The Analysis of Shenzhen-Hong Kong Stock Connect Policy's Impact on Shenzhen Stock Market Volatility

Yixin Yao

School of Economics and Management, Guangxi Normal University, Guilin, China
18343158148@163.com

Abstract: *Based on the Shenzhen-Hong Kong Stock Connect policy, this paper conducts a comparative study on the volatility of stock prices in Shenzhen stock market, and analyses the impact of opening up the capital market on the volatility of the stock market. Based on the Herd Effect theory, this paper uses fixed effects regression model with dummy variables to analyze short-term policy effects. Then, based on information spillover effect, the long-term policy effect on stock price volatility is comparatively analysed by using descriptive statistical analysis and FE double-difference methods. The results of the study show that the price volatility of the stock market increases in the early stage of the implementation of the policy; and reduces in the long run. This dampening effect becomes more and more significant over time.*

Keywords: *capital market opening, Shenzhen-Hong Kong Stock Connect, stock volatility, difference-in-difference*

1. Introduction

As global economic and trade interactions intensify, the world is progressively embracing economic globalization and advancing towards regional integration.A marked acceleration in the liberalization of capital markets has been discernible on a global scale. For example, the United States has been bolstering its engagement with emerging markets. In parallel, the internationalization of emerging markets like South Korea and Indonesia is experiencing a consistent ascent. China's capital market, in line with this trend, is expanding its openness to international investors, progressively enhancing its "interconnection" mechanisms.

The Shenzhen-Hong Kong Stock Connect, launched on December 5, 2016, has enabled foreign investors to trade in the constituent stocks of the Shenzhen Stock Exchange's indices and A+H shares of companies with a market capitalization over RMB 60 billion. The liberalization of capital markets to international participation is expected to yield a range of positive outcomes for the domestic economy, including the expansion of investment capital, a reduction in financing costs, and the stimulation of economic growth[5]. Additionally, it promotes the optimization and enhancement of corporate governance and operational efficiency[1][9], which are pivotal for maintaining the stability of the capital market[2].

The differences in trading regulations and hours between Shenzhen and HK confer distinct informational sensitivities upon their respective stock markets[3]. The Stock Connect serves as a mechanism for the Shenzhen market to adopt the more refined information sensitivity of the mature market. This exchange of practices may mitigate the volatility of Shenzhen-listed stocks[7]. Compared to mainland markets, the HK market demonstrates notably lower stock volatility. It is plausible that the Shenzhen market, through a phase of learning and integration, could adjust towards a projected equilibrium price, thereby enhancing the market's operational fluidity[6].

However, the liberalization of capital markets can also engender heightened stock price volatility due to the influx of foreign capital[4]. The exposure of nascent and volatile markets to external entities may draw significant speculative inflows, which are often at odds with the imperatives of stable, long-term stock market appreciation. Moreover, the rapid fluctuation of capital between inflows and outflows can exacerbate market volatility[8]. This scenario not only amplifies the risk borne by investors but also poses considerable challenges to regulatory authorities. Consequently, a meticulous evaluation of the benefits and risks associated with capital market liberalization is imperative.

The stability of capital markets is integral to a nation's financial stability, economic growth, and employment steadiness. If market regulators lack a nuanced comprehension of market dynamics or fail to precisely quantify risks when crafting or implementing policies, it could precipitate systemic financial

risks, impair asset allocation efficiency, and escalate economic operational costs, adversely affecting economic development. Compared to Western counterparts, China's capital market exhibits notable systemic and regulatory gaps, underscoring the necessity for effective share price volatility analysis.

The Shenzhen and HK stock markets post the Stock Connect's inception offer compelling case studies for capital liberalization research. The findings are anticipated to yield significant theoretical insights for China's capital market liberalization and bolster financial integration theory. This paper employs an event study methodology, delineating a time window around the policy's launch to examine its short-term market volatility effects. Utilizing descriptive statistics and fixed-effects regression analysis with panel data and dummy variables, the study assesses the daily data of 161 stocks for 60 days pre- and post-Connect policy implementation. The empirical results suggest a short-term increase in stock price volatility of approximately 0.4 percentage points following the policy's introduction.

Further, the paper leverages monthly data from 20 Shenzhen-listed companies from January 2015 to February 2021 to evaluate the long-term impact of the Connect on stock price volatility. Applying descriptive analysis and both OLS and FE double difference models, the study concludes that a reduction in volatility magnitude indicates the policy's maturing effect on market stability over time. An additional analysis focusing on the period from September 2016 to March 2017 reveals a less pronounced volatility reduction compared to the initial interval, indicating an increasing significance of the policy's impact on volatility suppression.

This research aids in quantifying and analyzing the risks inherent in China's capital market during its liberalization, informing strategic countermeasures, and enriching the discourse on the economic ramifications of capital market openness. It supports regulators in curbing risk dissemination and offers historical context for the continuous refinement of China's capital market liberalization policies.

2. Method

2.1. Sample Selection

This study is anchored in the A-shares listed on the Shenzhen Stock Exchange (SZSE), excluding those incorporated into the SZSE index post-study period and omitting any samples with data discrepancies or omissions, resulting in a final sample of 161 stocks. An event window is established centered on the commencement of the Stock Connect, with a 60-day period from November 2, 2016, to January 26, 2017, designated as the interval for analysis. The empirical data are sourced from the Stock Connect dataset provided by Flush Network Information Co., Ltd., and the Guotaian database, with data manipulation conducted using Stata 14.0 software.

To delve deeper into the effects of the Stock Connect on Shenzhen market price volatility, this study randomly selected 10 stocks from both the Shenzhen Stock Connect-eligible and non-eligible stocks, totaling 20 stocks. The 10 randomly chosen Shenzhen Stock Connect-eligible stocks were designated as the treatment group, while the 10 non-eligible stocks served as the control group. The composition of the treatment and control groups is detailed in Table 1.

Table 1: List of stocks in treatment and control groups

Underlying stocks of the treatment group	Underlying stocks of the control group
Dahua Technology	Xi'an Tourism
China Chengtong Holdings Group	Xinxiang Chemical Fibre
Zhuhai Port Holdings Group	Ganneng Power
Xingye Mining	Jilin Chemical Fiber
Rong'an Real Estate	Changhong M&L Electric
Zhongzhou Holdings	Shenyang Chemical Industry
Waneng Power	Shaanxi Golden Leaf
Dinglong Holding	Min Dong Power
Fangda Group	Changhong Huayi
Focus Media Holding	Guizhou tyre

2.2. Share price volatility

2.2.1. Metrics

In this study, stock price volatility is quantified by Swing, the individual stock's amplitude, employing the method of relative price difference., which is calculated as follows:

$$Swing_{i,t} = (\ high_{i,t} - low_{i,t}\ ) / close_{i,t-1}$$

$Swing_{i,t}$ is the volatility of stock i in period t, $high_{i,t}$ is the highest price of stock i in period t, $low_{i,t}$ is the lowest price of stock i in period t, and $close_{i,t-1}$ is the closing price of stock i in period t-1.

2.2.2. Descriptive statistics

The analysis of sample data across 30-day intervals before and after the launch of the Stock Connect indicates that the average Swing indicator value has increased from 2.65% to 2.75%, reflecting an approximate 3.8% rise. This uptick preliminarily suggests a short-term increase in the volatility of the constituent stocks following the SZX system's implementation.

Table 2 demonstrates the descriptive statistics results of the Swing indicator among a selection of representative stocks from January 2015 to February 2021. After the implementation of the policy, the mean amplitude of SZSE sample stocks exhibited a decline from 0.111 to 0.082, signifying a 26.13% reduction, and the volatility of non-SZSE sample stocks fell from 0.0981 to 0.0758, a 22.73% decrease. Regarding the standard deviation of returns, the SZSE sample stocks recorded a reduction from 0.186 to 0.110, amounting to a 40.86% decrease. For non-SZSE stocks, the standard deviation of returns slightly diminished from 0.155 to 0.152, reflecting a 2.27% decrease. These findings indicate a reduction in volatility for both SZSE and non-SZSE sample stocks post-policy implementation, albeit with a notably varying degree of impact.

Table 2: Descriptive statistics results of Swing indicator for different sample

Swing	mean	median	standard deviation	minimum	maximum
Master Sample	0.087	0.0844	0.0301	0.0317	0.199
Treatment group	0.0912	0.089	0.0291	0.0317	0.184
$D_t=1$	0.0822	0.0818	0.024	0.0317	0.173
$D_t=0$	0.111	0.109	0.0298	0.0503	0.184
Control group	0.0828	0.0779	0.0304	0.0351	0.199
$D_t=1$	0.0758	0.0691	0.0302	0.0351	0.199
$D_t=0$	0.0981	0.104	0.0248	0.0447	0.158

2.3. Regression Modelling

In order to analyse the impact of the opening of Stock Connect on the price volatility of the Shenzhen market, the following regression equation is used in this paper:

$$Swing_{it} = \beta_0 + \beta_1 D_t + \beta_2 D_i + \beta_3 D_i \times D_t + \beta_4 X_{it} + \varepsilon_{it}$$

$Swing_{it}$ measures the magnitude of stock price volatility and examines the extent and direction of changes in the price volatility of SZ stocks. D_t is a time dummy variable that differentiates between the point in time when SZ Stock Connect was opened, $D_t = 1$ denotes after SZ Stock Connect was opened and $D_t = 0$ denotes before SZ Stock Connect was opened. D_i is a grouping dummy variable that distinguishes between the treatment and control groups, $D_i = 1$ denotes SZSE stocks, which belong to the treatment group, and $D_i = 0$ denotes non-SZSE stocks, which belong to the control group. $D_i \times D_t$ are the interaction terms, $D_i \times D_t = 1$ denotes the treatment group of policy implementation, and its coefficient is the effect of the implementation of the Stock Connect policy on stock price volatility for the focused observation. The outstanding market capitalisation (lnCMV), turnover rate (TO), current yield (Yield), and turnover (lnVolume) are selected as a set of control variables , denoted by X_{it} .

3. Results

3.1. Short-term impact on stock market volatility

After Hausman's test, fixed effects were chosen to regress the panel data and the regression results are shown in Table 3.

Table 3: Regression results of short-term impact

Swing	Coef.	Std. Err.	t	P>|t|	[95%Conf. Interval]	
Dt	0.0042***	0.0011	3.72	0.000	0.0020	0.0064
lnCMV	-0.0099***	0.0015	-6.42	0.000	-0.1298	-0.0069
TO	0.2114***	0.1271	16.64	0.000	0.1865	0.2363
Yield	0.1659***	0.0063	26.37	0.000	0.1535	0.1782
lnVol	0.0159***	0.0003	48.86	0.000	0.1526	0.0165
N	9821					
Adj. R2	0.7066					

The regression results show that the coefficient estimate of the dummy variable is 0.0042 and the result is highly significant with a significant positive policy effect. This suggests that stock market volatility increases in the short term after the opening of Stock Connect. The paper posits several potential explanations for this outcome: (1) during the initial phase of the opening, the market's expectations for the Stock Connect were overly optimistic, leading to a substantial influx of foreign capital, a sharp rise in stock prices, and an increased risk exposure for domestic investors, thereby amplifying stock price volatility; (2) post-implementation, despite the inflow of funds through the Shenzhen Stock Connect constituting a minor fraction of total turnover, the concentrated influx of substantial capital into select stocks incited an investor herd effect, resulting in pronounced stock price movements;(3) the inflow of overseas funds not only channeled foreign capital into the stock market but also introduced global financial risks to the mainland capital market. Concurrently, China's stock market risk control mechanisms require enhancement, and risk management tools necessitate innovation to effectively mitigate price fluctuations in the early stages of market liberalization.

3.2. Long-term impact of on stock market volatility

This paper empirically analyses the monthly data of individual stocks of the treatment group and the control group from January 2015 to February 2021 (excluding the data of the month of the launch of the Stock Connections), and in order to observe the changes of the policy effect of the Stock Connections over time, September 2016 to March 2017 is intercepted to be denoted as Interval 2, and at the same time January 2015 to February 2021 is denoted as Interval 1. The double-difference between the OLS, FE regression model was analysed and the results were obtained as shown in Table 4.

Table 4: Regression results of long-term impact

	Int 1: 2015.1-2021.2		Int 2: 2016.9-2017.3	
	OLS	FE	OLS	FE
$D_i \times D_t$	-0.0088173*** (0.004)	-0.0083095*** (0.000)	-0.0033721** (0.066)	-0.0025616* (0.092)
D_i	0.0122619*** (0.000)	--	0.0084579*** (0.000)	--
D_t	-0.0145277*** (0.000)	--	-0.000718*** (0.001)	--
lnCMV	-0.002605 (0.135)	-0.0001268 (0.943)	0.0150564** (0.043)	0.0052137*** (0.000)
TO	0. 0037417** (0.024)	0.0097675*** (0.000)	.0260256* (0.070)	0.0022905*** (0.001)
Yield	0. 0076938 (0.132)	-0.0035603*** (0.003)	-0.0069519 (0.845)	0.0037547*** (0.000)
lnVol	0.006333*** (0.000)	0.0064079*** (0.000)	-0.01288* (0.096)	-0.0010098 (0.483)
_cons	0.015632 (0.521)	-0.123362 (0.675)	0.0381608 (0.738)	0.0196031*** (0.448)
Adj R-squared	0.2290	0.6753	0.1436	0.9881

From the empirical results, it can be seen that for the interval 2015.1-2021.2, the coefficients of the interaction terms Di×Dt are -0.0088173 and -0.0083095, respectively, which are both negative and significant at the 1% level. This indicates that there is an overall reduction in share price volatility in the treatment group compared to the control group by a magnitude of 0.83095% to 0.88173% in the sample interval 1. For the interval 2016.9-2017.3, the coefficients of the interaction terms Di×Dt are -0.0033721 and -0.0025616, respectively, which are positive and significant at the 10% level. This indicates that there is an overall reduction in stock price volatility by a magnitude of 0.33721 per cent to 0.25616 per cent in the treatment group compared to the control group in sample interval 2. The coefficients of the time dummy variables are significantly negative in interval 1 and interval 2, indicating a significant intertemporal effect of the policy. The coefficients of the interaction terms are significantly positive in both interval 1 and interval 2, and the magnitude of volatility suppression is significantly larger in interval 1 than in interval 2, suggesting that the suppression of stock price volatility by the implementation of Stock Connect becomes more and more significant over time.

The sample in Interval 2 represents the short-term performance of the Stock Connect policy, further verifying Hypothesis 1. The sample in Interval 1 represents the long-term performance of the Stock Connect, indicating that the volatility of Shenzhen stocks decreases in the long run of the opening of the Stock Connect, and that the risk of the stocks on the Shenzhen Stock Connect that have the participation of HK investors is reduced. It can be seen that the opening of Stock Connect has a dampening effect on the volatility of Shenzhen stocks in the long run. The reasons for this can be explained as follows: First, the volatility of the HK stock market is much lower compared to the mainland stock market. Based on the spillover effect of HK stocks, the Shenzhen market will make an expected equilibrium price re-emerge in the securities market through a certain period of learning and financing, which is conducive to the smooth operation of the Shenzhen stock market. Secondly, the opening of Stock Connect strengthens the connectivity between Shenzhen and HK, and in the process of learning from the mature regulatory system and operational experience, the mainland market can strengthen the expected price stabilisation effect, and gradually play a restraining role in the price volatility of the underlying stocks of the Shenzhen Stock Connect. Thirdly, after the opening of the Stock Connect, the active performance of foreign investors will bring in more long-term foreign capital into the mainland capital market, which can improve the capital structure and facilitate the transformation of the economic structure and enhance the maturity of the stock market, which will lead to lower volatility of stock prices in the long run.

3.3. Robustness Tests

Employing the parallel trend test, the year preceding the policy's inception serves as the reference point for creating interaction terms between the year dummy and the group dummy variables, labeled as Before3, Before2, Current, After1, After2, and After3. These terms are integrated into the regression model for analysis. The Difference-in-Differences (DID) parallel trend test plot (Figure 1) illustrates that the interaction term coefficients prior to the Stock Connect's launch include zero within their confidence intervals, indicating no significant divergence between the two stock groups pre-opening. This affirms the parallel trend assumption. Concurrently, a significant negative effect is observed in the initial year post-policy implementation, thereby substantiating the Stock Connect's mitigating influence on Shenzhen stock price volatility.
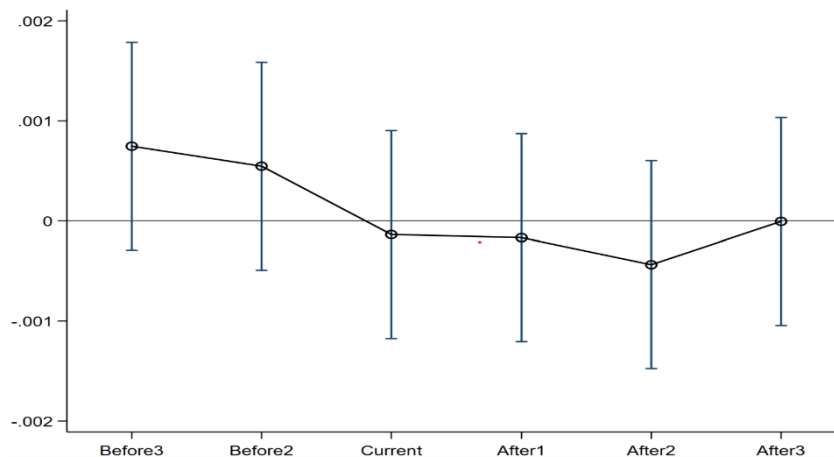

Figure 1: DID parallel trend test

4. Conclusions

This paper evaluates the impact of the Stock Connect system on stock market volatility using daily and monthly stock price amplitude Swing as a volatility metric. The empirical findings indicate that the Stock Connect's implementation exerts notable effects on both short-term and long-term market volatility.

In the immediate aftermath of the Stock Connect's opening, there is a detectable, albeit modest, escalation in the risk exposure of HK investors participating in the Shenzhen Stock Connect. This suggests that, in the short term, the opening did not effectively curb price volatility or stabilize prices; in fact, it may have heightened market volatility due to investor herd behavior. Over time, however, the Stock Connect policy has demonstrated a gradual suppressive effect on stock market volatility, with this effect intensifying as the policy continues to be implemented. As the policy progresses, an increasing influx of foreign capital into the Shenzhen market is observed, with a significant presence of rational and seasoned foreign investors entering through the Stock Connect. This influx enhances the overall investor maturity in the Shenzhen market, improves capital structure through more prudent investment practices, and bolsters the market's maturity. These developments, in turn, promote economic structural transformation and upgrading, which are expected to contribute to a reduction in stock price volatility in the long run.

In order to strengthen the stabilising effect of the Stock Connect system on the Shenzhen stock market, reduce the risks in the opening up of the capital market to the outside world, attract more foreign capital with a good regulatory system and transparent operation system, and promote the process of opening up of China's capital market to the outside world, it should be considered that (1) more small and medium-sized company stocks and stocks of entrepreneurial sectors should be supplemented within the scope of the Shenzhen Stock Connect stock market, so that the market's large fluctuations in stock prices can be controlled more precisely and, consequently, the stock market risks can be reduced. reduce the risk of stock market. (2) The opening up of the capital market to the outside world has a series of uncertainties, in the process of expanding the underlying stocks must not be hasty, and should gradually reduce the restrictions to stabilise the process of opening up the capital market to the outside world. (3) It is necessary to strengthen the promotion of value investment and increase the investment in investor education on professional concepts. In order to avoid irrational behaviour of the group, it is necessary to strengthen the education of mainland investors on professional investment knowledge, guide the tendency of value investment and curb the volatility of stock prices.

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