

Does Price Limit Hit's Patterns Follow Stock Return Patterns?

Haitham Nobanee

Maryam AlHajjar

Abstract

The purpose of this study is to examine patterns of price limit hits for stocks listed in the Tokyo Stock Exchange. Explanations are provided for the empirical findings and the extent to which the price limit hit patterns are related to existing stock returns patterns. We argue that if patterns of price limits can be explained in the same way as the patterns of stock returns, this mean price limit hits are not entirely due to noise trading. The Results show an increase of limit hits on Monday and Tuesday. These results of limit hits are consistent with the existing literature for the day-of-the-week effect of stock returns carried out on Japan. This indicates that such patterns of price limit hits are not all due to noise trading.

Keywords: Price Limits; Patterns; Japan

JEL classification: G10; G11; G12; G14; G15

1. Introduction

Following the market crash of 1987, there were a lot of debates regarding the causes of the crash and what should be done in order to avoid future crashes. Regularity authorities have conducted several studies that analysed the causes of the crash and place some recommendations to prevent future cashes, these studies include: the U.S. Securities and Exchange Commission (SEC) (1988); The Brady Commission (1988); the Chicago Board

of Trade (1987); the Commodity Futures Trading Commission (CFTC) (1988); the New York Stock Exchange (NYSE) (Katzenbach, 1987); and the U.S. General Accounting Office (GAO) (1988). According to these studies and reports, the main cause of the crash was the excess volatility caused by trading strategies such as portfolio insurance and index arbitrage. In order to avoid future crashes in the markets, regulatory authorities recommend coordinated margin requirements and price limits as device to curb excess volatility arguing that price limits provide a cooling-off period reducing overreactions in stock prices.

Price limits are artificial boundaries that restrict daily price changes of a stock to a pre-specified range. Price limits rules are applied in many stock markets around the world, including Austria, Belgium, France, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, Spain, Switzerland, Taiwan, and Thailand. Price limits are also used in the U.S. futures market.

There has been much debate about the pros and cons of price limits. Advocates of price limits claim that price limits prevent extreme price movements in two ways. First, price limits literally set a ceiling and a floor in the range in which the price can move within a trading day. Second, price limits provide a cooling-off period¹. Other proponents claim that price limits facilitate price discovery by providing a ‘time-out’ to pause, evaluate, inhibit stock prices and publicize order imbalances to attract value traders and to cushion violent movements in the market. Price limits are also said to reduce the potential default risk (see Brennan, 1986; Moser, 1990; Ma et al, 1989b), and counter overreaction,

¹ (see Anderson, 1984; Arak and Cook, 1997; Greenwald and Stein, 1991; Ma, Roa and Sears, 1989a, 1989b; Chou et al., 2000; Lee and Kim, 1995; Kim and Rhee, 1997; Lee and Chung, 1996; Bernstein, 1987; Brennan, 1986; Koders, 1993)

without interfering with trading activity (Cho et al, 2003). Other studies found that lower limit hits are related to market driven downward movements while upper price limit hits are more related to company driven upward movements. This indicates that price limits rules were effective in curbing undesired fluctuations of stock prices and in protecting the markets from crashes (AlShattarat et al, 2009, Nobanee et al, 2010, Nobanee and Alhajjar, 2009).

On the other hand, critics of price limits insist that price limits reduce market liquidity by artificially interfering with trading activity. This problem caused by price limits is also identified as ‘the trading interference hypotheses². In addition to the liquidity problem, the delay in price discovery is another costly problem induced by price limits. This happens because price limits prevent prices from reaching their equilibrium level effectively³. The effects of trading interference using price limits may also weaken market efficiency (Fama, 1989; Lehmann, 1989; Lee et al, 1994). Instead of reducing volatility, price limits may cause volatility to spread over longer periods of time, because limits prevent large one-day changes, and prevent immediate correction in order imbalance⁴. Kim and Sweeney (2000) also argue that price limits can affect trading

² (see Fama, 1989; Telser, 1989; Lehmann, 1989; Lauterbach and Ben-Zion, 1993; and Kim and Rhee, 1997).

³ (see Fama, 1989; Lehmann, 1989; Lee et al., 1994; Figlewski, 1984; Kim and Rhee, 1997; Meltzner, 1989; Miller et al., 1987; Telser, 1981; Lee and Kim, 1995; Ma et al., 1989a, 1989b; Chiang et al, 1997; Kim and Rhee, 1997).

⁴ (see Kim and Rhee, 1997; Lehmann, 1989; Fama, 1989; Kyle, 1988; Kuhn et al., 1991; Lee and Kim, 1995).

behaviour on non-limit hit days. In their model, informed traders strategically time their trading taking the existence of price limits into account.

The effectiveness of price limits in curbing undesired fluctuations of stock prices is tested in the existing literatures using deferent approaches. Some studies applied an event-study methodology to test for the effectiveness of price limits such as the study of Ma et al, 1989a and Ma et al, 1989b. Other studies applied a GARCH model to test for the effect of price limits on volatility, such as the study of Henke and Voronkova, 2003. Furthermore, some studies employed an extreme value approach to test the effectiveness of price limits rules (see Maghyereh et al, 2007 and Nobanee and Hilu, 2013). Other studies analyses the industrial differences of limit hits (Nobanee, 2007). However, Harris, (1998) argue that there is no perfect way to measure the effectiveness of price limits, as it is impossible to know what would have happened in the absence of price limits.

This study analysis the effect of price limits in curbing undesired fluctuations of stock prices by analysing patterns of limit hits. Patterns of limit hits are analysed by testing regularities of limit hits, such as the day-of-the-week effect of limit hits. The rationales behind analysing such regularities of limit hits is to test whether limit hits follow systematic patterns, and whether these patterns can be explained in the same way as the regularities occur in stock prices. If regularities of limit hits interpreted in the same way as the regularities of stock returns, then limit hits could follow systematic patterns that cannot be interpreted only by noise trading.

Day-of-the-week effect in stock returns is commonly reported in finance literature. Day-of-the-week effect refers to a higher average rate of return usually observed on Monday

relative to other days. The day-of-the-week effect of stock returns exists in Japan. However, in addition to Monday, Tuesday sometimes is the day associated with the negative and significant differences than most of other days (see Jaffe and Westerfield, 1985 and Kato, 1990). There are two potential explanations for the Tuesday effect that exists in the Tokyo Stock Exchange. The first explanation is referring to the time-zone differences between United States and Japan ⁵. Japanese Tuesday effect is also explained by some institutional factors unique to Japan, which are the limitations of short selling opportunities. These institutional factors could restrict the transmission of negative news into prices in a timely manner (Hiraki and Marberly, 1995). However, Hiraki, Maberly and Taube (1998) argue that Tuesday effect disappears in Japan after introduction of index futures in the year 1982 and Monday returns are found to be anomalous.

In this study we hypothesise that Monday and Tuesday experience more limit hit occurrences comparing with other days of the week.

The rest of the paper is organized along the following lines. The next section describes the institutional background of the Tokyo Stock Exchange, data and methodology are described in section three. Section four contains an analysis of the day-of-the-week effect of price limit hits, and finally, section five concludes.

2. Institutional Background of the Tokyo Stock Exchange

Tokyo Stock Exchange is a typical order-driven market without specialist or market makers to guide price formation. To prevent wild volatility, the Tokyo stock Exchange

⁵ The time difference between the two countries is about 14 hours (see Jaffe and Westerfield, 1985 and Kato, 1990).

sets several market mechanisms such as daily price limits, special quote, and tick size rules.

In the Tokyo Stock Exchange companies are listed either in the first section, which contains the largest or most successful companies which are often referred to as *blue chips*, the first section has about 1,500 companies in the year 2002 (see Tokyo Stock Exchange Website). Companies are also listed in the second section, which included about 500 companies in the year 2002; the second section is designed for smaller companies with lower level of trading volume. Second section stocks are reviewed at the end of each business year to assess whether they meet the criteria for transfer to the first section (see Tokyo Stock Exchange Website). Tokyo Stock Exchange also has a foreign section for companies registered in countries other than Japan. Tokyo Stock Exchange introduced in the year 1990 a new market section called Mothers (market for the high-growth and emerging stocks) which is designed for growth and emerging stocks that are newer, innovative venture enterprises, both in Japan and overseas (see Tokyo Stock Exchange Website).

Tokyo Stock Exchange has two daily trading sessions: a morning session from 9:00 AM to 11:00 AM and an afternoon session from 1:00 PM to 3:00 PM until April 29, 1991, when the afternoon session was moved forward 30 minutes to 12:30 PM. Tokyo Stock Exchange used to have a half-day Saturday trading, trading usually took place between 9:00 AM to 11:00 AM. However, this half-day Saturday trading was subject to many modifications over the past 30 years until it close in the year 1989. The above trading hours only illustrate the hours that the Tokyo Stock Exchange accepts orders from members. However investors can place orders with member firms during whatever hours

the member firms offer. Due to the advancement in communication technology, such as the widespread use of the Internet, some member firms accept orders 24 hours a day (see Guide to Tokyo Stock Exchange Trading Methodology, 2003). The Tokyo Stock Exchange introduced an evening session (3:30 PM to 6:00 PM) on 18 September 2000. However, trading on this session is only for some futures and options (See Guide to Tokyo Stock Exchange Trading Methodology, 2003). Most of the stocks in the first section and all the stocks in the second section are traded automatically through computerised matching system called Computerised Routing and Execution System (CORES) day (see Guide to Tokyo Stock Exchange Trading Methodology, 2003).

Short selling is restricted in the Tokyo Stock Exchange. Chung et al. (1994) argue that short selling in the Tokyo Stock Exchange is more difficult and more costly than on the New York Stock Exchange. The major impediment to short selling in Japan is the difficulty or even impossibility of borrowing stocks to sell short. They conjecture that because of short sale difficulties in Tokyo, good news is likely to be revealed faster in spot prices than bad news (see Chung et al., 1994).

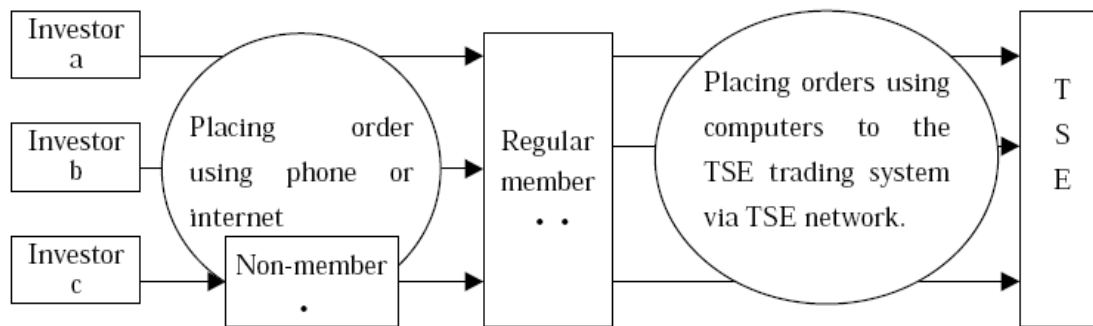
Tokyo Stock Exchange employs two-trading methods: *Itayose* and *zaraba*. *Itayose* is a call auction mechanism while *zaraba* is continuous trading mechanism. Trading starts with *Itayose* where buy and sell order accumulated, an equilibrium price is determined for buy and sells, and then all the orders are executed in these prices according to the price priority principle. This principle means that the lowest sell and highest buy orders take preference. After the *Itayose* clears, *zaraba*, which is the continuous price-setting method, is used during the continuous trading session to match orders during the rest of

the trading session (see Hamo, 1995, and Guide to Tokyo Stock Exchange Trading Methodology, 2003)

In the Tokyo Stock Exchange there are three kinds of stock transactions: *regular* transactions, *cash* transactions, and *when issued* transactions. In *regular* transactions settlement shall be made on the third business day after the day of transaction; provided that transactions made on ex-dividend or ex-rights dates shall be settled on the fourth business day after the day of transaction. In *cash* transaction settlements shall be made on the day of transaction; but may be carried forward to the next business day if both parties agree. *When issued* transactions are used for new shares issued by companies in capital increases and stock splits (see Guide to Tokyo Stock Exchange Trading Methodology, 2003).

Investors cannot trade directly on the Tokyo Stock Exchange. Settlements of funds and securities for transactions in the Tokyo Stock Exchange are done between member securities firms and the Tokyo Stock Exchange. In order to avoid insider and other manipulative transactions, members are required to screen orders before sending them to the Tokyo Stock Exchange market (see Guide to Tokyo Stock Exchange Trading Methodology, 2003). The diagram bellow highlights the rule of Tokyo Stock Exchange members firms.

Figure 2.1: Rule of the Tokyo Stock Exchange Members Firms



Source: Guide to TSE Trading Methodology, 2003, Tokyo Stock Exchange.

Tokyo Stock Exchange uses trading halts rule in order to reduce the effect of publication of material information on prices. Tokyo Stock Exchange has two types of trading halts; *temporary trading halt* and *built-in trading halt*. *Temporary trading halt* is used when there is information that affects investment decisions and the details of such information are unclear. Example of such information is merger, allotment to a third party or a capital reduction. *Built-in trading halt* are carried out when shareholders have to submit their stock certificates to listed companies due to a merger of shares, stock-split, and other capital actions decisions. *Built-in trading halts* last from three days before the submit-due date to the day before the merger, stock-split, or any other corporate action decisions. On Wednesday, December 1999, the Tokyo Stock Exchange amended its Temporary trading halt. Temporary trading halt were reduced from 90 to 60 minutes (see Guide to TSE Trading Methodology, 2003, Tokyo Stock Exchange) possibly to the belief that information can be released and observed quicker than previously due to technology and advertisements.

Tick size is the increment by which prices move. It is vital when placing limit orders, as it determines the possible prices available. In the Tokyo Stock Exchange there is a

positive relationship between minimum price fluctuations (tic size) and price level. Tick size rules were subject to two revisions, the first revision took place in April 13 1998, and the second revision took place on July 17, 2000. Table 1 presents the new and old tick size rules.

Table 1 Minimum Price Fluctuations or Tick Size Rules

Price per share (yen)		Before April 1998	April 1998- July 2000	July 2000- present
Up to	1,000	1	1	1
Up to	2,000	10	1	1
Up to	3,000	10	5	5
Up to	10,000	10	10	10
Up to	30,000	100	10	10
Up to	50,000	100	50	50
Up to	100,000	100	100	100
Up to	1 million	100	1,000	1,000
Up to	20 million	100	10,000	10,000
Up to	30 million	100	10,000	50,000
Up to	30 million	100	10,000	100,000

Table 1 Report minimum price fluctuations or tick size rules applied in the Tokyo Stock Exchange. Tick size Rules were subject to two revisions took place in April 1998 and July 2000.

Tokyo Stock Exchange imposes daily price limits. According to the Tokyo Stock Exchange Fact Book (2003) price limits rules have two major purposes; initially they protect investors from excess volatility. Price limits rules also play an important role in guiding price formation in the Tokyo Stock Exchange, which is a pure order-driven market that has no specialists or market makers. Price limits in the Tokyo Stock Exchange are based on the previous day's closing price or special quote. The base price of daily price limits is determined according to the previous day's closing price except in the

cases of special quote or ex-dividend date. Special quotes are applied when there is a marked imbalance between buy and sell orders. If this situation persists at the close of trading, the special quote is used as a base price instead of the closing prices. Ex-dividend date is three business days before the shareholder confirmation date. Since all stock prices in the Tokyo Stock Exchange include dividends, an amount equivalent to the cash dividend must be deducted after the ex-dividend date (see Guide to Tokyo Stock Exchange Trading Methodology, 2003).

On Monday 17 July 2000, Tokyo Stock Exchange amended its Daily Price Fluctuation on the stocks. This adjustment took place because of the replacement of computerised order-routing and executing system for stocks (around mid-2000). Daily price limits are set out in the table 2 below.

Table 2 Daily Price Limits for Different Stock Price Levels before and after July, 2000 Revision

Previous Day's Closing Price (yen)		Price Limits (before July 2000)	Price Limits (after July 2000)
Less than	100	30	30
Less than	200	50	50
Less than	500	80	80
Less than	1,000	100	100
Less than	1,500	200	200
Less than	2,000	300	300
Less than	3,000	400	400
Less than	5,000	500	500
Less than	10,000	1,000	1,000
Less than	20,000	2,000	2,000
Less than	30,000	2,000	3,000
Less than	50,000	3,000	4,000
Less than	70,000	5,000	5,000
Less than	100,000	5,000	10,000
Less than	150,000	50,000	20,000
Less than	200,000	50,000	30,000
Less than	300,000	80,000	40,000
Less than	500,000	80,000	50,000

Less than	1 million	100,000	100,000
Less than	1.5 million	200,000	200,000
Less than	2 million	300,000	300,000
Less than	3 million	400,000	400,000
Less than	5 million	500,000	500,000
Less than	10 million	1 million	1 million
Less than	15 million	2 million	2 million
Less than	20 million	2 million	3 million
Less than	30 million	2 million	4 million
Less than	50 million	2 million	5 million
Greater than or equal	50 million	2 million	10 million

2. reports daily price limits applied in the Tokyo Stock Exchange for different stock price levels before and after July 2000 Revision.

Special quotes are mechanisms to prevent short-term wild price movements. For example, if prices make a big jump during the trading session from ¥ 2000 to ¥2200, then market orders placed could be executed at unexpected and unbearable prices and this cause heavy losses for investors how are placing market orders. Immediate execution of orders in the Tokyo Stock Exchange only takes place if the next execution price is set within certain parameters based on the previous execution price (see Guide to Tokyo Stock Exchange Trading Methodology, 2003). Similarly to price limits rules, there are different special quotes rules for different price levels. Following the replacement of computerised order-routing and executing system for stocks (around mid-2000). Tokyo Stock Exchange amended its special quotes. The old and the current special quotes rules are set out in the table 3 below.

Returning to the previous example of special quote, if the stock price is ¥ 2000, according to the old and current special quote rules this price can only fluctuate to plus or minuses ¥30, the next execution price must be within the range ¥ 1970 - ¥ 2030.

Table 3 Special Quotes Rules for Different Stock Price Levels before and after July, 2000 Revision

Previous Trade's Price (yen)		Old Special Quotes (yen)	Current Special Quotes (yen)
Less than	500	5	±5
Less than	1,000	10	10
Less than	1,500	20	20
Less than	2,000	30	30
Less than	3,000	40	40
Less than	5,000	50	50
Less than	10,000	100	100
Less than	20,000	200	200
Less than	30,000	200	300
Less than	50,000	300	400
Less than	70,000	500	500
Less than	100,000	500	1,000
Less than	150,000	5,000	2,000
Less than	200,000	5,000	3,000
Less than	300,000	5,000	4,000
Less than	500,000	5,000	5,000
Less than	1 million	10,000	10,000
Less than	1.5 million	20,000	20,000
Less than	2 million	30,000	30,000
Less than	3 million	40,000	40,000
Less than	5 million	50,000	50,000
Less than	10 million	100,000	100,000
Less than	15 million	200,000	200,000
Less than	20 million	200,000	300,000
Less than	30 million	200,000	400,000
Less than	50 million	200,000	500,000
Greater than or equal	50 million	200,000	1 million

3 reports special quotes rules applied in the Tokyo Stock Exchange for different stock price levels before and after July 2000 Revision.

In short, The Tokyo Stock Exchange is a typical order-driven market without specialist or market makers to guide price formation. To prevent wild volatility the Tokyo stock Exchange sets several market mechanisms such as daily price limits, special quote, and tick size rules.

3. Data and Methodology

The data are downloaded from the *Datastream*. The data includes daily closing prices, cash dividends and ex-dividends dates. The data includes all stocks listed in the Tokyo Stock Exchange during the sample period of this study, 1 January 1990 until 12 July 2002. Preferred stocks and newly issued common stocks are excluded from the sample⁶. The final sample contains 1467 companies⁷.

Limit hits are determined according to price limits rules shown on Table 1. Prices are adjusted for cash dividends. An amount equivalent to the dividend payment is deducted from the closing price of the day previous to the ex-dividend date⁸. Base prices are also adjusted for corporate actions and tick size.

⁶ Price limits are relaxed for the newly listed stocks in the first few days after they listed in the market because they do not have base prices (base price is usually the previous days' closing price except of some cases).

⁷ Long period and large number of companies is selected due to the fact that the Tokyo Stock Exchange applies wider price limits rules than other markets. This makes limit hit events rare. Choosing a long period also makes the analysis to cover both normal periods and crisis periods (periods of crisis such as the years, 1990, 1997 and 2000).

⁸ For example, for stock with cash dividend of ¥10, the base price on the ex-dividend date is the previous day's closing price minus ¥10. Therefore, if the previous day's closing price was ¥25,000, the base price on the ex-dividend date will be ¥24,990 and trading may take place between ¥27,990 and ¥22,990 according to current price limits rules.

Day-of-the-week effect of limit hits analysed in this study using different methods, in addition to Kruskal-Wallis test and Mann-Whitney test we have also used the EGARCH which has proposed by Nelson (1991). Non-linear time series models such as ARCH and GARCH models introduced by Engle (1982) and Bollerslev (1986) are widely used to model financial time series, since they allow the conditional variance to depend on past information. As pointed out by Black (1976), there is empirical evidence that stock returns are negatively correlated with changes in returns volatility, i.e. volatility tends to rise in response to ‘bad news’ and tends to fall in response to ‘good news’. In order to model this asymmetry, Nelson (1991) introduced the exponential GARCH model. EGARCH is applied in this study in order to test the day-of-the-week effect of limit hits for the following reasons. First, it allows for the information asymmetry, the leverage effect in the model captures the asymmetric effect of the good news and bad news. In Tokyo Stock Exchange good news is more likely to reveal faster in spot prices than bad news due to the restricted short selling (Chung et al, 1994). Second, unlike GARCH specification, the EGARCH model, specified in logarithms, does not impose the non-negativity constraints on parameters. Hence, to test for the-day-of-the-week effect, an E-GARCH-M model with the following form is used:

$$L_t = \alpha_t \sum_{t=1}^5 d_t + \delta_t \sigma_t^2 + \varepsilon_t \quad (1)$$

$$\log(\sigma_t^2) = \alpha + \vartheta \cdot \log(\sigma_{t-1}^2) + \phi \cdot \frac{\varepsilon_{t-1}}{\sqrt{\sigma_t^2}} + \lambda \left[\frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}^2}} - \sqrt{\frac{2}{\pi}} \right] \quad (2)$$

where L_t is the limit hits in time t , d_t is a dummy variable where d_1 equals 1 for Monday and zero otherwise, d_2 equals 1 for Tuesday and zero otherwise, and so on. The test concerns the hypothesis that the day-of-the-week coefficients should be equal, such that $\alpha_1 = \alpha_2 = \dots = \alpha_5$. If Monday's limit hits or Tuesday's limit hits are significantly different than other days of the week, then α_1 or α_2 should be significant.

4. Empirical Results

Occurrences of limit hits are sorted by day for entire sample, small, medium and large stocks. Table 2 reports the occurrences and percentages of limit hits by day. The results of Table 4 show that percentages of limit hits are high on Monday and Tuesday comparing with other days of the week for the entire sample. The percentages of limit hits also increases on Monday and Tuesday for all the sub samples which, includes small, medium and large stocks as shown on Table 4 these results support the Monday and Tuesday effect of limit hits on Japan.

Table 4 Limit Hit Occurrences by Day

Day	All	Small	Medium	Large
Monday	1,825	594	646	585
Tuesday	1,844	667	578	599
Wednesday	1,430	582	463	385
Thursday	1,457	553	478	426
Friday	1,494	492	499	503
Total	8,050	2,888	2,664	2,498
Monday	23%	21%	24%	23%
Tuesday	23%	23%	22%	24%
Wednesday	18%	20%	17%	15%
Thursday	18%	19%	18%	17%
Friday	19%	17%	19%	20%
Total%	100%	100%	100%	100%

Table 4 reports the occurrences of limit hits for stocks listed in the Tokyo Stock Exchange during the period 1990-2002. I report the numbers and percentages of price limit hits by day for the entire sample and for small stocks, medium stocks and large stocks. Percentages of limit hits are the number of limit hits on each day as a percentage of total number of limit hits on all days.

The EGARH-M results of limit hits also show significant differences for Monday in the entire sample and medium stocks. It also shows significant differences for Tuesday in

small stocks. However, the results do not show any significant differences between days of the week for large stocks. The EGARCH-M results shown on Table 5 strongly support the Monday and Tuesday effect of limit hits on Japan⁹.

Table 5 EGARCH-M results of limit hits across days.

	Mean Equation					Variance Equation			
Entire Sample	Mon	Tue	Wed	Thu	Fri	C	ARCH	GARCH	Leverage
Coefficient	41.82	18.87	9.67	7.58	11.98	1.37	0.33	0.33	0.78
Std. Errors	17.34	19.42	23.09	20.11	23.89	0.72	0.08	0.06	0.09
Z Statistics	2.41*	0.97	0.42	0.38	0.50	1.91	4.38**	5.46**	8.19**
Small Stocks	Mon	Tue	Wed	Thu	Fri	C	ARCH	GARCH	Leverage
Coefficient	7.03	11.12	5.56	5.14	4.18	-0.04	0.07	0.18	0.99
Std. Errors	5.89	5.27	5.18	6.22	6.87	0.31	0.10	0.05	0.06
Z Statistics	1.19	2.11*	1.07	0.83	0.61	-0.14	0.70	3.28**	15.89**
Medium Stocks	Mon	Tue	Wed	Thu	Fri	C	ARCH	GARCH	Leverage
Coefficient	13.79	0.13	-2.38	-3.15	0.69	0.34	0.23	0.22	0.90
Std. Errors	6.84	6.23	7.29	7.02	5.95	0.29	0.08	0.04	0.06
Z Statistics	2.02*	0.02	-0.33	-0.45	0.12	1.17	3.02**	5.93**	16.26**
Large Stocks	Mon	Tue	Wed	Thu	Fri	C	ARCH	GARCH	Leverage
Coefficient	-1.04	-16.01	-8.49	-23.17	-15.72	6.14	0.41	0.20	-0.01
Std. Errors	37.15	36.36	35.10	39.34	38.09	1.28	0.24	0.13	0.15
Z Statistics	-0.03	-0.44	-0.24	-0.59	-0.41	4.81**	1.73	1.60	-0.05

Table 5 reports EGARCH-M results of limit hits for the entire sample, small stocks, medium stocks and large stocks across days.

* Coefficients are significant at 0.05 level.

** Coefficients are significant at 0.01 level.

5. Conclusion

Day-of-the-week effect of limit hits is discussed in this study. Explanations are provided for the empirical findings and the extent to which the price limit hit patterns are related to existing stock returns patterns. We argue that if the patterns of price limits can be explained in the same way as patterns of stock returns, this might mean price limit hits are not entirely due to noise trading.

⁹ The results of Kruskal-Wallis test and Mann-Whitney test (not reported) are similar to the results of EGARCH-M results.

The results for entire sample and medium stocks show that Monday has higher and significant limit hits comparing with other days. The results for limit hits for small stocks show that Tuesday has higher and significant limit hits comparing with other days. The results for the large stocks do not any differences of limit hits between days. This is logical since large capitalization stocks are least likely to have suffered losses. These results of limit hits are consistent with the existing literature for the day-of-the-week effect of stock returns carried out on Japan such as the study of Jaffe and Westerfield (1985), the study of Kato (1990) and the study of Hiraki, Maberly and Taube (1998). The results for day-of-the-week effect of price limit hits show that patterns of price limit hits could be interpreted similarly as patterns of stock returns. This is an indication that price limit hits are not entirely due to noise trading.

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