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Factors Affecting the Philippine Stock Market

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Abstract

While the Philippine Stock Exchange is one of the oldest stock exchanges in the region, it is by far relatively smaller in terms of market capitalization and trading volume than other stock exchanges from neighboring countries such as Hong Kong, China, Singapore, Malaysia, South Korea, Japan, and Thailand, making it more prone to be affected by macroeconomic factors. In addition, greater economic integration among ASEAN countries and other nearby countries is believed to have caused greater co-movements among their stock markets. Using OLS, VECM, Granger causality tests, and the Johansen cointegration test on panel as well as pooled data, this study provides evidence for increasing cointegration and Granger causality among the markets covered by the study.

Keywords: *Philippine stock exchange, macroeconomic factors, market integration, ASEAN stock markets, trading volume*

INTRODUCTION

The Philippine Stock Exchange, Inc. (PSE) was consolidated in 1992 as the Manila Stock Exchange (MSE) and the Makati Stock Exchange (MkSE). Considering that the MSE was established on August 8, 1927, the Philippine equity markets rank as one of the oldest bourses in the region. However, the exchange's seniority in the region did not really translate into an advantage, as its market capitalization is currently the lowest among the ASEAN 5 members.

Table 1. Domestic Market Capitalization (USD Millions)

Americas	26,980,513.0
Asia Pacific Region	17,992,021.8
Europe, Africa, and Middle East	12,866,680.5
World Federal Exchange Total	57,839,285.3
Philippine Stock Exchange	218,511.6
The Stock Exchange of Thailand	346,487.2
Singapore Exchage	716,463.5
Bursa Malaysia	482,572.0
Indonesia Stock Exchange	358,918.6
Korea Exchange	1,183,335.8
Shanghai Stock Exchange	2,414,391.4
New York Stock Exchange	17,006,535.4
Japan Exchange Group – Tokyo	4,420,684.0

Based on the report of the World Federation of Exchanges (WFE), the PSE's market capitalization of about $ 218.5 billion, as January 2014, is just a mere 0.378% of the total capitalization of $57.8 trillion for all WFE members or about 1.2% of the Asia-Pacific region's total of about $ 18 trillion. The figures for the other ASEAN 5 members, as can be seen in Table 1, are $359 billion for Indonesia, $ 483 billion for Malaysia, $716 billion for Singapore, and $346 billion for Thailand.

Considering the importance of the equity market in promoting the growth of an economy, research into the factors affecting it specifically in relation to its major ASEAN partners, its major trade partners, and other macroeconomic variables are well needed. While numerous studies have been conducted on ASEAN 5 as a whole, most have not been taken from the point of view of the Philippines and/or covered limited time horizons.

Related Literature

Much has been written about the supposed state of cointegration among ASEAN countries and/or other economies, as well as on the effects of other factors on equity markets. The Asian Crisis in 1997 gave impetus to much investigation that gave rise to conflicting conclusions about the effect of the crisis.

Baig and Goldfajn (1999) suggest discernible levels of contagion during the Asian crisis. Abd Majid et. al. (2009) further concluded that ASEAN 5 stock markets were integrated before and during the 1997 crisis. Zafar et al. (2012), on the other hand, conclude that linkages between Asian and US stock markets are stronger in the post-crisis period.

Similarly, Royfaizal et al. (2009) hold that ASEAN 5 + 3 and US stock markets are interdependent during crisis and post-crisis periods, and the impact of the US stock market is effective on ASEAN 5 + 3 only for pre- and during-crisis periods. Kim-Leng et al. (2005) maintain that stock indices are less cointegrated after the crisis.

Daly (2003) holds that there is some evidence of long-run cointegration, but not significant increases between ASEAN stock markets during the post-crisis period. Valadkhani et al. (2009) report that changes in returns in Singapore, Malaysia, and Indonesia in the pre-1997 crisis era and changes in Singapore, Philippines, and Korea in the 1997 era influence the Thai market.

Shi et al. (2010) suggest that both the flow and level of bilateral foreign investments between countries explain country-pair stock market integration. Similarly, Bakri and Hoe (2013) proposed that higher bilateral trade results in a higher degree of co-movement in stock markets.

In their quest to generate more robust models for forecasting, Ou and Wang (2010) compared the performance of the GARCH (1,1), EGARCH (1,1), and GJR (1,1) models with the least squares support vector machine (LSSVM) to forecast volatilities in three major ASEAN markets. Using the 2008 global financial crisis as a baseline, they were able to prescribe the hybrid models GARCH-LSSVM, EGARCH-LSSVM, and GJR-LSSVM, which provide improved performance in forecasting the leverage effects of volatilities.

Looking at another angle, Kabigting and Hapitan (2011) showed evidence of volatility spillover among ASEAN 5 and affirmed "hot money" as a driver of prices in the Philippine stock market. In addition, French and Vishwakarma (2013) uncovered evidence from the Philippines, suggesting that foreign equity investors are trend chasers and that equity flows are auto-correlated. Alternatively, Changwatchai (2010) proposes that the determinants of foreign direct investment include the GDP of the host country, per capita GDP, imports and exports, and output levels.

Jakpar et al. (2013) concluded that China has two-way relations with Indonesia, Thailand, and Singapore but none with Thailand & the Philippines. Arouri and Jawadi (2010) took a more global outlook, stating that their studies confirmed a non-linear financial integration of Mexico and the Philippines into the world stock market.

On the hedge angle, Vaziri and Zeise (2008) observed that none of the correlation coefficients of ASEAN countries are negatively correlated to the Standard & Poor's, and thus cannot serve as a hedge to the market index. Still on hedging, Lee et al. (2011) find that real estate stocks do not provide a hedge against inflation in the long run for Malaysia, the Philippines, and Taiwan.

Regarding other factors affecting stock markets, Nikkinen et al. (2008) find that emerging Asia-Pacific markets are affected by US macroeconomic news announcements. Similarly, Engle and Ng (1991) established the impact of news on the returns of Japanese TOPIX.

Aggarwal et al. (1999) observed that large shifts in the volatility of emerging markets tend to be local (e.g., the Marcos Aquino conflict, Mexico peso crisis). Valadkhani et al. (2009) also report that changes in oil prices negatively affected the Thai market prior to the Asian crisis.

Kabigting (2011) cited a lack of corporate governance as one of the causes of the global crisis of 2008 and the Asian crisis of 1997. She produced evidence demonstrating corporate governance as a determinant of performance. Ferrer and Banderlipe (2012) in like manner related board characteristics to listed companies' performance.

Data

This study uses the monthly closing stock market indices of the Philippines (Philippine Stock Exchange Composite Index), Thailand (Stock Exchange Thailand Index), Singapore (FTSE Strait Times Index), Malaysia(Kuala Lumpur Stock Exchange Composite Index), Indonesia (Jakarta Composite Index), Korea (South Korea Kospi Composite Index), China (Shanghai Stock Exchange Composite Index), the United States of America (Dow Jones Industrial Average Index), and Japan (Japan Nikkei 225 Stock Average) covering the period from May 1992 to June 2014.

In addition, the study employed month-end macroeconomic data of the Philippines consisting of the Consumer Price Index, Peso-Dollar Exchange rates, 31-day T Bill Rates to represent interest rate levels, and the Philippine M2 money supply for the ssame period. All data were taken from Bloomberg, while Philippine macroeconomic data were taken from the websites of Bangko Sentral ng Pilipinas and the Philippine Institute for Development Studies.

The abbreviations for the aforementioned variables are as follows: Philippine Stock Exchange Composite Index = PSE, Thailand's Stock Exchange Thailand Index = TH, Singapore's FTSE Strait Times Index = SG, Malaysia's Kuala Lumpur Stock Exchange Composite Index = MA, Indonesia's Jakarta Composite Index = IN, Korea's South Korea Kospi Composite Index = KO, China's Shanghai Stock Exchange Composite Index = CH, United States of America's Dow Jones Industrial Average Index = US, Japan's Nikkei 225 Stock Average = JA, Philippine Consumer Price Index = CPI, and Phil. Peso-Dollar Exchange rates = FX, 31-day T Bill Rates = INT, and Philippine M2 money supply = M2.

The 266-month data series is divided into four (1) temporal panels corresponding to four fiscal periods with seemingly different contexts:

- Panel 1: May 1, 1992 – May 31, 1997 – Pre- Asian Crisis Period
- Panel 2: June 1, 1997 – December 31, 2002 – Asian Crisis Period and aftermath
- Panel 3: January 1, 2003 – December 31, 2007 – Pre-Word Fin. Crisis Period
- Panel 4: January 1, 2008 – June 30, 2014 – World Financial Crisis Period to now.

METHODS

Raw data gathering is summarized and subjected to standard descriptive statistical tools that include the first few central moments, correlation tables, and line graphs in their nominal and standardized forms. This was performed on the pooled data, as well as on individual panels.

Considering the advantages of log models in terms of simplifying the first differential operation, facilitating the interpretation of coefficients, minimizing scale problems among variables, and reducing the impact of outliers and heteroskedasticity, all data were converted into their natural logarithm form.

To allow proper application of various statistical tools employed in this study, the variables are subjected to a couple of unit root tests: the ERS Modified Dickey-Fuller t test for a unit root (known as the DF-GLS test) developed by Elliot et al. (1992) and the Phillips-Peron Test unit root test by Phillips and Perron (1988). These tests allow us to ascertain whether the time-series data are I (0) or I (1) processes.

DF-GLS is an augmented Dickey-Fuller test in which the series is transformed via generalized least squares (GLS) regression before performing the test. The method reports three methods for choosing the value of k (number of lags): the Ng-Perron sequential t (Ng and Perron, 1995), the minimum Schwarz information criterion (Schwarz 1978), and the Ng-Perron modified Akaike information criterion or MAIC (Ng & Perron, 2001).

The operative formula for the DF-GLS after refitting the standard Dickey–Fuller equation transformed variable from the GLS is:

$$\Delta y_t^* = \alpha + \beta y_{t-1}^* + \sum_{j=1}^{k} \zeta_j \Delta y_{t-j}^* + \epsilon_t$$

The Phillips-Perron test also builds on the Dickey-Fuller test by using the Newey and West (1986) standard errors to account for serial correlation, making it robust with respect to unspecified autocorrelation and heteroskedasticity in the disturbance process and does not have to specify a lag length for the test regression.

This study treats the Philippine stock exchange as a dependent variable to the independent variables of eight other bourses (four from the rest of the ASEAN 5 and four from the big economies that include the USA, China, Japan, and South Korea) and four macroeconomic variables consisting of the country's consumer price index, peso-dollar exchange rate, interest rate as represented by its 91-day Treasury bill rate, and money supply as represented by M2.

The ordinary least squares (OLS) method was employed on the pooled data as well as on the four-panel data. Postestimation tests that are conducted on the resultant models include the Breusch Pagan test of multiplicative heteroskedasticity (Breusch & Pagan, 1979), the Information Matrix Test by Cameron and Trivedi (1990), which computes an orthogonal decomposition into test for heteroskedasticity, skewness, and kurtosis; the Ramsey regression specification-error test for omitted variables (Ramsey, 1969), Akaike Information Criteria (Akaike, 1973), Bayesian information criteria (Schwarz,1978), and the Durbin-Watson *d* statistic test for first-order serial correlation.

The OLS equation is defined as:

$$\Delta \ln PSE = \omega + \Sigma\theta\Delta\ln P_i + \Sigma\eta\Delta\ln M_i + u_i$$

Where: ω - intercept term,
θ - responsiveness of PSE to the other market,
P_i - Price index of other market,
η - responsiveness to the macroeconomic variable,
M_i - Macroeconomic variable,
u_i - error term

Another critical estimation of this study is the autoregressive conditional heteroskedasticity (ARCH) effect on residuals, as proposed by Engle et al. (1987) and known as the Lagrange Multiplier (LM) test. If this test indicates a significant ARCH effect, a GARCH in Mean or GARCH-M model as proposed by Engle et al. (1987) will be applied to the panel concerned. According to the developers of the tool, the GARCH-M model is well-suited to cases such as the stock market, where volatility becomes a determinant of the risk premium that the market will charge.

The GARCH model adds the conditional variance times the risk-return trade-off parameter in the mean of the OLS to cover for the ARCH effect, if any.

$$\Delta \ln PSE = \omega + \Sigma\theta\Delta\ln P_i + \Sigma\eta\Delta\ln M_i + \Upsilon\sqrt{h_i} + u_i$$

Where: ϒ - measure of risk-return tradeoff,
h_i - conditional variance

This study examines the interdependence of equity markets by testing for cointegration. The vector error correction model or VECM (Johansen 1988; 1991; 1995) was applied to test for cointegration. This VAR model is applied to the integrated multivariate time series. Assuming that the root tests performed earlier in the study indicated an I (1) process for our time-series data, we now estimate the VECM.

The basic VECM model is:

$$\Delta \mathbf{y}_t = \boldsymbol{\alpha}\boldsymbol{\beta}\mathbf{y}_{t-1} + \sum_{i=1}^{p-1} \boldsymbol{\Gamma}_i \Delta \mathbf{y}_{t-i} + \mathbf{v} + \boldsymbol{\delta} t + \epsilon_t$$

Where: δ – a K × 1 vector of parameters,
β –parameters of the cointegrating equations,
α –adjustment coefficients,
Γ – short-run parameters,
v – coefficients of the constants.

Because VECM models the differences in the data, the constant implies a linear time trend in the levels and the time trend implies a quadratic time trend in the levels of the data.

We determine the lag order for a VAR model with the I (1) variables as described by Nielsen (2001), where Akaike's information criterion or AIC (Akaike, 1973), Schwarz's Bayesian information criterion or SBIC (Schwarz, 1978), Hannan and Quinn's information criterion or HQIC (Hannan and Quinn, 1979) and a series of VAR likelihood ratios were used to suggest the maximum lag for the VAR or VECM model.

Johansen's (1995) procedure was adopted to estimate the number of cointegrating ranks or equations for the VECM. Often referred to as the Johansen cointegration test, it employs a couple of likelihood ratio tests, trace tests, and maximum eigenvalue tests to determine the number of co-integrating relationships. The null hypothesis of no cointegration is accepted when the number of cointegrating ranks (r) is equal to zero, or rejected otherwise.

Having established the lags and ranks required by the VECM, we now employ Johansen's (1995) maximum likelihood method to compute for the following parameters needed by the VECM: β for the cointegrating equations, α for the adjustment coefficients, Γ for the short-run parameters, and v as the coefficients of the constants.

The paper proceeds to apply the Granger Causality Test (Granger, 1969) to determine which variable "Granger-causes" another. A variable "Granger-causes" another variable if, given the past values of variable A and variable B, past values of A are helpful in predicting B. Testing for Granger causality entails regressing the dependent variable with its lagged values and on the other variable and testing the null hypothesis that the estimated coefficients of the lagged values are jointly zero.

Most of the methods described above were executed using Stata software. The procedure outlined here was performed for all four panels and for the pooled data covering June 1992 to June 2014.

RESULTS

Descriptive Statistics

Reviewing the comparative performance of the eight equity markets covered by the study, as presented in Table 2, we find that the Indonesian bourse showed the highest growth performance between June 1992 and June 2014 for an impressive incremental growth of 1,530%, which is almost four times that of the nearest top performer. Looking at the four time periods, the exchange topped the first and third periods, and was placed second during the fourth period. It's only low growth period that would be during the Asian Crisis period, where in place among the lower half performers.

Table 2. Comparative Performance of Equity Markets Covered

	PSE	TH	SG	MA	IN	KO	CH	US	JA
Pooled Data (June 1992-June 2014)									
Growth Rate	383.10%	115.69%	113.53%	219.60%	1530.42%	250.69%	65.90%	395.35%	-17.36%
Ranking	3	6	7	5	1	4	8	2	9
Period S.D.	101.999	54.082	41.843	61.266	473.419	92.793	76.468	98.344	21.625
Ranking	2	7	8	6	1	4	5	3	9
Skewness	1.297	0.419	0.239	0.565	1.143	0.513	1.429	-0.284	0.113
Kurtosis	1.153	-0.925	-0.863	-0.520	-0.114	-1.154	3.059	-0.468	-1.219
Panel 1 (June 1992-May 1997)									
Growth Rate	98.30%	-17.78%	35.47%	87.55%	132.61%	30.73%	4.09%	115.82%	9.38%
Ranking	3	9	5	4	1	6	8	2	7
Period S.D.	46.242	39.057	19.678	34.723	39.842	25.249	19.366	34.289	9.990
Ranking	1	3	7	4	2	6	8	5	9
Skewness	-0.653	-0.186	-1.001	-0.609	-0.117	-0.185	0.690	0.896	-0.334
Kurtosis	-0.981	-1.080	0.010	-0.816	-0.852	-0.710	0.016	-0.410	-0.638
Panel 2 (June 1997-December 2002)									
Growth Rate	-63.75%	-37.06%	-35.07%	-41.50%	-38.95%	-15.92%	5.64%	13.79%	-57.25%
Ranking	9	5	4	7	6	3	2	1	8
Period S.D.	31.258	12.261	22.484	25.072	31.122	31.275	26.515	33.635	17.668
Ranking	3	9	7	6	4	2	5	1	8
Skewness	0.434	0.911	-0.202	0.011	0.765	0.029	0.296	-0.368	-0.166
Kurtosis	-0.622	1.108	-0.420	0.702	0.539	-0.546	-1.074	-1.150	-0.932
Panel 3 (January 2003-December 2007)									
Growth Rate	255.61%	140.71%	159.67%	123.58%	546.16%	202.31%	287.55%	59.02%	78.43%
Ranking	3	6	5	7	1	4	2	9	8
Period S.D.	56.159	17.329	44.907	36.266	206.633	70.417	103.523	43.642	17.031
Ranking	4	8	5	7	1	3	2	6	9
Skewness	0.618	-0.999	0.531	0.889	0.843	0.543	1.843	0.261	0.010
Kurtosis	-0.683	1.451	-0.547	0.004	-0.011	-0.606	2.240	-0.238	-1.433
Panel 4 January 2008-June 2014)									
Growth Rate	88.99%	73.14%	-6.51%	30.29%	77.67%	5.54%	-61.07%	26.85%	-0.95%
Ranking	1	3	8	4	2	6	9	5	7
Period S.D.	110.662	47.858	27.707	47.540	360.973	47.328	42.363	70.437	12.496
Ranking	2	4	8	5	1	6	7	3	9
Skewness	0.219	-0.042	-1.698	-0.446	-0.378	-1.121	1.300	0.112	0.686
Kurtosis	-1.187	-1.020	2.345	-0.573	-0.942	0.701	2.334	-0.540	-0.894

This dramatic performance is more evident when the graph below is viewed, where the starting nominal levels of ASEAN 5 exchanges were assigned a base level of 100. With its high return, the bourse also leads in terms of volatility, as it displays the highest volatility or variability for the entire 22 years covered by the study, as evidenced by its standard deviation. It also ranked first during the periods before and during the World Financial Crisis, second during the first period, and fourth during the Asian Crisis.

The US and Philippine markets are close contenders in growth performance during the said periods, with the former taking second spot during the pre-Asian crisis period, top spot during the Asian Crisis panel, and 6th and 3rd for the remaining periods, respectively. The latter held the stop spot during the Financial Crisis period, third during the first and third panels, and last during the Asian Crisis period. Like the

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Indonesian market, the securities of these countries posted volatilities that gave them the 2nd and 3rd spots for the entire period.

Among the markets covered, only the Japanese security market posted a net reduction of approximately 17% for that period. The exchange, however, boasts of the lowest volatility with standard deviations were consistently the lowest among the eight saves for the period covering the Asian Crisis, where it had the second to the lowest level of variability.

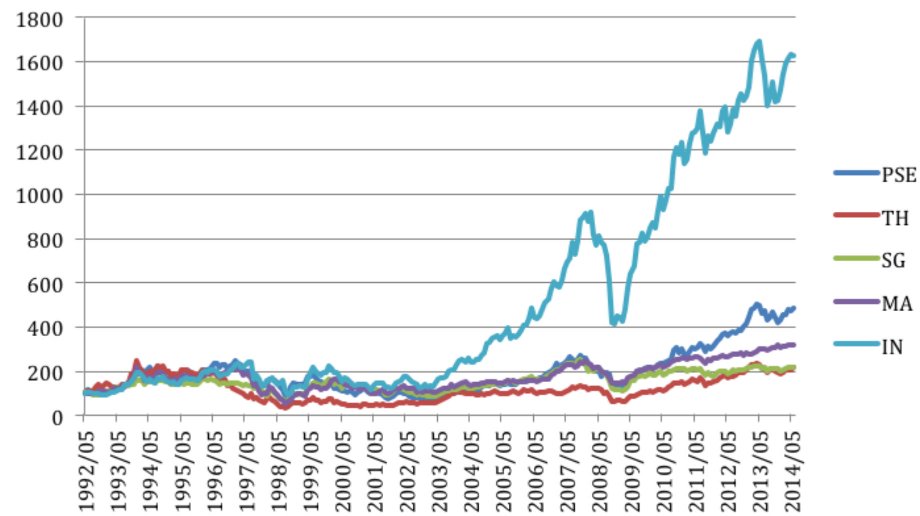

Figure 1. Line Graph of Indexed Growth of ASEAN 5 Security Markets

Looking at the other markets, we find that, in most cases, their ranking in returns is approximately the same as their ranking in variability. These observations are consistent with the long-held financial principle, which suggests that higher returns are associated with higher volatility and risks.

As expected, all exchanges in the Asia-Pacific incurred significant contraction in value during the Asian Crisis period. However, this was followed by substantive three-digit growth rates in the period that followed the US bourse, even with its respectable 59% increase in value, the poorest performer for the first time during the time horizon of the study.

A better appreciation of the variability of the indices can be better appreciated by reviewing Figure 2a to 2b, where we find a higher amplitude of variability corresponding to the periods of the Asian Crisis and the World Financial Crisis. The increase in variability during the crisis periods, unfortunately, does not manifest itself too well in the figures presented in Table 2 as the panels defined in this study, for the purpose of obtaining more observations per panel and covering periods well beyond the high volatility phases, thus diluting the reported volatility during crisis periods.

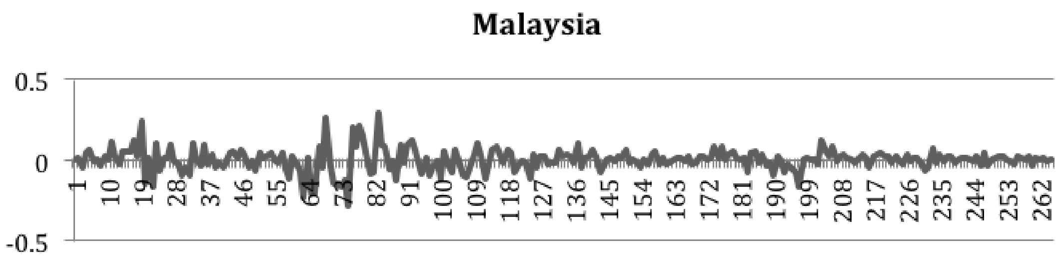

Figure 2a. Malaysia's Indexed Monthly Change in Value

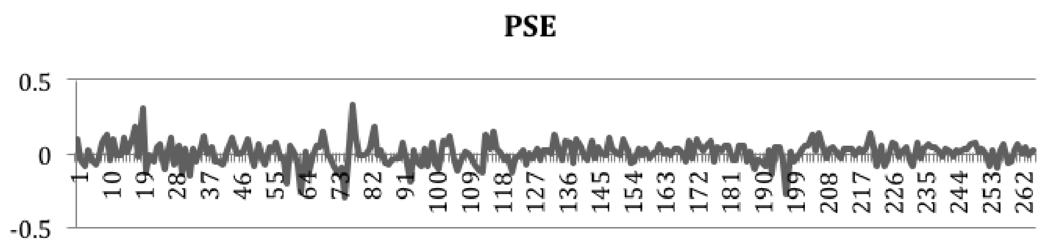

Figure 2b. Philippines' Indexed Monthly Change in Value

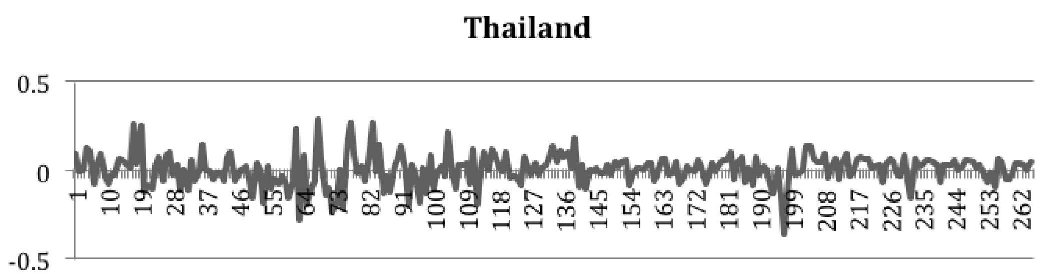

Figure 2c. Thailand's Indexed Monthly Change in Value

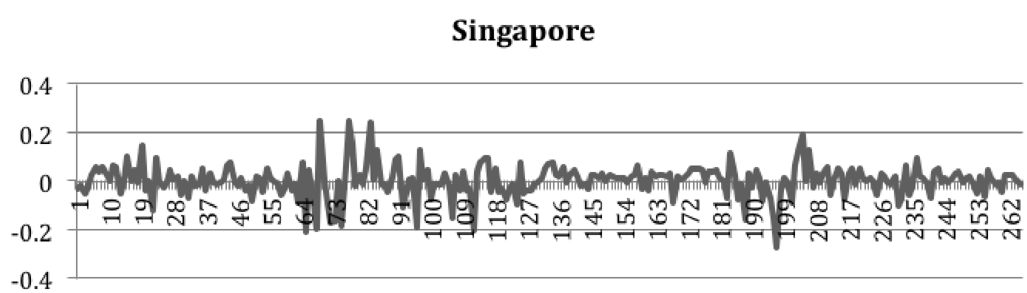

Figure 2d. Singapore's Indexed Monthly Change in Value

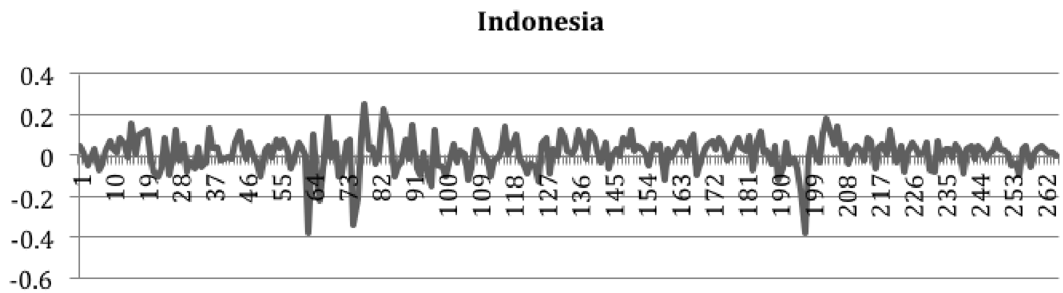

Figure 2e. Indonesia's Indexed Monthly Change in Value

The figures above do not present remarkable skewness and kurtosis, which warrants further study.

Performing a correlation table for the indices, it can be seen that the average correlation coefficient between these nine markets increased from approximately 0.367 to 0.567. The rise is more pronounced for the ASEAN 5 markets, whose average correlation rose from 0.73 during the pre-Asian crisis period to 0.897 during the 4th panel covering the World Financial Crisis and its aftermath.

Table 3. Comparison of Correlation Matrix of Panel 1 and Panel 2

Panel 1 (below diagonal) vs. Panel 4 (above diagonal) Comparison									
	PSE	**TH**	**SG**	**MA**	**IN**	**KO**	**CH**	**US**	**JA**
PS	1	0.9824	0.7233	0.9452	0.7724	0.7724	-0.4465	0.9037	0.4865
TH	0.4983	1	0.8009	0.9535	0.8441	0.8441	-0.359	0.9024	0.4736
SG	0.8936	0.6902	1	0.8423	0.9147	0.9147	0.1522	0.7749	0.537
MA	0.9698	0.4576	0.8966	0.9712	0.8915	0.8915	-0.2635	0.9175	0.5022
IN	0.9127	0.244	0.7989	1	0.8838	0.8838	-0.3422	0.8718	0.3942
KO	0.5922	0.8477	0.7758	0.3852	1	1	-0.022	0.7701	0.3509
CH	-0.272	-0.6924	-0.3993	-0.05	-0.5976	-0.5976	1	-0.2746	0.0545
US	0.6778	-0.1771	0.4737	0.848	0.0475	0.0475	0.1804	1	0.7271
JA	0.3867	0.1115	0.4786	0.3966	0.2428	0.2428	-0.091	0.3024	1

This observation is consistent with the observations of earlier studies that suggest that ASEAN and other Asia-Pacific economies have become more cointegrated since the Asian Crisis. This point will be discussed further when it presents the results.

Unit Root Test

Applying the DF-GLS test and the Phillips-Perron test (PP Test) at the pooled data level, we find that all variables save for CPI and INT, fulfill the requirement of being non-stationary at level but stationary at the 1% significant level at the first difference for both tests – a requirement for the cointegration test. Both tests indicated that CPI may be stationary at level, whereas only the PP Test declared this for INT. Table 4a presents the unit root tests for the pooled data. As the macroeconomic data series are primarily taken for the OLS Model and are not included in the cointegration model, the researcher is not concerned with this outcome. Consequently, macroeconomic variables will no longer be discussed in the remainder of the discussion on unit root tests.

Table 4a. Pooled Data Unit Root Tests

	ERS DF-GLS						Philip-Perron Test				
Variables	Level Value		k	1st Diff. Value		k	Level Value		P	1st Diff Value	
PSE	-1.420		1	-7.616	***	1	-0.782		0.8244	-15.097	***
TH	-1.346		1	-8.164	***	1	-1.209		0.6696	-15.369	***
SG	-2.599		1	-9.611	***	1	-2.046		0.2669	-15.070	***
MA	-2.151		4	-9.074	***	2	-1.631		0.467	-14.483	***
IN	-1.990		1	-10.891	***	1	-0.364		0.9159	-13.486	***
KO	-2.471		1	-10.475	***	1	-1.41		0.5776	-14.196	***
CH	-2.040		1	-10.858	***	1	-1779		0.391	-18.209	***
US	-1.268		1	-10.099	***	1	-1.591		0.4879	-16.032	***
JA	-2.118		1	-3.704	***	3	-1.999		0.2869	-15.02	***
CPI	-3.319	*	1	-7.416	***	11	-2.811	*	0.0567	-12.175	***
FX	-0.957		1	-9.259	***	1	-1.624		0.4709	-10.364	***
INT	-1.086		14	-4.295	***	13	-3.58	*	0.0062	-15.660	***
M2	-1.603		12	-3.486	***	11	-0.99		0.7568	-17.799	***

Note: ** denotes 10% significance level, ** 5%, and *** 1%*

At the panel level, market indices are diagnosed differently using the two-unit root tests. KO and US are diagnosed as stationary by the PP Test but not by the DF-GLS test in Panel 1, as presented in Table 4. b.

Table 4b. Panel 1 Unit Root Tests

	ERS DF-GLS						Phillip-Perron Test				
Variables	Level Value		k	1st Diff. Value		k	Level Value		p	1st Diff. Value	
PSE	-1.276		1	-4.408	***	1	-0.782		0.8244	-8.9	***
TH	-0.026		1	-4.734	***	1	-0.964		0.7662	-7.064	***
SG	-0.913		1	-4.754	***	1	-1.839		0.3612	-8.179	***
MA	-2.048		2	-3.897	***	1	-1.915		0.3253	-8.872	***
IN	-2.296		1	-4.364	***	1	-1.14		0.699	-6.387	***
KO	-1.130		1	-4.697	***	1	-1.93		0.3183	-7.104	***
CH	-1.081		1	-6.369	***	1	-2.825	*	0.0548	-9.422	***
US	0.529		1	-4.963	***	1	1.974		0.9989	-8.861	***
JA	-2.728		1	-5.594	***	1	-2.596	*	0.0938	-7.852	***
CPI	-1.826		1	-4.521	***	1	-1.615		0.4752	-6.545	***
FX	-2.351		1	-4.007	***	1	-1.94		0.3136	-4.592	***
INT	-4.216	***	1	-4.686	***	1	-2.718	*	0.071	-4.384	***
M2	-2.139		1	-5.028	***	1	-0.003		0.9583	-8.147	***

In Panel 2, DF-GLS identifies PSE as an I (0) variable, while the PP Test declared TH, MA, and IN as I (0) variables (Table 4.c). TH is again identified as a level stationary process by the PP in Panel 3. Panel 4 in Table 4.e presents reasons for concern as five of the variables are presented by DF-GLS as level stationary (PSE, SG, MA, IN, and KO), while CH is jointly labeled by both tests.

While this apparent loss of power by the test may be attributed to the lower number of observations at the panel level (i.e., 60+ observations/panel vs. 266 observations at the pool level), conclusions made from the cointegration tests on this panel must be tempered with caution.

Table 4c. Panel 2 Unit Root Tests

Variables	ERS DF-GLS					Philip-Perron Test				
	Level Value		k	1st Diff. Value		k	Level Value		p	1st Diff. Value	
PSE	-3.163	**	1	-5.335	***	1	-1.709		0.4264	-6.396	***
TH	-2.116		1	-4.633	***	1	-2.862	**	0.0499	-8.415	***
SG	-1.832		1	-4.437	***	1	-2.047		0.2665	-7.976	***
MA	-1.999		1	-4.172	***	1	-2.776	*	0.0618	-6.67	***
IN	-2.626		1	-6.346	***	1	-2.965	**	0.0383	-7.011	***
KO	-2.106		1	-5.025	***	1	-2.051		0.2645	-6.502	***
CH	-1.304		1	-4.701	***	1	-1.5		0.5336	-7.912	***
US	-1.232		1	-6.563	***	1	-2.245		0.1902	-8.923	***
JA	-1.489		1	-5.334	***	1	-0.369		0.9151	-8.439	***
CPI	-1.273		1	-5.547	***	1	-0.067		0.9527	-6.905	***
FX	-1.673		1	-4.68	***	1	-2.884	**	0.0473	-5.554	***
INT	-2.071		1	-4.759	***	1	-0.709		0.8445	-6.580	***
M2	-2.592		1	-7.691	***	1	-1.053		0.7334	-10.476	***

Table 4d. Panel 3 Unit Root Tests

Variables	ERS DF-GLS					Philip-Perron Test				
	Level Value		k	1st Diff. Value		k	Level Value		p	1st Diff. Value	
PSE	-2.069		1	-6.478	***	1	-1.865		0.3487	-10.32	***
TH	-1.809		1	-4.605	***	1	-2.586	*	0.096	-7.539	***
SG	-2.233		1	-4.766	***	1	-0.744		0.835	-7.033	***
MA	-1.416		1	-4.704	***	1	0.01		0.9593	-7.986	***
IN	-1.926		1	-4.559	***	1	-0.105		0.949	-8.248	***
KO	-2.433		1	-4.25	***	1	-0.394		0.9112	-8.471	***
CH	-0.390		1	-3.877	***	1	1.177		0.9958	-6.31	***
US	-1.928		1	-4.576	***	1	-1.1		0.7152	-7.555	***
JA	-1.162		1	-3.875	***	1	-1.475		0.5458	-6.545	***
CPI	-1.039		1	-2.315		1	1.543		0.5123	-6.499	***
FX	-0.342		1	-4.521	***	1	2.605		0.9991	4.194	***
INT	-1.535		1	-5.164	***	1	-1.105		0.7132	-6.267	***
M2	-3.600	**	1	-4.02	***	1	0.331		0.9787	-6.646	***

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Table 4e. Panel 4 Unit Root Tests

Variables	ERS DF-GLS							Philip-Perron Test			
	Level Value		k	1st Diff. Value		k	Level Value		p	1st Diff. Value	
PSE	-3.027	*	1	-2.288	*	2	-0.244		0.933	-7.923	***
TH	-2.693		1	-2.579		2	-1.839		0.3612	-6.68	***
SG	-3.382	**	1	-2.949	*	1	-2.098		0.2454	-6.989	***
MA	-3.865	***	1	-3.629	**	1	-0.633		0.8634	-7.377	***
IN	-4.203	***	3	-2.814	*	2	-0.811		0.816	-6.517	***
KO	-3.936	***	3	-1.885		2	-1.641		0.4615	-8.622	***
CH	-4.852	***	1	-3.539	**	1	-3.687	*	0.0043	-9.429	***
US	-1.579		1	5.075	***	1	-0.589		0.8736	-7.481	***
JA	1.160		1	-4.335	***	1	-1.776		0.3927	-7.422	***
CPI	-3.367	**	1	-4.305	***	1	-2.123		0.2353	-5.387	***
FX	-1.948		1	-6.332	***	1	-1.714		0.4239	-6.331	***
INT	-4.103	***	1	-6.752	***	2	-3.024	**	0.0327	-8.363	***
M2	-2.172		6	-2.713	*	11	1.197		0.996	-10.354	***

PSE as Dependent Variable

By running the OLS model in equation (2) on the pooled data and on four panels, we find the following estimations from the model and various tests on all five models

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Table 5. Estimation Results of OLS Models Employing All Identified Variables for the Pool and Panels

	Pooled Data			Panel 1			Panel 2			Panel 3			Panel 4		
Variables	coef.	t-stat	p-value	coef.	t-stat	p-value	coef.	t-stat	p-value	coef.	t-stat	p-value	coef.	t-stat	p-value
TH	0.288	5.47	0	0.305	2.79	0.008	0.274	2.42	0.019	0.156	1.2	0.237	0.187	0.12	0.128
SG	0.283	3.61	0	0.185	0.67	0.506	0.239	1.76	0.083	0.473	1.7	0.096	0.264	0.17	0.123
MA	0.132	2.11	0.036	0.498	2.83	0.007	0.013	0.12	0.908	-0.06	-0.3	0.787	-0.11	0.18	0.561
IN	0.224	4.22	0	0.3	1.76	0.086	0.208	2.17	0.035	0.162	1.03	0.309	0.389	0.13	0.003
KO	-0.1	-2.1	0.037	-0.25	-2.1	0.04	0.018	0.18	0.859	-0.19	-1.3	0.216	-0.22	0.14	0.121
CH	0.013	0.48	0.635	0.015	0.4	0.692	0.002	0.01	0.988	-0.01	-0.1	0.903	0.15	0.07	0.028
US	0.118	1.16	0.249	-0.37	-1.2	0.249	0.215	1.01	0.318	0.278	0.9	0.374	0.367	0.15	0.017
JA	-0.05	-0.8	0.431	0.082	0.61	0.542	-0.05	-0.3	0.783	-0.07	-0.4	0.714	-0.25	0.1	0.013
CPI	-0.02	-0.7	0.489	0.02	0.27	0.787	0.05	0.58	0.566	0.036	0.55	0.588	-0.08	0.03	0.009
FX	-0.15	-0.9	0.348	0.01	0.02	0.984	-0.33	-1.1	0.299	-0.23	-0.5	0.652	0.181	0.37	0.626
INT	-0	-0.3	0.783	0.007	0.07	0.943	0.013	0.13	0.893	-0.12	-1.6	0.118	-0	0	0.434
M2	-0.04	-0.3	0.749	-0.31	-1.4	0.177	0.066	0.19	0.847	0.035	0.12	0.903	0.031	0.18	0.862
Const.	0.002	0.51	0.612	0.013	1.45	0.153	-0.01	-0.8	0.426	0.007	0.97	0.336	0.005	0	0.284
Number of obs			265			60			67			60			78
F			30.61			8.59			8.76			2.19			12.99
Prob > F			0			0			0			0.028			0
R-squared			0.593			0.687			0.661			0.358			0.706
Adj R-squared			0.574			0.607			0.585			0.194			0.651
Root MSE			0.05			0.053			0.063			0.044			0.037
Breusch-Pagan test for heteroskedasticity															
chi 2			2.43			0.03			1.4			0.25			0.53
p			0.1188			0.855			0.237			0.619			0.467
Cameron & Trivedi's decomposition of IM-test															
	chi2	df	p	chi2	df	p	chi2	df	p	chi2	df	p	chi2	df	p
Heteroskedas.	62.79	20	0	60	59	0.439	67	66	0.443	60	59	0.439	78	77	0.447
Skewness	14.03	5	0.015	14.05	12	0.298	12.29	12	0.423	12.65	12	0.395	21.95	12	0.038
Kurtosis	0.62	1	0.433	0.02	1	0.88	0.04	1	0.833	2.33	1	0.127	0.04	1	0.851
Ramsey RESET test using powers of the fitted values of I															
	F		1.03			2.88			3.29			1.55			2.8
	Prob>F		0.3796			0.047			0.028			0.215			0.048
Information Criteria															
		AIC	BIC		AIC	BIC		AIC	BIC		AIC	BIC		AIC	BIC
		-824	-778		-171	-144		-169	-140		-194	-166.56		-281	-250.1
Durbin Watson			2.248			2.46			1.9981			2.511			2.266
Test for ARCH effect in the residuals															
	lags	chi2	p value	lags	chi2	p value	lags	chi2	p value	lags	chi2	p value	lags	chi2	p value
	1	0	0.954	1	0.29	0.588	1	0.13	0.72	1	0.39	0.533	1	0.21	0.501
	2	2.21	0.331	2	2.1	0.35	2	0.22	0.895	2	1.05	0.592	2	0.51	0.595
	3	13	0.005	3	3.67	0.3	3	0.27	0.967	3	1.35	0.717	3	0.65	0.674
	4	13.1	0.011	4	4.59	0.332	4	1.49	0.828	4	1.45	0.835	4	1.18	0.665

All five OLS models show statistical significance with p-values almost nil for four models and 0.028 Panel 3, the pre-World Financial Crisis period. All four models passed the Breusch–Pagan test of multiplicative heteroskedasticity (Breusch & Pagan, 1979). Converting the non-stationary data series of the market indices into their first-difference log form makes them suitable for OLS.

However, the pooled data model fails the Cameron & Trivedi (1990) test, where we find evidence of non-normal skewness and heteroskedasticity.

The models for Panels 1 and 2 fare well, with all tests saving the Ramsey RESET test for omitted variables, suggesting that there may be specification errors in the models for this period in the form of the exclusion of important variables. The OLS for Panel 4 also displays non-normal skewness.

Looking at the independent variables, none of the Philippine macroeconomic variables save for CPI in the fourth panel prove to be significant for the five OLS models. IN, SG, and TH appear to be the most endogenous variables, with each proving significant at least three times in the four models. Securities from large economies, such as the USA, China, and Japan, prove to be significant only in the fourth panel.

Parsimonious versions of the above models were specified and subjected to the same statistical tests as the first five models. Curiously, the parsimonious models, except for the Fourth Panel model, proved to have a higher predictive power and lower root-mean-square deviation. However, the larger models still exhibited slightly higher scores in the other test (esp. information criteria), these advantages do not appear to be material. The models are listed in Table 6.

Table 6. Estimation Results of Parsimonious OLS Models for the Pool and Four Temporal Panels Chosen

Pooled Data				Panel 1				Panel 2				Panel 3				Panel 4			
Variables	coef.	t-stat	p-value	**Var.**	coef.	t-stat	p-value	**Var.**	coef.	t-stat	p-value	**Var.**	coef.	t-stat	p-value	**Var.**	coef.	t-stat	p-value
TH	0.2875	0.051	0	**TH**	0.33197	0.1015	0.002	**TH**	0.2611	0.0848	0.003	**SG**	0.6488	0.161	0	**IN**	0.4931	0.0821	0
SG	0.3207	0.068	0	**MA**	0.51099	0.1303	0	**SG**	0.3604	0.095	0	**_cons**	0.0108	0.006	0.084	**CH**	0.1343	0.0592	0.026
MA	0.1407	0.06	0.021	**IN**	0.28704	0.1324	0.034	**IN**	0.2215	0.0799	0.007					**US**	0.4003	0.1363	0.004
IN	0.2286	0.051	0	**KO**	-0.19738	0.1085	0.074	**_cons**	-0.009	0.0073	0.206					**JA**	-0.1951	0.0913	0.036
KO	-0.1035	0.047	0.029	**_cons**	0.00398	0.0069	0.568									**CPI**	-0.0837	0.031	0.008
_cons	0.0017	0.003	0.59													**_cons**	0.0051	0.0043	0.244
Number of obs			265				60				67				60				78
F			73.84				26.54				37.77				16.33				29.68
Prob > F			0				0				0				2E-04				0
R-squared			0.5877				0.6587				0.6427				0.22				0.6733
Adj R-squared			0.5798				0.6339				0.6257				0.206				0.6507
Root MSE			0.04953				0.05092				0.05992				0.043				0.0371
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity																			
chi 2			2.43				0				0.63				0.13				0.62
p			0.1188				0.9703				0.4287				0.722				0.4324
Cameron & Trivedi's decomposition of IM-test																			
	chi2	df	p		chi2	df	p		chi2	df	p		chi2	df	p		chi2	df	p
Heteroskec	62.79	20	0		21.1	14	0.0991		19.31	9	0.0226		0.99	2	0.609		24.44	20	0.2238
Skewness	14.03	5	0.0154		3.12	4	0.5379		6.78	3	0.0791		1.33	1	0.249		8.22	5	0.1444
Kurtosis	0.62	1	0.4328		1.56	1	0.212		0.12	1	0.7304		2.75	1	0.097		1.19	1	0.2751
Ramsey RESET test using powers of the fitted values of PSE																			
	F		1.03				3.55				3.95				1.03				1.88
	Prob>F		0.3796				0.0206				0.0122				0.386				0.1413
Information Criteria																			
		AIC	BIC			AIC	BIC			AIC	BIC			AIC	BIC			AIC	BIC
		-834.8	-813.317			-182.26	-171.787			-183.16	-174.34			-204	-200			-286.6	-272.5
Durbin Watson			2.22556				2.32041				1.92195				2.681				2.2532
Test for ARCH effect in the residuals																			
	lags	chi2	p value		lags	chi2	p value		lags	chi2	p value		lags	chi2	p value		lags	chi2	p value
	1	0.003	0.9535		1	0.38	0.5374		1	0.159	0.6905		1	1.228	0.268		1	0.624	0.4312
	2	2.211	0.331		2	1.751	0.4167		2	0.073	0.964		2	1.446	0.485		2	0.684	0.6522
	3	13	0.0046		3	5.478	0.14		3	0.491	0.9208		3	1.642	0.65		3	0.960	0.7068
	4	13.13	0.0107		4	6.209	0.1841		4	1.812	0.7702		4	1.484	0.83		4	1.483	0.7199

These compact models, as long as their specifications are valid, could prove to be more practical for practitioners, as they allow them to predict with fewer variables to monitor.

Cointegration

To commence the fitting of VECM models for the pooled data and the four panels, the time series data for each of these periods are subjected to the process using a series of likelihood ratios, as prescribed by Nielsen (2001), to select lag order(s) for the model. Table 7 presents the sample software output.

Table 7. Sample output for lag order selection

Varsoc PSE-JA								
Selection-order criteria								
Sample: **1960m6 – 1982m2**							Number of obs = 261	
Lag	**LL**	**LR**	**df**	**p**	**FPE**	**AIC**	**HQIC**	**SBIC**
0	3351.28				6.1e-23	-25.6113	-25.5619*	-25.4884*
1	3434.04	165.53	81	0.000	6.0e-23*	-25.6248*	-25.1307	-24.3957
2	3508.63	149.18	81	0.000	6.3e-23	-25.5757	-24.6369	-23.2403
3	3565.85	114.44	81	0.009	7.6e-23	-25.3935	-24.0101	-21.9519
4	3617.45	103.21*	81	0.049	9.7e-23	-25.1682	-23.3401	-20.6204
Endogenous: PSE TH SG MA IN KO CH US JA								
Exogenous: _cons								

Using the lags prescribed for the five models, the Johansen cointegration test is executed to check for cointegration and to define the rank order or number of cointegrating equations per model. Johansen's test results are summarized below.

Table 8. Cointegration Test Results

Vectors	r = 0	r ≤ 1	r ≤ 2	r ≤ 3	r ≤ 4	r ≤ 5	r ≤ 6	r ≤ 7	r ≤ 8
Pooled Data (June 1992-June 2014), Lags = 4									
Trace	204.0149	144.2110*	104.2785	76.5358	52.1161	33.0397	17.047	5.7843	1.0631
Critical Value (5%)	192.89	156.00	124.24	94.15	68.52	47.21	29.68	15.41	3.76
Max-Eeigen	59.8039	39.9326*	27.7427	24.4196	19.0764	15.9927	11.2627	4.7212	1.0631
Critical Value (5%)	57.12	51.42	45.28	39.37	33.46	27.07	20.97	14.07	3.76
Eeigen Values	.	0.20408	0.14137	0.10047	0.08899	0.07022	0.05922	0.04208	0.01786
Panel 1 (June 1992-May 1997), Lags = 4									
Trace	464.5442	342.2755	239.7084	166.1224	106.3119	60.1038	32.0332	8.8665*	0.0179
Critical Value (5%)	192.89	156	124.24	94.15	68.52	47.21	29.68	15.41	3.76
Max-Eeigen	122.2687	102.5672	73.5859	59.8105	46.208	28.0706	23.1668	8.8486*	0.0179
Critical Value (5%)	57.12	51.42	45.28	39.37	33.46	27.07	20.97	14.07	3.76
Eeigen Values	.	0.88294	0.83461	0.725	0.64982	0.55544	0.38888	0.33398	0.14379
Panel 2 (June 1997-December 2002), Lags = 4									
Trace	338.2864	255.533	192.526	133.4994	86.6037	50.8959	24.8777*	11.0976	1.1721
Critical Value (5%)	192.89	156	124.24	94.15	68.52	47.21	29.68	15.41	3.76
Max-Eeigen	82.7535	63.007	59.0266	46.8957	35.7078	26.0182*	13.7801	9.9255	1.1721
Critical Value (5%)	57.12	51.42	45.28	39.37	33.46	27.07	20.97	14.07	3.76
Eeigen Values	.	0.7092	0.60953	0.58563	0.50338	0.41313	0.32181	0.1859	0.13769
Panel 3 (January 2003-December 2007), Lags = 4									
Trace	373.5712	278.5462	195.8796	143.1238	95.9247	51.7993	26.7570*	10.6506	0.1174
Critical Value (5%)	192.89	156	124.24	94.15	68.52	47.21	29.68	15.41	3.76
Max-Eeigen	95.025	82.6666	52.7558	47.1992	44.1254	25.0423*	16.1064	10.5332	0.1174
Critical Value (5%)	57.12	51.42	45.28	39.37	33.46	27.07	20.97	14.07	3.76
Eeigen Values	.	0.7948	0.74786	0.58491	0.54463	0.5207	0.34122	0.23543	0.16101
Panel 4 (January 2008-June 2014), Lags = 4									
Trace	344.2225	251.8115	175.0659	109.0486	72.6717	44.7745*	24.0915	7.5337	0.8463
Critical Value (5%)	192.89	156	124.24	94.15	68.52	47.21	29.68	15.41	3.76
Max-Eeigen	92.4111	76.7455	66.0173	36.3769	27.8972	20.683*	16.5578	6.6874	0.8463
Critical Value (5%)	57.12	51.42	45.28	39.37	33.46	27.07	20.97	14.07	3.76
Eeigen Values	.	0.69418	0.62616	0.57103	0.37273	0.30069	0.23292	0.19126	0.08216

Note: ** denotes significance at the 95% confidence interval*

The results show that the variables defined for the four panels and the pooled data are cointegrated and can be fitted to the VECM models. Considering the relatively large number of variables we defined for our models, each VECM requires approximately 12 pages to contain all of their parameters. We cannot present them in this paper, but we could, nonetheless, present summaries of the Granger Causality reports based on fitted VECM models.

Table 9a. Granger Causality Based on VECM – Panel 1

	Independent Variables								
Dep. Var.	**PSE**	**TH**	**SG**	**MA**	**IN**	**KO**	**CH**	**US**	**JA**
PSE		7.077903	7.941249*	5.124205	7.119394	3.415454	5.462635	0.986802	4.821772
		0.1318	0.0938	0.2748	0.1297	0.4908	0.2430	0.9118	0.3061
TH	4.359653		5.441479	2.327399	4.362652	1.700429	5.239993	1.354521	6.269811
	0.3595		0.2449	0.6758	0.3591	0.7906	0.2635	0.8521	0.1799
SG	2.691949	4.750590		4.828640	2.279440	2.183779	4.114130	1.930306	2.457557
	0.6106	0.3139		0.3053	0.6845	0.7020	0.3908	0.7486	0.6523
MA	2.312083	5.378621	5.932649		5.226095	4.483824	4.004466	1.120385	3.338447
	0.6786	0.2506	0.2042		0.2649	0.3445	0.4054	0.8910	0.5029
IN	9.491199**	12.47621**	10.25673**	4.282546		5.735040	14.69365***	2.082052	5.535386
	0.0499	0.0141	0.0363	0.3691		0.2198	0.0054	0.7207	0.2366
KO	15.42701***	6.122449	10.28154**	15.20251***	7.811054*		2.483450	5.018347	8.724339*
	0.0039	0.1902	0.0359	0.0043	0.0987		0.6476	0.2854	0.0684
CH	3.101209	0.933480	0.918105	3.971129	1.051879	0.743751		4.565947	1.161796
	0.5410	0.9197	0.9219	0.4099	0.9018	0.9458		0.3348	0.8843
US	9.291286*	4.252452	7.238897	4.663941	4.321712	4.066841	7.045332		4.473444
	0.0542	0.3729	0.1238	0.3235	0.3642	0.3970	0.1335		0.3457
JA	6.501347	8.142195*	2.116045	7.599258	7.223398	6.876988	1.320077	6.647746	
	0.1647	0.0865	0.7144	0.1074	0.1245	0.1425	0.8580	0.1557	

Note: ** denotes 10% significance level, ** 5%, and *** 1%*

Briefly, the table above shows that PSE is Granger-causing in IN, KO, and US. TH is Granger-causing IN and JA. SG is a Granger-causing PSE, IN, and KO. MA is a Granger-causing KO. IN is also a Grange-causing KO. CH is a Granger-causing IN, whereas JA is a Granger-causing KO. The first panel had 12 Granger relationships with KO (with 5) and IN (with 4) at the receiving end of 9 of these. PSE and SG were tied as top Granger users with three each.

Table 9b. Granger Causality Based on VECM – Panel 2

	Independent Variables								
Dep. Var.	**PSE**	**TH**	**SG**	**MA**	**IN**	**KO**	**CH**	**US**	**JA**
PSE		1.026235	2.281366	3.444467	0.160419	0.972853	7.317272**	4.390313	3.850210
		0.5986	0.3196	0.1787	0.9229	0.6148	0.0258	0.1113	0.1459
TH	1.650992		6.398015**	3.676490	1.473024	3.196653	2.086041	5.313386*	5.688311*
	0.4380		0.0408	0.1591	0.4788	0.2022	0.3524	0.0702	0.0582
SG	0.773977	9.891204***		0.623611	2.309883	4.472185	2.263782	6.959830**	1.097674
	0.6791	0.0071		0.7321	0.3151	0.1069	0.3224	0.0308	0.5776
MA	3.025265	2.185458	3.117647		0.053151	1.224234	1.357115	0.622834	0.186613
	0.2203	0.3353	0.2104		0.9738	0.5422	0.5073	0.7324	0.9109
IN	1.227176	18.10770***	9.698626***	10.98232***		6.487221**	1.416771	6.096890**	2.510239
	0.5414	0.0001	0.0078	0.0041		0.0390	0.4924	0.0474	0.2850
KO	1.431494	3.577701	0.960374	3.093064	0.981918		2.055325	3.151278	2.341698
	0.4888	0.1672	0.6187	0.2130	0.6120		0.3578	0.2069	0.3101
CH	0.765729	3.127158	1.531673	2.904136	2.255797	2.015057		2.149622	2.258484
	0.6819	0.2094	0.4649	0.2341	0.3237	0.3651		0.3414	0.3233
US	0.394740	0.342623	0.143659	1.146621	2.222787	2.105124	1.739590		1.857509
	0.8209	0.8426	0.9307	0.5637	0.3291	0.3490	0.4190		0.3950
JA	0.484077	6.390250**	13.38991***	2.571613	2.553086	0.256257	15.79030***	12.73131***	
	0.7850	0.0410	0.0012	0.2764	0.2790	0.8797	0.0004	0.0017	

Note: ** denotes 10% significance level, ** 5%, and *** 1%*

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Moving to Panel 2 or the Asian Crisis period, we find that the number of Granger relationships has increased to 14 with the US now as the top Granger-causer with four counts and SG a close second with three counts. IN (5), JA (3), and TH (3) dominate the receiving end of these relationships.

A simpler method for summarizing and presenting significant Granger relationships is presented in Table 10.

Table 10. Synopsis of Granger-causality Reports for Panels 1 to 4

12	Panel	3	2	3	1	1		1		1
	1	PSE	TH	SG	MA	IN	KO	CH	US	JA
1	PSE			X						
0	TH									
0	SG									
0	MA									
4	IN	X	X	X				X		
5	KO	X		X	X	X				X
0	CH									
1	US	X								
1	JA		X							

14	Panel		2	3	1		1	2	4	1
	2	PSE	TH	SG	MA	IN	KO	CH	US	JA
1	PSE							X		
3	TH			X					X	X
2	SG		X						X	
0	MA									
5	IN		X	X	X		X		X	
0	KO									
0	CH									
0	US									
3	JA			X				X	X	

14	Panel	1	2		3	1	1	3	2	1
	3	PSE	TH	SG	MA	IN	KO	CH	US	JA
0	PSE									
4	TH				X		X	X	X	
2	SG	X			X					
4	MA		X			X		X	X	
1	IN									X
0	KO									
0	CH									
3	US		X		X			X		
0	JA									

20	Panel	1		6	4		1	3	3	2
	4	PSE	TH	SG	MA	IN	KO	CH	US	JA
0	PSE									
1	TH			X						
3	SG				X			X	X	
4	MA	X		X					X	X
1	IN									X
4	KO			X	X			X	X	
2	CH			X			X			
3	US			X	X			X		
2	JA			X	X					

The number of Granger relationships in Panel 4, or the World Crisis and aftermath era, has risen to 20 with SG as a break-away Granger-causer with six counts and its close neighbor MA second with four counts. The giant economies of the US and CH have become more active since the Asian Crisis period until the fourth period.

SG leads the pack in Granger relations over the four periods as Granger-causer in 12 counts and receiver in 7 counts for a total of 19 relationships. MA, followed by 9 and 8, for a total of 17. The US has figures 9 and 7 for a total of 16. All the rest are clustered together with similar scores ranging from 11 to 14, except for PSE, whose Granger relationships have tapered down from four relationships in Panel 1 to just one per period from Panels 2 to 3 for a total score of 7.

At this point, we cannot say whether having fewer Granger relations is disadvantageous for PSE, considering that it has taken the top spot in terms of growth in the Fourth Panel. This could be a subject for future studies.

DISCUSSION

Based on the descriptive statistics presented in this paper, we confirm the relationship between return and risk, as manifested by the historic performances of the nine markets covered in our 22-year dataset.

This study strongly suggests that the bourses stated are becoming more cointegrated, as evidenced by (a) their increasing average correlation over the four panels covered by this study, (b) the positive results of the Johansen cointegration test, and (c) the increasing number of Granger causality relationships between the stock markets over time.

Lastly, we were able to develop robust predictive models for the Philippine Stock market using our VECM and OLS models. Aside from its forecast ability, the VECM provides evidence of a higher level of cointegration among the ASEAN 5 economies while the OLS reveals that the macroeconomic variables covered by the study had little or minimal causality in the Philippine stock market.

Conclusion

With the combined use of the OLS model, the VECM, and the Granger causality test, this study supports the conclusion of other studies that the economies of ASEAN 5 plus the other four major partner countries are growing more cointegrated and even provide causality with the other markets.

While the study covers 22 years, the decision to use monthly data to allow for correlations with macroeconomic variables has weakened the potential statistical power of the tools applied, as demonstrated by the mixed results of the unit root tests at the panel level.

Since macroeconomic variables appear virtually insignificant in our current formulations, follow-up research employing market indices only on a weekly or daily basis for the said time horizon may yield more definitive results.

Additionally, future research should verify whether having more Granger relations is better in the securities market.

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