Evaluating Impacts of Reduction in Fluctuation Limit on Stock Price Risks in Vietnam

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ABSTRACT

Vietnam's stock market in late 2007 experienced a sharp fall. Since March 2008, the State Security Commission of Vietnam (SSC) has from time to time adjusted the fluctuation limit on stock price in the hope of precluding the panic among investors and reducing the market risks. Theoretically, risks can be quantified by the volatility which can be measured by the conditional variance of the chain of rates of returns. A model that has been widely employed to measure the volatility is GARCH (General Autoregressive Conditional Heteroskedasticity). In this paper, GARCH will be employed to evaluate impacts of measure to narrow the fluctuation limit on risks in Vietnam's stock market.

Keywords: returns, GARCH, fluctuation limit, stock market

1. INTRODUCTION

Vietnam's stock market since late 2007 has suffered a sharp decline. Just from March 2008 to August 2008, SSC adjusted the fluctuation limit three times hoping to prevent an unexpected "panic" among investors and reduce market risks.

Measuring the dispersion of probability density of random variables is based on the price volatility, i.e. the standard deviation or the square root of variance of a random variable. Specifically, if we take stock indices into account, the volatility or the dispersion of rates of return of a stock or a market index can be measured by the standard deviation of the stock return at the time *t*. In the event that the rate of return of a stock is displayed by a logarithmic equation, the volatility can be written as follows:

$$(volatility) = \sigma_{t-1}\left[log\frac{P_t}{P_{t-1}}\right]$$

where, *Pt* is the market index or the stock price at the time *t*; and σ_{t-1} denotes the standard deviation at the time *t-1*. Accordingly, the higher the volatility, the higher the stock risk. In other words, the volatility reflects the uncertainty or the risk of stock price fluctuation. If the volatility is high, the stock price can easily fluctuate within a short period of time. Vice versa, the low volatility reflects a slow fluctuation over time. In short, volatility can be deemed as a significant concept in financial research using the time-series data because it can figure out fluctuations in the stock return as well as portfolio risks. This research utilizes the volatility to evaluate Vietnam's stock market risks while SSC works out a remedy to narrow down the fluctuation limit on stock price.

In reality, a feature of financial time series often called "volatility clustering," i.e., high volatility tends to follow high volatility and low volatility entails low one (see Figure 1). In this case, the variance of rates of return fluctuates over time; and it is reflected by the strong autocorrelation of squared returns or market indices. Therefore, the most basic method for testing this phenomenon is calculating autocorrelation coefficients of squared returns.

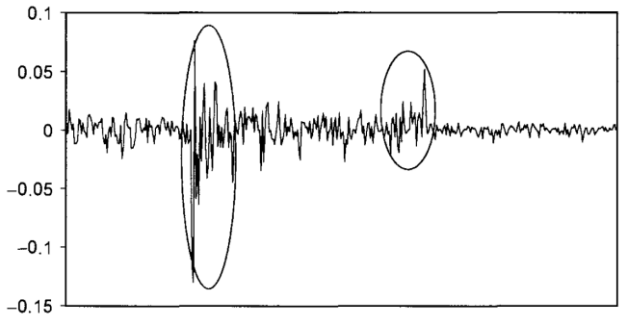

Figure 1: Volatility Clustering Phenomenon of Financial Time Series

Source: Alexander, C. (2001)

The volatility clustering can be deemed as the effect of Generalized Autoregressive Conditional Heteroskedasticity (GARCH) that was first modeled by Bollersley (1986); and then has played a significant role in evaluating stock returns and volatility.

The GARCH model was first used by Bollerslev (1986) to test effects of reducing fluctuation limit; yet, it has limitations. Specifically, Bollerslev (1986) grouped time-series data of the period when reduction measures were taken into a dummy variable. It equated different price fluctuation limits to contrast such periods with times when these measures are removed; and this approach is not appropriate to Vietnam's stock market because it will be nonsense if fluctuations of 2% and 7% in Hanoi Stock Exchange (HASTC) are considered as the same to contrast it with a 10% limit adopted by HCMC Stock Exchange (HoSE). This paper employs the GARCH model to evaluate impacts of each period when these reduction measures were applied on market risks with a view to addressing shortcomings in the research by Nguyễn Thu Hiền and Lê Đình Nghi (2010).

2. FLUCTUATION LIMITS IN VIETNAM'S STOCK MARKET

Research data are from a 2-year period (from March 1, 2007 to Feb. 28, 2009) and collated in both HoSE and HASTC (this term is now renamed HNX and will be employed throughout the paper so as to fit the research period). In March 2007, the stock indices in both markets were at their peak. VNIndex reached 1,000 points and HASTC Index was over 400; and the fluctuation limit on stock price was 10% in HASTC and 5% in HoSE. Such indices then slightly fell and it was until

November 2007 that they experienced a sharp fall. During the recession period, no adjustment was made to fluctuation limit. The market became more depressed from November 2007; and SSC made up their mind to reduce the stock price fluctuation limit to 2% in HASTC and 1% in HoSE on March 27, 2008 in order to restrain the sharp decline in the stock market. However, it resulted in a poorer liquidity of the stock market as the fluctuation limit was too narrow. Once, on April 7, 2008, in order to improve the liquidity in the stock market, the fluctuation limit was widened by 1%, making it 2% in HoSE and 3% in HASTC. On June 19, 2008, the fluctuation limit was adjusted up to 3% in HoSE and 4% in HASTC. As SSC put it, this adjustment was in accordance with the stock market's recovery and requests by HoSE and HASTC.

From March 27, 2008 through June 20, 2008, the decline was slow after the fluctuation limit had been reduced. On June 20, 2008 when the index came bottom with 366.02 points, HoSE started to recover, and then so did HASTC. Accordingly, from Aug. 18, 2008, the price fluctuation limits were adjusted up to 5% in Hose and 7% in HASTC to improve the market liquidity on the basis of macroeconomic favorable conditions, including information about falls in gasoline price. However, such recovery only lasted to late August 2008. From early September 2008 till December 2008, Vietnam's stock market once again became severely depressed and even fell through the bottom of 366.02 points in HoSE on June 26, 2008. However, until the end of Feb. 28, 2009, no decision on adjusting the price fluctuation limit was made.

Apparently, during the research period, SSC continuously adjusted the stock price fluctuation limit. Noticeably, at this time Vietnam just entered the WTO and the world was suffering a severe economic recession and pricing-to-market phenomenon was quite popular, stocks price (especially bank stock price) was very sensitive to related disclosures. Therefore, when there was some unfavorable information, the stock price plummeted, causing a panic in the stock market. Accordingly, SSC had to narrow the price fluctuation limit to stabilize the market reducing the market liquidity and hindering the market development. Hence, given the market progress and favorable conditions of the economy, SSC has step by step widened the fluctuation limit to facilitate the healthy development of stock market.

3. THEORETICAL BACKGROUND

a. GARCH Model:

Bollerslev (1986) introduced the GARCH model to measure the conditional variance of stock returns or the volatility. The stock return can be described by the ARMA model as follows:

$$r_t = \phi_0 + \sum_{i=1}^{k} \beta_i x_{it} + \sum_{i=1}^{p} \phi_i r_{t-i} + \sum_{i=1}^{q} \theta_i a_{t-i} + a_t$$

where, *k, p*, and *q* are positive integers; x_{it} stands for causal variables; r_{t-i} and a_{t-i} are respectively the returns and errors predicted at the time *t-i*. The GARCH model describing the volatility by the conditional variance can be written as follows:

$$a_t = \sigma_t \varepsilon_t, \qquad \sigma_t^2 = \alpha_0 + \sum_{i=1}^{m} \alpha_i a_{t-i}^2 + \sum_{j=1}^{s} \beta_j \sigma_{t-j}^2$$

Where, σ_t^2 is the conditional variance; $\{\varepsilon_t\}$ stands for identically distributed random variables with mean equaling zero and variance being 1; $\alpha_0 > 0$; $\alpha_i \geq 0$; $\beta_j \geq 0$; and $\sum_{i=1}^{\max(m,s)} (\alpha_i + \beta_i) < 1$. It is construed that α_i equals zero with $i>m$ and β_j being zero with $j>s$. The sum of α_i and β_j will be restricted so that the unconditional variance of a_t is finite while the conditional variance of σ_t^2 changes over time. ε_t is assumed to follow the normal distribution, the standardized student-t distribution or the generalized error distribution.

Thus, the GARCH model can describe the volatility and influential factors via the above-mentioned equation. It is visible that the volatility can be expressed in form of a function whose dependent variables include the volatility of preceding period (σ_t^2 _ j) and predicted errors of preceding period (a_{t-i}). Suppose that α_i (error coefficient) and β_i (lag time) are statistically significant, then the volatility of returns is affected by the fluctuation limit and errors (which represent unexpected ups and downs to investors) in the previous period. Additionally, α_i and β_i also have impacts on the volatility of time series. If β_i is enormous, it takes a long time to eliminate impacts of predicted errors on the volatility; and thus the volatility in

this case is persistent. If α_i is enormous, the volatility responds strongly to market upheavals.

b. Impacts of Price Limit on the Volatility:

Impacts of price limits on the volatility follow one of the two assumptions: either information or overreaction by investors.

Regarding information, let us consider a market where the real equilibrium price and the volatility depend on incoming information, and investors have gathered and analyzed it. If the price limit is applied and the equilibrium price is within the price limit, it may move to the limit during the trading session. In next sessions, it will approach the equilibrium value. Accordingly, the price limit increases the number of transaction days needed for the market to reach a state of equilibrium; and thereby creating a strong correlation between time-series returns. Yet in this case, the volatility is unchanged. Therefore, the hypothesis on information states that the price limit does not have impacts on the volatility.

Concerning the overreaction by investors, let us consider a market in which investors do not handle information effectively. Once new pieces of information appear, investors tend to overreact to it and the stock price can hit its limit. In the short run, the stock price reflects inexact information; and the price limit just provides investors with more time to reevaluate information and adjust their investing strategies. During this "reevaluation" period, the stock market may be partly frozen. If the price limit applies, the volatility will be low and vice versa. Therefore, the hypothesis on the overreaction states that the price limit can reduce the volatility.

Accordingly, it is possible to employ the GARCH model and include the price limit as a variable to test impacts of price limit on the volatility. The GARCH model can be rectified as follows:

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{m} \alpha_i a_{t-i}^2 + \sum_{j=1}^{s} \beta_j \sigma_{t-j}^2 + \sum_{k=1}^{l} D_{tk}$$

where, D_{tk} denotes dummy variables which bear value 1 when the price limit is used and zero otherwise; $k=1, \ldots l$ represents the times of price changes.

4. RESEARCH RESULTS

a. Analytical Data and Descriptive Statistics:

Research data comprise indices of VNIndex and HASTC_Index (which is now renamed HNX_Index) uploaded on the official websites of HoSE and HASTC from March 1, 2007 through Feb. 28, 2009. The two representative stock codes chosen for consideration include STB (Saigon Thương Tín Commercial Joint Stock Bank) of HoSE and ACB (Asia Commercial Bank) of HASTC, which has been holding a large amount of capital in the market. Moreover, because these two stocks are of the banking sector, they might suffer identical impacts from the macroeconomic situation and the governmental policies; and thus the reliability of testing results will be fortified.

In fact, the rate of return (RR) can be calculated as follows:

$$RR = ln\left(\frac{x_t}{x_{t-1}}\right)$$

Yet, due to the fact that the rate of return in Vietnam's stock market is small (i.e. it just fluctuates within a permitted range), the following equation will be employed:

$$RR = \frac{P_t - P_{t-1}}{P_{t-1}}$$

Where, *Pt* is the market index or the stock price at the time *t*.

The data are from the official websites of HoSE and HASTC. Several descriptive statistical results are reported in Table 1.

Table 1: Descriptive Statistical Results of the Stock Return

	VN-Index	**HASTC-Index**	**STB**	**ACB**
Mean	-0.002890	-0.002885	-0.002140	-0.001890
Median	-0.003280	-0.004333	-0.006870	-0.003550
Maximum	0.047520	0.100740	0.050000	0.099700
Minimum	-0.046880	-0.120692	-0.050000	-0.139890

Skewness	0.096550	0.039981	0.239504	0.160320
Kurtosis	2.851280	4.972634	2.240307	3.985180

Source: Author's calculation based on publicized data of HoSE and HASTC

As Table 1 indicates, the means of the return rate of chosen stocks are negative, which is definitely appropriate because they are tested in the recession period of Vietnam's stock market. The max and min of some indices in HASTC exceeds the permitted fluctuation limit. For example, HASTC_Index fluctuates in excess of 10%; and the min of ACB (-0.14) exceeding 10% is the sample of the return rate on Jan. 2, 2008, when it is the ex-rights day for convertible bonds and the permitted maximum fluctuation limit is 30%.

The positive skewness value of studied cases implies that this is an asymmetric distribution which skews to the right. This result is corresponding to the reality of Vietnam's stock market at this time when indices and stock prices continuously plummeted, causing the low rate of return (i.e. the left tail of distribution) to appear in a high frequency and the distribution to skew to the right (i.e. the right tail is long).

Kurtosis measures the concentration or distribution of data around its peak (Hoàng Trọng & Chu Nguyễn Mộng Ngọc, 2011); or it is used to measure whether a distribution is peaked or flat in comparison with the normal distribution. The Kurtosis in HASTC is larger than three, implying a peaked distribution (i.e. the two tails are short). In the meantime, the Kurtosis in HoSE is smaller than three, indicating a flat distribution (i.e. the two tails are long). Apparently, the rate of return in HASTC concentrates densely near its peak compared to that in HoSE.

b. GARCH in HASTC and HoSE:

Autocorrelation functions of the rate of return and the Augmented Dickey-Fuller (ADF) are employed to test the autocorrelation and the stationarity of time series. The results indicate that they are stationary. Moreover, autocorrelation functions and partial autocorrelation functions of the squared rate of return contend a strong autocorrelation in the time series; that is, the time series are dependent, which indicates the existence of GARCH effect.

The author employs Box-Jenkins methodology (Gujarati, 2004) to identify orders p and q in the return rate describing model [i.e. ARMA (p,q)] and GARCH (1,1) to describe the volatility. Other models of GARCH (p,q) with p and q being larger than one are merely used in long time series such as daily data of a decade or hourly data of several years (Engle, 2001).

The GARCH (1,1) model is taken into account and evaluated with the support of ARMA (p,q) to opt for an optimal model which can ensure the statistical significance of coefficients and eliminate GARCH effects. Orders p and q are determined by the Box-Jenkins method (Gujarati, 2004).

After many trials, the best model to obtain is the GARCH (1,1) with the q of moving average being 1 (see Table 2.)

Table 2: GARCH estimates

$$\mu_t = c_1 + \theta a_{t-1} + a_t$$

$$\sigma_t^2 = c_2 + \alpha a_{t-1}^2 + \beta \sigma_{t-1}^2$$

	VN_Index	HASTC_Index	STB	ACB
Moving average				
c_1	-0.001858	-0.000866	-0.003033	-0.002200
	(0.000918)**	(0.001298)	(0.001327)**	(0.001377)*
θ	0.364957	0.241247	0.258919	0.355748
	(0.049727)***	(0.053772)***	(0.049426)***	(0.048341)***
Variance				
c_2	1.49 x 10^{-5}	4.95 x 10^{-5}	5.02 x 10^{-5}	7.28 x 10^{-5}
	(9.16 x 10^{-6})*	(1.07 x 10^{-5})***	(3.02 x 10^{-5})*	(1.75 x 10^{-5})***
α	0.214736	0.386626	0.210441	0.410179
	(0.059727)***	(0.074515)***	(0.063069)***	(0.081713)***
β	0.754223	0.612161	0.723844	0.587324
	(0.064733)***	(0.047856)***	(0.075577)***	(0.058517)***

N.B.: *, **, and *** respectively denote the statistical significance at 10%, 5% and 1%.

Source: Author's calculation based on publicized data of HoSE and HASTC

The fact that $\alpha + \beta$ in all cases is smaller than one indicates estimates are involatile.

The coefficients α of ARCH and β of GARCH for the comprehensive indices and representative stocks of both studied markets are statistically significant at 1%. This implies that the volatility of Vietnam's stocks depends heavily on both volatility and errors (representing unexpected upheavals) of the previous period. In other words, the unexpected upheaval of rate of return and volatility of previous period determine investors' behavior and decisions. Specifically, the significant α =1 of ARCH shows that good and bad news measured by the lagged component of errors produce statistically remarkable effects on the volatility; while the significant β =1 of GARCH suggests that the preceding volatility does profoundly influence the current one. In sum, the volatility in HASTC and HoSE is affected by good and bad news, and volatility of previous periods.

Moreover, the α of the conditioned variance model in HASTC being larger than that in HoSE proves that impacts of the variables on the volatility of rate of return in HASTC are greater than those in HoSE. Meanwhile, the β in HASTC is smaller than that in HoSE and it implies that the volatility of rate of return in HoSE is more persistent than that in HASTC. This is also consistent with expectations about price fluctuations in both markets, that is, the volatility in HASTC is sharply affected by abrupt fluctuations in the market and it is just appropriate to extreme investors who are risk lovers.

c. Impacts of Price Limit Reduction:

Vietnam's stock market in late 2007 did experience a sharp fall. Since March 2008, SSC has many times adjusted the fluctuation limit. This section is devoted to testing impacts of reduction in fluctuation limit on the volatility. Accordingly, the aforementioned GARCH model is tested with the permitted fluctuation limit added as a variable. In HoSE, dummy variables D1, D2 and D3 represent permitted limits of 1%, 2% and 3% respectively. Meanwhile, in HASTC, dummy variables D1, D2, D3, and D4 respectively denote the fluctuation limit of 2%, 3%, 4% and 7%.

Estimation results are presented in Table 3.

Table 3: GARCH Model Evaluation with the Variable of Price Limit

$$\mu_t = c_1 + \theta a_{t-1} + a_t$$

$$\sigma_t^2 = c_2 + \alpha a_{t-1}^2 + \beta \sigma_{t-1}^2 + \sum_{k=1}^{l} d_k D_{tk}$$

	VN_Index	HASTC_Index	STB	ACB
Moving average				
c_1	-0.002106	-0.001799	-0.004204	-0.002427
	(0.000937)**	(0.001336)	(0.001380)***	(0.001391)*
θ	0.374488	0.254061	0.278115	0.353490
	(0.050307)***	(0.053876)***	(0.052510)***	(0.149649)***
Variance				
c_2	2.01 x 10^{-5}	6.87 x 10^{-5}	1.08 x 10^{-4}	9.02 x 10^{-5}
	(1.21 x 10^{-5})*	(1.33 x 10^{-5})***	(5.9 x 10^{-5})*	(2.20 x 10^{-5})***
α	0.182225	0.3675	0.211922	0.392012
	(0.059163)***	(0.074389)***	(0.082201)***	(0.086831)***
β	0.771012	0.6126	0.647999	0.604157
	(0.072713)***	(0.053490)***	(0.125289)***	(0.064682)***
d_1	-4.75 x 10^{-5}	-1.2 x 1-4	-1.16 x 10^{-4}	-2.13 x 10-4
	(2.44 x 10^{-5})*	(0.000148)	(7.85 x 10^{-5})	(0.000241)
d_2	-1.40 x 10^{-5}	-5.77 x 10^{-5}	-8.22 x 10^{-5}	-6.52 x 10^{-5}
	(1.13 x 10^{-5})	(3.14 x 10^{-5})*	(5.15 x 10^{-5})	(7.30 x 10^{-5})
d_3	2.81 x 10^{-6}	-2.14 x 10^{-5}	2.4 x 10^{-5}	-1.37 x 10^{-5}
	(2.70 x 10^{-5})	(4.04 x 10^{-5})	(1.17 x 10^{-4})	(1.27 x 10^{-4})
d_4		-1.15 x 10^{-5}		-5.08 x 10^{-5}
		(2.04 x 10^{-5})		(2.23 x 10^{-5})**

Source: Author's calculation based on publicized data of HoSE and HASTC

As Table 3 indicates, the fluctuation limit reduction helps reduce the volatility of rate of return as expected (i.e. most of coefficients of the price limit are negative). This impact, however, is not statistically remarkable (i.e. most coefficients are not statistically significant). Even though such fluctuation limit reductions aim at braking the stock price fall, it does not mean that it can curb the fluctuations in rate of return. In other words, the fluctuation limit reduction cannot reassure investors.

In addition, Vietnam's stock market follows the information hypothesis. The price limit is merely to boost the number of transaction days needed for the market to reach its state of equilibrium without affecting the volatility of rate of return. Specifically, in Vietnam's stock market, price limit prevents stocks from reaching the equilibrium price in a trading session. When the equilibrium price is outside the price limit, the price fluctuates and moves to the price limit during the trading session. In following days, the stock price will fluctuate in the same trend until it reaches the equilibrium. Thus, price limit will increase the number of trading days before the price reaches a state of equilibrium without changing the volatility.

In brief, to stabilize the market in the period of recession by means of reducing the fluctuation limit does not really work as expected by SSC. It is merely able to brake the stock price fall but fails to reassure investors. Therefore, it is advised that SSC should formulate better remedies to reassure investors and actively cope with further abrupt stock price falls.

5. CONCLUSION AND IMPLICATIONS

During the dismal period of Vietnam's stock market, SSC did many times reduce the fluctuation limit hoping to reassure investors and reduce risks. Yet, as this paper indicates, such solution does not really work as expected. It is suggested that SSC should observe the information hypothesis, that is, the price limit merely increases the number of transaction days needed to reach an equilibrium without affecting the volatility or reducing market risks. Therefore, SSC should formulate better remedies to reassure investors and actively cope with further abrupt stock price fall. Specifically, it is possible to:

- Manipulate better market information and assure the adequacy and transparency of the market,

- Collaborate with the SBV in exchanging financial and monetary information which can affect the stock market, and

- Develop appropriate transaction rules to avoid profiteering and cornering the market.

- Additionally, it is essential to enlarge the market scope and efficiency, which ~~is~~ are supposed to be the basic factors for stabilizing the market. If a market is large, strong and effective, it is possible to avoid profiteering based on asymmetric information. Accordingly, the stock market will develop healthily and sustainably.

In sum, the present paper has demonstrated that fluctuation limit reduction as a measure to curb falls in stock price and market risks has no positive impact. SSC should formulate better remedies to facilitate the healthy and sustainable development of Vietnam's stock market■

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