Research on the impact of private equity investment on IPO underpricing

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Abstract. With the development of the capital market, most companies will choose to go public to obtain financing and information resources, and private equity investment has a non-negligible impact on the IPO underpricing of enterprises while supporting the listing of enterprises. Based on previous researches, this paper explores the impact of private equity investment on IPO underpricing. Firstly, this paper expounds the diversified heterogeneity of private equity investment on IPO underpricing in different scenarios, including the different impacts of factors such as shareholding ratio and the number of institutions jointly holding shares. Then, the motivation of private equity investment to participate in the IPO of enterprises is analyzed, covering the motivation of long-term investment and strategic cooperation, signaling motivation and name-by-name motivation. Finally, this paper analyzes in detail the channels through which private equity investment affects corporate IPO underpricing, such as influencing market signal transmission through the macro-level certification and supervision effect, and influencing corporate IPO underpricing through the micro-level of differentiated investment.

Keywords: IPO underpricing, private equity, joint investment, shareholding ratio.

1. Introduction

China's securities market has been developed for more than 30 years, but compared with developed countries, China's stock market is still immature, and there is a high IPO underpricing rate. IPO underpricing is when the IPO price is significantly lower than the initial market price of the listing. The phenomenon of underpricing of new shares exists in almost all stock markets in the world, but the degree of underpricing varies greatly from country to country. According to statistics, among the average first-day IPO returns of European countries and non-European countries, the average first-day IPO returns of China's A-share market are the second highest, second only to Saudi Arabia. IPOs in Canada and France were underpriced by less than 10%; Malaysia's IPO underpricing rate is as high as 80%; In 2020, the average first-day return of U.S. IPOs was 41%, second only to the 56% during the dot-com bubble in 2000. In 2021, U.S. stocks rose by an average of 26%, as some popular IPOs pushed up the average. In 2022, U.S. stocks returned an average of 44% on the first day, although the median return was much lower at less than 1%, with 31% of IPOs falling on the first day.

GEM is an important part of the multi-level capital market. It plays an important complementary role to the main board market, providing financing and development space for entrepreneurial enterprises, small and medium-sized enterprises, and high-tech industry enterprises that cannot be listed on the main board market temporarily. So far, the characteristics of China's ChiNext market can be described as "how high": high growth, high technology, high yield, high price-earnings ratio, high issue price, and high fundraising. The GEM market is closely linked to private equity investment, and private equity investment is mainly exited through IPOs. Past data shows that the IPO underpricing rate of ChiNext is relatively high in China's stock market sector. Some studies have found that China's private equity capital tends to invest in high-valuation industries and has poor qualifications, and its holdings in ChiNext companies have higher IPO underpricing ratios. Therefore, in the stage of rapid development of the GEM market and private equity investment, it is necessary to clarify the relationship between the underpricing rate of GEM IPOs and private equity investment. However, it should be noted that the IPO underpricing rate is affected by a combination of factors,

including market environment, industry characteristics, corporate fundamentals, investor sentiment and issuance system.

2. Literature review

Since 1980, many studies have been carried out on the phenomenon of IPO underpricing at home and abroad, first, the "winner's curse model" of information asymmetry between investors and investors, Rock (1986) believes that investors have more information than issuers, but investors are divided into two groups: informed investors and uninformed investors. Informed investors know exactly the true value of the shares and will only participate in the subscription if the issue price is less than the value of the shares. There are also those who believe that some uninformed investors do not have enough information to make accurate judgments about new shares, and that they do not get "wins" when they buy new shares, but suffer losses. (Locke, 1986) Second, the supervision effect theory, enterprises with private equity participation will be subject to the supervision of external shareholders, and the higher the reputation of private equity, the stricter the requirements for the enterprise, to ensure the quality of the enterprise and reduce the degree of information asymmetry. Third, the certification theory, which explains that private equity institutions prefer start-ups with potential growth, participate in corporate governance in the process of enterprise growth, reduce the problems caused by information asymmetry, and effectively curb the phenomenon of IPO underpricing. Song He, Li Yao, and Long Yu (2019) said that for private placement for institutional investors, the certification effect of venture capital institutions can alleviate the information asymmetry faced by institutional investors and reduce the price compensation required by institutional investors for information costs. Fourth, the name-by-name theory states that venture capital institutions, out of the pursuit of fame and reputation, adopt short-term investment behaviors to promote the successful IPO listing of invested companies, which will promote the IPO underlisting of enterprises. Fifth, the theory of invalidity theory, different from the previous theory, the foreign scholars of this theory believe that the effect of private equity on the IPO underpricing of enterprises is not significant, or it plays a negative role in the market performance of the invested enterprises during the IPO, that is, the existence of venture capital further promotes the rise of the IPO underpricing rate of enterprises, so it is called a boosting factor.

There are many relevant studies at home and abroad on the impact of private equity investment on IPO underpricing, but the research results are different due to different research angles, different methods and different research samples. Barry (1990) proposed the certification effect, arguing that venture capital can help disclose the information of issuers and eliminate information asymmetry between different entities, thereby increasing the issuance scale and reducing the issuance cost, and ensuring the reasonable pricing of new shares. Clement et al. (2003) took the Singapore market as a research sample, and selected 82 listed companies with and without private equity financing background according to the same industry, similar issuance scale and other conditions, and the results showed that the IPO underpricing rate of enterprises with private equity financing background was only about 50% of the IPO underpricing rate of enterprises without private equity financing background. In addition, these companies with private equity financing backgrounds attracted more reputable underwriters at the time of their initial public offerings, but failed to reduce the underwriting and issuance costs of the enterprises, so the certification role of private placements has only been partially proven. There are also many scholars in China who have studied the impact of the authentication utility of private equity investment on IPO underpricing, but there are differences in research methods and results. Lu Zhenghua, Liang Tongying, and Chen Ruifeng (2008) studied the situation of China's A-share market from 1990 to 2007, selected 152 companies listed on the Shanghai Stock Exchange and Shenzhen Stock Exchange as samples, and conducted comparative analysis and regression tests on these enterprises, and found that the IPO underpricing rate of enterprises with private equity investment was 117.57%, which was significantly lower than that of enterprises without private equity investment (148.27%). Wang Shuyu (2017) used a sample of 484 companies

listed on the GEM between 2009 and 2015 and found that venture capital intervention inhibited IPO underpricing. Wu Zongrui (2019) said that to meet regulatory requirements or obtain higher issuance pricing, companies to be listed often whitewash their performance before listing, and improve short-term performance through earnings management, but their performance has declined significantly after listing.

3. Research Design

3.1. Hypothesis and Mechanism Analysis

(1) Certification supervision theory

In most studies, the participation of private equity investment will effectively reduce the underpricing rate of corporate IPOs, because private equity investment has a certain certification and supervision function. Certification theory argues that PE's participation sends a positive signal to the market about the quality of the enterprise. Since PE usually conducts detailed due diligence and evaluation before investing, its choice to invest in a certain enterprise indicates that the enterprise has certain development potential and value. This authentication helps to reduce the information asymmetry between investors and issuers, thereby reducing the degree of IPO underpricing. The supervision theory points out that PE will actively participate in the management and supervision of the enterprise after investment, and provide strategic guidance, resource integration, financial management and other support for the enterprise. By improving the governance structure and operational efficiency of enterprises, PE can enhance enterprise value, reduce the risk of enterprises in IPO, and thus reduce IPO underpricing.

However, this theory is not absolute. In practice, the impact of private equity investment on IPO underpricing is also influenced by a variety of factors. For example, the higher the shareholding ratio of private equity investment, the more interested and motivated it is to participate in the internal operation and management of the enterprise and play its certification and supervision function more effectively, and on the contrary, it intends to enhance the reputation of the institution itself through the success of the IPO (name-by-name theory), and the two different investment intentions will lead to different IPO underpricing rates.

(2) Name-by-name theory

To quickly build a reputation and visibility in the industry, some young private equity firms tend to push their portfolio companies to make IPOs as early as possible, even if this may lead to underpricing of IPOs. The name-by-name theory argues that the reputation of a private equity firm is critical in the capital markets. For newly established or lesser-known private equity firms, by successfully driving an IPO and achieving a high return on investment in the short term, they can quickly attract the attention and capital of investors, thereby enhancing their position and reputation in the industry. However, this rush for fame can lead to inaccurate and unreasonable pricing of businesses during the IPO process. To ensure the smooth running of the IPO and a successful listing, the private equity firm may accept a lower offering price, resulting in an underpriced IPO.

Private equity investment can be divided into long-term investment and short-term investment according to the length of the investment period, these two types of investment are significantly different in terms of investment methods and investment concepts, most of the PE of short-term investment lack of investment experience, for the financing of follow-up funds, it is urgent to send signals to the market to show their strength, enhance their reputation, and have a strong motivation to chase names, and the most effective way to send signals is to push the investment object to the IPO market, therefore, for short-term investment PE, IPO underpricing is a loss of wealth However, it is also an effective means to alleviate information asymmetry, and obtain the recognition of the capital market by increasing the IPO underprice, and then exchange for the opportunity to successfully go public.

(3) The theory of invalidity

The theory of the invalidity of private equity investment to IPO underpricing holds that the participation of private equity investment does not play a significant role in reducing the phenomenon of IPO underpricing. The theory points out that although PE is generally considered to have professional investment vision, rich industry experience and resources, and can provide value-added services and improve corporate governance, these factors may not necessarily be effective in reducing IPO underpricing. On the one hand, the uncertainty and complexity of the market make it difficult for PEs to accurately predict and control the stock price performance at the time of IPO. On the other hand, even if PE has carried out a series of optimization and preparation work before the company goes public, factors such as irrational behavior of market participants, information asymmetry, and macroeconomic environment may still lead to the emergence of IPO underpricing.

In conclusion, the theory of invalidity emphasizes that the ability of private equity investment to solve the problem of IPO underpricing is limited, and it cannot simply be assumed that the participation of private equity investment will inevitably reduce IPO underpricing.

Hypothesis 1: The shareholding ratio of private equity investment is negatively correlated with the IPO underpricing rate of listed companies. If the assumption is true, the certification supervision theory and the name-by-name theory are verified; On the contrary, the theory of invalidity is verified.

Hypothesis 2: Private equity investment and joint shareholding will significantly reduce IPO underpricing;

Hypothesis 3: The higher the number of PEs, the greater the decrease in IPOs. If the above two assumptions are true, the certification supervision theory is verified; On the contrary, the theory of invalidity is verified.

3.2. Sample sources and data processing

In this paper, companies listed on the Growth Enterprise Market of the Shenzhen Stock Exchange from January 1, 2014 to December 31, 2023 are selected as the research objects. The main screening criteria for the research data in this paper are as follows: (1) the listed company is supported by PE through the Guotaian database, and (2) the PE is among the top 10 shareholders of the invested company's prospectus; (3) exclusion of listed companies in the financial sector; (4) exclusion of ST Corporation; (5) Exclude companies with missing data. After screening, a sample of 644 companies listed on the GEM was selected in this paper, of which 470 were companies with private equity investment. As to whether an institution is PE, this paper screens it according to the following criteria: (1) by querying in the Qingke database, if the relevant institution can be found, it is PE; (2) Institutions whose names include "venture capital", "venture capital", "venture capital investment" and "direct equity investment" are also identified as PE (Wu Chaopeng et al., 2012). Other relevant data supplements come from RESSET database and PEDATA MAX database.

3.3. Model building

To further study the influencing factors of IPO underpricing ratio and the impact of heterogeneous private equity investment on corporate IPO underpricing, this paper will study the relationship between private equity investment, heterogeneous private equity investment shareholding, and co-investment and IPO underpricing. Based on the above related theories and hypotheses, the following models are designed and empirically analyzed by cross-sectional regression.

(1) $UP=\alpha_0+\alpha_1 Proportion+\alpha_2 Year+\alpha_3 Trade+\alpha_4 Size+\alpha_5 NAV+\alpha_6 EPS+\alpha_7 Pefstd+\alpha_8 Pnafstd+\alpha_9 Tnovfstd+\varepsilon$

(2) $UP=\alpha_0+\alpha_1 Num+\alpha_2 Year+\alpha_3 Trade+\alpha_4 Size+\alpha_5 NAV+\alpha_6 EPS+\alpha_7 Pefstd+\alpha_8 Pnafstd+\alpha_9 Tnovfstd+\varepsilon$

(3) $UP=\alpha_0+\alpha_1 Joint+\alpha_2 Year+\alpha_3 Trade+\alpha_4 Size+\alpha_5 NAV+\alpha_6 EPS+\alpha_7 Pefstd+\alpha_8 Pnafstd+\alpha_9 Tnovfstd+\varepsilon$

3.4. Variable definition

(1) The IPO issuance underpricing rate (UP), which reflects the degree to which the pricing of new shares is undervalued, where P1 represents the closing price on the first day of listing and P0 represents the issue price. Further considering the impact of market conditions on the IPO underpricing rate on the first day of listing, some scholars at home and abroad have adopted the

adjusted IPO underpricing to study the impact of the market's own macro environment on IPO underpricing. The adjusted IPO underpricing is based on the issuance IPO underpricing rate minus the changes in market income during the issuance and listing periods, to measure the degree of IPO underpricing of the enterprise itself.

(2) Joint investment (Joint): Dummy variable, which belongs to private equity joint investment, the value is 1, otherwise it is 0. If the number of PEs participating is greater than or equal to 2, it is a joint investment.

(3) Amount of PE (Num): The amount of PE under the co-investment.

(4) Proportion: It is expressed as the total shareholding of private equity investment under joint investment.

To better examine the impact of private equity investment on the underpricing rate of corporate IPOs, more objective research conclusions are drawn. Based on previous research, this paper controls the company's age (Year), trade (Trade), asset size (Size), net assets per share (NAV), earnings per share (EPS), price-to-earnings ratio (Pefstd), price-to-book ratio (Pnafstd), and turnover rate (Tnovfstd).

3.5. Analysis of regression

Table 1. The relationship between the IPO underpricing ratio and the proportion of PE holdings

	(1)	(2)	(3)
	UP	UP	UP
Proportion	-0.002**	-0.002**	-0.002**
	(-2.320)	(-2.380)	(-2.410)
Trade	0.101*	0.107*	0.108*
	(1.666)	(1.777)	(1.785)
NAV	-0.048***	-0.047***	-0.046***
	(-2.982)	(-2.947)	(-2.829)
EPS	0.085***	0.082***	0.081***
	(3.344)	(3.282)	(3.245)
Pefstd	0.020***	0.020***	0.020***
	(4.670)	(4.652)	(4.642)
Pnafstd	-0.033***	-0.034***	-0.033***
	(-3.079)	(-3.109)	(-3.068)
Tnovfstd	0.534***	0.556***	0.545***
	(2.608)	(2.721)	(2.636)
Year		-0.005	-0.005
		(-1.088)	(-1.096)
Size			0.016
			(0.370)
N	450	450	450
R^2	0.447	0.449	0.449

***p<0.01, **p<0.05, *p<0.10

According to Table1, with the addition of the control variables company age and asset size, the coefficient of Proportion in the model does not change, it is still -0.002, and it is significantly correlated with UP at the level of 5%, but with the addition of these two control variables, the R^2 value increases from 0.447 to 0.449, indicating that the model has better goodness of fit. The industry variables were significantly associated with UP at 10% levels in this model regression, and the other control variables (net assets per share, earnings per share, price-to-book ratio, price-to-earnings ratio, and turnover ratio) were all related to UP at different significant levels. This model verifies hypothesis 1, that is, the higher the proportion of private equity investment, the more interested and motivated it is to participate in the internal operation and management of the enterprise, thereby reducing the IPO underpricing rate of the enterprise. On the contrary, the lower the shareholding ratio, the more there

is a name-by-name motive, that is, to improve one's reputation in the industry with the help of the company's listing, which will increase the IPO underprice rate of the company.

Table 2. The relationship between the IPO underpricing ratio and the number of PEs

	(1)	(2)	(3)	(4)
	UP	UP	UP	UP
Num	-0.023**	-0.024**	-0.023**	-0.025**
	(-2.033)	(-2.127)	(-2.029)	(-2.195)
NAV	-0.042***	-0.041***	-0.045***	-0.042**
	(-2.775)	(-2.707)	(-2.771)	(-2.576)
EPS	0.077***	0.074***	0.080***	0.078***
	(3.167)	(3.083)	(3.201)	(3.135)
Pefstd	0.020***	0.020***	0.020***	0.020***
	(4.623)	(4.604)	(4.664)	(4.656)
Pnafstd	-0.033***	-0.033***	-0.034***	-0.033***
	(-3.057)	(-3.082)	(-3.122)	(-3.076)
Tnovfstd	0.556***	0.577***	0.575***	0.555***
	(2.688)	(2.806)	(2.801)	(2.679)
Year		-0.004	-0.005	-0.005
		(-0.975)	(-1.164)	(-1.189)
Trade			0.096	0.096
			(1.612)	(1.613)
Size				0.027
				(0.652)
N	450	450	450	450
R^2	0.445	0.446	0.449	0.450

***p<0.01, **p<0.05, *p<0.10

According to Table2, there is no significant relationship between the control variables company age, industry and asset size and the IPO underpricing rate, while the other control variables are significantly correlated with the IPO underpricing rate, and the turnover rate here is unexpectedly significantly positively correlated with the UP level of 1%. With the addition of the three control variables of company age, industry and asset size, the coefficient of Num is negative and stable at about -0.024, and is significant at the level of 5%, which indicates that the more institutions participating in private equity investment in the IPO, the more conducive it is to reduce the IPO underpricing rate, which verifies the third hypothesis of this paper.

According to Table3,With the addition of the control variables company age and industry, the coefficient of Joint in the model is stable at about -0.1, and is significantly correlated with UP at the level of 10%, and the P value is increased, indicating that the evidence supporting the null hypothesis 3 increases, that is, joint venture capital can achieve a "synergistic effect" through resource complementarity and information sharing among various venture capital institutions, thereby reducing the IPO underpricing rate of enterprises, and with the addition of these two control variables, R^2 The value increased from 0.473 to 0.474, which means that the goodness of fit of the model improved.

Table 3. The relationship between the IPO underpricing rate and whether to co-invest

	(1)	(2)	(3)
	UP	UP	UP
Joint	-0.098*	-0.103*	-0.102*
	(-1.819)	(-1.913)	(-1.918)
Size	0.028	0.030	0.030
	(0.738)	(0.775)	(0.782)
NAV	-0.038***	-0.037***	-0.037***
	(-2.824)	(-2.763)	(-2.681)
EPS	0.058***	0.056***	0.057***
	(2.841)	(2.771)	(2.710)
Pefstd	0.016***	0.016***	0.016***
	(4.082)	(4.074)	(4.106)
Pnafstd	-0.025**	-0.025***	-0.025***
	(-2.552)	(-2.593)	(-2.611)
Tnovfstd	0.726***	0.746***	0.746***
	(3.540)	(3.670)	(3.666)
Year		-0.004	-0.004
		(-0.845)	(-0.864)
Trade			0.013
			(0.225)
N	443	443	443
R^2	0.473	0.473	0.474

***p<0.01, **p<0.05, *p<0.10

4. Conclusion and recommendations

The participation of private equity investment will effectively reduce the underpricing rate of corporate IPOs, because private equity investment has a certain certification and supervision function. Certification theory argues that PE's participation sends a positive signal to the market about the quality of the enterprise. Since PE usually conducts detailed due diligence and evaluation before investing, its choice to invest in a certain enterprise indicates that the enterprise has certain development potential and value. This authentication helps to reduce the information asymmetry between investors and issuers, thereby reducing the degree of IPO underpricing. The supervision theory points out that PE will actively participate in the management and supervision of the enterprise after investment, and provide strategic guidance, resource integration, financial management and other support for the enterprise. By improving the governance structure and operational efficiency of enterprises, PE can enhance enterprise value, reduce the risk of enterprises in IPO, and thus reduce IPO underpricing.

There are different effects of private equity investment shareholding, shareholding period, and co-investment on IPO underpricing. First of all, the higher the shareholding ratio of private equity investment, the more interested and motivated it is to participate in the internal operation and management of the enterprise, and on the contrary, the intention is to enhance the reputation of the institution itself through the success of the company's IPO, and the two different investment intentions will lead to different IPO underpricing rates. Secondly, most of the short-term investment institutions lack investment experience and have a strong motivation to go after the name, and the most effective way to send signals is to push the investment object to the IPO market. Finally, although joint venture capital can achieve "synergies" through resource complementarity and information sharing among PEs, there may also be information asymmetry, and the differences in PE characteristics and development strategies and shareholding shares will also bring about conflicts of interest and the phenomenon of "free riding", which will weaken their "synergistic effect" and inhibit their role in reducing the company's IPO underpricing rate.

For enterprises, strengthen their own governance and capacity building, continuously improve the corporate governance structure, and improve the quality of information disclosure. Standardized corporate governance can enhance investor confidence and reduce information asymmetry, thereby reducing IPO underpricing. Enterprises should establish and improve internal management systems, and clarify the decision-making process and the division of rights and responsibilities. Enhance the core competitiveness, and enhance the sustainable development ability of the enterprise through continuous technological innovation, product optimization and market expansion. Strong core competitiveness helps to improve the bargaining power of enterprises in the capital market and reduce the degree of IPO underpricing.

For PE, it is necessary to enhance the ability of value-added services, strengthen the industry research and strategic planning guidance of the invested enterprises, and help the enterprises formulate scientific and reasonable development strategies. Provide value-added services in market expansion, talent recruitment, financial management, etc., to improve the operational efficiency and market competitiveness of enterprises. Actively participate in the corporate governance of enterprises, play the role of supervision and checks and balances, and promote the standardized operation of enterprises. By improving the ability of value-added services, we can create more value for enterprises and reduce IPO underpricing.

For regulators, strengthen investor education and carry out extensive investor education activities to improve investors' risk awareness and investment capabilities. Let investors understand the impact mechanism of private equity investment on corporate IPOs, and enhance their rational judgment and analysis ability of the market. Guide investors to pay attention to the fundamentals and long-term value of enterprises, avoid blind follow-up and short-term speculation, and promote the stable and healthy development of the capital market.

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