A Study on the Collusive Behavior in Book Building Mechanism, Institutional Investors' Bidding Behavior and IPO Performance

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Abstract

Based on the Chinese IPO book building mechanism as the background, the paper chooses the market-oriented period (from November,2010 to April,2012) of the IPOs as the samples, and studies the relationship between the collusive behavior, institutional investors' bidding behavior and underwriters' pricing strategy(as well as the post-IPO performance). The results show that: Firstly, in the case of the confusion contract, informed investors are likely to pretend to be emotional investors, which are defined as the collusive behavior between the informed investors and the emotional investors. Emotional investors are inclined to push up institutional investors' bidding price, so the collusive behavior would push up the institutional investors' bidding prices; Secondly, the underwriters would adjust the high bidding prices reversely which stem from the collusive behavior, the institutional investors' bidding behavior investors play a complete (or partial) intermediary role in the relation between the collusive behavior and the underwriters' pricing strategy; Thirdly, the collusive behavior influences the post-IPO performance negatively, and the institutional investors' bidding behavior investors play a complete (or partial) intermediary role in the relation between the collusive behavior and the post-IPO performance.

Keywords: the collusive behavior, the institutional investors' bidding behavior, the underwriters' pricing strategy, the post-IPO performance

1. Introduction

In the process of the development of capital market, the stock issuing system is one of the important fundamental factors which influence the operational efficiency of capital market, and the IPO pricing is related to the allocation efficiency of the IPO market. The present Chinese IPO market has been exposed with various problems, such as "Aosai Kang event", "Dengyun financial fraud event", which essentially are associated with the IPO pricing efficiency.

The IPO book building mechanism was carried out formally since January 2005 in China, and the IPO market started marketizational reform in June 2009.It's important to note that Chinese IPO book building mechanism lacked the value discovery function due to the lack of a basis of market supply and demand. Under the standard book building mechanism, the underwriters determine the final price based on the effective information the institutional investors provide, and implement the effective incentives to stimulate the institutional investors(Benveniste,1989).In contrast, under the book building mechanism in China, due to the existence of government regulation and the lack of the effective incentives, there exists a certain deviation from the institutional investors' bidding information, leading to the fact that the final price deviates from the intrinsic value(Yu Honghai,2013). The efficiency of the book building mechanism is closely related with the institutional investors' bidding behavior (Huang Yuqin, 2013).The pricing efficiency of the book building mechanism in China is low. This paper makes a contribution to the literature on IPO pricing mechanism. The paper introduces the collusion theory into the IPO process, analyzing the collusive behavior, the institutional investors' bidding behavior and the IPO performance, and the conclusion provides a new insight into the problem on how to improve the IPO pricing efficiency, which is a useful supplement to the existing related research.

2. The literature review

The standard book building mechanism was proposed by Benveniste (1989).Under the standard book building mechanism, the underwriter should fully collect the informed investors' bidding information, and the information is reflected in the IPO price effectively. The mechanism can reduce the degree of information asymmetry between the firm and investors, which would effectively weaken the "winner's curse" effect. In terms of underwriters' pricing strategy, the research emphasis is that how the underwriters motivate the institutional investors to provide the information which reflects the firm' true value. And the relevant incentive mechanism is the optimal allocation rules(Bennouri&Falconieri,2004) and the over-allotment option(Zhang,2004). In view of the Chinese book building mechanism, the domestic related research point out that the underwriters tend to focus on their own short-term interests due to its lack of the distribution authority(Lu Yujian,2015). The underwriters form the collusive behavior with the institutional investors in order to maximize the underwriting fees(Guo Haixing,2011).For another, the underwriters form the collusive behavior with China Securities Issuance Examination Committee(CSIEC) to increase the probability of IPO success (Huang Lianghua,2016). In addition, some literature focus on whether the underwriter reputation will urge the underwriters to make accurate pricing strategy. Tian Jia(2000) and Qiu Dongyang (2011) consider that the underwriter reputation hypothesis don't have universality in China; Chen Pengcheng (2015) considers that the underwriter reputation can influence the under-writers' pricing strategy. The underwriters with high reputation would make conservative pricing strategy, but underwriter with low reputation would make radical pricing strategy relatively.

In terms of institutional investors' bidding behavior, the research emphasis is on the following aspects: Einar Bakke (2016) shows that with the increase of public information accessibility, the institutional investors' private information would get less compensation. In China, the book building mechanism don't reflect the institutional investors' private information completely (Guo Min, 2015).Regardless of the underwriters' pricing strategy, institutional investors tend to drive down the bidding price (Hu Zhiqiang,2016). Specifically, on one hand, institutional investors would choose linear equilibrium bidding strategies as its optimal bidding strategies (Zhou Xiaohua,2009).On the other hand, the institutional investors would hide their real demand(Zhou Xiaohua,2013).In addition, there are also many scholars who study the relation between the institutional investors' bidding behavior and IPO underpricing. Liu Zhiyuan (2011) and Lin Qianhui (2012) show that the institutional investors' collusive behavior is closely related to the IPO underpricing. Li Dongxin (2014) shows that the institutional investors' disagreement plays an important role in IPO underpricing. Chen Pengcheng (2016) and Jonathan Clarke (2015) show that emotional investors push up IPO underpricing. Based on the previous studies, we find that the studies on the collusive behavior in IPO market are scarce. The paper introduces the collusion theory into the IPO process, analyzing the collusive behavior, the institutional investors' bidding behavior and the IPO performance. The conclusion provides a new insight into the problem on how to improve the IPO pricing efficiency, which is a useful supplement to the existing related research.

3. The hypothesis

3.1 The institutional investors' bidding behavior

The generation of the collusive behavior stems from the existence of rent essentially (Krueger,1974).Under the principal-agent model, different agents have different rent distribution. To simplify the analysis, we assumes that there are three main participant bodies in the IPO pricing process: underwriters (principal), the institutional investors who participate in the book building process (agent) and public media(supervisor).Our analysis focuses on the collusive behavior between the institutional investors who participate in the book building process (agent).
Theoretically, the book building mechanism is a process of information collection. Derrien (2005) shows that the IPO price mainly consists of two parts: one is the bids from the informed investors; the other is the bids from the emotional investors. The informed investors are able to obtain the IPO true intrinsic value, which is defined as high-efficient agent; the emotional investors could not obtain the true intrinsic value, which is defined as low-efficient agent. Our analysis focuses on the informed investors and the emotional investors in confusion cases. Under the premise of asymmetric information, the underwriter can't distinguish the capturing information abilities between different institutional investors.

In general, the underwriters would take the weighted average R_p of the overall distribution of the institutional investors as the payment level, i.e. $R_1 = R_2 = R_p$, R_1 is the payment of the informed investors, R_2 is the payment of the emotional investors. If $2R_p \geq \sum_{i=1}^{2} R(\theta_i)$, θ_i is the marginal cost of the institutional investors, the institutional investors of two types have high probability to behave collusively. The informed investors can imitate the emotional investors to acquire the additional rents, the utility level of the informed investors is (assuming the exogenous retained utility is zero):

$$U_1 = R_2 - \theta_1 q_2 = R_2 - \theta_2 q_2 + \Delta\theta q_2 = U_2 + \Delta\theta q_2$$

where θq is the negative utility (cost) of the institutional investors, U_1 and U_2 are the utility of the informed investors and the emotional investors respectively. We can conclude that the informed investors can imitate the emotional investors to acquire the additional rents in confusion cases, and the emotional investors can't acquire the additional rents. In conclusion, the informed investors are likely to pretend to be the emotional investors, which are defined as the collusive behavior between the informed investors and the emotional investors. From the above, the informed investors are likely to pretend to be the emotional investors, and the bidding price of the emotional investors is higher than that of the informed investors. The main reasons are as follows:

Firstly, compared with the informed investors, the emotional investors would mistakenly assume that the information they obtain is authentic, thus leading to irrational behaviors (Derrien,2005). So the emotional investors would have over-optimistic or over- pessimistic behavior (Cook,2006). Under the premise of short selling limits, the IPO price will only reflect the optimistic investors' idea, so there exits an obvious premium of the IPO price (Miller,1977). Secondly, the institutional investors' bids based on the public information and private information they obtained (Sherman,2000). The public information such as the market index is open for free, but the access to the private information is not free. The existence of private information cost would lead to the "free rider behavior" of the emotional investors (Degeorge et al,2010), generating the high bidding price in order to obtain the allotment qualification. So we can make the following conclusion: the higher proportion of the emotional investors, the more radically the institutional investors bid. That is to say, the collusive behavior tends to push up the institutional investors' bidding price. We put forward the hypotheses 1:

H1: There is a positive correlation between the collusive behavior and the institutional investors' price premium.

3.2 The underwriters' pricing strategy

For the underwriter, the underwriter is a bridge connecting the firms and the investors. On one hand, the underwriter should ensure that the offering is successful, which is responsible for the firms; on the other hand, the underwriters should make a rational judgment to provide a reasonable IPO price, which is responsible for the investors. At the same time, the underwriters hope to realize the maximization of underwriting fees. In conclusion, the underwriters should balance the interests of the parties. In China, raising the IPO price blindly has the following risks: firstly, the underwriters face the penalty by the regulatory agencies. Since October 2010, the mandatory information disclosure is required in IPO process to improve the transparency. If underwriters' unreasonable IPO pricing strategy is disclosed, the underwriters would face the penalty by the regulatory agencies. What's more, their reputation is lowered, and the reputation losses will reduce its subsequent market share. Secondly, the likelihood of subsequent IPO failure is increased. The institutional investors would lower the following participation in the IPO process. In conclusion, the underwriters would adjust the IPO final price based on the institutional investors' offering price. If the institutional investors' price is too radical, the underwriters will adjust the pricing reversely, pressing down the IPO price. On the contrary, the underwriters will push up the IPO price moderately. We put forward the hypotheses 2 and 3:

H2:There is a negative correlation between the collusive behavior and the underwriters' pricing strategy.
H3:The institutional investors' bidding behavior plays an intermediary role in the relation between the collusive behavior and the underwriters' pricing strategy.

3.3 The post-IPO performance

IPO has the feature of long-run underperformance(Ritter,1991).The heterogeneous hypothesis theory is the leading theory which explains IPO long-term underperformance (Miller,1977).Under the premise of the information asymmetry, the investors hold disagreements on the future development of the firms.

Under the premise of short selling limits, the pessimistic investors are unable to enter the market, and the IPO price will only reflect the optimistic investors' idea. So the price is always overvalued. As time goes on, with the degree of information asymmetry reduced, the IPO price tends to the true value. From above analysis, IPO has the feature of long-run underperformance. Based on the above analysis and the hypotheses 1, we consider that the more radically the institutional investors behave, the lower the IPO long-term yields tend to be. We put forward the hypotheses 4:

H4:The institutional investors' bidding behavior plays an intermediary role in the relation between the collusive behavior and the post-IPO performance.

Based on the collusion theory, the collusive behavior would lead to the organization's low operation efficiency (Jean Tirole,1986). Specifically, the collusive behavior hides some IPO bidding information in a certain extent in the IPO process, increasing the degree of information asymmetry. And the collusive behavior will influence the underwriters' final judgment. In the long run, the IPO price tends to its true value, and the negative impact of the collusive behavior will be apparent increasingly. We put forward the hypotheses 5:

H5: There is a negative correlation between the collusive behavior and the post-IPO performance.

4. Data and empirical results

4.1 Data

We obtain the data from the Wind database. We analyze Chinese A-share IPOs that went public on the SHSE and SZSE Board from November, 2010 to April, 2012.We choose the sample period for the following reasons: Firstly, the inquiry data was not disclosed until November, 2010.Secondly,China has experienced several IPO reform stages. The reform after 2013 has limited the institutional investors' pricing ability, and the IPO price was administrative controlled. Furthermore, we drop the IPO failure samples and the IPO samples from the Main Board. We only keep the IPO data from the SME and the ChiNext Board for the following reasons: the IPOs from the SME and the ChiNext Board are determined via the preliminary inquiry, but the IPOs from the Main Board are determined via the book building mechanism. So we only keep the IPO samples from the SME and the ChiNext Board to ensure the consistency. In our sample, there are 335 IPOs.

4.2 Definitions of variables

4.2.1The collusive behavior

The collusive behavior means that the homogeneity of IPO price between different institutional investors is high(Liu zhiyuan,2011).We use the variable ***collusion*** to measure the bidding similarity. The variable is calculated as follows:

$$similarity = sbidding / zbidding$$

where *sbidding* is the number of the institutional investors which offer different bids. *zbidding* is the number of total institutional investors who participate in the IPO bids. We take the variable ***collusion*** one if *similarity* is less than the mean value and zero otherwise.

Furthermore, the collusive behavior would lead to the "free rider" behavior. Under the standard book building mechanism, the institutional investors' bidding behavior is based on the effective treatment of their own information. In China, the underwriters cannot provide the effective incentives to stimulate the institutional investors to provide their own information due to the lack of the allocation rights. So the institutional investors lack the motivation to provide their private information. The presence of the private information lead to the "free rider" behavior for the institutional investors who don't have the private information(Degeorge et al,2010). Specifically, if the institutional investors are tend to offer high IPO bids under the premise of the fact that they don't have the strong motivation to purchase the new shares, we consider that the institutional investors have the "free rider" behavior. We introduce the Degeorge et al（2010）as a method of measuring the "free rider" behavior. Firstly we calculate the bidding price which is 1.1 times higher than the IPO initial ceiling price. We defined the subscription amount of the above bidding price as the "free rider" behavior. Then we use the variable ***free*** to measure the degree of the "free rider" behavior. The variable is calculated as follows:

$$free = purfree / totalpur$$

where *purfree* is the subscription amount which is defines as the "free rider" behavior. *totalpur* is the total subscription amount. We takes the variable ***free*** one if ***free*** is not equal to zero and zero otherwise.

4.2.2The institutional investors' bidding behavior

We use the variable ***bid*** to measure the institutional investors' bidding behavior. The variable is calculated as follows:

$$bid = \sum_{i=1}^{n} P_i Q_i \Big/ FV \bullet \sum_{i=1}^{n} Q_i$$

where P_i is bidding price. Q_i is the IPO demand. FV is the midpoint of the initial value scope. The higher the variable ***bid***, the more radically the institutional investors behave.

4.2.3The underwriters' pricing strategy

We use the variable ***pre*** to measure the underwriters' pricing strategy. The variable is calculated as follows(Purnanandam,2004):

$$pre = \frac{price}{\sum_{i=1}^{n} P_i Q_i / \sum_{i=1}^{n} Q_i}$$

where P_i is bidding price. Q_i is the IPO demand. $price$ is the IPO price. The higher the variable ***pre***, the higher the underwriters' pricing is beyond the reasonable degree.

4.2.4 The control variables

The control variables cover three traits, including the firm traits, the IPO traits and the market traits.

(1) Firm traits. Changqing Luo (2014) shows that the firm value and market environment are the important factors which affect the IPO pricing efficiency. We choose net asset value per share, ROE and asset-liability ratio to control the firm traits.

(2)IPO traits. Tinic (1988)shows that there is a correlation between the IPO size and IPO price. Michelle Lowrya(2004) shows that the underwriter's ability is closely related to the IPO pricing efficiency. We choose IPO size, underwriter reputation and VC backing to control the firm traits.

(3)Market traits. We choose market environment and government intervention to control the market traits. The definition of the control variables is as follows:

Table1 The definition of the control variables

Variables	symbol	Description
ROE	ROE	Net profits/equity interests
Lev	Lev	Total debt/total assets
net asset value per share	ln (netprice)	ln(netprice)
IPO size	ln(issue)	ln(IPO size)
VC backing	VC	A dummy variable set to one for a venture backing IPO and zero otherwise.
underwriter reputation	reputation	A dummy variable set to one for the underwriter which is among the top 10% advisors ranked according to the amounts of IPOs in 2012 and zero otherwise.
market environment	market	A-share market average return in the first three months before IPO
government intervention	gov	A dummy variable set to one if the score is higher than the mean value according to the *Marketization Index of China's Provinces* by Fan Gang and zero otherwise.

4.3 Model

We employ intermediary analysis to test our hypotheses. We use the following regression model:

$$bid = \beta_0 + \beta_1 collusion(free) + \alpha_i \sum D_i + \varepsilon \quad (1)$$

$$pre = \beta_0 + \beta_1 collusion(free) + \alpha_i \sum D_i + \varepsilon \quad (2)$$

$$pre = \beta_0 + \beta_1 collusion(\ free) + \beta_2 bid + \alpha_i \sum D_i + \varepsilon \quad (3)$$

Equ.（1）（2）（3）are used to test whether the institutional investors' bidding behavior(***bid***) plays an intermediary role in the relation between the collusive behavior(***collusion or free***) and the underwriters' pricing strategy(***pre***).

$$bid = \beta_0 + \beta_1 collusion(\ free) + \alpha_i \sum D_i + \varepsilon \quad (4)$$

$$BHAR = \beta_0 + \beta_1 collusion(\ free) + \alpha_i \sum D_i + \varepsilon \quad (5)$$

$$BHAR = \beta_0 + \beta_1 collusion(\ free) + \beta_2 bid + \alpha_i \sum D_i + \varepsilon \quad (6)$$

Equ.（4）（5）（6）are used to test whether the institutional investors' bidding behavior(***bid***) plays an intermediary role in the relation between the collusive behavior(***collusion or free***) and the post-IPO performance(***BHAR***).

We use the buy-and-hold return (BHAR) as a post-IPO performance measure. We compute 24, 48, and 72-month BHARs after the IPO by using the following computation:

$$BHAR_i = \prod_{t=1}^{T}(1+R_{it}) - \prod_{t=1}^{T}(1+MR_{it}) \quad T \in (24, 48, 72)$$

where BHAR is the buy-and-hold return. R_{it} is the monthly stock return of i firm in t month. We define month one as the month after the firm's IPO. MR_{it} is the market return of Shanghai Composite Index in t month.

4.4Empirical results

4.4.1 The descriptive statistics for the variables

Table 2 reports the descriptive statistics for the variables. It can be summarized as the following points: Firstly, on average, the underwriters' pricing strategy (***pre***) for sample IPO firms is 1.079, which shows that the IPO price is at a reasonable level. Secondly, on average, the institutional investors' bidding behavior(***bid***) is 0.830, which shows that the institutional investors behave conservatively in the IPO process. Thirdly, the sample firms are of high quality, which is embodied in the following respects: the average value of ROE is 34.02%,which shows that the sample firms have good profitability. The average value of Lev is 44.81%,which shows that the debt level of the sample firms areas is in a normal level.

Moreover, table 2 shows that the underwriters with high reputation are responsible for 37% of the firms. 51.9% of the firms are backed by the VC capital.59.4% of the firms have a higher degree of marketization.

Table2 Descriptive statistics for the variables of the samples

Variables	Mean	SD.	Minimum	Maximum
pre	1.079	0.080	0.752	1.561
bid	0.830	0.200	0.429	2.290
collusion	0.537	0.499	0.000	1.000
free	0.325	0.469	0.000	1.000
VC	0.519	0.500	0.000	1.000
market	-0.096	1.291	-5.156	3.044
reputation	0.370	0.484	0.000	1.000
ROE	34.023	15.011	7.105	145.109
Lev	44.807	16.043	4.654	82.212
netprice	3.227	1.154	1.270	9.380
gov	0.594	0.492	0.000	1.000
issue	2884.071	1667.177	867.000	20000.000

4.4.2 Regression results

Table 3 reports the relationship between bidding similarity, the institutional investors' bidding behavior and the underwriters' pricing strategy. In model (1), we evaluate the effect of bidding similarity on the institutional investors' bidding behavior. The result shows that the coefficient of the variable ***collusion*** is positive as expected and is significant at the 1% level. The result clearly supports Hypothesis 1.It means that there is a positive relation between the collusive behavior and the institutional investors' bidding behavior. In model (2), we evaluate the effect of bidding similarity on the underwriters' pricing strategy. The result shows that the coefficient of the variable ***collusion*** is negative as expected and is significant at the 5% level. It means that there is a negative relation between the collusive behavior and the underwriters' pricing strategy. In model (3), we evaluate the effect of bidding similarity and the institutional investors' bidding behavior on the underwriters' pricing strategy. The result shows that the coefficient of the variable ***collusion*** is not significant, and the variable ***bid*** is significant at the 1% level. It means that the institutional investors' bidding behavior plays a complete intermediary role in the relation between the collusive behavior and the underwriters' pricing strategy. The result clearly supports Hypothesis 2 and 3. We also control several variables. Model (3)shows that the coefficient of the variable ***reputation*** is negative and is significant at the 10% level. It means that there is a negative relation between the underwriters' behavior and the underwriter reputation. The coefficient of the variable ***VC*** is negative but is not significant. It means that venture capital don't play the supervisory role in the IPO process in China.

Table 3 The relationship between bidding similarity, the institutional investors' bidding behavior and the underwriters' pricing strategy

	(1)	(2)	(3)
	bid	pre	pre
bid			-0.124***
			(-4.585)
collusion	0.140***	-0.019**	-0.002
	(6.701)	(-2.238)	(-0.228)
VC	-0.005	0.000	-0.000
	(-0.259)	(0.034)	(-0.043)
market	-0.008	0.002	0.001
	(-0.978)	(0.790)	(0.488)
reputation	0.022	-0.016*	-0.013*
	(1.175)	(-1.928)	(-1.676)
ROE	-0.002***	0.001**	0.000*
	(-2.836)	(2.557)	(1.760)
lev	0.000	0.000	0.000
	(0.111)	(1.073)	(1.136)
ln(netprice)	-0.090***	0.019	0.008
	(-3.215)	(1.414)	(0.653)
gov	-0.016	-0.007	-0.009
	(-0.736)	(-0.826)	(-1.111)
ln(issue)	-0.031	0.038***	0.034***
	(-1.353)	(4.159)	(4.091)
Constant	1.170***	0.744***	0.889***
	(6.565)	(9.478)	(11.923)
Adjusted R-squared	0.171	0.081	0.163
F	11.28	4.733	6.542

The t-values are reported in parentheses.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 4 reports the relationship between free rider, the institutional investors' bidding behavior and the underwriters' pricing strategy. In model (1), we evaluate the effect of free rider on the institutional investors' bidding behavior.

The result shows that the coefficient of the variable ***free*** is positive as expected and is significant at the 1% level. The result clearly supports Hypothesis 1.In model (2), we evaluate the effect of free rider on the underwriters' pricing strategy. The results show that the coefficient of the variable free is negative as expected and is significant at the 1% level. It means that there is a negative relation between the collusive behavior and the underwriters' pricing strategy. In model (3), we evaluate the effect of free rider and the institutional investors' bidding behavior on the underwriters' pricing strategy. The result shows that the coefficient of the variable ***free*** is not significant, and the variable ***bid*** is significant at the 1% level. It means that the institutional investors' bidding behavior plays a complete intermediary role in the relation between the collusive behavior and the underwriters' pricing strategy. The result also clearly supports Hypothesis 2 and 3.

Table 4 The relationship between free rider, the institutional investors' bidding behavior and the underwriters' pricing strategy

	(4)	(5)	(6)
	bid	pre	pre
bid			-0.143***
			(-3.278)
free	0.288***	-0.030***	0.011
	(14.090)	(-3.526)	(0.723)
VC	0.001	-0.000	-0.000
	(0.038)	(-0.037)	(-0.029)
market	0.003	0.001	0.002
	(0.405)	(0.483)	(0.633)
reputation	0.004	-0.014*	-0.014*
	(0.279)	(-1.774)	(-1.783)
ROE	-0.001*	0.001**	0.000*
	(-1.698)	(2.202)	(1.875)
lev	-0.000	0.000	0.000
	(-0.227)	(1.140)	(1.139)
ln (netprice)	-0.062***	0.018	0.009
	(-2.999)	(1.426)	(0.729)
gov	-0.007	-0.009	-0.010
	(-0.405)	(-1.035)	(-1.195)
ln(issue)	-0.013	0.036***	0.034***
	(-0.686)	(3.910)	(4.041)
Constant	0.953***	0.764***	0.901***
	(6.328)	(9.829)	(11.481)
Adjusted R-squared	0.489	0.098	0.165

The t-values are reported in parentheses.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table5 reports the relationship between bidding similarity, the institutional investors' bidding behavior and the post-IPO performance. The dependent variable of the model (1) (2) is BHAR24.The dependent variable of the model (3) (4) is BHAR48.The dependent variable of the model (5) (6) is BHAR72.The regression results of model (1) (2) (7) show that the institutional investors' bidding behavior play a complete intermediary role in the relation between the collusive behavior and BHAR24.Similarly,the regression results of model (3) (4) (7) show that the institutional investors' bidding behavior plays a complete intermediary role in the relation between the collusive behavior and BHAR48.From the regression results of model (5) (6) (7), the coefficient of the variable ***collusion*** is significant at the 1% level in model(5)and model(6).Specifically, P value of ***collusion*** in model(5) is 0.000,and P value of ***collusion*** in model(6) is 0.002.

The significance is lower in model (6) than that in model (5).The regression results of model (5) (6) (7) show that the institutional investors' bidding behavior play a partial intermediary role in the relation between the collusive behavior and BHAR72.The partial mediation effect is 52.7 percent in the total effect. The result clearly supports Hypothesis 4 and 5.

Table 5 The relationship between bidding similarity, the institutional investors' bidding behavior and the post-IPO performance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	BHAR24	BHAR24	BHAR48	BHAR48	BHAR72	BHAR72	bid
bid		-0.508***		-0.300***		-0.478***	
		(-5.552)		(-2.924)		(-3.871)	
collusion	-0.110***	-0.038	-0.107**	-0.064	-0.127***	-0.061***	0.140***
	(-2.667)	(-0.933)	(-2.357)	(-1.352)	(-5.819)	(-3.160)	(6.701)
VC	-0.023	-0.025	0.009	0.009	0.032	0.028	-0.005
	(-0.599)	(-0.679)	(0.190)	(0.192)	(1.196)	(1.150)	(-0.259)
market	0.035***	0.031***	0.004	0.002	0.049***	0.045***	-0.008
	(3.232)	(2.930)	(0.256)	(0.104)	(3.632)	(3.524)	(-0.978)
reputation	0.005	0.017	0.006	0.012	-0.022	-0.011	0.022
	(0.121)	(0.373)	(0.137)	(0.255)	(-0.814)	(-0.401)	(1.175)
ROE	-0.004***	-0.005***	-0.005***	-0.006***	0.001	0.000	-0.002***
	(-2.710)	(-3.502)	(-4.109)	(-4.349)	(1.461)	(0.298)	(-2.836)
lev	-0.002*	-0.002*	0.001	0.001	-0.001	-0.001	0.000
	(-1.699)	(-1.760)	(0.682)	(0.694)	(-1.207)	(-1.180)	(0.111)
ln(netprice)	-0.085	-0.131**	-0.177**	-0.203***	0.128***	0.085**	-0.090***
	(-1.274)	(-2.060)	(-2.484)	(-2.843)	(3.044)	(2.134)	(-3.215)
gov	-0.006	-0.014	0.039	0.035	-0.026	-0.035	-0.016
	(-0.160)	(-0.375)	(0.888)	(0.802)	(-1.120)	(-1.551)	(-0.736)
ln(issue)	0.109***	0.093**	0.084*	0.073	-0.012	-0.025	-0.031
	(2.739)	(2.445)	(1.787)	(1.571)	(-0.448)	(-0.985)	(-1.353)
Constant	-0.844***	-0.246	-1.151***	-0.786**	-0.066	0.484*	1.170***
	(-2.618)	(-0.732)	(-3.027)	(-1.974)	(-0.315)	(1.916)	(6.565)
Adjusted R-squared	0.060	0.125	0.041	0.055	0.176	0.288	0.171

The t-values are reported in parentheses.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 6 reports the relationship between free rider, the institutional investors' bidding behavior and the post-IPO performance. The regression results of model (1) (2) (7) show that the institutional investors' bidding behavior plays a partial intermediary role in the relation between free rider and BHAR24.The partial mediation effect is 59.8 percent in the total effect. The regression results of model (3) (4) (7) show that the institutional investors' bidding behavior plays a complete intermediary role in the relation between free rider and BHAR48.From the regression results of model (5) (6) (7), the coefficient of the variable ***free*** is significant at the 1% level in model(5)and model(6).Specifically, P value of ***free*** in model(5) is 0.000,and P value of ***free*** in model(6) is 0.002.The significance is lower in model (6) than that in model (5). The regression results of model (5) (6) (7) show that the institutional investors' bidding behavior plays a partial intermediary role in the relation between the collusive behavior and BHAR72.The partial mediation effect is 37.7 percent in the total effect. The result clearly supports Hypothesis 4 and 5.

Table 6 The relationship between free rider, the institutional investors' bidding behavior and the post-IPO performance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	BHAR24	BHAR24	BHAR48	BHAR48	BHAR72	BHAR72	bid
bid		-0.413***		-0.270**		-0.302**	
		(-3.704)		(-2.090)		(-2.169)	
free	-0.199***	-0.080*	-0.129***	-0.053	-0.231***	-0.144***	0.288***
	(-5.474)	(-1.745)	(-3.168)	(-0.994)	(-6.594)	(-3.106)	(14.090)
VC	-0.028	-0.026	0.005	0.008	0.026	0.026	0.001
	(-0.743)	(-0.713)	(0.119)	(0.171)	(1.071)	(1.087)	(0.038)
market	0.028***	0.029***	0.001	0.002	0.041***	0.042***	0.003
	(2.601)	(2.716)	(0.077)	(0.104)	(3.171)	(3.294)	(0.405)
reputation	0.018	0.019	0.013	0.012	-0.008	-0.006	0.004
	(0.407)	(0.431)	(0.283)	(0.271)	(-0.298)	(-0.243)	(0.279)
ROE	-0.004***	-0.005***	-0.005***	-0.005***	0.001	0.000	-0.001*
	(-3.021)	(-3.461)	(-4.014)	(-4.170)	(0.738)	(0.274)	(-1.698)
lev	-0.002*	-0.002*	0.001	0.001	-0.001	-0.001	-0.000
	(-1.671)	(-1.735)	(0.743)	(0.723)	(-1.009)	(-1.055)	(-0.227)
ln(netprice)	-0.100*	-0.126**	-0.176***	-0.193***	0.110***	0.092**	-0.062***
	(-1.731)	(-2.127)	(-2.675)	(-2.825)	(2.933)	(2.404)	(-2.999)
gov	-0.015	-0.017	0.028	0.028	-0.037	-0.039*	-0.007
	(-0.378)	(-0.432)	(0.602)	(0.599)	(-1.646)	(-1.763)	(-0.405)
ln(issue)	0.097**	0.090**	0.075	0.069	-0.026	-0.029	-0.013
	(2.495)	(2.388)	(1.604)	(1.475)	(-1.100)	(-1.236)	(-0.686)
Constant	-0.709**	-0.304	-1.084***	-0.805*	0.091	0.377	0.953***
	(-2.242)	(-0.899)	(-2.939)	(-1.959)	(0.483)	(1.621)	(6.328)
Adjusted R-squared	0.103	0.129	0.046	0.052	0.286	0.312	0.489
F	10.04	11.00	3.537	3.310	8.046	7.889	37.10

The t-values are reported in parentheses.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

4.4.3 Robust tests

As a robust check for the collusive behavior on IPO performance, we repeat the regression analysis from Table 2 to Table 6.Following the study of Purnanandam (2004),we replace the variable ***bid*** by the variable ***wenjian.*** The variable is calculated as follows:

$$wenjian = (Max - Min) / (Upper - Floor)$$

where Max is the highest bids of the institutional investors, and Min is the lowest bids of the institutional investors. Upper is the ceiling on IPO valuation, and Floor is the floor on IPO valuation. Table 7 reports the relationship between the collusive behavior, the institutional investors' bidding behavior and the underwriters' pricing strategy. The regression results show that the institutional investors' bidding behavior plays a partial intermediary role in the relation between the variable ***wenjian*** and the underwriters' pricing strategy.

Table 7 Robustness test 1

	Bidding similarity			Free rider		
	（1）	（2）	（3）	（4）	（5）	（6）
	wenjian	pre	pre	wenjian	pre	pre
wenjian			-0.010***			-0.009***
			(-4.175)			(-3.433)
collusion	0.432**	-0.019**	-0.015*			
	(2.140)	(-2.238)	(-1.789)			
free				1.243***	-0.030***	-0.019**
				(5.440)	(-3.526)	(-1.979)
VC	0.161	0.000	0.002	0.189	-0.000	0.001
	(0.792)	(0.034)	(0.241)	(0.979)	(-0.037)	(0.172)
market	-0.090	0.002	0.001	-0.039	0.001	0.001
	(-1.138)	(0.790)	(0.489)	(-0.498)	(0.483)	(0.366)
reputation	-0.037	-0.016*	-0.017**	-0.126	-0.014*	-0.016*
	(-0.176)	(-1.928)	(-2.029)	(-0.632)	(-1.774)	(-1.963)
ROE	-0.001	0.001**	0.001**	0.004	0.001**	0.001**
	(-0.111)	(2.557)	(2.560)	(0.660)	(2.202)	(2.370)
lev	-0.006	0.000	0.000	-0.007	0.000	0.000
	(-0.891)	(1.073)	(0.894)	(-1.045)	(1.140)	(0.967)
ln(netprice)	-0.177	0.019	0.018	-0.003	0.018	0.018
	(-0.505)	(1.414)	(1.345)	(-0.009)	(1.426)	(1.444)
gov	-0.051	-0.007	-0.007	-0.032	-0.009	-0.009
	(-0.227)	(-0.826)	(-0.906)	(-0.155)	(-1.035)	(-1.086)
ln(issue)	-0.172	0.038***	0.036***	-0.110	0.036***	0.035***
	(-0.836)	(4.159)	(4.004)	(-0.573)	(3.910)	(3.800)
Constant	5.325***	0.744***	0.799***	4.334**	0.764***	0.804***
	(2.916)	(9.478)	(10.578)	(2.585)	(9.829)	(10.633)
R-squared	0.003	0.081	0.132	0.091	0.098	0.135

The t-values are reported in parentheses.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 8 reports the relationship between the bidding similarity, the institutional investors' bidding behavior and the post-IPO performance. The regression results of model (1) (2) (5) show that the institutional investors' bidding behavior plays a partial intermediary role in the relation between the collusive behavior and BHAR24. P value of the variable ***collusion*** in model (3) is 0.019,and P value of the variable ***collusion*** in model(4) is 0.024.The significance is lower in model (4) than that in model (3). The regression results of model (3) (4) (5) show that the institutional investors' bidding behavior plays a partial intermediary role in the relation between the collusive behavior and BHAR48.

Table 8 Robustness test 2

	(1)	(2)	(3)	(4)	(5)
	BHAR24	BHAR24	BHAR48	BHAR48	wenjian
wenjian		-0.0284***		-0.0109	
		(-3.269)		(-1.172)	
collusion	-0.110***	-0.0974**	-0.107**	-0.102**	0.432**
	(-2.667)	(-2.372)	(-2.357)	(-2.274)	(2.140)
VC	-0.0230	-0.0185	0.00854	0.0103	0.161
	(-0.599)	(-0.492)	(0.190)	(0.231)	(0.792)
market	0.0348***	0.0323***	0.00399	0.00301	-0.0901
	(3.232)	(3.070)	(0.256)	(0.195)	(-1.138)
reputation	0.00548	0.00442	0.00625	0.00584	-0.0372
	(0.121)	(0.0990)	(0.137)	(0.128)	(-0.176)
ROE	-0.00359***	-0.00361***	-0.00487***	-0.00487***	-0.000737
	(-2.710)	(-2.825)	(-4.109)	(-4.140)	(-0.111)
lev	-0.00245*	-0.00262*	0.00122	0.00116	-0.00607
	(-1.699)	(-1.836)	(0.682)	(0.640)	(-0.891)
ln(netprice)	-0.0852	-0.0902	-0.177**	-0.179**	-0.177
	(-1.274)	(-1.388)	(-2.484)	(-2.516)	(-0.505)
gov	-0.00630	-0.00775	0.0387	0.0381	-0.0510
	(-0.160)	(-0.199)	(0.888)	(0.875)	(-0.227)
ln(issue)	0.109***	0.104***	0.0843*	0.0824*	-0.172
	(2.739)	(2.627)	(1.787)	(1.749)	(-0.836)
Constant	-0.844***	-0.692**	-1.151***	-1.093***	5.325***
	(-2.618)	(-2.138)	(-3.027)	(-2.846)	(2.916)
R-squared	0.085	0.105	0.067	0.069	0.030

The t-values are reported in parentheses.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 9 reports the relationship between free rider, the institutional investors' bidding behavior and the post-IPO performance. The regression results of model (1) (2) (7) show that the institutional investors' bidding behavior plays a partial intermediary role in the relation between the collusive behavior and BHAR12. P value of the variable ***free*** in model(3) is 0.002,and P value of the variable ***free*** in model(4) is 0.004.The significance is lower. P value of the variable ***free*** in model(5) is 0.000,and P value of the variable ***free*** in model(6) is 0.001.The significance is lower. The regression results of model (3) (4) (7) show that the institutional investors' bidding behavior plays a partial intermediary role in the relation between the collusive behavior and BHAR48.The regression results of model (5) (6) (7) show that the institutional investors' bidding behavior plays a partial intermediary role in the relation between the collusive behavior and BHAR60.We can come to conclusion that the results are unchanged with respect to previous findings. Our findings are robust.

Table 9 Robustness test 3

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	BHAR12	BHAR12	BHAR48	BHAR48	BHAR60	BHAR60	wenjian
wenjian		-0.0146*		-0.00405		-0.0234**	
		(-1.692)		(-0.410)		(-2.134)	
free	-0.0995***	-0.0813**	-0.129***	-0.124***	-0.193***	-0.164***	1.24***
	(-3.022)	(-2.414)	(-3.168)	(-2.872)	(-4.081)	(-3.487)	(5.440)
VC	-0.000508	0.00226	0.00532	0.00608	-0.00685	-0.00242	0.189
	(-0.0153)	(0.0682)	(0.119)	(0.137)	(-0.152)	(-0.0543)	(0.979)
market	0.00636	0.00578	0.00118	0.00102	0.039***	0.038***	-0.0394
	(0.583)	(0.537)	(0.0767)	(0.0664)	(2.694)	(2.659)	(-0.498)
reputation	0.00713	0.00528	0.0130	0.0124	0.0402	0.0372	-0.126
	(0.200)	(0.148)	(0.283)	(0.271)	(0.914)	(0.848)	(-0.632)
ROE	-0.00257**	-0.00250**	-0.0051***	-0.0050***	-0.00136	-0.00126	0.00435
	(-2.273)	(-2.206)	(-4.014)	(-3.995)	(-0.685)	(-0.648)	(0.660)
lev	-0.00335***	-0.0035***	0.00133	0.00130	-0.00208	-0.00224	-0.00669
	(-2.839)	(-2.897)	(0.743)	(0.719)	(-1.350)	(-1.453)	(-1.045)
ln(netprice)	-0.0796	-0.0797	-0.176***	-0.176***	0.122*	0.121*	-0.00309
	(-1.649)	(-1.648)	(-2.675)	(-2.673)	(1.787)	(1.787)	(-0.009)
gov	-0.0761**	-0.0765**	0.0277	0.0276	0.00859	0.00784	-0.0321
	(-2.148)	(-2.162)	(0.602)	(0.598)	(0.184)	(0.169)	(-0.155)
ln(issue)	0.102***	0.101***	0.0746	0.0741	0.0840*	0.0814*	-0.110
	(2.837)	(2.781)	(1.604)	(1.591)	(1.764)	(1.715)	(-0.573)
Constant	-0.725**	-0.662**	-1.084***	-1.067***	-1.222***	-1.120***	4.334**
	(-2.449)	(-2.203)	(-2.939)	(-2.845)	(-3.091)	(-2.821)	(2.585)
R-squared	0.101	0.107	0.072	0.072	0.091	0.100	0.115

The t-values are reported in parentheses.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

5. Conclusions

The paper introduces the collusion theory into the IPO process, providing a new insight into the problem on how to improve the IPO pricing efficiency, which is a useful supplement to the existing related research. We choose the market-oriented period (from November 2010 to April ,2012) of the IPOs as the samples, and studies the relationship between the collusive behavior, institutional investors' bidding behavior and underwriters' pricing strategy(as well as the post-IPO performance). The results show that: Firstly, in the case of the confusion contract, informed investors are likely to pretend to be emotional investors, which are defined as the collusive behavior between the informed investors and the emotional investors. Emotional investors are inclined to push up institutional investors' bidding price, so the collusive behavior would push up the institutional investors' bidding prices; Secondly, the underwriters would adjust the high bidding prices reversely which stem from the collusive behavior, the institutional investors' bidding behavior investors play a complete (or partial) intermediary role in the relation between the collusive behavior and the underwriters' pricing strategy; Thirdly, the collusive behavior influences the post-IPO performance negatively, and the institutional investors' bidding behavior investors play a complete (or partial) intermediary role in the relation between the collusive behavior and the post-IPO performance.

Overall, our study provides evidence to suggest that the collusive behavior is harmful in the IPO process. Furthermore, our study shows some suggestions to reduce the occurrence of the collusive behavior. Firstly, the institutional investors should be responsible for their bidding behavior. It is essential to design a reasonable incentive mechanism to urge them to disclose the useful information. And it is essential to identify their different investors' pricing ability, realizing their interests in line with the final IPO price. Secondly, it is essential to cultivate the institutional investors who have long-term investment value, and realize the diversity of institutional investors in the IPO market. Thirdly, improving the transparency in the IPO process is important. Ensure the

execution of judicial regulators and deterrence, establishing a fair and rational media supervision mechanism in order to raise the transaction cost of the collusive behavior.

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