.

	(1) Large IPOs	(2) Small IPOs	(3) High tech	(4) Others	(5) High market volatility	(6) Low market volatility	(7) High policy Uncertainty	(8) Low Policy Uncertainty
<i>Contemporaneous info-spillover measures</i>								
<i>Contem_AInstOversub</i>	0.0077*** (5.62)	0.0061*** (4.37)	0.0026 (1.61)	0.0090*** (7.55)	0.0034*** (2.81)	0.0089*** (5.30)	0.0050** (2.43)	0.0029*** (3.71)
<i>Contem_RetailOversub</i>	-0.0001 (-1.51)	0.001 (0.54)	0.0002 (1.54)	-0.0001 (-1.52)	0.001 (0.38)	0.001 (-0.07)	-0.0001 (-0.91)	0.0001* (2.55)
<i>Contem_IR</i>	0.2855*** (4.00)	0.1220** (2.10)	0.2102*** (2.78)	0.1546*** (3.24)	0.1552*** (3.60)	0.2435** (2.28)	-0.1597 (-1.38)	0.2145*** (5.21)
<i>Contem_MktRet</i>	-5.4424 (-1.52)	-3.6599 (-0.94)	-4.0626 (-0.95)	-4.6843 (-1.46)	-7.6438* (-2.31)	-5.0947 (-1.18)	-5.9226 (-1.03)	6.3780* (2.28)
constant	81.5128*** (7.89)	75.9731*** (7.86)	113.8154*** (9.71)	72.8245*** (9.37)	74.9454*** (7.27)	79.9484*** (6.48)	138.7154*** (5.31)	41.9309 (1.31)
Firm- and offer-specific characteristics	Y	Y	Y	Y	Y	Y	Y	Y
Market Microstructure Characteristics	Y	Y	Y	Y	Y	Y	Y	Y
Macroeconomic Characteristics	Y	Y	Y	Y	Y	Y	Y	Y
Year Indicators	Y	Y	Y	Y	Y	Y	Y	Y
Industry Indicators	Y	Y	Y	Y	Y	Y	Y	Y
Market Indicators	Y	Y	Y	Y	Y	Y	Y	Y
R-sqr	72.80 %	71.07 %	75.06 %	70.24 %	63.01 %	68.09 %	63.37 %	69.74 %
N	508	482	360	624	505	478	426	557

This table presents the estimates of cross-sectional WLS regressions that analyse the impact of contemporaneous information spillovers on the entry of institutional investors into the current IPO auction. The dependent variable for each regression is the natural logarithm of the number of institutional bidders in the current IPO's auction tranche. The independent variables of interest are two information-spillover measures: *Contem\_AInstOversub* is the average difference in oversubscription between large and small institutional investors as revealed in the announcements of the results of contemporaneous IPO auction tranches; *Contem\_RetailOversub* is the average oversubscription of retail investors as revealed in the announcements of the results of contemporaneous IPO public tranches. Variable definitions are summarised in Appendix 1. Large and small IPOs are defined as larger than the median (600 mil) and smaller than the median. High tech is high IPOs and others are all other industry IPOs. High and low market volatility is categorised as higher than and lower than median market volatility (0.22). High and low Policy uncertainty is defined as higher and lower than median policy uncertainty (114). Cluster (year and industry) adjusted robust *t*-statistics are reported in parenthesis. \*, \*\*, and \*\*\* denote statistical significance at the 10 %, 5 %, and 1 % levels, respectively.

auction tranche is expected to increase by 3.45 % in the highly volatile period, while the number is 9.31 % during the low volatile period. Contemporaneous IPO pricing results (*Contem\_IR*) have more impact during the low volatility period compared to the high volatility period. Contemporary market return (*Contem\_MktRet*) has a negative and significant impact during the high volatility period as expected (see Table 10).

Finally, we look at the high political uncertainty period and low political uncertainty period. Almost all the explanatory variables are significant in the low political uncertain period. Even contemporary retail oversubscription is positive and significant in the low political uncertain period. As the Chinese market is a controlled economy, during low political uncertainty all the information production channels work while during the high political uncertainty nothing works. In sum, the results in this section show that information asymmetry, difficult to value companies, market volatility, and political uncertainty has an impact on the information production by the investors.

## 7.2. The underlying mechanisms of information spillovers within the sealed-bid hybrid IPO auction mechanism

In this section, like the previous section, we partition our sample into subsamples to analyse the heterogeneity of our results to shed light on the underlying mechanisms of information spillover on retail participation. We partition our sample IPOs by size, tech and others, high/low market volatility and high/low political uncertainty. First, when we divide the sample IPOs by size as a measure of information asymmetry, we find interesting results. The current institutional participation is positive and significant in both sub-samples. However, the magnitude of the coefficient is higher for large IPOs. The oversubscription difference between contemporaneous large and small institutional investors (*Contem\_ΔInstOversub*) is negative and significant for large IPOs and the average repo rate is negative and significant for small IPOs. Contemporaneous IPO pricing results (*Contem\_IR*) are significant for both sub-samples, however, it has a larger impact on large IPOs (see Table 11).

Next, we partition the IPOs by high tech and others. The number of current institutional bidders has a similar impact on retail participation in both groups of IPOs. The average repo rate has a negative impact on the other IPOs. Contemporary retail oversubscription has a positive and significant impact on retail participation in the other IPOs (see Table 11).

**Table 11**  
Underlying mechanisms of Information spillover within the sealed-bid hybrid IPO auction mechanism.

	(1) Large IPOs	(2) Small IPOs	(3) High tech	(4) Others	(5) High market volatility	(6) Low market volatility	(7) High policy Uncertainty	(8) Low Policy Uncertainty
<i>Information production by investors in current auction</i>								
Ln(No. of Institutional Bidders)	0.3756*** (7.11)	0.2082*** (3.94)	0.3484*** (5.39)	0.3442*** (7.34)	0.5281*** (9.38)	0.1861*** (3.63)	0.1845*** (3.64)	0.6414*** (12.06)
Current_ΔInstOversub	-0.0030*** (-2.79)	0.0015 (1.30)	-0.0004 (-0.32)	-0.0013 (-1.34)	-0.0026*** (-2.84)	0.0004 (0.30)	-0.0015 (-1.03)	-0.0029*** (-3.26)
Avg. Repo Rate	-2.6797 (-1.10)	-6.2885** (-2.59)	-2.0477 (-0.69)	-4.2557* (-1.99)	-2.0745 (-0.94)	-4.645 (-1.74)	-4.7554 (-1.67)	-0.2335 (-0.11)
<i>Contemporaneous info-spillover measures</i>								
Contem_ΔInstOversub	0.0005 (0.33)	-0.0018 (-1.48)	-0.0005 (-0.35)	-0.0009 (-0.78)	0.0012 (1.09)	-0.0027 (-1.68)	-0.0045** (-2.60)	0.0002 (0.23)
Contem_RetailOversub	0.0001* (1.73)	0.0001 (1.64)	0.0001 (1.39)	0.0001** (2.25)	0.001 (0.58)	0.0001 (1.16)	-0.0001 (-0.49)	0.001 (-0.16)
Contem_IR	0.4780*** (6.25)	0.1384** (2.85)	0.2655*** (3.73)	0.1520*** (3.44)	0.0386 (1.05)	0.7352*** (7.38)	0.7334*** (7.78)	-0.0313 (-0.90)
Contem_MktRet	3.6979 (0.99)	-3.0776 (-0.94)	-5.7208 (-1.39)	1.7167 (0.57)	-2.7904 (-0.90)	2.0544 (0.51)	3.6646 (0.78)	-7.0362** (-2.69)
constant	27.1538* (2.31)	33.8124*** (3.79)	29.1884* (2.35)	20.9503** (2.62)	15.6784 (1.50)	54.4256*** (4.55)	68.1062** (3.19)	-4.1874 (-0.42)
Firm- and offer-specific	Y	Y	Y	Y	Y	Y	Y	Y
Market microstructure characteristics	Y	Y	Y	Y	Y	Y	Y	Y
Macroeconomic Characteristics	Y	Y	Y	Y	Y	Y	Y	Y
Year Indicators	Y	Y	Y	Y	Y	Y	Y	Y
Industry Indicators	Y	Y	Y	Y	Y	Y	Y	Y
Market Indicators	Y	Y	Y	Y	Y	Y	Y	Y
R-sqr	71.10 %	55.96 %	61.64 %	65.18 %	64.66 %	61.10 %	51.82 %	70.31 %
N	503	479	357	619	502	473	423	552

This table presents the estimates of cross-sectional WLS regressions that examine the effect of information spillovers from the current IPO's auction tranche on the participation of retail investors in the current IPO's public tranche. The dependent variable used in the other regressions is the natural logarithm of the number of retail investors in the current IPO's public tranche. Variable definitions are summarised in Appendix 1. Large and small IPOs are defined as larger than the median (600 mil) and smaller than median. High tech is high IPOs and others are all other industry IPOs. High and low market volatility is categorised as higher than and lower than median market volatility (0.22). High and low Policy uncertainty is defined as higher and lower than median policy uncertainty (114). Cluster (year and industry) adjusted robust *t*-statistics are reported in parenthesis. \*, \*\*, and \*\*\* denote statistical significance at the 10 %, 5 %, and 1 % levels, respectively.

Then, we divide the sample by high market volatility and low market volatility. When market volatility is high then the information production might be less precise and valuable. The results show that when the market volatility is higher the current institutional demand is strongly positively related to retail participation. The oversubscription difference between contemporaneous large and small institutional investors (*Contem\_InstOversub*) is negative and significant for the high volatility period. Contemporaneous IPO pricing results (*Contem\_IR*) are significant only for the low market volatility period (see [Table 11](#)).

Finally, we divide the sample by political uncertainty. The current institutional bidders are positive and significant; however, the impact is higher on retail participation in a low policy uncertainty period. The oversubscription difference between contemporaneous large and small institutional investors (*Contem\_InstOversub*) and Contemporaneous IPO pricing results (*Contem\_IR*) is significant for the high political uncertainty period. Contemporary market return (*Contem\_MktRet*) has a negative and significant impact during the low political uncertainty period as expected. In sum, the results in this section show that information asymmetry, difficult-to-value companies, market volatility, and political uncertainty has an impact on the information production by the investors and participation by the retail investors (see [Table 11](#)).

## 8. Conclusion

In this paper, we examine the effect of information spillovers on investor participation and IPO price discovery in the context of China's hybrid IPO auctions. We report several interesting findings. First, we find that the information produced by institutional investors in contemporaneous IPO auctions has a positive spillover effect on the participation (or entry) of institutional investors in the current IPO auction. This information-spillover effect is stronger among IPOs that share a common valuation factor (i.e., they are in the same industry), which, to some extent, is consistent with the prediction of [Benveniste et al.'s \(2002\)](#) and [Alti's \(2005\)](#) information-spillover models. By contrast, the information generated by retail investors in contemporaneous IPO public tranches does not have a significant influence on institutional participation in the current IPO auction. These results are robust concerning the tests conducted at the investor level by logit regressions.

Second, we find that the reaction of retail investors to the announcements of contemporaneous hybrid IPO auction results is very different from that of institutional investors. Specifically, the information generated by contemporaneous retail investors has a significant impact on the entry of retail investors into the current IPOs' public tranche. By contrast, the information spillover from contemporaneous institutional investors has little association with the participation of retail investors in the current IPO, unless such information spills over from contemporaries in the same industry. These results suggest that retail investors are susceptible to the spillover information that conveys the sentiment or collective mood of the contemporaneous unsophisticated investors prevailing at the time of the offering phase.

Third, we find that, even in a sealed-bid environment, the participation of retail investors in the current IPO's public tranche is significantly influenced by the participation of institutional investors in the current IPO's auction tranche. Fourth, we find that the information produced by institutional investors in contemporaneous IPO auctions spills over and has a positive influence on the price revision of the current IPO. By contrast, the information generated by retail investors in contemporaneous IPO public tranches appears to be less valuable for assessing the current IPO and therefore is not incorporated into the offer price of the current offering.

Finally, we find that the bids submitted by institutional investors in the current IPO auction (in terms of their oversubscription) are informative to the underwriter for choosing an offer price. Moreover, as predicted by [Jagannathan et al. \(2015\)](#) and [Schnitzlein et al. \(2016\)](#), by setting up a separate public tranche for retail investors, the hybrid IPO auction mechanism used in China can prevent the participation of these unsophisticated investors affecting the price-discovery process. This information extraction is not only valid at the auction stage, but they are significant at the IPO stage and Post IPO stage. We also conduct a heterogeneity analysis and find that information asymmetry, difficult to value companies, market volatility, and political uncertainty have an impact on the information production by the institutional investors and participation by the retail investors.

There are some implications of our study. First, the findings of this study suggest that the information spillover from contemporaneous IPO auction results is an important factor that should be considered when analysing the investor participation and price formation in an auction-based IPO market (or in an IPO market that makes investors' bidding information publicly available). Second, by offering evidence on the effectiveness of adding a separate public tranche to prevent unsophisticated investors from disrupting the price-setting process, our results may help to guide the regulator in improving the standard IPO auction mechanism.

## Data availability

Data will be made available on request.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**Appendix 1 1. A summary of the variable definitions**

Variable	Description
<i>Dependent variables</i>	
Ln(No. of Institutional Bidders)	The natural logarithm of the number of institutional bidders entering the current IPO's auction tranche.
Ln(Institutional Oversubscription)	The natural logarithm of the overall level of institutional oversubscription (i.e. the total number of shares ordered by institutional bidders divided by the number of shares offered by the issuer) in the current IPO's auction tranche.
D_Institutional Participation	An indicator variable that is equal to 1 if the institutional investor participated in the current IPO's auction tranche and 0 otherwise.
Ln(No. of Retail Investors)	The natural logarithm of the number of retail investors entering the current IPO's public tranche.
Ln(Retail Oversubscription)	The natural logarithm of the overall level of retail oversubscription (i.e. the total number of shares ordered by retail investors divided by the number of shares offered by the issuer) in the current IPO's public tranche.
Price Revision (Offer price normalized using the midpoint of the initial filing range)	Following <a href="#">Hanley's (1993)</a> approach, the normalized offer price is calculated using the change of the final offer price relative to the midpoint of the initial filing range (also known as the indicative price range).
Offer mid	Offer mid is defined as the offer price divided by the mid-point of the upper and lower limit of the offering price
Offer range	The offer range is defined as the difference between the upper and lower limit divided by the offer price
Underpricing	Underpricing is defined as the closing market price minus the offering price divided by the offering price
Lockup BHAR	Lockup BHAR is the IPO firm's buy-and-hold abnormal return over the lock-up period (three calendar months) after IPO
Lockup Exp return	IPO firms lockup expiration returns for (0,1) event days relative to lockup expiration
BHAR 1 yr	IPO firms Buy-and-hold abnormal returns for a year after IPO.
<b>Independent variables</b>	
<i>Information spillovers from contemporaries</i>	
Contem_ΔInstOversub	The difference between average oversubscriptions submitted by contemporaneous large and small institutional investors revealed in the announcements of the results of contemporaneous IPO auction tranches occurring between the current IPO firm <i>i</i> 's filing date and its final offering date.. The criteria for dividing the institutional investors into large and small groups is based on the median value of the size of their asset management. In particular, the measure of institutional investors' asset management varies by their company type: the size of assets managed by <i>mutual funds</i> is measured using the scale of their portfolio management; the size of <i>Qualified Foreign Institutional Investors' (QFII)</i> asset management is measured using their investment quotas in China; the size of the asset management of other institutional investors (including <i>securities, insurance, financial and trust companies</i> ) is measured using their registered capital. An institutional investor will be assigned to the large group if the size of its asset management is greater than the median value of assets managed by all institutional investors.
Contem_ΔInstBidders	The difference between average numbers of contemporaneous large and small institutional investors revealed in the announcements of the results of the contemporaneous IPO auction tranches occurring between the current IPO firm <i>i</i> 's filing date and its final offering date.. The approach used for grouping large and small institutional investors coinciding with the aforementioned method (see

## Appendix (continued)

Variable	Description
Contem_ΔInstShares	Contem_ΔInstOversub for details). The difference between an average number of shares ordered by contemporaneous large and small institutional investors revealed in the announcements of the results of contemporaneous IPO auction tranches between the current IPO firm <i>i</i> 's filing date and its final offering date.. The approach used for grouping large and small institutional investors is coinciding with the aforementioned one.
Contem_ΔInstAggressive	The difference between average numbers of contemporaneous large and small institutional investors who submitted aggressive bidding orders was revealed in the announcements of the results of contemporaneous IPO auction tranches occurring between the current IPO firm <i>i</i> 's filing date and its final offering date.. The approach used for grouping large and small institutional investors coincides with the aforementioned method (see Contem_ΔInstOversub for details). If the number of shares ordered by an institutional investor is greater than the total number of shares offered by the auction tranche in which this investor participated, then this institutional investor is defined as an aggressive bidder in that auction tranche.
Contem_RetailOversub	The average oversubscription of retail investors revealed in the announcements of the results of contemporaneous IPO public tranches occurring between current IPO firm <i>i</i> 's filing date and its final offering date.
Contem_IR	The average one-day initial return of the contemporaneous offerings occurs between the current IPO firm <i>i</i> 's filing date and its final offering date.
Contem_MktRet	The return on the market index occurs between the current IPO firm <i>i</i> 's filing date and its final offering date, where the index uses either the Shanghai Stock Exchange (SSE) Index or Shenzhen Stock Exchange (SZSE) Index depending on the listing venue of the IPO firm.
<i>Information spillovers from the current (sealed-bid) IPO auction tranche</i>	
Current_ΔInstOversub	The oversubscription difference between large and small institutional bidders was generated in the current IPO's auction tranche. The approach used for grouping large and small institutional investors coincides with the aforementioned method (see Contem_ΔInstOversub for details).
Current_ΔInstBidders	The difference between the number of large and small institutional bidders entering the current IPO's auction tranche.
Avg. Repo Rate [auction start, end date]	The average of the seven-day interbank repo rates between the start date and end date of the current IPO's auction tranche, where the seven-day interbank repo rate is one of the main short-term interbank interest rates in China's interbank market.
Auction Duration [in days]	The number of days between the start date and end date of the current IPO's auction tranche.
<i>Firm- and offer-specific characteristics</i>	
EPS [-3yr, IPO]	The average earnings per share (EPS) of the IPO firm in the most recent three years before its filing. If the firm's IPO prospectus has more than three years of information disclosure about its EPS, the pre-filing window will be extended accordingly.
Leverage [-3yr, IPO]	The average ratio of the IPO firm's total liabilities relative to total assets in the most recent three years before its filing. If the firm's IPO prospectus has more than three years of accounting-information disclosure about its liabilities and assets, the pre-filing window will be extended accordingly.
Ln(Proceeds)	The natural logarithm of the gross proceeds raised by the IPO.

(continued on next page)

## Appendix (continued)

Variable	Description
Ln(Firm Age)	The natural logarithm of one plus the IPO firm's age, where the age is calculated as the difference between the firm's offering year and founding year.
Reputation	We use the annual income rankings of China's securities companies from 2002 to 2012 (particularly in their role as underwriters) published by the Securities Association of China (SAC) as a replacement. Specifically, following Carter and Manaster's (1990, p.1055) method, we use the 2002 ranking as the first reference point, in which the top-five underwriters are treated as in Section A of the "tombstone announcement" and are thereby assigned Grade 9; then, the next five underwriters in this ranking list are treated as in Section B of the "tombstone announcement", and thereby assigned Grade 8; and so on. Next, we reassign the preceding reference point using the 2003 ranking. If any of the underwriters in the 2003 ranking are listed above any of those in Section B from the first reference point, then these new underwriters are assigned Grade 9 and the original group is moved down to lower Grade 8 accordingly, etc. This is done until all rankings from 2002 to 2012 are exhausted.
Non-tradable	The proportion of IPO firm's non-tradable shares relative to the total number of shares outstanding at the time of the offering.
Largest Ownership	The percentage ownership retained by the largest shareholder of the IPO firm at the time of the offering.
D_SOE	An indicator variable that is equal to 1 if the IPO firm is a state-owned enterprise (SOE) and 0 otherwise.
D_Big4	An indicator variable that is equal to 1 if the IPO firm is managed by one of the international Big Four auditors and 0 otherwise.
D_Cross-listing	An indicator variable that is equal to 1 if the A-share IPO firm also has H- and/or B-share offerings (in Hong Kong and Mainland China, respectively), and 0 otherwise.
<i>Market Microstructure</i>	
Market return	Market return calculated on the day of IPO
Market Volatility	Market volatility was calculated over the 90 days before IPO.
Market Abnormal Volume	Abnormal volume is a log of the average abnormal volume in the market calculated over the 90 days prior to IPO.
<i>Macroeconomic Controls</i>	
Policy Uncertainty Index	Newspaper based policy Uncertainty index taken from <a href="https://www.policyuncertainty.com/china_epu.html">https://www.policyuncertainty.com/china_epu.html</a>
Log GDP	Log value of GDP collected from World Bank.
Gross Capital Formation	Gross capital formation as percentage taken from World bank.
Inflation	Inflation as GDP deflator taken from World Bank.
GDP growth	GDP growth taken from World Bank.

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