

Holiday Effect of East Asian Markets Reciprocally

Beenish Bashir and Shumaila Zeb

Abstract—This paper reconnoitered the holiday effect of East Asian stock markets over each other. SSE-180 index (Shanghai Stock Exchange), NIKKIE 225 (Japan), TWII (Taiwan Weighted Index), HSI (Hang Seng) epitomized East Asian region. The key objective is to investigate the return effect on East Asian stock markets coinciding with the S&P 500 (Standard and poor) holidays further the return effect on East Asian stock markets during the trading session when there is no trading on other East Asian stock markets. By means of TGARCH model using daily return of East Asian Stock Exchanges and S&P 500 from January 1, 2003 to December 31, 2012. Day-of-the-Week effect, as well as regional and international spillovers has been considered, robust results have been found by this study. Outcomes of this paper have implications for international investors. It is of immense importance for an investor to consider the holidays of the interlinked stock markets when investing in a particular market of a region as holidays not only affect the returns of the portfolios but risk as well.

Index Terms—Holiday effect, international spillovers, TGARCH model, volatility.

I. INTRODUCTION

Globalization has made the worldwide financial markets more interconnected and linked, an indulgence of the correlations and interactions among various financial markets is essential for financial institutions, investors, and governments. Capital market liberalization results into a high correlation amongst local and international markets [1]. East Asian countries are considered for studying the interconnection. As, economy of this region is rising being the home of world's most affluent economies like China, Taiwan, Japan and Hong Kong. "Reference [2] shows that East Asia contributed 40% of world growth and the regional growth was 7.5%. It is anticipated that in 2013 this regional growth will raise to 7.8%". This research focus on stock markets and efficient market hypothesis (EMH) is the most vital concept for such analysis. Financial markets are information-ally efficient and market prices completely reflect available information [3]. However, seasonal effects are one of the prominent anomalous return trends, specifically, day-of-the-week effect, pre-holiday effect [4]. Further reference [5] explored significant pre-holiday effects in the New Zealand market; and reference [6] documented pre-holiday effect in Australia. Studies are also conducted to investigate the information integration in these markets, various stock market indices of Asia, Europe and US market to explore how these markets are linked and how information flow from one market to another market holiday. The lag of

Asian market is found statistical significant for the flow of holiday information because of the time zone difference in developed countries sock markets and emerging markets [7]. Similar results are found in future market [8]. There is also an impact of US holiday on other global markets. On US holiday, European market expects to get average return, because of unavailability of US investor and lack of macroeconomic information. These out comes of US holiday will change the investor mix on European markets [9]. The data comprise of the daily opening and closing of five indexes: SSE-180 index (China), NIKKIE 225 (Japan), TWII (Taiwan), HSI (Hong Kong) and S&P 500 (US). These indexes reflect overall stock market activities of selected countries. Using opening and closing prices, we have obtained two return measures: The ordinary return (R_t^{cc} close to close returns) and the intraday return (R_t^{oc} open to close return).

II. METHODOLOGY

In this study we aim to model the returns of selected indexes, with conditional volatility models. Results given in this paper are from TGARCH model by using the following TGARCH model:

$$r_t^i = \alpha_0 + \phi_1 r_{t-1}^i + \sum_{i=1}^4 \alpha_i D_o w_{it} + \sum_{i=1}^3 \beta_i r_t^i + \delta_1 r_{t-1}^{us} + \sum_{i=1}^4 \rho_i p D_h + \sum_{i=1}^4 \xi_i n D_h + \varepsilon_t \quad (1)$$

where

ε_t follows a $N(0, h_t)$;

$$h_t = \omega + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 h_{t-1} + \gamma_3 I_t \varepsilon_{t-1}^2 + \sum_{i=1}^4 v_i D_t I_t \varepsilon_{t-1}^2 + \sum_{i=1}^4 \theta_i \varepsilon_{t-1}^2 \quad (2)$$

$$I_t = \begin{cases} 1 & \text{if } \varepsilon_{t-1} < 0 \\ 0 & \text{if } \varepsilon_{t-1} \geq 0 \end{cases}$$

$$D_t = \begin{cases} 1 & \text{if there is market off in country } i, \\ 0 & \text{otherwise} \end{cases} \quad (3)$$

Refer to "(1)", $\sum_{i=1}^4 \alpha_i D_o w_{it}$ is dummy variable for the Day-of-the-Week with value "1" for Tuesday, Wednesday, Thursday and Friday, $i=1 \dots 4$. $\phi_1 r_{t-1}^i$ is the lagged term of index on the left side of the equation which identify serial correlation in the data and also tell us whether return of day 1 affects the return of day 2 i -e next day returns. $\sum_{i=1}^3 \beta_i r_t^i$ is the return of remaining three East Asian markets when the fourth one is acting as r_t^i , $i=1, 2, 3$. As US is 12 hours behind the East Asian time zone, lagged term of US return r_{t-1}^{us} is considered [6]. $\sum_{i=1}^4 \rho_i D_h$ is the dummy variable for

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positive US holiday after positive closure of S&P 500 and for three regional countries on the right side of mean equation when one of the regional country is on the left side of the mean equation, $i=1 \dots 4$. This dummy variable takes the value of "1" on positive US holiday and on the positive holiday of three regional countries otherwise "0". $\sum_{i=1}^4 \xi_i nD_h$ is the dummy variable for negative US holiday after negative closure of S&P 500 and for three regional countries on the right side of mean equation when one of the regional country is on the left side of the mean equation, $i=1 \dots 4$. This dummy variable takes the value of "1" on negative US holiday and on the negative holiday of three regional countries otherwise "0". Conditional volatility equation is the form of asymmetric GARCH model [10]. Refer to "(2)",

checks impact of positive and negative innovation on volatility by using dummy variable I_t . This dummy variable is "1" if $\varepsilon_{t-1} < 0$ otherwise "0". The positive and significant value of this dummy depicts that non-positive jolt has more impact as compare to the positive jolt of the equal extent. $\sum_{i=1}^p \theta_i \varepsilon_{t-1}^2$ are lag of squared error terms of Taiwan, Hong Kong, Japan and US indices to testify volatility transmission from regional and international markets. If $\nu_i < 0$ then it is concluded that holiday has a reducing effect on the volatility. If = 0 then there is no impact of holiday on market volatility and if > 0 then holiday increased the market volatility. Holiday is modeled through dummy variable holiday. This dummy is "1" on holiday of US and East Asian markets and "0" otherwise.

TABLE I: DESCRIPTIVE STATISTICS

Statistics		Hong Kong	Japan	China	Taiwan	USA
Mean	CC	0.000339	6.76E-05	0.000254	0.000204	0.000204
	OC	-0.000188	-0.000315	0.000818	-0.001245	0.000243
Median	CC	0.000000	0.000000	0.000000	5.37E-05	0.000452
	OC	0.000000	0.000000	0.000000	-0.000506	0.000506
Maximum	CC	0.134068	0.132346	0.107116	0.065246	0.109572
	OC	0.121553	0.116581	0.084430	0.059570	0.102457
Minimum	CC	-0.135820	-0.121110	-0.105661	-0.069123	-0.094695
	OC	-0.116162	-0.105634	-0.101384	-0.055916	-0.091272
SD	CC	0.015687	0.014939	0.017304	0.013252	0.012882
	OC	0.011019	0.011359	0.016017	0.010326	0.012446
Skewness	CC	0.034131	-0.582261	-0.303955	-0.366019	-0.299995
	OC	0.293570	-0.596340	-0.244074	-0.133175	-0.352445
Kurtosis	CC	12.78474	12.56809	7.504199	6.133648	13.64460
	OC	18.69388	18.69388	6.276953	6.168689	13.17956
Jarque-Bera	CC	10408.36	10099.48	2245.628	1125.743	12356.61
	OC	26133.85	28945.85	1163.074	1071.401	11032.42
Probability	CC	0.000000***	0.000000***	0.000000***	0.000000***	0.000000***
	OC	0.000000***	0.000000***	0.000000***	0.000000***	0.000000***
Sum	CC	0.883430	0.176488	0.661943	0.531567	0.450384
	OC	-0.477777	-0.801849	2.080440	-3.167244	0.617163

TABLE II: CORRELATION MATRIX-ORDINARY RETURN

Correlation(CC)	Hong Kong	Japan	China	Taiwan	USA
Hong Kong	1.000000				
Japan	0.608600*** (0.0000)	1.000000			
China	0.404672*** (0.0000)	0.239845*** (0.0000)	1.000000		
Taiwan	0.569828*** (0.0000)	0.548801*** (0.0000)	0.246439*** (0.0000)	1.000000	
USA	0.224620*** (0.0000)	0.115615*** (0.0000)	0.066550*** (0.0000)	0.129891*** (0.0000)	1.000000

TABLE III: CORRELATION MATRIX-INTRADAY RETURN

Correlation(OC)	Hong Kong	Japan	China	Taiwan	USA
Hong Kong	1.000000				
Japan	0.306383*** (0.0000)	1.000000			
China	0.360209*** (0.0000)	0.135094*** (0.0000)	1.000000		
Taiwan	0.422690*** (0.0000)	0.287504*** (0.0000)	0.199917*** (0.0000)	1.000000	
USA	0.310153*** (0.0000)	0.136243*** (0.0000)	0.081211*** (0.0000)	0.179563*** (0.0000)	1.000000

TABLE IV (A): ESTIMATION- ORDINARY RETURN

Mean Equation	r_t^{sse}	r_t^{hgkg}	r_t^{jap}	r_t^{tai}	Variance Equation	sse	hgkg	jap	tai
α_0	0.0003(0.56)	0.000*(0.06)	0.00(0.83)	-0.00(0.39)	ω	0.000*** (0.00)	0.00** (0.03)	0.00*** (0.00)	0.000*** (0.00)
ϕ_1	0.0050 (0.79)	-0.076 (0.32)	-0.03(0.12)	0.038(0.22)	γ_1	0.035*** (0.00)	0.04*** (0.00)	0.02*** (0.00)	0.06*** (0.00)
α_1	-0.0011(0.19)	-0.008*(0.08)	-0.00(0.38)	-0.00(0.89)	γ_2	0.93 *** (0.00)	0.87*** (0.00)	0.86*** (0.00)	0.84*** (0.00)
α_2	0.0003(0.70)	-0.001 ** (0.02)	-0.00(0.52)	0.01** (0.04)	γ_3	0.025*** (0.00)	0.053*** (0.00)	0.08*** (0.00)	0.06*** (0.00)
α_3	-0.0016** (0.04)	-0.000 (0.30)	0.00(0.48)	0.00(0.77)	u_{sse}	-11.0** (0.01)	2.68(0.81)	5.70(0.67)	28.5* (0.09)
α_4	0.00004(0.5936)	-0.000(0.50)	-0.00(0.24)	0.00(0.20)	u_{tai}	20.0(0.17)	8.47*(0.06)	1.12(0.78)	14.7(0.11)
β_{sse}		0.14*** (0.00)	0.01(0.92)	0.00(0.39)	u_{hgkg}			-11.46(0.12)	14.7(0.11)
β_{tai}	0.0265(0.3111)	0.32*** (0.00)	0.26*** (0.00)	0.26*** (0.00)	u_{jap}	73.2 *** (0.00)	19.0*(0.06)		-15.0*(0.07)
β_{hgkg}	0.422 *** (0.00)		0.27*** (0.00)	0.32*** (0.00)	u_{us}	0.01 ** (0.01)	4.35(0.25)	0.007* (0.09)	-0.00(0.70)
β_{jap}	0.0249(0.36)	0.242*** (0.00)		0.26*** (0.00)	θ_{sse}		0.00(0.41)	-0.02*** (0.00)	0.00(0.80)
δ_1	-0.07 *** (0.00)	0.237*** (0.00)	0.33*** (0.00)	0.05*** (0.00)	θ_{tai}	-0.004(0.14)	0.00(0.10)	0.013*** (0.00)	0.013*** (0.00)
ρ_{sse}		0.003*** (0.00)	-0.05(0.67)	-0.00(0.54)	θ_{hgkg}	0.013*** (0.00)		0.00(0.32)	0.00(0.22)
ρ_{tai}	0.0010(0.65)	0.001(0.24)	0.017(0.25)	0.02* (0.09)	θ_{jap}	-0.04 ** (0.03)	0.00(0.80)		-0.00(0.85)
ρ_{hgkg}	-0.0004(0.82)		-0.04(0.74)	0.02* (0.09)	θ_{us}	-0.003(0.24)	0.02*** (0.00)	0.007*** (0.09)	0.02*** (0.00)
ρ_{jap}	-0.0002 (0.93)	-0.00(0.37)		0.00(0.48)					
ρ_{us}	0.0035 *(0.05)	0.001(0.17)	-0.00(0.43)	-0.00(0.67)					
ξ_{sse}		-0.000(0.16)	-0.00(0.72)	0.00(0.43)					
ξ_{tai}	0.0010(0.59)	-0.001(0.29)	0.02** (0.04)						
ξ_{hgkg}	-0.0007 (0.72)		-0.001(0.18)	0.00(0.29)					
ξ_{jap}	0.000(0.88)	0.0009(0.29)		0.00(0.78)					
ξ_{us}	-0.0010(0.63)	0.00(0.40)	0.00(0.95)	-0.03** (0.03)					

III. EMPIRICAL RESULTS

Table I and Table II highlights the value of correlation for the returns used in this study. All the markets are correlated which signifies the importance of this study. If markets are correlated then there is a chance that holidays in one market affect other markets. The multicollinearity problem in both types of returns (ordinary returns and intraday returns) has been tested separately through the correlation matrix using

Pearson’s correlation test. The correlation result in both types indicates that there is no stern multicollinearity problem.

Table III summarizes the descriptive statistics and distributional properties of index of ordinary returns (R_t^{cc} close to close returns) and the intraday return (R_t^{oc} open to close return). The returns are slightly skewed. Furthermore surfeit kurtosis confirms the leptokurtic nature of the distributions of index return.

TABLE IV (B): ESTIMATION- INTRADAY RETURN

Mean Equation	r_t^{sse}	r_t^{hkg}	r_t^{jap}	r_t^{tai}	Variance Equation	sse	hkg	jap	tai
α_0	0.0003(0.56)	0.000*(0.06)	0.00(0.83)	-0.00(0.39)	ω	0.000****(0.00)	0.00****(0.03)	0.00****(0.00)	0.00****(0.00)
ϕ_1	0.0050(0.79)	-0.076(0.32)	-0.03(0.12)	0.038(0.22)	γ_1	0.035****(0.00)	0.04****(0.00)	0.02****(0.00)	0.06****(0.00)
α_1	-0.0011(0.19)	-0.008*(0.08)	-0.00(0.38)	-0.00(0.89)	γ_2	0.93****(0.00)	0.87****(0.00)	0.86****(0.00)	0.84****(0.00)
α_2	0.0003(0.70)	-0.001***(0.02)	-0.00(0.52)	0.01****(0.04)	γ_3	0.025****(0.00)	0.053****(0.00)	0.08****(0.00)	0.06****(0.00)
α_3	-0.0016***(0.04)	-0.000(0.30)	0.00(0.48)	0.00(0.77)	u_{sse}		2.68(0.81)	5.70(0.67)	28.5*(0.09)
α_4	0.00004(0.5936)	-0.0000(0.50)	-0.00(0.24)	0.00(0.20)	u_{tai}	-11.0***(0.01)	8.47*(0.06)	1.12(0.78)	14.7(0.11)
β_{sse}		0.14****(0.00)	0.01(0.92)	0.00(0.39)	u_{hkg}	20.0(0.17)		-11.46(0.12)	14.7(0.11)
β_{tai}	0.0265(0.3111)	0.32****(0.00)	0.26****(0.00)		u_{jap}	73.2****(0.00)	19.0*(0.06)		-15.0***(0.07)
β_{hkg}	0.422		0.27****(0.00)	0.32****(0.00)	u_{us}	0.01***(0.01)	4.35(0.25)	0.007*(0.09)	-0.00(0.70)
β_{jap}	0.0249(0.36)	0.242****(0.00)		0.26****(0.00)	θ_{sse}	0.00(0.41)	0.00(0.41)	-0.02****(0.00)	0.00(0.80)
δ_1	-0.07****(0.00)	0.237****(0.00)	0.33****(0.00)	0.05****(0.00)	θ_{tai}	-0.004(0.14)	0.00(0.10)	0.013****(0.00)	0.00(0.22)
ρ_{sse}		0.003****(0.00)	-0.05(0.67)	-0.00(0.54)	θ_{hkg}	0.013****(0.00)		0.00(0.52)	0.00(0.22)
ρ_{tai}	0.0010(0.65)	0.001(0.24)	0.017(0.25)		θ_{jap}	-0.04***(0.03)	0.00(0.80)		-0.00(0.85)
ρ_{hkg}	-0.0004(0.82)		-0.04(0.74)	0.02*(0.09)	θ_{us}	-0.003(0.24)	0.02****(0.00)	0.007****(0.09)	0.02****(0.00)
ρ_{jap}	-0.0002(0.93)	-0.00(0.37)		0.00(0.48)					
ρ_{us}	0.0035*(0.05)	0.001(0.17)	-0.00(0.43)	-0.00(0.67)					
ξ_{sse}		-0.000(0.16)	-0.00(0.72)	0.00(0.43)					
ξ_{tai}	0.0010(0.59)	-0.001(0.29)	0.02****(0.04)						
ξ_{hkg}	-0.0007(0.72)		-0.001(0.18)	0.00(0.29)					
ξ_{jap}	0.0000(0.88)	0.0009(0.29)		0.00(0.78)					
ξ_{us}	-0.0010(0.63)	0.00(0.40)	0.00(0.95)	-0.03****(0.03)					

Thus all the returns can be used to test the model. Parameter estimates of East Asian stock market for both types of returns showing mean and variance equation is summarized in Table IV (a) & IV (b). Analyzing coefficients estimates of mean equation, Chinese market shows negative Day-of-the-week effect for Thursday [11]. In Hong Kong market we found significant negative Day-of-the-week effect for Wednesday in both types of returns but negative effect of Tuesday is statistically significant in ordinary returns only, inconsistent with previous literature [12]. In Taiwan market we establish significant positive Day-of-the-week effect for Wednesday [13]. In Chinese market, for intraday returns Hong Kong and Taiwan is showing positive significant effect

with no effect of international spillover but in ordinary returns only Hong Kong is showing positive significant effect and negative effect of global spillover in Chinese market. In case of Hong Kong, area and international spillover coefficients are significant but extent of the spillover effect from area and international markets varies. For Japanese market, intraday returns these coefficients have significant impact with the variability of magnitude These results are consistent in ordinary returns with the exception of Chinese market. Coefficients estimates of (Taiwan) mean equation shows that in intraday returns area and international spillover coefficients are found to be significant. But the intensity of regional and international spill over is different. These results

are consistent in ordinary returns with the exception of Chinese market. The sign of news may have an impact on price movements [9].

Chinese market shows statistical significant effect of lag of positive closure in US market for ordinary return whereas lag of positive closure of Japanese market is having negative significant effect for intraday return. In Hong Kong market statistical significant effect of lag of positive closure in Chinese market for both types of returns. But intraday returns have an additional impact of second lagged positive closure of USA and negative closure of Chinese market. Japanese market shows statistical positive significant effect of lagged negative closure in Taiwan market for ordinary return whereas lagged negative closure of Taiwan and Hong Kong market is having positive and negative significant effect for intraday return respectively. Taiwanese market shows statistically significant effect of second lagged negative closure in USA market for ordinary return and intraday return, as there is time zone difference of 12 hours in East Asian market and USA. Lag of positive closure Hong Kong market is having positive significant effect in both cases. These results are consistent with previous studies [7]. Turning towards the variance equation. Positive coefficient of γ_1 in both types of returns for four selected East Asian market proposes that abrupt stock returns (ε_{t-1}^2) upsurge the riskiness in stock market.

Additionally, positive and significant values of (γ_2) expresses that uncertainty in the East Asian stock market is highly tenacious. As (γ_3) is statistically significant and positive, we can clinch that non positive information in these markets has more effect in contrast to positive information of the same magnitude. In Chinese market, volatility spillover effect of Hong Kong and Japan remain significant in both types of returns. First lag of Taiwan holiday has negative significant effect on volatility in both types of return. First lag of Japanese holidays has positive effect on the volatility of intraday and ordinary return. But the second lag of USA is statistically significant in ordinary returns only.

In Hong Kong market international volatility spillover effect is significant in both types of return. In regional volatility spillover effect only Taiwan is showing significant effect. Second lag effect of US holiday is negatively significant in intraday return. Lag effect of Japanese holiday is statistical significant in both cases. But lag effect of Chinese holiday has positive significant effect for intraday returns. Japanese market in both types of returns, regional volatility spillover effect remains significant in intraday return. There is positive spillover effect of Taiwan and negative spillover effect of China along with positive global spillover effect. Second lag effect of USA holiday is statistically significant in ordinary return. But in intraday return lag effect of holiday in China and Taiwan are significant. For Taiwanese market there is positive global spillover effect in ordinary as well in intraday return. In regional volatility spillover effect Hong-Kong is statistically significant in intraday return. Second lag effect of USA holiday is statistically significant in intraday return. Lag effect of Japanese holiday is significant in both types of returns. But lag effect of holiday in China is significant in

ordinary return.

IV. CONCLUSION

This paper contributes to the debate on effect of holidays of interconnected stock markets on one another. Empirical results showed that stock markets in East Asian region are having statistically significant correlation. Also there are return and volatility spillovers from one market to other. But mainland Chinese stock market being biggest market in the region has minimum spillovers from other markets. Our empirical results on lagged effect of holidays show that information inflow and flow of investment due to portfolio adjustment plays a vital role in market activities. If one market is closed in the region it has effect on the following days return due to portfolio adjustment. Not only returns are being affected but volatility of the market as well. Even there is different effect of holiday which is after a positive or negative return day. Our results also shows that in the East Asian economies investors are not good news seekers instead investors react strongly to negative information in comparison to positive news of same magnitude. Results provided by this paper have implications for international investors. It is of immense importance for an investor to consider the holidays of the interlinked stock markets when investing in a particular market of a region as holidays not only affect the returns of the portfolios but risk as well. Future research can be conducted on volume data as well as spread of ask and bid prices so that effect of holidays can be studied on other dynamics of market.

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