

Post Asian Financial crisis Day-of-the-week Effect and volatility in Stock Returns: Evidence from East Asian Financial Markets

By

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Abstract

In this study, I examine the post Asian Financial crisis day-of-the-week effect and volatility in the stock markets returns of ten East Asian countries. I use both parametric and non-parametric tests such as the ANOVA, Kruskal-Wallis, and Levene to test equality of mean returns across the- day-the-week and the equality of the standard deviations across the-day-of-the week. I find that though the day-of- the- week effect exists in most of the East Asian financial markets, the difference in the mean returns for most of the ten markets is not significant. All the East Asian stock markets have positive Friday. The days on which these observations occur for the various countries differ from previously documented days of the week.

There is less volatility in the daily returns in these Asian Pacific markets since the Asian Financial crisis. Seven of the countries show the highest standard deviation on Monday. This evidence is more consistent with past documentation (Ho, and Cheung, 1994). However, again the days on which the maximum and minimum standard occurs differ from previous findings,

The results of the Levene's test show that in none of the fifteen Asian Pacific countries can the homoskedasticity hypothesis be rejected. I therefore conclude that both the developed and emerging East Asian markets in the post Asian financial crisis period have a low degree of variation across the day-of-the-week returns and this variation is not significant at any level.

1.0. Introduction

There is abundant documented evidence confirming the day-of-the-week-effect in stock returns in the U.S. Market. The mean Monday stock return is negative or significantly lower than the non-Monday return while mean stock return on Friday is relatively high. For example, Fama (1965), Cross (1973), French (1980) and Jaff, Westerfield and Ma (1989), Gibbons and Hess (1981), Lakonishok and Levi (1982), Rogalski (1984), Keim and Stambaugh (1984), Mirlock and Starks (1986), Harris (1986), Lakonishok and Smidt (1988) among others document the Monday effect or other daily anomalies in the US stock market. Jaffee and Westerfield (1985a, b) found a negative Monday effect in Canada and the UK but a negative Tuesday effect in Japan and

Australia. Condoynani et al. (1987) confirms these findings on the Japanese and Australian markets. Kato (1990) also finds that the Tuesday return is negative and Wednesday and Saturday returns are strongly positive in Japan. Jaff, Westerfield, and Ma (1989) drew attention to this phenomenon when they provided international evidence. Findings relating to the linkage between “bad Fridays” and the Monday effect are robust internationally. Bad Friday refers to a decline of the market on the Friday usually preceding a Monday with increased stock selling pressure.

The research on seasonal variations and the-day-of-the-week effect on stock has also been extensively done on the Asian Pacific stock markets. Wong and Ho (1986) find the existence of a significant day-of-the-week seasonal effect for the Singapore market during the period 1975-84. In addition they find that the pattern is similar to that of the US market but is different from that of Japan and Australia because the lowest return occurs on Monday and is negative. The highest return occurs on Friday and is positive. Wong and Ho (1986) also find that the negative Monday returns occur during February through November of the year. The average daily returns in January are also higher than that for other months but the turn-of the year effect in Singapore is not significant at all. Kim (1988) reports results for Japan and Korea that are similar to that of Jaffe and Westerfield (1985a, b). Aggarwal and Rivoli (1989) also confirm the existence of the Day-of-the-week effect in some Asian markets including Hong Kong, Korea, Taiwan, Japan and Singapore. Ho (1990) performs a comprehensive study on seasonalities in ten Asia-Pacific markets and finds strong day-of-the-week effects for most of the Asian markets and there are more day-of- the-week variations in the non-January months than in January. Ho (1990) also finds it hard to reject the hypothesis that the day-of-the-week

variations in the Asia-Pacific markets are similar to that of the US Market after adjusting for time-zone differences. This phenomenon is especially true for smaller markets. Using a non-parametric test, Wong et al. (1992) further confirm the day-of-the-week effect in Singapore, Malaysia, Hong Kong and Thailand. Using the Levene test, Ho and Cheung (1994) found the existence of day-of-the week variations in volatility with Monday returns having the highest volatility, in most of the emerging Asian stock markets including Hong Kong, Malaysia, Singapore and Taiwan, with the exception of Korea whose highest volatility occurred on Tuesday.

Most of these studies were done before July 1997, the official beginning of the Asian financial crisis. The crisis involved extreme currency depreciation and consequent collapse of the stock values in the stock markets and real estate markets. Demand for real and financial assets was seriously dampened and many of the countries faced bankruptcy before the International Monetary Fund came to their rescue. This crisis specifically affected Thailand, Indonesia, South Korea, Malaysia and Philippines [East Asian countries]. This crisis affected many if not of the Asian Pacific economies because of the traditional trade links. It is therefore necessary to determine the post Asian financial crisis seasonal variations in stock returns or the-day-of-the-week effect and volatility in stock returns in the East Asian financial markets.

2.0. Research Objective

The objective of this research is to test the pre 1987 (Asia financial crisis) existing evidence of the day-of-the-week returns in the East Asian stock markets and determine the volatility of such returns.

3.0. Data and Methodology

We use the daily closing values of 10 developed and emerging East Asian stock market indices from August 1998 to October 31, 2003. The financial markets studied are: China, Shanghai Composite, (SSEC); India, BSE 30 (BSESN); Indonesia, Jakarta Composite (JK); Japan, Nikkei 225 (N225); Malaysia, KLSE Composite (KLSE); Philippines, PSE Composite (PSI); Singapore, Straits Times (STI); South Korea, Seoul Composite (KSII); Thailand, SET (SETI); Taiwan, Taiwan Weighted (TWII).

The daily stock returns for the East Asian stock indices are calculated as follows:

$$\ln (P_t/P_{t-1}) * 100 \text{ ----- (1)}$$

Where P_t is the stock index at date t . Except for the returns on Monday, I excluded any returns that are preceded by a holiday. This exclusion as was done in previous studies to avoid speculation that observed day-of-the-week-effect could be partially due to these non-trading days. I use the standard deviations in the returns to measure the volatility substantiated by parametric and non parametric tests.

I test the hypothesis of an equal mean return across all days of the week using the standard F-test (ANOVA). I also use the non-parametric test, the Kruskal-Wallis to check for the results on equality on mean returns because ANOVA depends on the assumption of normality. The Kruskal-Wallis statistic is as follows:

$$\frac{12}{N(N+1)} \sum_{j=1}^k \frac{R_j^2}{n_j} - 3(n+1) \text{ ----- (2)}$$

Where:

- k = number of samples
- n_j = number of values in jth sample
- N = ∑n_j = total number of values
- R_j = sum of ranks in the sample when N values are ranked together (the statistic is approximately Chi-square distributed degrees of freedom equal to k-1)

Test on Equality of Variances

Bartlett's homogeneity test of equal variance is employed to test the equal variance across all weekdays. The test criterion is as follows (Snedecor and Cochran, 1970)

$$M = v \left(a \ln s^{-2} - \sum \ln s_i^2 \right)$$

Where

- a = the number of samples
- v = degree of freedom

$$s^{-2} = \sum s_i^2 / a$$

s_j² = estimate of the σ² from sample i

then, the quantity M/C is distributed approximately as a Chi-square distribution with degrees of freedom equal to (a-1).

The above test is for the case when all groups have the same degrees of freedom. When the degrees of freedom differ, as with samples of unequal sizes, the test criterion is as follows as follows:

$$M = \left(\sum v_i \right) \ln s^{-2} - \sum \left(v_i \ln s_i^2 \right)$$

$$C = 1 + \left\{ \frac{1}{[3(a-1)]} \right\} \left(\sum \frac{1}{v_i} - \frac{1}{\sum v_i} \right)$$

Where

$$s^{-2} = \sum \left(v_i s_i^2 \right) / \sum v_i$$

s_i² is an estimate of the σ² from sample I

a = the number of samples

v_i = the degree of freedom of samples i

The quantity M/C is distributed approximately as a Chi-square with degrees of freedom equal to $(a-1)$. In our case, as we have five weekdays in a week, degrees of freedom are four.

However, as Bartlett's test of homogeneity of variance is sensitive to non normality in stock return distribution, I also employ Levene's (1960) test to check the results on equality of variance. In measuring the variation within a class, Levene's test uses the average of the absolute deviations instead of the mean square of deviations. This avoidance of squaring makes the test criterion much less sensitive to non-normal distributions (Snedecor and Cochran, 1976). The Levene's statistic is as follows:

$$F = \left[\frac{\sum_{j=1}^J n_j (D_{.j} - D_{..})^2}{\sum_{j=1}^J \sum_{i=1}^{n_j} (D_{ij} - D_{.j})^2} \right] \times \left[\frac{(N - J)}{(J - 1)} \right]$$

where $D_{ij} = |R_{ij} - M_{.j}|$, R_{ij} is the return for week i and weekday j for $j=1, 2, \dots, J$ and $J=5$ if the last trading day of the week is a Friday.

4.0. Empirical Results

Day-of-the week effect

Table 1. contains the mean return for each day of the week, for the ten East Asia financial markets. Similar to the U.S. case and pre Asian financial crisis East Asian case, eight of the ten East Asian markets have negative Monday returns. They are China, Indonesia, Malaysia, Philippines, Singapore, South Korea, Sri Lanka, and Thailand. The returns of Indonesia, Malaysia, and Thailand are marginally significant at 10% level. However Japan which showed a negative Monday return in pre East Asian financial crisis studies on day-of-the-week returns did not show negative returns in this study.

Japan, Philippines, Thailand and Taiwan show negative Tuesday returns. In pre East Asian financial crisis studies on day-of-the-week returns Taiwan showed positive returns on Tuesday. However, consistent with past results, the stock market returns of Philippines and Taiwan are significantly negative at the 10% level.

Indonesia and Japan show negative Wednesday returns. China, Indonesia, Japan, South Korea and Taiwan show negative Thursday returns. In pre 1997 studies, Thursday returns in all Asian Financial markets were positive (Ho, 1990).

All the East Asian stock markets have positive Friday returns except Japan. This observation is important because Japan is the largest and most developed in the East Asia region. Only a few were significantly positive, South Korea, Sri Lanka and Thailand at 10% level and Malaysia at 5% level. India is the only East Asian country whose stock market shows positive returns for all days of the week during the period.

Table 1 Mean Returns of Asia/Pacific stock markets for the period August 4th 1998-October 31st 2003

Name of Country/Index	Monday	Tuesday	Wednesday	Thursday	Friday	Total no of observations
China (SSEC)	-0.0451	0.0378	0.0293	-0.0028	0.0052	1204
India BSE 50	0.0383	0.0149	0.0605	0.0116	0.0605	1219
Indonesia (JKSE)	-0.0902	0.0031	-0.0237	0.1142	0.0663	1198
Japan Nikkei 225	0.0268	-0.001	-0.0093	-0.0382	0.0136	1228
Malaysia (KLSE)	-0.0909	0.0513	0.0727	0.0292	0.064	1291
Philippines (PSE)	-0.0204	-0.0929	0.0077	0.0317	0.0428	1251
Singapore Strait Times	-0.0615	0.0136	0.0202	0.0373	0.043	1259
South Korea (KSII)	-0.0271	0.064	0.113	-0.0786	0.0831	1281
Thailand (SETI)	-0.1176	-0.0061	0.0138	0.0324	0.1886	1218
Taiwan	0.0002	-0.1366	0.0895	-0.0091	0.0407	1240

(TWII)

Table 2 summarizes the days in which the highest and lowest return and standard deviation occur. Four of the East Asian stock markets record the lowest return on Monday and they include China, Malaysia, Singapore, and Thailand. Lowest returns also occur on Tuesday for two of the stock markets, namely Philippines and Taiwan. This is an interesting finding because in previous studies the lowest return did not occur on Tuesday for Philippines and Taiwan. In fact it is documented that except for New Zealand, Philippines and Taiwan, all Asian Pacific stock markets show their lowest return on Tuesday (Ho, 1990). The sample of this previous study contained ten Asian Pacific stock markets and Indonesia, China and India were not included. In this study three of East Asian stock markets record their lowest return on Thursday and they are India, Japan, and South Korea.

Four of the East Asian stock markets show their highest return on Friday and they include Thailand, Singapore, Philippines, and India. Highest returns also occur on Wednesday for three of them namely Malaysia, South Korea and Taiwan. Indonesia records highest return on Thursday. Japan and China record their highest return on Monday and Tuesday respectively. Even though there is mixed results with respect to on which day the highest return occurs, in general it mostly occur on Friday and Wednesday. Previous studies document a highest return on last trading day of the week (Ho, 1990).

Table 2 Summary of maximum/minimum returns/standard deviations of the day-of-the week effect for the period August 4th 1998-

October 31st 2003

Country/Index	Name of mean/stdev value	Maximum	Day of occurrence-	Minimum mean/stdev	Day of occurrence
China	0.0378/		Tuesday	-0.0451	Monday
(SSEC)	0.7484		Monday	0.5017	Friday
India	0.0605/		Friday	0.0116	Thursday
BSE 50	0.7765		Monday	0.6439	Wednesday
Indonesia	0.1142/		Thursday	-0.0902	Monday
(JKSE)	0.8025		Tuesday	0.7436	Wednesday
Japan	0.0268/		Monday	-0.0382	Thursday
Nikkei 225	0.786		Monday	0.6409	Friday
Malaysia	0.0727/		Wednesday	-0.0909	Monday
(KLSE)	0.9742		Monday	0.5704	Thursday
Philippines	0.0428/		Friday	-0.0929	Tuesday
(PSE)	0.8131		Monday	0.5728	Tuesday
Singapore	0.043/		Friday	-0.0615	Monday
Strait Times	0.7697		Monday	0.5602	Tuesday
South Korea	0.113/		Wednesday	-0.0786	Thursday
(KSII)	1.1554		Monday	0.9443	Friday
Thailand	0.1886/		Friday	-0.1176	Monday
(SETI)	0.8078		Friday	0.6919	Thursday
Taiwan	0.0895/		Wednesday	-0.1366	Tuesday
(TWII)	0.8883		Tuesday	0.6697	Monday

Note: The bracketed figures are standard deviations

Table 3. shows the one way ANOVA results. The variations in the mean returns are significant at 5% level only for Indonesia, Sri Lanka, Thailand and Taiwan. I

therefore accept the hypothesis of equal mean returns across the days of the week for the other eight stock markets of China, India, Japan, Malaysia, Pakistan, Philippines, Singapore and South Korea. The hypothesis of equal means across the days of the week is rejected for Indonesia, Sri Lanka, Thailand and Taiwan.

To substantiate the evidence of the day-of-the-week effects shown in Table 1, the Kruskal-Wallis test is carried out to test the null hypothesis of equality of mean returns across the days of the week. As shown in Table 3, the values of the χ^2 -statistics are significant at 5% level for the markets except Taiwan, Thailand, Sri Lanka, Pakistan and Malaysia. These results support the existence of the day-of-the-week effect in stock returns in six countries namely; China, India, Japan, Philippines, Singapore, South Korea. The evidence leads to the conclusion that there is no day-of-the-week effect in Taiwan, Thailand, Sri Lanka, Pakistan and Malaysia. This result is similar to the previous findings of (Wong, Hui, and Chan, 1992).

Table 3. Test of Equal Mean Returns Across Day-of-the-Week

Countries	<u>ANOVA</u>		<u>Kruskal-Wallis</u>		<u>W Test for Normality</u>		<u>Bartlett Test</u>	<u>Levene Test</u>
	F Value	P Value	Chi-square	P Value	StDev	R	Chi-square	Statistics
China	0.63	0.638	2.46	0.651	0.629	0.9596*	41.793	3.459
India	0.74	0.566	1.42	0.841	0.705	0.9889*	11.796	2.051
Indonesia	2.46	0.044**	5.74	0.22	0.784	0.909*	1.781	0.077
Japan	0.29	0.884	1.4	0.843	0.692	0.9939*	13.733	3.491
Malaysia	1.91	0.107	17.24	0.002**	0.782	0.8549*	82.436	1.826
Philippines	1.48	0.205	7.77	0.1	0.695	0.9425*	45.206	1.777
Singapore	1.05	0.378	3.36	0.499	0.651	0.9827*	29.437	3.242
South Korea	1.56	0.184	5.37	0.251	1.035	0.9903*	15.129	2.015
Thailand	5.09	0**	19.32	0.001**	0.774	0.9849*	7.186	1.141
Taiwan	2.77	0.026**	9.23	0.056**	0.794	0.9922*	22.131	2.656

Notes ** Significant at 5% level

Volatility of Returns

There seems to be in general less volatility in the daily returns in these Asian Pacific markets since the Asian Financial crisis. The countries with the highest SD are South Korea 1.1554; Malaysia 0.9742; and Taiwan 0.8883. These are all East Asian emerging economies involved in the Asian financial crisis.

Table 4 contains the standard deviation of returns. The highest SD of 0.8883% occurs for Taiwan occurs on Tuesday and the lowest SD of 0.6697 occurs on Monday. The days on which the maximum and minimum SD occurs differ from previous findings. For example (Ho, and Cheung, 1994) document that the highest SD for Taiwan occurred on Monday and the lowest SD occurred on Friday.

In addition there seems to be a more even distribution across the days of the week regarding the day in which the lowest SD occurs. Philippines and Singapore experience their lowest SD on Tuesday; Indonesia and India experience their lowest SD on Wednesday, and China, South Korea, Japan and China experience their lowest SD on Friday.

Seven of the countries show the highest SD on Monday and they include China, Japan, Malaysia, Philippines, Singapore, South Korea and India. This evidence is more consistent with past documentation regarding the fact that most of the Asian countries show highest SD on Monday (Ho, and Cheung, 1994). For Indonesia and Taiwan the highest SD occurs on Tuesday. The results are contained in Table 4 below.

Table 4. Standard deviation of Returns Asian/Pacific Stock Indices by Daily return for the period August 4th 1998-October 31st 2003

Name of Countries	Monday	Tuesday	Wednesday	Thursday	Friday
China (SSEC)	0.7484	0.5994	0.6013	0.6709	0.5017
India BSE 50	0.7765	0.6623	0.6439	0.6946	0.7413
Indonesia (JKSE)	0.7977	0.8025	0.7436	0.776	0.7905
Japan Nikkei 225	0.786	0.6472	0.6918	0.6844	0.6409
Malaysia (KLSE)	0.9742	0.8603	0.7176	0.5704	0.7274
Philippines (PSE)	0.8131	0.5728	0.7826	0.6361	0.6299
Singapore Strait Times	0.7697	0.5602	0.6712	0.6047	0.6302
South Korea (KSII)	1.1554	0.9815	1.0936	0.9443	0.9803
Thailand (SETI)	0.7641	0.6919	0.8069	0.7675	0.8078
Taiwan (TWII)	0.8263	0.8883	0.812	0.6697	0.7484

However as the skewness and kurtosis statistics of the returns for each day are generally well above zero and 3 respectively, normality of the returns is rejected. This is confirmed by the results of the W Test for normality shown on Table 3. For all the stock markets, the null hypothesis that the sample is normally distributed is rejected. As a result, I use non parametric tests for further analysis.

In testing the equality of variance I employ Bartlett's test of homogeneity of variance. The Levene's test (1960) is also used here in addition because the non-normality of the distribution has been established and it has been found that Bartlett's test

tends to reject the hypothesis of homoskedasticity more often in the case of non-normal or leptokurtosis distribution. The results of the Levene's test show that in none of the ten East Asian countries can the homoskedasticity hypothesis be rejected. I therefore conclude that both the developed and emerging Asia Pacific markets in the post Asian financial crisis period have a low degree of variation across the day-of-the-week returns and this variation is not significant at any level. This observation is at variance with the pre Asian financial crisis findings. The earlier findings indicate that emerging Asian markets have a higher degree of variation in SD across the day-of-the-week than the developed markets (Ho and Cheung, 1994). In this study according to the Levene's statistics, Japan with the most developed market has the highest variation of 3.491. Other emerging markets that ranked high in terms of variation of their SD include China and Singapore with variations of 3.459 and 3.242 respectively.

5.0. Summary of findings

A) Though the-day of the week effect exists in most East Asian Pacific financial markets, the difference in the mean returns for most of the markets is not significant: nine stock markets of China, Hong Kong, India, Japan, Malaysia, Pakistan, Philippines, Singapore and South Korea. The evidence leads me to the conclusion that there is no day-of-the-week effect in Taiwan, Thailand, Sri Lanka, Pakistan and Malaysia. This result is similar to the previous findings of (Wong, Hui, and Chan, 1992).

B). Eight of the fifteen Asia Pacific markets have negative Monday returns. They all belong to the Asia Market group and they include China, Indonesia, Malaysia, Philippines, Singapore, South Korea, Sri Lanka, and Thailand.

- C). The stock market returns of Philippines and Taiwan are significantly negative at the 10% level.
- D). Four Asian stock markets show negative returns on Tuesday and they include Japan, Philippines, Thailand and Taiwan
- E). All the Asia Pacific stock markets have positive Friday returns except Japan.
- F). India is the only East Asian country whose stock market shows positive returns for all days of the week during the period.
- G). Six of the East Asian stock markets record the lowest return on Monday and they include China, Malaysia, Singapore, Sri Lanka and Thailand.
- H). Six of the Asian Pacific stock markets show their highest return on Friday and they include Thailand, Sri Lanka, Singapore, Philippines and India.
- I). There is less volatility in the daily returns in these East Asian markets since the Asian Financial crisis. The countries with the highest SD are South Korea 1.1554; Malaysia 0.9742; and Taiwan 0.8883.
- J). Seven of the countries show the highest SD on Monday and they include China, Japan, Malaysia, Philippines, Singapore, South Korea and India. This evidence is more consistent with past documentation regarding the fact that most of the Asian Pacific countries show highest SD on Monday (Ho, and Cheung, 1994).
- K). The results of the Levene's test show that in none of the 10 East Asian countries can the homoskedasticity hypothesis be rejected. I therefore conclude that both the developed and emerging East Asian markets in the post Asian financial crisis period have a low

degree of variation across the day-of-the-week returns and this variation is not significant at any level.

6.0. Conclusion

The study confirms the existence of the day-of-the week effect in East Asian stock markets. It further confirms that the variation in stock returns is not significant for most of the Asian financial markets. However the results of the Levene's test for homoskedasticity across the days of the week show evidence of lower degree of variation in standard deviation across day-of-the week for all the East Asian stock markets. This is an important finding. Prior to the Asian financial crisis, the Asian markets were characterized by high returns and volatility. Future research will attempt to identify the reasons for this new observation.

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