ORIGINAL ARTICLE

Can experience mitigate precautionary bidding? Evidence from a quasi-experiment at an IPO auction

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Abstract

This paper explores whether market experience exacerbates or mitigates institutional investors' precautionary bidding behavior. Using an IPO reform in China as an exogenous shock, we apply a difference-in-difference approach to identify a causal relationship between willingness to bid and market experience. The mutual funds' willingness to bid for the IPOs decreased by 13.53 percentage points after the removal of the three-month IPO lockup period. A one-standard-deviation increase in market experience in terms of IPO participation mitigated 4.36 percent of the decline. The mitigation effect of market experience on precautionary bidding is more pronounced for IPO firms with disadvantaged geographical locations, is attenuated for IPOs certified by reputable underwriters, and is attenuated in mutual funds that have strong business ties with the lead underwriters. Furthermore, we find investors with more market experience help to improve the efficiency of IPO pricing.

Keywords Experience · Precautionary bidding · IPO lockup

JEL Classification L14 · G10 · G23

Introduction

The effect of market experience on decision-making has received considerable attention in recent years, especially in the field of auctions. While there is a general consensus that economic agents can learn from past participation and form their bidding strategy (Camerer and Ho 1999; Kaustia and Knüpfer 2008), the influence of market experience on bidding behavior remains a subject of ongoing debate. On the one hand, economic agents with greater market experience have motivations to bid more aggressively, as they are subject to naive reinforcement learning and willing to undertake more risk following higher gains in past auctions (Glaser and Weber 2009; Chiang et al. 2011; Ben-David et al. 2018). On the other hand, experienced players have motivations to submit their bids conservatively, as they acquire more information and can bid at more accurate prices to obtain a higher winning probability at a lower cost (Li and Philips 2012; Pownall and Wolk 2013; Cao et al. 2016).

Unfortunately, a simple correlation of market experience and bidding outcomes is unlikely to measure the causal effect since auction participation is endogenous (Chiang et al. 2010; Sogo et al. 2016). Bidders who obtain better payoffs from past auctions are more likely to enter future auctions. Therefore, clean identification of the direction of causality is one of the biggest hurdles facing empirical work in this area. Furthermore, the precise channels through which market experience affects bidding behavior remain unclear. In this paper, we use a natural experiment created by the government mandate to achieve identification in our test. Specifically, we study whether market experience mitigates or exacerbates the effect of rising uncertainty caused by the government mandate on investors' bidding behavior.

In April 2012, China initiated a reform of its IPO policy and removed the prohibition on institutional investors selling their allocated new shares within three months after the IPO. The removal of the three-month lockup period has increased the supply of new shares in the post-IPO market and placed downward pressure on stock prices. Institutional investors face rising uncertainty caused by this mandate, and they may reduce their willingness to bid for the IPO auction. This phenomenon is a typical case of precautionary bidding, which refers to the situation in which bidders

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reduce their bids by more than the appropriate risk premium when the auctioned good is a risky lottery (Eso and White 2004; Kocher et al. 2015). We use the removal of IPO lockup as a natural experiment to examine the market experience-bidding behavior nexus to determine whether greater market experience mitigates or exacerbates precautionary bidding in the IPO auction process.

In our unique dataset for institutional bids for Chinese IPOs, we focus only on mutual fund bids. Mutual funds are the largest type of institutional investors in China in terms of equity investment (Tang et al. 2012), and they account for nearly half of total investor bids in the IPO auctions (Gao et al. 2020). Using a comprehensive sample of 11,935 bids from mutual funds for 341 Chinese IPOs from February 2011 to November 2012, we find that market experience plays an important role in mitigating precautionary bidding in auctions with ex-post risk. Following the removal of the three-month IPO lockup, mutual funds' willingness to bid decreases by 13.53 percentage points. This is mainly because mutual funds' precautionary bidding is exacerbated when they anticipate the increased risk of stock price fluctuation after trading begins. A one-standard-deviation increase in market experience in terms of IPO participation mitigates 4.36 percent of the 13.53-percentage-point decrease caused by the reform. The results are highly statistically significant at conventional levels after controlling for fund, industry and year fixed effects as well as firm and fund characteristics. We further explore cross-sectional patterns in the strength of the documented market experience-precautionary bidding relationship. We find the negative association between market experience and precautionary bidding is accentuated in IPO firms that are far away from financial centers, is mitigated for IPOs that are underwritten by reputed investment banks, and is mitigated in mutual funds that have close ties with the lead underwriters. Taking together, investors with more market experience help to improve the efficiency of IPO pricing.

We contribute to the literature along two important dimensions. Our first contribution is to the literature examining the effects of learning from experience. The majority of studies on investors' learning behavior focus on the stock market, finding that trading experience can improve investors' performance (Nicolosi et al. 2009; Seru et al. 2010; Kempf et al. 2017; Lunawat 2021) and reduce the behavioral bias of the disposition effect (Feng and Seasholes 2005; Dhar and Zhu 2006; Da Costa et al. 2013; Meng and Weng 2018). Moreover, they find that investors are more likely to participate in IPOs after good returns from past IPOs (Kaustia and Knupfer 2008; Chiang et al. 2011; Anagol et al. 2021). Our paper complements this literature by showing that market experience can also mitigate investors' precautionary bidding behavior.

Second, by using the removal of IPO lockup as a natural experiment, our study contributes to the growing literature on the effects of IPO lockup on stock pricing. Existing studies (Gao et al. 2017, 2018) argue that the removal of IPO lockup allows institutional investors to recover the opportunity cost of being unable to sell IPO shares; hence, they will submit higher bids after lockup removal. However, we find contrasting evidence that investors lower their bids after lockup removal, largely because the increase in the supply of new shares after lockup removal puts potential downward pressure on stock prices.

The remainder of this paper proceeds as follows: section "Institutional background" introduces the institutional background. Section "Identification strategy" presents our identification strategy. Section "Sample and data" describes the sample and data. Section "Empirical analysis" reports the empirical results and provides various heterogeneous analyses. Section "Mechanism" discusses the potential mechanism. Section "Discussions" discusses the implication of our main result with respect to pricing efficiency and section "Conclusion" concludes the paper.

Institutional background

The IPO process in China has been regulated by the Chinese Securities Regulatory Commission (CSRC), which has initiated a series of reforms to improve the price and allocation efficiency of IPOs. Since December 2004, the CSRC has adopted a hybrid auction/fixed price mechanism that includes an offline phase and an online phase.[1] In the offline phase, the lead underwriter conducts a road show, organizes the auction, sets the offer price and allocates the offer quantities for a maximum of 50% of the IPO shares. On November 1, 2010, which marks the beginning of our sample period, the CSRC implemented a reform of the IPO auction process that mainly encompasses two major changes. The first is the mandatory disclosure of bid information in auctions. The CSRC requires that issuers and underwriters disclose institutional investors' bid prices and quantities after the auction process is finished. The second is the change from a pro-rata basis to a lottery basis. In the lottery system, all qualified bids that institutional investors submit above the final offer price enter a lottery through which shares are allocated by underwriters via a lottery process. Institutional investors winning the lottery subscribe at the fixed offer price.

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[1] China uses a hybrid of auction and fixed price offering in its IPO process. China's IPO method is also referred to as a dirty Dutch auction in which the winning bidders pay the same price for the shares. Dirty Dutch auctions have been also used in other markets such as Australia, Belgium, Finland, France, Hungary, New Zealand, and the UK (Sherman 2005; Jagannathan et al. 2015).

However, the overevaluation of IPOs in the Chinese stock market has become a serious problem since 2010. The phenomenon of the "three highs" (high IPO offer price, high PE ratio and high excess fundraising) has generated much concern by the regulatory authority and various market participants. Although the firms that were listed raised much more capital than the amount required for their investment projects, the investors lost money on overvalued new shares that then dropped off dramatically after trading began. The percentage of broken IPOs (meaning the closing price on the first trading day is below the initial offer price) was 4.27% in 2010, but it reached 23.44% in 2011. Several factors have been found to contribute to the overevaluation of Chinese IPOs, among which overcompetition among institutional investors in the auction process was one of the main drivers (Yu et al. 2013; Song and Tang 2015).

To alleviate overcompetition among institutional investors in IPO auctions and improve the efficiency of IPO pricing, on April 28, 2012, the CSRC announced the removal of the three-month lockup policy. Before this date, it was required that the shares allotted to institutional investors be held for a three-month lockup period. After this date, the CSRC removed this restriction for offline institutional bidders. The removal of the three-month lockup period is set to boost the circulation of new shares on the first day of trading. This policy change made the new stocks no longer scarce, and the increase in supply naturally put downward pressure on stock prices.

In November 2012, the CSRC suspended the Chinese IPO market when the stock index hit a new low. In January 2014, the CSRC reopened the IPO market with a series of market-based IPO reforms, including mandates that placed limits on the ratio of overfunding and deleting 10% of the highest bids (Gao et al. 2020). These new mandates resulted in systematic changes in the incentives of institutional investors. To control for the potential effect of these structural changes, following Gao et al. (2020), we end our sample in November 2012.

Identification strategy

Precautionary bidding was first proposed by Eso and White (2004), in which they theoretically show that bidders exhibiting decreasing absolute risk aversion (DARA) unambiguously reduce their bids by more than the appropriate risk premium. The intuition is that DARA bidders prefer higher income in case that they win the auction and must bear the ex-post risk involved in the good and therefore bid more conservatively. There is a general consensus in the literature that most bidders exhibit decreasing absolute risk aversion (see such as Vasserman and Watt (2021)). All goods whose resale value or quality is uncertain ex ante to all buyers involve some ex-post risk (Kocher et al. 2015).[2]

Removing the three-month lockup policy may intensify the institutional investors' precautionary bidding behavior. After removal of the lockup policy, institutional investors with allocated shares have strong motivations to sell the stocks in the post-IPO market, as IPOs tend to be poor long-term investments in comparison to existing listed companies (Ritter and Welch 2002). Removing the lockup policy could increase the supply of new shares and cause a downward pressure on the stock prices (Field and Hanka 2001). We provide empirical evidence on this in Appendix B. Since investors could have anticipated the rising risk of post-IPO stock prices, they may become more precautionary or conservative in submitting their bids in the IPO auction process.

We employ a difference-in-difference approach to analyze the effects of market experience on precautionary bidding around the removal of the lockup policy. We design the analysis based on mutual funds' participation frequency in terms of IPO participation before the removal of the three-month lockup policy. This measure is motivated by several recent papers that exploit the variation across institutional investors in their frequency of IPO participation (Cao et al. 2016; Güçbilmez and Ó Briain 2021).[3] The rationale of using this measure is that, there is learning-by-bidding among institutional investors through participation in IPO auctions. Investors can acquire two bidding skills from past IPO auctions (Chiang et al. 2010, 2011), namely the ability to judge firm quality and the ability to shave bids sufficiently.[4]

As mutual funds have acquired bidding skills from past market experience, those with greater market experience may react less radically to the removal of the three-month lockup compared with those less experienced. We compare the bid prices from mutual funds before and after the policy reform as a function of their participation frequency,

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[2] As pointed out by Kocher et al. (2015), examples of auctions with ex-post risk are numerous and financially significant. One such example is the auction of television rights for Olympic Games. The winner bears the risk of a more or less attractive host, a risk arising from information unavailable to any bidder at the time the rights are allocated.

[3] While prior bidding frequency is a widely adopted measure for market experience, we admit that it is not a perfect measure. For example, there might be some investors that are very experienced in the market but did not participate in IPO bidding for a short period. These non-bidding episodes by the highly experienced investor would then be identified as inexperience in the marketplace. We thank the anonymous referee for pointing out the limitation of this measure.

[4] The first ability is about judging firm quality. If a bidder receives high returns from previous IPO auctions, she is more confident on her judgment regarding firm quality, and thus she is more likely to participate in future auctions. The second ability is about whether the bidder shaves her bids adequately. A bidder has to weigh the costs and benefits of a higher bid. When she participates more auctions, she learns how to submit bids to address the winner's curse.

Fig. 1 Trends of bid prices
for firms with different market
experience. Notes: We plot the
trends of normalized bid prices
for firms with different levels
of market experience. The
normalized bid price is defined
as the bid price divided by the
midpoint of the IPO price range
and subtract one. "*Frequent
Bidders*" corresponds to mutual
funds that are above the 50th
percentile of the distribution
of auction participation times
before April 28, 2012. "*Nonfre-
quent Bidders*" corresponds to
mutual funds that are below the
50th percentile of the distribu-
tion of auction participation
times before April 28, 2012.
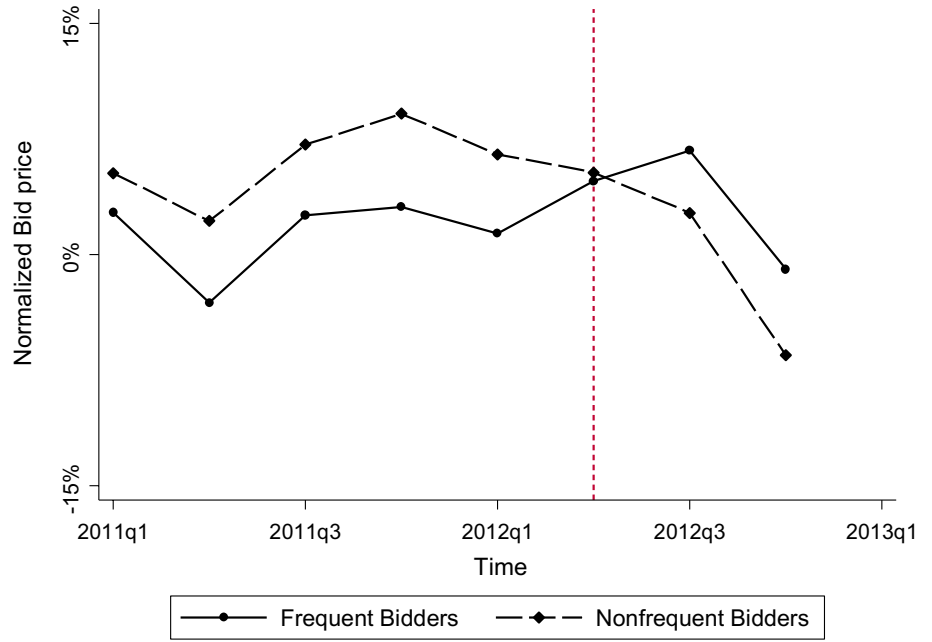
controlling for fund, industry and year fixed effects, as well
as stock and investor characteristics. The identification
assumption is that, without the policy reform, the bid prices
would follow the same trend for mutual funds with differ-
ent levels of participation frequency. As the removal of the
three-month lockup period was unexpected, mutual funds
were unlikely to systematically adjust their bidding behavior
before the policy reform. Therefore, mutual funds' frequency
of IPO participation before the policy reform is not associ-
ated with unobserved fund characteristics that might cor-
relate with their bid prices. We later show that this common
pretrend assumption is supported by our data.

To test our hypothesis on the effect of market experience
on precautionary bidding around the removal of the IPO
lockup policy, we estimate the following regression model:

$$BidPrice_{i,j,t} = \beta_0 + \beta_1 Frequency_i + \beta_2 Reform_t$$
$$+ \beta_3 Frequency_i \times Reform_t \qquad (1)$$
$$+ \gamma Controls + \delta_y + \phi_i + \lambda_{industry} + \varepsilon_{i,j,t}$$

where subscript i, j, t denotes fund i, IPO firm j and time
t, respectively. BidPrice$_{i,j,t}$ denotes the normalized bid price
from fund i for IPO firm j at time t. $Frequency_i$ is the loga-
rithm of the total number of IPOs that fund i has participated
before the policy reform. $Reform$ is an indicator variable for
the policy reform, with a value of 1 for IPOs conducted after
April 28, 2012, the official date that the IPO lockup period is

removed, and zero otherwise. Our key variable of interest is
the interaction between participation frequency (*Frequency*)
and policy reform (*Reform*). We control for various firm
characteristics, such as firm size, debt-to-asset ratio, return
on assets, and various fund characteristics, such as fund size
and the number of fund bidders. In addition, we control for
market emotion, defined as the stock market return during
30 trading days before the IPO. We include year fixed effects
δ_y, fund fixed effects ϕ_i and industry fixed effects $\lambda_{industry}$ and
cluster the standard errors at the mutual fund level.

The key concern about inferences from studies using the dif-
ference-in-difference framework is whether the parallel trend
assumption holds. Figure 1 plots the pre-event trends of normal-
ized bid prices made by mutual funds with different levels of
participation frequency before the removal of the lockup pol-
icy. We refer to mutual funds that bid frequently in the auctions
(above the median of the distribution of participation frequency)
as frequent bidders and those that participate in IPO auctions
less frequently as nonfrequent bidders. Before the reform, the
figure shows that nonfrequent bidders (long dashed lines) and
frequent bidders (solid lines) show a similar trajectory of bid
prices. However, after the policy reform, bid prices from non-
frequent bidders dropped dramatically, and the magnitude of
their decline exceeded that of the frequent bidders. This pattern
demonstrates the validity of the parallel trend assumption in our
difference-in-difference framework.

Table 1 Sample distribution

Year	# of firms	% of firms
Panel A: Firm distribution by year		
2011	213	62.46
2012	128	37.54
Total	341	100
Board	**# of firms**	**% of firms**
Panel B: Firm distribution by listing-board		
Small and medium-size Enterprise	157	46.04
ChiNext	184	53.96
Total	341	100.00
Investment type	**# of funds**	**% of funds**
Panel C: Fund distribution by investment type		
Stock fund	10	2.72
Bond fund	83	22.62
Hybrid fund	274	74.66
Total	367	100.00
Investment type	**# of bids**	**% of bids**
Panel D: Bid distribution by fund's investment type		
Stock fund	164	1.37
Bond fund	6071	50.87
Hybrid fund	5700	47.76
Total	11,935	100.00

This table shows the firm distribution across year and listing board, fund distribution across investment type and bid distribution across fund investment type

Sample and data

Data and sample

Our sample period is from February 2011 to November 2012.[5] Considering the difference in auction mechanisms between the main board in SHSE and the SME board and ChiNext board in SZSE (Cao et al. 2016; Gao et al. 2020), we only focus our sample on firms listed on the SME board and the ChiNext board.[6] There are a total of 341 IPO firms

in our sample. The year and listing-board distributions of our sample are presented in Panels A and B of Table 1, respectively. Two hundred thirteen IPOs occurred in 2011, followed by 128 in 2012. The number of IPO firms from the SME board and the ChiNext board are almost balanced. We hand collected a large database of 11,935 bids from mutual funds in 341 order books. Each order book contains detailed IPO bidding information, including bidder name, bid price, and the corresponding demand quantity. It also lists the final offer price and the number of actual shares allocated to each mutual fund after the closure of the bidding period. The distributions of fund type and bid prices across different fund types are shown in Panels C and D of Table 1. A total of 367 mutual funds participated in the auction process, of which approximately 74.66% were hybrid funds, 22.62% were bond funds and 2.72% were stock funds. Bond funds are the most active investors, accounting for 50.87% of total bids. Hybrid funds are the second most common, submitting 47.76% of total bids. We obtain financial and stock market data from the Wind database and the Chinese Stock Market Accounting Research (CSMAR).

Summary statistics

Table 2 provides variable descriptions for all of the dependent and independent variables in our study. We follow the method of Hanley (1993) and Gao et al. (2020) and normalize the bid price using the midpoint of the IPO price range. To calculate our main variable of interest, *Normalized Bid Price*, we divide the bid price by the midpoint of the IPO price range and subtract 1. The normalized bid price has a mean (median) value of 2.85% (3.74%), indicating that the average bid from mutual funds is above the midpoint of the initial IPO price range.

Table 2 also describes the other variables employed in this study. The natural logarithm of assets for IPO firms ranges from 4.57 to 10.88, with a mean value of 6.16 and a median value of 6.07. The ratio of debt to assets for IPO firms ranges from 4.65 to 81.99%, with a mean value of 42.99% and a median value of 43.05%. The IPO firms in our sample are on average profitable, with a mean value of 16.2% for the return on assets. The number of fund bidders participating in the IPO varies significantly, ranging from 3 to 263, with a mean value of 35.68. The stock market return during the 30 trading days before the IPO is negative on average, with a mean value of -1.83%. The natural logarithm of total net assets for mutual funds ranges from

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[5] Our institutional background section explains the underlying reasons for using this time period. In addition, we drop the observations of the first three months (November 2010 to January 2011) since the 2010 IPO reform. This is because the mutual fund bidders may gain limited experience at the beginning of IPO auctions, therefore the effect of market experience on bidding behavior will be noisy during the first three months. To control for this effect, we delete the observations of the first three months.

[6] Prior to November 1, 2010, the allocation of IPO shares in the offline phase in China followed a pro rata system in which allocations were proportional to investors' bidding volume. After this date, the allocation rule remained the same on the main board in the Shanghai

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Footnote 6 (continued)

Stock Exchange but switched to a lottery system on the SME Board and the ChiNext Board in the Shenzhen Stock Exchange.

Table 2 Summary statistics

	N	Mean	SD	Min	Median	Max
Panel A: IPO-level observations						
Stock size	341	6.16	0.78	4.57	6.07	10.88
Debt-to-asset ratio (%)	341	42.99	16.14	4.65	43.05	81.99
Return on the asset (%)	341	16.2	7.74	2.25	14.5	48.76
Number of fund bidders	341	35.68	25.3	3	30	263
Market emotion (%)	341	−1.83	6.56	−17.09	−2.73	13.76
Panel B: Fund-level observations						
Number of IPO participation	367	27.31	38.64	1	12	211
Log (number of IPO participation)	367	2.48	1.34	0	2.48	5.35
Fund size	367	7.52	1.13	2.67	7.60	10.17
Bond fund	367	0.23	0.42	0	0	1
Panel C: Bid-level observations						
Normalized bid price (%)	11,935	2.85	17.37	−61.11	3.74	58.33
Alternative bid price 1 (%)	11,935	−14.37	25.46	−86.58	−15.21	94.38
Alternative bid price 2 (%)	11,935	−16.19	23.7	−88.8	−17.84	94.38

This table reports the summary statistics of our variables. Our sample includes 341 Chinese IPOs on the SME Board and the ChiNext Board from February 2011 to November 2012. We hand collect complete bid prices from 367 mutual funds for these IPOs. We obtain financial and stock market data on IPO firms from the Wind database and the Chinese Stock Market Accounting Research (CSMAR). The Appendix contains detailed variable definitions

2.67 to 10.17, with a mean value of 7.52. The total number of IPO participation for each mutual fund before the removal of the IPO lockup ranges from 1 to 211, with a mean value of 27.31. Our key variable of interest, the natural logarithm of IPO participation (also known as frequency), has a mean value of 2.48, with a standard deviation of 1.34.

Empirical analysis

Baseline results

Table 3 reports the estimated effect of market experience on bidding behavior following the policy reform with a full set of controls and fixed effects. In column (1), the model includes year and industry fixed effects, and in column (2), the model includes fund and industry fixed effects.[7] In column 3, the model includes year, fund and industry fixed effects. The main variable of interest is the interaction between *Frequency* and *Reform*, which captures the impact of market experience on mutual fund bidding behavior following policy reform.

In columns 1–3, the coefficients on *Reform* are consistently negatively significant, indicating that mutual funds lower their bids after the removal of the three-month lockup period. On average, the bid prices from mutual funds

decrease by 13.53 percentage points after the policy reform. This indicates that mutual funds become more precautionary in submitting their bids when they anticipate the rising risk of post-IPO stock prices. Our main variable of interest is the interaction term between *Frequency* and *Reform*. The coefficients on *Frequency*Reform* are consistently positive and significant at the 1% level across all specifications. This suggests that mutual funds with higher levels of participation frequency experience an overall decrease in bid prices after the policy reform but much less so than mutual funds with lower levels of participation frequency. The variable (logarithm of) participation frequency also has explanatory power, mitigating the effect of policy reform. The mitigation effect is economical: a one-standard-deviation increase in participation frequency would mitigate 4.36 (3.255*1.34) percent of the 13.53-percentage-point decrease in the normalized bid price. These findings hold after we control for time-unvarying unobserved heterogeneity across funds (fund fixed effects) and industry (industry fixed effects) and time-specific effects (year fixed effects). The robust standard errors are clustered at the mutual fund level to address the possible serial correlation of the dependent and independent variables within funds.

Robustness

To further assess the robustness of our findings, we conduct two sensitivity tests.

First, we examine the sensitivity of our results to alternative measures of market experience. As outlined earlier,

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[7] We follow the industry classification code in Wind. In our sample, the IPO firms are subject to 49 industry classifications.

Table 3 Results for baseline regressions

Variables	Normalized bid price		
	(1)	(2)	(3)
Frequency	−2.184***		
	(0.288)		
Reform	−13.913***	−14.505***	−13.528***
	(1.970)	(1.832)	(2.089)
Frequency*Reform	3.267***	3.210***	3.255***
	(0.457)	(0.498)	(0.492)
Stock size	0.840***	0.876***	0.917***
	(0.306)	(0.292)	(0.297)
Debt ratio	−0.083***	−0.081***	−0.084***
	(0.018)	(0.017)	(0.017)
ROA	−0.042	−0.041	−0.036
	(0.036)	(0.033)	(0.034)
Number of fund bidders	3.125***	3.095***	2.991***
	(0.486)	(0.458)	(0.486)
Market emotion	−0.058*	−0.078**	−0.061**
	(0.030)	(0.031)	(0.030)
Fund size	−0.134	2.971*	2.936*
	(0.271)	(1.550)	(1.553)
Constant	0.235	−31.312**	−31.145**
	(3.562)	(12.242)	(12.290)
Year fixed	Yes	No	Yes
Fund fixed	No	Yes	Yes
Industry fixed	Yes	Yes	Yes
Observations	11,935	11,935	11,935
R-squared	0.073	0.154	0.155

This table examines how mutual funds' market experience affects their bidding behavior after the removal of the three-month lockup policy. Our sample includes 341 Chinese IPOs on the SME Board and the ChiNext Board from February 2011 to November 2012. We hand collect complete bid prices from 367 mutual funds for these IPOs. We obtain financial and stock market data on IPO firms from the Wind database and the Chinese Stock Market Accounting Research (CSMAR). The controls include firm size, debt-to-asset ratio, return on assets, fund size, the number of fund bidders, and market emotion. Appendix A contains detailed variable definitions. We control for year, fund, and industry fixed effects and cluster for standard errors at the mutual fund level. Standard errors are reported in parentheses. One, two and three asterisks denote significance at the 10%, 5% and 1% levels, respectively

we construct our participation frequency measure based on the number of IPO auctions in which the mutual funds have participated. Since each mutual fund is allowed to submit multiple bids with different bid prices during the auction, the fund manager may acquire more experience and gain more information by submitting multiple bids. To capture this bidding strategy, we re-estimate our baseline model using an alternative measure of participation frequency, *Bid_Frequency*. It is the logarithm of the total number of bids submitted by the mutual fund before the policy reform.

In addition, there is an information sharing channel among mutual funds affiliated with the same fund family (Gaspar et al. 2006; Liu et al. 2017; Li and Wang 2022), and a mutual fund may learn from its sibling funds which have participated in IPO auctions. Therefore, a fund manager's bidding behavior may also be influenced by the market experience acquired at the fund family level. To capture this effect, we re-estimate our baseline model using a second alternative measure of participation frequency, *Fam_Frequency*, which is the logarithm of the total number of IPOs participating at the fund family level before the policy reform. The results, reported in Table 4, show that the coefficients on the interaction term *Bid_Frequency*Reform* and coefficients on the interaction term *Fam_Frequency*Reform* all remain positive and statistically significant at the 1% level. This suggests that the use of different measures of participation frequency has no material impact on our findings.

Second, we explore the robustness of our findings to alternative measures of the normalized bid price. As outlined earlier, we normalize the bid price using the midpoint of the initial IPO price range, which represents the expected offer price. To ensure that our results are not sensitive to the selection of scale factors, we re-estimate our baseline model using two alternative measures of normalized bid price. The first measure is *ABP_1*, which uses the stock price three months after the IPO as the scale factor. Before April 28, 2012, the CSRC mandated that institutional investors hold their allocated new shares for at least three months. When mutual funds make decisions on their bid prices they will submit, they may use their expectation for the stock price three months after the IPO as the reference point. We use this reference point as the scale factor, and it can evaluate the reasonableness of the bid price *ex-post*. The second measure, *ABP_2*, is a modified version of *ABP_1*. After April 28, 2012, the CSRC removed the restriction requiring the three-month lockup period for institutional investors. Therefore, we replace the scale factor in *ABP_1* after the policy change by using the closing price on the first day of the IPO. The results reported in Table 5 show that the coefficients on the interaction term *Frequency*Reform* remain positive and significant (p-value < 0.01). Based on these results, we conclude that our findings are not sensitive to alternative measures of the normalized bid price.

Third, we expand our sample to include all institutional investors and examine whether the overall bidding has changed with the policy reform. Seven types of institutional investors have participated in the IPO auctions (Qian et al. 2021), including mutual funds, securities companies, insurance companies, financial firms (conglomerates' financing subsidiaries), trust firms, recommended institutional investors by underwriters, and qualified foreign institutional investors (QFIIs). We re-estimate the baseline model using this new data sample. As shown in Table 6, the coefficient

Table 4 Robustness check: alternative measures for participation frequency

Variables	Normalized bid price					
	(1)	(2)	(3)	(4)	(5)	(6)
Bid_Frequency	−2.339***					
	(0.317)					
Reform	−19.052***	−19.699***	−18.766***	−19.436***	−22.423***	−22.092***
	(2.424)	(2.203)	(2.451)	(6.126)	(6.042)	(6.466)
Bid_Frequency*Reform	4.121***	4.101***	4.128***			
	(0.526)	(0.548)	(0.546)			
Fam_Frequency				−2.352***		
				(0.562)		
Fam_Frequency*Reform				3.582***	4.114***	4.142***
				(1.222)	(1.334)	(1.295)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed	Yes	No	Yes	Yes	No	Yes
Fund fixed	No	Yes	Yes	No	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,935	11,935	11,935	11,935	11,934	11,934
R-squared	0.076	0.156	0.156	0.066	0.102	0.102

This table reports the regression results of the robustness checks for our baseline results. We use two alternative measures to proxy for market experience. Our sample includes 341 Chinese IPOs on the SME Board and the ChiNext Board from February 2011 to November 2012. We hand collect complete bid prices from 367 mutual funds for these IPOs. We obtain financial and stock market data on IPO firms from the Wind database and the Chinese Stock Market Accounting Research (CSMAR). The controls include firm size, debt-to-asset ratio, return on assets, fund size, the number of fund bidders, and market emotion. Appendix A contains detailed variable definitions. We control for year, fund, and industry fixed effects and cluster for standard errors at the mutual fund level. Standard errors are reported in parentheses. One, two and three asterisks denote significance at the 10%, 5% and 1% levels, respectively

on the interaction term has the same sign with similar magnitude as that in our baseline regression result. It suggests that the overall bid prices of the institutional investors have decreased after the removal of the three-month lockup policy, and the price decline is smaller for institutional investors with higher levels of participation frequency compared to those with lower levels of participation frequency. It confirms that our main results hold if we expand our sample to include all institutional bidders.

Heterogeneous analysis

In this subsection, we identify three cross-sectional factors that strengthen or weaken our baseline result.

The effect of geographic location

We investigate the moderating effect of the IPO firm's geographic location on the relation between market experience and precautionary bidding. IPO firms are typically young, immature, and relatively informationally opaque (Ljungqvist 2007); therefore, both information asymmetry and the limited attention of investors play an important role in IPO pricing. As argued by (El Ghoul et al. 2013), a firm's geographic location with respect to central areas is a good measure of

the severity of information asymmetry, and remote firms suffer greater information asymmetry than firms located in large cities (Loughran and Schulz 2005; Loughran 2007).[8] Therefore, we expect the moderating effect of market experience on funds' bidding behavior to be more pronounced in IPO firms with disadvantaged locations. We use the measure *Remote* as a proxy for remote firms, which equals one if the headquarters of the IPO firm is at least 200 kilometers away from any of three financial centers (Shanghai, Beijing and Shenzhen) and zero otherwise.

Table 7 presents regression evidence of the role of geographical location in moderating the effect of market experience on precautionary bidding following the policy reform. We estimate a triple-differences regression model, including an indicator for remote firms and its interactions with participation frequency and the policy variable. The point estimates imply that although the mutual funds' overall bid prices decrease after the policy reform, the mitigation effect

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[8] Local investors benefit from their access to soft information through improved monitoring due to daily exposure to news stories about the local economy and its firms (Gaspar and Massa 2007). However, financial institutions and analysts that are predominately located in financial centers tend to neglect remote firms (Loughran 2007).

Table 5 Robustness check: alternative measures for bid price

Variables	ABP_1			ABP_2		
	(1)	(2)	(3)	(4)	(5)	(6)
Frequency	−1.683***			−1.573***		
	(0.344)			(0.338)		
Reform	−6.995***	−15.228***	−7.755***	−11.517***	−17.806***	−11.931***
	(1.977)	(2.144)	(2.271)	(1.843)	(1.924)	(2.068)
Frequency*Reform	3.114***	2.990***	3.330***	2.091***	1.938***	2.205***
	(0.492)	(0.552)	(0.537)	(0.458)	(0.506)	(0.497)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed	Yes	No	Yes	Yes	No	Yes
Fund fixed	No	Yes	Yes	No	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,935	11,935	11,935	11,935	11,935	11,935
R-squared	0.259	0.293	0.303	0.244	0.285	0.292

This table reports the regression results of the robustness checks for our baseline results. We use two alternative measures to proxy for the normalized bid prices. Our sample includes 341 Chinese IPOs on the SME Board and the ChiNext Board from February 2011 to November 2012. We hand collect complete bid prices from 367 mutual funds for these IPOs. We obtain financial and stock market data on IPO firms from the Wind database and the Chinese Stock Market Accounting Research (CSMAR). The controls include firm size, debt-to-asset ratio, return on assets, fund size, the number of fund bidders, and market emotion. Appendix A contains detailed variable definitions. We control for year, fund, and industry fixed effects and cluster for standard errors at the mutual fund level. Standard errors are reported in parentheses. One, two and three asterisks denote significance at the 10%, 5% and 1% levels, respectively

Table 6 Using the sample of all institutional bidders

Variables	Normalized bid price		
	(1)	(2)	(3)
Frequency	−1.574***		
	(0.257)		
Reform	−9.663***	−10.793***	−10.844***
	(1.558)	(1.702)	(1.534)
Frequency*Reform	2.362***	2.649***	2.646***
	(0.372)	(0.405)	(0.413)
Controls	Yes	Yes	Yes
Year fixed	Yes	No	Yes
Bidder fixed	No	Yes	Yes
Industry fixed	Yes	Yes	Yes
Observations	28,902	28,902	28,902
R-squared	0.046	0.170	0.170

This table examines how bidders' market experience affects IPO pricing efficiency after the removal of the three-month lockup policy. Our sample includes all institutional bidders for 341 Chinese IPOs on the SME Board and the ChiNext Board from February 2011 to November 2012. We obtain financial and stock market data on IPO firms from the Wind database and the Chinese Stock Market Accounting Research (CSMAR). The controls include firm size, debt-to-asset ratio, return on assets, fund size, the number of fund bidders, and market emotion. Appendix A contains detailed variable definitions. Standard errors are reported in parentheses. One, two and three asterisks denote significance at the 10%, 5% and 1% levels, respectively

of participation frequency on bid prices is approximately 2.26 percentage points higher for IPO firms with disadvantaged locations than for IPO firms located close to financial centers. The results indicate that the mitigation effect of market experience on precautionary bidding is more pronounced in IPO firms with proximity to financial centers than in IPO firms in remote locations.

The effect of IPO certification

There is a considerable degree of information asymmetry between insiders and outside investors in the IPO process. Outside investors attempt to use various indicators to infer the quality of the IPO firm, such as whether the firm is underwritten by a high-quality underwriter (Carter and Manaster 1990). The presence of a reputable underwriter mitigates the information asymmetry by certifying the quality of the issue (Chen et al. 2020). Therefore, we hypothesize that the mitigation effect of market experience on precautionary bidding should be attenuated for IPOs with greater levels of certification. We use the measure *Underwriter* as a proxy for the reputable underwriter indicator variable, which is equal to one if the lead underwriter ranks in the top 10 in terms of the total number of IPOs she has managed in the year prior to the current IPO.

We use a triple-differences regression to study the role of IPO certification in moderating the impact of experience on bidding behavior after the policy change. Table 8 reports

Table 7 Heterogeneous analysis: moderating effect of geographic location

Variables	Normalized bid price		
	(1)	(2)	(3)
Frequency	−2.084***		
	(0.300)		
Reform	−8.223***	−8.914***	−8.307***
	(2.064)	(2.009)	(2.215)
Remote	2.748	2.096	2.011
	(1.805)	(1.805)	(1.810)
Frequency*Reform	2.238***	2.292***	2.336***
	(0.472)	(0.531)	(0.521)
Frequency*Remote	−0.192	0.029	0.040
	(0.456)	(0.451)	(0.451)
Reform*Remote	−15.066***	−14.241***	−14.045***
	(3.009)	(2.997)	(3.003)
Frequency*Reform*Remote	2.537***	2.294***	2.263***
	(0.744)	(0.740)	(0.741)
Controls	Yes	Yes	Yes
Year fixed	Yes	No	Yes
Fund fixed	No	Yes	Yes
Industry fixed	Yes	Yes	Yes
Observations	11,935	11,935	11,935
R-squared	0.080	0.161	0.161

This table presents the regression results for the effects of geographic location on the relation between market experience and precautionary bidding. Our sample includes 341 Chinese IPOs on the SME Board and the ChiNext Board from February 2011 to November 2012. We hand collect complete bid prices from 367 mutual funds for these IPOs. We obtain financial and stock market data on IPO firms from the Wind database and the Chinese Stock Market Accounting Research (CSMAR). The controls include firm size, debt-to-asset ratio, return on assets, fund size, the number of fund bidders, and market emotion. Appendix A contains detailed variable definitions. We control for year, fund, and industry fixed effects and cluster for standard errors at the mutual fund level. Standard errors are reported in parentheses. One, two and three asterisks denote significance at the 10%, 5% and 1% levels, respectively

the regression results. The coefficients of the triple-interaction term are statistically negative across all regression specifications. The point estimates imply that although the mutual funds' overall bid prices decrease after the policy reform, the mitigation effect of participation frequency on bid prices is approximately 1.50 percentage points lower for IPO firms underwritten by a prestigious underwriter than for IPOs underwritten by an undistinguished underwriter. The results indicate that the mitigation effect of market experience on precautionary bidding is attenuated for IPOs with strong certification characteristics.

The effect of business ties

The relationship between underwriters and institutional investors can exert a large influence on the efficiency of IPO pricing (Sherman and Titman 2002; Loughran and Ritter 2002). Investment banks are also brokerage firms that promote trading through their research and, in return, receive commissions. Trading commissions from institutional investors, especially mutual funds, are the primary source of revenue for investment banks' brokerage business (Gu et al. 2013). Strong business ties between mutual funds and underwriters may lead to higher bid prices in the IPO auction. Therefore, we hypothesize that the impact of market experience on precautionary bidding may be mitigated in mutual funds with strong business ties with underwriters. We use the measure *DTies* as a proxy for business ties, which equals one if the mutual fund family has paid brokerage commission to the lead underwriters and zero otherwise.

We use a triple-differences regression to study the role of business ties in mitigating the impact of market experience on precautionary bidding. As shown in Table 9, the coefficients on the triple-interaction term are statistically negative at conventional levels of significance. The point estimates imply that although mutual funds' overall bid prices decrease after the policy reform, the mitigation effect of participation frequency on bid prices is approximately 1.24 percentage points lower for mutual funds with

Table 8 Heterogeneous analysis: moderating effect of IPO certification

Variables	Normalized bid price		
	(1)	(2)	(3)
Frequency	−2.086***		
	(0.344)		
Reform	−18.033***	−18.564***	−17.575***
	(2.298)	(2.101)	(2.385)
Underwriter	2.614	1.597	1.757
	(1.658)	(1.701)	(1.706)
Frequency*Reform	3.928***	3.870***	3.891***
	(0.544)	(0.567)	(0.563)
Frequency*Underwriter	−0.255	−0.070	−0.095
	(0.400)	(0.410)	(0.410)
Reform*Underwriter	7.981***	8.529***	8.214***
	(2.433)	(2.483)	(2.512)
Frequency*Reform*Underwriter	−1.449**	−1.543**	−1.497**
	(0.612)	(0.621)	(0.625)
Controls	Yes	Yes	Yes
Year Fixed	Yes	No	Yes
Fund Fixed	No	Yes	Yes
Industry Fixed	Yes	Yes	Yes
Observations	11,935	11,935	11,935
R-squared	0.080	0.159	0.160

This table presents the regression results for the effects of IPO certification on the relation between market experience and precautionary bidding. Our sample includes 341 Chinese IPOs on the SME Board and the ChiNext Board from February 2011 to November 2012. We hand collect complete bid prices from 367 mutual funds for these IPOs. We obtain financial and stock market data on IPO firms from the Wind database and the Chinese Stock Market Accounting Research (CSMAR). The controls include firm size, debt-to-asset ratio, return on assets, fund size, the number of fund bidders, and market emotion. Appendix A contains detailed variable definitions. We control for year, fund, and industry fixed effects and cluster for standard errors at the mutual fund level. Standard errors are reported in parentheses. One, two and three asterisks denote significance at the 10%, 5% and 1% levels, respectively

Table 9 Heterogeneous analysis: moderating effect of business ties

Variables	Normalized bid price		
	(1)	(2)	(3)
Frequency	−1.898***		
	(0.370)		
Reform	−18.282***	−19.374***	−18.375***
	(2.386)	(2.254)	(2.489)
DTies	3.506**	1.959	2.015
	(1.486)	(1.456)	(1.461)
Frequency*Reform	3.845***	3.911***	3.929***
	(0.555)	(0.585)	(0.582)
Frequency*DTies	−0.543	−0.208	−0.212
	(0.356)	(0.350)	(0.351)
Reform*DTies	6.557***	8.017***	7.776***
	(2.256)	(2.195)	(2.197)
Frequency*Reform*DTies	−0.971*	−1.278**	−1.240**
	(0.546)	(0.532)	(0.531)
Controls	Yes	Yes	Yes
Year fixed	Yes	No	Yes
Fund fixed	No	Yes	Yes
Industry fixed	Yes	Yes	Yes
Observations	11,935	11,935	11,935
R-squared	0.079	0.159	0.159

This table presents the regression results for the effects of business ties between mutual funds and underwriters on the relation between market experience and precautionary bidding. Our sample includes 341 Chinese IPOs on the SME Board and the ChiNext Board from February 2011 to November 2012. We hand collect complete bid prices from 367 mutual funds for these IPOs. We obtain financial and stock market data on IPO firms from the Wind database and the Chinese Stock Market Accounting Research (CSMAR). The controls include firm size, debt-to-asset ratio, return on assets, fund size, the number of fund bidders, and market emotion. Appendix A contains detailed variable definitions. We control for year, fund, and industry fixed effects and cluster for standard errors at the mutual fund level. Standard errors are reported in parentheses. One, two and three asterisks denote significance at the 10%, 5% and 1% levels, respectively

a strong connection with lead underwriters than for mutual funds with a weak connection. The results suggest that the mitigation effect of market experience on precautionary bidding is attenuated in mutual funds with strong business ties.

Mechanism

In our previous analysis, we show that investors' market experience mitigates their precautionary bidding behavior. There may be one potential mechanism that we can explain the result. The underlying mechanism is that learning by doing from market experience alleviates information asymmetry between issuers and investors, thus reducing the extent of precautionary bidding.

Information asymmetry is widely viewed as a source of market failure and can be alleviated by learning-by-doing through information production (Freedman and Jin 2011). In our context, institutional investor may learn by bidding from past IPO auctions. As they participate in more IPO auctions, they may become more and more sophisticated in evaluating firm value, thus reducing their precautionary bidding. As argued by Chiang et al. (2010, 2011), bidders can learn how to judge firm quality from past IPO auctions. A bidder begins with a prior about the firm's value based on its prospectus and updates her belief upon receiving private information. Over time, she learns how

much to trust her private information relative to public information when selecting auctions. As a result, a bidder will select auctions more accurately as she gains more experience.

Investors may also learn more about the market-wide risk through their past participation (Freedman and Jin 2011), which reduces the ex ante valuation uncertainty regarding the value of the IPO firms. In other words, the information to be learned from auctions is the true average risk of IPOs. Investors bid more conservatively when their perception of ex ante risk increases; however, the reduction of valuation uncertainty by market experience mitigates investors' incentives to engage in precautionary bidding.

Discussions

IPO pricing efficiency is a key issue both from an investor and a regulator perspective. We go a little further in this section to assess the potential implication of our main results with respect to pricing efficiency. We examine whether fund bidders' market experience improves IPO pricing efficiency after the removal of the three-month lockup policy. In an efficient IPO market, both the issuer and the underwriter want to set the offer price as high as possible given that the underwriter can successfully place the shares with the investors. However, the literature has found that IPOs tend to be underpriced due to various behavioral reasons (Ritter 1991; Loughran and Ritter 2002; Binay et al. 2007), thus eroding the pricing efficiency. A major reason for underpricing is the information asymmetry between issuers and investors (Lee et al. 1996; Lees and Wahal 2004). As market experience can mitigate information asymmetry, it may help to reduce underpricing and improve IPO pricing efficiency. Based on this rationale, we investigate whether fund bidders with higher frequency of IPO participation helps to improve IPO pricing efficiency (i.e., reduce IPO underpricing) compared with fund bidders with lower frequency of IPO participation, after the removal of the three-month lockup policy. Following Kao and Chen (2020), we use first-day return (the return from the final offer price to the closing price on the first trading day) to examine the efficiency of the final offer price. First-day return is a widely used measure for IPO underpricing (less IPO underpricing suggests more efficiency of the final offer price).

Table 10 presents the estimation results. In column (1), the model includes year and industry fixed effects, and in column (2), the model includes fund and industry fixed

Table 10 Market experience and IPO pricing efficiency

Variables	First-day return		
	(1)	(2)	(3)
Frequency	1.350***		
	(0.461)		
Reform	49.862***	49.968***	60.143***
	(5.805)	(6.377)	(6.548)
Frequency*Reform	−6.827***	−9.734***	−9.271***
	(1.329)	(1.503)	(1.521)
Controls	Yes	Yes	Yes
Year fixed	Yes	No	Yes
Fund fixed	No	Yes	Yes
Industry fixed	Yes	Yes	Yes
Observations	11,935	11,935	11,935
R-squared	0.338	0.366	0.369

This table examines how mutual funds' market experience affects IPO pricing efficiency after the removal of the three-month lockup policy. Our sample includes 341 Chinese IPOs on the SME Board and the ChiNext Board from February 2011 to November 2012. We hand collect complete bid prices from 367 mutual funds for these IPOs. We obtain financial and stock market data on IPO firms from the Wind database and the Chinese Stock Market Accounting Research (CSMAR). The controls include firm size, debt-to-asset ratio, return on assets, fund size, the number of fund bidders, and market emotion. Appendix A contains detailed variable definitions. Standard errors are reported in parentheses. One, two and three asterisks denote significance at the 10%, 5% and 1% levels, respectively

effects. In column (3), the model includes year, fund and industry fixed effects. The coefficients on *Reform* are all significantly positive, indicating that removing the three-month lockup policy makes the IPO price more underpriced. As shown in column (3), on average, IPO underpricing increases by 60.14 percentage points after the removal of the lockup policy. The main variable of our interest is the interaction term between *Frequency* and *Reform*, which captures the estimated effect of market experience on IPO underpricing following the policy reform. The coefficients on *Frequency*Reform* are consistently negative and significant at the 1% level across all specifications. It implies that although IPO underpricing becomes exacerbated after the policy reform, mutual funds with higher levels of participation frequency could help to mitigate the underpricing by submitting higher bid prices relative to mutual funds with lower levels of participation frequency. The mitigation effect is economically meaningful: a one-standard-deviation increase in participation frequency would mitigate 12.42 (9.271*1.34) percent of the 60.14-percentage-point increase in IPO underpricing. Therefore, the results imply that fund bidders with more market experience could help to improve pricing efficiency.

Conclusion

Taking advantage of the exogenous shock of regulatory changes in a difference-in-difference framework, we find that market experience mitigates mutual funds' precautionary bidding in the IPO auction after the restriction on the IPO lockup is removed. Specifically, mutual funds' willingness to bid decreased by 13.53 percentage points following the removal of the IPO lockup; however, a one-standard-deviation increase in market experience in terms of IPO participation mitigated 4.36 percent of the 13.53-percentage-point decrease. Furthermore, we find that the mitigation effect of market experience on precautionary bidding is accentuated in IPO firms in disadvantaged geographic locations and is attenuated for IPOs certified by reputable underwriters. Additionally, the mitigation effect of market experience on precautionary bidding is attenuated in mutual funds with strong business ties with the lead underwriters. Furthermore, we find that investors with more market experience helps to improve the efficiency of IPO pricing.

The findings from our analysis have policy implications for many other markets that use a hybrid of auction and fixed price offering in the IPO process, such as Australia, Belgium, Finland, France, Hungary, New Zealand, and the UK (Sherman 2005; Jagannathan et al. 2015). First, the regulatory authority should encourage investment banks to invite experienced investors to bid in the IPO auction. Investors with greater experience in prior IPO auctions are more rational in submitting bid prices, and their involvement can help improve the efficiency of IPO pricing. Second, it is beneficial for institutional investors to participate in more IPO auctions. They can learn from their past participation in the auctions and alleviate the information asymmetry they are facing; in this way, they can adjust their bidding strategies accordingly over time.

Appendix A: Variable definition

Normalized Bid Price = normalized bid price calculated as $(Bid - Mid)/Mid$, where *Bid* is the bid price and *Mid* is the midpoint of the initial price range.

Reform = a dummy variable that equals one for IPOs conducted after April 28, 2012, the official date that the IPO lockup period was removed, and zero otherwise.

Frequency = the logarithm of the total number of IPOs the mutual fund has participated before the policy reform.

Bid_Frequency = the logarithm of the total number of bids submitted by the mutual fund before the policy reform.

Fam_Frequency = the logarithm of the total number of IPOs participating at the fund family level before the policy reform.

ABP_1 = alternative bid price 1, calculated as $(Bid - ClosePrice)/ClosePrice$, where *Bid* is the bid price and *ClosePrice* is the closing price for the stock three months after the IPO.

ABP_2 = alternative bid price 2, calculated as $(Bid - ClosePrice2)/ClosePrice2$, where *Bid* is the bid price. *ClosePrice2* equals the closing price for the stock three months after the IPO if the issue date is before April 28, 2012 and equals the closing price for the stock on the first day of the IPO if the issue date is later than April 28, 2012.

Remote = a dummy variable that equals one if the headquarters of the IPO firm is at least 200 kilometers away from any of the three financial centers (Shanghai, Beijing or Shenzhen).

Underwriter = a dummy variable that equals one if the lead underwriter ranks in the top 10 in terms of the total number of IPOs she has managed in the year prior to the current IPO and zero otherwise.

DTies = an indicator for business ties, which equals 1 if the mutual fund family has paid a brokerage commission to the lead underwriters and zero otherwise. For IPOs in 2012, we measure business ties using brokerage commission payment data from 2011; for IPOs in 2011, we measure business ties using brokerage commission payment data from 2010; and for IPOs in November and December of 2010, we measure business ties using brokerage commission data from the first half of 2010.

Return = cumulative stock return after the IPO, which is proxied by the first-day return, 90-day return and 180-day return.

Stock Size = the natural logarithm of the total assets of the IPO firm in the calendar year prior to the IPO.

Debt Ratio = the debt-to-asset ratio for the IPO firm in the calendar year prior to the IPO.

ROA = return on assets for the IPO firm in the calendar year prior to the IPO.

Number of Fund Bidders = the number of mutual funds that participated in the IPO auction.

Market Sentiment = the return on the SZSE Component Index during the 30 trading days prior to a given IPO.

Fund Size = the natural logarithm of total net assets for the mutual fund.

Appendix B: Effect of removing lockup policy on stock prices

We conjecture that removing the three-month lockup will encourage institutional investors to sell the stocks on the first trading day after IPO. As a result, it will increase the supply of new shares in the post-IPO market and place downward pressure on stock prices. However, it is a little difficult to

examine whether the institutional investors really do so and whether it causes a decline in stock prices, since IPO stocks have no pre-IPO trading and price information in China. Therefore, we use an alternative way to examine our conjecture. We investigate the stock price movement and variation in trading volumes around the expiration day of the three-month lockup period, when the selling ban has not been lifted.

We find that, when lockup period expires, there is a sudden large increase (86 percent) in average trading volume and a significant drop in stock prices (three-day abnormal return is −1.77 percent) on the unlock day. This result supports our conjecture that, when the restriction on selling stocks is removed, institutional investors with allocated IPO shares may flood the market with selling orders, resulting in a sudden decline in stock prices. Our empirical analysis is as follows.

Following Field and Hanka (2001), we calculate cumulative abnormal return over a three-day (−1 to +1) event window. The cumulative abnormal return is measured as follows.

$$CAR_i = \prod_{t=-1}^{+1} \left(\frac{1 + R_{i,t}}{1 + R_{m,t}} \right) - 1 \qquad (2)$$

where $R_{i,t}$ is the simple return of firm i on day t relative to the unlock day and $R_{m,t}$ is the simple return on the market index (Shanghai Composite Index).

Our sample includes 349 IPOs with lockup agreements in the period November 2010 to April 2012. Figure 2 presents a time series plot of the average (median) cumulative abnormal return. It shows that the stock price declines suddenly around the unlock day. Five days before the expiration of lockup period, the three-day abnormal return is around zero on average. It declines to −1.77 percent immediately on the unlock day. Five days after the expiration, the three-day abnormal return reverses back to around zero on average. This pattern of price movement may imply that many institutional investors with allocated IPO shares sell the stocks on the unlock day and put downward pressure on the stocks. To reinforce our hypothesis, in the following part, we also examine the stocks' trading volume around the unlock day.

Following Field and Hanka (2001), we calculate abnormal daily trading volume relative to each firm's average daily trading volume. The abnormal daily trading volume is measured as follows.

$$ATV_{i,T} = \frac{Vol_{i,T}}{\sum_{t=-3}^{-1} Vol_{i,t}} - 1 \qquad (3)$$
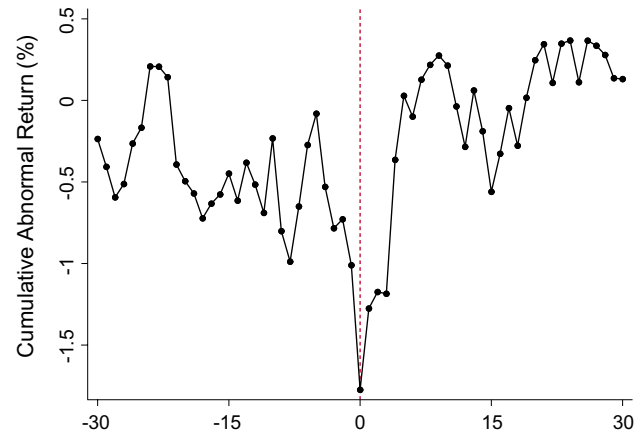

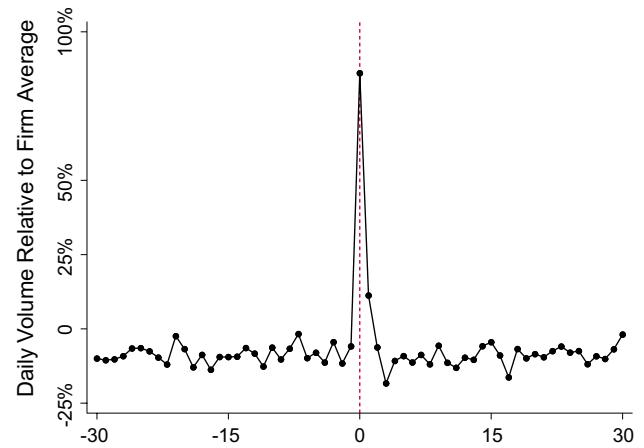**Fig. 2** Market-adjusted returns around the unlock day

Fig. 3 Abnormal trading volume around the unlock day

where $Vol_{i,t}$ is the trading volume for firm i on day t relative to the unlock day.

Figure 3 plots the sample median of the daily abnormal volume. It shows that the trading volume increases temporarily to 86 percent above average on the unlock day. Then it drops quickly to pre-unlock level and remains throughout out the post-event window. It indicates that the abnormal return may be caused by the increase in the supply of shares.

In summary, the expiration of lockup period will result in a significant price decline and abnormal trading volume. It supports our conjecture that if the regulatory authority removes the three-month lockup period, institutional investors with allocated shares will sell the shares in the post-IPO market, which might further cause an increase in the supply of new shares and a decline on stock prices.

Declarations

Conflict of interest The authors report there are no competing interests to declare.

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