Analysis of the Influence of Investor Sentiment on IPO Underpricing under Full Registration System: Empirical Analysis Based on PSM-DID

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Abstract: In February 2023, China promulgated the full implementation of the registration system in the entire stock market, replacing the original verification system. Taking the main board and GEM companies listed from January 2019 to January 2023 as research samples, this paper uses PSM-DID Model to investigate the impact of the registration system on the IPO underpricing rate. Meanwhile, OLS model is used to analyze the impact of investor sentiment and the interaction of the registration system on the IPO underpricing rate. The implementation of the registration system significantly improves the IPO underpricing rate on the basis of 1%. Parallel trend test and placebo test further verify the robustness of the conclusion. the interaction between investors' speculation and the registration system also improves the IPO underpricing rate.

Keywords: registration system, IPO underpricing, investor sentiment, PSM-DID, demonstration

1. Introduction

On Feb 17, 2023, China implemented a comprehensive registration system reform, which will help improve the transparency and fairness of the IPO market, promote the long-term development of the capital market and reduce market volatility. In this context, the implementation of the registration system has put forward more stringent requirements for the capital market, and the policy needs to be evaluated and improved through empirical research. Compared with developed countries, China's financial market has the problem of late start and relatively immature, and existing literature shows that "the IPO underpricing of China's stock market will affect the effective resource allocation of the capital market, reduce the operation efficiency, and even adversely affect the stable and healthy operation of the national economy"[1]. In the IPO market, for profit-seeking investors, a high IPO underpricing rate means a higher expected rate of return. Confused by this, many individuals' irrational investment behaviors rise sharply, and the resulting frenzied investment sentiment often leads to noise trading, that is, a large deviation in the judgment of the IPO price and value. After the comprehensive registration system, how to affect investors "hype" sentiment is worthy of in-depth study. Therefore, this paper takes the main board and GEM companies listed from January 2019 to January 2023 as research samples and establishes PSM-DID model to study the impact of investor

sentiment on IPO underpricing. It is found that the implementation of the registration system significantly improves the IPO underpricing rate on the basis of 1%. The interaction between the new investor sentiment and the registration system also improves the IPO underpricing rate.

The existing literature has carried out a lot of beneficial exploration on the registration system and IPO underpricing. The research finds that "The inquiry system of the registration system of the Science and Technology Innovation Board not only avoids excessive competition among inquiry institutions, but also effectively controls the irrational behavior of investors in the secondary market, thus improving the efficiency of IPO pricing"[2]. However, this paper chooses the GEM registration system for research. Focus on whether the GEM registration system can alleviate IPO underpricing and explore, in order to test the implementation results of the registration system reform and provide suggestions for promoting the registration system in an all-round way. This paper will use propensity score matching model and differential model to analyze the impact of registration system on IPO underpricing, construct investor sentiment indicators from multiple rich perspectives, and use least squares regression method to analyze the relationship between investor sentiment and IPO underpricing. According to the empirical results, suggestions are put forward from the aspects of regulatory authorities, government and individual investors to promote joint efforts to maintain the stability of the stock market.

In this paper, 697 companies listed on the main Board and GEM from January 2019 to January 2023 are selected as research samples, and the influence of investor sentiment is added to the discussion on the effect of registration system on IPO price suppression, so as to innovate theoretical research methods and enrich literature in related fields. At the same time, this paper provides theoretical reference for the promotion effect and mechanism optimization of the registration system in the A-share market. First, in a practical sense, this paper will promote the alleviation of IPO underpricing, improve IPO pricing efficiency, clarify the impact path, promote the promotion of comprehensive registration system, optimize the capital market mechanism, improve the modern financial system, cultivate rational investors, and improve the efficiency of capital allocation. Secondly, the empirical analysis of the impact of registration system and investor sentiment intermediary effect on IPO underpricing draws scientific conclusions, promotes the effective implementation of comprehensive registration system, promotes the IPO pricing in China's capital market to be more efficient, and provides basis and practical support for the establishment and improvement of modern financial system.

2.   Model setting

Through literature review, "it is found that investor sentiment is positively correlated with IPO underpricing, and IPO price limit on the first day of IPO leads to high investor sentiment, resulting in IPO underpricing."[3]

So suppose:

H1: The implementation of the registration system helps reduce the IPO underpricing rate. H2: Investor sentiment and registration system will synergistically affect IPO underpricing rate.

(1)The data source for this article is the CSMAR database. After excluding ST stocks in the CSMAR database classification and financial industry in the 2012 edition of the CSRC industry classification, a total of 697 samples were obtained. Among them, the control group - mainboard-listed companies - totaled 128; And the experimental group - GEM listed companies - 569 in total. The main Board and GEM companies listed between January 2019 and January 2023 are used as research samples in this paper. Since August 24, 2020 is the listing time of the first batch of enterprises under the GEM registration system, the issuing system of new shares on GEM after this time is the registration system[4].

In this paper, all the sample data are de-extremised, and the companies with low activity ratings are excluded. In the process of regression analysis, logarithmic processing is also carried out for the relevant continuity explanatory variables.

In addition, the data of closed-end fund discount, turnover rate, trading volume and circulation market value are from CSMAR database, Baidu Search index is from the official website of Baidu Index, and the number of stock forum posts is obtained by Python crawler grabbing the information of stock forum posts of "financial community".

(2)The following empirical regression model is adopted stablish PSM-DID as follows to validation H1.

$$underpricing_i = \beta_0 + \beta_1 did_i + \beta_2 time_i + \beta_3 block_i + \sum r_i\, control_{n,i} + \varepsilon_i \qquad (1)$$

The explained variable is underpricing, which represents the IPO underpricing rate of sample I implementing the registration system, The formula is:

$$underpricing = \frac{\text{The First} - \text{day Closing Price} - \text{Issue price}}{\text{Issue price}} \qquad (2)$$

For the sample of the implementation of the approval system, because the first-day closing price of the new shares is limited by the increase and policy constraints, the maximum can only reach 144% of the issue price, so the first-day closing price can not fully reflect the market value, resulting in the phenomenon of continuous daily limit of new shares. In order to ensure that the first-day return rate of IPO after the implementation of the first-day increase policy is not underestimated, and to ensure that the actual IPO underpricing rates under the registration system and the approval system are comparable, the above formula is revised as follows:

$$underpricing = \frac{\text{First} - \text{day closing price} - \text{Issue price}}{\text{Issue price}} \qquad (3)$$

The core explanatory variable is a dummy variable. If the i-th observation is issued under the registration system or labeled with a time later than August 24, 2020, then the value of $did_i time_t$ is 1; otherwise, the variable equals zero. And the $Block_t$=1 if the i-th observation is located on GEM; otherwise, it remains zero.

$$did_t = \begin{cases} 1, & \textit{The I} - \textit{th sample was issued under the registration system,} \\ 0, & \textit{otherwise} \end{cases} \qquad (4)$$

In this paper, control variables are selected in terms of IPO characteristics and company characteristics. In terms of IPO characteristics, it includes: underwriter reputation, issuing interval, issuing price/earnings ratio, number of new shares issued, amount of capital raised in initial public offering, IPO ratio, IPO issuing cost ratio of the company; In terms of the characteristics of the company, it includes: return on equity, net interest rate on total assets, company size, asset-liability ratio, company age, earnings per share, whether the company is state-owned, and the proportion of the largest shareholder. As Table 1 says:

In order to verify the impact of investor sentiment on IPO underpricing, this paper adopts the following empirical regression model: As Table 2 says:

$$underpricing_t = \alpha_0 + \alpha_1 DCEF_t + \alpha_2 TURN_t + \alpha_3 CMV_t + \alpha_4 TR_t + \alpha_5 BSI_t + \alpha_6 SFPN_t + u_t \quad (5)$$

The explained variable represents the average IPO underpricing rate of all registered samples listed on the T-day and all approved samples that do not rise or fall by the limit for the first time on the T-day. The explanatory variables are modeled from practice, $underpricing_t$ Six single sentiment indicators, including closed-end fund discount, trading volume, circulating market value, turnover rate, Baidu search index and number of stock forum posts, were selected to represent investor sentiment.

In order to explore the impact of registration system on investor sentiment, this paper adopts the following empirical regression model:

$$CICSI_t = \rho_0 rate_t + v_t \tag{6}$$

Explanatory variable represents the proportion of all new shares listed on the t day implementing the registration system, and the explained variable represents the investor sentiment composite index on the t day. The investor sentiment composite index is constructed by extracting principal components from the advance variables and lagging variables of the above six source indicators. Then, the correlation coefficient between the index and these 12 indicators is solved respectively, and the variable with large correlation coefficient is selected as the final source index for constructing investor sentiment. Finally, the principal component is extracted according to the principle that the cumulative variance contribution rate is not less than 85%, and the variance contribution rate of the principal component is taken as the weight to obtain the expression of the final result of the investor sentiment composite index:

$$CICSI_t = \rho_1 DCEF_t + \rho_2 TURN_t + \rho_3 CMV_t + \rho_4 TR_t + \rho_5 BSI_t + \rho_6 SFPN_t \tag{7}$$

Table 1: Variable definition table

Variable Names	Variable symbol	Variable definition
IPO underpricing rate	underpricing	Actual IPO underpricing = (Closing price on the first day of the IPO or the day on which the IPO does not rise by the limit - the IPO price)/IPO price
Implementation time of the registration system	time	Dummy variable, 1 for listings on or after August 24, 2020, or 0 otherwise
IPO sector	block	Virtual variable, GEM listing is 1, otherwise 0
Underwriter reputation	fame	1 when the IPO company's underwriters are among the top 10 in the country, and 0 otherwise
Ipo interval	lag	The time interval between issuance and listing, logarithm
Issue P/E ratio	pe	Issue P/E = Issue price per share/earnings per share before issue
Number of new shares issued	number	The number of shares issued (in tens of thousands) in logarithm
The amount of capital raised in the IPO	money	Amount of capital raised in the IPO = Number of shares issued (unit: 100 million yuan), logarithm×
IPO overraise ratio	pi	IPO overraise ratio = (actual proceeds raised - projected proceeds raised)/projected proceeds raised (%)
Percentage of the company's IPO issuance expenses	fe	Company IPO offering fee percentage = Offering fee/actual funds raised (%)
Return on equity = %	roe	Profit margin on net assets in the year before the company goes public
Net interest rate on total assets	roa	Profit margin on total assets in the year before the company goes public

Table 1: (continued).

Company size	size	The natural logarithm of the company's total assets in the year prior to listing (in 10,000 yuan)
Asset-liability ratio	lev	The asset-liability ratio of the company in the year before it goes public
Age of the company	age	Age of company = year of company listing - year of company incorporation, take logarithm
Earnings per share	eps	Net profit per share for the year prior to issuance
Whether the company is state-controlled	soa.	Dummy variable, 1 if the company is state-controlled, 0 otherwise
The shareholding ratio of the largest shareholder	shareholder	The largest shareholder's shareholding

Table 2: Definition of sentiment indicators

Variable Names	Variable symbol	Variable definition
Closed-end fund discount rate	DCEF	Closed-end fund discount rate = (net value per unit - market value per unit)/market value per unit
Trading volume	TURN	Trading volume = Shanghai stock market trading volume + Shenzhen stock market trading volume)ln(
Market value in circulation	CMV	Float market value = Float market value of Shanghai stock market + float market value of Shenzhen stock market)ln(
Turnover rate	TR	Market turnover rate weighted by outstanding market capitalization of A shares and B shares
Baidu Search Index	BSI	Following the processing method of Meng Xuejing et al. (2016), 30 keywords such as financial market are selected, the Baidu search index of these 30 keywords is added up and the natural logarithm is taken
The number of stock forum posts	SFPN	Follow the practice of Yin Haiyuan and Wu Xingying (2019), climb the stock forum post of "financial community", delete the invalid post, get the number of posts, and then take the natural logarithm

3. Empirical analysis

3.1. Matching Score: Difference-difference Model (PSM-DID)

Tables 3 to 6 report the baseline regression results of this paper.

Table 3 shows the regression estimation results of the DID model, including the effect value levels of the control group and the experimental group before and after the experiment, respectively. The data showed that before the experiment, the difference effect size (Diff(T-C)) of the experimental group and the control group was -9.981, which did not show significance (p=0.261>0.1), indicating that the effect levels of the experimental group and the control group were basically the same before the experiment, without significant difference, reliminatively indicating that they met the "parallel trend hypothesis". After the experiment, the difference effect size (Diff(T-C)) of the experimental group and the control group was 144.432, and showed significance (p=0.000***<0.01), indicating that at the time point after the experiment, the effect size of the experimental group was significantly higher than that of the control group. Finally, by looking at the double difference value (FF-in-diff), it can be seen that the double difference value is 154.413 and presents a significant significance (p=0.000***<0.01), which indicates that the differential effect is significant, and further indicates that the registration system has a significant impact on the improvement of IPO underpricing rate.

Table 3: Regression results of DID model sample of the impact of registration system on IPO underpricing rate

Time	item	Effect size underpricing	St.Err.	|t|	P>|t|
Before the experiment	Control group	572.695	8.877	1.12	0.261
	Experimental Group	582.676			
	Diff(T-C)	9.981			
After the experiment	Control group	556.704	12.721	11.35	0.000 * * *
	Experimental group	412.272			
	Diff(T-C)	144.432			
Diff-in-Diff		154.413	17.273	8.94	0.000 * * *

R-square: 0.39
* Means and Standard Errors are estimated by linear regression
**Robust Std. Errors
**Inference: *** p<0.01; ** <0.05; * p<0.1
Note: ***, **, and * indicate significant at 1%, 5%, and 10% levels, respectively

In addition, in order to ensure that the characteristics of IPO companies in the sample period of the main board and GEM are consistent, this paper adopts the tendentiousness score matching method (PSM) to find similar companies. Specifically, this paper takes the listed sector (block) as the processing variable, and the net profit on total assets (roa), the reputation of the underwriter (fe), the size of the company (size), the asset-liability ratio (lev), the age of the company and the proportion of the largest shareholder (shareholder) as the covariables. The new shares with similar characteristics listed on the main Board and GEM during the sample period are matched. Table 4 reports the sample regression results after PSM matching. The regression results showed that before the experiment, there was no significance (p=0.175>0.1); after the experiment, it was significant (p=0.000***<0.01); Double difference values showed significant (p=0.000***<0.01). It further shows that the registration system significantly increases the IPO underpricing rate compared with the approval system during the sample period.

Table 4: Sample regression results after PSM matching

time	item	Effect size underpricing	St. Err.	|t|	P>|t|
Before experiment	Control group	572.695	7.349	1.36	0.175
	Experimental Group	582.676			
	Diff(T-C)	9.981			
After the experiment	Control group	556.704	12.756	11.32	0.000 * * *
	Experimental Group	412.272			
	Diff(T-C)	144.432			
Diff-in-Diff		154.413	15.685	9.84	0.000 * * *

**Inference: *** p<0.01; ** <0.05; * p<0.1

Table 5: Difference analysis of PSM effect size

Explanatory variable	Before experiment				After experiment				Diff-in-Diff	
	Control	Experi	Diff(T-C)	|t|	Control	Experi	Diff(T-C)	|t|	coefficient	|t|
Effect size underpricing	572.695	582.676	9.981	1.36	556.704	412.272	144.432	11.32	154.413	9.84

Note: (1) The null hypothesis of the t-test is that the sample means of the experimental and Control groups are equal; (2) The Control is the Control group and Experi denote the Experiment group.

In this paper, the least squares estimation method (OLS) is used to conduct regression analysis on the efficiency of investor sentiment on IPO underpricing rate, and the results are shown in Table 6. The regression Coefficient (Coefficient) of CICSI was positive 7.093727 and significant at 1% (p=0.000***<0.01), indicating that investors' speculation on new sentiment had a significant impact on the IPO underpricing rate in the GEM sample.

Table 6: OLS model regression results of the influence of investors' new sentiment speculation on the IPO underpricing rate of GEM sample

underpricing	Coefficient	Robust St. Err	|t|	P>|t|	[95% conf.interval]	
CICSI	7.0937***	1.161231	6.11	0.000 * * *	4.811017	9.376437
__cons	222.1998***	51.97514	4.28	0.000 * * *	324.3708	120.0288

Number of obs = 412
F(1,410) = 37.32
Prob > F = 0.0000
R-squared = 0.1058
Root MSE = 166.48
* Means and Standard Errors are estimated by linear regression
**Robust Std. Errors
Note: (1) ***, **, and * indicate significant at 1%, 5%, and 10% levels, respectively; (2) N is the number of observation.

In order to further investigate the interaction effect between registration system and investor sentiment, this paper constructs an interaction term to investigate its interaction on IPO underpricing rate, and the relevant regression results are shown in Table 7. The results show that the regression coefficient of IPO underpricing rate relative to regression coefficient (C) of the interaction term is positive 7.093727, and is significant at 1% level (p=0.000***<0.01), indicating that under the joint effect of registration system and investor sentiment, IPO underpricing rate increases significantly. In the face of the market-oriented reform of the IPO issuance system to the registration system, investors' new sentiment is further fermented, which jointly improves the degree of IPO underpricing.

Table 7: DID model regression results of interactive items

underpricing	Coefficient	St. Err	|t|	P>|t|
C	7.0937***	1.018524	6.96	0.000
_cons	222.1998***	50.96686	4.36	0.000 * * *
F(1,410)	37.42			
N	412			
R^2	0.158			

Note: (1) ***, **, and * indicate significant at 1%, 5%, and 10% levels, respectively; (2) St. Err is the standard error of estimator; (3) N is the number of observation.

3.2. Robust test

This paper will conduct robust test on the conclusion of empirical analysis from two levels.

First, parallel trend test. Only when the experimental group and the control group meet the Parallel Trends hypothesis, can the difference model (DID) be used to make a more accurate estimate of the effect. The so-called parallel trend assumption is that the IPO underpricing rate of the experimental group and the control group has a similar change trend in time before the policy takes place.

Specifically, there was no significant difference between all control variables before and after August 24, 2020, indicating that the experimental group and the control group met the parallel trend assumption before the implementation of the registration system.

The regression results are shown in Table 8. Data labeled Pr(|T|>|t|) represents the regression result after controlling for relevant variables. Most of the control variables basically approached to 0 and were basically significant, indicating that the experimental group and the control group met the parallel trend hypothesis before the implementation of the registration system; All control variables are basically positive, indicating that the implementation of the registration system improves the IPO underpricing rate.

Table 8: Parallel trend test results

Variable	Mean Control	Mean Treated	Diff.	|t|	Pr(|T|>|t|)
Underpricing		212.366	169.089	2.80	0.0054 * * *
Fame	43.277	0.500	0.075	0.62	0.5379
Pe	0.425	30.651	12.243	4.85	0.0000 * * *
Pi	18.408	0.000	0.019	0.39	0.6952
Fe	0.019	8.986	1.014	1.41	0.1589
Roe	10.001	25.027	3.387	1.41	0.1584
Roa	21.641	15.449	2.785	1.93	0.0544 *
Size	12.663	11.419	0.666	4.12	0.0000 * * *
Lev	12.086	36.834	4.503	1.23	0.2208
Eps	41.337	1.394	0.883	3.47	0.0006 * * *
Soa	2.278	0.056	0.046	0.81	0.4173
Shareholder	0.101	38.754	2.048	0.70	0.4854
Number	40.803	7.944	0.525	4.59	0.0000 * * *
Money	8.469	2.253	0.258	1.82	0.0700 *
Age	1.996	2.620	0.143	1.31	0.1907
	2.763				

*** p<0.01; ** <0.05; * p<0.1

Second, placebo test. Since the core explanatory variable did is related to time, it is possible that the empirical results in this paper are caused by time trend rather than policy implementation. Therefore, this paper constructs a new registry implementation dummy variable did2 to perform placebo test by assuming that the policy is implemented one year ahead of schedule. For the new registry implementation variable did2, the control variable was selected to mimic the DID model, while controlling for month and industry fixed effects.

The regression results are shown in Table 9, Table 10. The coefficient of did2 is basically close to 0. The placebo test indicates that the change of IPO underpricing rate is caused by the implementation of the registration system, rather than by the time trend.

Table 9: Control variable coefficients of comfort test

Number of observations in the DIFF-IN-DIFF: 767

	Before	After	
Control:	81	274	355
Treated:	45	367	421
	126	641	

Table 9: (continued).

Reprot-Covariateds and coefficients:

Variable	Coeff.	Std. Err.	z	P>|z|
Fam	10.782	9.158	1.177	0.239
Pe	0.115	0.401	0.287	0.774
Pi	1.660	3.5 e+04	0.000	1.000
Fe	3.492	1.905	1.833	0.067
Roe	4.632	1.724	2.686	0.007
Roa	4.319	2.370	1.822	0.068
Size	35.000	11.162	3.136	0.002
Lev	1.765	0.821	2.150	0.032
Eps	2.938	2.034	1.445	0.149
Soa	19.185	15.142	1.267	0.205
Shareholder	0.040	0.238	0.167	0.867
Number	41.625	11.712	3.554	0.000
Money	102.543	20.401	5.026	0.000
Age	0.478	9.469	0.050	0.960

The regression results are shown in Table 10. The P-value of did2 (Diff-in-Diff) is basically close to 0,which passes the placebo test, indicating that the change of IPO underpricing rate is caused by the implementation of the registration system rather than by the time trend.

Table 10: Results of regression analysis of placebo test

Number of observations in the DIFF-IN-DIFF:767

	Before	After	
Control:	81	274	355
Treated:	45	367	421
	126	641	

Outcome var.		Under ~ g	S. Err.	|t|	P>|t|
Before					
	Control	44.005	23.658	0.00	1.000
	Treated	43.999			
	Diff(T-C)	0.006			
After					
	Control	43.062	10.159	9.39	0.000 * * *
	Treated	138.461			
	Diff(T-C)	95.399			
Diff-in-Diff		95.405	25.748	3.71	0.000 * * *

R - square: 0.12
* Means and Standard Errors are estimated by linear regression
**Robust Std. Errors
**Inference: *** p<0.01; ** <0.05; * p<0.1
Note: ***, **, and * indicate significant at 1%, 5%, and 10% levels, respectively

3.3. Heterogeneity test

In order to further explore the impact of the implementation of the registration system and investor sentiment on the IPO underpricing rate, this paper takes some concept stocks that are easy to stimulate investors' "speculation" sentiment as the research object to study whether the implementation of the registration system has a greater impact on the IPO underpricing for such stocks. This paper describes those concept stocks that are easy to be hyped by investors from two aspects: low price earnings ratio and low amount of funds raised.

As for the issuance of new shares with low P/E ratio, the stock price often has a large room to rise, so it is easy to stimulate investors "new speculation" sentiment. For the new shares with low fundraising amount, the cost of stock price speculation is often low, so it is easy to become the object of investors "speculation new". To sum up, this paper selects two aspects of the issue price-earnings ratio (pe) and the amount of funds raised in the first IPO (money) to conduct a heterogeneity test on whether the registration system is implemented or not in IPO underpricing.

Specifically, this paper divides the whole sample into high and low groups according to the median PE ratio and the median money raised in the IPO, and tests them according to the groups. The control variables are modeled after the DID model, and the fixed effects of month and industry are also controlled.

The test results are shown in Table 11. For the IPO with low P/E ratio and low fundraising amount, the implementation of registration system has a significant underpricing rate, while for the ipos with high P/E ratio and high fundraising amount, it is relatively insignificant, indicating that the implementation of registration system has a greater impact on IPO underpricing for those concept stocks that are easy to stimulate investors' "speculation" sentiment. In addition, Fisher's Permutation test was applied to test the coefficient difference of did, the implementation variable of the registration system, in each two subsamples.

Table 11: Results of heterogeneity test

	(1) underpricing	(2) underpricing	(3) underpricing	(4) underpricing	(5) underpricing	(6) underpricing
	High P/E ratio	Low P/E ratio	High fundraising	Low fundraising amount	High winning rate	Low win rate
did	0.380 (0.272)	2.416*** (0.698)	0.001 (0.284)	1.400*** (0.399)	0.862 (2.971)	0.992*** (0.298)
time	-0.170 (0.319)	3.658*** (1.318)	-0.105 (0.344)	-0.189 (0.933)	0.037 (1.082)	-0.341 (0.459)
block	0.306 * (0.178)	0.207 (0.263)	0.458 * (0.241)	0.094 (0.278)	-0.143 (0.610)	0.248 (0.155)
_cons	-11.507*** (2.944)	-8.987** (4.525)	-3.764 (2.315)	4.769 (6.038)	-21.358** (9.447)	-6.943** (2.836)
N	327	200	264	263	104	423
R2	0.690	0.845	0.696	0.721	0.962	0.636
adj-R2	0.539	0.665	0.477	0.540	0.702	0.509
month	Yes	Yes	Yes	Yes	Yes	Yes
industry	Yes	Yes	Yes	Yes	Yes	Yes
controls	Yes	Yes	Yes	Yes	Yes	Yes
empirical p-value	0.000 * * *		0.002 * * *		0.064 *	

Note: ***, **, and * indicate significant at 1%, 5%, and 10% levels, respectively, with robust standard error in brackets. The empirical P-value was obtained through bootstrap sampling 100 times and was used to represent the significance of differences in did coefficients between groups.

4.   Empirical conclusions and policy recommendations

In the above empirical analysis, first of all, the P value of the regression coefficient of the IPO institutional variable obtained by the DID model is significant at the level of 1%, indicating that the registration system has a significant impact on the improvement of IPO underpricing rate; Secondly, PSM was used to match the ipos listed on the main board and GEM with similar characteristics during the sample period, and then regression was carried out to obtain similar results, which further demonstrated the above conclusions. The results of parallel trend test and placebo test further verified and supported the above conclusions. Then, this paper uses the least squares estimation method (OLS) to conduct regression analysis on the efficiency of the impact of registration system on investor sentiment. The P value of the regression coefficient of investor sentiment (CICSI) is significantly positive at the level of 1%, indicating that investors' speculation on new shares has a significant impact on the improvement of IPO underpricing rate in the GEM sample. Finally, this paper conducts a heterogeneity test on the new shares that are easy to be hyped by investors with low P/E ratio and low raised amount, and finds that the implementation of the registration system further stimulates investors' "new speculation" sentiment, leading to a significant increase in the IPO underpricing rate of related new shares. In addition, this paper constructs an interaction term to investigate its interaction effect on IPO underpricing rate. The regression coefficient (C) of the interaction term is significantly positive at the level of 1%, indicating that the IPO underpricing rate increases significantly under the joint action of the registration system and investor sentiment.

5.   Conclusion and policy suggestions

On the basis of summarizing the existing literature research results in the academic community, based on the natural experiment of GEM registration system reform, and using the IPO data of the main board and GEM companies listed from January 2019 to January 2023, this paper established a PSM-DID model to identify the impact efficiency of registration system on IPO underpricing rate, and took consumer sentiment as the intermediary. To test whether the registration system can further affect the IPO underpricing rate by affecting investor sentiment. At the same time, this paper also uses OLS model to explore the direct impact of investor sentiment on IPO underpricing rate[5].

The empirical results show that for GEM, the implementation of the registration system does not reduce the IPO underpricing rate as expected, but significantly increases the IPO underpricing rate at the level of 1%, and the results of robustness and placebo tests further prove that the registration system leads to the increase of IPO underpricing rate. In addition, investor sentiment has a positive impact on IPO underpricing rate, and investor sentiment has a significant effect on IPO underpricing. At the same time, the results show that the interaction effect of the registration system reform and investor sentiment has a significant positive growth effect on the IPO underpricing rate of GEM. After the registration system reform, the impact of investor sentiment on IPO is significantly amplified, and the implementation of the registration system will stimulate investors' enthusiasm for new speculation, thus increasing the degree of IPO underpricing. According to the empirical results of this paper, on the whole, the reform of the registration system of GEM has not met the expectation of reducing the IPO underpricing rate, and the phenomenon of IPO underpricing rate is too high may not be alleviated for the time being and will continue to exist. The market-oriented reform of the IPO issuance system in China's financial market has a long way to go.

The excessively high IPO underpricing rate will seriously affect the efficiency of the capital market, and at the same time aggravate the motive of market speculation, which is easy to cause the operation of the capital market to deviate from the reasonable track. The GEM registration system is an important measure for the market-oriented reform and inclusive development of China's capital

market, and is of great significance for the subsequent promotion of a comprehensive registration system.

Based on the above research conclusions, this paper will put forward the following policy suggestions for the implementation and future promotion of the GEM registration system:

(1) Improve the quality of information disclosure and establish an efficient capital market

In the new stock market, the irrational investment behavior of small and medium-sized investors, mainly retail investors, is often caused by information asymmetry. The information disclosure of enterprises is not timely, inaccurate and incomplete, resulting in the failure of retail investors to obtain effective information in time and make reasonable judgments, which affects the efficiency of the capital market. Therefore, in view of the legal or illegal means taken by some enterprises to beautify their own financial data and reporting methods that do not attract investors, the only way is to further improve the IPO information disclosure system, take strict penalties on enterprises that falsify data[6], and standardize the IPO information disclosure process. Only by effectively alleviating the irrational investment behavior caused by the high investor sentiment and blindly chasing up new shares in order to obtain excess returns, improving the transparency and fairness of the IPO market, can the capital market really play the role of value recognition and resource allocation, thereby reducing the excessive degree of IPO underpricing in China, and making the capital market increasingly mature.

(2) Strengthen investor education and cultivate rational investors

At present, China's capital market is still dominated by small and medium-sized investors, whose research ability is limited and they are easily influenced by emotions. Therefore, the relevant departments can carry out certain investment knowledge education for small and medium-sized investors, and financial intermediaries can provide professional investment advisory services for small and medium-sized investors. Institutional investors have professional investment knowledge and investment skills, and vigorously developing institutional investors can reduce the volatility of the capital market, guide individual investors to carry out rational investment through institutional investors[7], and promote the sustainable development of China's stock market.

(3) The regulatory authorities will strictly review and improve the investor protection mechanism

The reform of the registration system is a process of returning power to the market, and regulators should strictly review it on the one hand and play the role of the market on the other hand. Securities regulators and relevant departments should fulfill their supervisory duties and prevent unethical companies from taking advantage of system loopholes to deliberately speculate and infringe on the legitimate rights and interests of investors.

(4) The intermediary institutions are diligent and responsible, and independently and properly exercise various functions and powers

Intermediaries are the key to the reform of registration system. The responsibility of intermediary institutions should be consolidated to avoid unreasonable behaviors. Intermediary institutions should be diligent and responsible, effectively play the role of authentication and gatekeeping, reduce market fluctuations caused by information asymmetry[8], stabilize market sentiment, maintain the basic interests of investors, and better serve investors.

(5)Promote the design of a top-level system and prudently promote the comprehensive registration system

Nowadays, the reform of the registration system of the securities market has been fully implemented, and it is necessary to do a good job of top-level design, improve management and other systems, establish and improve relevant policies and regulations, create a good environment for the new stock market, urge enterprises to accurately and truly disclose information, prudently promote the reform of the comprehensive registration system, and improve the efficiency of the capital market.

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