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Stock Market Integration: Case of the Philippines

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This study examines the relationships of stock returns in various international market—the US, UK, Japan, Singapore, China (via Shanghai and Hong Kong)—with those in the Philippines for the period 2000 to 2010. The study uses the Markov-Switching (MS) model to define the structural breaks in the returns. The results indicate that the Philippine stock market integration with the world—whether US, UK or Asia— is low.

Keywords: Markov switching models, Regime-switching, MSVAR, Philippine stock market, structural breaks

1 Introduction

The interest in the relationship between international stock markets has increased in the past two decades. Studies such as Hamao, Masulis and Ng (1990), Liu and Pan (1997), and Chan and Karim (2010) focus on the volatility spillover effects of major stock markets such as the US, UK, and Japan towards Canada and Germany (Theodossiou & Lee, 1993), the Pacific-Basin (Liu & Pan, 1997), and ASEAN countries (Chan & Karim, 2010). While few studies find presence of positive contagion effects internationally (Hsin, 2004; Chan-Lau, Mathieson & Yao, 2004; Billio, Duca & Pelizzon, 2005) and regionally through trade in goods and services (Kaminsky & Reinhart, 2000), others like Forbes and Rigobon (2002) contradict most of the findings of contagion effects, concluding that there is no contagion among stock market movements, but only interdependence.

Studies have explored the effects of the world financial crises on the relationship of various international stock markets. The structural changes are centered around the crises, such as the 1987 stock market crash in the US (Hamao et al*.,* 1990; Liu & Pan, 1997; Forbes & Rigobon, 2000; Theodossiou and Lee, 1993), the 1997 Asian financial crisis (Hsin, 2004; Kaminsky & Reinhart, 2000; Forbes & Rigobon, 2000; Hu & Shin, 2008; Chan-Lau et al*.,* 2004; Yang, Kolari & Min, 2003; Chancharat, 2009), and the 2007 Asian financial crisis (Chan & Karim, 2010). The financial crisis periods are treated exogenously, defining the crisis periods as breakpoints, where structural changes are tested.

The linkage after a crisis between international stock market returns can be examined in a number of ways. One way is to measure the volatility spillover effects across international stock markets and determine which market affects which market (Hamao et al*.,* 1990; Theodossiou & Lee, 1993; Chan-Lau et al*.*, 2004; Liu & Pan, 1997; Hsin, 2004). A second way of examining the relationship is to observe for the presence of contagion through the changes in correlation between the movements of the stock returns. If the cross-market linkage significantly increases, then it is said that contagion is present (Chan-Lau et al*.,* 2004; Forbes & Rigobon, 2002). Most of the empirical literature uses one of the following methodologies to measure how much shocks are transmitted internationally (and regionally) and the magnitude of its effect on other economies: cross-market correlation coefficients, ARCH and GARCH models, cointegration techniques and direct estimation of specific transmission mechanisms[1].

This study examines the relationships of stock returns in various international market—the US[2], UK, Japan, Singapore, and China (via Shanghai and Hong Kong)—with those in the Philippines for the period 2000 to 2010. (Figure 1 shows the relative levels of stock market indices of selected countries

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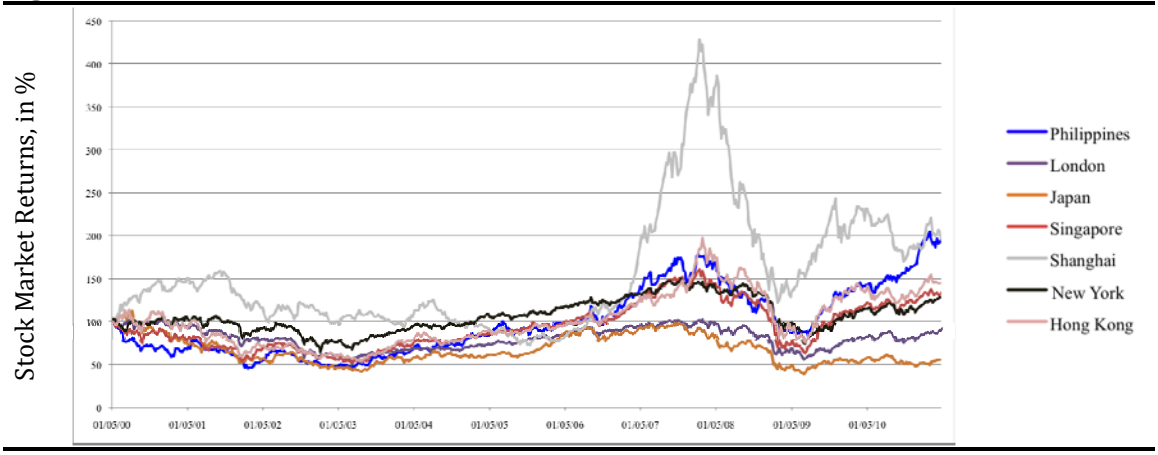
1 See Forbes and Rigobon (2002) for a more comprehensive review of literature on the methodologies used.

2 The author decided to use the Dow Jones Industrial Average (DJIA) to represent the US. The S&P 500 stock index was considered and examined but results were not substantially different with DJIA. For example, by region, the correlations of the PSE with DJIA in regime 1 is 0.22 compared with 0.12 with S&P indices and in regime 2, it is 0.38 and 0.22 respectively.

for the period.) Since the international propagation of financial shocks may be nonlinear (Billio et al., 2005), Markov-switching (MS) model is used to define the structural breaks (regime switch) in the returns.

Figure 1. Stock market returns for 2000 – 2010.



This figure graphs stock market indices of the seven countries included in the paper. The indices are set to 100 on January 5, 2000 and are based on its respective local currencies.

The paper has three primary motivations. First, the study adds to the literature on Philippine stock market returns in relation with major international stock markets. Since Asia is on the rise, the Philippine market may present a profitable market opportunity. Second, the paper examines whether world events affect the Philippine market similarly as it affects the major stock markets. Empirical results show that international stock market relationships change after a world financial crisis, e.g., the October 1987 stock market crash, (Hamao et al., 1990) and the 1997 Asian financial crisis (Yang et al., 2003; Click & Plummer, 2003). But is this true in the case of the Philippines? Lastly, the study investigates the relative importance of regional (within Asia) and global (US and UK) factors in the performance of the Philippine equity market.

The results of this paper demonstrate that the Philippine stock market is likely to stay in one regime when the source of volatility is domestic rather than foreign. Second, the local market is more regionally correlated than globally in both regimes of high and low variances from January 2000 to December 2010.

The paper is organized as follows: Section 2 briefly reviews the literature. Section 3 describes the empirical methods and data. Section 4 presents the empirical results and the last section concludes the paper.

2 Review of Literature: Relationships of international stock markets

One way of illustrating the relationship of international stock markets is to explore the volatility spillover of each market's mean and variance. The analysis of Hamao et al. (1990) utilizes the autoregressive conditionally heteroskedastic (ARCH) family of statistical models to explore the relationship of the market returns of the three major stock markets in the world, namely, New York, London, and Japan. Using daily returns from April 1, 1985 to March 31, 1988, they find positive correlations between "contemporaneous" Tokyo and London returns, London and New York returns, and lagged New York and Tokyo (p. 289). A similar study by Theodossiou and Lee (1993) includes Canada and Germany in their sample and uses weekly data and a wider span of sample period, from January 11, 1980 to December 27, 1991. Their results show that the correlations structure of returns in the five markets is constant over the sampling period. They conclude that "a constant correlation structure implies that the increased co-movements in the stock indices that are observed after major market corrections are due to changes in the covariance structure of returns rather than the

correlation structure. In particular, the increased magnitude of volatility is offset by an equivalent magnitude in the covariance structure, leaving the correlation structure unchanged" (p. 350).

Liu and Pan (1997) use daily returns from January 3, 1984 to December 30, 1991 to examine the interdependence of the stock markets in US and Japan with four Asian markets, namely Hong Kong, Singapore, Taiwan, and Thailand. Their study shows that after the 1987 stock market crash, the mean return and volatility spillover from the US and Japan to the Asian markets appear to have increased significantly. A study by Hsin (2004) investigates the stock market co-movements among G-7 and major Asia-Pacific developed markets, namely, the United States, Canada, the U.K., Germany, France, Italy, Japan, Australia, Hong Kong, and Singapore. The study provides evidence of significant international transmission effects among these major world markets, with the U.S. market having the most pervasive and significant effect on all markets across continents. The evidence also indicates that there are strong regional transmission effects. These results are consistent with those of Chan and Karim (2010) on the linkage of US and Japan market returns to five ASEAN countries, namely, Malaysia, Indonesia, Thailand, Singapore, and the Philippines. Using daily stock indices from March 1, 1999 to December 31, 2007, their study concludes that the market returns of the ASEAN 5 are highly dependent on their own past returns and are more influenced by the United States than Japan.

Another way of exploring the relationship is to test for the presence of contagion[3]. Chan Lau et al. (2004) uses the extreme value theory to analyze contagion among mature markets (France, Germany, Japan, the UK, and the US) and emerging markets (in Latin America and Asia) during the crises between 1994 to 2001 such as the Mexican crisis (1994), the Asian crisis (1997), the 1998 Russian and Brazilian crises and the Argentinean debt crisis in 2001. The study uses weekly stock market returns for periods December 31, 1987 to October 25, 2001 and concludes that contagion patterns differ significantly within and across regions, contagion is higher for negative returns than for positive returns and that only the 1998 Russian and Brazilian crises led to global increase in contagion. In another study, using daily returns from January 1996 to February 1998, Billio et al. (2005) conclude that there is partial contagion only in the short term (during the high volatility regime) between European and US stock markets and Hong Kong stock market during the period of the Asian crisis in 1997. After adjusting for the heteroskedasticity in the correlation coefficients[4] (relative to the increase in the variance), Forbes and Rigobon (2002) argue that financial crisis (1987 US stock market crash, 1994 Mexican peso devaluation and the 1997 Asian crisis) do not support the presence of contagion. They conclude that 'the estimates show a high level of market co-movement during all states of the world (during crises as well as more stable prices)" which they call "interdependence".

Another way of analyzing the relationships of international stock markets returns is to examine the cointegration among them. Yang et al. (2003) examine the long-run relationships and short-run dynamic causal linkages among the US, Japan, and ten Asian emerging markets (Hong Kong, India, Indonesia, Japan, South Korea, Malaysia, Pakistan, the Philippines, Singapore, Thailand, and Taiwan) around the 1997-1998 Asian financial crisis. They conclude that both long-run and short-run relationships among these markets were strengthened during the crisis and that these markets have generally been more integrated after the crisis. Click and Plummer (2003) examine the stock market integration of the original ASEAN 5 (Indonesia, Malaysia, the Philippines, Singapore and Thailand) in the aftermath of the Asian crisis in 1997. The authors use daily and weekly stock index quotes in local currencies, US Dollar, and Japanese Yen, from July 1, 1998 to December 31, 2002 and conclude that the stock markets are cointegrated, and have only one co-integrating relationship. The authors

[3] There is no one agreed universal definition for contagion. Chan-Lau et al. (2004) defines contagion as the probability of observing large return realizations simultaneously across different financial markets rather than as increases in correlations. Eichengree et al. (1996) focused on contagion as a case where knowing that there is a crisis elsewhere increases the probability of a crisis at home (as cited in Kamisky and Reinhart, 2000). Forbes and Rigobon (2001) define contagion as a significant increase in cross-market linkages after a shock to an individual country (or group of countries).

[4] See Forbes and Rigobon (2002) for a review of the different definitions and empirical approaches to measuring contagion.

conclude that "the ASEAN-5 stock markets are integrated in the economic sense, but that integration is not complete" (p. 19).

Yu et al. (2010) use various integration approaches to investigate the integration indicators between the US and 10 economies in the Asian region (Japan, Mainland China, Hong Kong SAR, Taiwan, South Korea Singapore, Malaysia, Thailand, Indonesia, and the Philippines) from March 1994 to December 2008. The indicators suggest that integration in the region is weak and individual equity market indices are becoming more responsive to regional than global influences. "Except for Japan, the Philippines and Mainland China, all other Asian economies in the study show greater integration within the region in terms of their slightly higher sensitivity to the regional factors" (p. 2884).

The above studies examined the world market interdependence by traditionally setting the world crises as structural breaks. These studies exogenously determine the cut off dates.

More recent studies used MS models to endogenously determine structural breaks in the sample periods to examine the relationships of the markets (Billio et al., 2005; Moore & Wang, 2007; Girardin & Liu, 2006). Billio et al. (2005) use MS models to detect contagion during the period of the Hong Kong stock market crash in 1997. Using the indices from the US, European, and Hong Kong markets from January 3, 1996 to February 28, 1998, their analysis confirms the presence of nonlinearities during the Asian crisis. They conclude that "the link among developed countries strengthened and the European stock market increased its dependence on the American stock market while both the American and European stock market show a loss of interdependence from the Hong Kong stock market" (p. 17). Girardin and Liu (2006) use the MS model to examine the financial integration of China internationally for the periods October 1992 to March 2005 and conclude that, consistent with earlier studies and using various approaches, there is a lack of co-integration with either the New York or Hong Kong market, in spite of the high trade openness of China.

To the knowledge of the author, there seems to be no studies that have explored the relationship of the world stock markets with that of the Philippines employing the MS model. Hence, this paper uses the MS model as an alternative to examine the relationships of the stock returns.

3 Empirical Methods and Data

The MS model that was introduced by Hamilton (1989) is used for this paper. This study uses of the MSVAR system developed by Krolzig (1997) that runs on Ox Console version 3.3 program. The output is interpreted to determine any differences in the relationships of local returns with the other markets during the period under study.

3.1 Switching regime asset pricing models

3.1.1 The base model: VAR framework

The study utilizes a vector-autoregression (VAR) framework to estimate cross-market correlations. This framework adjusts for the differences in the opening time of the stock markets and controls serial correlation in stock returns and any exogenous global shocks (as cited in Forbes & Rigobon, 2000). The base specification of the model is:

$$Y_t = \phi(L)Y_t + \Phi(L)i_t + \eta_t \quad (1)$$

$$Y_t \equiv \{y_t^j\}'; \text{ where } j = 1, 2, \ldots 7 \quad (2)$$

$$I_t \equiv \{i_t\} \quad (3)$$

where y_t^j is the stock market return in country j at time t; Y_t is a transposed j-dimensional time series vector $y_t = (y_{1t},\ldots, y_{jt})'$, t = 1,…,T, j = 1,…,7 for the whole sample. $\phi(L)$ and $\Phi(L)$ are vectors of lags; i_t are short-term interest rates; and η_t is a vector of reduced-form disturbances. This specification is

patterned after Forbes and Rigobon (2000) who consider interest rates as an imperfect measure of aggregate shocks that proxy for global shifts in real economic variables.

The VAR methodology is appropriate for this study because it is difficult to segregate the degree of shocks that is transmitted from one market to the other. This methodology considers the endogeneity of the variables in the system and incorporates the impact of lagged values of these variables.

3.1.2 The Markov switching model

Another element of the model concerns the regimes. The Markov regime-switching vector-autoregression (MSVAR) model introduced by Hamilton (1989) 'has proved useful in capturing important nonlinearities in economic process'[5] and 'allows the variance of stock returns to switch across different states, taking into account any changes in the variance over the sample period'[6].

Since y_t are fixed and the only observed data, Hamilton (1989) provided a recursive method to draw the probabilistic inferences about the state of y_t, given its past data. Let s_t be the unobserved regime (state of y_t) at time t, and assume that the transition between states follows a first-order Markov chain, then:

$$\begin{aligned} &\text{Prob } [S_t = 1 \mid S_{t-1} = 1] = p, \\ &\text{Prob } [S_t = 0 \mid S_{t-1} = 1] = 1 - p, \\ &\text{Prob } [S_t = 0 \mid S_{t-1} = 0] = q, \\ &\text{Prob } [S_t = 1 \mid S_{t-1} = 0] = 1 - q. \end{aligned} \tag{4}$$

$$\text{where} \quad P_{ij} = \text{Prob } [S_t = j \mid S_{t-1} = i] \text{ with} \qquad P_{ij} = 1 \text{ for all } i.$$

The MSVAR model is considered in this case because y_t, a time series generated as an autoregression of order p (VAR(p) model), depends upon the unobservable regime variable, s_t. Therefore, the MSVAR model used in this paper is:

$$y_t = \mu_{st} + \phi_1(y_{t-1} - \mu_{st-1}) + \ldots + \phi_j(y_{t-j} - \mu_{st-j}) + \varepsilon_t \tag{5}$$

where the ϕ_j coefficients are the j autoregression parameters and ε_t is a white noise process. μ_{st} is the mean of y_t when state s_t occurs. Where the probability of being in a particular state, if a strongly exogenous variable is included, is:

$$p(y_t \mid y_t, y_{t-1},\ldots,y_{t-j}, x_t, s_t) = \text{ if } \begin{cases} f(y_t \mid y_t, y_{t-1},\ldots,y_{t-j}, x_t, \Omega_1) & \text{if } S_t = 1 \\ f(y_t \mid y_t, y_{t-1},\ldots,y_{t-j}, x_t, \Omega_M) & \text{if } S_t = M \end{cases} \tag{6}$$

Ω_M is the parameter vector and x_t is a vector of strongly exogenous variables.

The $p(y_t \mid y_t, y_{t-1},\ldots,y_{t-j}, x_t, s_t)$ determines the probability of being in regime s_t. In this study, by way of smooth probabilities, the state of this variable is interpreted and the correlation coefficients between the two regimes are evaluated. The number of regimes is set to two for parsimony. With this, volatility can be in a low or high state.

3.2 Data and sample descriptions

This study uses the weekly Wednesday closing price indices of seven stock markets taken from the yahoo finance website[7]. The global stock markets are represented by the US Dow Jones Industrial Average, and the London FTSE 100 index. The Asian stock markets are represented by Japan's Nikkei

[5] As cited in p. 295 of Ehrmann et al. (2003).
[6] As cited in p. 283 of Moore and Wang (2007).
[7] Yahoo website: http://finance.yahoo.com accessed on January 6, 2011 at 3pm

225 Stock Average, the Singapore's Strait Times Index, the Mainland China's Shanghai A-shares, Hong Kong's Hang Seng Index and the Philippines' PSE Index.

The stock markets that are included in this study are chosen based on their economic importance to the Philippines. The United States is the Philippines' largest foreign investor[8]. In the case of UK, bilateral trade with the Philippines has increased in 2009 and is expected to exceed £1 billion in 2010[9]. Japan is the second biggest export market of the Philippines. The US, UK, and Japan are three of the four largest stock exchanges in the world[10]. China has turned into a major player in the global economy: It now ranks second in economic size, only behind the US[11]. Lastly, Singapore is a major mover in the Asia-Pacific markets. It has the fourth largest foreign exchange market, behind London, New York, and Tokyo[12]. The movements in these major stock markets are an interest in this paper because they are known to have pervasive and significant effects in all markets across the continents (i.e., Hsin, 2004; Liu & Pan, 1997; Yang et al. 2003).

The Wednesday closing price of every week is used to control for any possible weekend effects (Hamao et al., 1990). For missing data due to holidays in one market while other markets are open, the Tuesday's closing price is used (Liu & Pan, 1997).

The weekly stock returns were computed by taking the first difference of the natural logarithm of the stock index for each market multiplied by 100, i.e., $r_t = 100*(lnP_t - lnP_{t-1})$, where r_t is the weekly log return and P_t is the stock price index of a country at time *t*. Local currencies were used.

The estimation period is from January 3, 2000 to December 27, 2010 for a total of 572 observations. This period is chosen to investigate the effects of the two US-based crisis that affected the world greatly, namely, the 2001 World Trade bombing and the 2007-2008 financial crisis. In addition, the late-2000s financial crisis (often called the Global Recession, Global Financial Crisis, or the Credit Crunch) is considered by many economists to be the worst financial crisis since the Great Depression of the 1930s[13].

The focus of the paper is to examine the changes, if any, in the relationships of the Philippine stock market to other stock markets. To do this, the stock market return in each country is regressed by its own lagged values and is then compared with the movements in stock returns in other countries covered in the study. The stock return is assumed to follow a first-order autoregression in the form of $r_t = \phi_0 + \phi_1 + e_t$, where r_t is the stock return and e_t has mean of zero and a constant variance[14].

Two world major crises are selected to serve as comparison, namely, the 2001 World Trade bombing in New York and the 2007 – 2008 financial crises (whose full effect was virtually felt in 2008). The sample is also divided between regional and global markets to determine changes in the relationships. Finally, the seven nations are evaluated together. In all cases, the US FED interest rates are used to control for any exogenous, aggregate shocks and/or monetary policy coordination (Forbes & Rigobon, 2002; Billio et al., 2005).

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[8] As cited at http://www.economywatch.com/world_economy/philippines/export-import.html (date of article March 29, 2010) accessed on December 5, 2011 at 6:40pm.

[9] http://www.mb.com.ph/node/308582/bilateral-trade-between-philippine accessed on December 5, 2011 at 8:07pm

[10] http://www.stockexchangesecrets.com/largest-stock-exchanges.html accessed on December 5, 2011 at 7:07pm. The World Federation of Exchanges (WFE) ranking was made as of September 2005. WFE sorts the exchanges around the world by size (i.e., market capitalization, number of listed companies, total volume of shares and many other statistics).

[11] http://asia.investorplace.com/asia-services/china-strategy/Top_5_Largest_Asian_Economies_0308.html accessed on December 5, 2011 at 7:36pm.

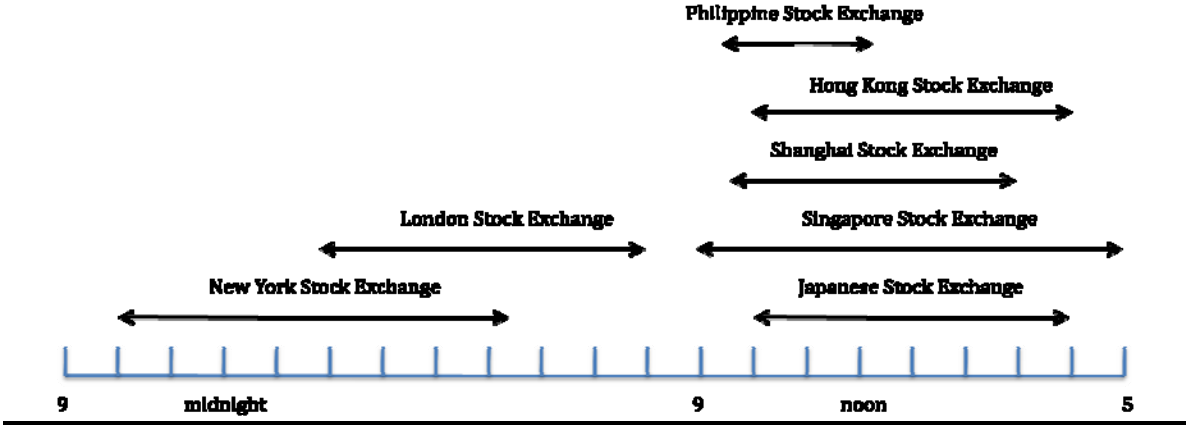
[12] http://www.economywatch.com/world_economy/singapore/?page=full (date of article: March 18, 2010) accessed on December 5, 2011 at 8:14pm

[13] As cited http://en.wikipedia.org/wiki/Late-2000s_financial_crisis accessed on December 5, 2011 at 8:55pm. Article also available at http://www.reuters.com/article/2009/02/27/idUS193520+27-Feb-2009+BW20090227

[14] Lagrange Multiplier tests on the residuals of OLS estimates on the Philippine stocks return on all the countries in the study showed the presence of ARCH effects.

Lagged values of one is used for foreign market returns when compared with the Philippines stock market because: (1) the Philippine trading hours is relatively shorter than that of the other Asian markets in the study; Thus, the previous closing of other Asian markets may affect the Philippine stock indices; and (2) the previous trading day's closing may affect current trading in the Philippines due to time differentials in the US and UK markets,. Figure 2 shows the exchange trading hours in Philippine time.

Figure 2. Exchange trading time[15] in Philippine time.



4 Results and Analysis

Table 1 presents the descriptive statistics of the stock market returns and the US FED Rate. It is worth noting that, with the exception of Japan, the expected weekly stock market returns in Asian countries are higher than those in the US and UK. The expected return in the Philippine stock market ranks second to Mainland China which posted a dramatic rise in 2007. However, there is a correspondingly higher volatility in the Asian markets relative to the US and UK. The low probability values of the Jarque-Bera statistic and the likelihood ratio suggest non-normality of the data and the presence of non-linearities. These are among of the stylized facts observed in stock returns.

Table 1. Descriptive Statistics

	Philippines	Singapore	Hong Kong	Shanghai	Japan	London	US	FED
Mean	0.118	0.051	0.065	0.117	-0.102	-0.015	0.044	2.703
Std. Dev.	3.298	2.967	3.423	3.638	3.233	2.624	2.551	2.072
Skewness	-0.074	-0.084	-0.369	-0.079	-0.506	-0.373	-0.599	0.368
Kurtosis	5.320	7.157	5.753	3.997	6.652	6.562	7.148	1.748
Jarque-Bera*	128.856	412.511	193.676	24.270	342.279	315.669	444.275	50.232
Likelihood Ratio*	50.52	138.06	137.28	30.20	62.00	162.51	149.29	

* probability of less than 0.0001. Likelihood ratio is a test of one-state against two-state, it tests the null hypothesis that the equation is linear.

Table 2 presents the transition matrix results. Each stock market was regressed by its own lagged values and the FED interest rate. Weekly, FED rate is used to control for any exogenous, aggregate shocks and/or monetary policy. FED rate was considered in the paper for two reasons.

[15] Trading time in local time. NY: 0900 – 1630 (GMT -5); London: 0900 – 1600 (GMT 0); Philippines: 0930 – 1210 (GMT +8); Hong Kong: 1000 – 1600 (GMT +8); Shanghai: 0930 – 1500 (GMT +8); Singapore: 0900 – 1700 (GMT +8); Japan: 0900 – 1500 (GMT +9)

First, the paper includes countries that have strong trade relations with the US and are affected by the FED rate. Second, the difference between the FED and 1-month-LIBOR rate is consistently within the -0.5 to 0.5 percentage point range from January 2000 to December 2010, except for some periods between September 2007 and December 2008 due to the 2007–2008 financial crisis.

The transition matrix shows that the probability for the Philippines to remain in regime 1 is only 0.58. This is very low compared to Singapore (0.94) and Hong Kong (0.988) but it is comparable to Shanghai (0.60), which can also be seen in the smoothed probability graph in figure 3. The probability of the Philippines to remain in the regime 2 (0.896) is higher than in regime 1 but still lower than that of Singapore's (0.9553) and much lower than that of Hong Kong (0.997). This suggests greater persistence of the prevailing regime in these developed markets, most notably Hong Kong. Table 2 also shows the duration of each state in weeks for every country. The duration of each state for the Philippines is short, compared to all of the countries except for Shanghai.

Table 2. Transition matrix results

	Transition Probability		Duration (weeks)	
	P_{11}	P_{22}	State 1	State 2
Philippines	0.5845	0.8958	2.41	9.59
Singapore	0.9397	0.9553	16.57	22.36
Shanghai	0.6013	0.4275	2.51	1.75
Hong Kong	0.9883	0.9966	85.3	290.35
Japan	0.8723	0.9597	7.83	24.81
US	0.9172	0.9665	12.08	29.84
London	0.9146	0.9634	11.71	27.33

Table 3 shows the regime classification for the Philippines. Only a total of 56 weeks belonged to regime 1 compared to 515 weeks classified as regime 2 for the years 2000 to 2010. Relating the table 2 with the smoothed probability (Figure 3), it seems that the Philippines stock market is more prone to shifts in regime compared to the more developed stock markets like Singapore, Hong Kong, US and UK. This does not necessarily mean that the country's stock market movement is more volatile compared to the more developed markets.

Table 3. Regime Classification

Regime 1 From	To	# of Weeks	Regime 2 From	To	# of Weeks
2/16/00	3/1/00	3	1/19/00	2/9/00	4
5/24/00	5/31/00	2	3/8/00	5/17/00	11
11/8/00	11/8/00	1	6/7/00	11/1/00	22
1/10/01	1/24/01	3	11/15/00	1/3/01	8
9/26/01	10/24/01	5	1/31/01	9/19/01	34
11/28/01	11/28/01	1	10/31/01	11/21/01	4
1/23/02	1/23/02	1	12/5/01	1/16/02	7
6/4/03	6/18/03	3	1/30/02	5/28/03	70
2/4/04	2/4/04	1	6/25/03	1/28/04	32
9/8/04	9/8/04	1	2/11/04	9/1/04	30
7/6/05	7/6/05	1	9/15/04	6/29/05	42
5/10/06	6/14/06	6	7/13/05	5/3/06	42
7/5/06	7/5/06	1	6/21/06	6/28/06	2
2/28/07	2/28/07	1	7/12/06	2/21/07	33
8/1/07	8/15/07	3	3/7/07	7/25/07	21
10/3/07	10/3/07	1	8/22/07	9/26/07	6
1/9/08	1/30/08	4	10/10/07	1/2/08	13
6/11/08	7/2/08	4	2/6/08	6/4/08	18
9/17/08	11/12/08	9	7/9/08	9/10/08	10
1/7/09	1/21/09	3	11/19/08	12/31/08	7
3/18/09	3/25/09	2	1/28/09	3/11/09	7
			4/1/09	12/29/10	92
	Total weeks	56		Total weeks	515

Table 4 shows the mean and variance of the changes in the stock movements of selected countries. Regime 1 is characterized as the high volatility state and regime 2 as the low volatility state. The average movement of the Philippines for regime 1 is -116% while regime 2 is only 26% with variance of 52.10 and 6.08, respectively. It seems that during the period under study, the Philippines is more prone to be in one regime being 92 weeks as the longest duration, which includes local events[16] such as the Philippine election and *Ondoy* typhoon in May and September 2009, respectively and the hostage crisis in August 2010.

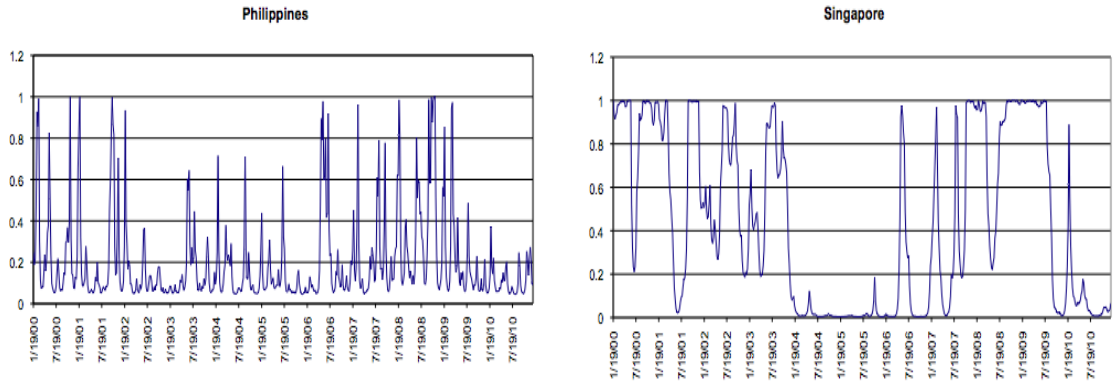
Table 4. Mean and Variance of Regime Classification for Selected Countries

	Philippines		Singapore		US	
	Regime 1	Regime 2	Regime 1	Regime 2	Regime 1	Regime 2
Mean	-116%	26%	-42%	37%	48.48%	25%
Variance	52.1	6.08	17.11	2.53	16.54	2.49

The result is somewhat in line with an earlier study made by Aquino (2004), where he concludes that the stock market reacts to news about political, economic events and to some extent natural phenomena. It seems that when there are locally triggered events, the investors in the local market takes more cautionary steps.

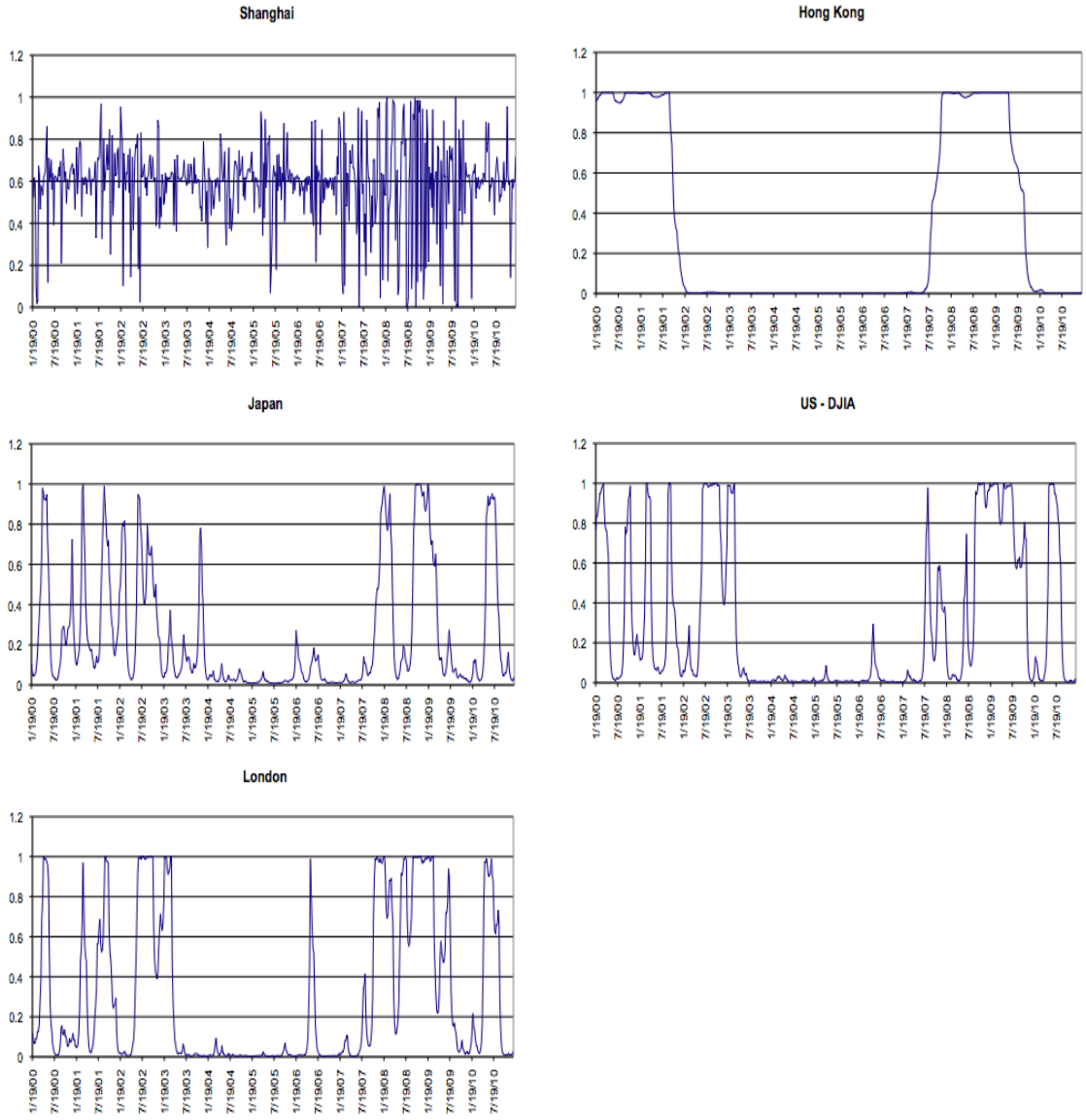
Singapore, Japan and London have average similar duration period for regime 2 with that of the US, averaging from 22 to 30 weeks. Interestingly, figure 3 shows the smoothed probabilities for regime 1; all except the Philippines and Shanghai seem to move in the same general direction. Looking at the smoothed probabilities graphs of these countries, the structural shifts were mainly caused by the US-led misfortunes. These were the 2001 World Trade bombing in New York and the 2007 financial crisis. In the case of the Philippines, it seems that when the source of volatility is foreign (like the above), there are quick regimes switches. However, if the trigger is domestic, the regime tends to persist longer[17].

Figure 3. Smoothed Probabilities in state 1 of each stock market



[16] Source: www.inquirer.net

[17] The author acknowledges and thanks the anonymous reviewer for this thought.



Tables 5a and 5b are the correlation matrix for each group, global and regional. The mature markets in this sub-sample, namely, Hong Kong, Japan and Singapore, seem to be more correlated to each other than the emerging markets Philippines and Shanghai. In regime 1, Hong Kong and Singapore has a high correlation of 0.78 and 0.66 in regime 2. Singapore and Japan has a positive correlation of 0.63 in regime 1 and slightly lower correlation in regime 2 of 0.60. Japan and Hong Kong has 0.68 and 0.52 in regimes 1 and 2, respectively. The stronger relationship among these developed equity markets in the region is consistent with the findings of Yu, Fung and Tam (2010). The Philippines has the highest correlation coefficient with Singapore for both regimes 1 and 2 with 0.45 and 0.50, respectively, followed by Hong Kong with 0.43 and 0.41. Shanghai has the lowest correlation coefficient in this sub-sample, which is consistent with the findings of Yu et al. (2010). They write that "the markets on Mainland China (Shanghai) are far less correlating with the rest of

the equity markets in the region" (p. 2882). The authors further explain that the result is not surprising due to the characteristics and features[18] of the Shanghai A-share market.

Table 5a. Contemporaneous correlation matrix of the ASIAN stock markets under study in Regime 1

Regime 1	Philippines	Singapore	Shanghai	Hong Kong	Japan
Philippines	1.0000				
Singapore	0.4493	1.0000			
Shanghai	0.2181	0.2546	1.0000		
Hong Kong	0.4294	0.7785	0.3408	1.0000	
Japan	0.3770	0.6287	0.2064	0.6813	1.0000

Table 5b. Contemporaneous correlation matrix of the ASIAN stock markets under study in Regime 2

Regime 2	Philippines	Singapore	Shanghai	Hong Kong	Japan
Philippines	1.0000	0.5037	0.1736	0.4127	0.3762
Singapore		1.0000	0.2443	0.6651	0.5951
Shanghai			1.0000	0.3522	0.1359
Hong Kong				1.0000	0.5178
Japan					1.0000

Table 6 shows that there is a relatively low positive correlation between the Philippine stock market growth and that of the US and UK stock markets. As expected, UK and US have positive correlation.

Table 6a. Contemporaneous correlation matrix of the major global stock markets under study for regime 1

Regime 1	Philippines	London	New York
Philippines	1.0000		
London	0.2701	1.0000	
New York	0.2187	0.7419	1.0000

Table 6b. Contemporaneous correlation matrix of the major global stock markets under study for regime 2

Regime 2	Philippines	London	New York
Philippines	1.0000	0.3911	0.3784
London		1.0000	0.6984
New York			1.0000

The results in Tables 5 and 6 suggest that the Philippine market integration with the rest of the world, be it with the Western or Asian nations, is low. The relatively higher correlations with Singapore may have been triggered by the uncertainties resulting from the US-led crises. It seems that the local investors may look to Singapore for signals whether or not the crises in Europe or in the States will affect Asia[19]. This result lends support to the conclusion of Yu et al. (2010) that regional factors seem to be more important than global factor on the Asian equity market as the

[18] From Yu et al. (2010): Because most of the investors of the A-share market are residents of Mainland China and selected foreign institutional investors (known as the Qualified Foreign Institutional Investors or the QFII). From Girardin and Liu (2006): Because the Mainland China market is protected from foreign influences by capital controls.

[19] The author acknowledges and thanks the anonymous reviewer for this thought.

nations work financial integration among economies to help improve their capacity to absorb shocks and foster development.

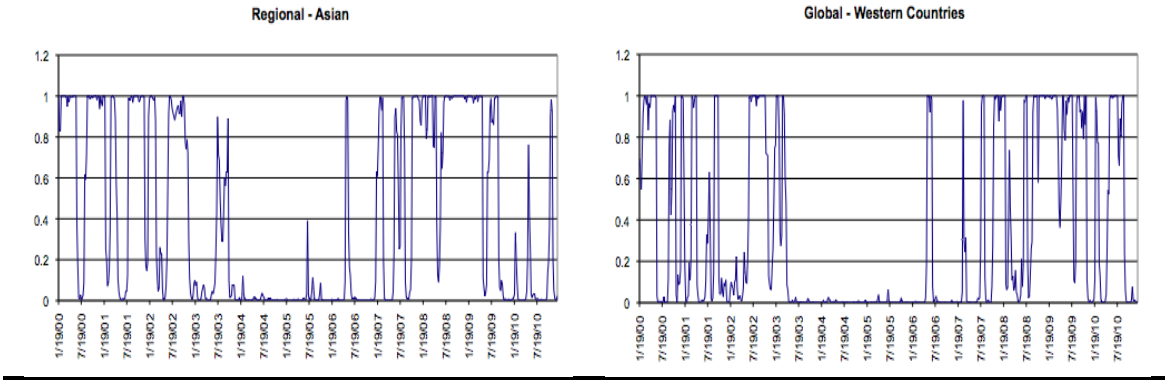
Figure 4 shows the smoothed probabilities for the sub-samples. The similarity of the regional and global graphs arising from the two US-led global crises that affected the world greatly, namely, the 2001 World Trade bombing and the 2007-2008 financial crisis caused the major shifts in the structure. Figure 5 is the smoothed probability of the entire sample and again, it resembles the regional and global graphs shown in figure 4. This is most likely because of the relatively strong positive correlation between the US and the developed markets (UK, Hong Kong, Singapore and Japan) ranging from 0.45 to 0.75 in both states. This also shows that either the Philippine and Shanghai stock markets are not significant movers regionally (Asian) and globally or that both countries are simply not financially integrated with the other economies[20].

Popular belief is that the Philippine stock market movement is greatly affected by the performance of Dow Jones but looking at the correlation matrix results (tables 4, 5 and 6), it seems that Philippines stock market movement may be more affected by the Singapore stock market movement (i.e., stronger relationship with Singapore compared to the US). In table 6, in one state, Philippine stock market has a higher correlation with Singapore at 0.44, compared with the US of only 0.25. In another state, it is 0.51 for Singapore and 0.40 for the US.

Table 7 presents the contemporaneous correlation matrix of all the 7 countries included in the study. Interestingly, the increase in correlation from state 1 to state 2 (0.25 to 0.40) between the Philippines and the US is not similar with that of some of the developed countries. For example, for London – US, the correlation from state 1 to state 2 decreased from 0.75 to 0.68. The trend is also seen in the case of Singapore – US and Japan – US from 0.55 to 0.50 and 0.48 to 46 respectively, though the change in correlation is almost negligible compared to London.

Figure 4. Smoothed Probabilities in state 1

Philippines, Hong Kong, Singapore, Japan and Shanghai	Philippine, US, and UK



[20] Regarding the case of Shanghai, this is consistent with existing literature. For a consensus in existing literature of the non-international integration of the Mainland China A-market, see Girardin and Liu (AEA Conference 2006, Boston). Their study shows that there is little or no evidence of integration with Hong Kong and US (represented by S&P 500) equity markets.
Regarding the Philippines, this can be explained by the findings of Yang et al. (2003). The authors write that the Philippine stock market was a fairly isolated market because it 'had little response to shocks from other markets'. Their study included Hong Kong, India, Indonesia, Japan, South Korea, Malaysia, Pakistan, Philippines, Singapore, Thailand, Taiwan and the US.

Figure 5. Smoothed Probabilities in state 1 all countries

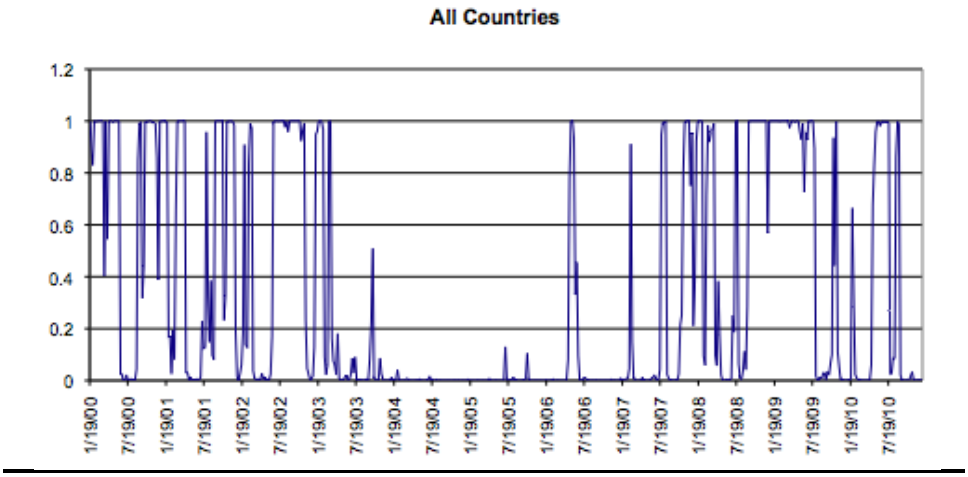


Table 7a. Contemporaneous correlation matrix of the seven stock markets under study for regime 1.

Regime 1	Philippines	London	Singapore	Shanghai	Hong Kong	Japan	New York
Philippines	1.0000						
London	0.3032	1.0000					
Singapore	0.4420	0.5818	1.0000				
Shanghai	0.2318	0.1506	0.2522	1.0000			
Hong Kong	0.4321	0.6398	0.7683	0.3352	1.0000		
Japan	0.3615	0.5701	0.6165	0.2249	0.6801	1.0000	
New York	0.2528	0.7528	0.5549	0.0898	0.5002	0.4784	1.0000

Table 7b. Contemporaneous correlation matrix of the seven stock markets under study for regime 2.

Regime 2	Philippines	London	Singapore	Shanghai	Hong Kong	Japan	New York
Philippines	1.0000	0.4167	0.5059	0.1807	0.4002	0.3858	0.4029
London		1.0000	0.5907	0.2613	0.5871	0.5274	0.675
Singapore			1.0000	0.297	0.6967	0.5693	0.5022
Shanghai				1.0000	0.387	0.1712	0.2677
Hong Kong					1.0000	0.5105	0.531
Japan						1.0000	0.4572
New York							1.0000

In addition, the Philippines is most correlated with Singapore and Hong Kong compared to US and UK in regime 1 (0.44, 0.43, 0.25, 0.30, respectively). The relationship is similar in regime 2 (0.51, 0.40, 0.40, 0.41). Also, Singapore is more correlated with Hong Kong (0.77, 0.70) and Japan (0.62, 0.57) compared to UK (0.58, 0.59) and US (0.55, 0.50); and the reverse is the same, Hong Kong is more correlated with Singapore (0.77, 0.70) compared to UK (0.64, 0.59) and US (0.50, 0.53). Even Japan is more correlated to Singapore (0.62, 0.57) than to UK (0.57, 0.53) and US (0.48, 0.46). This seems to indicate that there is a stronger relationship among the economies in the same region. This is consistent with the findings of Hsin (2004) that "there are strong regional transmission effects" (p. 446) and of Yang et al. (2003) that "Singapore market is an influential market in the Asian region" (p. 14).

For UK, the correlation with US is high for regimes 1 and 2 (0.75, 0.68, respectively). On the contrary, US correlation coefficients with the Asian markets are relatively low. As for Shanghai, it seems that it is most correlated with Hong Kong.

5 Conclusion

This study examines the nature of the relationships of various international market returns such as the US, UK, Japan, Singapore, China (via Shanghai and Hong Kong) and the Philippines from the periods 2000 to 2010. Weekly, Wednesday stock market returns were used. The objective of the paper is to focus more on the relationship of the Philippine stock market with the other countries. It is believed that the Philippine stock market is not only influenced by its own innovation but also by other countries within and outside its region.

MSVAR model introduced by Hamilton (1989) was used to exogenously determine the structural breaks between high and low variance periods. The VAR methodology seems to be appropriate to segregate the degree of shocks that is transmitted from one market to the other.

The results are as follows:

(1) When each stock market was regressed by its own lagged values and the US FED interest rate, the transition matrix shows that the average duration in weeks for the Philippines to remain in a single regime is only 2.31 (regime 1) and 9.6 (regime 2), which is relatively short compared to the other markets[21] (averaging 12 for regime 1 and 26 weeks for regime 2). Given the sample period of 11 year, 2000 to 2010, it seems that the Philippines stock market is more prone to regime shifts if the source of volatility is foreign. In this study, the volatility of the US and other developed economies persisted in a single regime because the trigger was US-led, but which is foreign to the Philippines. However, if the trigger is domestic, the regime tends to persist longer.

(2) When grouped according to regional (Philippines, Singapore, Japan, Hong Kong and Shanghai) and global (US and UK), the correlation matrix indicated that the mature markets in the regional group, namely, Hong Kong, Japan and Singapore, seem to be more correlated to each other than the emerging markets Philippines and Shanghai. It seems that the Philippine economic or market integration with the rest of the world, be it with the Western or Asian nations, is still low. However, the relatively higher correlation with Singapore may have been triggered by the uncertainties resulting from the US-led crises. It seems that the local investors may look to Singapore for signals whether or not the crises in Europe or in the States will affect Asia.

(3) When treated as one sample set, it seems that the Philippines is most correlated with Singapore and Hong Kong compared to US and UK in both regimes. This seems to indicate that there is a stronger relationship among the economies in the same region. The presence of the world crises caused structural change in the correlation among the nations. The study finds that there is a time-varying correlation between the markets.

[21] Excluding Hong Kong and Shanghai (see Table 1 for computation of the average weeks)

References

Aquino, R. (2004). *News, Noise and Stock Price Movements.* UP College of Business Administration Discussion Paper No. 0404, http://www.upd.edu.ph/~cba.

Bautista, C. (2001). *Stock Market Volatility in the Philippines*, UP College of Business Administration Discussion Paper No. 0103, http://www.upd.edu.ph/~cba.

Billio, M., Duca, M. L., & Pelizzon, L. (2005). *Contagion detection with switching regime models: A short- and long-run analysis* (Working Paper No. 05.01). Retrieved from GRETA website: http://www.greta.it/wp/05.01.pdf

Chan, S. & Mohd, Z. (2010). Volatility spillovers of the major stock markets in ASEAN-5 with the U.S. and Japanese stock markets. *International Research Journal of Finance and Economics, 44*. Retrieved from http://www.eurojournals.com/finance.htm

Chan-Lau, J., Mathieson, D., & Yao, J. (2004). Extreme contagion in equity markets. *International Monetary Fund Staff Papers, 51(*2), pp. 386-408.

Chancharat, S. (2009). Stock market integration – An overview. *NIDA Economic Review, 4(*2), pp. 23-35.

Click, R. & Plummer, M. (2003). *Stock market integration in ASEAN after the financial crisis* (Working Paper Series, Vol, 2003-06). Retrieved from The International Centre for the Study of East Asian Development website: http://www.icsead.or.jp/7publication/workingpp/wp2003/2003-06.pdf,

Cutler, D. M., Poterba, J. M., & Summers, L. H. (1989). What moves stock prices? *Journal of Portfolio Management*, *15*(3), pp. 4-11.

Eichengreen, B., A. Rose & C. Wyplosz (1996). *Contagious Currency Crises* (National Bureau of Economic Research Working Paper No. 5681).

Ehrmann, M., Ellison, M., & Valla, N. (2003). Regime-dependent impulse response functions in a Markov-switching vector autoregression model. *Economic Letters*, *78*, pp. 295-299.

Forbes, K. & Rigobon, R. (2001). Measuring contagion: Conceptual and empirical issues. In Claessen, S. & Forbes, K. (Eds.), *International Financial Contagion*. Norwell, Massachusetts: Kluwer Academic Publishers. Retrieved from http://web.mit.edu/~kjforbes/www/papers/measuringcontagion.pdf

Forbes, K. & Rigobon, R. (2002). No contagion, only interdependence: Measuring stock market comovements. *The Journal of Finance, 57(*5), pp. 2223-2261.

Girardin, E. & Liu, Z. (2006). The financial integration of China: New evidence on temporally aggregated data for the A-share market. Paper presented at the AEA Conference 2006, Boston session on "China in the world economy," Boston, USA. Retrieved from http://www.aeaweb.org/assa/2006/0107_0800_0501.pdf.

Hamao, Y., Masulis, R., & Ng, V. (1990). Correlation in price changes and volatility across international stock markets. *The Review of Financial Studies, 3*(2), pp. 281-307.

Hamilton, J. (1989). A new approach to the economic analysis of nonstationary time series and the business cycle. *Econometrica, 57*(2), pp. 357-384.

Hu, L. & Shin, Y. (2008). Optimal test for Markov switching GARCH models. *Studies in Nonlinear Dynamics and Econometrics, 12*(3). Retrieved from http://www.bepress.com/snde/vol12/iss3/art3

Hsin, C. (2004). A multilateral approach to examining the comovements among major world equity markets. *International Review of Financial Analysis, 13*, pp. 433-462.

Kaminsky, G. & Reinhart, C. (2000). On crises, contagion, and confusion. *Journal of International Economics, 51*(1), pp. 145-168.

Krolzig, H. (1998). Econometric Modelling of Markov-Switching Vector Autoregression using MSVAR for Ox. Website: http://fmwww.bc.edu/ec-p/software/ox/msvardoc.pdf, accessed on Jan 17, 2011 at 10:24pm.

Liu, Y. & Pan, M. (1997). Mean and volatility spillover effects in the U.S. and Pacific-Basin stock markets. *Multinational Finance Journal, 1*(1), pp. 47-62.

Moore, T. & Wang, P. (2007) Volatility in stock returns for new EU member states: Markov regime switching model. *International Review of Financial Analysis, 16*, pp. 282-292.

Theodossiou, P. & Lee, U. (1993). Mean and volatility spillover effects across major national stock markets: Further empirical evidence. *The Journal of Finance Research, 16*(4), pp 337-350.

Yang, J., Kolari, J., & Min, I. (2003). Stock market integration and financial crises: The case of Asia. *Applied Financial Economics*, *13*(7), pp. 477-486. Retrieved from http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN026336.pdf

Yu, I., Fung, K., & Tam, C. (2010). Assessing financial market integration in Asia – equity markets. *Journal of Banking and Finance*, *34*, pp. 2874-2885.

Yu, J., Goyeau, D., & Bautista C. (2011). UP College of Business. Regime switching market risk: Evidence from the Philippines. *Philippine Management Review, 18*, pp. 43-50.