

Research Article

IPO Pricing, Investor Behavior, and IPO Underpricing of High-Tech Companies: Evidence from SSE STAR Market and Nasdaq Market

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There is a significant IPO underpricing phenomenon in the stocks of high-tech companies on China Science and Technology Innovation Board (STAR Market). In order to analyze the causes of high IPO underpricing on STAR Market, from the perspective of investor behavior, this paper uses the Two-tier Stochastic Frontier Model to decompose IPO underpricing into two parts, the pricing impact of the primary market and the transaction impact of the secondary market, and then studies the differences of the impact of different markets on IPO underpricing. The results show the following: (1) the primary market pricing of most stocks, that is, the difference between the issuance price of stocks and the real value of stocks is small, which shows that the primary market pricing has a weak impact on the IPO underpricing of the STAR Market, which in turn shows that the implementation of the registration system has significantly improved the IPO pricing efficiency of the STAR Market; (2) the closing price of most stocks fell on debut, that is, the trading price of stocks is significantly higher than its real value, which shows that the blind optimism of investors in the secondary market and the irrationality of investor structure are the main factors leading to the IPO underpricing of the STAR Market; and (3) through the variance decomposition and the robustness test of grouping the industry to which the enterprise belongs, the year of listing, and issuance and the size of the enterprise, we find that in different years and different industries, the impact of investor behavior in the secondary market on IPO underpricing is significantly higher than that in the primary market. In addition, the IPO underpricing of enterprises is not affected by the size of enterprises. This shows that the behavior of investors in the secondary market has always been the main means to affect the IPO underpricing of the STAR Market. This paper expands the analysis idea of IPO underpricing, which has a certain reference significance for the reform of STAR Market and the listing and financing of scientific and technological innovation enterprises.

1. Introduction

For a long time, initial underpricing, “hot issue” markets, and long-term underperformance, as the “three anomalies” associated with the initial public offering (IPO), widely existed in major stock markets all over the world, especially in China’s stock market. Among them, IPO underpricing refers to the phenomenon that the price of new shares rises sharply on the first trading day, which is significantly higher than the stock offering price. The degree of IPO underpricing in China’s stock market is significantly higher than that in

other countries, which seriously restricts the effectiveness of resource allocation in China’s stock market. Some scholars pointed out that the restrictions of China’s stock issuance system are important factors causing the high degree of IPO underpricing in the stock market [1]. Based on the experience of the stock markets in Europe and the United States, the stock issuance registration system with the core function of disclosing issuers’ information can effectively reduce IPO Underpricing and other issues [2–4]. On June 13, 2019, STAR Market was officially launched, and the registration system was piloted. Theoretically, with the implementation

of a registration system, the stocks' prices should gradually return to the real value in the stock market. However, through the analysis of the IPO data of enterprises listed on STAR Market, it is found that the IPO underpricing phenomenon of the STAR Market is still widespread and significantly higher than that of the stock market represented by the Nasdaq. The reason for this is that the listed enterprises on STAR Market are mainly scientific and technological innovation enterprises facing the world's scientific and technological frontier and serving the national strategy. Therefore, the secondary market investors would irrationally prefer the firms listed on the STAR Market easily. At present, the research on IPO underpricing of STAR Market mostly focuses on pricing efficiency, and there is less analysis on the causes of IPO underpricing. To study whether the IPO underpricing of scientific and technological innovation enterprises is mainly affected by the behavior of investors in the secondary market, the IPO underpricing is divided into two parts: the impact of offering pricing in the primary market and the impact of investor behavior in the secondary market. By comparing their impact factor to IPO underpricing, the part which mainly influences the IPO underpricing will be conducted. At the same time, as a control, the Nasdaq Market is selected to compare the differences between the IPO underpricing of high-tech companies in an emerging capital market and a developed capital market. Through the decomposition of IPO underpricing, we can get the main influencing factors of IPO underpricing of the STAR Market. The research conclusion is of great significance to ensure the smooth operation of STAR Market and improve the Chinese capital market system.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature on IPO underpricing. Section 3 presents the research methods, data, and methodology. Section 4 presents and interprets the empirical results. Section 5 is the robustness test. Section 6 concludes and discusses the policy implications.

2. Literature Review

The research on IPO underpricing has a long history, which can be traced back to the 1970s. Dennis [5] and others discovered IPO underpricing earlier in the process of studying the stock market but did not study this phenomenon further. Ibbotson [6] first put forward the concept of IPO underpricing when studying American-listed enterprises to describe the phenomenon that the trading price on the first day of IPO is higher than the offering price. The previous research was mainly based on the information asymmetry theory and analyzed the IPO underpricing phenomenon on the premise that the secondary market is effective. At this stage, scholars generally believed that the discount of the primary market is the main factor causing the IPO underpricing phenomenon. On this basis, they studied and formed the underwriter monopoly theory, "Winner's Curse" theory, and signal theory. The underwriter monopoly theory holds that the stock issuer lacks effective supervision over the underwriter, and the underwriter tends to bring the IPO pricing downward from the real value of the

stock. On the one hand, IPO issued at discount can reduce the risk of underwriters and maintain their reputation; on the other hand, it can compensate the investors who are at a disadvantage of information and maintain the relationship with investors [7, 8]. The "Winner's Curse" theory was developed by Rock [9] based on the underwriter monopoly theory. Rock [9] believes that there is information asymmetry among investors in the secondary market. Investors with information can buy stocks with high investment value according to their information, while investors without information can only buy stocks with no investment value abandoned by investors with information, which eventually leads to investors without information exiting the market. To ensure the smooth issuance of shares, we must attract investors who do not have information through discount issuance. Allen and Faulhaberborad [10] put forward the signal theory of IPO underpricing by bringing the information mastery of stock issuers, underwriters, and investors into the same framework. This theory assumes that the information of the real value of the stock issuer is higher than that of the investor, so it is necessary to transmit the information of the real value of the stock through discount issuance. At the same time, to transmit the low-risk signal of stocks, stock issuers often entrust reputable underwriters to underwrite the stocks. With the continuous development of the capital market and economic theory, some scholars found that the effectiveness of the secondary market remains to be discussed. The traditional stock discount issuance theory is insufficient to explain many phenomena in the process of stock IPO, and the research focus began to shift to the behavior of investors in the secondary market [11], Jay and Lvo [12] pointed out that the irrational behavior of investors in the secondary market is the main reason for IPO underpricing. According to Jay and Lvo [12], combined with the theoretical support of behavioral finance, François [13] and Alexander et al. [14] proposed the mechanism of secondary market investors affecting IPO underpricing. They believed that individual investor sentiment in the secondary market is the main reason for IPO underpricing. The excessive optimism of individual investors will lead to the valuation of enterprise stocks in the secondary market being significantly higher than the real value of enterprise stocks. Therefore, in the process of stock pricing, underwriters can issue stocks at an issue price lower than the stock trading price in the secondary market but higher than the real value of enterprise stocks. In recent years, scholars have studied the influencing factors of IPO underpricing more widely. Baschieri et al. [15] pointed out that the preference of local investors for local IPO companies will significantly affect the IPO underpricing rate of the company. Boulton et al. [16] found that the IPO underpricing of enterprises with Wikipedia records was significantly higher than that of enterprises without Wikipedia records. At the same time, some scholars found that government risk management and market manipulation rules also have a significant impact on IPO underpricing by studying international samples [17, 18].

With the development of China's capital market, the researches on IPO underpricing in China gradually rose after 2000. Yang and Wang [19] first tested the explanatory

power of information asymmetry theory on IPO underpricing in China's stock market by studying the stocks issued in China's A-share market from 1998 to 2000. Different from foreign stock markets, China's stock market has the characteristics of short development time, low market effectiveness, imperfect infrastructure, etc. Therefore, China scholars' research on IPO underpricing focused more on the level of market effectiveness and regulation. Liu and Xiong [20] found that the market environment under the special system will distort the interest mechanism and lead to the heterogeneity of investors' behavior, resulting in the phenomenon of high IPO underpricing. Tian [21] pointed out that IPO underpricing in China is mainly affected by the regulatory policies of stock issuance, which is an institutional underpricing. Chu and Zhang [22] divided the reform of China's stock issuance system into seven stages to study the impact of the IPO issuance system on IPO underpricing. The results show that pricing regulation is an important reason for the high IPO underpricing in the process of IPO in China, and with the continuous reform of China's stock issuance system, the degree of IPO underpricing shows a downward trend. Another major feature of China's stock market is the large proportion of individual investors. Therefore, some China scholars studied its impact on IPO underpricing from the perspective of investor sentiment. Han and Wu [23] put forward a systematic research framework on the impact of investor sentiment on IPO underpricing for the first time. The results showed that high investor sentiment can significantly improve the level of IPO underpricing. Subsequently, the research conclusions of Song and Wang [24] and Shi et al. [25] further verified the impact of investor sentiment on IPO underpricing. In addition, the reform of the registration system is an important measure for the development of China's stock market. The impact of the implementation of registration system on IPO underpricing is also a popular research question. Zhang and Wu [26] and Lv et al. [27] studied the impact of the registration system of the science and Innovation Board on IPO underpricing from the aspects of the underwriter follow-up investment system and the sponsor's approval system and recommendation experience, and found that the implementation of the registration system can reduce the IPO underpricing level.

Based on the above analysis, the following assumptions are proposed:

- (i) H1: registration-based system can improve IPO pricing efficiency and has a positive impact on reducing IPO underpricing level
- (ii) H2: the irrational behavior of investors in the secondary market has a positive impact on improving the IPO underpricing level

To sum up, scholars at home and abroad have a long history of IPO Underpricing and have developed a series of theoretical hypotheses. The empirical research on IPO underpricing covers a wide range, and makes a more comprehensive analysis on the influencing factors of IPO underpricing from the perspectives of stock issuers,

underwriters, and investors. In view of the reality of China, Chinese scholars' research on IPO underpricing focuses more on policy and system. Although the existing literature on IPO underpricing has been more comprehensive, most studies only focus on the unilateral impact of the primary market or the secondary market, and there are few studies on the joint impact of the two markets. Only Huang et al. [28] studied the IPO underpricing phenomenon of STAR Market by integrating the primary market impact and secondary market impact into the same framework with the help of two-tier stochastic frontier model. In addition, the existing research on IPO underpricing of science and innovation board is mostly theoretical analysis, which may be caused by the short establishment time and limited data of science and innovation board. However, so far, the scientific innovation board has been officially opened for more than two years, with more than 350 listed companies, and the amount of data is enough to support the empirical research on IPO underpricing. The main marginal contributions of this paper are as follows: (1) from the perspective of market classification, this paper makes a quantitative study on the IPO underpricing of scientific and technological innovation enterprises by using the two-tier stochastic frontier model, systematically analyzes the impact of the primary market and the secondary market on the IPO underpricing of scientific and technological innovation enterprises. It avoids the limitations of the study on the impact of a single market, and enriches the research ideas of IPO underpricing; (2) this paper compares the sci-tech innovation board and Nasdaq Market into the same research framework, and clearly points out the similarities and differences between the IPO underpricing in those two capital markets through comparative analysis, which provides empirical help for the construction of an international stock exchange market in China; and (3) through empirical research on the characteristics of IPO underpricing on the STAR board, this paper reveals the difference between IPO Underpricing on STAR Market and that on China's A-share market. This paper also provides some policy implications and suggestions for the construction of multi-level capital market in China.

3. Data and Methodology

3.1. Research Method. According to the efficient market hypothesis and other economic theories, under the condition of complete symmetry of information, the IPO pricing of listed enterprises should truly reflect the reasonable valuation of the real value of enterprises. However, neither the emerging capital market nor the capital market has reached a fully effective market, and there is a situation that the pricing of stock IPO deviates from the real value of enterprises. According to the analysis of the existing literature, IPO underpricing can be divided into two parts: primary market pricing and secondary market investor behavior. Under the idea of traditional econometrics, the multiple linear regression method can be used to study the impact of IPO underpricing on the pricing of the primary market and the behavior of investors in the secondary

market. However, Hunt-McCool et al. [29] pointed out that linear regression models such as OLS have great deficiencies in the ability to explain IPO underpricing. Therefore, the Two-tier Stochastic Frontier Model (SFA) is proposed for the following research and analysis. The Two-tier Stochastic Frontier Model (SFA) was first proposed by Meeusen and Den [30] and Aigner et al. [31] when studying the input-output efficiency of enterprises. After further development in the 1990s, it was widely used in economic research.

Since both the STAR Market and the Nasdaq Market adopt the registration system, in theory, the closing price on the first day of listing can fully reflect the information of the secondary market. Therefore, we can use the closing price on the first day of listing as an approximate substitute for the trading price in the stock market, and the expression of IPO underpricing is as follows:

$$UP_i = \frac{CP_i - IP_i}{IP_i}, \quad (1)$$

where UP_i represents the IPO underpricing level of stock i , CP_i and IP_i represent the market trading price and issuance price of stock i , respectively. Algebraic Treatment of (1) shows that

$$\ln(UP_i + 1) = \ln CP_i - \ln IP_i. \quad (2)$$

In the above formula, replacing $\ln UP_i$ with $\ln(UP_i + 1)$ has no significant impact on the research conclusion, and after processing, it ensures that the IPO underpricing level in the sample data is greater than 0, which is conducive to calculation. According to the idea of the Two-tier Stochastic Frontier Model, in theory, there is an effective boundary where there is no difference between the issue price and the market transaction price of the stock. On this boundary, the issue price and the market transaction price of the stock should be equal to the real value of the stock, that is,

$$CP_i^* = \ln_i^* = TP_i^*, \quad (3)$$

$$TP_i^* = f(X_i; \beta_i) + \rho_i, \quad (4)$$

where CP_i^* and IP_i^* , respectively, represent the trading price and issuing price of the stock market in the ideal state, IP_i^* represents the real value of the stock, X_i represents the enterprise and market characteristics that affect the real value of the stock, β_i represents the corresponding influence coefficient, and ρ_i represents the random error term. However, in reality, the issue price and market transaction price of stocks are affected by many factors and always deviate from the real value of stocks. Therefore, the actual stock market transaction price and issue price can be expressed as

$$\ln IP_i = \ln IP_i^* + \delta_i + \mu_i. \quad (5)$$

$$\ln CP_i = \ln CP_i^* + \varepsilon_i + \omega_i, \quad (6)$$

where ε and δ represent an unobservable random error term, μ_i and ω_i represent the deviation degree of the issue price and

market transaction price relative to the real value of the stock, respectively. According to the previous analysis, μ_i and ω_i are greater than 0. The final expression of IPO underpricing can be obtained by combining formulas (2), (3), (4), (5), and (6):

$$\ln(UP_i + 1) = g(X_i; \gamma_i) + \theta_i, \quad \theta_i = \nu_i + \omega_i - \mu_i. \quad (7)$$

(7) is the standard form of the Two-Tier Stochastic Frontier Model. Among them, γ_i represents the parameter to be estimated, X_i represents the influencing factors at the enterprise and market level, ν_i represents the general random error term, μ_i represents the impact of stock issue price on IPO underpricing, and ω_i represents the impact of stock market transaction price on IPO underpricing. According to the theoretical analysis and the setting of model (7), μ_i and ω_i all obey unilateral distribution, assuming $\mu_i \sim EXP(\lambda_\mu, \lambda_\mu^2)$, $\omega_i \sim EXP(\lambda_\omega, \lambda_\omega^2)$. For the general random error term ν_i , it is generally assumed that it follows the standard normal distribution, that is, $\nu_i \sim N(0, \sigma^2)$. At the same time, it is assumed that the random error terms ν_i , μ_i , and ω_i are independent of each other; so, the total random error term can be obtained as θ_i Probability density function of $f(\theta_i)$:

$$f(\theta_i) = \frac{\exp(a_i)\Phi(c_i) + \exp(b_i)\phi(d_i)}{\lambda_\mu + \lambda_\omega}. \quad (8)$$

Here,

$$\begin{aligned} a_i &= \frac{\sigma^2}{2\lambda_\mu^2} + \frac{\theta_i}{\lambda_\mu}, \\ b_i &= \frac{\sigma^2}{2\lambda_\omega^2} - \frac{\theta_i}{\lambda_\omega}, \\ c_i &= \frac{\theta_i}{\sigma} - \frac{\sigma}{\lambda_\mu}, \\ d_i &= \frac{\theta_i}{\sigma} - \frac{\sigma}{\lambda_\omega}, \end{aligned} \quad (9)$$

where $\Phi(\cdot)$ and $\phi(\cdot)$ are cumulative distribution function and probability density function of standard normal distribution, respectively. Key research variables are λ_μ and λ_ω . It only appears in the variables a_i , c_i and b_i , d_i , respectively, so it can be identified. According to (8), the natural function expression in logarithmic form can be obtained as

$$\ln L = -n \ln(\lambda_\mu + \lambda_\omega) + \sum_{i=1}^n \ln[e^{a_i}\Phi(c_i) + e^{b_i}\phi(d_i)]. \quad (10)$$

The maximum likelihood estimation of the correlation coefficient can be obtained by solving the log likelihood function. In view of the impact of primary market pricing and secondary market investor behavior on IPO underpricing, which this paper focuses on, we need to get the conditional distributions of μ_i and ω_i . After calculation, we can get

$$f(\mu_i|\theta_i) = \frac{\tau \exp(-\tau\mu_i)\Phi((\mu_i/\sigma) + d_i)}{\Phi(d_i) + \exp(a_i - b_i)\Phi(c_i)}, \quad (11)$$

$$f(\omega_i|\theta_i) = \frac{\tau \exp(-\tau\omega_i)\Phi((\omega_i/\sigma) + c_i)}{\exp(a_i - b_i)[\Phi(d_i) + \exp(a_i - b_i)\Phi(c_i)]}. \quad (12)$$

Including $\tau = 1/\mu_i + 1/\omega_i$. The conditional expectation functions of μ_i and ω_i can be further obtained according to (11) and (12):

$$E(1 - e^{-\mu_i} | \theta_i) = 1 - \frac{\tau}{1 + \tau} \frac{\Phi(d_i) + \exp(a_i - b_i)\exp((\sigma^2/2) - \sigma c_i)\Phi(c_i - \sigma)}{\Phi(d_i) + \exp(a_i - b_i)\Phi(c_i)}, \quad (13)$$

$$E(1 - e^{-\omega_i} | \theta_i) = 1 - \frac{\tau}{1 + \tau} \frac{\Phi(c_i) + \exp(b_i - a_i)\exp((\sigma^2/2) - \sigma d_i)\Phi(d_i - \sigma)}{\exp(a_i - b_i)[\Phi(d_i) + \exp(a_i - b_i)\Phi(c_i)]}. \quad (14)$$

For this paper, (13) and (14), respectively, represent the extent to which the stock issuance price and market transaction price deviate from the real value of the stock, which can reflect the impact of primary market pricing on IPO underpricing effect (FE) and the impact of secondary market investor behavior on IPO underpricing effect (SE). The difference between the two is the net effect (NE) = SE - FE. According to the above formula, we can analyze the IPO underpricing effect of different samples.

3.2. Data Source and Model Setting. As of October 28, 2021, STAR Market has issued 352 stocks. After excluding the stock samples with missing data and breaking on the first day of listing, we obtained a total of 322 sample data. We also selected the stocks issued in the Nasdaq Market as the control sample. After excluding the stock samples with missing data and breaking on the first day of listing, we obtained a total of 613 sample data.

In order to study the impact of IPO underpricing on the pricing of the primary market and the behavior of investors in the secondary market, based on the practice of Huang et al. [28], the total amount of IPO funds raised, underwriting sponsor fees and underwriter reputation are selected as the measurement indicators of the pricing of the primary market, and the stock turnover rate on the first day of listing price to book ratio and relative market rise and fall are used as indicators to measure the behavior of investors in the secondary market. Among them, the underwriter's reputation is a dummy variable. If the stock IPO underwriters rank among the top ten in that year, it is 1, otherwise it is 0. At the same time, based on the practices of Hu and Zhao [32], Qiu and Cao [33] and Zhang et al. [34], enterprise age, enterprise profitability, enterprise scale, and enterprise growth are selected as the measurement indicators at the enterprise level. Combined with the above analysis, the following regression model is constructed:

$$\begin{aligned} \text{UP} = & \alpha_0 + \alpha_1 \text{Age}_i + \alpha_2 \text{ROE}_i + \alpha_3 \text{Size}_i + \alpha_4 \text{Growth}_i + \alpha_5 \text{TFR}_i + \alpha_6 \text{URF}_i \\ & + \alpha_7 \text{UR}_i + \alpha_8 \text{FT}_i + \alpha_9 \text{PBR}_i + \alpha_{10} \text{RRF}_i + v_i + \omega_i - \mu_i. \end{aligned} \quad (15)$$

Among them, the meanings of symbols v_i , μ_i , and ω_i are the same as those above. See Table 1 for other specific variable names, symbols, and definitions.

The selected variable data are from the Wind Financial Database and the CSMAR China stock database. Some enterprise-level measurement index variable data are manually collected through the prospectus. In the primary market measurement index, the underwriter reputation is calculated according to the ranking of the lead underwriter in the current year of stock IPO. In the empirical analysis, in order to avoid the impact of dimensionality and other problems on the results, and to ensure the reasonable interpretation of various variable coefficients, some data are logarithmized. Tables 2 and 3 are the descriptive statistics of the processed data of STAR Market and Nasdaq Market, respectively. It can be found that the average IPO underpricing value of STAR Market is significantly higher than that of the Nasdaq Market, which is consistent with the later empirical research results.

4. Empirical Research

4.1. Benchmark Regression. Based on (15), this paper decomposes the IPO underpricing in STAR Market and the Nasdaq Market, respectively, and measures the impact of the primary market pricing and the secondary market investor behavior on IPO underpricing through the Two-tier Stochastic Frontier Model. The regression results are given in Tables 4 and 5, respectively.

The OLS regression results of model (15) are given in column 1 of Tables 4 and 5 for comparison. The second column gives the maximum likelihood estimation results of model (15) under additional constraint ($\lambda_\mu = 0$, $\lambda_\omega = 0$). The third column gives the maximum likelihood estimation results of model (15) under the Two-tier Stochastic Frontier Model. Columns 4–5 are the regression results of gradually adding industry dummy variables and year dummy variables based on column 3. It can be found that there is almost no significant change in the coefficient of each column of regression results,

TABLE 1: Variable symbols and definitions.

Variable type	Variable name	Variable symbol	Variable description
Explained variable	IPO underpricing	UP	$\text{IPO underpricing} = \ln((\text{first day closing price} / \text{initial price}))$
Explanatory variable	Enterprise-level metrics	Enterprise age	Age
		Profitability	ROE
		Enterprise scale	Size
	Primary market measurement indicators	Growth	Growth
		Total IPO funds raised	TFR
		IPO underwriting and recommendation fee	URF
		Underwriter reputation	UR
		Turnover rate on the first day of listing	FT
Secondary market metrics	Price to book ratio on the first day of listing	PBR	
	Relative market rise and fall	RRF	

TABLE 2: Descriptive statistics of variables of STAR Market.

Variable symbol	Mean	Std	Min	Max
UP	0.938	0.446	0.019	2.620
Age	8.568	0.358	7.432	9.587
ROE	0.127	0.074	0.011	0.686
Size	20.596	0.969	18.643	25.467
Growth	18.362	0.762	16.363	22.036
TFR	11.523	31.036	1.076	532.302
URF	6.247	5.096	1.835	69.199
UR	0.643	0.48	0	1
FT	75.076	5.948	53.075	98.965
PBR	0.283	0.104	0.102	0.874
RRF	-4.257	86.206	-96.11	727.121

TABLE 3: Descriptive statistics of variables of NASDAQ.

Variable symbol	Mean	Std	Min	Max
UP	0.363	0.282	0.096	2.493
Age	7.607	1.074	2.833	10.567
ROE	-0.887	6.575	-114.996	14.218
Size	18.362	1.928	8.573	23.982
Growth	-0.024	0.099	-0.964	0.612
TFR	1.742	2.689	0.053	34
URF	1.148	1.304	0.042	9.625
UR	0.954	0.209	0	1
FT	19.668	33.101	0.073	521.052
PBR	0.007	0.448	-5.519	2.949
RRF	6.572	9.541	0.01	95.54

indicating that the variables at different levels we choose are reasonable. In addition, in the regression results under the two-tier stochastic Frontier model, all other random errors μ and ω both are significant at the significance level of 1%. Only the random error μ of measuring the impact of the primary market on IPO underpricing in column 3 of Table 4 is not significant. Therefore, it can be considered that the IPO underpricing of the STAR Market and Nasdaq Market are

significantly affected by the pricing of the primary market and the behavior of investors in the secondary market.

4.2. Variance Decomposition. The research focuses on the difference in the impact of primary market pricing and secondary market investor behavior on IPO underpricing. Therefore, it is necessary to conduct variance decomposition

TABLE 4: Estimation of the IPO underpricing model of the STAR Market.

Variable	(1) OLS	(2) MLE	(3) Two-tier SFA	(4) Two-tier SFA	(5) Two-tier SFA
Age	0.040 (0.664)	0.021*** (3.302)	0.054 (0.962)	0.030 (0.530)	-0.027 (-0.499)
ROE	0.860 (1.305)	0.892*** (45.570)	0.964* (1.708)	0.873 (1.530)	0.592 (1.081)
Size	0.218*** (2.699)	0.240*** (50.533)	0.229*** (3.292)	0.236*** (3.363)	0.209*** (3.109)
Growth	-0.237*** (-2.775)	-0.285*** (-65.497)	-0.257*** (-3.390)	-0.250*** (-3.270)	-0.211*** (-2.892)
TFR	0.001 (0.967)	0.002*** (28.882)	0.002 (1.642)	0.002 (1.490)	0.002 (1.417)
URF	-0.006 (-0.661)	-0.009*** (-16.954)	-0.011 (-1.273)	-0.012 (-1.324)	-0.009 (-1.058)
UR	0.030 (0.649)	0.036*** (6.950)	0.042 (0.957)	0.019 (0.442)	-0.007 (-0.163)
FT	0.031*** (7.286)	0.032*** (58.973)	0.028*** (6.955)	0.028*** (7.007)	0.031*** (8.158)
PBR	-0.386 (-1.632)	-0.330*** (-18.198)	-0.299 (-1.292)	-0.495** (-2.014)	-0.298 (-1.283)
RRF	-0.001*** (v4.071)	-0.001*** (-27.938)	-0.001*** (-3.741)	-0.001*** (-3.962)	-0.001*** (-3.261)
Cons	-1.859** (-1.978)	-1.422*** (-20.709)	-1.920** (-2.255)	-1.821** (-2.173)	-1.712** (-2.151)
Industry	—	—	—	Control	Control
Year	—	—	—	—	Control
ω	—	—	-1.262***	-1.334***	-1.362***
μ	—	—	-4.806	-4.798**	-4.861***
Adj-R ²	0.267	—	—	—	—
LL	-141.580	-317.207	-132.144	-124.768	-108.659
LR	—	—	370.13	384.88	417.10
Pvalue	—	—	0.000	0.000	0.000
N	322	322	322	322	322

Note. The symbols *, **, and ***, respectively, mean significant at the level of 10%, 5%, and 1%, respectively, and the values in brackets are *t* statistics.

analysis on the regression results according to (13) and (14). Tables 6 and 7 show the variance decomposition results of IPO underpricing in the STAR Market and Nasdaq Markets, respectively. It can be found in Tables 6 and 7 that σ_μ and σ_ω both are greater than 0, which verifies again that IPO underpricing is affected by both the primary market and the secondary market. However, there are significant differences in IPO underpricing between the STAR Market and Nasdaq Market. Specifically, the impact of the primary market pricing of the STAR Market on IPO underpricing is 0.0077, and the impact of the secondary market investor behavior on IPO underpricing is 0.2562, with a net effect of $NE = \sigma_\omega - \sigma_\mu = 0.2485$. In addition, the total variance of the random term is 0.1246, of which 52.7% is contributed by the influence effect of primary market pricing and secondary market investor behavior. In the total influence of primary market pricing and secondary market investor behavior, the influence degree of secondary market investor behavior accounts for as high as 0.9991%, and the influence degree of primary market pricing accounts for only 0.0009%. This shows that the IPO underpricing phenomenon of the STAR Market is mainly affected by the behavior of investors in the secondary market, and the impact of pricing in the primary market is very weak. This conclusion verifies the previous

hypothesis. In the Nasdaq Market, the impact of primary market pricing on IPO underpricing is 0.0729, and the impact of secondary market investor behavior on IPO underpricing is 0.0869, with a net effect of $NE = \sigma_\omega - \sigma_\mu = 0.014$. In addition, it is found that the total variance of the random term is 0.0129, which is completely composed of the influence degree of primary market pricing and secondary market investor behavior, indicating that the influence of primary market pricing and secondary market investor behavior has a strong ability to explain IPO underpricing. In the total impact of primary market pricing and secondary market investor behavior, the impact of secondary market investor behavior accounts for 58.75%, and the impact of primary market pricing accounts for only 41.25%. This shows that IPO underpricing in the Nasdaq Market is not affected by the pricing of the primary market and the behavior of investors in the secondary market.

Further estimate the conditional expectation of the influence degree of pricing in the primary market (FE) and the influence degree of investor behavior in the secondary market (SE) in the phenomenon of IPO underpricing according to formula (13), (14). The results are shown in Tables 8 and 9, where Q1–Q3 represent 25%, 50%, and 75% of the quantiles, respectively. According to the results in

TABLE 5: Estimation of the IPO underpricing model of the Nasdaq Market.

Variable	(1) OLS	(2) MLE	(3) Two-tier SFA	(4) Two-tier SFA	(5) Two-tier SFA
Age	-0.017*** (-2.668)	-0.005*** (-5.749)	-0.004*** (-84.549)	-0.004*** (-31.270)	-0.005*** (-83.440)
ROE	-0.209 (-0.648)	0.008 (0.164)	0.022*** (6.280)	0.047*** (11.972)	0.082*** (30.353)
Size	-0.010** (-2.573)	-0.005*** (-9.186)	-0.005*** (-152.128)	-0.002*** (-49.039)	-0.004*** (-302.304)
Growth	0.084 (1.136)	0.063*** (9.594)	0.060*** (127.438)	0.063*** (296.781)	0.060*** (368.263)
TFR	-0.018*** (-3.493)	-0.001 (-1.614)	-0.001*** (-9.220)	-0.006*** (-140.157)	-0.005*** (-223.433)
URF	0.003 (0.294)	-0.008*** (-15.346)	-0.008*** (-184.969)	-0.004*** (-33.996)	-0.005*** (-60.248)
UR	0.016 (0.498)	-0.010 (-0.506)	-0.011*** (-60.357)	-0.001* (-1.813)	0.009*** (28.826)
FT	-0.813*** (-3.770)	0.291*** (10.436)	0.300*** (159.561)	0.091*** (9.596)	0.006 (0.978)
PBR	0.034** (2.243)	0.005*** (5.899)	0.005*** (81.583)	0.003*** (74.837)	0.003*** (75.164)
RRF	0.026*** (32.898)	0.0321*** (100.647)	0.0321*** (2588.458)	0.0301*** (1935.413)	0.0301*** (3619.262)
Cons	1.110*** (5.944)	0.436*** (17.184)	0.484*** (164.738)	0.541*** (561.612)	0.528*** (902.236)
Industry	—	—	—	Control	Control
Year	—	—	—	—	Control
ω	—	—	-2.475***	-2.432***	-2.443***
μ	—	—	-2.508***	-2.606***	-2.619***
Adj-R ²	0.661	—	—	—	—
LL	242.977	-475.642	489.565	503.903	511.132
LR	—	—	1930.41	1959.09	1973.55
P-value	—	—	0.000	0.000	0.000
N	613	613	613	613	613

Note. The symbols *, **, and ***, respectively, mean significant at the level of 10%, 5%, and 1%, and the values in brackets are *t* statistics.

TABLE 6: Measurement results of IPO underpricing decomposition of the STAR Market.

Symbol	Symbolic meaning	Measure value
σ	Random error term	0.2428
λ_μ	Primary market impact	0.0077
λ_ω	Influence degree of secondary market	0.2562
$\sigma^2 + \lambda_\mu^2 + \lambda_\omega^2$	Sum of variance of random items	0.1246
$\lambda_\mu^2 + \lambda_\omega^2 / (\sigma^2 + \lambda_\mu^2 + \lambda_\omega^2)$	Proportion of primary market and secondary market influence in total variance	52.7%
$\lambda_\mu^2 / (\lambda_\mu^2 + \lambda_\omega^2)$	Proportion of primary market influence in total variance	0.0009%
$\lambda_\omega^2 / (\lambda_\mu^2 + \lambda_\omega^2)$	Proportion of secondary market influence in total variance	0.9991%

TABLE 7: Measurement results of IPO underpricing decomposition of the Nasdaq Market.

Symbol	Symbolic meaning	Measure value
σ	Random error term	0.0000
λ_μ	Primary market impact	0.0729
λ_ω	Influence degree of secondary market	0.0869
$\sigma^2 + \lambda_\mu^2 + \lambda_\omega^2$	Sum of variance of random items	0.0129
$\lambda_\mu^2 + \lambda_\omega^2 / (\sigma^2 + \lambda_\mu^2 + \lambda_\omega^2)$	Proportion of primary market and secondary market influence in total variance	100%
$\lambda_\mu^2 / (\lambda_\mu^2 + \lambda_\omega^2)$	Proportion of primary market influence in total variance	41.25%
$\lambda_\omega^2 / (\lambda_\mu^2 + \lambda_\omega^2)$	Proportion of secondary market influence in total variance	58.75%

Table 8, it can be found that the IPO underpricing level of the STAR Market is more affected by the behavior of investors in the secondary market. On average, the influence of the

behavior of investors in the secondary market is about 26 times that of the pricing in the primary market, and the influence of the pricing in the primary market basically does

TABLE 8: Estimated results of FE, SE, and NE of the STAR Market.

Symbol	Mean (%)	Std (%)	Q1 (%)	Q2 (%)	Q3 (%)
SE:E(1-e ^{-ω} θ)	20.28	11.75	11.51	16.72	25.46
FE:E(1-e ^{-μ} θ)	0.77	0.02	0.75	0.76	0.78
NE:SE-FE	19.51	11.77	10.73	15.95	24.71

TABLE 9: Estimated results of FE, SE, and NE of the Nasdaq Market.

Symbol	Mean (%)	Std (%)	Q1 (%)	Q2 (%)	Q3 (%)
SE:E(1-e ^{-ω} θ)	7.76	7.99	3.81	4.16	9.12
FE:E(1-e ^{-μ} θ)	6.41	7.73	3.81	3.81	6.26
NE:SE-FE	1.35	12.00	-2.45	0.35	5.30

not change at different quantiles, but the influence of the behavior of investors in the secondary market changes significantly. This shows that there is heterogeneity in the impact of secondary market investor behavior on IPO underpricing of different stocks in the STAR Market. According to the results in Table 9, it can be seen that the IPO underpricing phenomenon in the Nasdaq Market is not affected by the pricing of the primary market and the behavior of investors in the secondary market, and the net effect (NE) is only 1.35%, which is far less than 19.51% of the STAR Market, indicating that the IPO underpricing degree in the Nasdaq Market is significantly lower than that in the STAR Market. At the same time, by comparing the results of different quantiles, it can be further found that the IPO underpricing of different stocks in the Nasdaq Market is heterogeneous and is affected by the pricing of the primary market and the behavior of investors in the secondary market, which shows that the Nasdaq Market is highly perfect, and the judgment of investors at different levels on the stock price is closer to the real value level of stocks.

Figures 1(a)–1(c) and 2(a)–2(c) show the frequency distribution histograms of FE, SE, and NE in the STAR Market and Nasdaq Market, respectively. Through the graph, we can more intuitively see the difference of the impact of primary market pricing and secondary market investor behavior on IPO underpricing in different stock markets. For the STAR Market, both the influence degree (FE) of primary market pricing on IPO underpricing and the influence degree (SE) of secondary market investor behavior on IPO underpricing show obvious distribution characteristics of tailing to the right, and the influence degree (FE) of primary market pricing is mainly concentrated in the range of 0.74%–0.82%. The influence degree (SE) of investor behavior in the secondary market is widely distributed between 10%–70%, and the net impact (NE) is all distributed on the right side of 0, which shows that the IPO underpricing of STAR Market within the sample range is mainly affected by the behavior of investors in the secondary market. For the Nasdaq Market, Fe and se also show the distribution characteristics of tailing to the right to a certain extent, and both Fe and Se are distributed between about 0% and 20%, with a small range of change. About 30% of the net impact (NE) is located on the right side of 0, indicating that only about 60% of the stocks in the Nasdaq Market within the

sample range are affected by the pricing of the primary market and the behavior of investors in the secondary market, thus improving the IPO underpricing level.

5. Robustness Test

To describe the decomposition of IPO underpricing in more detail and avoid the estimation deviation of empirical results caused by accidental factors, the empirical results are grouped according to different standards to test the robustness of the empirical results. There are great differences in financial indicators of listed enterprises in different industries, and investors' preference for stocks in different industries is also inconsistent. Therefore, firstly, the sample listed companies are grouped according to their industries to study whether their IPO underpricing level is affected by different markets. Tables 10 and 11, respectively, show the net effect (NE) of IPO underpricing of sample stocks classified by industry in the STAR Market and Nasdaq Market, which is affected by the pricing of primary market and the behavior field of investors in the secondary market. The industry classification standard refers to the primary industry classification standard of Wind Database. It can be seen from the results in Table 10 that the net effect of IPO underpricing in different industries affected by the pricing of the primary market and the behavior of investors in the secondary market is positive. From the average value, there is little difference in IPO underpricing among industries. It shows that IPO underpricing is common in enterprises listed on the STAR Market, and the behavior of investors in the secondary market is the main reason for IPO underpricing. Through the data of different quantiles, it can be found that there are obvious individual differences in the impact of IPO underpricing level in some industries. For example, in the health care industry, the net effect of IPO underpricing at the first and third quantiles is nearly three times different, which may be related to the investment preference of investors in the market. On the whole, the estimated results of IPO underpricing decomposition of stocks in different industries of the STAR Market are consistent with the IPO underpricing decomposition results of the overall sample, while the estimated results of IPO underpricing decomposition of stocks in different industries of the Nasdaq Market are different from the IPO underpricing decomposition results

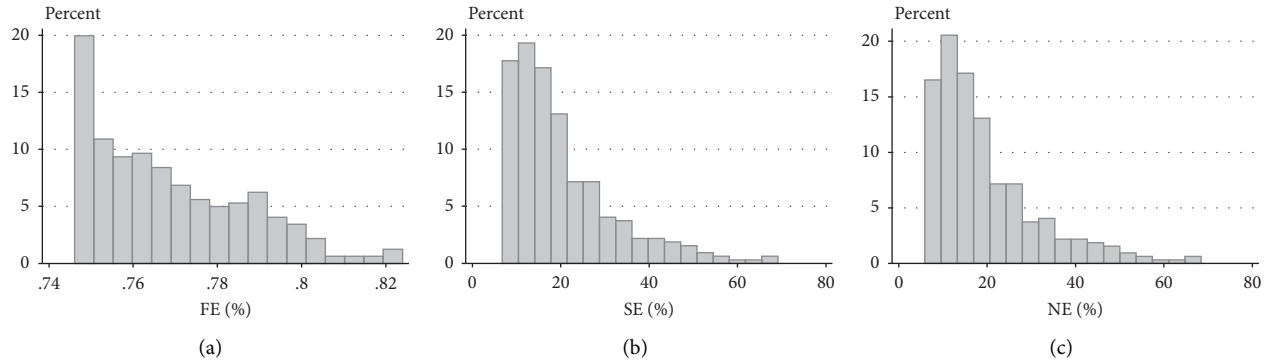


FIGURE 1: (a) STAR Market FE, (b) STAR Market SE, and (c) STAR Market NE.

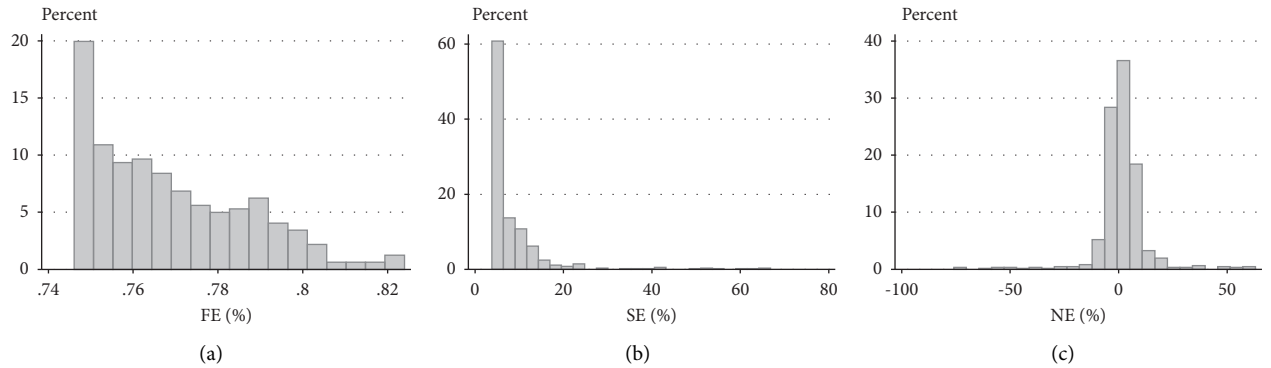


FIGURE 2: (a) Nasdaq Market FE, (b) Nasdaq Market SE, and (c) Nasdaq Market NE.

TABLE 10: Net effect of IPO underpricing decomposition in different industries of the STAR Market (NE).

Group	Mean (%)	Std (%)	Q1 (%)	Q2 (%)	Q3 (%)
Information technology	19.57	12.16	11.16	15.66	24.76
Public utility	14.54	—	14.54	14.54	14.54
Medical care	21.01	13.62	9.75	16.63	27.75
Consumer discretionary	15.69	6.47	10.39	14.51	18.32
Industry	18.44	10.48	11.08	15.74	22.56
Daily consumption	20.48	—	20.48	20.48	20.48
Material science	20.06	11.32	10.67	17.62	26.68
Energy	14.54	—	14.54	14.54	14.54

TABLE 11: Net effect of IPO underpricing decomposition in different industries of the Nasdaq (NE).

Group	Mean (%)	Std (%)	Q1 (%)	Q2 (%)	Q3 (%)
Information technology	-0.75	16.47	-2.91	0.53	5.57
Public utility	6.00	6.52	-1.14	7.50	11.64
Medical care	1.19	6.10	-2.46	0.58	4.77
Consumer discretionary	2.44	17.89	-3.66	0.04	6.38
Industry	5.27	14.38	-1.42	0.49	11.54
Real estate	-15.33	32.35	-5.93	-5.79	0.00
Daily consumption	5.77	20.92	-0.67	1.18	11.23
Material science	12.39	15.81	-2.47	13.02	18.98
Finance	2.69	9.42	-1.39	0.04	3.02
Energy	-6.79	2.16	-8.32	-6.79	-5.27

of the overall sample. In Table 11, the average net effect of IPO underpricing decomposition in information technology, real estate, and energy industries is less than 0. Therefore, for the above three industries, the impact of

primary market pricing on IPO underpricing is greater than that of secondary market investor behavior. Further study found that the net effect of IPO underpricing decomposition at the first quantile of all industry classifications was less than

TABLE 12: Net effect of IPO underpricing decomposition of the STAR Market in different years (NE).

Group	Mean (%)	Std (%)	Q1 (%)	Q2 (%)	Q3 (%)
2019	18.89	10.20	10.39	16.88	23.35
2020	19.36	12.02	10.89	14.87	23.52
2021	19.99	12.32	10.73	16.29	26.34

TABLE 13: Net effect of IPO underpricing decomposition of the Nasdaq Market in different years (NE).

Group	Mean (%)	Std (%)	Q1 (%)	Q2 (%)	Q3 (%)
2011	-2.77	22.09	-1.66	0.24	7.20
2012	0.12	5.84	-2.25	0.16	4.21
2013	1.23	6.52	-2.28	0.18	4.60
2014	1.24	6.52	-4.22	0.33	4.10
2015	1.79	6.85	-1.93	0.04	4.27
2016	3.44	11.46	-4.16	0.49	5.94
2017	2.00	7.52	-3.66	0.10	5.30
2018	2.62	7.52	-1.88	1.44	6.08
2019	-0.76	8.12	-3.07	0.00	3.64
2020	-1.03	13.49	-2.43	0.86	5.20
2021	2.86	17.51	-1.89	0.91	6.19

Note. The 2011 group includes the samples of stocks listed and issued before 2011. Due to too few data and scattered years, they are combined into one group of data.

TABLE 14: Net effect of IPO underpricing decomposition of different enterprise sizes on the STAR Market (NE).

Group	Mean (%)	Std (%)	Q1 (%)	Q2 (%)	Q3 (%)
Small and medium-sized enterprises	19.46	11.66	10.68	16.12	24.76
Large enterprises	19.87	12.57	10.97	15.90	21.67

TABLE 15: Net effect of IPO underpricing decomposition of different enterprise sizes on the Nasdaq Market (NE).

Group	Mean (%)	Std (%)	Q1 (%)	Q2 (%)	Q3 (%)
Small and medium-sized enterprises	1.69	12.47	-2.74	0.59	5.57
Large enterprises	-0.15	9.53	-1.36	0.00	3.31

0. This shows that the IPO underpricing of different industries and different individuals in the same industry in the Nasdaq Market is affected by different markets.

STAR Market was launched late, and the first batch of science and Innovation Board enterprises were officially listed and traded on July 22, 2019. However, since 2019, it has coincided with a great change that has not been seen in a century, profound changes have taken place in economic development, and the capital market has been deeply affected. To explore whether there are differences in IPO underpricing among enterprises listed in different years, it is tested according to the listing year. The results are shown in Tables 12 and 13. It can be seen that the net effect of IPO underpricing of listed companies on the STAR Market affected by different markets gradually expands with the increase of years, and the average net effect increases from 18.89% in 2019 to 19.99% in 2021. In contrast, the net effect of NASDAQ's IPO underpricing in different years changes frequently, and the net effect in 2019 and 2020 is even negative, indicating that there are annual differences in the degree of IPO underpricing affected by different markets. However, the average net effect of NASDAQ's IPO underpricing decomposition in different years is the largest, which was 3.44% in 2016, which is significantly less than the average

net effect of 18%–19% in the science and innovation board market, indicating that the IPO underpricing of STAR Market is more vulnerable to the behavior of investors in the secondary market, which once again confirms the previous conclusion.

Different enterprise sizes may also have different effects on IPO underpricing. Therefore, taking the average value of the sample enterprise size as the classification standard, enterprises with total assets below the average value are divided into small and medium-sized enterprises, and enterprises with total assets above the average value are divided into large enterprises. The estimation results are shown in Tables 14 and 15. According to the results in the table, it can be found that the IPO underpricing of small and medium-sized enterprises of Nasdaq-listed enterprises is mainly affected by the behavior of investors in the secondary market, with an average of 1.69%; large enterprises are mainly affected by the pricing of the primary market, with an average of -0.15%. The IPO underpricing of listed enterprises on the STAR Market, whether small and medium-sized enterprises or large enterprises, is mainly affected by the behavior of investors in the secondary market, and the average value is about 19%. This reflects the high degree of pursuit of the newly issued stocks by investors in the secondary market of

the STAR Market, which makes the stock price seriously deviate from the real value of enterprise stocks. In short, through the analysis of Tables 10 to 15, it is found that the average net effect (NE) and the net effect of each quantile of IPO underpricing of sample enterprises on the STAR Market are greater than 0, regardless of different industry categories, different listing years, or different enterprise sizes, indicating that the behavior of secondary market investors is always the main factor affecting the IPO underpricing of science and Innovation Board stocks.

6. Conclusion

STAR Market dominated by scientific and technological innovation enterprises is at the forefront of the pilot implementation of the registration system in China. Studying its IPO underpricing phenomenon can effectively grasp the factors affecting the IPO underpricing of scientific and technological innovation enterprises, and it is also an important way to observe the effectiveness of policies related to the reform of the registration system. This paper takes the enterprise stocks listed on the STAR Market as the main research object by October 2021, compares the Nasdaq Market, and uses the Two-tier Stochastic Frontier Model to decompose the IPO underpricing for empirical analysis. Through the decomposition of IPO underpricing, we find that: (1) the implementation of registration system significantly improves the IPO pricing efficiency of the STAR Market, and the primary market pricing has a weak impact on the IPO underpricing of the STAR Market; (2) blind optimism of secondary market investors and irrational investor structure are the main factors leading to IPO underpricing of science and innovation board; and (3) through the variance decomposition and the robustness test of grouping the industry of the enterprise, the year of listing and issuance and the scale of the enterprise, the results show that the behavior of investors in the secondary market is always the main way to affect the IPO underpricing of the STAR Market.

According to the previous theoretical analysis and empirical test, it can be found that the primary market pricing has little impact on the IPO underpricing of the STAR Market, which shows that the implementation of the registration system has corrected the deviation of the primary market pricing from the real value of stocks to a certain extent, and the price discovery function of the primary market has been restored. This shows that the implementation of the registration system has alleviated the phenomenon of IPO underpricing widely existing in the Main-Board Market to a great extent. In addition, it can be seen from the decomposition results of IPO underpricing of various industry sectors of the STAR Market that there is no significant difference between the net impact of primary market pricing and secondary market investor behavior on IPO underpricing among different industries, indicating that there is no industry-level heterogeneity in the phenomenon of IPO underpricing of the science and innovation board. However, it should be noted that the IPO underpricing of the STAR Market is significantly affected by the behavior of

investors in the secondary market than that in the Nasdaq Market, indicating that the behavior of investors in the secondary market is the main influencing factor of IPO underpricing of science and innovation board. Although the fund access mechanism of the STAR Market has optimized the investor structure to a certain extent, there is still a large gap in the overall financial literacy of investors compared with the mature capital market. At the same time, the small scale of institutional investors leads to a heavy speculative atmosphere in the secondary market, which further increases the IPO underpricing degree of STAR Market enterprises. Based on the above analysis, the following policy suggestions are put forward:

First, continue to adhere to the reform of the registration system of the STAR Market and improve the information disclosure system. The reform of the registration system in the Main-Board Market is difficult, and the IPO pricing efficiency is low, which has seriously hindered the healthy development of China's capital market. As the forefront of the pilot reform of the registration system, STAR Market has achieved certain results after more than two years of development. The implementation of the registration system with the information disclosure system as the core has improved the pricing efficiency of the primary market of the STAR Market, reshaped the price discovery function of the primary market, and alleviated the impact of primary market pricing on IPO underpricing. We must adhere to the reform of the registration system of the STAR Market and speed up the construction of a perfect information disclosure system, including the integrity education of stock issuers, the timely transformation of the regulatory functions of regulators, as well as the training of intermediaries' sense of responsibility and professional ethics.

Second, actively guide the correct investment concept and improve the financial literacy of market investors. Different from Nasdaq and other mature stock markets, individual investors are the main participants in China's stock secondary trading market. Moreover, the development of China's stock market started late, the financial literacy of investors is not high, and there is no systematic and reasonable understanding of stock investment. Especially in recent years, with the progress of science and technology, the investment threshold of the stock market has been reduced, and more and more investors without stock investment experience have entered the market. Such investors often refer to institutional investors or all kinds of gossip and blindly follow the trend of the investment, which is easy to form a "herd effect," resulting in sharp fluctuations in stock prices, resulting in serious deviation of IPO secondary market premium from the real value and disturbing the normal order of the market. Therefore, it is necessary to standardize and guide investors' investment ideas, continue to promote the popularization of basic financial knowledge, and improve the financial literacy of investment groups. At the same time, actively publicize the official website of listed enterprises to publish public information, so as to reduce the degree of information asymmetry between investors and stock issuers, so as to enhance investors' rational cognition of listed enterprises.

Third, support the expansion of the scale of institutional investors and improve the composition of investors. At present, blind follow-up investment and speculation in the secondary market are important factors causing IPO underpricing. In order to completely solve the high IPO underpricing phenomenon of the STAR Market, we must start from the root and improve the overall level of investors. Individual investors have natural disadvantages compared with institutional investors in screening the authenticity of public information of listed enterprises. Therefore, while guiding individual investors to the correct investment concept, we should also take policy measures, such as encouraging institutional investors to innovate financial products, so as to expand the proportion of institutional investors in the investment group.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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