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JEL classification: D82; G12; G24; G32

Keywords: IPO; underpricing; winner's curse; investor sentiment

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1 Introduction

Underpricing has been a permanent feature of IPO markets around the world. While its level varies over time (Loughran and Ritter, 2004, Lowry and Schwert, 2002) and across markets (Loughran et al., 1994), there is no sign that new issues will cease to be underpriced on average. The persistence of underpricing in IPO markets has motivated a large literature that tries to explain this phenomenon (see e.g., Ljungqvist (2007) for a review). One of the most widely-cited models of underpricing is due to Rock (1986), who offers a theoretically sound reason for why issuers agree to sell underpriced shares in equilibrium. Rock argues that uninformed investors are more likely to be allocated shares in overpriced issues, since allocations in underpriced issues are rationed due to the participation of informed investors. Because of this winner's curse, uninformed investors could refuse to participate in the IPO market. Therefore, the issuers have to attract the uninformed demand by selling shares at a sufficient discount.

Testing Rock's theory of underpricing directly is far from straightforward. It requires bookbuilding data, which is notoriously difficult to obtain due to its proprietary nature (see the discussion in Jenkinson and Jones (2004)). The few papers that offer tests rely on data from the countries where allocation to subscribers can be observed (Koh and Walter (1989), Levis (1990), Keloharju (1993), Amihud et al. (2003)). These papers test two main hypotheses: (1) the relationship between initial returns and allocation rates is negative;[1] and (2) the allocation-weighted average initial return is zero.[2] In terms of the first test, the papers are in agreement and find a strong negative relationship. However, Amihud et al. (2003) note that such a relationship can also be observed if the offer price is set too low by the underwriters due to a misjudgement of the market's expectations. Therefore, the first test cannot provide conclusive evidence. In terms of the second test, there are mixed results. Koh and Walter

[1] Initial return is typically measured as the change between the closing price on the first day of trading and the offer price. Allocation rate is related to the probability of receiving shares. Underpriced issues are likely to yield positive initial returns, and if informed investors as well as uninformed ones participate in such issues, allocation rates go down and a negative relationship between initial returns and allocation rates is expected.

[2] If issue prices are not set at a discount, the average return of uninformed investors, which is reflected by the allocation-weighted initial return (not the equally-weighted return due to the winner's curse), will be negative and uninformed investors will stop participating. The discount pulls the allocation-weighted initial return up to zero (or more), so that uninformed investors can (at least) break even.

(1989) find that uninformed investors earn a zero abnormal return, which is the predicted result. However, Keloharju (1993) shows that while the abnormal return is zero for small orders, it is negative for large ones, which is evidence against Rock's model. Amihud et al. (2003) document a negative abnormal return as well. Levis (1990), on the other hand, finds a low but positive abnormal return that varies with the order size.

It seems that the literature cannot offer conclusive evidence on the theory by testing the two hypotheses described above. Tests of the first one supports the theory, but fails to rule out a competing hypothesis. Tests of the second one yields conflicting results across the papers and makes it hard to judge the validity of the model.

This paper tests Rock's model on the basis of novel hypotheses, as well as the two traditional ones discussed above. The motivation is to shed more light on the empirical validity of the model from new angles. At the heart of Rock's model lies the assumption that there are informed investors in the market who can avoid cold (overpriced) issues and target hot (underpriced) ones only. Testing this assumption is critical, since there is no winner's curse in the absence of informed demand. We hypothesize that informed investors will be more skilled in cherry-picking hot IPOs and that they realize higher average initial returns as a result. We capitalize on a unique dataset to test these novel hypotheses. Furthermore, unlike previous papers we do not resort to *simulating* the returns of investors, and can calculate the *actual* return of each institutional investor.

The dataset consists of all the 355 IPOs that took place on ChiNext since its launch in October 2009 until the end of October 2012. ChiNext is part of the Shenzhen Stock Exchange (SZSE) and is formed to help high-technology Chinese firms gain access to public equity markets. We have data on initial returns and allocation rates for all the 355 IPOs, but thanks to a change in listing rules that resulted in additional disclosure, we have complete bookbuilding data on bids and allocations at the institution level for the 214 IPOs that took place between December 2010 and October 2012. The data is mainly hand collected from documents that issuers are required to publish on websites designated by the regulator. The institutional setting allows us to test Rock's model, since there is no underwriter discretion

in allocations. In all of the 214 IPOs the shares are allocated via balloting.[3]

The only significant variation between our setting and the one modeled in Rock (1986) is the price uncertainty. In Rock's setting, investors know the offer price when they decide to subscribe for shares. In our setting, institutions do not know the offer price when they submit non-binding step bids (series of limit bids) in the bookbuilding period. Only the bids that end up above the offer price, which is set at the end of the bookbuilding period, remain valid in the subscription period.[4] We use this variation between the settings to our advantage. In particular, we hypothesize on how institutions and underwriters should behave if Rock's model allowed former to influence the offer price. We argue that uninformed institutions will take the matter of winner's curse into their own hands and ensure a price discount. We also hypothesize that underwriters will revise the offer price upward partially when the discount demanded by uninformed institutions is more than necessary.

The main results of the paper are as follows. In both sub-sample periods (141 IPOs before the change in listing rules, 214 IPOs after), there is a negative relationship between initial returns and allocations; and the allocation-weighted initial returns are substantially lower than equal-weighted ones. While these results appear to be consistent with Rock's model, there is cause for caution. In the first sub-sample period, there were only 2 IPOs with negative initial returns. This demonstrates that the tests of traditional hypotheses lack power, since they yield results consistent with the model even when there is no winner's curse.

In the second sub-sample period more than 20% of the IPOs yielded negative initial returns. Therefore, there is a real risk of winner's curse in this period if informed institutions are present. Our tests provide evidence for the existence of institutions that can avoid overpriced IPOs and spot underpriced ones. In particular, we find that some institutions are significantly more skilled in cherry-picking hot IPOs than others. If institutions with such skill are genuinely informed, they should also bid strategically in the bookbuilding stage, so that

[3]This also alleviates the concern raised by Amihud et al. (2003) about the ex-post determination of the allocation mechanism that is present in the settings of Koh and Walter (1989), Levis (1990) and Keloharju (1993).

[4]For instance, if an institution bid 1 million shares at 21 yuans, 2 million at 20 yuans, and 4 million at 18 yuans, and if the offer price is set at 19 yuans, the institution can subscribe for at most 3 million shares at 19 yuans.

they increase their chances of allocation in the subscription stage when balloting takes place. Indeed, the institutions skilled in cherry-picking are successful in winning share allocations in hot issues, such that they experience much higher average initial returns than institutions with no skill in cherry-picking.

The existence of institutions that can avoid overpriced issues and that experience higher average initial returns lends support to the winner's curse hypothesis. However, we find that institutions with no cherry-picking skill also realize high average initial returns, albeit not as high as the skilled ones. At first sight this contradicts Rock's model, since it constrains abnormal profits of uninformed institutions to zero, but the results are consistent with the version of his model in which the discount that is applied to attract uninformed demand is deeper than the required minimum level. This attenuates the winner's curse, implies oversubscription for overpriced as well as underpriced IPOs, which is the case in our sample, and can lead to positive abnormal returns to uninformed investors. We argue that the fact that institutions can influence the offer price is the cause of the excessive discount. We provide evidence that the price demanded by the institutions in bookbuilding is significantly below the minimum of the initial price range, let alone its midpoint, which is assumed to reflect the underwriter's expectation of the aftermarket price (Cornelli and Goldreich, 2003). Furthermore, there is evidence that underwriters seem to yield to the pressure from issuers when institutions demand a very low price, such that the difference between the price set for the issue and the price demanded by institutions is generally positive, and higher when the price demanded by institutions is lower. In other words, underwriters seem to partially adjust the offer price upwards in order to strike a balance between institutional investors and issuers.

Finally, we investigate why the winner's curse emerged in the second sub-sample period, while it was absent in the first one. Derrien (2005), Cornelli et al. (2006), and Ljungqvist et al. (2006) present models in which the overoptimism of retail investors cause underwriters to price issues above their fundamental values. Overpriced issues still yield positive initial returns due to the sentiment of retail investors. Consistent with these models and the results in Clarke et al. (2013), we find that the unmet demand of retail investors (a proxy of their

overoptimism) is a strong driver of initial returns in the first period.[5] Furthermore, like Purnanandam and Swaminathan (2004), we find that IPOs are overpriced relative to their peers in this period. However, the results also indicate that as ChiNext becomes a more mature market retail investors start acting more rationally, such that the unmet retail demand becomes more elastic to the unmet institutional demand, which is a strong indicator of initial returns. In the second sub-sample period, institutional investors are no longer guaranteed positive initial returns due to the fading overoptimism. The winner's curse emerges as a real risk for uninformed institutions, who consequently bid strategically low to ensure a discount. Consistent with this view, unlike the first-period IPOs, the second-period ones are underpriced relative to their peers.

It is also worth emphasizing that uninformed retail investors in ChiNext do not suffer from a winner's curse. This is because they can condition their subscription decision on the level of institutional demand, which becomes public information earlier. Löeffler et al. (2005) and Clarke et al. (2013) study IPO markets in Germany and India respectively. They offer similar arguments on why retail investors in these markets would not suffer from the winner's curse. They argue that the fact that initial returns are on average positive in these markets cannot be consistent with the winner's curse explanation. They provide evidence in favor of the investor sentiment explanation. In ChiNext, while it is true that uninformed retail investors can observe institutional demand when bidding, uninformed institutional investors cannot. Therefore, in our setting it is not the retail investors who demand a discount due to the winner's curse, but the uninformed institutions.

Overall, our results indicate that Rock's model is an important determinant of initial returns in a market where at least some of the uninformed investors cannot condition their subscription on the level of demand by informed investors. The paper is also unique in terms

[5] There is also anecdotal evidence of overoptimism. Days before the launch of ChiNext, the chairman of China Securities Regulatory Commission (the Chinese equivalent of the U.S. Securities and Exchange Commission) stresses that the regulators will closely monitor the exchange's first day of trading and act to prevent excessive speculation (SZSE press release, October 28, 2009). At the same time, the chairman of the SZSE urges retail investors to invest cautiously and not to be in a "blind rush" to bid prices up (SZSE press release, November 2, 2009). Another news item reports that many of the retail investors lack a sufficient understanding of risks involved in trading shares of ChiNext firms and that they exhibit herd behavior (SZSE press release, March 2, 2012).

of demonstrating how the main determinant of initial returns in a market evolves as the market becomes more mature. In the early months following the launch of ChiNext initial returns are mainly driven by the euphoria of retail investors. During this period uninformed institutions do not suffer from a winner's curse, since they anticipate that all IPOs will yield positive initial returns due to the sentiment of retail investors. However, as overoptimism subsides, the risk of having IPOs with negative initial returns grows and in the presence of informed institution that can avoid such issues the winner's curse becomes a more important determinant of initial returns.

The remainder of the paper is organized as follows. We discuss the institutional framework of going public on ChiNext in Section 2. The testable hypotheses are developed in Section 3. In Section 4, we describe the data. Empirical tests are performed in Section 5. Finally, Section 6 concludes.

2 Overview of the institutional framework

China Securities Regulatory Commission (CSRC) is the main regulatory body of capital markets in China. Participants in the IPO market has to abide by the rules set out by the CSRC. Since the launch of ChiNext, there have been two significant revisions in these rules: Decree No. 69 (effective October 11, 2010) and No. 78 (effective May 18, 2012), hereinafter referred to as Revision 1 and Revision 2 respectively. Revision 1, which involves a change in the allocation mechanism, is more significant for our research. It divides our sample into two periods, such that we have complete data on bids submitted by each institution in each IPO in the second period. Revision 2 includes among other changes an increase in the percentage of shares allocated to the institutional offering. Of the 214 IPOs that take place after Revision 1 (i.e., in the second period), only 36 are after Revision 2.

2.1 The process of going public

Once a firm decides to go public on ChiNext, it hires a sponsor to manage its IPO. The sponsor's role is akin to a lead underwriter, so we use these two terms interchangeably. The

sponsor submits the firm's IPO application documents to the CSRC, which either accepts or rejects the application within five working days. If the application is accepted, a red herring prospectus, which contains no price information, is published and a review by the ChiNext Public Offering Review Committee commences. This is a quiet period during which the issue cannot be promoted. At the end of the review, the CSRC makes the approval decision.[6]

Following the CSRC approval, the preliminary prospectus and a notice for the preliminary inquiry are issued. The preliminary inquiry begins the next working day, such that the sponsor goes on a roadshow and meets with institutional investors in Shenzhen, Shanghai, and Beijing over three working days. This is the bookbuilding stage. The issuer and the underwriter set the offer price once this stage is completed. The final prospectus, the order book, and a notice for the online roadshow for retail investors are issued the next day. Finally, subscriptions take place the following day.

There are separate offerings for institutional and retail investors.[7] Up to 20% of shares are offered to institutional investors and the remaining shares are offered to retail investors. In other words, at least 80% of shares are sold to retail investors in the primary market.[8] However, since Revision 2, at least 50% of the shares has to be reserved for the institutional offering. But, when the retail offering is heavily oversubscribed, up to 20% of the shares are clawed back.[9]

Institutional and retail offerings are both heavily oversubscribed.[10] Consequently, there is rationing in share allocations. Before Revision 1, shares were being allocated on the basis of equal proration and balloting has been used since the effect of Revision 1.[11] Balloting for

[6] In the sample, the period between the filing and approval dates lasts about two months on average.

[7] Eligible institutional investors include asset management, securities, financial, investment, and insurance firms. Qualified foreign institutional investors can also participate in the offline subscription. Following Revision 1, institutions *recommended* by the lead underwriter can become participants as well. The rationale for the new rule is to encourage institutions that have a long-term investment horizon take part in the process.

[8] This is a high proportion relative to the markets in other countries. Ljungqvist and Wilhelm Jr. (2002) examine 37 countries and report that institutional investors get twice more shares than retail investors on average.

[9] There were 319 IPOs before Revision 2. 244 of these allocated exactly 20% of the shares to institutions, and the average allocation in the remaining 75 IPOs was 19.7%. Clearly, the 20% limit was a binding constraint and was relaxed with Revision 2. For the 36 IPOs that took place after Revision 2, the average proportion of shares allocated to institutions has increased to 33.5%.

[10] The median coverages are 27.5 and 125 respectively.

[11] With the former mechanism, an institution that bid a price no less than the offer price in the preliminary

the institutional offering takes place on the next working day after the subscriptions, and the one for the retail offering takes place one working day later.

The shares do not start trading immediately after they are allocated. The median number of calendar days between the subscription date and the first-day of trading is 14. In other words, the median firm's shares start trading 2 weeks after its IPO. We control for this time gap when calculating the initial returns.

To summarize, the timeline for a typical IPO following the CSRC approval is as follows:

T-6: The preliminary prospectus and a notice for the bookbuilding are issued.

T-5: Bookbuilding takes place.

T-2: The offer price is set.

T-1: The final prospectus is issued. The order book is published. An online roadshow takes place for retail investors.

T: Subscriptions for the institutional and retail offerings take place.

T+1: Balloting for the institutional offering takes place.

T+2: Balloting for the retail offering takes place. Allocations to institutions are announced.

T+3: Allocations to individuals are announced.

T+14: The shares start trading on ChiNext.

2.2 Bookbuilding and subscription by institutional investors

Bookbuilding takes place during the preliminary inquiry when the lead underwriter meets institutional investors. The lead underwriter provides institutional investors a detailed valuation report. Regulations prevent the contents of this report from being shared with the public.

inquiry is guaranteed an allocation, but the allocation is decreasing in the level of oversubscription. With the latter mechanism, depending on the outcome of balloting, such an institution may not receive any allocation, or if lucky can receive more shares than it would under the former mechanism.

Only after Revision 1, the documents started including the initial price range suggested by the lead underwriter together with the balloting results.

Institutional investors submit limit bids during the bookbuilding stage. Step bids are allowed, such that each investment account of an institution can bid for up to 3 different price levels. The tick size for the prices is 0.01 yuan, and the quantities are submitted in multiples of a minimum quantity bid. The total quantity bid by an investment account is capped by the total number of shares offered in the offline subscription.

At the end of the bookbuilding stage, the firm and the lead underwriter set the offer price according to the order book, the valuation of comparable firms, the financing requirements of the firm, and the industry and market conditions. As we show later, the offer price is set well below the clearing price and usually in the vicinity of the quantity-weighted price of the book.[12]

After the offer price is set, the institutional offering takes place. The workings of the institutional offering is best explained by an example. One of the issuers in the sample offered 12 million shares to institutions. The offer price was set at 13.30 yuan. Only the institutions that had bids at or above the offer price in the preliminary inquiry are eligible to take part in the subscription. In this case, there were 7 such institutions, all of which took part in the subscription. The total quantity demanded by these institutions was 42 million shares, so the issue was covered 3.5 times.

The balloting involved drawing 10 tickets (=12 million shares supply / 1.2 million shares per ticket) out of 35 tickets (=42 million shares demand / 1.2 million shares per ticket). Therefore, for an institution with a single ticket, the probability of receiving share allocation was 0.2857, or inverse of the coverage ratio. The institutions had different numbers of tickets. For instance, two institutions had valid bids for 12 million shares each. Therefore, both of them were holding 10 tickets, whereas others had fewer tickets, as low as a single one. At the end of the balloting, one institution had three winning tickets and got allocated 3.6 million shares, three institutions had two winning tickets and got allocated 2.4 million shares each, and one institution had one winning ticket and got allocated 1.2 million shares. Two

[12]This is consistent with Cornelli and Goldreich (2003).

institutions did not have winning tickets.

2.3 Subscription by retail investors

The retail offering takes place on the same day as the institutional offering. The results of the preliminary inquiry are published before the offerings. Thus, retail investors can actually see the order book and the number of the institutions that took part in the preliminary inquiry. They can use this information when they decide to subscribe for shares in the IPO. They cannot see the identities of institutions, which become public information two days after the offerings when the results of the balloting for institutions are announced.

Retail investors submit single bids at the offer price. The bid has to be a multiple of a minimum quantity bid, which is typically 500 shares. There is a maximum limit for the bid, which is usually 0.1% of the shares offered in the offline subscription.

Like institutional offerings, retail offerings are heavily oversubscribed and shares are allocated through balloting. The issuer used as an example in Section 2.2 offered 48 million shares to retail investors. About 188 thousand individuals subscribed for 4.19 billion shares, yielding a coverage ratio of 87.3. 96,000 tickets, each worth 500 shares, were drawn out of 8.38 million tickets, such that the probability that an individual with a single ticket gets a share allocation was about 1.15%.

As a final note, institutions that take part in the preliminary inquiry cannot participate in the retail offering. This means that if an institution's bid was below the offer price in the preliminary inquiry, there is no way for this institution to purchase the issuer's shares at the offer price in the primary market. If the institution is willing to hold the issuer's shares, it should purchase them in the secondary market. On the other hand, it is not worth for the institution to skip the preliminary inquiry to participate in the retail offering, since: (1) the allocation rates are much lower in retail offerings, and (2) the maximum bid is capped at 0.1% of the shares offered to retail investors.

3 Testable hypotheses

According to Rock's model, issues that are likely to yield high initial returns will attract informed as well as uninformed demand. Therefore, such issues will be characterized by high levels of oversubscription and low rates of allocation.

> H1: There exists a negative relationship between initial returns and the rate of allocation.

Another testable hypothesis is that in a large market uninformed investors expect to earn approximately the risk-free rate.

> H2: Allocation-weighted initial return net of the risk-free rate of return is zero.

H1 and H2 are the two main hypotheses tested in the literature. In this paper, we go beyond them and test other novel ones.

Rock's model rests on the critical assumption that there are informed investors who can avoid cold issues and participate in hot ones only. The adverse selection argument collapses in the absence of informed demand. The dataset allows us to investigate whether informed institutions coexist with uninformed ones in ChiNext. We split IPOs into quartiles on the basis of their initial returns. The top quartile is assigned a value of 4, and the bottom one 1. We define a variable named cherry-picking score CP_{ij} to measure an institution's informedness. For an institution i that participated in issue j, CP_{ij} is equal to the value of the quartile of that issue. An uninformed institution that participates in all issues or that participates randomly is expected to have $\overline{CP}_i = 2.5$. In general, if all institutions are uninformed, the sample mean $\overline{\overline{CP}}$ should center at 2.5 with some dispersion due to luck. However, if there are informed institutions as assumed by the model, their presence will cause a shift in $\overline{\overline{CP}}$.

> H3: The mean value of the average cherry-picking score is significantly higher than 2.5.

In Rock's model, investors subscribe for shares at a fixed offer price, whereas in ChiNext, there is price uncertainty when institutions submit bids in the bookbuilding stage. The offer price is set at the end of this stage and only the bids above the offer price qualify for

subscription. This setting opens up possibilities for strategic bidding. The bidding strategy of uninformed investors cannot vary across hot and cold issues by definition. But, we hypothesize that informed institutions will not only cherry-pick hot issues, but also bid large quantities at high prices in such issues in order to increase their chances of allocation. Consequently, informed institutions are expected to experience higher average initial returns than uninformed ones.

> H4: The average initial return experienced by an institution increases with its average cherry-picking score.

While there should not be variation in the bidding strategy of uninformed institutions across issues, such institutions will have a bidding strategy nonetheless. Cornelli and Goldreich (2003) assume that the midpoint of the initial price range reflects "the prebookbuilding expectation of the issue price." Then, Rock's theory implies that uninformed institutions have an incentive to bid lower than the midpoint to secure a sufficient discount that acts as a cushion against the losses caused by the adverse selection problem.[13]

> H5a: The quantity-weighted price is on average lower than the midpoint of the initial price range.

On the other hand, if the discount is deeper than necessary, the issuer can pressure the lead underwriter to revise the issue price upward. This implies that a greater upward revision is more likely to be observed when the discount is deeper.

> H5b: The difference between the offer price and the quantity-weighted price is on average positive, and it is higher when the quantity-weighted price is below the midpoint of the initial price range.

Finally, in ChiNext, retail investors can observe the level of subscription by institutional ones before they submit their bids. We hypothesize that if there is a strong positive relationship between initial returns and institutional demand (i.e., if H1 is supported), retail investors

[13]Note that institutions can submit step bids. Therefore, they can submit bids at high prices to make sure they qualify for subscription, but at the same time they can demand relatively larger quantities at low prices to pull the price down.

will become aware of this fact and condition their bidding decision on the level of institutional demand, such that there will be a positive correlation between retail and institutional levels of subscription.

> H6a: The subscription level in the retail offering is positively correlated with the one in the institutional offering.

While initially a small number of retail investors might be aware of the link between initial returns and institutional demand, as ChiNext becomes a more mature market, this number is likely to increase, strengthening the relationship between retail and institutional levels of subscription.

> H6b: Retail demand becomes more elastic to institutional demand over time.

4 Data

The sample contains all the 355 IPOs that took place on ChiNext since its launch in October 2009 until the end of October 2012. The list of IPOs is obtained from the official website of Shenzhen Stock Exchange. The information contains the ticker, name, listing date, and industry. The data on the issue price, number of shares issued, and proceeds are also obtained from this website manually via press releases. The bookbuilding data is obtained from websites that are designated by CSRC. It includes the institutional demand schedule (aggregate quantity demanded at each price level), the number of institutions that took part in the institutional offering, the number of investors participated in the retail offering, the chances of allocation in institutional and retail offerings, the issuer's price-to-earnings ratio implied by the issue price, and the average price-to-earnings ratio of the issuer's peers. Furthermore, for the sub-sample period following Revision 1 (i.e., December 2009 - October 2012), we have data on all bids submitted by institutional investors and the initial price range determined by the lead underwriter. During this period there are 10,472 limit bids submitted by 353 unique institutions in 214 IPOs.[14] The closing price on the first day of trading is collected from the

[14]There are actually 19,104 limit bids. However, an institution can submit bids via multiple accounts. We aggregate the quantities submitted at the same price by each institution in an issue. The number of bids falls

websites where the documents are published. Finally, we also collect data from the SDC and double check the IPO date, listing date, offer price, number of shares, and proceeds.

The variables used in the paper are defined as follows. N_i and N_r are the total numbers of institutional and retail investors that participate in an offering respectively. N_r is expressed in thousands. A_i (A_r) is the allocation rate to institutional (retail) investors, which is calculated as the number of shares offered divided by the number of shares demanded in the institutional (retail) subscription. R_u is the unadjusted initial return. It is the change between the offer price and the closing price on the first day of trading. R_a is the adjusted initial return, such that $R_a = R_u - R_m$, where R_m is the change in Shenzhen A-Share Stock Price Index between the day offer price is set and the first day of trading. R_w is defined as the allocation rate to institutions times the adjusted initial return: $R_w = A_i R_a$. P_r is the width of the initial price range relative to its midpoint. P_o is the offer price normalized by the initial price range. Similarly, P_w is the quantity-weighted price normalized by the initial price range. Pro is the total proceeds raised in millions of yuans. P/E is the change between an IPO firm's price-to-earnings ratio implied by its offer price and the average price-to-earnings ratio of peers. Mom is the 30-day return of the Shenzhen A-Share Stock Price Index on the IPO date.

Descriptive statistics of variables are presented in Table 1. The first batch of 28 IPOs include the firms listed on the day when ChiNext was launched. The second batch of 113 IPOs covers the period until Revision 1. Following Revision 1, we have data on bids, allocations, and the initial price range. The third batch includes 178 IPOs that went public between Revisions 1 and 2, and the last batch contains 36 IPOs following Revision 2.

The split into subperiods reveals a clear time pattern in panel A. There has been a decline in the median numbers of institutions and individuals participating in the primary market in parallel with a drop in the median level of initial returns. While the median initial return is still high after Revision 1, its level has come much closer to the levels observed in more developed markets. Finally, once initial returns are weighted by allocation rates, they drop substantially. This is in line with the adverse selection argument of Rock (1986).

In panel B, we observe that the width of the initial price range P_r is quite similar to

to 10,472 as a result.

Cornelli and Goldreich (2003) and Jenkinson and Jones (2004). The former study, which examines international equity issues, reports that the offer price P_o averaged at 51%, and the corresponding figure in the latter study, which examines European IPOs, is 61%. These figures suggest that the offer price is set close to the midpoint on average. On the contrary, the offer price is set well below the midpoint in ChiNext IPOs. The median (mean) for the period between December 2010 and May 2012 is -30% (-33%), and it is 27% (6%) for the remaining period. Furthermore, Cornelli and Goldreich (2003) find that the quantity-weighted price is very close to the midpoint as well. In ChiNext, the quantity-weighted price is well below not only the midpoint, but also the offer price. This is consistent with uninformed institutions' incentive to bid lower than the midpoint to secure a sufficient discount, and issuers' incentive to put pressure for an offer price higher than the quantity-weighted price when the discount is more than required. Finally, we observe that IPO firms are overvalued about 4% relative to their peers in the first sub-sample period, whereas they are undervalued about 10% in the second sub-sample period.

5 Tests

5.1 Initial returns and allocation rates to institutional investors

We begin our tests by regressing initial returns R_a on allocation rates to institutions A_i. The allocation rates will be lower when informed institutions participate, and since they will participate in hot issues only a negative coefficient is predicted. Our first specification follows Amihud et al. (2003) and uses the logistic transformation of A_i, such that $A_i^t \equiv log(A_i + (0.5/n))/(1 - A_i + (0.5/n))$, where n is the sample size. As expected, a strong negative relationship is found (model (1) in Table 2). We also add $\ln(Pro)$, Mom and a set of industry dummies to the model as control variables. $\ln(Pro)$ serves as a proxy of ex-ante uncertainty, which can affect initial returns (Beatty and Ritter, 1986). Mom has predictive power on initial returns (Derrien and Womack, 2003) and captures "market-wide investor sentiment" (Cornelli et al., 2006). Finally, industry dummies are added, due to the evidence

that hot issue markets with high average initial returns can emerge as a result of industry clustering (see e.g., Ritter (1984)). The results remain the same after adding the control variables (model (2)). Furthermore, the negative relationship is observed both in the first sub-sample period (model (3)) and the second one (model(4)).

Levis (1990) uses a different specification to test the relationship between initial returns and allocation rates. He regresses initial returns on the level of subscription, which is $1/A_i$. This time a positive coefficient is predicted. The prediction is supported by the data (models (5) and (6)), and is valid for both sub-sample periods (models (7) and (8)).

5.2 Equal- versus allocation-weighted average initial returns

We now turn our attention to the allocation-weighted average initial returns R_w. When allocation is made via balloting, an uninformed institution that participates in all issues *cannot* receive the equally-weighted average initial return $\overline{R}_a$, since getting allocations in hot issues that yield high initial returns is less likely. The institution's experience is better reflected by $\overline{R}_w$. On the other hand, when allocation involves equal proration as in Amihud et al. (2003), the institution that subscribes a fixed amount of money in all issues *does* receive $\overline{R}_a$, *but* since its orders are filled more in oversubscribed issues, the institution's experience is again better reflected by $\overline{R}_w$ (rather than $\overline{R}_a$). In both cases, $\overline{R}_w$ is expected to be significantly lower than $\overline{R}_a$, and at a level that leaves no abnormal return to the uninformed strategy.

Before comparing the distributions of R_a and R_w using our data, we summarize the findings in previous papers. Amihud et al. (2003) report that $\overline{R}_a = 12\%$ and $\overline{R}'_w = -1.18\%$, where R'_w is equal to R_w net of opportunity costs. They interpret the negative return as evidence against the adverse selection argument, since an uninformed investor could be better off by avoiding the IPO market. In Koh and Walter (1989), $\overline{R}'_w$ varies with the size of the bid, but no bid size yields a return that is significantly different from zero. In Keloharju (1993), $\overline{R}'_w$ varies with the application size as well. For small sizes, the return is indistinguishable from zero, but for large sizes it becomes significantly negative. Finally, in Levis (1990), $\overline{R}'_w$ follows a bell-shaped pattern across the sizes of application. It is positive and statistically

significant for most size levels, but still lower than the equally-weighted average initial return. The results in Koh and Walter (1989) support Rock's model. Those in Levis (1990) support the model as well, but indicate excessive underpricing. On the other hand, negative returns reported in Keloharju (1993) and Amihud et al. (2003) provide contradictory evidence.

The distributions of R_a and R_w in our sample are plotted in Figure 1. Panels (a) and (b) ((c) and (d)) include the IPOs from the first (second) sub-sample period. In the first period, only 2 (out of 141) IPOs yielded negative initial returns. The fact that almost all IPOs yielded positive initial returns implies that there was hardly a winner's curse in this period and any rational institution (informed or not) that anticipated this would participate in all issues.[15] Interestingly, the negative relationship between R_a and A_i still obtains in the first period. The mean value of $R_w = A_i R_a$ (0.8%) is much lower than the mean value of R_a (51%). The existence of a negative relationship between R_a and A_i in the absence of a winner's curse validates the concern raised by Amihud et al. (2003): "If underwriters set a different offer price than what investors believe it should be [...], there will be a negative relationship between initial returns and allocations. When the offer price is smaller than the market's expectation of the company's value, there will be excess demand (low allocation) and high initial return." In other words, evidence in favor of H1 and H2, which are the two main hypotheses tested in the literature, cannot constitute sufficient proof of Rock's model, since these hypotheses are supported even when there is no winner's curse. This warrants the tests of the novel hypotheses developed in this paper, which are subsequently presented in Sections 5.3 and 5.4.

There is a marked shift in the distribution of R_a in the second period. Less than 1.5% of the IPOs yielded negative initial returns in the first period. The corresponding figure is more than 20% in the second period. There is definitely the risk of a winner's curse in the second period if uninformed institutions end up getting more shares in the IPOs with negative initial returns and less in those with positive initial returns due to the selective participation of informed institutions. The negative relationship between initial returns and allocation rates

[15] Indeed the descriptive statistics in Table 1 suggest that the median number of institutions is almost twice more in the first sub-sample period.

is observed in the second period as well. The mean values of R_a and R_w are 23% and 1.6% respectively.

We conclude that initial returns are much lower when they are allocation weighted rather than equal weighted. Moreover, while the negative relationship between R_a and A_i is clearly not due to the winner's curse in the first period, it can be in the second period, since the second period contains quite a few IPOs with negative initial returns.

5.3 Cherry-picking hot IPOs

As we have already emphasized a few times in the paper, support for H1 and H2 cannot provide conclusive evidence in favor of Rock's model. Therefore, tests of novel hypotheses derived from the model are needed. In this spirit, we test whether there exist institutions that can avoid cold IPOs and submit bids in hot IPOs only. In particular, we split the 241 IPOs that took place between December 2010 and October 2012 into quartiles in terms of R_a.[16] The quartiles are denoted by R_q, such that R_q is equal to 1 (4) for an IPO in the bottom (top) quartile of the initial return distribution. IPOs in the bottom (top) quartile have an average initial return of -3.2% (62.56%). Clearly, institutions would like to avoid the cold IPOs in the bottom quartile and receive shares in the hot IPOs that are in the top quartile. An uninformed institution i cannot tell hot IPOs apart from the cold ones. Consequently, if such an institution is participating in either all IPOs or some IPOs randomly, its average cherry-picking score $\overline{CP}_i$ must be 2.5, where $\overline{CP}_i$ is the average of R_q across the IPOs that institution i submitted bids. On the other hand, an informed institution should have $\overline{CP}_i$ that is significantly higher than 2.5. If all institutions that participate in the ChiNext IPOs were uninformed, the distribution of $\overline{CP}_i$ would be closely centered around 2.5 and deviate from this value due to chance only. But, if there are informed institutions, the mean value of the distribution will be higher than 2.5.

[16] There are several reasons why we do not use the IPOs before December 2010. The data on bids is incomplete before December 2010. The documents report only the bids that qualified for subscription. Starting from December 2010, we have data on unqualified as well as qualified bids. Furthermore, the data on the initial price range, which is used in later tests, is also not available before December 2010. Finally and most importantly, the tests in Section 5.2 show that there is no sign of a winner's curse before December 2010, since almost all IPOs yielded positive initial returns.

Between December 2010 and October 2012, 353 institutions submitted 10,472 bids in 214 IPOs. While the mean number of participation by institutions was 30, the median was only 8, suggesting that half of the institutions are occasional investors in ChiNext IPOs. 25% of the institutions participated only in 2 IPOs. If those 2 IPOs are in the top quartile of R_a, such institutions get an average cherry-picking score of 4, which gives the false impression that they are informed. To avoid such cases, we calculate $\overline{CP}_i$ only for institutions that participated in at least 10 IPOs. There are 167 such institutions, which account for 9,978 bids.

Figure 2 illustrates the distribution of $\overline{CP}_i$. The distribution peaks slightly to right of 2.5. Its left tail does not go much below 2, which is about two standard deviations below 2.5. Most strikingly, there is a kink in the right tail around the value of 3. The cherry-picking scores of 16 institutions are more than two standard deviations above 2.5. These institutions pull the mean value of $\overline{CP}_i$ to 2.62. A two-tailed t test comfortably rejects the null that the mean is equal to 2.5 at 1% significance level. This is consistent with H3 and lends support to the Rock's idea that informed investors are present alongside uninformed ones in the IPO market. Note that informed institutions were most likely present during the first period too. However, uninformed institutions would not be worried about it, since almost all IPOs yielded positive initial returns in that period.

We split the 167 institutions into four groups on the basis of their cherry-picking score. An institution can be classified as having (i) very high ($CP_i \geq 3$), (ii) high ($3 > CP_i \geq 2.7$), (iii) no ($2.7 > CP_i \geq 2.3$), or (iv) poor ($CP_i < 2.3$) skill in cherry-picking hot IPOs. The institutions with no skill participated in 76 IPOs on average, whereas those with very high skill in 31 IPOs only.

The previous literature offers tests of Rock's model by simulating returns to uninformed strategies. Our dataset allows us to compute the actual returns of institutions that appear to be uninformed (no skill in cherry-picking). Furthermore, we can investigate whether institutions with higher cherry-picking score tend to experience higher initial returns on average. This is important, since cherry-picking hot IPOs is a necessary but not sufficient condition for appropriating higher initial returns. As well as being able to cherry-pick hot issues, informed

institutions should bid large quantities at high prices during bookbuilding to secure a decent chance of allocation when the balloting takes place.

For each institution, we determine the issues in which the institution received shares and calculate the average of R_a for those issues. This is the average initial return that is actually experienced by the institution. Panel A in Table 3 shows that the mean value of the average actual return is 17% for institutions with no skill, while it is 43% for those with very high skill. This panel excludes the institutions that participated in at least 10 IPOs, but never received a share allocation. Proportionally, there will be more of such institutions in the very high skill category, since they participate less often in the IPO market. Panel B includes all institutions by assuming that an institution that never received an allocation has experienced a return of zero. The mean value of the very high skill category goes down to 24% as a result, but the figure is still 9 percentage points higher than the mean value of the no skill category. In both panel A and panel B, one way ANOVA tests for the equality of means and Kruskal-Wallis tests for the equality of populations are rejected at 1% significance level. It is also worth noting that no institution with very high skill experienced a negative initial return on average, whereas 8 institutions with no skill had that experience.

We also calculate the returns in yuans: $R_a\times$ offer price in yuans $\times$ millions of shares received. For each institution, we compute the average across the issues in which it received an allocation. The statistics in panel C show that the mean value for institutions with no skill is 3.23 million yuans. The corresponding figure is 8.02 million yuans for institutions with very high skill. Panel D includes institutions that never received an allocation by assigning them a value of zero. The mean value goes down to 4.51 million yuans for institutions with very high skill, but it is still more than 1.5 million yuans higher compared to the institutions with no skill. Like in panels A and B, the tests for the equality of means and populations are rejected at 1% significance level in panels C and D as well. Overall, the results in Table 3 lend support to H4.

Table 4 provides further evidence that institutions with high or very high skill in cherry-picking are informed. The table provides a breakdown of demand and allocations by the skill

in cherry-picking hot IPOs. For each IPO, we calculate the percentage of shares demanded by (or allocated to) each skill group. Then, for each skill group, we calculate the average across the IPOs that are in the same quartile of initial returns. Panel A considers all bids submitted in the bookbuilding stage, panel B is based on bids that remain valid in the subscription stage, and panel C uses shares allocated to each skill group according to the results of balloting. We consider the demand by institutions with poor or no skill as the uninformed demand, and the demand by those with high or very high skill as the informed demand. In all three panels the proportion of informed demand (or share allocation to it) rises at the expense of uninformed demand (or share allocation to it) as the initial return quartile increases.[17] For instance, uninformed demand on average represents about 83.5% of the total bookbuilding demand in cold issues (bottom quartile of R_q), whereas this representation falls to 72% in hottest issues (top quartile of R_q). It is even lower at 67% if the total subscription demand is considered. This is a strong indication of the winner's curse. It suggests that informed demand not only rises as issues become hotter, but also when $R_q \geq 3$ informed institutions start bidding more aggressively in bookbuilding to grab an even higher fraction of the total demand in subscription, since such an action increases their chances of allocation further. More specifically, the informed bookbuilding demand rises from 13.5% to 26% across the quartiles of R_q, but the informed subscription demand rises further to 31%. Consequently, while uninformed demand constitutes 72% of the total bookbuilding demand in hottest issues, it only receives 64% of all shares. On the other hand, informed demand receives 36% of all shares, despite representing 27% of the total bookbuilding demand. The Wilcoxon signed-rank tests in panel D confirm that the paired differences between the bookbuilding demand and the subscription demand are highly significant for both uninformed and informed institutions when $R_q \geq 3$. Overall, when we interpret these results with the finding in Table 3 that skilled institutions appropriate higher returns, we conclude that in ChiNext some institutional investors are better informed than others, such that they can avoid cold issues and bid more aggressively in hot ones to appropriate higher average returns.

Before concluding this section, we touch upon one more issue. The figures in Table 3

[17] The p values in the last column reject the equality of populations across R_q for each skill group.

suggest that while institutions skilled in cherry picking realize higher initial returns, institutions not skilled in cherry picking experience high initial returns as well. The mean value of the average return an uninformed institution gets is well above the level simulated by the allocation-weighted average initial return (see panels (b) and (d) in Figure 1). At first sight, this contradicts Rock's model, since the model constrains abnormal profits of uninformed investors to zero. In fact, the results are consistent with the version of the model that implies oversubscription for overpriced as well as underpriced issues. Rock finds the minimum discount to the expected aftermarket price that is necessary to ensure that all shares in overpriced issues are sold. He argues that if the offer price is set lower than this 'full subscription price' (i.e., if the discount is more than necessary), overpriced issues as well as underpriced ones will be oversubscribed. This seems to be the case in our sample of 355 IPOs, since the minimum value of institutional oversubscription is 1.5. Rock shows that when this is the case, the winner's curse is attenuated such that the probability of allocation in underpriced issues relative to that in overpriced ones rises. The facts that all issues are oversubscribed and uninformed institutions earn high initial returns on average are both consistent with this version of the model. What remains to be explained is the mechanism that pulls the offer price below the full subscription price, thereby causing an unnecessarily high level of discount. We offer an explanation in the next subsection.

To summarize, the evidence in this subsection suggests that some of the institutions that participate in ChiNext IPOs are more skilled than others in terms of avoiding overpriced IPOs and bidding aggressively in highly-underpriced ones. It follows that such institutions experience higher average initial returns. We conclude that these institutions are informed and their presence imparts a winner's curse on uninformed institutions.

5.4 The offer price versus the quantity-weighted price

The IPO process in ChiNext differs from the one modelled by Rock (1986) in one significant respect. In Rock's model investors subscribe for shares at a predetermined offer price. In ChiNext, institutions first submit non-binding bids in the bookbuilding stage. The offer price

is set at the end of this stage, and only the bids that end up above the offer price qualify for the subscription stage. Allocations are determined in the subscription stage via balloting as in Rock's model.

The bookbuilding stage gives institutions power to influence the offer price to the extent that the lead underwriter takes into account the information acquired during the bookbuilding process when setting the offer price with the issuer. Therefore, given the evidence provided in Section 5.3 regarding the presence of informed institutions, uninformed institutions can take the matter of dealing with the winner's curse into their own hands and submit bids at low prices to secure a sufficient discount.

There are a few points exploring about this hypothesis. While the institutions can exert downward pressure on the offer price by bidding low, they cannot submit unrealistically low bids, since they are playing a repeated game. No issuer would go public on ChiNext, if they believed that the offer prices were set extremely low. This gives weight to the role of the lead underwriter who can act as an intermediary between the institutions and the issuing firm. The lead underwriter can ensure uninformed institutions a sufficient discount by setting the offer price close to the quantity-weighted price. At the same time, if the discount demanded by institutions is too deep, the issuer can put pressure on the underwriter to revise the quantity-weighted price upwards when setting the offer price. The lead underwriter has to maintain the balance between institutions and issuers, since it also plays a repeated game and puts its reputation at stake à la Beatty and Ritter (1986). Therefore, we expect that the offer price P_o will be set close to the quantity-weighted price P_w, which will tend to be lower than the midpoint of the initial price range and the lead underwriter will intervene when P_w is too low and revise it upwards.

It is clear that bidding unrealistically low prices is not optimal for institutions, as it can deter issuers from the market. The optimal strategy of uninformed institutions seems to be bidding low enough to secure the necessary discount. However, we have to investigate whether an uninformed institutions can do better if it deviates from this equilibrium by bidding higher. When many institutions take part in bookbuilding, a higher bid by one institution will have

a small impact on the offer price, but the institution can increase its chances of allocation in the balloting as a result. However, the winner's curse undermines the viability of this strategy. The institution's strategy increases its chance of allocation in not only underpriced issues but also overpriced ones. Therefore, the deviation from the equilibrium of bidding low prices might not be profitable when the winner's curse is severe enough.

Figure 3 presents a scatter plot of the offer price P_o against the quantity-weighted price P_w for the sub-sample of 214 IPOs between December 2010 and October 2012. In 82% of these IPOs, P_w is less than 0.5 (see the vertical line), which means that the price demanded by the institutions is typically lower than the midpoint of the initial price. The mean value of P_w is -63% with a 95% confidence interval of (-84%,-43%). Therefore, institutions bid well below the low end of the price range, let alone its midpoint. This bidding behavior is consistent with H5a.

There are only 3 IPOs for which the revision from P_w to P_o is less than -5%. In contrast, for 100 IPOs the revision is more than 5%. This demonstrates the asymmetry in revisions. The average revision is 6% across the 214 IPOs, which is significant at 1% level. Moreover, positive revisions are larger when P_w is low. The mean (median) revision is only 2% (2%) for the IPOs with $P_w \geq 0.5$, whereas it is 7% (6%) for those with $P_w < 0.5$. A t-test rejects the equality of means at 1% significance level. These findings lend support to H5b, such that the lead underwriter intervenes by revising P_w upwards when it is set too low by institutions.

5.5 Initial returns and the sentiment of retail investors

The evidence presented in the paper so far indicates that uninformed institutions in ChiNext suffer from a winner's curse in the second sub-sample period due to the presence of informed institutions (Section 5.3). In this period uninformed institutions respond by bidding strategically low so that the offer price reflects a discount (Section 5.4).

There are two questions that are not fully addressed in the paper yet. Why was there no winner's curse in the first sub-sample period? How can uninformed institutions (being subject to a winner's curse) earn average returns as high as 17% in the second sub-sample

period? The latter question is partially answered, since the discount applied to the offer price is higher than the minimum requirement, such that even IPOs that yielded negative initial returns were oversubscribed. However, an average return of 17% seems too high to be explained by an excessive discount only.

A strand of literature links high initial returns with investor exuberance. Given that ChiNext is a new market and the capital markets history in China is still relatively short, it seems possible that when retail investors subscribe for IPO shares in ChiNext they behave in a way that is not fully rational. Therefore, in this section we investigate the extent to which initial returns are driven by the sentiment of retail investors.

We first investigate the relationship between retail demand and institutional demand. We follow Clarke et al. (2013) and interpret the oversubscription levels of the retail offering $1/A_r$ and the institutional offering $1/A_i$ as proxies of unmet retail and institutional demand respectively. Models (5)-(8) in Table 2 show that $1/A_i$ is an important determinant of initial returns R_a. It alone explains a quarter of the total variation in R_a. An important feature of ChiNext is that retail investors can observe $1/A_i$ before subscribing for shares in an IPO. Given that $1/A_i$ is a strong indicator of R_a, it is rational for retail investors to condition their subscription decisions on $1/A_i$, such that $1/A_r$ is elastic with respect to $1/A_i$. On the other hand, if retail investors are overoptimistic they might subscribe for shares even when institutional demand is relatively weak.

We run several regression models to test these arguments. The models include dummy variables SP_t to investigate the changes in retail demand and its influence on initial returns over time. More specifically, $SP_1 = 1$, $SP_2 = 1$, $SP_3 = 1$, and $SP_4 = 1$ if the IPO took place between Oct 2009 - Nov 2009 (first batch of IPOs), Dec 2009 - Nov 2010 (the period until Revision 1), Dec 2010 - May 2012 (the period between Revisions 1 and 2), and Jun 2012 - Oct 2012 (the period since Revision 2) respectively. The regression results are reported in Table 5. In model (1), we regress the log of retail oversubscription on the log of institutional oversubscription and sub-period dummies. The model also includes interaction terms. There are two important results: (1) the unmet retail demand decreased since the launch of ChiNext,

(2) it became more elastic with respect to the unmet institutional demand. To the extent that $1/A_i$ captures the overoptimism of retail investors, the first result suggests that the overoptimism has been declining steadily since ChiNext started its operations ($SP_2 = SP_3 = SP_4$ is rejected at 1% significance level). The second result provides evidence that retail investors start acting more rationally over time, such that their demand becomes more elastic to the institutional demand ($SP_2 \times \ln(1/A_i) = SP_3 \times \ln(1/A_i) = SP_4 \times \ln(1/A_i)$ is rejected at 1% significance level). The estimates suggest that a 1% increase in institutional demand increases retail demand by 0.19% when $SP_2 = 1$, whereas the corresponding increase is 0.63% when $SP_4 = 1$, a marked shift in the elasticity. Adding $\ln(Pro)$, Mom, and industry dummies as controls (model (2)) increases the model's explanatory power substantially. Not surprisingly there is a very strong relationship between $\ln(1/A_r)$ and $\ln(Pro)$, such that unmet retail demand is higher for smaller issues. Furthermore, unmet retail demand is positively related to Mom as expected. After controlling for $\ln(Pro)$ and Mom, SP_2, SP_3 and the interaction terms involving them lose significance, but SP_4 and $SP_4 \times \ln(1/A_i)$ still remain significant.

Model (3) suggests that while unmet institutional demand is significant in explaining initial returns and unmet retail demand is not. This finding is opposite to Clarke et al. (2013) and highlights the importance of winner's curse as a driver of initial returns. Interacting institutional and retail demand with sub-period dummies (model (4)) sheds more light to the relative powers of winner's curse and investor sentiment in explaining initial returns. Overoptimism was a stronger driver of initial returns when ChiNext was launched, but the results suggest that it has since lost its explanatory power. As a robustness check, we run a median regression (model (5)) instead of an OLS one using the variables in model (4). The results remain the same.

The models developed in Derrien (2005) and Cornelli et al. (2006) both argue that overoptimism of investors cause not only positive initial returns, but also overpricing. Similarly, Ljungqvist et al. (2006) argue that "from the vantage of a longer horizon, IPOs can arguably be regarded as "overpriced" in the aftermarket." The papers argue that the offer price is set

below the price sentiment traders are willing to pay, hence the positive initial returns, but above the fundamental value, hence the overpricing. Consistent with this strand of literature Purnanandam and Swaminathan (2004) show that relative to industry peers IPO firms are substantially overvalued.

When a firm that goes public on ChiNext publishes its order book it also includes the price-to-earnings ratios of its peers, which typically include comparable listed companies from the same industry. This gives us a chance to compare the issuer's price-to-earnings ratio implied by the offer price with the average price-to-earnings ratio of its peers. In particular, we compute P/E as the change between the issuer's price multiple and the average price multiple of the peers. Figure 4 compares the distribution of P/E across the two sub-sample periods (empty bars with black outlines for the first period, the superimposed gray ones for the second period). During the first period, 58% of the IPOs are overpriced relative to comparable firms; there are 10 IPOs overpriced by more than 100% (i.e., $P/E > 1$) and 1 IPO underpriced by more than 50% (i.e., $P/E < -0.5$); the mean (median) value of overpricing is 12% (4%). In contrast, during the second period, only 31% of the IPOs are overpriced, while 69% are underpriced; there are no IPOs overpriced by more than 100%, but 6 IPOs underpriced by more than 50%; the mean (median) value of underpricing is 6% (10%). The shift in the distribution of P/E across the two periods is visible from Figure 4. The empty bars with black outlines are higher to the right of $P/E = 0$, and lower to the left of it, which suggests relatively more IPOs were overpriced (underpriced) in the first (second) period. A Wilcoxon-Mann-Whitney test rejects the null hypothesis that P/E samples in the first and second sub-sample periods come from the same distribution at 1% significance level. A t-test rejects the equality of means at the same significance level.

To wrap up, the evidence in this subsection suggests that the reason there was no winner's curse in the first period is the overoptimism of retail investors. We find that, in anticipation of this overoptimism, IPO firms are overvalued relative to their peers, but, as argued by Derrien (2005), Cornelli et al. (2006), and Ljungqvist et al. (2006), offer prices do not seem to be set at the maximum level sentiment traders are willing to pay as almost all IPOs yield positive

initial returns in the first period, thereby eliminating the winner's curse. However, the results in Table 5 are indicating that the overoptimism has been declining over time and the retail investors have started acting more rationally by following the level of institutional demand more closely. Consequently, without sufficient overoptimism to guarantee positive initial returns and in the presence of informed institutions that can avoid issues with negative initial returns, winner's curse emerges as a risk for uninformed institutions, who bid strategically low to ensure that the offer price reflects a discount. Consistent with these views, while the average IPO firm is overpriced relative to its peers in the first period, it is underpriced in the second period.

6 Conclusion

The model developed in Rock (1986) predicts that when investors are asymmetrically informed about the value of shares issued by IPO firms the issuers will voluntarily underprice their shares to attract the uninformed demand. Empirical tests of the model find a negative relationship between initial returns and allocation rates. While such a relationship is consistent with the model, our results indicate that the negative relationship is also observed in the absence of a winner's curse. Furthermore, papers yield conflicting results on the level of allocation-weighted initial returns, which has to be zero according to the model. Therefore, traditional tests fail to conclude whether Rock's theory of underpricing has power to explain the variation in initial returns.

The winner's curse hypothesis is further challenged by the strand of literature that links initial returns with investor sentiment. The papers in this area argue that initial returns are driven by overoptimism and IPO shares are in fact overpriced. For instance, Löeffler et al. (2005) and Clarke et al. (2013) dismiss winner's curse as a potential explanation of initial returns, since in their settings uninformed investors have a chance to condition their subscription decision on signals that are informative about initial returns.

This paper provides comprehensive tests of Rock's model and also builds a bridge between the competing explanations of IPO initial returns based on the winner's curse and the investor

sentiment. We study the determinants of initial returns in ChiNext, which is a new market, and investigate the existence of institutions that are more skilled than others in avoiding IPOs that yield negative initial returns and picking those that yield positive initial returns. We find that such institutions exist and they realize substantially higher average returns than those with no skill in cherry-picking hot issues. This finding lends support to Rock's argument that IPO underpricing stems from a discount to the offer price that compensates uninformed investors against the losses caused by the presence of informed investors in the market. Moreover, we show that in ChiNext the uninformed institutions guarantee a discount by bidding low during the bookbuilding, such that the quantity-weighted price is typically well below the midpoint of the initial price range. The lead underwriter partially adjusts the quantity-weighted price upwards when setting the offer price if the discount is too deep.

Interestingly, although institutions with no cherry-picking skill realize lower average returns than skilled institutions, their average returns are still quite high. We offer two explanations for this finding. First, the discount applied to the offer price seems to be higher than necessary, such that even the issues that yield negative initial returns are oversubscribed by institutions. Second, part of the initial return might have been driven by the investor sentiment. We find evidence of strong investor overoptimism especially at the time when ChiNext was launched as a new market. At that time, overoptimism was a strong determinant of initial returns, but its influence has diminished since. As a result, high average initial returns of uninformed institutions are attributable to both an excessive discount and investor sentiment, such that the portion due to the latter factor has become smaller over time.

Investor overoptimism also explains the lack of a winner's curse in the first sub-sample period, during which almost all IPOs yielded positive initial returns. Unmet retail demand is a powerful driver of initial returns in ChiNext during the exchange's early period of operation. IPO firms are overvalued relative to their peers in this period, a finding that complies with the predictions of models based on investor overoptimism. However, overoptimism loses momentum over time and we find evidence that retail investors start to act more rationally by following the institutional demand more closely when subscribing for IPO shares. As the

overoptimism fades away, the winner's curse emerges and not surprisingly IPO firms start being undervalued relative to their peers, since uninformed institutions require a discount to participate in the market given that a positive initial return is no longer guaranteed.

Overall, our results suggest that Rock's assumption about asymmetric information between investors regarding the value of IPO shares is well founded and his model can explain the variation in initial returns well. Furthermore, the model works when we expect it to do so. That is, there is no winner's curse in a market populated with overoptimistic aftermarket investors, since initial returns are always positive. But when aftermarket investors act more rationally, we observe that the asymmetric information between institutions cause IPOs to be underpriced. Similarly, there is no winner's curse when all uninformed investors (institutional as well as retail ones) can observe informed demand before submitting bids. However, a winner's curse exists and leads to IPO underpricing when at least some of the uninformed investors (like uninformed institutions in ChiNext) cannot condition their bids on the level of subscription by informed demand. The results also imply that the explanatory powers of different factors that drive initial returns can vary over time as the market evolves. The investor sentiment is an important driver during the early stages of a market's development, but as the market matures and overoptimism subsides the winner's curse becomes a more powerful driver of initial returns than the investor sentiment.

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Table 1: Descriptive Statistics

Medians are reported. The variable definitions are in Section 4.

Panel A								
	count	N_i	N_r	A_i	A_r	R_u	R_a	R_w
Sub-sample period 1								
Oct 2009 - Nov 2009	28	89.000	299.619	0.013	0.008	0.882	0.831	0.012
Dec 2009 - Nov 2010	113	80.000	293.680	0.016	0.006	0.360	0.337	0.005
Sub-sample period 2								
Dec 2010 - May 2012	178	44.000	172.094	0.063	0.009	0.163	0.164	0.011
Jun 2012 - Oct 2012	36	49.000	144.271	0.053	0.012	0.114	0.148	0.004

Panel B							
	count	Pro	P/E	Mom	P_r	P_o	P_w
Sub-sample period 1							
Oct 2009 - Nov 2009	28	411.550	0.047	-0.011			
Dec 2009 - Nov 2010	113	644.700	0.040	0.015			
Sub-sample period 2							
Dec 2010 - May 2012	178	497.050	-0.098	-0.019	0.147	-0.303	-0.580
Jun 2012 - Oct 2012	36	402.500	-0.106	-0.019	0.168	0.274	-0.231

Table 2: Initial returns and allocation rates to institutional investors

OLS regression results are reported. The dependent variable is R_a. The variable definitions are in Section 4. $A_i^t = log(A_i + (0.5/n))/(1 - A_i + (0.5/n))$, where n is the sample size. All models except (1) and (5) include industry dummies. Models (3) and (7) ((4) and (8)) use the IPOs from the first (second) sub-sample period only. Robust t statistics are in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A_i^t	-0.201	-0.160	-0.333	-0.104				
	(-10.41)	(-7.91)	(-3.70)	(-4.42)				
$1/A_i$					0.005	0.004	0.005	0.004
					(10.22)	(8.34)	(3.97)	(5.93)
ln(Pro)		-0.073	-0.058	-0.091		-0.083	-0.077	-0.095
		(-2.93)	(-1.26)	(-3.07)		(-3.55)	(-1.77)	(-3.24)
Mom		1.217	1.432	1.148		1.187	1.406	1.130
		(6.64)	(3.52)	(4.87)		(6.65)	(3.60)	(4.84)
Constant	-0.338	0.170	-0.357	0.302	0.132	0.595	0.774	0.536
	(-5.49)	(0.86)	(-0.63)	(1.63)	(5.73)	(3.51)	(1.99)	(3.32)
Obs.	355	351	137	214	355	351	137	214
Adj. R-sq.	0.21	0.32	0.17	0.21	0.25	0.36	0.20	0.24

Table 3: Actual returns experienced by institutions

For each institution, the mean value of R_a conditional on receiving a share allocation is calculated. In panel A, statistics across different categories of institutions are reported. Panel B includes the institutions that never received an allocation by assigning a value of zero. Panels C and D report returns in millions of yuans ($R_a \times$ offer price in yuans $\times$ millions of shares received) conditional on receiving a share allocation. Panel C excludes institutions that never received a share allocation, panel D includes them with a value of zero.

Cherry-picking	mean	median	min	max	count
		Panel A			
Poor skill	0.03	0.03	-0.07	0.14	11
No skill	0.17	0.16	-0.05	0.63	81
High skill	0.26	0.24	-0.05	0.94	40
Very high skill	0.43	0.35	0.12	0.97	9
Total	0.20	0.16	-0.07	0.97	141
		Panel B			
Poor skill	0.02	0.02	-0.07	0.14	15
No skill	0.15	0.15	-0.05	0.63	89
High skill	0.22	0.19	-0.05	0.94	47
Very high skill	0.24	0.21	0.00	0.97	16
Total	0.17	0.14	-0.07	0.97	167
		Panel C			
Poor skill	0.59	0.60	-1.59	3.03	11
No skill	3.23	3.28	-0.91	10.29	81
High skill	4.69	4.14	-0.66	17.97	40
Very high skill	8.02	7.97	3.25	13.25	9
Total	3.74	3.32	-1.59	17.97	141
		Panel D			
Poor skill	0.44	0.38	-1.59	3.03	15
No skill	2.94	2.83	-0.91	10.29	89
High skill	3.99	3.46	-0.66	17.97	47
Very high skill	4.51	4.59	0.00	13.25	16
Total	3.16	2.78	-1.59	17.97	167

Table 4: Breakdown of demand and allocations by the skill in cherry-picking hot IPOs

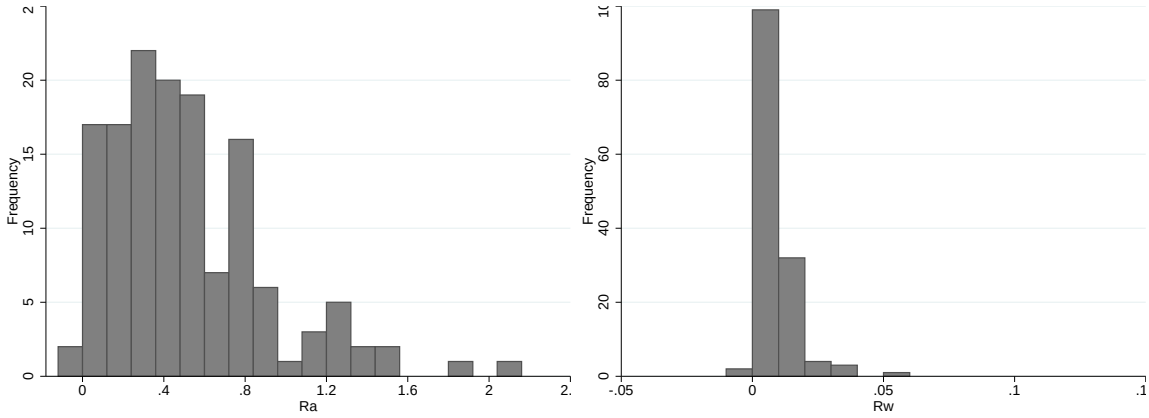
For each of the 214 IPOs in the second sub-sample period, the percentage of total shares demanded by (or allocated to) each skill group is calculated. The table reports averages of these percentages separately for each quartile of initial returns. The last column reports the p values of Kruskal-Wallis tests. In panel A, demand is calculated on the basis of all bids submitted in the bookbuilding stage. In panel B, the basis is the bids that remain valid in the subscription stage. In panel C, percentage of shares allocated to each skill group after balloting is calculated. In panel D, the number of skill groups is reduced to two by combining poor skill with no skill and high skill with very high skill. Then, Wilcoxon signed-rank tests are conducted to compare the percentage demand in bookbuilding with the percentage demand in subscription. The p values of the two-sided tests are reported.

Cherry-picking	$R_q = 1$	$R_q = 2$	$R_q = 3$	$R_q = 4$	p value
Panel A: Percentage demand in bookbuilding					
Poor skill	3.65	3.14	1.69	0.78	0.0001
No skill	79.69	78.76	76.61	71.41	0.0001
High skill	13.40	14.12	16.67	20.92	0.0001
Very high skill	1.08	2.10	3.42	5.10	0.0001
Panel B: Percentage demand in subscription					
Poor skill	3.71	3.60	1.26	0.85	0.0001
No skill	75.93	76.36	72.28	66.33	0.0002
High skill	16.14	15.08	21.90	25.83	0.0001
Very high skill	1.01	3.33	3.17	5.09	0.0001
Panel C: Percentage allocation after balloting					
Poor skill	4.00	4.94	1.28	0.47	0.0011
No skill	81.11	78.93	76.49	63.42	0.0001
High skill	14.10	13.23	19.50	29.75	0.0001
Very high skill	0.78	2.91	2.73	6.37	0.0178
Panel D: Wilcoxon signed-rank tests					
P+N skill	0.0278	0.2303	0.0046	0.0013	
H+V skill	0.2150	0.2103	0.0019	0.0009	

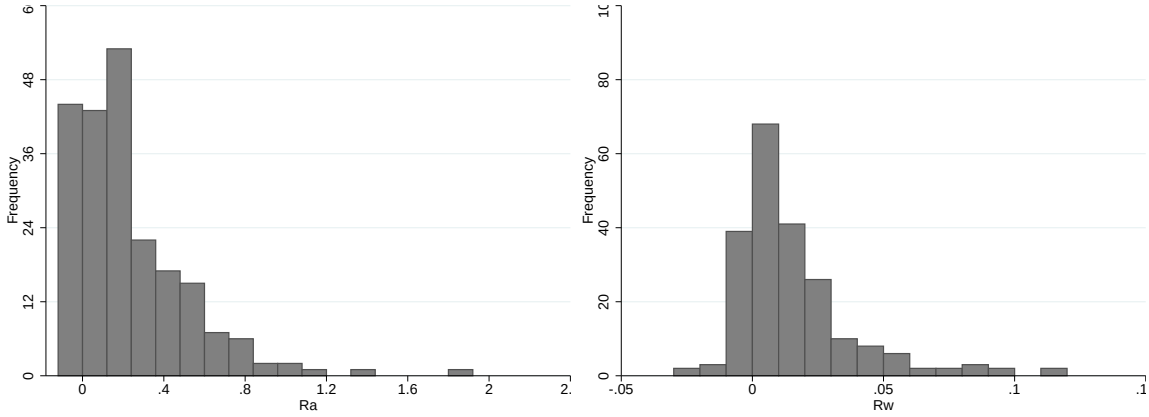
Table 5: Initial returns and the sentiment of retail investors

OLS (models (1)-(4)) and median (model (5)) regression results are reported. SP_ts are dummy variables such that $SP_1 = 1$, $SP_2 = 1$, $SP_3 = 1$, and $SP_4 = 1$ if the IPO took place between Oct 2009 - Nov 2009 (first batch of IPOs), Dec 2009 - Nov 2010 (the period until Revision 1), Dec 2010 - May 2012 (the period between Revisions 1 and 2), and Jun 2012 - Oct 2012 (the period since Revision 2) respectively. Other variables are defined in Section 4. All models except (1) include industry dummies. Robust t statistics are in parentheses.

	(1)	(2)	(3)	(4)	(5)
	$\ln(1/A_r)$	$\ln(1/A_r)$	R_a	R_a	R_a
SP_2	-1.55	0.78		4.12	2.88
	(-2.46)	(1.01)		(4.54)	(2.73)
SP_3	-2.13	-0.18		4.26	3.03
	(-3.90)	(-0.25)		(5.08)	(3.02)
SP_4	-3.42	-1.22		4.31	3.07
	(-6.27)	(-1.65)		(5.02)	(2.95)
$\ln(1/A_i)$	-0.21	0.24	0.15	0.26	0.22
	(-1.83)	(1.47)	(9.13)	(2.24)	(1.88)
$SP_2 \times \ln(1/A_i)$	0.40	-0.11		-0.06	-0.07
	(2.71)	(-0.63)		(-0.48)	(-0.55)
$SP_2 \times \ln(1/A_i)$	0.56	0.13		-0.17	-0.15
	(4.18)	(0.76)		(-1.50)	(-1.27)
$SP_2 \times \ln(1/A_i)$	0.84	0.31		-0.11	-0.04
	(6.64)	(1.78)		(-0.77)	(-0.29)
$\ln(1/A_r)$			0.03	0.88	0.62
			(1.09)	(4.93)	(4.14)
$SP_2 \times \ln(1/A_r)$				-0.89	-0.63
				(-4.72)	(-3.90)
$SP_2 \times \ln(1/A_r)$				-0.84	-0.61
				(-4.67)	(-4.00)
$SP_2 \times \ln(1/A_r)$				-0.92	-0.72
				(-4.69)	(-3.91)
$\ln(Pro)$		-0.59	-0.22	-0.19	-0.15
		(-10.97)	(-5.68)	(-4.60)	(-4.88)
Mom		2.81	1.06	1.11	1.09
		(7.89)	(5.40)	(5.84)	(5.52)
Constant	5.80	7.68	1.06	-3.24	-2.15
	(11.39)	(10.53)	(3.41)	(-3.74)	(-2.13)
Obs.	355	355	355	355	355
Adj. R-sq.	0.24	0.49	0.38	0.57	0.41



(a) R_a (Oct 2009 - Nov 2010) (b) R_w (Oct 2009 - Nov 2010)



(c) R_a (Dec 2010 - Oct 2012) (d) R_w (Dec 2010 - Oct 2012)

Figure 1: The distribution of initial returns

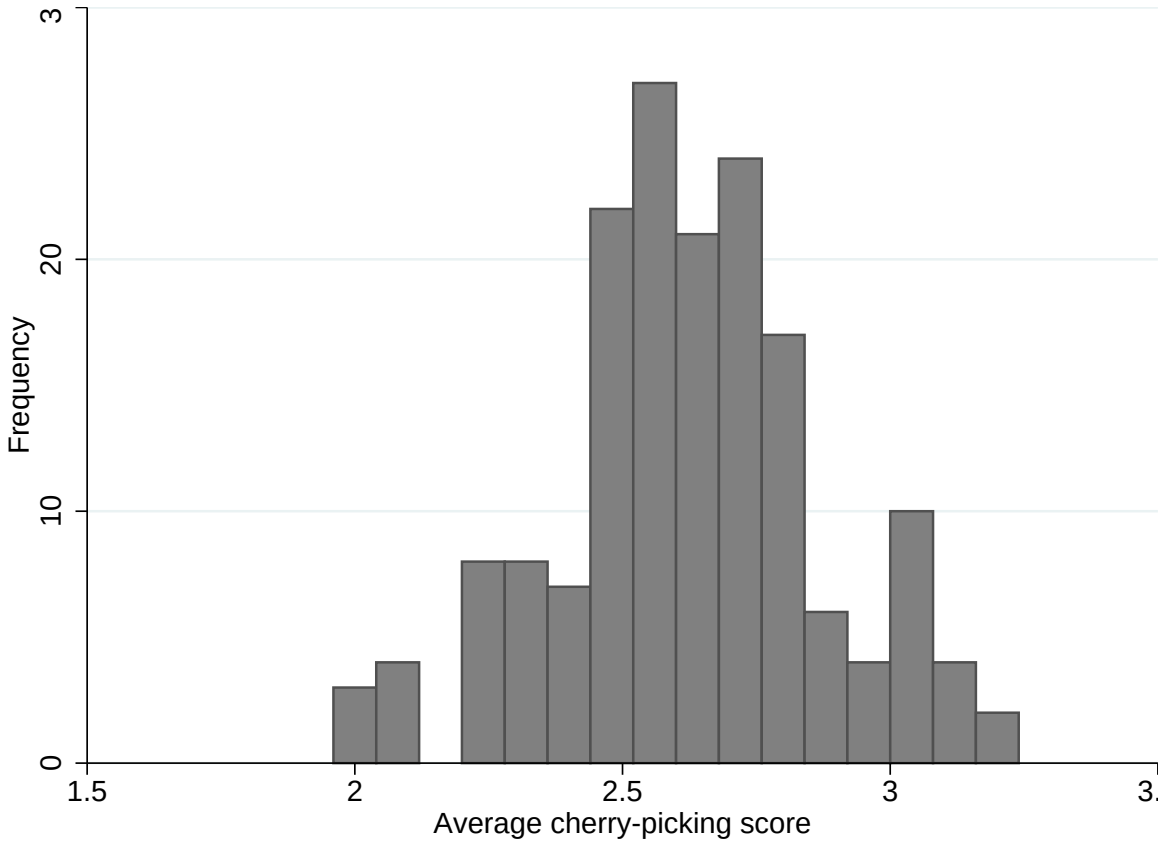


Figure 2: The distribution of $\overline{CP}_i$

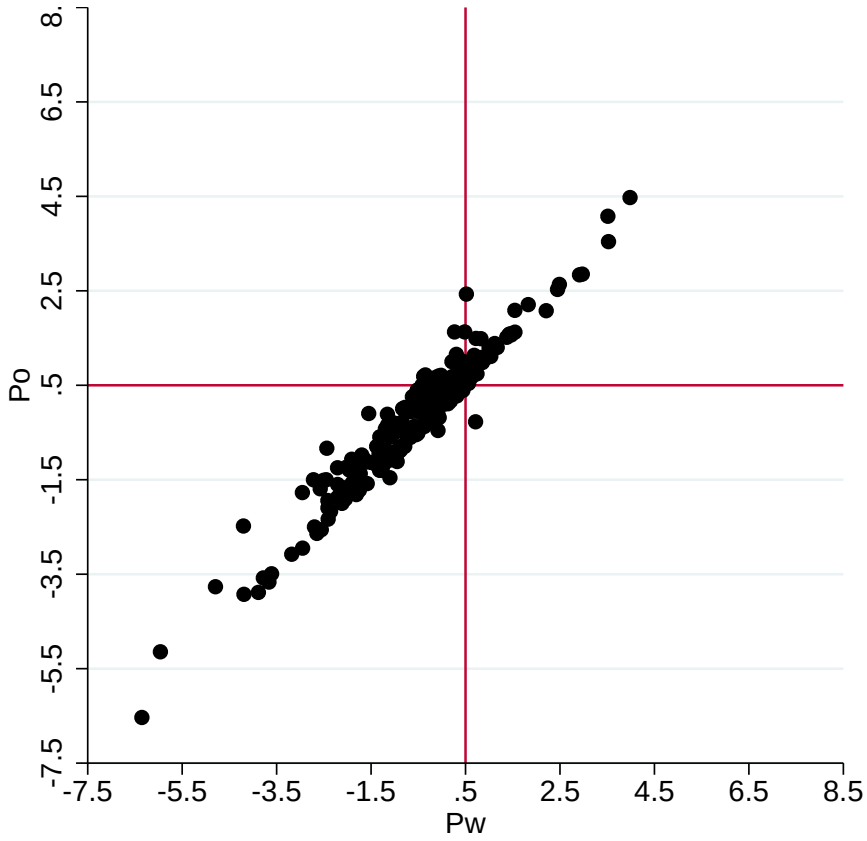


Figure 3: The offer price P_o versus the quantity-weighted price P_w

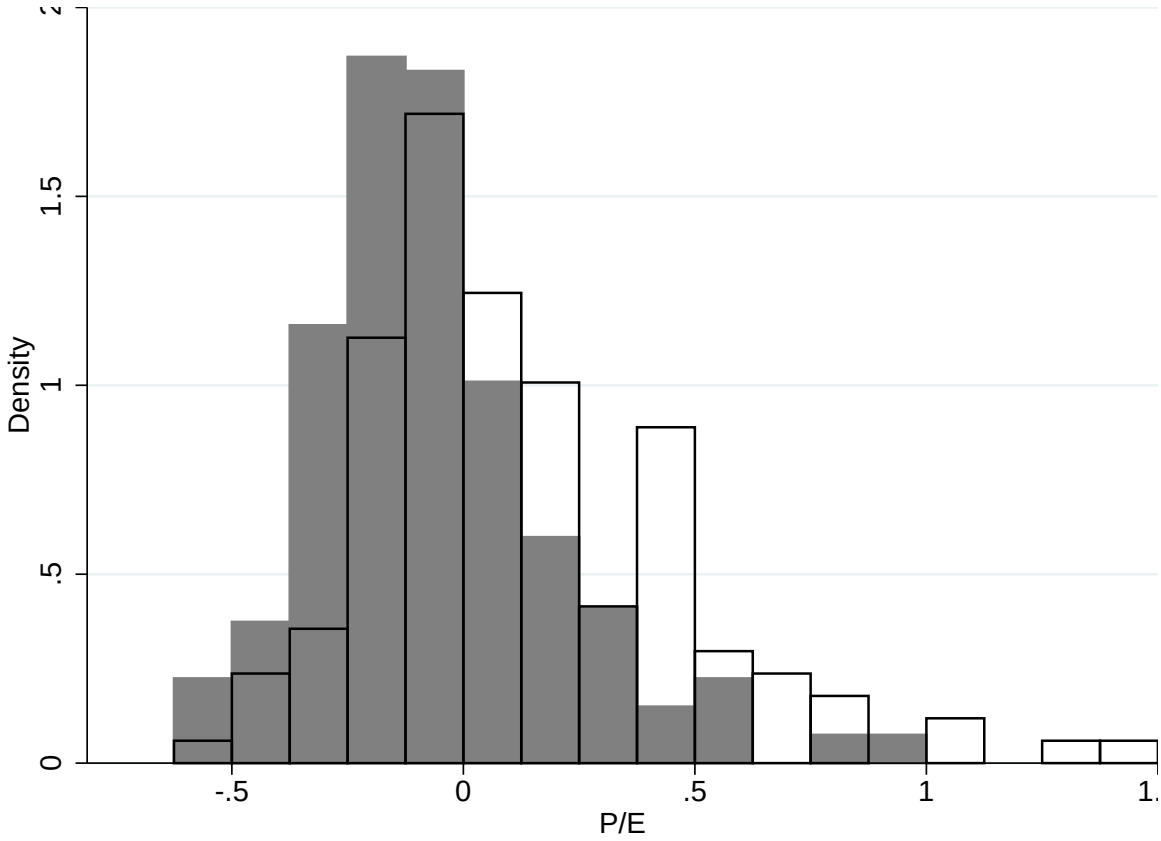


Figure 4: Price-to-earnings ratios of issuers relative to their peers

Empty bars with black outlines depict the distribution between October 2009 and November 2010. The superimposed gray bars depict the distribution between December 2010 and October 2012.