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Day-of-the-week effect on stock returns and volatility: The case of Ho Chi Minh Stock Exchange, Vietnam

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ABSTRACT

This paper aims to investigate the day-of-the-week effect in stock returns and volatility for the Ho Chi Minh Stock Exchange (HOSE). The data used in this study is daily series of the market index (VN-Index) over the period from March 1st 2002 to March 1st 2011. To test for the presence of the day-of-the-week effect on stock market returns and volatility, the OLS and GARCH (1,1) regression models are employed in this study. The empirical findings obtained from the models confirm that the day-of-the-week effects on stock returns and volatility are present in the Market. Specifically, a negative effect is observed for Tuesday while a positive effect occurs on Friday. Moreover, the highest volatility occurs on Thursday, and the lowest volatility is observed on Monday.

Keywords: Day-of-the-week effect, stock returns, volatility, GARCH, HOSE

1. Introduction

Seasonal anomalies (day-of-the-week effect, January effect, turn-of-the-month effect) in stock returns have been extensively studied and documented in the financial literature for the last decades. Among such anomalies, the day-of-the-week effect has been seen as one of the most important patterns and it has been found in many stock markets (French, 1980; Jaffe and Westerfield, 1985; Balaban, 1995; Lian and Chen, 2004). The day-of-the-week effect indicates that returns are abnormally higher on some days of the week than on other days. Specifically, results derived from many empirical studies have documented that the average return on Friday is abnormally high, and the average return on Monday is abnormally low. For a rational investor, besides returns, risk or volatility of returns must be taken into the account when he/she makes investment decisions. It is expected that differences in volatility across day of the week could be existence in stock markets. In fact, the day-of-the-week effect on stock volatility has been empirically found in some markets (Balaban *et al*., 2001; Berument and Kiymaz, 2001; Kiymaz and Berument, 2003).

Although the day-of-the-week effect in stock returns and stock volatility has been significantly documented in the financial literature, no study has been found on this issue for the Ho Chi Minh Stock Exchange (the main Vietnamese stock-market). This study tries to enrich the literature by testing for the existence of daily seasonal anomaly in the HOSE. The remainder of this paper is organised as follows. Section 2 reviews empirical literature related to the day-of-the-week effect in stock returns and volatility. Section 3 provides an overall description of the operation and performance of the HOSE. Section 4 describes the data that are used in this study and explains the models that are employed for examining the day-of-the-week effect on stock returns and volatility. Section 5 presents the results while conclusion of the paper is presented in Section 6.

2. Empirical literature review

This section reviews the findings from empirical studies on the day-of-the-week effect in both developed and emerging stock-markets. Because it is not possible to list all the relevant studies here, the review just focuses on those which are supposed to be re-presentable for this field. For the reason of convenience, the empirical evidence on the daily seasonal anomaly in developed and emerging stock-markets are separately examined.

2.1 Day-of-the-week effect in developed stock-markets

It is observed that the day-of-the-week effect on stock returns is primarily reported for the U.S. stock-market. Indeed, French (1980), Gibbon and Hess (1981), Condoyanmi *et al*. (1987), Jaffe and Westerfield (1985), Dubois and Louvet (1996) document that the mean return is significantly negative on Monday, but it is significantly positive on Friday. Similarly, a daily seasonal anomaly is found in the Canadian stock-market with a negative Monday and positive Friday effect as observed in the U.S. stock-market (Jaffe and Westerfield, 1985; Condoyanmi *et al*., 1987; Dubois and Louvet, 1996; and Kiymaz and Berument, 2003).

In Europe, the day-of-the-week effect is observed in all developed stock-markets. In fact, a significant negative Monday effect is reported for the U.K., Germany, France, and Switzerland, and a significant positive Friday effect is observed in France (Jaffe and Westerfield, 1985; Condoyanmi *et al.*, 1987; Dubois and Louvet, 1996; and Kiymaz and Berument, 2003). In addition, a significant negative mean return on Tuesday is reported for the U.K., Germany, France, Austria and the Netherlands (Jaffe and Westerfield, 1985; Condoyanmi *et al*., 1987; Balaban *et al*., 2001). Moreover, a negative Friday effect is abnormally identified for Germany and Austria (Balaban *et al*., 2001).

Turning to stock-markets in the Pacific Rim region, it is evident that the highest mean return is observed on Friday while the lowest mean return is found on Tuesday for both the Japanese and Australian stock-markets (Jaffe and Westerfield, 1985, Condoyanmi *et al*., 1987; and Dubois and Louvet, 1996). The findings of negative Tuesday effect in these markets are completely different from those derived from the empirical studies in the U.S. stock-market. According to Jaffe and Westerfield (1985), the negative Tuesday effect in the Japanese and Australian stock-markets could result from the time zone differences between such markets and the U.S. market. However, their empirical evidence indicates that the time zone difference could only explain the daily seasonal anomaly in the Australian stock-market, but it is not able to explain the day-of-the-week effect in the Japanese one.

It is clear that the day-of-the-week effect is present in all papers that are reviewed above. Further, some studies have tried to bring various explanations for the day-of-the-week effect. Lakonishok and Levi (1982) argue that the day-of-the-week effect can be partly derived from the delay between trading and settlements in stocks and in clearing checks. Specifically, they explain that the buyer will have eight calendar days before losing funds for stock purchases on a business day other than Friday based on rules of the U.S. stock-market while for Friday purchases, the buyer will have ten calendar days. In other words, the buyer has two more days of interest earning. Therefore, the buyer would be willing to pay extra for stocks bought on Fridays. Another explanation for the daily seasonal anomaly, proposed by Fortune (1991) is that companies and governments tend to release good news during market trading when it is easily absorbed, and keep bad news until the close on Friday when investors can not react

to the information until the Monday opening. Furthermore, according to Keim and Stambaugh (1984), measurement errors would partly contribute to the weekend effect. They hypothesise that the low Monday returns could result from positive "errors" in prices on Friday. However, none of these studies can provide satisfactory explanations for the daily seasonal anomaly (Chen *et al*., 2001; Oguzsoy and Guven, 2003).

It is important to note here that most surveyed studies investigate the daily seasonal anomaly for the periods before 1990. In the most recent period, Kohers *et al*. (2004) find that the day-of-the-week effect has disappeared in most developed stock-markets. Specifically, they document that the daily seasonal anomaly is observed in the U.S., Japan, the U.K., France, Germany, Canada, Italy, the Netherlands, Switzerland, and Australia for the period from 1980 to 1990, but conversely it is no longer in all markets, except Japan, during the period between 1991 and 2002. These findings indicate that long-term improvements in market efficiency would have diminished the day-of-the-week effect on stock returns.

Beside day-of-the-week effect on stock returns, the day-of-the-week effect on stock volatility is also documented in the literature. Indeed, Balaban *et al*. (2001) find that day-of-the-week effect on volatility is present in Austria, Belgium, Denmark, France, Italy, Norway, Switzerland, and the U.S. for the period from July 1993 to July 1998. Specifically, a significant negative effect is observed on Tuesday for Belgium, Denmark, France, Italy and Switzerland, on Wednesday and Thursday for Italy, and on Friday for Italy and Norway while a positive effect on Tuesday is reported for Austria, on Thursday for Austria, Denmark and the U.S. In addition, Berument and Kiymaz (2001) show that the lowest and highest volatility occurs on Wednesday and Friday respectively for returns of the S&P 500. Furthermore, Kiymaz and Berument (2003) document the highest Monday volatility for Japan and Germany, the highest Thursday volatility for the U.K., and the highest Friday volatility for the U.S. and Canada.

2.2 Day-of-the-week effect in emerging stock-markets

A number of empirical studies on the daily seasonal anomaly have been recently conducted in emerging stock-markets. In Eastern European stock-markets, Poshakwale and Murinde (2001) report that the day-of-the-week effect does not exist in Budapest and Warsaw stock exchanges during the period of 1994-1996. Moreover, Ajayi *et al*. (2004) find that the day-of-the-week effect is present in only four of eleven studied markets (Estonia, Lithuania, Russia and Slovenia). Specifically, the significantly negative Monday effect is observed in Estonia and Lithuania while positive Monday and Friday effects are found in Russia and Slovenia respectively. Furthermore, regarding the Turkish stock-market, Balaban (1995) documents that the mean return is significantly highest on Friday for the period from January 1988 to August 1994. Then, Oguzsoy and Guven (2003) re-examine the daily seasonal anomaly in this market by extending the studied period to November 1999 and find that the Turkish stock-market exhibits the significant negative effect on Monday and Tuesday and positive effect on Friday.

Turning to the Asian region, it is surprising to find that the day-of-the-week effect is not present in the Taiwanese stock-market for the early stage from 1975 to 1988 (Wong *et al*., 1992), but it exists in the recent periods, from January 1990 to June 1995 with a significantly negative mean return on Tuesday (Choudhry, 2000) and from December 1989 to January 1996 with the negative average return on Wednesday (Brooks and Persand, 2001). Moving to the South Korea stock-market, the empirical evidence on daily seasonal anomaly is mixed.

Indeed, Choudhry (2000) report that the day-of-the-week effect exists in South Korea with a negative effect on Tuesday while Brooks and Persand (2001) find no evidence to support the presence of day-of-the-week effect in this market. The difference in findings between the two studies may result from the different methods used in these studies because the data employed in these studies are almost the same. In China, Mookerjee and Yu (1999) document that a significant positive effect on Thursday and Friday is present in the Shanghai Securities Exchange, but the daily seasonal anomaly does not exist in the Shenzhen Securities Exchange for the period between April 1991 and April 1994. Finally, the Indian stock-market exhibits a positive effect on Friday (Choudhry, 2000).

In ASEAN, the day-of-the-week effect is likely to be present in all stock-markets for a certain period. Indeed, the Singapore stock-market exhibits a negative Monday and positive Friday effect for the period of 1975-1988 and only a negative Monday effect for the period from January 1992 to January 1997 (Wong *et al.,* 1992; and Lian and Chen, 2004) respectively, but no day-of-the-week effect for the period from February 1997 to August 2002 (Lian and Chen, 2004). The findings indicate that improvements in market efficiency over time may have faded away the daily seasonal anomaly effect on stock returns. In Thailand, Wong *et al*. (1992), Choudhry (2000), Chusanachoti and Kamath (2002) and Lian and Chen (2004) find that the mean returns are significant negative on Monday and Tuesday, but positive on Friday. These results are consistent with those obtained from the studies in the developed stock-markets. Moreover, Brooks and Persand (2001) report a significantly positive Monday effect for Thailand over the period from December 1989 to January 1996. Similar to these ASEAN stock-markets, the negative Monday and positive Friday effects are observed in the Malaysian stock-market (Wong *et al*., 1992; Choudhry, 2000). Furthermore, Wong *et al*. (1992), Wong and Yuanto (1999), Choudhry (2000), and Lian and Chen (2004) find that the negative effect on Monday and Tuesday and positive Friday effects exist in the Jakarta Composite Index (Indonesia). Finally, the empirical evidence on the day-of-the-week effect in the Philippines stock-market is mixed. Specifically, Choudhry (2000) and Lian and Chen (2004) report the positive Friday and negative Tuesday mean returns for the period from January 1990 to June 1995 and from October 1998 to August 2002 respectively while Brooks and Persand (2001) show no day-of-the-week effect in the Philippines stock-market. Like the case of South Korea, the difference may due to the different methods employed in these studies.

3. Overview of the Ho Chi Minh Stock Exchange (HOSE)

The HOSE, formerly named as the Securities Trading Centre, was launched on July 28th 2000. At the opening trading session, only two individual stocks with a total market capitalisation of VND 444,000 million (about USD 23.45 million)[1] were traded on the market. The growth of the number of listed companies has been rather slow during the period from 2000 to 2005. At the end of 2005 still only 32 joint-stock companies were listed. By the end of 2010, a total of 287 joint-stock companies with a total market capitalisation of VND 534,610 billion (USD 28.24 billion)[2] have been given permission to float their shares on the Exchange. Most of the listed firms are former state-owned enterprises (SOEs) that were previously restructured by equitisation, the Vietnamese version of privatisation (see, *e.g.*, Truong, Lanjouw and Lensink; 2006).

[1] Exchange rate on December 31st 2010: 1 USD = 18,936 VND
[2] Market capitalisation is calculated based on closing price of stocks on December 31st, 2010.

The slow pace in progress of the HOSE in term of the number of listed companies could result from the following reasons. First, the main reason could be that most of joint stock companies are not willing to disclose their financial information once their shares are listed. They fear that when the financial information is publicly disclosure, their competitors can exploit the information. Consequently, their business can be suffered. Second, many companies have not realised benefits of listing on the stock-market yet. They think that the benefits of listing they can get are less than the risk they have to face. Finally, the slowness of equitisation programme and related policies could be a reason that affects on the development of the HOSE. In addition, many equitised firms are small in term of capital, so they do not meet the capital requirement by the HOSE for listing[3].

All shares listed at the HOSE should be denominated in Vietnamese Dong (VND) with a standardised par value for each of VND 10,000. For the first period from July 28, 2000 to March 1 2002, trading sessions have been conducted on Monday, Wednesday and Friday. From March 1, 2002, the market trades daily with two order-matching sessions at 9.20 am and 10.30 am. To satisfy the requirements for the market's growth, the HOSE has applied continuous order matching method since July 30th, 2007.

In order to prevent excessive changes in individual stock prices at a given trading session and to foster an orderly market, the State Securities Commission (SSC) has regulated the daily price limits for all stocks listed on HOSE. The price limits, which bound the daily stock price movements, are determined on the basis of the previous day's closing prices and limit rates. It is observed that the limit rates have changed several times since the establishment of the stock-market. Indeed, the limit rate was initially set at 2 percent during the period from July 28th, 2000 to July 31st, 2002, except the short period from June 13th, 2001 to October 8th, 2001 the rate was 7 percent. Then, the rate was adjusted to 3 percent for the period between August 1st, 2002 and December 31st, 2002, and to 5 percent over the period from January 2nd, 2003 onwards.

The development of the HOSE is rather slow for the period from 2000 to 2005. However, the market has remarkably increased since the end of 2005. The key indicators of the development of the HOSE over the period from the opening year (2000) through 31 December 2010 are presented in Table 1.

Table 1: Key development indicators for the HOSE over the period 2000-2010

Indicators	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of listed companies	5	10	20	23	26	32	108	141	174	200	287
Market capitalisation (billion VND)	1,049	1,661	2,650	2,514	3,945	6,338	244,445	352,000	225,000	495,094	534,610
Market capitalisation on GDP (%)	0.2	0.3	0.5	0.4	0.6	0.7	22.7	40.0	17.5	30.3	27.0
Yearly	91	925	763	423	1,6	2,4	38,17	205,7	124,57	432,6	380,6

[3] Before the year of 2004, a minimum required capital of companies listed on HOSE had been VND 10 billions. At the present, the minimum required capital is VND 80 billions.

trading value (billion VND)					93	36	5	32	6	50	85
Average daily trading value (billion VND)	1.4	6.1	3.2	1.7	6.8	9.8	153.3	839.7	527.9	1,723.7	1,522.7
Yearly trading volume (million shares)	3.6	19.0	35.7	28.1	76.4	121.0	643.3	2,008.5	2,977.8	11.089	11.849
VN-INDEX (point)	207	235	183	167	239	308	752	927	316	495	485

Source: Own calculation on the basis of data obtained from the website of HOSE (www.hsx.vn)

Note: All figures refer to the end of the year indicated.

4. Data and methodology

4.1 Data

The data used to investigate the daily seasonal anomaly in the HOSE is primarily the daily market index series (VN-Index). The VN-Index is a composite index calculated from prices of all common stocks traded on the HOSE. Specifically, the Index is a market capitalisation weighted price index which compares the current market value of all listed common shares to the value on the base date of July 28th, 2000 when the first session was traded on the market. The VN- Index was primarily set at 100 points.

The data are obtained over the period from March 1st 2002 to March 1st 2011 from the website of HOSE (www.hsx.vn). Then, a natural logarithmic transformation is performed for the primary data. To generate a time series of continuously compounded returns, daily returns are computed as follows:

$$r_t = \log(p_t) - \log(p_{t-1}) = \log(p_t / p_{t-1})$$

where p_t and p_{t-1} are the stock prices at time t and $t-1$.

4.2 Methodology

To test for the presence of a day-of-the-week effect on stock returns and stock volatility in the HOSE, a set of regression models are employed in this study. The first model, which is used to examine the day-of-the-week effect on stock returns, is the OLS (Ordinary Least Square) regression with the following form:

$$R_{it} = \alpha_1 D_{1t} + \alpha_2 D_{2t} + \alpha_3 D_{3t} + \alpha_4 D_{4t} + \alpha_5 D_{5t} + \varepsilon_t \qquad \varepsilon_t \approx N(0, h_t) \tag{1}$$

where R_{it} is the log return of the market index; D_{1t}, D_{2t}, D_{3t}, D_{4t} and D_{5t} are dummy variables for Monday, Tuesday, Wednesday, Thursday, and Friday respectively (i.e., D_{1t} = 1 if observation t falls on a Monday and 0 otherwise); and ε_t is an error term and assumed to be independently and identically distributed (iid).

It is likely to be that the assumption of homocesdaticity (the variance of the errors is constant over time) is usually violated in the context of financial time series. Moreover, according to Brooks (2002), if the assumption is not satisfied and the OLS model is still employed, the standard errors could be wrong and thus any inferences drawn from the model could be misleading. To deal with this issue, Engle (1982) proposed the class of ARCH models (ARCH stands for "autoregressive conditional heteroscedasticity") in which the variance of errors allows to evolve over time as a function of past errors. Then, Bollerslev (1986) generalised the ARCH models as GARCH that allows the conditional variance to be dependent upon earlier own lags. In this study, the simplest form of GARCH [GARCH (1,1)] is employed. To examine the day-of-the-week effect on the market returns, the GARCH (1,1) takes the following form:

$$R_{it} = \alpha_1 D_{1t} + \alpha_2 D_{2t} + \alpha_3 D_{3t} + \alpha_4 D_{4t} + \alpha_5 D_{5t} + \varepsilon_t \qquad \varepsilon_t \approx N(0, h_t)$$

$$h_t = \omega + \delta h_{t-1} + \gamma \varepsilon_{t-1}^2 \tag{2}$$

If any significant coefficients (α_i) are found in the simple OLS and GARCH (1,1) models, which are mentioned above, the hypothesis of day-of-the-week effect can be accepted. Furthermore, to test for the presence of day-of-the-week effect on stock volatility, this study employs the GARCH (1,1) with additive dummy variables for each day of the week in the conditional variance equation (hereafter it is called as volatility model), which was used in studies of Berument and Kiymaz (2001) and Kiymaz and Berument (2003). To avoid the problem of collinearity in the regression model, only four out of five days in the week are included in the variance equation as the dummy variables. Specifically, the volatility model can be expressed by the following equations:

$$R_{it} = \alpha_1 D_{1t} + \alpha_2 D_{2t} + \alpha_3 D_{3t} + \alpha_4 D_{4t} + \alpha_5 D_{5t} + \varepsilon_t \qquad \varepsilon_t \approx N(0, h_t)$$

$$h_t = \omega + \beta_1 D_{1t} + \beta_2 D_{2t} + \beta_3 D_{3t} + \beta_4 D_{4t} + \delta h_{t-1} + \gamma \varepsilon_{t-1}^2 \tag{3}$$

where D_{1t}, D_{2t}, D_{3t} and D_{4t} are dummy variables for Monday, Tuesday, Thursday, and Friday respectively (Wednesday is not included in the Equation 3).

5. Empirical results

The empirical evidence of day-of-the-week effect on returns and volatility in the HOSE is presented in Table 1. The results of the OLS model (Model 1) show that the average return on Friday is significantly higher than other days of the week at the 1 percent level. However, the findings derived from Model 1 confirm that mean return of the Index is significant negative on Tuesday at the five percent level. On the basis of these results, it can be concluded that day-of-the-week effect (Tuesday and Friday effects) is presence in the stock returns of the Vietnamese stock market.

It is important to note here that the conclusion above is based on the OLS method, which ignores the time-varying volatility (ARCH effect) that is suspected to be presence in the observed series. If ARCH effect exists in the market returns, the GARCH (1,1) model should be applied. To check for the presence of ARCH effect, the Lagrange Multiplier (LM) test, proposed by Engel (1982), is conducted, using 5 lags[4]. The results of ARCH-LM test strongly

[4] The author also performs several lag orders and the basic results remain the same.

indicate that ARCH effect is presence in the Model 1 since the test statistic of the model is higher than the LM-critical value at the one percent level significant. Clearly, due to ARCH effects in the series, GARCH (1,1), which takes into account time-varying variance, is more appropriate than the OLS method in testing for the daily seasonal volatility in the market returns. The findings of GARCH (1,1) model (Model 2) reveal that a negative Monday and Tuesday effects exist in the market returns at the 10% and 5% levels of statistical respectively. In addition, results derived from the Model 2 are consistent with results of Model 1 that the positive Friday effect is still present in the VN-Index returns.

Table 2: Day-of-the-week effect on the stock market returns and volatility

	Model 1	Model 2	Model 3
Conditional mean equation			
Monday	-0.00012 (-0,36)	-0.00025 (-1.71)[c]	-0.00034 (-1.55)
Tuesday	-0.00069 (-2,09)[b]	-0.00029 (-2.02)[b]	-0.00047 (-2.37)[b]
Wednesday	0.00021 (0,63)	-0.00022 (-1.43)	-0,00002 (-0.04)
Thursday	0.00048 (1,43)	-0.00006 (-0.41)	0,00007 (0.26)
Friday	0.00099 (2,97)[a]	0.00031 (2.12)[b]	0.00058 (2.66)[a]
Observations	2,226	2,226	2,226
ARCH-LM tests (5 lags)	114.93[a]		
Conditional variance equation			
ω		4.62E-07 (7.20)[a]	0,00004 (17.92)[a]
ε^2_{t-1}		0.30785 (14.00)[a]	0.16083 (12.00)[a]
h_{t-1}		0.72807 (53.23)[a]	0.59848 (27.17)[a]
Monday			-0.00003 (-13.15)[a]
Tuesday			-0,00004 (-16.48)[a]
Thursday			-0.00005 (-36.12)[a]
Friday			-0.00004 (-12.63)[a]

[a, b,c]: significant at the 1%, 5% and 10% levels respective.,
t-values in parentheses for model 1; z-values in parentheses for model 2 and 3.

Finally, to investigate the day-of-the-week effect on stock volatility, the GARCH (1,1), with dummy variables for each day of the week in the conditional variance equation is performed (Model 3). With respect to market returns, results of the Model 3 consistently indicate that the estimated coefficient of the Monday dummy variable is negative and statistically significant at the 5% level. In addition, the findings obtained from Model 3 also show that average return on Friday is higher than average return of other days in the week at the significantly statistical level of one percent. Returning to the main objective of the last model,

the results show that all dummy variables in the conditional variance equation are statistically significant at one percent level. Specifically, the highest volatility occurs on Thursday while the lowest volatility is observed on Monday after controlling the persistence effect with the lag values of the conditional variance and squared lag values of the residual term.

5.1 Conclusion

This paper is devoted to investigating the day-of-the-week effect on stock returns and volatility in the HOSE. The empirical results derived from the regression models generally indicate that the day-of-the-week effects on stock returns and volatility are present in the Market. Specifically, the negative Tuesday and positive Friday effects on market returns are found when the OLS model is employed. Moreover, the results derived from the GARCH (1,1) model reveal that the negative Monday and Tuesday effects are present in the HOSE. Furthermore, the empirical evidence obtained from the GARCH (1,1) with day-of-the-week dummy variables to be added in the conditional variance equation documents that a negative effect is observed for Tuesday while a positive effect occurs on Friday. Finally, the empirical findings fail to reject the hypothesis of day-of-the-week effect on stock-market volatility for the HOSE. Specifically, the highest volatility occurs on Thursday while the lowest volatility is observed on Monday.

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