The Effects of Price Limits in an Emerging Market:Evidence from the Bursa Malaysia

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***Abstract*— One type of circuit breaker is price limit, which is used in future markets and other stock exchanges of emerging markets in order to prevent markets from excessive volatility, market controlling, crash occurrence and to enhance the market stability. The range of price limits in most of stock exchanges have changed with specific reasons. Researchers have different opinions about the effects of applying the price limit system, and the positive or negative effects that are caused by using this system are not yet confirmed in conducted researches definitely. This paper examines the effects of price limits on Bursa Malaysia (previously known as Kuala Lumpur Stock Exchange, KLSE) before and after the 2007-2008 crisis by testing the volatility spillover and trading interference hypotheses. The statistical results of this study do not support the tested hypotheses since smaller volatility is experienced by stockshit category during postlimit days compared to other categories. In addition, the trading volume of stockshit does not increase after price-limit-hits that it leads to understanding the concept that this system does not prevent rational trading on price-limit-hit day.**

Keywords- Price Limits; Volatility Spillover; Trading Interference; Trading Volume; Bursa Malaysia

I. INTRODUCTION

Market regulators set price limit as a literal boundary to restrict daily movements of stock prices within a predetermined range. The principal objective is to prevent severe fluctuations in prices and provide a time-out period for the market to cool off. Hence, the markets will experience less volatility. However, whether or not price limits succeed in reducing volatility, in a meaningful economic sense, is a somewhat unresolved issue [1]. As Kim and Yang [2] mention "price limits regulate the magnitude of the change in price that can occur for a given asset during a single trading session".

Telser [3] concludes that price limit will provide investors more time for consultation and re-evaluation in market turbulence and the informal limits exist in stock markets since the officers of the exchange believe it is sometimes desirable and necessary to temporarily stop trading. Many researchers consider that panic behavior was effective in increasing fluctuations which led to the crisis in October 1987 [4-5]. So in the financial markets, stock price limits are recommended to use [6]. These researchers claim that price limit has prevented price freefall in the crisis, calmed upset and uneasy traders, on top of being effective in reducing the crisis.

Sudden fluctuations of stock price are caused due to the imbalance in buy and sell or agiotage transactions that are not beneficial to shareholders. Therefore, the price limit mechanism is applied in many stock exchanges around the world, including Austria, Belgium, France, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, Spain, Switzerland, Taiwan, and Thailand as well as the U.S. future markets [6-8]. Some of these markets use a wider price limit band such as Malaysia (30%) while others use narrower limit like Taiwan (3.5%).

One of the negative effects of imposition of price limits is the phenomenon of volatility spillover. This hypothesis says that volatility will increase in the following trading days after the limit moves, since the limit restricts the large price fluctuations on the event day and impede immediate corrections in order imbalance, but then cause distribute over a long period of time span [9-10]. Kim and Rhee [11] empirically prove this hypothesis in their study related to the effects of price limits on the Tokyo Stock Exchange. Fama [12] indicates that if the intervention is created in the process of reaching to actual price, volatility will actually increase. This argumentation is empirically supported by Kuhn, Kurserk, and Locke [13]. Furthermore, Lehmann [10] argues that imbalances in supply and demand of trading will affect the price to reach their limit and this event causes transactions to transfer to following days. Thus, it may cause volatility to extend over the time and spread out to the subsequent trading days. He also explained since the price limit prevent stock volatility to reach the real price in a day, it create an upward or downward trend to get closer to the real price, and this issue could further lead to an increase in stock price volatility in the long term. In another study, Berkman and Lee [14] find long-term volatility will be increased and in return, total trading volume will be decreased by the expansion of price limits due to testing of revision of price limit system on the Korean Stock Exchange. Recently, Kim and Yang [2] examine the effect of price limit system by applying transactions data for developed volatility and information asymmetry hypotheses on the Taiwan Stock exchange and their findings support volatility hypothesis.

Another distinguished issue emerged in price limits is trading interference. This hypothesis examines the behavior of turnover after reaching to the price limits. According to

this hypothesis, trading can be interfered by price limits which means if the limits are hit and increase in volume and volatility after a trading halt in comparison to normal days, the liquidity of stock decreases [3,10,15]. It is also expressed that since the market participants prohibit mutually beneficial trades at prices without limit, price limits may inflict additional risks on participation in the market [16]. Lauterbach and Ben-Zion [17] note the impact of price limits on stocks liquidity and introduced it as the "obvious cost" for imposition of circuit breakers such as price limit. This subject was also observed in other previous studies by researches such as Fama [12] and Telser [18]. On the other hand, Lehmann [10] offers a different interpretation of trading volume. He believed that order imbalances in buying and selling shares and therewith lack of trading will help stock prices to reach their limit. Trading volume is expected to increase by resolving imbalances in supply and demand on the subsequent limit-days. Chou and Wu [19] note that trading interference is more important in upper limit moves since it can cool off the market when it hits a lower limit without any significant impact on volatility reduction. In another similar study, Cho et al. [20] find evidence of tendency to hasten toward the upper limits and reduce effects on reduction of stocks volatility. Lin, M. C. [21] notes an asymmetric effect of price limit on trading interference.

This paper examines the effects of price limits on Bursa Malaysia before and after the 2007-2008 crisis through testing volatility spillover and trading interference hypotheses by applying methodology of Kim and Rhee [11]. The remains of this article are structured as follows: Section II describes the data and methodology; empirical results are presented in Sections III and the last section gives the conclusions.

II. Data and Methodology

A. Data

The data was gathered from Bloomberg and KLSEs' daily dairy. It covered a period of 25 months from 01/08/2006 to 30/08/2008, which included the period of Global economic crisis. Parallel to the analysis of the effect of price limits on a sample of 30 companies' stocks prices, the daily closing, opening, low, high, trading volume and number of shares outstanding were gathered.

B. Methodology

In order to investigate when prices hit their limit, upper and lower limits are considered to happen once the following relationships are established, where the H_t is the high price in Day t, C_{t-1} is the closing price in Day t-1, $LIMIT_t$ is the maximum allowable upward price movement for each Day t and L_t is the low price in Day t.

$$H_t \geq C_{t-1} + LIMIT_t \quad (1)$$
$$L_t \leq C_{t-1} - LIMIT_t \quad (2)$$

These stocks that came within their limits are represented by $stocks_{hit}$. Two subgroups are also classified on days when prices reach to their limits, $stocks_{0.9}$ and $stocks_{0.8}$. These stocks did not reach the price limits, thus $stocks_{0.90}$ are stocks that experience at least 0.90 ($LIMIT_t$) daily limit. These two samples are used to increase accuracy of study and show that the differences which are observed between $stocks_{hit}$ and $stocks_{0.9}$ are not related to difference that happens in price movement on Day 0.

Table I provides a detailed statement about the price-limit-hit occurrences and indicates the number of events for each of the three stock groups in two different conditions, upward and downward, respectively.

TABLE I. Summary Statistics

Stockshit	**Upward**	**Downward**	**Total**
	4447	1415	5862
Percent	76	24	
Stocks0.90	**Upward**	**Downward**	**Total**
	5199	1439	6638
Percent	78	22	
Stocks0.80	**Upward**	**Downward**	**Total**
	5503	1674	7177
Percent	77	23	

As shown in Table I, if a stock fluctuates 30%, there will be 76% probability of positive fluctuation and the proportion for $stocks_{0.90}$ and $stocks_{0.80}$ are 78% and 77%, respectively. This Table also indicates that the number of upward returns is greater than the number of downward returns in Kuala Lumpur Stock Exchange during the study period, which shows that the limit impede stock price from experiencing increases rather than decreases.

According to the Kim and Rhee's study [11], the sample is minimized to occurrences that happened not in consecutive order for both upward and downward trend. Following their study, the results for upward occurrences reported, since there is lack of time, additional perception and space. Also, they have shown the empirical findings of upwards are similar to downward movements from a qualitative point of view. Therefore, our final sample is as follows:

TABLE II. Number of Final Samples

Stockshit	**Upward**	**Downward**
Total	256	196
Stocks0.90	**Upward**	**Downward**
Total	239	199
Stocks0.80	**Upward**	**Downward**
Total	242	199

III. Empirical Results

A. Volatility Spillover

In order to examine volatility spillover hypothesis, it will be tried to utilize a 21-day event term which includes 10 days after and 10 days before the limit-hit session, t_0. Day t=0 has different meanings for each categories of stocks

($stocks_{hit}$, $stocks_{9\%}$ and $stocks_{8\%}$). For example, day t=0 shows the day that stocks endured a price change of at least 0.90($LIMIT_t$) price movement for $Stock_{0.90}$, while for $stocks_{hit}$, it illustrates the limit-hit day. Square rate of return is used to measure volatility for each stock in all groups even downward or upward price movements by the following equation, where $r_{t,j}$ denotes the close-to-close return of stock j on day t.

$$Vt,j = (rt,j)2 \quad (3)$$

After this step, the averages for each 21-day period will be calculated. If we can prove statistically that $stocks_{hits}$ has larger volatility compared to other categories during post-limit-hit days, then volatility spillover hypothesis will be confirmed. Based on the method which was chosen by Kim and Rhee [11], the volatility results are reported just for the upper limit-hit situations since both findings are the same from a qualitative point of view.

1) Empirical Findings for Volatility Spillover Hypothesis

Table III is the summary of the test findings. It indicates the average volatility data of price increases for three employed categories. The symbol ‘‘<’’ represents that the right hand volatility value is larger than the left hand value at 0.05 level of significance.

TABLE III. VOLATILITY SPILLOVER, UPPER LIMIT REACHES

Day	Stockshit	Result	Stocks0.90	Result	Stocks0.80
-10	0.37392		0.37924767		0.5921909
-9	0.487151		0.52843444		0.6580709
-8	0.291329		0.4423178		0.5916447
-7	0.472691		0.46145011		0.5509452
-6	0.896575		0.95224186		0.9668365
-5	0.474573	<	0.66528394	<	0.9104792
-4	0.350586	<	0.39579472	<	0.650247
-3	0.431675		0.75924367	<	0.79861
-2	0.80644	<	1.01021005	<	1.5498304
-1	0.570394	<	1.68812932	<	1.9672722
0	2.58005	<	3.62358822	<	5.3488878
1	0.32344	<	0.35355381	<	0.4707923
2	0.775606	<	1.29320539	<	1.5016044
3	0.309435	<	0.37533927	<	0.6346322
4	0.378086	<	0.49645068	<	0.6283115
5	0.611884	<	0.70664221	<	0.7637895
6	0.497332	<	0.58547629	<	0.6473139
7	0.326025	<	0.40585388	<	0.3814738
8	0.358659	<	0.45383782	<	0.6724907
9	0.42592	<	0.46212357	<	0.6465167
10	0.380179	<	0.63836446	<	0.7456442

It is clear that all stock categories face their largest level of volatility on the price-limit-hit day (Day 0). In addition, on Day 1, an extremely large fall in volatility of stocks categories could be observed. The average volatility size is reduced even more for $stocks_{0.80}$ category (from 5.3488878 on Day 0 to 0.4707923 on Day 1). From this result, it cannot be concluded that price limit can effectively reduce the price volatility, since volatility is reduced before reaching its price limit. Nevertheless, it can be concluded that the reduction of volatility on Day 1 is not due to the effect of price limit.

$Stocks_{hit}$ volatility did not increase significantly compared to the other groups after reaching the positive 30 % limit. Thus, in the Kuala Lumpur Stock Exchange, it is not possible to state if a stock experiences positive 30% in a day, it will consequently experience large volatility in the coming days.

B. Trading Interference

To test this hypothesis, the results of just 10 days in the event period from Day -4 to Day +5 are used since days outside this period will not give additional perception. If the trading volume for $stocks_{hit}$ increases the day after the limit-hit day, the hypothesis will be supported. This volume increase will imply severe trading continues, and a detrimental interference to liquidity. Since price limit does not impede other stock subgroups’ trade on Day 0, decline or stability in trading activity will be expected to be observed on the following days. The turnover ratio is applied as a measurement for trading activity. It is calculated as follows, where $TVOL_{t,j}$ is the trading volume for each stock j on day t and $SOUT_{t,j}$ is the total number of shares outstanding for stock j on Day t.

$$TAt,j = TVOLt,j / SOUTt,j \quad (4)$$

This ratio is calculated for each stock in all groups and averages are calculated for each Day t. A percentage change of this ratio from the day before day t is calculated since the liquidity interference hypothesis is involved in the daily change of trading activity. To test this hypothesis, similar samples of upper limit are used to volatility analysis, and included non consecutive limit- days are chosen.

1) Empirical findings for trading interference hypothesis

The trading interference hypothesis is based on certain circumstances; if a stock reaches its limit in a day, the shareholders will not conduct transactions and thereby price limit will damage the stock's liquidity. In order to test this hypothesis, the trading activity behavior of $stocks_{hit}$ category must compare with the others. If trading volume of $stocks_{hit}$ increases more than other categories after hitting price limit, the hypothesis will be confirmed. A method similar to the method of volatility spillover is used and the changes of trading volume for 30% group are compared with other groups using Wilcoxon signed-rank test.

The summary of trading activity changes of three employed groups are demonstrated in the Table IV. As shown, there is no regular trend in increasing or decreasing of changes, but the only significant case is the largest changes that happened on Day 0, compared to the other days. And, the most noticeable result is the experience of the largest one by $stocks_{0.80}$. As a conclusion, it can be said that it is not possible to comment with certainty about the liquidity of stocks before and after reaching the 30% limit.

TABLE IV. TRADING INTERFERENCE, UPPER LIMIT REACHES

Day	Stockshit	Result	Stocks0.90	Result	Stocks0.80
5	2.87%		4.13		1.31
4	2.18%		1.16		-0.18
3	-4.29%		-5.68		1.71
2	11.75		17.05		10.55
1	-11.93		-12.54		-19.05
0	22.17	<	26.59	<	43.71
-1	-22.89	>	-27.33		-32.10
-2	3.84	<	4.34	>	2.32
-3	7.53		2.44		2.68
-4	-0.52	<	2.85	>	-2.90
-5	-6.44		-9.22		-7.65

IV. CONCLUSION

Since there are different opinions about the effectiveness of the price limit system imposed on stock exchanges, it has been tried to investigate on KLSE price limit system, which is wide in comparison to other stock exchanges, by conducting a nonparametric event study. And to achieve the issue of whether this system impact on stocks prices, trading volumes and volatility of prices.

Therefore, according to the range of daily changes in price movement, three categories of stocks are chosen to test the KLSE price limit system in order to show how volatility levels and trading activity are different. Parallel to this aim, examining the soundness of the price limits effects on KLSE are conducted by testing the volatility spillover and trading interference hypotheses. One of the distinctive features of this study is the analysis of the volatility and trading activity being conducted before and after the crisis period. The following results are substantiated for the three determined categories:

1. Volatility of $stocks_{hit}$ is not greater than the other categories during the post limit days.
2. Trading activity trend of $stocks_{hit}$ does not increase consistently after stocks prices reach the price limits since irregular fluctuations are observed after the price-limit-hit day.

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