

Empirical Study on the Effect of Registration Reform on the Yield of ChiNext

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Abstract. The advancement of capital market to a more mature stage is shown in the construction of the securities issuance registration system. ChiNext announced the registration system reform in June 2020, which has helped ChiNext make significant strides and attracted investors' attention. The DID Model will be used in this study to assess the effects of the registration system reform on the volatility over the past four years for Shenzhen Component Index and ChiNext Index. At the same time, linear regression was used to verify the validity of the Fama-French three-factor model on ChiNext yield in recent four years. The results show that the introduction of the registration system increases the volatility of ChiNext yield; In ChiNext market, the ability of the Fama-French three-factor model to predict the yield has declined slightly after the implementation of the registration system, while the market risk premium factor is highly significant, and the model still has the predictability of returns.

Keywords: Registration system, ChiNext, DID analysis, Fama-French three-factor model.

1. Introduction

The securities issuance registration system was initially available to the general public in China in 2009. On March 5, 2022, China time, the fifth Session of the 13th National People's Congress of China announced that the securities issuance registration system would be fully implemented, before which, the approval system was typically used on the domestic stock market. Different from the registration system, the approval system had very high requirements for enterprises to enter the stock market. The securities regulatory agency would review the materials submitted by enterprises and various value indicators. Due to the complicated procedures, enterprises needed to wait for one to two years before listing. The situation was particularly bad for start-ups, which are mostly small, underpriced and less profitable. Start-ups needed to issue securities to raise money, but it was even harder to survive a year or two and pass the IPO review. The approval system inevitably blocked and frustrated many enterprises which have development potential; to some extent, the old system hindered the development of domestic entrepreneurial enterprises and emerging technologies.

It has been more than two years since the registration system was introduced on the ChiNext market. From the pilot reform on Science and Technology Innovation Board to its expansion on ChiNext, the registration reform has brought lots of positive feedback to markets and aroused the continuous attention of investors. The registration system has made up for the shortcomings, such as a long waiting time and complicated examination procedures, of the approval system. The new system has lowered the threshold for new enterprises to participate, relaxed limits on the rise and fall of yield rate and made the follow-up supervision more stringent. However, due to the short time of the reform, the relevant research and data have not kept up in time, so it is necessary to further analyse the influence of the registration system.

This paper will conduct an empirical study on the impact of the implementation of the registration system on the yield rate of ChiNext. DID analysis and adopt the regression analysis to compare the yield volatility of ChiNext before and after the reform and test the explanatory ability of the classic Fama-French three-factor model on investment return.

2. Literature Review

Generally, there are three methods of stock issuance: approval system, authorized system and registration system. Compared with the Western economic markets, it is generally believed that the registration system is superior and more efficient. Thus, the issue caused numerous investigations domestically. For example, Gu pioneered the view that the registration system would be the ultimate goal of the future reform of China's stock markets and put forward pilot proposals for the GEM [1].

Jiang and He concluded that the registration system has a significant valuation premium effect and follower effect on emerging industries by building a double difference model of GEM 50, and they put forward an empirical basis and suggestions for the subsequent reform of the registration system [2]. Yan proposed that the implementation of the registration system would improve investors' investment sentiment and increase irrational investment behaviour, exacerbating the volatility of corporate stock prices and affecting the efficiency of enterprise financing and refinancing [3].

The Fama-French three-factor model extracts beta, the market risk premium factor, SMB, the scale factor, and HML, the value factor, from stock fundamentals and other information and is also a research hotspot in China's A-share market [4]. For example, Zhu and He empirically studied that there was a small corporate effect on China's stock market, also small and medium-sized enterprises often brought excess returns [5]. Zhang analysed the 18 enterprises piloted by the GEM for the first time from 2019 to 2020 after the implementation of the registration system and then claimed that under the influence of the registration system the yield of stocks showed a significant growth trend [6].

3. Data and Method

3.1 Research Framework

China's GEM announced the reform of the registration system on June 12, 2020, and the reform was officially implemented on August 24, 2020. To briefly study the impact of the reform of China's GEM registration system on the rate of return and the rate of return volatility, this paper carries out two sets of empirical analyses. The first study is DID analysis. This paper takes the date that ChiNext officially implemented the reform of the securities registration system, that is, August 24, 2020, as the time node of the grouping, to study the impact of this policy on the yield volatility of different markets. The second research is Fama-French three-factor regression analysis, which uses the same time node to test the characterisation ability before and after the reform.

3.2 Data

The data in this paper come mainly from CSMAR database and RESSET database. Double difference analysis (DID) takes the daily data of the volatility of index-weighted moving average logarithmic earnings of the Shenzhen Component Index and the Growth Enterprise Market Index from June 12, 2014, to June 11, 2018, and from June 12, 2018, to June 11, 2022, respectively. Given that the range of yields of the Shenzhen Component Index and the Growth Enterprise Market Index are different, the paper normalises all volatility rates.

In the three-factor regression analysis of Fama-French, 494 GEM stocks are selected to build a portfolio, excluding ST stocks and stocks with missing data. The daily data of individual stocks that do not take into account the rate of return on reinvestment of cash dividends are selected. The risk-free interest rate is the 3-month Shanghai interbank offered rate, and the three-factor data of the past

two years before and after the reform implementation are weighted daily data of total market capitalisation which are used to test whether the model can effectively predict the return rate of GEM. The reform of the Growth Enterprise Market is not long ago. Therefore, to select the latest data, the deadline has been pushed back as long as possible in the study. Based on ensuring that the impact brought by policy publicity can be relatively stable over time, the period of data since the reform has been expanded.

3.3 Model Introduction

DID analysis can avoid the endogenous problem, so there is no inward cause and effect problem, also there is no problem if the omitted variables are reduced [7]. It applies to reflect qualitative factors, such as some policies with a pilot nature or changes brought by some impact events. Its essence is the estimation of the fixed effect of panel data. The formula is as follows:

$$y_{it} = \delta_0 + \delta_1 T + \delta_2 A + \delta_3 TA + \mu_{it} \quad (1)$$

The first step is to set the grouping variable T. It defines the normalized volatility data from Shenzhen Component Index as figure 0, which becomes a control group. The treatment group is made up of the normalized volatility data from ChiNext Index, which are labelled in figure 1. The second step is to set the time dummy variable A which is marked as number 0 when the data is before August 24, 2020, and as number 1 after the time. The cross-aggregation from DID shows the impact of the registration system reform on the yield volatility of the explained variable Y. Meanwhile, co-integration adopts the Placebo test. The treatment group is composed of data 4 years before June 12, 2018, that is, from June 12, 2014, to June 12, 2018, which takes August 24, 2016, as the time node, then repeats the DID analysis.

Fama and French optimized the CAPM model in 1993 and established a three-factor model to explain the stock yield. It assumes that the excess return Y can be interpreted by three factors: the market risk premium factor ($R_m - R_f$), the market capitalization factor (SMB) and the book-to-market ratio factor (HML) [8].

$$y_{it} = E(R_{it}) - R_{ft} = \beta_{it} [E(R_{mt} - R_{ft})] + s_t^E (SMB_t) + h_t^E (HML_t) + \varepsilon_{it} \quad (2)$$

3.4 Descriptive Statistics

The placebo test has valid data of 977 trading days, 541 days before the implementation of the registration system, and 436 days after the implementation. The original DID analysis has valid data of 925 trading days, 536 days before the implementation, and 389 days after the implementation.

Table 1. Descriptive statistics for DID analysis

Placebo Test	Before	After	Total
Control	541	436	977
Treated	541	436	977
Total	1082	872	1954
Original	Before	After	Total
Control	536	389	925
Treated	536	389	925
Total	1072	778	1850

Before the implementation of the registration system, valid transaction data of the stock portfolio for the Fama-French three-factor analysis has 536 days. Besides, the average of the abnormal returns is 0.001. After the implementation, valid transaction data of the same stock portfolio has 434 days. Abnormal returns have declined, also the overall fluctuation range of the three factors has enlarged.

Table 2. Descriptive statistics for Fama-French three-factor analysis

Before	Obs	Mean	Std. Dev.	Min	Max
r	536	0.001	0.019	-0.084	0.053
riskpremium2	536	0.001	0.018	-0.078	0.057
smb2	536	0	0.005	-0.031	0.018
hml2	536	0	0.004	-0.011	0.017
After	Obs	Mean	Std. Dev.	Min	Max
r	434	0	0.017	-0.088	0.052
riskpremium2	434	0.001	0.017	-0.067	0.109
smb2	434	0	0.01	-0.05	0.034
hml2	434	0	0.006	-0.022	.023

4. Results

The placebo test would have been significantly different before and after the implementation of the fictitious policy; the coefficient of the double difference term is -0.075 and the t-value has -3.482, indicating a significant negative effect on return volatility.

Table 3. Estimation Results for Placebo Test

Trade Date	Term	Coefficient	Std. Dev.	t
Before	Control	0.340		
	Treated	0.443		
	Diff (T – C)	0.103	0.011	9.421***
After	Control	0.089		
	Treated	0.135		
	Diff (T – C)	0.046	0.012	3.778***
Diff-in-Diff		-0.057	0.016	-3.482***

Notes: R2 for the regression model is 0.395, *** represents the significance at 1% level.

In the formal DID double difference analysis, the double difference term reflects the warp effect of policy implementation of 0.017, the coefficient turns from negative to positive, indicating that the registration reform significantly increases the volatility of GEM returns and increases the return risk for investors [9].

Table 4. DID Model Estimation Results

Trade Date		Coefficient	Std. Dev.	t
Before	Control	0.376		
	Treated	0.477		
	Diff (T – C)	0.100	0.011	9.055***
After	Control	0.214		
	Treated	0.456		
	Diff (T – C)	0.242	0.013	18.578***
Diff-in-Diff		0.141	0.017	8.270***

Notes: R2 for the regression model is 0.227, *** represents the significance at 1% level.

In this paper, the Pearson correlation coefficient matrix is carried out before linear regression of the data. The results show that the core explanatory variable market risk premium factor has a significant positive correlation with an excess return before the registration reform, which is consistent with the expected hypothesis. In addition, the market capitalization factor among the

explanatory variables is positively correlated with excess returns, which means large companies have slightly better returns than small companies; the book-to-market ratio factor and excess returns are negatively correlated, which means growth stocks have slightly better returns than value stocks. After the reform, the correlation between market risk premium factor and excess return decreases slightly but considering that the correlation coefficient matrix only measures the relationship between the bivariate variables and does not exclude the interference of control variables and potential variables, the results are for reference only, and further regression analysis is needed to determine the specific relationship.

To avoid data covariance, a multiple covariance test is needed, and the variance inflation factor VIF is generally used to detect whether there are multiple covariances, (Variance Inflation Factor, VIF): the ratio of variance when there are multiple covariances between explanatory variables, to variance when there are no multiple covariances. The inverse of the tolerance, the larger the VIF, the more serious the covariance is shown. The empirical judgment method shows that when $0 < VIF < 10$, there is no multicollinearity; when $10 \leq VIF < 100$, there is strong multicollinearity; and when $VIF \geq 100$, there is strong multicollinearity. The following table shows the results of the multicollinearity test of the model. The result shows that the VIF values of all variables before and after the reform are less than 10. Thus, the indicators selected in this paper do not have multicollinearity.

Table 5. Correlation coefficients and VIF tests

Before Reform	r	riskpr~2	smb2	hml2
r	1			
riskpremium2	0.976***	1		
smb2	0.184***	0.00700	1	
hml2	-0.163***	-0.229***	0.133***	1
Before reform	VIF			1/VIF
hml2	1.076			0.93
riskpremium2	1.057			0.946
smb2	1.019			0.981
Mean VIF	1.051			.
After Reform	r	riskpr~2	smb2	hml2
r	1			
riskpremium2	0.775***	1		
smb2	0.410***	-0.129***	1	
hml2	-0.0650	-0.351***	0.299***	1
after reform	VIF			1/VIF
hml2	1.233			0.811
riskpremium2	1.141			0.876
smb2	1.099			0.91
Mean VIF	1.158			.

The premise of OLS regression is that the disturbance term is homoscedastic, which otherwise might affect the regression results. White's heteroscedastic test is used before and after the reform, and its statistic is 20.95. So, the null hypothesis was rejected, indicating the existence of heteroscedasticity. Therefore, all subsequent regressions are in the form of additional robust standard errors. Meanwhile, the results show that the residuals before and after the reform conform to normal distribution.

Table 6. White's heteroskedasticity test results

	chi2(9)
Ho: Homoskedasticity	20.95***

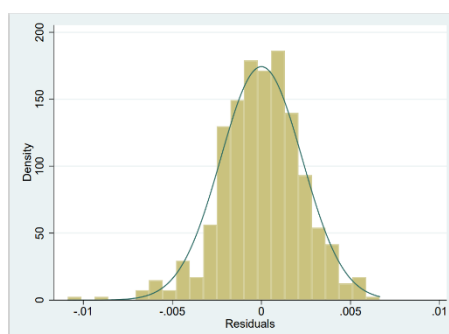


Fig. 1 Pre-Registration Reform Stock Portfolio Residual Distribution of GEM

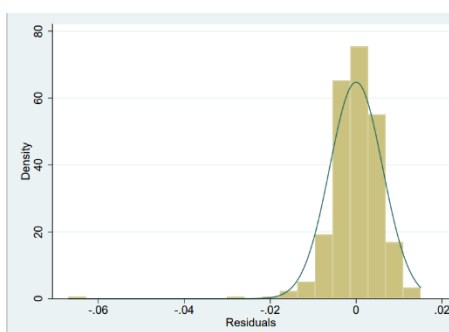


Fig. 2 Stock portfolio residual distribution after GEM registration reform

The significance of the market risk premium factor decreases a bit, and the excess return increases by 0.862 units for every 1 unit increase in this factor after the reform. The significance of the remaining two factors increases slightly. By running linear regression before and after the reform, the characterisation ability of the three-factor model descends, from 0.985 to 0.871, indicating that merely 87.1% of post-reform yields, main thanks to the market risk premium factor, can be captured by the model. The model is still informative despite the decrease in fit [10]. Moreover, the intercept term is highly significant before and after the reform, although the coefficient decreases after the reform, informing that more factors affecting returns are unknown and further alpha needs to be explored.

Table 7. Regression results of Fama-French three-factor model before and after GEM

	Before Reform	After reform
Variable	r	r
riskpremium2	1.009*** (0.006)	0.862*** (0.063)
smb2	0.606*** (0.022)	0.819*** (0.029)
hml2	0.173*** (0.026)	0.247*** (0.060)
Constant	-0.000*** (0.000)	-0.001*** (0.000)
Observations	536	434
R-squared	0.985	0.872
F	11679	366.2
Adj R-squared	0.985	0.871

5. Conclusion

It has been more than two years since the implementation of the registration system of China GEM, but the related research is not sufficient. In this paper, we analyse the return volatility and return before and after the ChiNext registration system reform by DID analysis and the Fama-French linear regression, mainly using the daily GEM data from 2018-2022 as the sample. This paper normalises the GEM data for the liberalized upside and downside and finds that the GEM return volatility actually increases significantly, along with the risk increase after the implementation of the registration system. Meanwhile, with small intercept term coefficients and strong portrayal power, the Fama-French three-factor model still has some reference value. The market risk premium factor, market capitalisation factor, and book-to-market ratio factor all are significant before and after the reform, with the market risk premium factor playing the biggest role and showing a subtle decline in the sector excess returns compared to the pre-reform period. Anyway, the overall explanatory power of the model decreases after the reform, and further alpha mining is necessary.

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