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RESEARCH ARTICLE

The Effect of Global Financial Crisis on ASEAN Growth: Evidence From Stock Market Analysis

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Abstract: This study empirically examines the effects of the global financial crisis on economic growth through a model that considers various sectoral indices, with particular reference to the stock market, bank, and real estate. Using analysis of cointegration, parsimonious error correction model (PECM), impulse response function (IRF) and variance decomposition analysis (VDC), the study found that the effect of the global financial crisis on growth differs among ASEAN-5 countries. The PECM analysis reveals that the crisis has the real effect on the stock market and bank equations. Three out of five ASEAN countries show that the global financial crisis has a bigger effect on bank equations. This suggests that the global financial crisis created the conditions for the current credit crisis wherein increased risk premium is charged on banks loans globally. The findings from IRF and VDC highlight the shock and error variance in economic growth which were mostly explained by the stock market and banks. This finding suggests that the stock market and the banking sector provide the best leading information for economic activity, especially in developing countries. Thus, a new regulatory governance needs to be based on a well-functioning network of national and regional authorities and include international supervision of financial institutions with a global reach.

***Keywords*:** global financial crisis, stock market, economic growth, cointegration, error correction models.

JEL Classification: G01, G12, O47, C22

The stock markets of ASEAN members Indonesia, Malaysia, the Philippines, Singapore, and Thailand have undergone substantial liberalization since the late 1980s and early 1990s (World Bank, 1993; 1997). These five stock markets have a long history in the financial market. The Malaysia stock exchange was set up in 1960 and Singapore in 1973. In 1973 when Singapore left Malaysia, the Malayan stock exchange was split into the Kuala Lumpur Stock Exchange (Malaysia) and the Singapore Stock Exchange

(Singapore). Meanwhile, the Jakarta Stock Exchange (Indonesia) was established in 1977, the Manila Stock Exchange (Philippines) in 1927 and Bangkok Stock Exchange (Thailand) in 1962. The ASEAN stock markets remained relatively small in terms of market capitalization until the late 1980s. However, the ASEAN stock market has grown rapidly since 1992, following the increase in investment from foreign investors who wanted to diversify their portfolios in the Asian region.

Table 1 shows the growth of the ASEAN stock markets in the 10-year period. The ASEAN stock market is dominated by the Malaysian stock market and Singapore stock market. As can be seen from Table 1, the ASEAN stock markets experienced high growth in market capitalization in the 10-year period since 1992. Although, the Indonesian stock market growth has shrunk since 1992. Growth in the ASEAN stock markets has shown an increase in the trading value of companies and the number of companies listed (Ng, 2002). In fact, the trading volume is also taking into account the substantial decline in the value of ASEAN stock markets in 1997 following the Asian financial crisis and the global financial crisis in 2008 – 2009.

Meanwhile, as can be seen in Figure 1, the ASEAN stock markets show increasing trend from 1986 until the second quarter of 1996, and later show a downward trend in the third quarter of 1998 till the early-1999. The ASEAN stock markets also started to decline in late-2008 due to the global economic downturn. The Asian and global financial crisis has adversely affected the ASEAN stock market and financial system through "contagion effect". This "contagion effect" can cause the sudden rise in risk aversion and financial market volatility because financial markets are highly integrated at the global level.

Table 2 illustrates GDP growth, market capitalization, and nonperforming loans for the period 2002 to 2012 in the five ASEAN countries. The ratio of delinquencies and nonperforming loans (NPL) to total loan in Indonesia went down to 2.1% in 2012 as compared to 24.0% in 2002. In June 2010, the Central Bank of Indonesia (BI) introduced a policy package to develop the money markets. A wider range of instruments has been provided, and banks have been encouraged to conduct more transactions in the wholesale market. Thus, the soundness of the banking sector has improved over time.

For the Malaysian banking system, the ability to rein in loan impairment during the global economic downturn has caused the fall in gross NPL ratios from 6.5% in 2007 to 3.4% in 2010, even the growth of GDP contracted by 1.6% in 2009 as compared to 6.3% in 2007. The NPL were at healthy levels. In fact, the Malaysian banking system operates within a diversified financial system, with a developed capital market.

The percentage of NPLs in the Philippine banking sector decreased from a peak of 26.5% in 2002 to 2.4% in 2012. In brief, the banking system in the Philippines is relatively stable due to the reforms that were put in place since the Asian financial crisis in 1997.

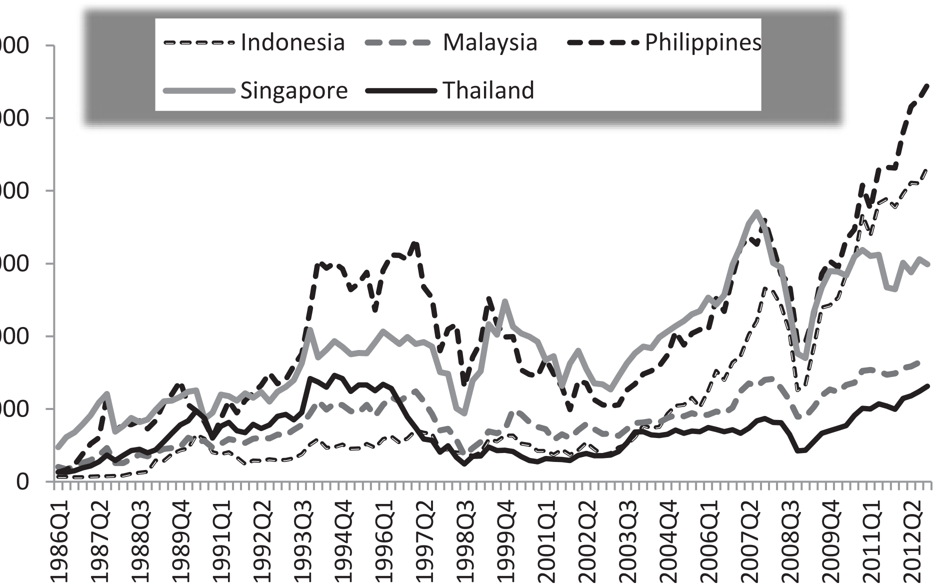
As can be seen in Table 2, Singapore's banking sector remains strong and has improved since the 1997 Asian financial crisis. The asset quality improved with nonperforming loans at 1.0% of total loans in 2012, down from 7.7% in 2002. The stock market capitalization grew from $101.9 billion in 2002 to $414.1 billion in 2012.

Meanwhile, the asset quality of Thai banks has improved over the past 10 years, with the sector's NPL ratio dropped from 15.7% to 2.7% at end-2012. Over the same period, the GDP growth increased from

Table 1. *Growth of the ASEAN Stock Markets*

	Market capitalization of listed companies (current $)			**Market capitalization of listed companies (% of GDP)**		
	1992	2002	2012	1992	2002	2012
Indonesia	1200	2999	39677	8.6	15.3	45.2
Malaysia	9400	12387	47634	158.9	122.8	156.9
Philippines	1530	3902	26414	28.9	48.0	105.6
Singapore	4880	10190	41413	99.5	112.5	150.8
Thailand	5830	4617	38300	52.3	36.4	104.7

Source: Asian Development Bank (2013)



Source: Datastream database 5.1.

Note: Quarterly observation of the local currency total index.

Figure 1. ASEAN stock markets performance between 1986:Q1–2012:Q4.

Table 2. *ASEAN GDP Growth, Market Capitalization, and Nonperforming Loans for the Period 2002–2012*

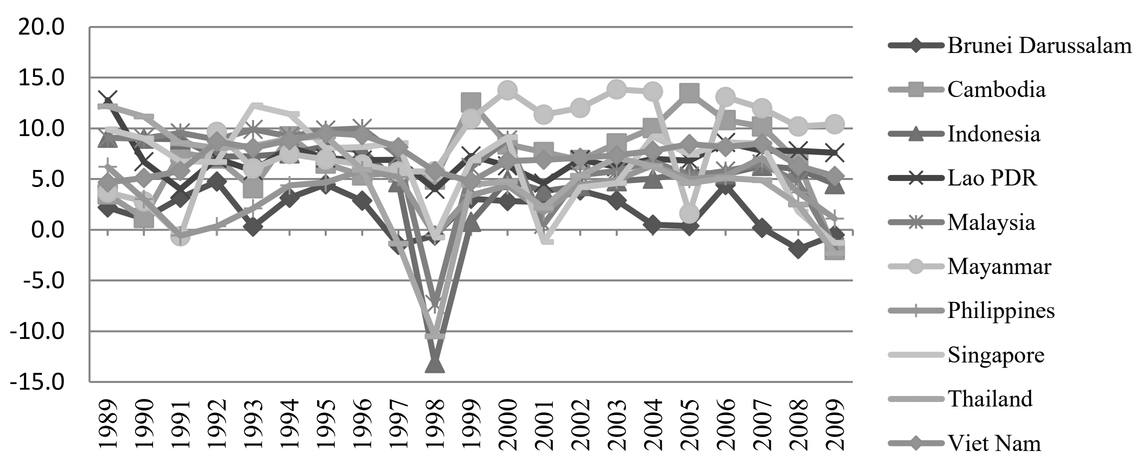
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
GDP Growth (%)											
Indonesia	4.5	4.8	5.0	5.7	5.5	6.3	6.0	4.6	6.2	6.5	6.2
Malaysia	5.4	5.8	6.8	5.3	5.6	6.3	4.8	-1.6	7.2	5.1	5.6
Philippines	3.6	5.0	6.7	4.8	5.2	6.6	4.2	1.1	7.6	3.6	6.8
Singapore	4.2	4.6	9.2	7.4	8.6	9.0	1.7	-0.8	14.8	5.2	1.3
Thailand	5.3	7.1	6.3	4.6	5.1	5.0	2.5	-2.3	7.8	0.1	6.5
Bank Nonperforming Loans to Total Gross Loans (%)											
Indonesia	24.0	6.8	4.5	7.4	6.1	4.0	3.2	3.3	2.5	2.1	2.1
Malaysia	15.9	13.9	11.7	9.6	8.5	6.5	4.8	3.6	3.4	2.7	2.2
Philippines	26.5	16.1	14.4	10.0	7.5	5.8	4.5	3.5	3.4	2.6	2.4
Singapore	7.7	6.7	5.0	3.8	2.8	1.5	1.4	2.0	1.4	1.1	1.0
Thailand	15.7	13.5	11.9	9.1	8.1	7.9	5.7	5.3	3.9	2.9	2.7
Market Capitalization of Listed Companies (billion $)											
Indonesia	30.0	54.7	73.3	81.4	138.9	211.7	98.8	178.2	360.4	390.1	
Malaysia	123.9	168.4	190.0	181.2	235.4	325.7	187.1	256.0	410.5	395.1	
Philippines	39.0	23.6	28.9	40.2	68.4	103.2	52.1	80.1	157.3	165.4	
Singapore	101.9	229.3	277.0	316.7	276.3	353.5	180.0	310.8	370.1	308.3	
Thailand	46.2	121.2	116.7	124.9	141.1	196.0	102.6	138.2	277.7	268.5	

Source: The World Bank. Retrieved October 3, 2013 from: http://databank.worldbank.org

5.3% in 2002 to 6.5% in 2012. As a whole, the banking sector in Thailand is moderate as compared to other ASEAN countries.

The economic growth in the ASEAN countries has developed very well relative to other developing regions. As can be seen from Figure 2, the growth in GDP shows a positive sign after the Asian crisis, and continuously increased until 2007. In 2008, the growth decreased due to the eruption of the U.S. subprime crisis. It shows that the growth rates of the ASEAN member countries have become increasingly correlated with each other since the Asian crisis, especially in the intra-industry trade. The product fragmentation is one of the intra-industry trade that causes the development of multinational activities in ASEAN (Rana, 2006). In fact, the intra-ASEAN trade reached its highest share nearly at 27.0% in 2008, but it dropped back by 24.5% in 2009[1]. At the same time, the ASEAN's shares with each of its top partners (Japan, EU, China and the United States) also decline due to the global economic downturn. The crisis has reduced both the absolute and relative demand from ASEAN's major partners, cause the global production networks damage, and affect the intra-regional trade (Plummer & Yue, 2009). Consequently, the global financial architecture as a whole must be revamped to improve the regulation and supervision of financial institutions. This is to enable early preventive measures to be taken to prevent the crisis that would lead to the downfall of any bank or financial institution that in turn may affect the stability of the world financial system.

As reported by the International Monetary Fund (2010), the economic growth in emerging and developing economies is expected to be over 6.2% during 2010–2011, compared to 2.5% in 2009. Among the developing countries, the ASEAN countries have been growing rapidly and among the fastest growing countries. In the past 30 years, the five ASEAN countries have undergone profound transformations and have grown faster than other regions in the world, excluding the high-performing North-East Asian economies. Besides, each country has experienced substantial industrial diversification and fast economic growth due to the adoption of export-oriented trade policies, the rapid flow of foreign direct investment, and sound macroeconomic policies. Selected indicators for the five ASEAN countries in 2011 is shown in Table 3. The economic growth of five ASEAN countries in 2011 shows that Singapore had the highest income and had no external debt, with the growth in GDP per capita of 2.7%. Although Indonesia is classified as a lower-income country, it has the highest GDP per capita by 5.4% compared to Singapore. The sources of rapid and sustained economic growth–and characteristics that are shared among the five ASEAN countries–are caused by outward orientations, such as trade openness and foreign direct investment. Moreover, human capital investment is also regarded as one of the main factors contributing to the rapid growth in this region. In addition, foreign trade also promotes the dissemination of new products and new technologies,



Source: IMF, World Economic Outlook Database.

Figure 2. GDP growth (percentage) of ASEAN (1989 to 2009).

Table 3. *Selected Indicators of Five ASEAN Countries in 2011*

Indicators	Indonesia	Malaysia	Philippines	Singapore	Thailand
Land area (sq. km)	1,811,570	328,550	298,170	700	510,890
Population (millions)	242.3	28.8	94.8	5.1	69.5
Population growth (%)	1.0	1.6	1.7	2.1	0.6
GDP growth (annual %)	6.5	5.1	3.9	4.9	0.1
GDP per capita growth (%)	5.4	3.4	2.2	2.7	-0.5
Exports ($ billions)	144.9	169.5	62.5	416.9	146.1
Imports ($ billions)	111.8	157.2	65.4	357.9	130.9
External debt ($ billions)	38.2	43.7	7.01	nil	44.9
Inflation (annual %)	5.4	3.2	4.6	5.3	3.8

Sources: The World Bank. Retrieve from: https://data.worldbank.org/indicator

while international investment brings technological improvements (Lim & McAleer, 2004).

Literature Review

The global financial crisis and slowdown in the industrialized economies has an impact on Asia's financial markets through capital flows and also have an impact on the real economy through the trade channel. Before the outbreak of the U.S. subprime crisis, most Asia economies receiving too much private capital inflow which potentially could have undermined macroeconomic and financial sector stability. Nevertheless, the global financial crisis has induced capital outflows from many emerging Asian economies, thereby resulting currency depreciation and sharp falls in stock market prices. The reason is that many U.S. financial institutions trying to secure needed cash and capital by deleveraging their over-extended balance sheets through selling domestic and foreign assets. As a result, many Asian countries are now facing steeply rising risk premiums and their access to the international capital markets is severely curtailed. Furthermore, the prospect of weak demand for emerging Asia's product due to the downturn in economic growth of U.S., European and Japanese not only slow the exports and foreign direct investment inflows, but also reducing Asia's economic growth (Kawai, 2008).

The global financial crisis has also affected the banking sector because majority of the mortgage funds is provided by the banking sector. The real sector and the banking sector go hand-in-hand because the banking sector is the major source of fund (loans). However, the banking sector has also been facing the crisis in the capital market because the market price of shares has decreased due to the expatriates, and investors move their investment money to their home country. In fact, credit markets, in particular the interbank market became highly liquid and led to the collapse of many financial institutions, as well as reducing the flow of capital into the economy (Brunnermeier & Pedersen, 2009; Adrian & Shin, 2010; Borio, 2010; Tirole, 2011).

Well-functioning financial systems play an important role in promoting long-run economic growth, and economies with well-developed financial systems tend to grow faster in the long-term period (Levine, 2005; Demirguc-Kunt & Levine, 2008). However, the recent financial crises and the collapse of many large corporations are suggestive of the existence of asymmetric information especially in the financial sector. The central argument of the finance-growth relationship is still inconclusive, and an in-depth study is needed, especially in developing countries. The central debate of study is whether the growth of the financial sector drives the growth of the real sector or whether it is the growth of the real sector that leads the development of the financial sector (Odhiambo, 2008).

Much of the early studies concentrated on the stock market, bank credit and broad money over GDP to represent the financial development. The findings justified the financial development influences which promoted the economic growth. A considerable amount of work on finance-growth nexus dealt with economic growth that causes financial development. The commonly used methods are simple regression analysis, cointegration test, and Granger causality. However, the estimated economic growth of a sub-sector in the stock market relatively receives less attention. This is because the channel is less controversial and not determined very well. Some works on the issue are discussed by Evrensel and Kutan (2007). They argued that the financial sector responded to IMF-related news, such as announcements of program negotiations, and approval varied among countries. In fact, the weaknesses in the financial sectors have been viewed as a major source of the crisis. Thus, the reduction of bank interest rate on a reasonable level could increase liquidity in the market, and may perhaps stimulate economic growth (Alnajjar, Noor, Nazem & Issa, 2010).

Mansor (2007) and Ellahi and Khan (2011) presented empirical evidence on financial development and economic growth in developing countries. Likewise, the results were varied. It is important to note that most of the studies were exclusively based on the aggregate data. Alnajjar et al. (2010) and Evrensel and Kutan (2007) used disaggregate financial data to explore the impact of the crisis on the financial sector. Among the sectoral data use are banks, insurance, diversified financial services, real estate, and investment. Disaggregate data analysis revealed that some sectors are more sensitive to economic growth. In short, this gap and mixed results deserve further research. Furthermore, there are no studies in the developing countries which focused totally on the sectoral indices, particularly in the bank and real estate sector. Also, the issue concerning finance and growth remains controversial and still debated. Therefore, this study attempts to examine the effects of the global financial crisis on economic growth in a model that considered various sectoral indices, with particular reference to the stock market, bank and real estate. The study also examines the influence of economic growth on the volatility of sectoral indices in ASEAN-5. It is the interest of this study to examine the shocks of sectoral indices on economic growth when they are introduced simultaneously in the model. This will allow us to gauge the effects of the sectors more meaningfully and draw useful policy implications.

Data Description and Research Methodology

The study used quarterly data covering the period 1990:1 to 2016:2 for Indonesia, Malaysia, Philippines, Singapore and Thailand. The analysis involves sectoral stock market indices of Jakarta Stock Exchange, Kuala Lumpur Stock Exchange, Philippines Bomposite Index, Singapore Stock Exchange and Bangkok Stock Exchange with selected macroeconomic variables of real gross domestic product (Y_{gdp}), broad money M2 (m), the interest rate (r), inflation (p), and the exchange rate (e). The quarterly data of macroeconomic variables were taken from the International Financial Statistics compiled by the IMF, and all the indices were obtained from the Datastream database[2]. All the series are in logarithmic form except for the interest rate and the exchange rate. The study covered five ASEAN countries namely: Indonesia, Malaysia, Philippines, Singapore, and Thailand. The effects of the global financial crisis on the stock market and economic growth in ASEAN-5 is examined using the following model:

$$\Delta y_t = \alpha + \sum_{i=1}^{\rho_i} \delta_{1i}\, \Delta_{sp\ \text{t-1}} + \sum_{i=1}^{\rho_i} \tau_{1i} \Delta m_{\text{t-1}} + \sum_{i=1}^{\rho_i} \theta_{1i} \Delta r_{\text{t-1}} + \quad (1)$$

$$+ \sum_{i=1}^{\rho_i} \eta_{1i} \Delta p_{\text{t-1}} + \sum_{i=1}^{\rho_i} \psi_{1i} \Delta e_{\text{t-1}} + \varphi crisis + \gamma ECT_{t-1} + \varepsilon_t$$

where *sp* is stock market of Indonesia, Malaysia, the Philippines, Singapore and Thailand, whereas *y*, *m*, *r*, *p*, *e*, *crisis*, and *ECT* are: real GDP, money supply, interest rate, inflation, exchange rate, dummy crisis, and error-correction term, respectively. The *ECT* is obtained from the cointegration equation using the Johansen maximum likelihood procedure.

To obtain credible and robust results for any regression analysis, the data to be analyzed should be stationary (Gujarati, 2003). Hence, to test for stationarity, two unit root tests–Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test–were used in the study to assess the degree of integration of the variables. These tests are performed based on model with a drift and trend (τ_μ), and, with a drift and without trend (τ_τ). To identify the selection of lag length, it is necessary to choose the order of autoregression either by an automated procedure based on Akaike information criterion (AIC), or with some specification search.

Unit Root Test

A time series is defined as a stationary process if its mean and variance remain unchanged time by time and the value of the covariance between two time periods relies only on the distance between the two-time periods and not the actual time at which the covariance is computed (Gujarati, 2003).

The phenomenon of spurious regression was originally discussed in Granger and Newbold (1974) and has been widely realized and explained in both theoretical and empirical research (Stock & Watson, 2006; Gujarati, 2003). Suppose there are two non-stationary (random walk) variables, Y_t and X_t processes, with drift parameters (∂ and γ). It suggests that the means and variances of these two series Y_t and X_t must increase over time.

$$Y_t = \partial + Y_{t-1} + \sigma_t \tag{2}$$

$$X_t = \gamma + X_{t-1} + \varepsilon_t \tag{3}$$

where σ_t and ε_t are uncorrelated white noise error terms. Each of them is NIID (0,1), implying that they are both normally and independently distributed with zero mean and unit variance (i.e. standard normal distribution).

Consider the following simple regression model:

$$Y_t = \alpha + \beta X_t + \varepsilon_t \tag{4}$$

Reasonably, it is expected that the regression output is generating insignificant coefficient β since the two variables Y and X are unrelated. However, Granger and Newbold (1974) found that this test mostly produces a significant coefficient of β and a very high explanatory R^2 together with very low DW statistic. Therefore, tests for identifying nonstationary series are essentially required at the early stage of statistical analysis.

The general practice suggests three methods that can be employed to examine the presence of unit roots in time series, namely graphical analysis, correlogram, and unit root analysis (Gujarati, 2003). However, the two former informal analyses possibly generate imprecise conclusions due to a minor difference in performance of a near unit root series compared with a real unit root series.

It is known that there are several formal tests using unit root analysis that have been introduced in practice. Concerning a large number of unit root tests, Maddala and Kim (1998, p.45) claimed that no test for unit root hypothesis has been found as the uniformly most powerful one. Therefore, the study employs two different unit root techniques, which are most commonly used: ADF (Dickey & Fuller, 1979; 1981) and PP (Phillips & Perron, 1988).

The hypothesis for the ADF and PP tests are the same, in which the null hypothesis claims the presence of a unit root. Statistically, the ADF tests the following equation:

$$\Delta Y_t = \alpha_0 + \beta Y_{t-1} + \textstyle\sum_{i=1}^{p} \gamma_i \Delta Y_{t-1} + u_t$$

(without time trend) (5)

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \beta Y_{t-1} + \textstyle\sum_{i=1}^{p} \gamma_i \Delta Y_{t-1} + u_t$$

(with time trend) (6)

The null hypothesis is H_0: $\gamma = 0$, against the alternative hypothesis where is H_1: $\gamma \neq 0$. The major critical problem of the ADF test refers to the difficulty selecting the appropriate lag length p. If p is too small, the test can get bias result because of the remaining serial correlation in the errors. Otherwise, if p is too large, the power of the test will be affected. Together with some suggestions in the literature to mitigate this issue (i.e. see Ng and Perron, 1995), the statistical software Eviews 9.0 fortunately allows lag length to be selected automatically regarding Akaike Information Criteria (AIC) and Schwarz Information Criteria (SIC), with a maximum lag length set equal to 9.

To differentiate from ADF test when additional lags of the first differences variable are used, the PP test uses Newey-West (Newey & West, 1987) heteroskedasticity and an autocorrelation-consistent covariance matrix estimator to account for serial correlation. The PP test takes advantages of the ADF test by performing heteroskedasticity in the error term and does not require a lag length specification in the regression. The PP equation can be formulated as:

$$Y_t = \alpha_0 + \beta Y_{t-1} + u_t$$

(without time trend) (7)

$$Y_t = \alpha_0 + \alpha_1 t + \beta Y_{t-1} + u_t$$

(with time trend) (8)

Even though the PP test seems powerful than the ADF test regarding lag length specification, it remains subject to severe issues of "bandwidth" parameter selection as part of the Newey-West estimator. However, this can be resolved with the Eviews software, as it allows the bandwidth to be selected automatically using the kernel function Bartlett.

Cointegration Test

In the context of the multivariate regression test, this study adopts the Johansen and Juselius (1990) maximum likelihood method. Generally, the approach is applied to $I(1)$ variables. The method is an extended work of Johansen (1988) and it provides a likelihood-ratio statistic to test for the maximum number of independent equilibrium vectors in the cointegrating matrix. To test the restrictions on the cointegrating vector, Johansen defined the two matrices α and β, both of dimension where is the rank of . The properties of and can be written in the form of:

$$\pi = \alpha\beta' \tag{9}$$

Note that β is the matrix of cointegrating parameters and α is the matrix of weights with which each cointegrating vector enters the n equations of the VAR. In a sense, α can be viewed as the matrix of the speed of adjustment parameters. Using maximum likelihood estimation, it is possible to: (i) determine the rank of π, (ii) use the r most significant cointegrating vectors to form β', and (iii) select α such that $\pi = \alpha\beta'$.

The number of lags applied in the cointegration tests is based on the information provided by the multivariate generalization of the AIC. To test for the number cointegrating vectors of , Johansen and Juselius (1990) provided two likelihood ratio tests statistics. These tests can be defined as λ_{trace} and λ_{max}:

$$\lambda_{trace} = -T\sum_{i=r+1}^{n} \ln(1-\hat{\lambda}_i) \tag{10}$$

$$\lambda_{max} = -T\ln(1-\hat{\lambda}_{r+1}) \tag{11}$$

where λ_i is the estimated value of characteristic roots obtained from the estimated Π matrix, n is the number of characteristic root of Π, and T is the number of observations. The former tests the null hypothesis that there are at most distinct cointegrating vectors, while the latter tests the null hypothesis r of cointegrating vectors against the alternative hypothesis of r + 1 cointegrating vectors. These statistics have nonstandard distributions. Both likelihood ratio test statistics are compared to the critical values tabulated and presented by Johansen and Juselius (1990).

Vector Error Correction Model (VECM)

Generally, VECM is derived from a vector autoregression (VAR) model in cointegrated variables framework. In a VAR model, each variable is regressed on lagged values of its own and other variables in the system. The method treats all variables as endogenous. It estimates how each variable is related to the lagged values of all variables in the system. There are no restrictions imposed on the variables like the exogeneity of the variables. The method estimates the problems of error term correlated with regressors and reduces the possibility of missing any contemporaneous effect originating from the variables that are not included in the equation. Ordinary least squares estimation gives an efficient estimate of the parameter in each of the equation in the system. The VAR modelling has been used widely in analyzing the stock market and economic growth (Dritsaki & Dritsaki-Bargiota, 2005; Nieuwerburgh, Buelens, & Cuyvers, 2006; Pradhan, Arvin, Hall, & Bahmani 2014; Tsouma, 2009; Zivengwa, Mashika, Bokosi, & Makova, 2011). The VAR can be written in matrix form as:

$$\begin{bmatrix} 1 & b_{12} \cdots & b_{1n} \\ b_{21} & 1 \ \cdots & b_{2n} \\ \vdots & \vdots \ \cdots & \vdots \\ b_{n1} & b_{n2} \cdots & 1 \end{bmatrix} \begin{bmatrix} y_{1t} \\ y_{2t} \\ \vdots \\ y_{nt} \end{bmatrix} = \begin{bmatrix} b_{10} \\ b_{20} \\ \vdots \\ b_{n0} \end{bmatrix} + \begin{bmatrix} x_{11} & x_{12} \cdots & x_{1n} \\ x_{21} & x_{22} \cdots & x_{2n} \\ \vdots & \vdots \ \cdots & \vdots \\ x_{n1} & x_{n2} \cdots & x_{nn} \end{bmatrix} \begin{bmatrix} y_{1t-1} \\ y_{2t-1} \\ \vdots \\ y_{nt-1} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ \vdots \\ e_{nt} \end{bmatrix} \tag{12}$$

Or

$$By_t = \Pi_0 + \Pi_1 y_{t-1} + e_t \tag{13}$$

where y_t is a (n x 1) vector of endogenous variables, y_{t-1} is a (n x 1) vector of a predetermined variable, and e_t is a (n x 1) vector of structural disturbance. Square matrix B (n x n) measures the contemporaneous response of endogenous variables; Π_0 (n x 1) measures the coefficients of constant and Π_1 (n x n) measures the contemporaneous response of endogenous variables to predetermined variables. Multiplying by B^{-1} gives VAR in standard form as:

$$y_t = A_0 + A_1 y_{t-1} + u_t \tag{14}$$

Where $A_0 = B^{-1}\Pi_0, A_1 = B^{-1}\Pi_1$ and $u_t = B^{-1}e_t$

In a higher-order system, the standard VAR is

$$y_t = A_0 + A_1 y_{t-1} + A_2 y_{t-2} + \ldots + A_n y_{t-p} + u_t \tag{15}$$

Or

$$y_t = A_0 + \sum_{i=1}^{p} A_i\, y_{t-1} + u_t \qquad E(u_t u_s) = \Sigma_u \quad \text{if } t \neq s \tag{16}$$

where u_t is serially uncorrelated disturbances with zero mean; $E(u_t) = 0$, and variance-covariance matrix $E(u_t u_s) = \Sigma_u$ if $t \neq s$ is symmetric positive semi definite matrix.

The estimates of the constants and the coefficients are obtained by applying ordinary least squares (OLS) to each equation in the system. The estimates of variance/covariance matrix, Σ_u are obtained from the OLS residuals. To avoid identification problem in the model, Cholesky decomposition is used to orthogonalize the residuals, that is, it involves specification of a recursive ordering of the variables so that the matrix of structural coefficients is unique lower triangular. It requires all elements above the main diagonal to be zero.

$$\begin{aligned} b_{12} = b_{13} = b_{14} = \ldots\ b_{1n} &= 0 \\ b_{23} = b_{24} = \ldots\ b_{2n} &= 0 \\ b_{34} = \ldots\ b_{3n} &= 0 \\ &\ldots \\ b_{n\text{-}1n} &= 0 \end{aligned}$$

The parameter is restricted such that, the first variable responds to its own exogenous shock with no contemporaneous effect from other variables; the second variable responds to the first variable and its own exogenous shock; the third variable responds to the first variable, second variable, and its own shock and so on. The system is exactly identified when imposing $(n^2 - n)/2$ restrictions on the structural model where n is the endogenous variables or equations included in the system. The variance/covariance matrix of the forecast errors is, Σ_u

$$\sum = \begin{bmatrix} \phi_1^2 & \phi_{12} & \cdots & \phi_{1n} \\ \phi_{12} & \phi_2^2 & \cdots & \phi_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ \phi_{1n1} & \phi_{n2} & \cdots & \phi^{nm} \end{bmatrix}$$

where $\phi_{ij} = (1/N)\sum_{t=1}^{n} u_{it}u_{jt}$ and N is the number of usable observations.

VAR models are useful in assessing the dynamic responses of the economic variables to shocks. Using the variance or covariance matrix, through the impulse response functions, the dynamic responses of the variables in response to shocks are traced out at a different time path. The variance decomposition determines the proportion of the unexpected movements in variables that is attributable to each of the orthogonalized shock. Nevertheless, consistent estimates of the responses are greatly influenced by the ordering of the variables in the system. That is, the variables are ordered according to their causal priority or prior belief in nature of contemporaneous feedback among the variables in the system.

To examine the multivariate relationship among the variables, this study uses the VECM framework. The VECM regresses the change in both dependent and independent variables on lagged deviations. Having obtained the long-run cointegration relations using the Johansen approach, it is possible to formulate the model in equation (14) and estimate the VECM with the error correction terms. The multivariate relationship test based on VECM can be formulated as follows:

$$\Delta y_t = \Gamma_0 + \Gamma_1 \Delta y_{t\text{-}1} + \Gamma_2 \Delta y_{t\text{-}2} + \ldots + \Gamma_p \Delta y_{t\text{-}p} + \Gamma_p \Delta y_{t\text{-}p} + \alpha(\beta_1' y_{t\text{-}1} + \beta_2' y_{t\text{-}2}) + \varphi D_{qt} + e_t \tag{17}$$

where D_{qt} is the zero/one vector of dummies corresponding to quarter q and y_t enters the error correction term with a lag of t - 1 or $t - k$. At this stage, no separate restrictions are placed on a. Thus, OLS is an efficient way to estimate equation (17); given that each has a common set of (lagged) regressors. Since all the variables in the model are now I(1), statistical inference using standard t-tests and F-tests is valid.

Estimating the multivariate system denoted by equation (17) confirms the tests of weak exogeneity and whether all the common lagged ΔX_{t-p} are significant in every equation. Thus, parsimony can be achieved by removing the insignificant regressors and testing whether this reduction in the model is supported by an F-test. For parsimony, the parameter estimates are derived by dropping some of the insignificant variables from the estimated model and retaining only the desirable variables. This model is called as parsimonious error correction model (PECM). In addition, dropping all non-significant lagged terms resulted in the acceptance of the null hypothesis that the omitted regressors have zero coefficients. Finally, the resultant model is checked in terms of diagnostic tests on the residuals together with parameter constancy involving the recursive properties of the model, such as the residuals test and Chow F-test. The parsimonious reduced-form system is generally congruent as defined by the Hendry general-to-specific approach to modeling (Campos, Ericsson, & Hendry, 2005).

Impulse Response Function (IRF)

The study also employs IRF to investigate the dynamic interactions among the variables. The IRF are able to trace temporal responses of variables to its own shocks and shocks in other variables. In fact, the IRFs can assess the direction, magnitude, and persistence of economic growth responses to innovations in the financial sector.

Sims (1980) VAR approach has the desirable property that all variables are treated symmetrically. A VAR model can be used in examining the relationship among a set of economic variables. Moreover, the model also can also be used for forecasting purposes.

In the two-variable case, the time path of $\{Y_t\}$ is affected by current and past realizations of the $\{z_t\}$ sequence and let the time path of the $\{z_t\}$ sequence be affected by current and past realizations of the $\{y_t\}$ sequence. Consider the simple bivariate equation as follows:

$$y_t = b_{10} - b_{12}z_t + \gamma_{11}y_{t-1} + \gamma_{12}z_{t-1} + \varepsilon_{yt} \quad (18)$$

$$z_t = b_{20} - b_{21}y_t + \gamma_{21}y_{t-1} + \gamma_{22}z_{t-1} + \varepsilon_{zt} \quad (19)$$

where it is assumed that (i) both y_t and z_t are stationary; (ii) ε_{yt} and ε_{zt} are white-noise disturbances with standard deviations of σ_y and σ_z, respectively; and (iii) $\{\varepsilon_{yt}\}$ and $\{\varepsilon_{zt}\}$ are uncorrelated white-noise disturbances.

Equations (18) and (19) constitute a first-order VAR because the longest lag length is unity. The simple two variable first-order VAR is useful for illustrating the multivariate higher order systems. The structure of the system incorporates feedback because y_t and z_t are allowed to affect each other. For example, $-b_{12}$ is the contemporaneous effect of a unit change of z_t on y_t, and γ_{12} is the effect of a unit change in z_t on y_t. Note that the terms of ε_{yt} and ε_{zt} are pure innovations (or shocks) in y_t and z_t respectively. Hence, if $-b_{12}$ is not equal to zero ($-b_{12} \neq 0$), ε_{yt} has an indirect contemporaneous effect on z_t, and if $-b_{12} \neq 0$, ε_{zt} has an indirect contemporaneous effect on y_t.

Equations (18) and (19) are not reduced-form equations since y_t has a contemporaneous effect on z_t and vice versa. It is possible to transform the system of equations into a more usable form. Using the matrix, the equations can be written as:

$$\begin{bmatrix} 1 & b_{12} \\ b_{21} & 1 \end{bmatrix} \begin{bmatrix} y_t \\ z_t \end{bmatrix} = \begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{zt} \end{bmatrix}$$

Or

$$Bx_t = \Gamma_0 + \Gamma_1 x_{t-1} + \varepsilon_t$$

where:

$$B = \begin{bmatrix} 1 & b_{12} \\ b_{21} & 1 \end{bmatrix}; \; x_t = \begin{bmatrix} y_t \\ z_t \end{bmatrix}; \; \Gamma_0 = \begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix};$$

$$\Gamma_1 = \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix}; \; \varepsilon_t = \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{zt} \end{bmatrix}$$

Premultiplication by allows obtaining the VAR model in standard form as follows:

$$x_t = A_0 + A_1 x_{t-1} + e_t \quad (20)$$

Where: $A_0 = B^{-1}\Gamma_0$; $A_1 = B^{-1}\Gamma_1$; $e_t = B^{-1}\varepsilon_t$

Using the new notation, equation (20) can be written in the following form:

$$y_t = a_{10} + a_{11}y_{t-1} + a_{12}z_{t-1} + e_{1t} \quad (21)$$

$$z_t = a_{20} + a_{21}y_{t-1} + a_{22}z_{t-1} + e_{2t} \quad (22)$$

To distinguish between the equations represented by (18) and (19) versus (21) and (22), the first two equations are called a structural VAR or the primitive equation, whereas, equations (21) and (22) are called VAR in standard form. It is important to note that the error terms of e_{1t} and e_{2t} are composites of the two shocks ε_{yt} and ε_{zt}. Since $e_t = B^{-1}\varepsilon_t$, it can compute e_{1t} and e_{2t} as:

$$e_{1t} = (\varepsilon_{yt} - b_{12}\varepsilon_{zt})/(1 - b_{12}b_{21}) \quad (23)$$

$$e_{2t} = (\varepsilon_{zt} - b_{21}\varepsilon_{yt})/(1 - b_{12}b_{21}) \quad (24)$$

Equation (23) and (24) can be simplified as:

$$\begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} = \frac{1}{1 - b_{12}b_{21}} \begin{pmatrix} 1 & -b_{12} \\ -b_{21} & 1 \end{pmatrix} \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{zt} \end{bmatrix}$$

Given the economic model above, ε_{yt} and ε_{zt} are the autonomous changes in y_t and z_t in period t, respectively. Thus, to obtain the impulse response functions or the variance decompositions, it is necessary to use the structural shocks of ε_{yt} and ε_{zt}.

In general, the shocks will be uncorrelated if $b_{12} = b_{21} = 0$ or in the other words, there are no contemporaneous effects of y_t on z_t and vice versa. It is useful to define the variance/covariance matrix of the ε_{yt} and ε_{zt} shocks as:

$$\begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} = \frac{1}{1 - b_{12}b_{21}} \begin{pmatrix} 1 & -b_{12} \\ -b_{21} & 1 \end{pmatrix} \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{zt} \end{bmatrix}$$

since all the elements of Σ are time-dependent. The more compact form can be represented as follows:

$$\Sigma = \begin{bmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{21} & \sigma_2^2 \end{bmatrix}$$

where $var(\varepsilon_{it}) = \sigma_i^2$ and $cov(\varepsilon_{1t}, \varepsilon_{2t}) = \sigma_{12} = \sigma_{21}$.

Variance Decompositions (VDC)

The variance decomposition, also known as innovation accounting, measures the importance of each shock in the independent variable that would explain the variance in the dependent variable at different step-ahead forecasts. To examine dynamic interactions among the variables in the VAR system, this study used the VDC analysis. It measures the percentage of the forecast error of variable that is explained by another variable. Also, it shows the relative effect of one variable with another variable. At the same time, it provides information on how a variable of interest responds to shocks or innovations in other variables. Understanding the properties of the forecast errors is helpful in uncovering interrelationships among variables in the system. Thus, in the context of this study, it allows to the exploration of the relative importance of the stock market in accounting for variations in economic growth. To interpret economic implications from VDC findings, Sims' (1980) innovation accounting procedure is employed. This procedure involves the decomposition of forecast error variance of each variable into components attributable to its innovations and shocks of other variables in the system.

Assume that the coefficient A_0 and A_1 are known, and we want to forecast the various values of x_{t+i} conditional on the observed value of x_t. Updating equation (20) one period and taking the conditional expectation of x_{t+i}, we obtain:

$$E_t x_{t+1} = A_0 + A_1 x_t$$

Note that, the one-step-ahead forecast error is $E_t x_{t+1} = A_0 + A_1 x_t$. Similarly, updating two periods, we get:

$$x_{t+2} = A_0 + A_1 x_{t+1} + e_{t+2}$$

$$= A_0 + A_1(A_0 + A_1 x_t + e_{t+1}) + e_{t+1}$$

Taking the conditional expectations, the two-step-ahead forecast of x_{t+2} is:

$$E_t x_{t+2} = (I + A_1)A_0 + A_1^2 x_t$$

The two-step-ahead forecast error is $e_{t+2} + A_1 e_{t+1}$. To obtain n-step-ahead forecast, the equation can be written as:

$$E_t x_{t+n} = (I + A_1 + A_1^2 + \ldots + A_1^{n\text{-}1})A_0 + A_1^n x_t$$

Thus, the associated forecast error is:

$$e_{t+n} + A_1 e_{t+n\text{-}1} + A_1^2 e_{t+n\text{-}2} + \ldots + A_1^{n\text{-}1} e_{t+1} \quad (25)$$

If we use $x_t = \mu + \sum_{i=0}^{\infty} \varnothing_i \varepsilon_{t\text{-}i}$ to conditionally forecast x_{t+1}, the one-step-ahead the forecast error is $\varnothing_i \varepsilon_{t+1}$. In general,

$$x_{t+n} - E_t x_{t+n} = \mu + \sum_{i=0}^{n\text{-}1} \varnothing_i \varepsilon_{t+n\text{-}i}$$

So that the n-period forecast error $x_{t+n} - E_t x_{t+n}$ is:

$$x_{t+n} - E_t x_{t+n} = \mu + \sum_{i=0}^{n\text{-}1} \varnothing_i \varepsilon_{t+n\text{-}i}$$

By focusing on the $\{y_t\}$ sequence, the n-step-ahead forecast error is:

$$\begin{aligned} y_{t+n} - E_t y_{t+n} &= \varnothing_{11}(0)\varepsilon_{yt+n} + \varnothing_{11}(1)\varepsilon_{yt+n\text{-}1} + \ldots \\ &\quad + \varnothing_{11}(n\text{-}1)\varepsilon_{yt+1} + \varnothing_{12}(0)\varepsilon_{zt+n} \\ &\quad + \varnothing_{12}(1)\varepsilon_{zt+n\text{-}1} + \ldots + \varnothing_{12}(n\text{-}1)\varepsilon_{zt+1} \end{aligned}$$

Denote the n-step-ahead forecast error variance of y_{t+n} as $\sigma_y(n)^2$:

$$\sigma_y(n)^2 = \sigma_y^2[\emptyset_{11}(0)^2 + \emptyset_{11}(1)^2 + \ldots + \emptyset_{11}(n\text{-}1)^2] + \sigma_z^2[\emptyset_{12}(0)^2 + \emptyset_{12}(1)^2 + \ldots + \emptyset_{12}(n\text{-}1)^2]$$

Because all the values of $\emptyset_{jk}^{(i)^2}$ are necessarily nonnegative, the variance of the forecast error increases as the forecast horizon increases. It is possible to decompose the n-step-ahead forecast error variance into the proportions due to each shock. Respectively, the proportions of $\sigma_y(n)^2$ due to shocks in the $\{\varepsilon_{yt}\}$ and $\{\varepsilon_{zt}\}$ sequences are:

$$\frac{\sigma_y^2[\emptyset_{11}(0)^2 + \emptyset_{11}(1)^2 + \ldots + \emptyset_{11}(n\text{-}1)^2}{\sigma_y(n)^2}$$

and

$$\frac{\sigma_z^2[\emptyset_{12}(0)^2 + \emptyset_{12}(1)^2 + \ldots + \emptyset_{12}(n\text{-}1)^2}{\sigma_y(n)^2}$$

The forecast error variance decomposition shows that the proportion of the movements in a sequence is due to it's "own' shocks versus shocks to the other variable. If ε_{zt} shocks explain none of the forecast error variance of at all forecast horizons, it can be said that the $\{y_t\}$ sequence is exogenous. In this circumstance, $\{y_t\}$ evolves independently of the ε_{zt} shocks and the $\{z_t\}$ sequence. At the other extreme, ε_{zt} shocks could explain all of the forecast error variances in the $\{y_t\}$ sequence at all forecast horizons, so that $\{y_t\}$ would be entirely endogenous.

It is important to note that the variance decomposition contains the same problem inherent in impulse response analysis. To identify the $\{\varepsilon_{yt}\}$ and $\{\varepsilon_{zt}\}$ and sequences, it is necessary to restrict the B matrix (Equation 12). In practice, it is useful to examine the variance decompositions at various forecast horizons. As increases, the variance decompositions should converge. Moreover, if the correlation coefficient is significantly different from zero, it is customary to obtain the variance decompositions under various orderings. Nevertheless, impulse response analysis and variance decompositions can be useful tools to examine the relationships amongst variables.

Empirical Results

The empirical findings and analysis of the study begins with the stationary test of a unit root. This test is carried out based on ADF test and PP test. Testing the presence of a unit root is the first step in the empirical study before it continues with cointegration test. Then, the analysis proceeds with Johansen cointegration test to identify the presence of the cointegrating vectors. Identifying the cointegration relationship using the Johansen and Juselius approach provides valuable information regarding the dynamic interactions among vectors. After estimating the cointegration relations for all models, the study extends with the PECM to examine the effects of the global financial crisis on economic growth in a model that considers various sectoral indices, with particular reference to stock market, bank, and real estate. It analyzes how far the global financial crisis transmits its effects into the ASEAN-5 economies in the short-run as well as in the long-run. The impulse response functions and variance decomposition analysis of the variance of decomposition are used to investigate the effects of the stock market, bank, and real estate to shocks on economic growth. This analysis determines which of these variables are relatively endogenous or exogenous to the system by decomposing proportional variances due to its own shock and the shock of other variables in the system. For example, if the shocks of other independent variables in the system explain less of the forecast error variance of the dependent variable, it means that the dependent variables are exogenous to the system. However, if it turns out that most of the shocks of the independent variables explain the forecast error of dependent variables, it means that it is then endogenous to the system.

Unit Root Tests

The ADF and PP tests were performed based on the model with intercept (τ_μ), and, with trend and intercept (τ_τ). Table 4 reports the ADF test and PP test for the log levels and first differences. The analysis involved stock market indices of banks (bnk), real estate (res), stock market (jkse, klse, psei, sti, set), and selected macroeconomic variables like the real output (Y_{gdp}), the broad money (m), the interest rate (r), inflation (p), and the exchange rate (e). The ADF test statistics showed that the null hypothesis of the

Table 4. *Unit Root Tests for ASEAN-5*

Series	Augmented Dickey Fuller (ADF) H_0: Unit Root			Phillips Perron (PP) H_0: Unit Root		
	Level		Difference	Level		Difference
	Tμ	Tτ	Tμ	Tμ	Tτ	Tμ
Indonesia						
Y_{gdp}	-0.08 [4]	-2.09 [4]	-3.80 [4]*	-0.03 [4]	-1.79 [4]	-10.23[4]*
jkse	-0.08 [4]	-1.49 [4]	-4.55 [4]*	-0.18 [4]	-1.79 [4]	-8.05 [4]*
bnk	-1.42 [4]	-0.92 [4]	-3.85 [4]*	-1.30 [4]	-0.89 [4]	-6.63 [4]*
res	-1.46 [4]	-1.65 [4]	-3.87 [4]*	-1.47 [4]	-1.62 [4]	-7.25 [4]*
m	-1.62 [4]	-1.92 [1]	-2.95 [4]**	-2.01 [1]	-1.60 [1]	-8.22 [4]*
r	-2.35 [5]	-2.64 [5]	-5.33 [4]*	-2.48 [4]	-2.73 [4]	-7.44 [4]*
p	-1.29 [4]	-1.21 [4]	-4.15 [4]*	-1.33 [4]	-1.19 [4]	-4.45 [4]*
e	-1.77 [4]	-1.31 [4]	-3.80 [4]*	-1.69 [4]	-1.66 [4]	-6.42 [4]*
Malaysia						
Y_{gdp}	-1.59 [4]	-2.64 [4]	-5.94 [4]*	-1.36 [4]	-2.32 [4]	-9.28 [4]*
klse	-1.98 [4]	-2.87 [4]	-5.77 [4]*	-2.28 [4]	-2.98 [4]	-9.67 [4]*
bnk	-1.41 [4]	-3.00 [4]	-5.67 [4]*	-1.67 [4]	-3.03 [4]	-9.53 [4]*
res	-2.15 [5]	-3.01 [5]	-5.63 [4]*	-2.45 [4]	-3.14 [7]	-10.60[4]*
m	-0.84 [4]	-1.62 [4]	-3.41 [4]**	-0.67 [4]	-1.32 [4]	-8.09 [4]*
r	-2.21 [4]	-2.93 [2]	-6.80 [4]*	-2.56 [9]	-2.92 [4]	-7.83 [4]*
p	-1.39 [4]	-1.26 [4]	-4.37 [4]*	-0.86 [4]	-1.16 [4]	-7.88 [4]*
e	-1.69 [4]	-1.38 [4]	-4.69 [4]*	-1.61 [4]	-1.47 [4]	-9.24 [4]*
Philippines						
Y_{gdp}	-1.11 [4]	-2.03 [4]	-5.14 [4]*	-0.72 [4]	-10.22[4]*	-33.06[4]*
Psei	-1.58 [4]	-1.86 [4]	-3.73 [4]*	-1.20 [4]	-1.76 [4]	-9.71 [4]*
bnk	-2.16 [4]	-2.64 [4]	-3.94 [4]*	-1.66 [4]	-2.18 [4]	-8.69 [4]*
res	-1.83 [4]	-2.02 [4]	-3.58 [4]*	-1.56 [4]	-2.09 [4]	-9.87 [4]*
m	-1.95 [1]	-1.32 [4]	-3.06 [4]**	-2.30 [4]	-1.84 [4]	-14.31[4]*
r	-1.67 [4]	-2.73 [7]	-4.45 [4]*	-1.69 [4]	-4.02 [4]**	-11.88[4]*
p	-0.96 [4]	-2.12 [4]	-4.99 [4]*	-0.53 [4]	-1.78 [4]	-7.39 [4]*
e	-1.32 [4]	-0.91 [4]	-4.59 [4]*	-1.82 [4]	-1.04 [4]	-7.68 [4]*
Singapore						
Y_{gdp}	-1.97 [4]	-2.06 [4]	-4.72 [4]*	-1.12 [4]	-1.45 [4]	-7.08 [4]*
sti	-2.57 [4]	-3.04 [6]	-6.02 [4]*	-1.91 [4]	-3.12 [8]	-9.88 [4]*
bnk	-1.68 [4]	-2.98 [8]	-6.51 [4]*	-1.31 [4]	-4.04 [1]**	-9.59 [4]*
res	-2.50 [4]	-2.97 [3]	-5.92 [4]*	-2.26 [4]	-2.73 [4]	-9.25 [4]*
m	-1.82 [4]	-2.68 [4]	-4.02 [4]*	-1.63 [4]	-1.72 [4]	-9.07 [4]*
r	-2.12 [4]	-2.97 [4]	-4.47 [4]*	-3.09 [2]**	-4.32 [2]*	-14.64[2]*
p	-0.51 [4]	-1.29 [4]	-4.30 [4]*	-1.40 [4]	-0.69 [4]	-5.79 [4]*
e	-1.03 [4]	-1.48 [4]	-3.72 [4]*	-0.94 [4]	-1.46 [4]	-10.58[4]*
Thailand						
Y_{gdp}	-1.27 [4]	-2.70 [4]	-3.05 [4]**	-2.55 [4]	-3.01 [4]	-9.99 [4]*
set	-1.65 [4]	-1.58 [4]	-4.24 [4]*	-1.72 [4]	-1.71 [4]	-8.47 [4]*
bnk	-1.85 [4]	-1.93 [4]	-4.05 [4]*	-1.86 [4]	-1.89 [4]	-10.43[4]*
res	-1.48 [4]	-1.46 [4]	-3.81 [4]*	-1.48 [4]	-1.99 [4]	-9.14 [4]*
m	-2.46 [4]	-2.43 [4]	-3.17 [4]**	-3.43 [1] **	-2.59 [4]	-8.92 [4]*
r	-2.35 [4]	-2.47 [5]	-4.86 [4]*	-2.26 [4]	-3.07 [4]	-7.66 [4]*
p	-1.62 [4]	-1.85 [4]	-4.11 [4]*	-2.40 [4]	-1.90 [4]	-7.09 [4]*
e	-1.52 [4]	-1.14 [4]	-4.54 [4]*	-1.54 [4]	-1.22 [4]	-6.75 [4]*

Notes: * ,** and *** represents significant level at 1 %, 5 % and 10 % respectively. τ_μ represents the model with intercept; and, τ_τ is the model with trend and intercept. Numbers in brackets are number of lags used in the ADF test in order to remove serial correlation in the residuals.

unit root for all variables are not rejected in the level series with intercept (τ_μ), and, with trend and intercept (τ_τ). The findings suggested that the time series data for Indonesia, Malaysia, Philippines, Singapore, and Thailand contain a unit root. Also, the first difference of ADF test statistics can be rejected at 1% and 5% significant levels, thus the results shows that all variables are stationary after differencing once.

The PP test statistics for Indonesia and Malaysia confirmed that all variables contain a unit root. Hence, the tests revealed that the null hypothesis of the presence of a unit root at the level series cannot be rejected even at 1% significance level. The same tests are applied to the first differences, and the results showed that all variables are stationary after differencing once. This result demonstrates that all variables are stationary and integrated at the same order of *I*(1). However, the study found that the null hypothesis is rejected at 1% and 5% significance levels in the level series for real output (Philippines), interest rate (Philippines and Singapore), bank indices (Singapore), and the broad money (Thailand). All these variables does not contain a unit root in the level form and not integrated at the order of *I*(0). Overall, the findings conclude that all variables are integrated at the same order of *I*(0) and *I*(1).

Cointegration Test

The results of the Johansen and Juselius (1992) cointegrating vector in the presence of linear trends are reported in Table 5. The tests detect whether the non-stationary series are cointegrated. The endogenous variables are stock price indices (jkse, klse, psei, sti and set), financial sector stock market indices (banks and real estate), real GDP (Y_{gdp}), the money supply M2 (m), the interest rate (r), inflation (p), and the exchange rate (e). The exogenous variables included in the model are seasonal dummies and financial dummy representing financial crisis event in 2008. The results of cointegration test are reported by λ-max and trace statistics. The critical values computed by the Microfit 4.0 are based on Pesaran, Shin, and Smith (2000).[3] Both tests statistics rejected the null hypothesis of no cointegration (r = 0) at the 5% significant level in most of the cases. There is at least one cointegrating vector at 5% significant level. This indicates the presence of cointegrating among the variables. That is, there exists a unique cointegrating vector in the model that constraints the long-run movements of the variables. However, it is possible that if the series is greater than two (r > 2) there can be more than one cointegrating vectors. For example, there are two cointegrating vectors in VAR model of real estate in Indonesia, Malaysia and Singapore, and three cointegrating vectors in VAR model of the stock market in Indonesia, Philippines and Thailand. As a result, it is concluded that all vectors in the VAR models move together in the long-run. On the whole, there exist a long-run relationship among the variables of the real output (Y_{gdp}), the broad money (m), stock market indices (stock market, bank, real estate), the interest rate (r), inflation (p), and the exchange rate (e) in the five ASEAN countries.

Parsimonious Error-Correction Model

Having acquired long-term cointegration relationships, it is now possible to estimate economic growth using an error correction model framework. The number of lags is similar to that used in the cointegration test. The main importance of the analysis is to examine the effects of the global financial crisis on economic growth. To take into account this event,

Table 5. *Summary of Results of Cointegration Tests*

Countries	Cointegrating Vector (λMax)			Cointegrating Vector (λTrace)		
	Stock market	Bank	Real estate	Stock market	Bank	Real estate
Indonesia	r = 3	r = 3	r = 2	r = 3	r = 3	r = 2
Malaysia	r = 2	r = 1	r = 1	r = 3	r = 2	r = 2
Philippines	r = 2	r = 3	r = 1	r = 3	r = 3	r = 3
Singapore	r = 1	r = 1	r = 2	r = 1	r = 1	r = 2
Thailand	r = 3	r = 3	r = 3	r = 3	r = 4	r = 2

Notes: The finding is based on the results of Cointegration Test represents in Appendix A1 the dummy variable is added to the regression to measure its effect. The identified financial crisis period takes on a value of one and in other periods, zero. The shocks of the global financial crisis were measured in the third quarter of 2007 to the second quarter of 2009. The essential finding of the estimates is a negatively significant error correction term (ECT) in all the estimated models. This estimation implies the speed at which a dependent variable returns to equilibrium after a change in an independent variable. Some parts of the current variation and dynamics of the economic growth (Y_{gdp}) are explained by the ECT. The coefficient measures the speed of adjustment in the short-run responses toward restoring the long-run equilibrium in the system. The negative coefficient indicates the system is stable (refer to Appendix A2).

The robustness of the results is evaluated by the diagnostic tests which consist of serial correlation, misspecification regression, normality, and heteroskedasticity. The estimated values are based on chi-squares (χ^2) and F-statistics, except for normality test which refers to just the chi-squares (χ^2) statistics. Serial correlation is tested up to the fourth lag; the functional test is RESET (regression specification error test) test by Ramsey (1969); normality tests are based on the Jarque-Bera test; while the heteroskedasticity test is based on the regression of squared residuals on squared fitted values. The overall diagnostic tests are found to be satisfactorily. The residuals have a normal distribution. The insignificant serial correlation test indicated that the residuals are white noise. RESET test supported that the models are correctly specified. To keep the model as simple as possible, the insignificant regressors are removed from the equation. The model follows the general-to-specific modeling process. Variables with t-statistics less than one are first considered for the deletion. A variable is statistically significant if the p value is less than 10% significant level. However, there are some insignificant variables retained in the final model because the variables captured the interest of the study and to avoid the problem with misbehaved residuals. Also, dropping the variables may lead to specifications error that may seriously bias estimating the true values of the coefficient. In fact, the variables are jointly significant judging from the significant F statistics with a very small p value (0.000).

Table 6 present summaries of findings from PECM in ASEAN-5 countries. The results from the PECM estimations of Indonesia revealed that Indonesia was affected by the 2008 financial crisis. The crisis dummies were run to measure the shocks at different quarters, ranging from 2007Q3 to 2009Q2. As can be seen in the results in Appendix 2, the crisis dummy of CRISIS08 is significant and has a negative sign. The crisis that occured in 2007Q3 to 2009Q2 had an effect on the economic activity. The deterioration in the global economy had triggred considerable outflows of hot money from Indonesia that threatened the share prices and the rupiah exchange. There was output disruption in 2009. In 2009, after the rupiah exchange fell by 45.2% and stocks sold off by 49.5% from the beginning of the global financial crisis, the private consumption declined from 5.3% in 2008 to 4.9% in 2009 (Badan Pusat Statistik Indonesia, 2012). The output fall may reflect the current value of real output which is strongly related to its past value combined with the crisis that is still present in that period.

Moreover, the study demonstrates that the coefficient of CRISIS08 is negative and significant which explain that the impact of the global financial crisis on output has a high impact on the real estate equation in Malaysia. For the case of Malaysia, the impact of the global financial crisis on growth showed the biggest contraction in real estate equation. The finding revealed that the coefficient in real estate equation recorded the highest reduction among other sectors. As the property market started weakening in 2009 when the base lending rate increased. The BNM's 2009 quarterly report also showed that the real estate and business services fell by -2.0% in the third quarter of 2008 and -6.7% in the first quarter of 2009. As highlighted in this report, the slowdown in real estate sector was due to developers taking caution in light of the global economic uncertainty and declining consumer spending.

This study also represents the dummy variable CRISIS97 that was added to the model to capture the effects of the Asian financial crisis 1997 on the Philippines economy. It failed to get any significant effects in all models. In fact, dropping this dummy improved the model criterion. The Philippines was not spared from being affected by the massive financial crisis in 2008. The Philippines central bank

Table 6. *Summary of Findings the Effect of Financial Crisis on Output in ASEAN-5*

Countries	PECM		
	Stock market	**Bank**	**Real estate**
Indonesia	**-.0057546** *	-0.00050	-.0024725
Malaysia	-.035365 *	-.028817 **	**-.048337** *
Philippines	-.0079668	**-.033065** ***	-.017664 **
Singapore	-.0092354	**-.022939** **	-.0088515
Thailand	-.038641 *	**-.041670** *	-.039360 *

Notes:
*1. *, ** and *** represent significant level at 1, 5 and 10 % respectively. The value represents the coefficient from CRISIS08.*
2. The finding is based on the results of Parsimonious Error Correction Model (PECM) represents in Appendix A2

had intervened heavily to defend the peso since July 1997. Furthermore, the less rapid capital market liberalization had protected its economy from huge foreign borrowing and external debt. The floating exchange rate regime adopted in 1970, to some extent, insulated the economy from the external shock. This supports the fact that the Philippine economy was less affected by the global financial crisis and less vulnerable to the shock.

In the case of Singapore, the impact of global financial crisis showed the highest reduction on output in bank equation compared to the stock market and real estate equations. Although Singapore's banking sector had minimal exposure to the global financial crisis, the NPL increased to 2.5% in the second quarter of 2009, and the entire loan in the Asian currency unit contracted 16% from its peak in October 2008 and September 2009. The crisis led to a slowdown in business activity and caused the reduction in the demand for local bank loans. In brief, the case study for Malaysia and Singapore showed that the contribution of financial and non-financial sectoral indices on economic growth could only occur if other monetary indicators are also taken into account in the economic development of a country. Indeed, a sound financial system with well-structured economic policies serves to ensure economic success and development. Therefore, more complete and more effective financial regulation is required.

Finally, in Thailand's case, the dummy crisis CRISIS08 that represented the global financial crisis in 2008 is significant and has a negative sign. There was severe output disruption in 2008. The impact of the global financial crisis had caused a contraction in the Thai economy and loan growth. The loan growth decreased from 11.4% at end 2008 to -3.1% at end September 2009 (World Bank, 2013). The fall in growth may reflect the current value of real GDP, which is strongly related to its past value combined with the crisis that was still present in that period.

Impulse Response Functions and Variance Decompositions Analysis

From the findings of cointegration test, this study estimated a level VAR to detect dynamic causal interactions among the variables in the system. The VAR lag order was selected based on the need of the model to have desirable statistical properties (no serial correlation, normality, homoskedastic variance and correct model specification) rather than using some information theoretic criterion (AIC and SBC). From the estimated VAR, this study generated IRF with the following variables' ordering: real GDP, sectoral stock market indices, money supply, interest rate, inflation, and exchange rate. The IRF was used to discover a temporal response of real GDP to innovations in stock market indices. The impulse response function is represented in Appendix A3: Figure 1 to 5.

Appendix A3: Figure 1 presents generalized responses of the stock market, bank, and real estate to the shock in real GDP using the sample period for Indonesia. The study revealed that the GDP responded positively and significantly to the stock market, bank, and real estate innovations. The positive response of GDP to a stock price increase is in line with Teng, Yen, and Chua (2013) and Pradhan, Arvin, Bele, and Taneja (2013) for the case of Asian countries. The positive response of GDP to stock market is as expected since an increase in economic growth may spur equity market by affording the investment in costly financial structure and providing more diversification opportunities. As the economy grows faster, the expansion of stock markets becomes more rapid and extensive (Kim & Lin, 2013). The positive response of real GDP to bank shocks explains that an increase in economic growth in Indonesia provides more available funds for banks to provide loans and increase bank deposits. Furthermore, positive response of GDP to real estate shocks implies that higher economic growth reflects the future potential of the market, attracts foreign direct investment and increase property prices (Kim & Yang, 2011; Bo & Bo, 2007).

For Malaysia, the GDP responded positively and significantly to shocks in the stock market, bank, and real estate (Appendix A3: Figure 2). The positive response of GDP to a stock market is in line with Mansor (2006). It is also consistent with the earlier findings from PECM that the effect of the stock market on GDP is statistically significant and even greater than banks and real estate. This means that, for the case of Malaysia, the speed of economic growth is highly dependent on the activeness of the stock market. The study supports the findings of Levine and Zervos (1998) that "stock market liquidity positively and robustly correlated with future rate of economic growth" (p. 554).

In the Philippines, the study found that GDP has a negative response to the shocks in the stock market and real estate, but the response died out quickly except for the impact of GDP to the banking sector (Appendix A3: Figure 3). The negative response of the stock market indices may reflect contractionary effects of currency depreciation since share prices anticipate future real economic activity (Mansor, 2006). From the variance decomposition analysis, the study observed that nearly 75% to 95% forecast error of shock is explained by its own shock. Among the stock return indices, shock in the stock market has the larger effect on economic growth and the effect remained strong until period 20. It is evident that the economic growth in the Philippine explains a larger percentage of variation in the stock market. The real estate comes second with about 7.7% of the error variance in economic growth being explained by the shock in the real estate. Economic growth is less responsive to the innovation in the banking sector and implies that shock in the bank has less effect on economic growth.

For the analysis of IRF in Singapore, the findings showed that the GDP responded positively to the stock market and real estate, while negatively responded to the bank (Appendix A3: Figure 4). GDP's positive response to the stock market shock suggests that an economy with a well-developed stock market stimulates higher economic growth. Stock markets may spur economic growth through the creation of liquidity. The high liquidity in equity markets make investment less risky and more attractive, and thus, improve the allocation of capital and enhances the economic growth. In relation to positive responses of GDP to real estate, the finding suggested that the real estate plays a key role in supporting economic activities in Singapore. The property price indices for the office and industry sectors increased by 83.5% to 94.6 % for three consecutive years (1993–1996). This finding supports the evidence that positive economic growth and a strong influx of funds into the property market, coupled with low interest rates, results to buoyancy in the property market (Deng, McMillen, & Sing, 2014).

Finally, in Thailand's case, the finding showed that the shock generated in the stock market, bank, and real estate has a positive effect on GDP and lasts for about six years (Appendix A3: Figure 5). Other interesting findings that this study discovered are that the result of PECM (see Appendix A2: Table 5) is consistent with the IRF. The GDP responded positively and higher to shocks in the stock market as compared to bank and real estate. It can be said that the stock market contributes positively to economic growth, at the same time, economic progress tends to stimulate the development of the stock market. The evidence from Thailand showed that the GDP is more responsive to the stock market. Well-developed stock markets have increased saving and capital accumulation, which leads to the economic growth. The study also noted positive responses of the GDP to innovation in bank and real estate. The positive response of GDP to a bank increase is in line with Harrison, Sussman, and Zeira (1999). According to Harrison et al. (1999), an efficient banking sector could decrease transaction costs and the margin between lending and deposit rates. This, in turn, increases the share of savings allocated to the investments and lead to higher economic growth.

Table 7. *Summary of Findings from IRF and VDC Analysis*

Countries	Impulse Response Function (IRF)			Variance Decomposition (VDC)		
	Stock Market	Bank	Real Estate	Stock Market	Bank	Real Estate
Indonesia	√			√		
Malaysia	√				√	
Philippines		√		√		
Singapore		√			√	
Thailand	√			√		

Notes: √ represents the relative importance of shocks in sectoral indices and their influences on the economic growth. The finding is based on the results of IRF and VDC represents in Appendix A3 and Appendix A4

Conclusion

The main focus of this study is to examine the effects of the global financial crisis on economic growth in a model that consider various sectoral indices, with particular reference to the stock market, bank, and real estate; and also, to identify the influence of economic growth on the volatility of sectoral indices in ASEAN-5. As reported from the findings in the unit root tests, all variables are integrated at the same order of I(0) and I(1), and thus, the study continued with cointegration tests to identify the cointegrating vectors for each estimated model. Results from the cointegration test revealed that all vectors moved together in the long-run. It shows that there exists a long-run relationship among the economic growth (Y), stock indices (stock market, bank, and real estate), the broad money (m), the interest rate (r), inflation (p), and the exchange rate (e).

By examining the effect of the financial crisis on economic growth in ASEAN-5 by incorporating the sectoral stock market indices into the model, the results from the PECM showed that growth is affected by the global financial crisis. The crisis that occurs in 2007Q3 to 2009Q2 had an effect on the economic activity in ASEAN-5. The effect of the crisis on output revealed that the crisis had a real effect on the banking sector for the Philippines, Singapore, and Thailand. Also, the crisis had a significant effect on the stock market and real estate equation for Indonesia and Malaysia. The findings revealed that, in three out of five ASEAN countries, the effect of the global financial crisis could be associated with inadequate regulation and supervision of the banks. This is supported by the views of Bartram and Bodnar (2009), AuYong, Gan, and Treepongkaruna (2004), and Huang, Yang, and Hu (2000) that the global financial crisis was one of the most severe crises due to negative impact on equities, real estate, foreign exchange, and capital markets. Although, the study by Bartram and Bodnar (2009) showed that the global financial crisis created the conditions for the current credit crisis with increased risk premium is charged on loans in the banking sector globally. The crisis also had an almost instantaneous negative impact on equity markets, particularly in the emerging market economy. Notwithstanding these concerns, capital flows to emerging market economies (EMEs) recovered relatively quickly. In fact, net and gross capital flows to EMEs rebounded starting around the second quarter of 2009 after declining sharply in the last 186 basis points quarter of 2008 indicating an early recovery in foreign investor interest in EMEs (Bank for International Settlements, 2010).

In order to correct the main market failure of financial markets, Greenwald and Stiglitz's (1986) contend that the companies should diversify the operating risk, this could reduce the level of operations as another method of risk management. In the meantime, the banking sector should decrease the transaction costs and the margin between lending and deposit rates, channeling saving into investments and promotes economic growth. In addition, the development of the banking sector may induce higher economic growth by allocating financial resources efficiently and combined with sound regulation of the banking system. A sound banking system instills confidence among the savers so that resources can be effectively mobilized to increase productivity in the economy (Tang, 2005; Kim and Lin, 2013; Pradhan, et al., 2014). In fact, a sound financial system with well-structured economic policies serves to ensure economic success and development (Ocampo, 2003).

Furthermore, the IRF and VDC analysis provided information on how economic growth responds to

Table 8. *Summary of Findings PECM, IRF and VDC Analysis*

Countries	PECM	IRF	VDC
	Effect of Crisis on Y_{gdp}	Response on Y_{gdp}	Shock on Y_{gdp}
Indonesia	Stock market	Stock market	Stock market
Malaysia	Real Estate	Stock market	Bank
Philippines	Bank	Bank	Stock market
Singapore	Bank	Bank	Bank
Thailand	Bank	Stock market	Stock market

Notes: The finding is based on the results of Parsimonious Error Correction Model (PECM), Impulse Response Function (IRF), and Variance Decomposition (VCD) represents in Appendix A2-A4.

shocks in financial and non-financial sectoral indices. Understanding the properties of the forecast errors is helpful in uncovering interrelationships among variables in the system. Thus, in the context of this study, it allowed the exploration of the relative importance of the financial sector in accounting for variations in economic growth. The findings from IRF and VDC highlighted the shock and error variance in economic growth which were mostly explained by the stock market and banks. This finding suggested that the stock market and banking sector provides the best leading information for economic activity, especially in developing countries. An unstable financial system would destroy the economic system as a whole.

The empirical contribution of this study presented a comprehensive model that integrates sectoral stock market indices of the stock market, banks, and real estate with macroeconomic indicators in the context of five ASEAN countries. The empirical findings contribute to our understanding that the inclusion of sectoral stock market estimates can provide meaningful evidence on the financial sector's capability to stimulate economic growth. Besides, this study contributes to the literature by providing a thorough analysis of the interactions among stock markets, banks, real estate, and economic growth. To this purpose, the study estimated simultaneously three equations in the system to allow for the joint determination of stock market, banks, real estate, on economic growth, along with other potential explanatory variables. This approach not only contributes to our understanding and provides comparative evidence in the findings, but also to the understanding of how the sectoral indices react to the global economic uncertainty.

Notes

[1] ASEAN Trade Statistics Database, as of October 2011.

[2] Datastream Database retrieved from: https://financial.thomsonreuters.com/en/products/data-analytics/economic-data.html

[3] The eigenvalue and trace statistics reported by Microfit 4.0 and Eviews 9.0 are almost similar.

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Appendix

Appendix A1

Cointegration Test of GDP with Stock Indices for ASEAN-5

Hypothesis				Critical Value			
				Max		Trace	
H_0	H_1	λmax	λtrace	5%	10%	5%	10%
Indonesia							
Vector: [Y_{gdp}, jkse, m, r, p, e] k=4							
r = 0	r > 0	120.8250**	250.265**	39.83	36.84	95.87	91.40
r ≤ 1	r > 1	58.9651**	129.440**	33.64	31.02	70.49	66.23
r ≤ 2	r > 2	40.4394**	70.4754**	27.42	24.99	48.88	45.70
r ≤ 3	r > 3	20.7073	30.0361	21.12	19.02	31.54	28.78
r ≤ 4	r > 4	9.0708	9.3287	14.88	12.98	17.86	15.75
r ≤ 5	r > 5	0.2579	0.2579	8.07	6.50	8.07	6.50
Vector : [Y_{gdp}, bnk, m, r, p, e] k=3							
r = 0	r > 0	148.8715**	291.879**	39.83	36.84	95.87	91.40
r ≤ 1	r > 1	76.6572**	143.007**	33.64	31.02	70.49	66.23
r ≤ 2	r > 2	34.9888**	66.3504**	27.42	24.99	48.88	45.70
r ≤ 3	r > 3	20.9261	31.3617	21.12	19.02	31.54	28.78
r ≤ 4	r > 4	10.3381	10.4356	14.88	12.98	17.86	15.75
r ≤ 5	r > 5	0.09746	0.09746	8.07	6.50	8.07	6.50
Vector : [Y_{gdp}, res, m, r, p, e] k=6							
r = 0	r > 0	97.0422**	190.695**	39.83	36.84	95.87	91.40
r ≤ 1	r > 1	55.5972**	93.6535**	33.64	31.02	70.49	66.23
r ≤ 2	r > 2	18.4274	38.0563	27.42	24.99	48.88	45.70
r ≤ 3	r > 3	16.2343	19.6288	21.12	19.02	31.54	28.78
r ≤ 4	r > 4	3.3197	3.3945	14.88	12.98	17.86	15.75
r ≤ 5	r > 5	0.0748	0.0748	8.07	6.50	8.07	6.50
Malaysia							
Vector : [Y_{gdp}, klse, m, r, p, e] k=8							
r = 0	r > 0	67.0081**	160.155**	39.83	36.84	95.87	91.40
r ≤ 1	r > 1	40.7768**	93.1476**	33.64	31.02	70.49	66.23
r ≤ 2	r > 2	23.4008	52.3708**	27.42	24.99	48.88	45.70
r ≤ 3	r > 3	17.4236	28.9701	21.12	19.02	31.54	28.78
r ≤ 4	r > 4	10.5539	11.5465	14.88	12.98	17.86	15.75
r ≤ 5	r > 5	0.99262	0.99262	8.07	6.50	8.07	6.50
Vector : [Y_{gdp}, bnk, m, r, p, e] k=8							
r = 0	r > 0	58.9492**	133.864**	39.83	36.84	95.87	91.40
r ≤ 1	r > 1	32.2420	74.9156**	33.64	31.02	70.49	66.23
r ≤ 2	r > 2	25.3284	42.6736	27.42	24.99	48.88	45.70
r ≤ 3	r > 3	10.4902	17.3451	21.12	19.02	31.54	28.78
r ≤ 4	r > 4	4.5685	6.8549	14.88	12.98	17.86	15.75
r ≤ 5	r > 5	2.2864	2.2864	8.07	6.50	8.07	6.50

Vector : [Y_{gdp}, res, m, r, p, e] k=7							
r = 0	r > 0	61.2396**	133.042**	39.83	36.84	95.87	91.40
r ≤ 1	r > 1	32.1477	71.8027**	33.64	31.02	70.49	66.23
≤ 2	r > 2	20.0012	39.6549	27.42	24.99	48.88	45.70
r ≤ 3	r > 3	12.0021	19.6538	21.12	19.02	31.54	28.78
r ≤ 4	r > 4	5.8311	7.6517	14.88	12.98	17.86	15.75
r ≤ 5	r > 5	1.8206	1.8206	8.07	6.50	8.07	6.50
Philippines							
Vector : [Y_{gdp}, psei, m, r, p, e] k=3							
r = 0	r > 0	62.5122**	154.4596**	39.83	36.84	95.87	91.40
r ≤ 1	r > 1	39.6425**	91.9474**	33.64	31.02	70.49	66.23
r ≤ 2	r > 2	23.8747	52.3050**	27.42	24.99	48.88	45.70
r ≤ 3	r > 3	17.5988	28.4302	21.12	19.02	31.54	28.78
r ≤ 4	r > 4	10.6148	10.8314	14.88	12.98	17.86	15.75
r ≤ 5	r > 5	0.21654	0.21654	8.07	6.50	8.07	6.50
Vector : [Y_{gdp}, bnk, m, r, p, e] k=4							
r = 0	r > 0	88.3880**	187.3518**	39.83	36.84	95.87	91.40
r ≤ 1	r > 1	38.3063**	98.9638**	33.64	31.02	70.49	66.23
r ≤ 2	r > 2	31.0090**	60.6575**	27.42	24.99	48.88	45.70
r ≤ 3	r > 3	17.6933	29.6485	21.12	19.02	31.54	28.78
r ≤ 4	r > 4	11.9488	11.9552	14.88	12.98	17.86	15.75
r ≤ 5	r > 5	0.00644	0.00644	8.07	6.50	8.07	6.50
Vector : [Y_{gdp}, res, m, r, p, e] k=3							
r = 0	r > 0	55.2173**	142.6725**	39.83	36.84	95.87	91.40
r ≤ 1	r > 1	31.3636	87.4552**	33.64	31.02	70.49	66.23
r ≤ 2	r > 2	26.3717	56.0916**	27.42	24.99	48.88	45.70
r ≤ 3	r > 3	20.7649	29.7199	21.12	19.02	31.54	28.78
r ≤ 4	r > 4	8.9537	8.9550	14.88	12.98	17.86	15.75
r ≤ 5	r > 5	0.0013	0.0013	8.07	6.50	8.07	6.50
Singapore							
Vector : [Y_{gdp}, sti, m, r, p, e] k=5							
r = 0	r > 0	58.1184**	124.0462**	39.83	36.84	95.87	91.40
r ≤ 1	r > 1	32.4834	65.9279	33.64	31.02	70.49	66.23
r ≤ 2	r > 2	16.5492	33.4444	27.42	24.99	48.88	45.70
r ≤ 3	r > 3	13.9138	16.8952	21.12	19.02	31.54	28.78
r ≤ 4	r > 4	2.8891	2.9814	14.88	12.98	17.86	15.75
r ≤ 5	r > 5	0.0923	0.0923	8.07	6.50	8.07	6.50
Vector : [Y_{gdp}, bnk, m, r, p, e] k=6							
r = 0	r > 0	65.8559**	132.6652**	39.83	36.84	95.87	91.40
r ≤ 1	r > 1	32.2000	66.8094	33.64	31.02	70.49	66.23
r ≤ 2	r > 2	16.4130	34.6094	27.42	24.99	48.88	45.70
r ≤ 3	r > 3	14.7924	18.1964	21.12	19.02	31.54	28.78

r ≤ 4	r > 4	2.3870	3.4040	14.88	12.98	17.86	15.75
r ≤ 5	r > 5	1.0169	1.0169	8.07	6.50	8.07	6.50
Vector : [Ygdp, res, m, r, p, e] k=6							
r = 0	r > 0	59.9690 **	133.2553 **	39.83	36.84	95.87	91.40
r ≤ 1	r > 1	37.1984 **	73.2863 **	33.64	31.02	70.49	66.23
r ≤ 2	r > 2	17.8571	36.0879	27.42	24.99	48.88	45.70
r ≤ 3	r > 3	16.6038	18.2308	21.12	19.02	31.54	28.78
r ≤ 4	r > 4	1.6216	1.6270	14.88	12.98	17.86	15.75
r ≤ 5	r > 5	0.0054	0.0054	8.07	6.50	8.07	6.50
Thailand							
Vector : [Y_{gdp}, set, m, r, p, e] k=4							
r = 0	r > 0	73.8299 **	162.8458 **	39.83	36.84	95.87	91.40
r ≤ 1	r > 1	34.5617 **	89.0159 **	33.64	31.02	70.49	66.23
r ≤ 2	r > 2	30.6373 **	54.4541 **	27.42	24.99	48.88	45.70
r ≤ 3	r > 3	16.7295	23.8168	21.12	19.02	31.54	28.78
r ≤ 4	r > 4	5.8902	7.0873	14.88	12.98	17.86	15.75
r ≤ 5	r > 5	1.1971	1.1971	8.07	6.50	8.0700	6.50
Vector : [Y_{gdp}, bnk, m, r, p, e] k=5							
r = 0	r > 0	72.3160 **	168.8723 **	39.83	36.84	95.87	91.40
r ≤ 1	r > 1	31.5232 ***	96.5563 **	33.64	31.02	70.49	66.23
r ≤ 2	r > 2	28.0711 **	65.0331 **	27.42	24.99	48.88	45.70
r ≤ 3	r > 3	20.8994	36.9620 **	21.12	19.02	31.54	28.78
r ≤ 4	r > 4	15.1207	16.0626	14.88	12.98	17.86	15.75
r ≤ 5	r > 5	0.94184	0.94184	8.07	6.50	8.07	6.50
Vector : [Ygdp, res, m, r, p, e] k=7							
r = 0	r > 0	81.1504 **	180.4307 **	39.83	36.84	95.87	91.40
r ≤ 1	r > 1	52.8210 **	99.2804 **	33.64	31.02	70.49	66.23
r ≤ 2	r > 2	28.1770 **	46.4593	27.42	24.99	48.88	45.70
r ≤ 3	r > 3	12.6233	18.2824	21.12	19.02	31.54	28.78
r ≤ 4	r > 4	5.3670	5.6590	14.88	12.98	17.86	15.75
r ≤ 5	r > 5	0.2920	0.2920	8.07	6.50	8.07	6.50

Notes:
*1. ** and *** denote significant at 5% and 10% levels respectively. λ trace and λmax are the likelihood ratio statistics for the number of cointegrating vectors. The lag length (k) was selected based on Akaike Information Criteria (AIC).*
2. Cointegrating vector includes intercept, time trend, seasonal dummies and dummy for outliers.

Appendix A2: Parsimonious Error Correction Model (PECM)

Table 1. *PECM of Real GDP with Stock Return Indices for Indonesia*

Dependent variable is ΔY_{gdp}					
Sample 1990:1 – 2016:2					
JKSE		**BNK**		**RES**	
Regressor	Coefficient	Regressor	Coefficient	Regressor	Coefficient
INT	-.37709	INT	1.3147 ***	INT	.68285
ΔY_{t-1}	-.63374 *	ΔY_{t-1}	-.54961 *	ΔY_{t-2}	-.43046 *
ΔY_{t-2}	-.68508 *	ΔY_{t-2}	-.50745 *	ΔY_{t-3}	-.24753 *
ΔY_{t-3}	-.72660 *	ΔY_{t-3}	-.56202 *	ΔY_{t-4}	.52098 *
$\Delta JKSE_{t-1}$	-.030408 *	ΔBNK_{t-2}	-.018375 *	ΔY_{t-5}	-.18377 ***
$\Delta JKSE_{t-2}$	-.032398 *	Δm_{t-2}	.14078 **	ΔRES_{t-5}	.0064559 ***
Δm_{t-2}	.13737 **	Δr_{t-1}	.0016771 *	ΔRES_{t-6}	-.0065410 ***
Δm_{t-4}	-.050054	Δr_{t-2}	.7369E-3 ***	Δm_{t-2}	.18808 *
Δr_{t-1}	.0014035 *	Δr_{t-3}	-.0011334 *	Δm_{t-3}	.067677
Δr_{t-3}	-.9975E-3 **	Δp_{t-1}	-.075981	Δm_{t-4}	.12121 **
Δr_{t-4}	.0011130 *	Δp_{t-2}	.17129 **	Δm_{t-5}	.13053 **
Δp_{t-1}	-.16477 **	Δp_{t-3}	.33550 *	Δr_{t-4}	.8262E-3 ***
Δp_{t-2}	.070510	Δe_{t-2}	-.10645 *	Δr_{t-5}	-.6033E-3
Δp_{t-3}	.21128 **	Δe_{t-3}	-.041544 **	Δr_{t-6}	.5725E-3
Δe_{t-1}	-.061339 *	CRISIS08	-.0005097	Δp_{t-1}	-.20999 **
Δe_{t-2}	-.13656 *	SR3	.010675 *	Δp_{t-2}	.31903 *
Δe_{t-3}	-.053572 *	ECT_{t-1}	.10075 *	Δp_{t-3}	.062995
SR3	.0088631 *	ECT_{t-2}	-.023718 ***	Δp_{t-6}	-.12383 ***
CRISIS08	-.0057546 *	ECT_{t-3}	-.037395 *	Δe_{t-2}	-.11639 *
ECT_{t-1}	-.062803 *			Δe_{t-5}	-.030947
ECT_{t-2}	.038122 *			Δe_{t-6}	-.036858 **
ECT_{t-3}	-.019600 *			CRISIS08	-.0024725
				SR3	.0060659 **
				ECT_{t-1}	-.024129 *
				ECT_{t-2}	-.0068401
R^2	.93340	R^2	.91664	R^2	.92288
AIC	247.0286	AIC	244.9554	AIC	230.6197
F-stat. F(21,57)	38.0398[.000]	F-stat. F(18,61)	37.2662[.000]	F-stat. F(24,52)	25.9271[.000]
χ^2_{SC} [4]	6.7111[.152]	χ^2_{SC} [4]	7.0701[.132]	χ^2_{SC} [4]	1.9126[.752]
χ^2_{FF} [1]	13.0198[.000]	χ^2_{FF} [1]	20.7158[.000]	χ^2_{FF} [1]	17.4453[.000]
χ^2_{N} [2]	.68594[.710]	χ^2_{N} [2]	.92213[.631]	χ^2_{N} [2]	.74556[.689]
χ^2_{H} [1]	.74257[.389]	χ^2_{H} [1]	.050833[.822]	χ^2_{H} [1]	.082939[.773]

Table 2. *PECM of Real GDP with Stock Return Indices for Malaysia*

Dependent variable is ΔY_{gdp}					
Sample 1990:1 – 2016:2					
KLSE		**BNK**		**RES**	
Regressor	Coefficient	Regressor	Coefficient	Regressor	Coefficient
INT	1.2119*	INT	1.1596*	INT	.59803**
ΔY_{t-1}	-.16062	ΔY_{t-2}	-.33788*	ΔY_{t-1}	.20211***
ΔY_{t-2}	-.30450*	ΔY_{t-3}	-.36004*	ΔY_{t-2}	-.33582*
ΔY_{t-3}	-.37657*	ΔY_{t-5}	-.40745*	ΔY_{t-3}	-.11190
ΔY_{t-5}	-.31274*	ΔBNK_{t-2}	.091393*	ΔY_{t-4}	.19852***
$\Delta KLSE_{t-2}$	.10076*	Δm_{t-2}	.35955*	ΔY_{t-5}	-.30274*
$\Delta KLSE_{t-8}$	-.027696	Δm_{t-3}	-.16352	ΔY_{t-6}	-.13834
Δm_{t-2}	.31791*	Δm_{t-8}	-.25664**	ΔY_{t-7}	-.12636
Δm_{t-8}	-.20176	Δr_{t-3}	-.0070345	ΔRES_{t-2}	.030663**
Δr_{t-3}	-.011662**	Δr_{t-4}	.013248*	ΔRES_{t-3}	-.029545**
Δr_{t-4}	.012321**	Δr_{t-5}	-.014688*	ΔRES_{t-4}	-.022666
Δr_{t-5}	-.012965**	Δr_{t-6}	-.0096266**	ΔRES_{t-6}	-.011959
Δr_{t-6}	-.010847*	Δr_{t-7}	.0045572	Δm_{t-1}	-.28546**
Δr_{t-7}	.0065378***	Δr_{t-8}	-.0055419***	Δm_{t-2}	.43791*
Δr_{t-8}	-.0061646***	Δp_{t-1}	.62395	Δm_{t-5}	-.30126**
Δp_{t-1}	.66142***	Δp_{t-2}	-.63876	Δm_{t-7}	.10089
Δp_{t-2}	-.62440	Δp_{t-3}	.90609**	Δr_{t-3}	-.0094588***
Δp_{t-3}	.75167***	Δp_{t-7}	-.98915**	Δr_{t-4}	.015543*
Δp_{t-7}	-.63535	Δe_{t-2}	-.13772**	Δr_{t-5}	-.0074937***
Δp_{t-8}	-.52038	Δe_{t-6}	-.10858	Δp_{t-2}	-1.1767**
Δe_{t-2}	-.13339**	CRISIS08	-.028817**	Δp_{t-3}	1.0186**
Δe_{t-3}	-.13824**	SR1	-.031605*	Δp_{t-5}	.90119***
Δe_{t-6}	-.087318	SR3	.022078*	Δp_{t-6}	.73606***
CRISIS08	-.035365*	ECT_{t-1}	-.013956	Δe_{t-2}	-.12960**
SR1	-.027267*	ECT_{t-2}	-.046636*	Δe_{t-3}	-.076806
SR3	.023196*			Δe_{t-7}	-.17445**
ECT_{t-1}	-.019312			CRISIS08	-.048337*
ECT_{t-2}	-.048015*			ECT_{t-1}	-.018911
ECT_{t-3}	-.011018			ECT_{t-2}	-.049239*
R^2	.83461	R^2	.82093	R^2	.79337
AIC	234.8772	AIC	234.9437	AIC	226.8916
F-stat. F(28,70)	2.6155[.000]	F-stat. F(24,74)	14.1351[.000]	F-stat. F(28,71)	9.7358[.000]
χ^2_{SC}[4]	5.7677[.217]	χ^2_{SC}[4]	6.9953[.136]	χ^2_{SC}[4]	6.9367[.139]
χ^2_{FF}[1]	2.5504[.110]	χ^2_{FF}[1]	2.2973[.130]	χ^2_{FF}[1]	1.7257[.189]
χ^2_{N} [2]	.016958[.992]	χ^2_{N} [2]	.020813[.990]	χ^2_{N} [2]	4.2430[.120]
χ^2_{H} [1]	.3696E-3[.985]	χ^2_{H} [1]	.0019337[.965]	χ^2_{H} [1]	.5428E-3[.981]

Table 3. *PECM of Real GDP with Stock Return Indices for Philippines*

Dependent variable is ΔY_{gdp}					
Sample 1990:1 – 2016:2					
PSEI		**BNK**		**RES**	
Regressor	Coefficient	Regressor	Coefficient	Regressor	Coefficient
INT	2.4143*	INT	3.1112*	INT	.17162
ΔY_{t-1}	-.29171*	ΔY_{t-2}	-.25401*	ΔY_{t-1}	-.74981*
ΔY_{t-3}	-.67021*	ΔY_{t-3}	-.56630*	ΔY_{t-2}	-.66045*
$\Delta PSEI_{t-1}$	.080602**	ΔBNK_{t-1}	.090519*	ΔY_{t-3}	-.68500*
$\Delta PSEI_{t-2}$	.075930**	ΔBNK_{t-2}	.066965***	ΔRES_{t-2}	.0086817
$\Delta PSEI_{t-3}$	.059813	ΔBNK_{t-3}	.094331*	ΔRES_{t-3}	.026741**
Δm_{t-3}	.44461*	ΔBNK_{t-4}	.049111	Δm_{t-1}	-.034820
Δr_{t-3}	.0061527***	Δm_{t-1}	-.41368*	Δm_{t-2}	-.057184
Δp_{t-1}	.72485	Δm_{t-4}	.29361**	Δm_{t-3}	-.050537
Δp_{t-2}	.98783**	Δr_{t-2}	.0058600**	Δr_{t-1}	.0036680**
Δe_{t-1}	.34943*	Δr_{t-3}	.0084131*	Δr_{t-2}	.0022723***
Δe_{t-3}	-.19484***	Δr_{t-4}	.0033921	Δr_{t-3}	.0018423
CRI-SIS08	-.0079668	Δp_{t-1}	1.6303*	Δp_{t-1}	.79019*
ECT_{t-1}	.17942*	Δp_{t-2}	1.1445**	Δp_{t-2}	.56787*
ECT_{t-2}	-.040219	Δp_{t-4}	.54131	Δp_{t-3}	.23094
ECT_{t-3}	-.12406*	Δe_{t-1}	.25269	Δe_{t-1}	.017840
		Δe_{t-3}	-.12786*	Δe_{t-3}	-.061382***
		CRISIS08	-.033065***	CRISIS08	-.017664**
		ECT_{t-1}	-.12468*	SR1	-.029764*
		ECT_{t-2}	-.17306*	ECT_{t-1}	.010301
		ECT_{t-3}	.038127	ECT_{t-2}	.046805*
				ECT_{t-3}	-.071679*
R^2	.84676	R^2	.89575	R^2	.98380
AIC	145.9562	AIC	156.2864	AIC	238.8344
F-stat. F(15,72)	26.5230[.000]	F-stat. F(20,66)	28.3534[.000]	F-stat. F(21,66)	190.9042[.000]
χ^2_{SC} [4]	34.4971[.000]	χ^2_{SC} [4]	16.2013[.003]	χ^2_{SC} [4]	6.9429[.139]
χ^2_{FF} [1]	.12162[.727]	χ^2_{FF} [1]	2.0475[.152]	χ^2_{FF} [1]	.65221[.419]
χ^2_{N} [2]	1.1325[.568]	χ^2_{N} [2]	1.1561[.561]	χ^2_{N} [2]	.36994[.831]
χ^2_{H} [1]	1.0999[.294]	χ^2_{H} [1]	2.1628[.141]	χ^2_{H} [1]	3.0520[.081]

Table 4. *PECM of Real GDP with Stock Return Indices for Singapore*

Dependent variable is ΔY_{gdp}					
Sample 1990:1 – 2016:2					
STI		BNK		RES	
Regressor	Coefficient	Regressor	Coefficient	Regressor	Coefficient
INT	.32484**	INT	1.3410*	INT	1.1687*
ΔY_{t-1}	.12909	ΔY_{t-2}	.14516	ΔY_{t-4}	-.065639
ΔY_{t-3}	.17373***	ΔY_{t-5}	.067731	ΔRES_{t-1}	.049402*
ΔSTI_{t-1}	.031904***	ΔBNK_{t-2}	.071332*	ΔRES_{t-3}	.027001**
ΔSTI_{t-2}	-.018351	ΔBNK_{t-3}	-.015789	ΔRES_{t-4}	.024293***
ΔSTI_{t-5}	.011003	ΔBNK_{t-5}	.026516	ΔRES_{t-6}	.029146**
Δm_{t-2}	.19806**	Δm_{t-2}	.23889*	Δm_{t-1}	-.24393**
Δm_{t-4}	.18114**	Δm_{t-3}	.18258**	Δm_{t-2}	.18932**
Δm_{t-5}	-.058787	Δm_{t-4}	.20696**	Δm_{t-4}	.14141
Δr_{t-1}	.0059138**	Δm_{t-5}	.093366	Δm_{t-5}	-.21934**
Δr_{t-2}	.0060007**	Δm_{t-6}	-.10985	Δr_{t-2}	.0034254
Δr_{t-5}	-.0039200	Δr_{t-1}	.013137*	Δr_{t-4}	-.0037493
Δp_{t-1}	1.1055**	Δr_{t-2}	.011577*	Δr_{t-5}	-.0069298**
Δp_{t-2}	.96167**	Δr_{t-3}	.0050125	Δr_{t-6}	-.0060093***
Δp_{t-3}	.18647	Δr_{t-5}	-.0041480	Δp_{t-1}	.91103**
Δp_{t-5}	.43476	Δr_{t-6}	-.0044398	Δp_{t-2}	.93530***
Δe_{t-2}	-.087303	Δp_{t-1}	.62009	Δp_{t-6}	.16318
Δe_{t-3}	-.12123	Δp_{t-2}	.76929***	Δe_{t-1}	.089197
Δe_{t-4}	-.092741	Δp_{t-6}	.33033	Δe_{t-3}	-.15924***
Δe_{t-5}	-.14534***	Δe_{t-3}	-.088015	Δe_{t-5}	-.083733
CRISIS08	-.0092354	Δe_{t-5}	-.055625	Δe_{t-6}	-.12122
ECT_{t-1}	-.038092**	Δe_{t-6}	-.12998***	CRISIS08	-.0088515
		CRISIS08	-.022939**	SR1	.0034941
		ECT_{t-1}	-.047010*	ECT_{t-1}	.0027114
				ECT_{t-2}	-.041103*
R^2	.51098	R^2	.54749	R^2	.55102
AIC	259.1619	AIC	258.1926	AIC	257.6044
F-stat. F(21,84)	4.1796[.000]	F-stat. F(23,81)	4.2609[.000]	F-stat. F(24,80)	4.0909[.000]
χ^2_{SC}[4]	4.6421[.326]	χ^2_{SC}[4]	2.5719[.632]	χ^2_{SC}[4]	3.1124[.539]
χ^2_{FF}[1]	15.5455[.000]	χ^2_{FF}[1]	16.3099[.000]	χ^2_{FF}[1]	19.9069[.000]
χ^2_{N}[2]	3.9272[.140]	χ^2_{N}[2]	.33545[.846]	χ^2_{N}[2]	.085115[.958]
χ^2_{H}[1]	1.7236[.189]	χ^2_{H}[1]	.74422[.388]	χ^2_{H}[1]	.88431[.347]

Table 5. *PECM of Real GDP with Stock Return Indices for Thailand*

Dependent variable is ΔY_{gdp}					
Sample 1990:1 – 2016:2					
SET		**BNK**		**RES**	
Regressor	Coefficient	Regressor	Coefficient	Regressor	Coefficient
INT	$.37973^{**}$	INT	$.56984^{***}$	INT	1.2600^{*}
ΔY_{t-1}	$-.45950^{*}$	ΔY_{t-1}	$-.61544^{*}$	ΔY_{t-1}	$-.50146^{*}$
ΔY_{t-2}	$-.56431^{*}$	ΔY_{t-2}	$-.50822^{*}$	ΔY_{t-2}	$-.44144^{*}$
ΔY_{t-3}	$-.35182^{*}$	ΔY_{t-3}	$-.43170^{*}$	ΔY_{t-3}	$-.35882^{**}$
ΔSET_{t-3}	$.049733^{**}$	ΔY_{t-5}	.18836	ΔY_{t-4}	$-.26264^{***}$
Δm_{t-1}	$.16163^{**}$	ΔBNK_{t-3}	.023167	ΔY_{t-7}	$-.22537^{***}$
Δm_{t-3}	$.16606^{***}$	ΔBNK_{t-5}	$.033439^{**}$	ΔRES_{t-3}	-.017029
Δm_{t-4}	.14619	Δm_{t-4}	$.19056^{***}$	ΔRES_{t-4}	$.022106^{***}$
Δr_{t-4}	-.0024903	Δr_{t-3}	$-.0029592^{***}$	ΔRES_{t-5}	$-.021856^{***}$
Δp_{t-4}	$-.55627^{***}$	Δr_{t-4}	.0024226	Δm_{t-1}	$.22000^{**}$
Δe_{t-3}	-.054636	Δr_{t-5}	.0012270	Δm_{t-2}	-.15695
CRISIS08	$-.038641^{*}$	Δp_{t-1}	$.89935^{**}$	Δm_{t-3}	$-.25508^{**}$
ECT_{t-1}	-.012552	Δp_{t-5}	$-.90026^{*}$	Δm_{t-7}	$.21859^{***}$
ECT_{t-2}	$-.073909^{*}$	Δe_{t-2}	$-.15811^{***}$	Δr_{t-1}	$-.0067609^{*}$
ECT_{t-3}	$.035112^{***}$	Δe_{t-3}	-.092853	Δr_{t-3}	.0032298
		Δe_{t-5}	-.090345	Δr_{t-4}	.0034156
		CRISIS08	$-.041670^{*}$	Δr_{t-5}	$-.0057090^{*}$
		ECT_{t-1}	.012249	Δr_{t-7}	$-.0039894^{**}$
		ECT_{t-2}	$-.055026^{*}$	Δp_{t-1}	$.74251^{**}$
		ECT_{t-3}	-.010420	Δp_{t-2}	$.82801^{**}$
		ECT_{t-4}	$.035150^{***}$	Δp_{t-5}	$-.69580^{***}$
				Δe_{t-2}	-.090345
				Δe_{t-3}	$-.22057^{*}$
				Δe_{t-4}	$.16875^{***}$
				Δe_{t-5}	$-.30822^{*}$
				CRISIS08	$-.039360^{*}$
				SR2	$-.023021^{*}$
				ECT_{t-1}	-.0098061
				ECT_{t-2}	-0.0008076
				ECT_{t-3}	$-.068947^{*}$
R^2	.54342	R^2	.61106	R^2	.69779
AIC	198.9375	AIC	197.6960	AIC	193.6640
F-stat. F(14,78)	6.6310[.000]	F-stat. F(20,71)	5.5774[.000]	F-stat. F(30,59)	4.5410[.000]
χ^2_{SC} [4]	3.7268[.444]	χ^2_{SC} [4]	2.5698[.632]	χ^2_{SC} [4]	5.8893[.208]
χ^2_{FF} [1]	.41853[.518]	χ^2_{FF} [1]	1.3449[.246]	χ^2_{FF} [1]	1.5266[.217]
χ^2_{N} [2]	344.8154[.000]	χ^2_{N} [2]	230.0246[.000]	χ^2_{N} [2]	140.236[.000]
χ^2_{H} [1]	1.1711[.279]	χ^2_{H} [1]	.44046[.507]	χ^2_{H} [1]	1.038[.308]

Appendix A3: Impulse Response Functions (IRF)

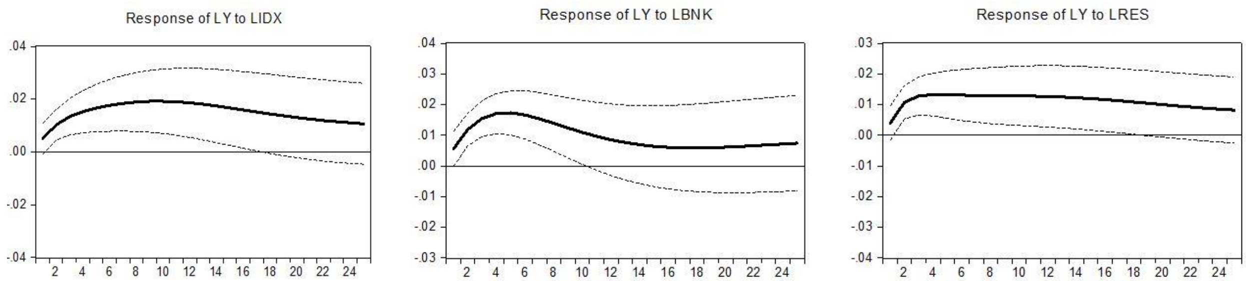

Figure 1. Generalized responses of GDP (Y_{gdp}) to stock indices in Indonesia

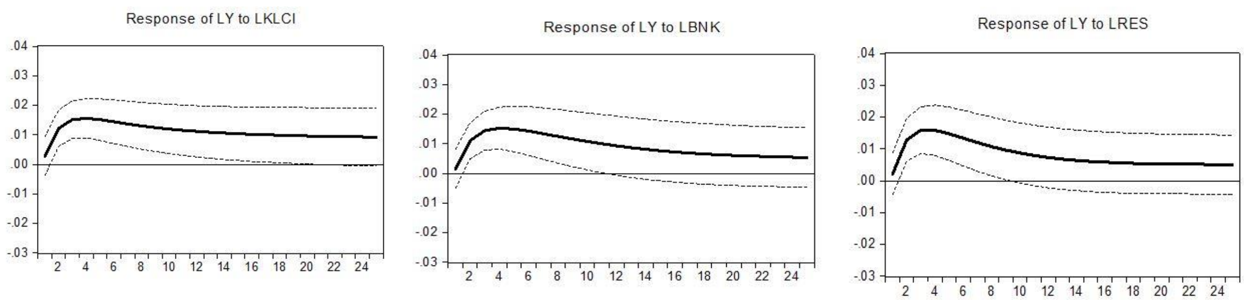

Figure 2. Generalized responses of GDP (Y_{gdp}) to stock indices in Malaysia

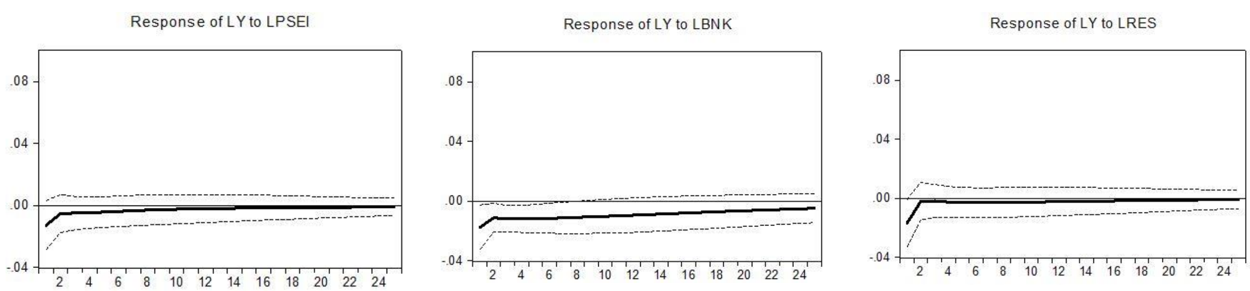

Figure 3. Generalized responses of GDP (Y_{gdp}) to stock indices in the Philippines

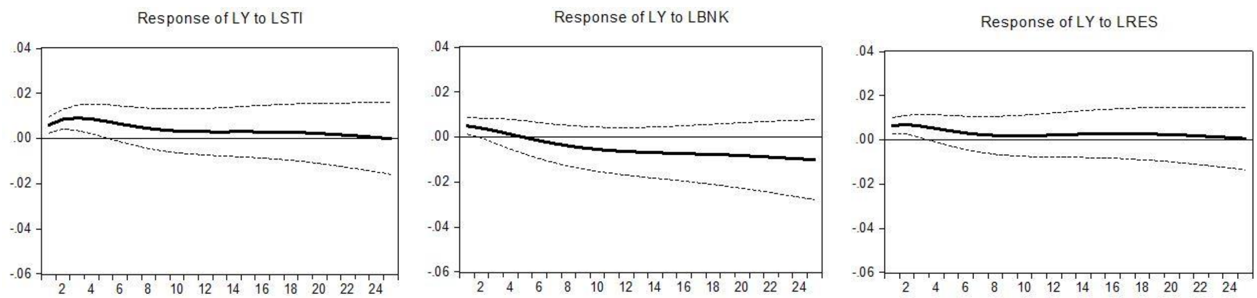

Figure 4. Generalized responses of GDP (Y_{gdp}) to stock indices in Singapore

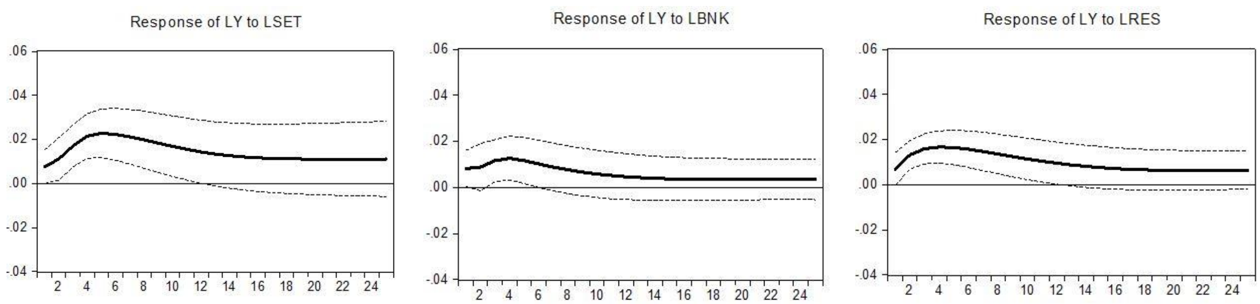

Figure 5. Generalized responses of GDP (Y_{gdp}) to stock indices in Thailand

Appendix A4: Variance Decomposition Analysis (VDC)

Forecast Error Variance Decomposition for GDP (Y_{gdp})

Indonesia						
Period	ΔY_{gdp}	ΔJKSE	ΔM	ΔR	ΔP	ΔE
1	96.71143	1.222450	1.610026	0.000816	0.010360	0.444918
5	77.61582	7.923468	12.31827	0.440999	0.016912	1.684534
10	63.45014	12.04821	20.84341	2.067680	0.357280	1.233283
20	49.58211	17.60350	22.97708	4.445037	2.163223	3.229049
Period	ΔY_{gdp}	ΔBNK	ΔM	ΔR	ΔP	ΔE
1	99.46283	0.000054	0.460186	0.012617	0.005153	0.059158
5	94.23595	0.000139	5.319365	0.026217	0.167504	0.250828
10	86.40749	0.082511	12.04839	0.446557	0.825198	0.189855
20	73.79416	3.592364	16.69672	2.044467	2.365301	1.506987
Period	ΔY_{gdp}	ΔRES	ΔM	ΔR	ΔP	ΔE
1	99.00225	0.159470	0.691149	0.003053	0.003103	0.140973
5	89.26568	1.117359	8.362447	0.140603	0.039489	1.074422
10	77.50021	1.948613	18.21111	0.693667	0.617249	1.029160
20	63.44948	5.382627	23.86637	1.835621	2.673504	2.792398
Malaysia						
Period	ΔY_{gdp}	ΔKLSE	ΔM	ΔR	ΔP	ΔE
1	96.21455	0.301673	1.029783	0.783888	0.163098	1.507008
5	71.08120	10.64435	2.570460	11.58732	0.205595	3.911074
10	57.34792	13.92589	3.566668	15.38684	1.770519	8.002162
20	52.44557	15.57207	2.647364	13.67578	5.388900	10.27032
Period	ΔY_{gdp}	ΔBNK	ΔM	ΔR	ΔP	ΔE
1	95.76339	0.272409	1.479625	0.427971	0.358776	1.697831
5	72.72884	11.14557	1.602380	8.349161	0.389031	5.785011
10	57.36336	18.64973	2.235422	12.60103	1.088510	8.061950
20	53.17045	18.30193	1.812575	12.38601	3.899560	10.42947
Period	ΔY_{gdp}	ΔRES	ΔM	ΔR	ΔP	ΔE
1	95.11241	1.616986	1.221733	0.617803	0.497818	0.933252
5	70.61906	10.60311	2.849233	10.52864	0.438700	4.961254
10	56.91745	13.42771	4.900585	14.86537	1.887798	8.001079
20	52.27687	12.95023	4.402230	13.75290	5.681979	10.93578
Philippines						
Period	ΔY_{gdp}	ΔPSEI	ΔM	ΔR	ΔP	ΔE
1	95.79741	0.482202	0.580489	2.758490	0.301837	0.079573
5	87.95537	2.913453	1.856318	4.639773	2.383404	0.251681
10	82.83555	5.642238	1.890700	4.037535	5.277922	0.316060
20	76.42114	8.489226	1.546403	3.275018	9.860288	0.407926

Period	ΔY_{gdp}	ΔBNK	ΔM	ΔR	ΔP	ΔE
1	95.32887	0.130360	1.207651	1.822639	0.406473	1.104012
5	85.89504	0.191504	3.362964	4.517983	2.150592	3.881914
10	81.17647	0.204135	3.633680	4.919729	4.363487	5.702495
20	76.06471	0.301588	3.092775	4.541889	8.163757	7.835280
Period	ΔY_{gdp}	ΔRES	ΔM	ΔR	ΔP	ΔE
1	95.87049	0.499535	0.484195	2.713526	0.329589	0.102660
5	88.02950	2.946564	1.289146	4.658631	2.729455	0.346709
10	82.54283	5.509488	1.191668	4.072619	6.202087	0.481304
20	75.51691	7.724241	1.054113	3.357929	11.61872	0.728083
Singapore						
Period	ΔY_{gdp}	ΔSTI	ΔM	ΔR	ΔP	ΔE
1	96.14862	2.943937	0.470278	0.261514	0.136157	0.039496
5	75.15480	11.70880	7.108352	1.078977	2.708991	2.240083
10	60.27477	10.26198	14.56360	0.853641	7.141083	6.904915
20	53.12753	8.746803	15.49900	2.679968	11.32905	8.617642
Period	ΔY_{gdp}	ΔBNK	ΔM	ΔR	ΔP	ΔE
1	95.44827	3.066991	0.621704	0.093626	0.125738	0.643670
5	69.61881	14.70442	8.111628	0.518811	2.237366	4.808965
10	53.19235	15.29411	17.22411	0.469141	6.076812	7.743488
20	45.81688	12.64294	19.89918	2.952079	10.08232	8.606607
Period	ΔY_{gdp}	ΔRES	ΔM	ΔR	ΔP	ΔE
1	96.11415	2.750738	0.467019	0.511099	0.155526	0.001467
5	76.48110	11.30681	6.501805	1.673840	2.403803	1.632639
10	61.04892	12.34794	13.75221	1.082655	6.002080	5.766193
20	51.19480	14.48675	16.14745	2.084513	9.712852	6.373627
Thailand						
Period	ΔY_{gdp}	ΔSET	ΔM	ΔR	ΔP	ΔE
1	98.17808	1.179574	0.038161	0.578505	0.017264	0.008413
5	83.18640	9.198465	0.377477	6.976563	0.247948	0.013149
10	69.32862	14.70136	0.499126	14.49804	0.965713	0.007147
20	61.76522	15.61875	0.325126	19.16247	3.106665	0.021770
Period	ΔY_{gdp}	ΔBNK	ΔM	ΔR	ΔP	ΔE
1	98.72874	0.011881	0.219701	0.901275	0.060418	0.077988
5	86.63716	0.116900	1.694385	10.46042	0.209588	0.881544
10	74.76850	0.120186	2.164267	21.14022	0.149631	1.657195
20	69.30944	0.256212	1.466712	26.29985	1.104068	1.563717
Period	ΔY_{gdp}	ΔRES	ΔM	ΔR	ΔP	ΔE
1	98.68650	0.468890	0.082759	0.755410	0.006097	0.000342
5	85.03278	5.652068	0.538552	8.376744	0.399457	0.000395
10	70.63933	10.75972	0.560130	16.29716	1.738152	0.005508
20	62.80752	11.65409	0.341653	20.76619	4.351315	0.079237