Day-of-the-week effects in selected East Asian stock markets

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Abstract

This study examines the day-of-the-week effects in the Taiwan, Singapore, Hong Kong and South Korea stock markets. Various significant day-of-the-week effects, including the typical negative Monday and positive Friday effects are detected in the stock markets of Taiwan, Singapore and Hong Kong. Further analysis shows that only Friday effect in Taiwan is sustainable while all other effects disappeared completely after accounting for equity risks. Besides, this study also finds evidences of risk and return tradeoff as well as asymmetrical market effects.

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I. Introduction

The day-of-the-week effect, in which the mean returns are observed to be different on each day of the week, is one of the most well-known stock market anomalies. The presence or absence of this effect has important implications for investors. Their investment strategies, portfolio selection and management will vary in accord to different effects, to reap maximum profits. Due to its importance, this issue has received extensive research in the past. Most empirical studies reported significant negative average daily return on Monday, although there is also some evidence of the lowest mean returns on other days of the week (see, Brooks and Persand, 2001; Basher and Sadorsky, 2006). Interestingly, most of the previous findings are obtained by estimation procedures that do not allow for the consideration of asymmetric behavior in stock returns[1].

However, there is no reason to pre-suppose that the return in the stock market is symmetric is nature[2]. Indeed, Alexakis and Xanthaki (1995), among the few, are able to find evidence of the asymmetric behavior in day-of-the-week effect in the Greek stock market. Similar evidence from the stock markets of 19 developed countries is found in Balaban *et al.* (2001). Working along this line of research, the major objective of this paper is to study the asymmetric behavior in the stock markets of Hong Kong, Taiwan, Singapore and South Korea. The four economies are collectively known as East Asian

[1] One exceptional case is the work of Basher and Sadorsky (2006), who estimated conditional models that allow for asymmetric market effects.

[2] Few researchers like Engle and Ng (1993), for instance, have pointed out that the market reaction on bad and good news appears to be asymmetry in nature. Besides, Engle (2001) argued that market participant react differently with negative and positive return. Indeed, there are empirical findings to suggest asymmetrical stock market behavior. For instance, Nelson (1991) found that negative returns are followed by a higher volatility than the positive returns. Glosten *et al*. (1993) show that positive (negative) unanticipated returns tend to result in downward (upward) market revision.

Tigers for maintaining high growth rates and rapid industrialization between the since early 1960s[3]. Today, these markets are the main platforms for foreign investments in the East Asian region[4], other than the Tokyo Stock Exchange market. Thus, it is worth to scrutinize whether there is any calendar anomaly (in the present context, day-of-the-week effect) in these markets. Previously, some evidence of day-of-the-week effects in these four markets has been provided by Wong *et al.* (1992), Choudhry (2000), Brooks and Persand (2001), just to name a few, using various methodologies[5]. Nonetheless, the above mentioned studies have not accounted for the asymmetrical market behavior. Hence, this study extends the study of day-of-the-week effects in these markets, by incorporating asymmetrical behavior.

II. Data and Methodology

The data for this study consists of daily closing composite indices on the East Asian Tigers stock markets, covering the period from 1st January 2000 to 31st December 2006. This study adopts the following commonly used model to examine the day-of-the-week effect:

$$R_t = a_1 + \sum_{i=2}^{5} a_i \delta_{it} + \sum_{i=1}^{k} b_i R_{t-i} + \varepsilon_t \qquad (1)$$

[3] See http://www.imf.org/external/pubs/ft/issues1/issuse1.pdf. [Retrieved: 26-10-2007].
[4] According to the World Federation of Exchange (2007), as of the end of 2006, the total market capitalization of these four stock markets is USD 3.53 trillions, which is about one-third (one-half if Japan is excluded) of the total market capitalization in the East Asian region.
[5] These authors have included at least one of the four Tigers markets in their studies, but none of these studies are solely devoted to the study of the Tiger markets as a whole using comparable methodology.

where $R_t = 100 \times \ln(I_t / I_{t-1})$ is the rate of return in period t. I_t is the stock index at the end of period t. a_{2t} to a_{5t} represent the dummy variables for Tuesday to Friday[6]. ε_t denotes the disturbance term with zero mean and constant variance.

Besides, the following Exponential Generalized Autoregressive Conditional Heteroscedasticity in mean (EGARCH-M) model, which allows one to incorporate volatility effect, risk premium as well as asymmetrical behavior in estimation, is also included in this study:

$$R_t = d_1 + \sum_{i=2}^{5} d_i \delta_{it} + \sum_{i=1}^{k} e_i R_{t-i} + f\sigma_t^2 + \xi_t \qquad (2)$$

where

$$\log\sigma_t^2 = g + \sum_{j=1}^{p} \gamma_j \log\sigma_{t-j}^2 + \sum_{i=1}^{q} \left(\beta_i \left| \frac{\xi_{t-i}}{\sigma_{t-i}} - \sqrt{\frac{2}{\pi}} \right| + \psi_i \frac{\xi_{t-i}}{\sigma_{t-i}} \right) + \sum_{i=2}^{5} h_i \delta_{it} \qquad (3)$$

where f measures the reward to risk ratio, ξ_t is an error term with zero mean and conditional variance σ_t^2 (see Nelson, 1991 for details). The signs of the estimated f and ψ_i are of particular interest. If $f < 0$, it indicates that there is a tradeoff relationship between return and risk. If $\psi_i \neq 0$, it can be interpreted as evidence of stock market asymmetric behavior.

[6] Monday dummy variable is excluded to avoid the dummy variable trap.

III. The Results

Table 1 contains summary statistics for the daily returns for all the East Asian Tigers stock indices. Among others, the most interesting features revealed by this table include: First, Monday returns are consistently negative while the Friday returns are always positive in these markets. Second, all returns have asymmetrical distribution as they have non-zero skewness. These two features sum up to suggest the presence of asymmetrical day-of-the-week effects in these markets, which is confirmed by the succeeding formal analysis.

[Insert Table 1 here]

Table 2 presents the OLS results for the day-of-the-week effects in this study. The results show that the coefficient of intercept term (a_1) that represents the average daily return on the benchmark day of Monday is significantly negative in the Taiwan (-0.26%) and Singapore (-0.13%) stock markets. This observation is consistent with previous finding of significant negative Monday and positive Friday effects in most stock markets. In the case of Hong Kong, there is a Friday effect, although negative Monday effect is not present. Besides, Tuesday and Thursday effects in also found in Singapore. In addition, Taiwan has significantly different effects throughout the 5 trading days, while there is no effect at all in South Korea, however. It is noteworthy that Brooks and Persand (2001) also reported no day-of-the-week effect in South Korea.

[Insert Table 2 here]

In further analysis, the significant mean returns reported in Table 2 are included as part of the explanatory variables in the EGARCH - M models, to determine whether the effects are due to the equity risks (Lucey, 2000). The estimated results are summarized in Table 3. Note that, if the included dummy variables (for days significant in OLS estimation) are still significant in the mean equation of the EGARCH –M model, it may be concluded that the calendar effect is not due to the variation in the equity risk. By this principle, Table 3 reveals that equity risk can account for the all the identified day-of the-week effects in Taiwan, Hong Kong and Singapore stock markets, with the exception of Friday effect in Taiwan. In other words, only the Friday effect in Taiwan is sustainable after adjusting for equity risks[7]. Besides, two other stylized features are observed in Table 3: First, the risk premium has negative impact (indicated by the sign of f) on stock returns in Taiwan (significant at 10% level), Singapore and Hong Kong. This implies a tradeoff between return and risk. Second, the three market returns exhibit asymmetrical behavior, since at least one ψ is statistically different from zero. Moreover, the statistically significant positive values of ψ 's in most cases reveals that positive return will induce higher volatility in return than negative return in these markets except South Korea.

[Insert Table 3 here]

IV. Conclusion

This study examines the day-of-the-week effects in the Taiwan, Singapore, Hong Kong and South Korea stock markets. Among others, this study, in line with most previous studies, finds the existence of various significant day-of-the-week effects, including the

[7] This finding is consistent with Basher and Sardorsky (2006), which show that day-of-the-week effects are present in, among others, Taiwan even after adjusting for market risk.

typical negative Monday and positive Friday effects, in all these markets except the South Korea stock market. However, after adjusting for equity risks, only the Friday effect (positive return) in Taiwan is sustainable while all other effects disappeared completely. Besides, this study also finds evidences of risk and return tradeoff as well as asymmetrical market effects. One major implication of these findings is that investors in Taiwan, Singapore and Hong Kong may consider buying shares on Monday and selling them on Friday, or conversely short-selling on Friday and buying back on Monday. As for the South Korea stock market, further researches may be conducted to see whether there are other forms of anomalies to be exploited.

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Table 1. *Summary statistics on the day-of-the-week effects in the East Asian Tigers stock markets*

	Mean	Std. Dev	Skewness	Kurtosis	Jarque-Bera (*P* - value)	Mean Return per unit of Risk
Taiwan						
Monday	-0.2463	1.8688	-0.6728	5.8934	154.8570 (0.0000)	-0.1318
Tuesday	-0.0262	1.4096	0.7688	5.5869	137.7322 (0.0000)	-0.0186
Wednesday	0.0782	1.5810	0.0814	4.5576	37.2993 (0.0000)	0.0495
Thursday	-0.0049	1.5053	-0.2012	5.6575	109.8724 (0.0000)	-0.0033
Friday	0.1684	1.4318	0.0836	5.1381	69.9500 (0.0000)	0.1176
Singapore						
Monday	-0.1218	1.3169	-1.0379	9.7559	759.6619 (0.0000)	-0.0925
Tuesday	0.0393	0.9901	0.0213	4.3615	28.2203 (0.0000)	0.0397
Wednesday	-0.369	1.0957	-1.3701	11.2584	1151.4180 (0.0000)	-0.3368
Thursday	0.031	1.0613	0.4091	4.3634	38.4510 (0.0000)	0.0292
Friday	0.128	0.9985	-0.1441	7.1984	269.3332 (0.0000)	0.1282
Hong Kong						
Monday	-0.0443	1.3918	-0.8205	8.2208	455.4873 (0.0000)	-0.0318
Tuesday	0.0222	1.1166	0.4271	4.4624	43.6221 (0.0000)	0.0199
Wednesday	-0.0188	1.4053	-1.0202	10.1497	840.7446 (0.0000)	-0.0134
Thursday	-0.0315	1.2704	-0.0802	4.6142	40.0202 (0.0000)	-0.0248
Friday	0.1106	1.1556	0.1214	5.1198	69.2343 (0.0000)	0.0957
South Korea						
Monday	-0.1262	2.1431	-0.7807	6.6746	242.4364 (0.0000)	-0.0589
Tuesday	0.0397	1.5352	-0.0329	4.9128	55.7076 (0.0000)	0.0259
Wednesday	0.0683	1.9337	-0.8865	9.7877	748.4972 (0.0000)	0.0353
Thursday	0.0271	1.6829	0.2486	6.3283	172.2269 (0.0000)	0.0161
Friday	0.0743	1.7284	-0.3745	4.7477	54.9855 (0.0000)	0.0430

Table 2. *OLS results for day-of-the-week effects*

Parameter	Taiwan	Singapore	Hong Kong	South Korea
Constant	-0.2644*	-0.1254**	-0.0473	-0.1363
a_1	(0.0013)	(0.0281)	(0.4738)	(0.1515)
Tuesday	0.2429**	0.1745**	0.0800	0.1796
a_2	(0.0369)	(0.0310)	(0.3918)	(0.1811)
Wednesday	0.3479*	0.0945	0.0443	0.2199
a_3	(0.0028)	(0.2423)	(0.6348)	(0.1015)
Thursday	0.2794**	0.1586**	0.0278	0.1713
a_4	(0.0163)	(0.0495)	(0.7656)	(0.2022)
Friday	0.4105*	0.2532*	0.1541***	0.2174
a_5	(0.0004)	(0.0017)	(0.0987)	(0.1055)
Return (-1)	0.0257	0.0217	0.0191	0.0033
b_1	(0.2712)	(0.3540)	(0.4161)	(0.8871)
Return (-2)	0.0525**	-0.0027	-0.0290	-0.0376
b_2	(0.0249)	(0.9076)	(0.2148)	(0.1092)
Return (-3)	0.0318	0.0489**	0.0310	-0.0059
b_3	(0.1742)	(0.0354)	(0.1819)	(0.8004)
Return (-4)	-0.0891*	0.0644*	0.0206	-0.0025
b_4	(0.0001)	(0.0056)	(0.3757)	(0.9136)
ARCH-LM Statistic (p-value)[a]				
5 lags	0.0000	0.0000	0.0000	0.0000
10 lags	0.0000	0.0000	0.0000	0.0000
Ljung-Box Q^2 Statistic (p-value)[b]				
5 lags	0.0000	0.0000	0.0000	0.0000
10 lags	0.0000	0.0000	0.0000	0.0000
Wald Test (p-value)[c]				
F-statistic	0.0056	0.0265	0.5178	0.4544
Chi square	0.0054	0.0262	0.5176	0.4542

*, ** and *** denote significant at 1, 5 and 10% level respectively. Numbers in parentheses depict p-values. [a] Test for remaining ARCH effect. [b] Test for serial correlation. [c] Null hypothesis is: $H_0 = a_2 = a_3 = a_4 = a_5$ (same average daily return for the week).

Table 3. *Estimated EGARCH - Mean model*

Parameter	Taiwan	Singapore	Hong Kong
(*p,q*)	(*1,4*)	(*4,3*)	(*3,3*)
Constant, d_1	0.0491 (0.5559)	0.0302 (0.4759)	0.0185 (0.6171)
Tuesday, d_2	-0.0502 (0.5641)	0.0100 (0.8408)	--
Wednesday, d_3	0.0998 (0.2864)	--	--
Thursday, d_4	0.0582 (0.5430)	-0.0177 (0.7265)	--
Friday, d_5	0.1789 (0.0508)***	0.0532 (0.2907)	0.0441 (0.4127)
Return (-1), e_1	0.0074 (0.7402)	0.0077 (0.7097)	0.0302 (0.1480)
Return (-2), e_2	0.0065 (0.7890)	0.0174 (0.4550)	-0.0255 (0.2123)
Return (-3), e_3	-0.0009 (0.9691)	0.0039 (0.8634)	0.0382 (0.0620)***
Return (-4), e_4	-0.0653 (0.0068)*	0.0330 (0.1612)	-0.0074 (0.7234)
f	-0.0400 (0.0952)***	-0.0169 (0.6305)	-0.0006 (0.9826)

Table 3. *Estimated EGARCH - Mean model (continued)*

Variance Equation			
Parameter	Taiwan	Singapore	Hong Kong
g	0.8457 (0.0000)*	-0.2119 (0.0000)*	0.1118 (0.0000)*
γ_1	-0.0470 (0.0000)*	-0.0292 (0.0000)*	-0.1883 (0.0000)*
γ_2	--	-0.0724 (0.0000)*	-0.0002 (0.9823)
γ_3	--	-0.0781 (0.0000)*	0.1663 (0.0000)*
γ_4	--	-0.0465 (0.0000)*	--
γ_5	--	--	--
β_1	1.3718 (0.0000)*	-0.2996 (0.0000)*	0.7362 (0.0000)*
β_2	0.1769 (0.0000)*	0.2685 (0.0000)*	0.9614 (0.0000)*
β_3	-1.3707 (0.0000)*	0.9722 (0.0000)*	-0.7037 (0.0000)*
β_4	0.8160 (0.0000)*	--	--
β_5	--	--	--
ψ_1	0.1017 (0.0000)*	0.0500 (0.0000)*	-0.1506 (0.0000)*
ψ_2	--	0.1758 (0.0000)*	-0.0045 (0.8021)
ψ_3	--	0.1501 (0.0000)*	0.2114 (0.0000)*
ψ_4	--	0.1539 (0.0000)*	--
Tuesday, h_2	-1.7023 (0.0000)*	-0.0592 (0.4350)	--
Wednesday, h_3	-0.8954 (0.0000)*	--	--
Thursday, h_4	-0.3366 (0.0816)***	-0.4857 (0.0000)*	--
Friday, h_5	-1.6667 (0.0000)*	-0.4736 (0.0000)*	-0.7676 (0.0000)*
ARCH-LM Statistic (p-value)[a]			
5 lags	0.7760	0.3289	0.6258
10 lags	0.6384	0.4251	0.6784
Ljung-Box Q^2 Statistic (p-value)[b]			
5 lags	0.7880	0.3310	0.6220
10 lags	0.6480	0.4450	0.6250
Wald Test (p-value)[c]			
F-statistic	0.0000	0.0000	0.0000
Chi square	0.0000	0.0000	0.0000

Notes: SIC is used to select the best fit GARCH (p, q) models, out of the various combination of p and q, which range from 1 to 5 in both cases, see Lucey (2000). *, ** and *** denote significant at 1, 5 and 10% level respectively. Numbers in parentheses depict p-values. [a] Test for remaining ARCH effect. [b] Test for serial correlation. [c] Test the significance of the variance equation.