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EXPORT DIVERSIFICATION AND ECONOMIC GROWTH IN ASEAN

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Abstract: *This paper tries to assess empirically the relationship between export diversification and economic growth on selected countries in ASEAN. Using annual data or time-series over the period 1989 to 2010 and econometric techniques (Granger causality and cointegration) are applied to test the relationship between export diversification and economic growth. The result show that, in case of Indonesia and Malaysia, there are exist uni-directional causality from GDP to export diversification. For Singapore and Thailand, the results show that there are no causal relationship between export diversification and economic growth.*

Keywords: *export diversification, economic growth, causality, ASEAN*
JEL Classification: *F13, F43, O40*

Abstrak: *Tulisan ini mencoba mengkaji secara empiris hubungan antara diversifikasi ekspor dan pertumbuhan ekonomi di negara yang dipilih di ASEAN. Dengan menggunakan data tahunan atau time series selama periode 1989 sampai 2010 dan teknik ekonometrik (Granger kausalitas dan kointegrasi) yang diterapkan untuk menguji hubungan antara diversifikasi ekspor dan pertumbuhan ekonomi. Hasil penelitian menunjukkan bahwa, dalam kasus Indonesia dan Malaysia, ada ada uni-directional kausalitas dari PDB untuk ekspor diversifikasi. Untuk Singapura dan Thailand, hasil menunjukkan bahwa tidak ada hubungan sebab akibat antara diversifikasi ekspor dan pertumbuhan ekonomi.*

Kata kunci: *diversifikasi ekspor, pertumbuhan ekonomi, kausalitas, ASEAN*
Klasifikasi JEL: *F13, F43, O40*

INTRODUCTION

The dependence on primary-product exports has been frequently mentioned as one of the main features of developing nations. As stated by Todaro and Smith (2006), less developed countries (LDCs) tend to specialize in the production of primary products, instead of secondary and tertiary activities. Consequently, exports of primary products play a very significant role in terms of foreign exchange generation in these countries, traditionally representing a significant share of their gross national product. Specially in the case of the non-mineral primary products exports, markets and prices are frequently unstable, leading to a high degree of exposure to risk and uncertainty for the countries that rely on them (Todaro and Smith 2006). Primary-products exports have been characterized by relatively low income elasticity of demand and inelastic price elasticity, being fuels, certain raw materials, and manufactured goods, some exceptions that exhibit relatively high income elasticity (Todaro and Smith, 2006).

Taking these arguments into account, the cause for export diversification has been commonly supported based on the so-called "export instability argument". Consequently, export diversification has been proposed as a policy mechanism seeking to stabilize export earnings, which would be especially required in those developing countries where the share of commodities in its export basket is particularly pronounced. This situation is additionally complicated by the fact that many of the LDCs have incurred in deficits on their balance of payments, due to their import demands of capital goods, intermediate goods, and consumer products that their industrial expansion requires. Furthermore, LDCs are usually more dependent on trade than developed nations, in terms of its share in national income.

Export diversification entails changing the composition of a country's export mix, being it "directly related to the structure of the economy and how it changes as development proceeds". The underlying consideration behind export diversification as a possible developmental strategy is related to the expectation of achieving stability-oriented and growth-oriented policy objectives (Ali *et al.* 1991). A broader exports base, coupled with a special promotion of those commodities with positive price trends, should be beneficial for growth. Hence, the value-added export commodities would be stimulated, by means of additional processing and marketing activities. A country's degree of diversification is usually considered as dependent upon the number of commodities within its export mix, as well as on the distribution of their individual shares.

The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) has stated that for small, low-income economies such as the least developed countries (LDCs), reasonable development goals cannot be limited to primary products exports. Diversification, both in terms of "non-traditional" and "traditional" commodities, is considered as an element of utmost importance for growth and development (ESCAP 2004). It has also been frequently stated that growth and export diversification may be linked. Besides structural changes of an economy, as Al-Marhubi (2000) points out, traditional development models propose that economic growth also implies a shift from dependence on primary exports towards diversified manufactured exports. Another interesting concept is linked to the so-called "graduation concept" addressed by empirical studies such as the ones conducted by Michaely (1977) and Moschos (1989). It suggests that the process of "graduation" from developing to developed status should be joined by a structural change of exports toward diversity (Amin Gutierrez de Pineres and Ferrantino, 1997a). This would suggest that the connection between exports and growth enters, when a certain level of development is attained.

Against this background, this study intends to examine the impact of export diversification (*DX*) on economic growth in selected ASEAN Economies. Particularly, to examine the relationship between *DX* and economic growth. The relation between export diversification and economic growth has been analyzed in a wide number of empirical studies. The possible influence of export diversification on growth is examined by Amin Gutierrez de Pineres and Ferrantino (1997a), by analyzing the Chilean experience within the period 1962–1991. They study the possible link between diversification, export growth and aggregate development, by constructing different measures of diversification and structural change in exports. These measures are afterward used to test different relationships among the structure of exports and export growth. Two different interesting findings are reported: first of all, a link between the domestic economic performance and diversification is reported, suggesting that diversification in Chile has taken place mostly during times of internal crisis or external shock. Secondly, that the new products most successfully introduced in that country were mainly primary products (such as tobacco, coffee and tea, and dairy products) while a number of manufactures (like plastics, manufactured fertilizers, electrical and non-electrical machinery) have shown less dynamism. Their study also proposed that export diversification, in the long run, has boosted Chilean growth performance.

Al-Marhubi (2000) conducts an empirical study of 91 countries, in the 1961–1988 periods, to test the hypothesis of a possible link between export diversification and growth. He finds out that those economies with a larger number of export products experienced faster growth. Besides that, he argues that greater export diversification and lower export concentration is associated with faster growth. The relationship between export diversification and growth proved to be economically large. He also concludes that when export diversification occurs, growth in developing countries is positively influenced by stimulating the accumulation of capital.

Agosin's study (2006) investigates whether export diversification has any explanatory power in a standard empirical model of growth. Cross-sectional data in the 1980–2003 periods is considered, for a sample of ASEAN and Latin American countries. It is suggested that export growth by itself does not appear to be relevant for growth, while export growth together with diversification appears to be relevant. This argument is supported by the fact that the interactive variable (measuring diversification and export growth) showed the expected sign and was highly significant, providing the strongest explanatory power. Export diversification is supposed to contribute to growth through two different channels, namely, the "portfolio effect" – less export volatility- and the widening of comparative advantages, as a result of a more diversified economy.

Klinger and Lederman (2004) estimating the Herfindahl index on the log of income per capita and its squared term find a nonlinear relationship which suggests that countries diversify their export structure up to some point in their development after which get more concentrated in their exports. To test whether the change brings higher growth rate, the squared term of the Herfindahl index is added into the regression. So in another estimation of the growth rate the squared term of the Herfindahl index will be added as an explanatory variable. The finding of a U-shaped relation of export concentration on economic growth would mean that for some countries export concentration is more beneficial than diversification.

Hesse (2008) together with the World Bank's Commission on Growth and Development using the system GMM estimator for a sample of 99 countries and Herfindahl index of export concentration studies the impact of export concentration on economic growth of countries based on augmented Solow model in the period of 1961-2000. Adding the squared term of the index he finds some evidence of nonlinearity in the relationship, but the coefficients on the squared index are not significant in the work.

Theoretical Framework. Export dependency on primary products of a country can be reduced through diversification of the export portfolio. However, export diversification can take place in different forms and dimensions and thus its analysis can be undertaken at different levels. Usually, by changing the shares of commodities in the existing export mix, or by including new commodities in the export portfolio, a country can attain export diversification. In this context, there are two well-known forms of export diversification that are common in the trade literature, namely, horizontal and vertical diversification. While horizontal diversification entails alteration of the primary export mix in order to neutralize the volatility of global commodity prices, vertical diversification involves contriving further uses for existing and new innovative commodities by means of value-added ventures such as processing and marketing. It is expected that vertical diversification could augment market prospects for raw materials that may compliment economic growth and thus lead to further stability as processed commodities tend to have more stable prices than raw materials.

Export diversification can be categorized into two types, the horizontal diversification and vertical diversification. The former refers to diversity of product across different type of industry, while the latter covers diversity of product within the same industry—i.e. value-added ventures in further downstream activities. Both type of diversification is expected to positively induce economic growth (Kenji & Mengistu, 2009).

There are many way through which export diversification promotes economic growth. Export diversification could positively affect economic growth by reducing the dependency on limited number of commodities (Herzer and Nowak-Lehmann, 2006). This argument is particularly true in the case of commodity-dependent developing countries, where overdependence on agricultural sector could—according to the Prebisch-Singer thesis—reduce the terms of trade. The basic reason for this due to Hesse (2008) is the high degree of price volatility of commodity products.

Another way of illustrating the dynamic effect of export diversification on growth is by linking the connection between these two variables based on modern theory vis-à-vis the classical trade theory. Based on the modern trade theory, there are three main features of modern market behaviour. *First*, the increasing dynamic features of production factors and national policies to influence the production capacity to grow with increasing return. *Second*, the expansions of trade model from perfect competition to the imperfect competition especially the monopolistic competition. This is partially related to the first factor, whereby increasing intensity of trade liberalization among nations and mobilization of production factors have enable firms in one country to expand their production without being constrained by diminishing return Krugman & Obstfeld (2003). This arguments—in contrast to the classical trade theory—implies that could involve in various production activities without confining to their comparative advantage (Arip, Yee, & Karim, 2010).

While the aforementioned two factors explain the market behaviour from the supply side, the third characteristic of modern trade theory is attributed to the demand side. This is reflected by domestic market peculiarities across different countries, which are not fixed and varies in various aspects such as taste, average income, knowledge, gender, age, culture and geographical division. While production in each particular country tries to meets unique characteristic of domestic market demand, it also enters symmetrically into the international market demand and subsequently offers the market with goods and services, which are different in the form of functionalities, taste, design, ingredient, quality, and appearances. This is termed as the home market´ effects on the pattern of trade by Krugman (1980). According to Krugman (1980) a country tends to export those goods for which they have relatively large domestic market.

RESEARCH METHOD

Empirical Framework

This paper use time-series techniques of cointegration and Granger causality tests to examine the long-run relationship and dynamic interactions among the variables of interest. Since these methods are now well known, we mention only those aspects that are relevant in our study. Firstly, for proper model specification, we conduct the unit root and cointegration tests. We apply group unit root test, such as: Levin, Lin and Chu *t* (assumes common unit root process), *lm*, Pesaran and Shin W-Stat, Augmented Dickey-Fuller (*ADF*) and Phillips-Perron (*PP*) unit root tests (assumes individual unit root process) for determining the variables orders of integration. Then, to test for cointegration, we employ a vector autoregressive (VAR) based approach of Johansen (1988) and Johansen & Juselius (1990), henceforth the *JJ* cointegration test. Since the results of the *JJ* cointegration test tend to be sensitive to the order of *VAR*, following Hall (1989) and Johansen (1992), we specify the lag length that renders the error terms serially uncorrelated.

Having implemented unit root and cointegration tests, we proceed to specification and estimation of Granger causality. In particular, the findings that the variables are non-stationary and are not cointegrated suggest the use of Granger causality of *VAR* model in first differences. However, if they are cointegrated, a vector error correction model (*VECM*) or a level *VAR* can be used (Engle & Granger, 1987: 251-276). According to Granger representation theorem, for any cointegrated series, error correction term must be included in the model. Engle & Granger (1987) and Toda & Phillips (1993) indicate that omitting this error correction term (*ECT*) in the model, leads to model misspecification. Through the *ECT*, the *ECM* opens up an additional channel for Granger-causality to emerge that is completely ignored by the standard Granger and Sims tests (Masih, A. M. M. & Masih, R; 1999).

Utilizing *VECM* procedure permits us to make a distinction between the short- and long-run forms of Granger-causality. The short-run causality is determined by the significance of the *F*-test or chi-square statistics of the differenced independent variables while the long-run causality is determined by the significance of *t*-test of the lagged *ECT*. The non-significance of both the *t* and-tests in the *VECM* indicates econometric exogeneity of the dependent variable (Masih and Masih, 1999). The *VECM* can then be simply reformulated in matrix form as follows:

$$\begin{bmatrix}\Delta GDP \\ \Delta DX \\ \Delta EMP \\ \Delta CAP\end{bmatrix} = \begin{bmatrix}\alpha_0 \\ \alpha_1 \\ \alpha_2 \\ \alpha_3\end{bmatrix} + \sum_{i=1}^{k} \Gamma_i \begin{bmatrix}\Delta GDP \\ \Delta DX \\ \Delta EMP \\ \Delta CAP\end{bmatrix}_{t-k} +$$

$$\Pi \begin{bmatrix}GDP \\ DX \\ EMP \\ CAP\end{bmatrix}_{t-1} + \begin{bmatrix}v_0 \\ v_1 \\ v_2 \\ v_3\end{bmatrix} \quad (1)$$

where *GDP* is gross domestic product, *DX* is export diversification index, *EMP* is employment, and *CAP* is capital expenditure.

Data Description

The data used in this study are annual data for the period of 1989 to 2010.The data set is compiled into a panel data from sources as the International Financial Statistics of the *IMF*, the World Integrated Trade Solution of the World Bank and the Key Indicators of the ASEAN Development Bank (*ADB*). In this paper, the focal variables are gross domestic product (*GDP*) and the export diversification index (*DX*). However focusing on these two variables in a bivariate context may not be satisfactory since they may be driven by common factors thus the results will be misleading. Following Herzer and Nowak-Lehmann (2006), we also include capital expenditure (*CAP*) and the number of people employed (*EMP*) as control variables.

Export diversification is held to be important for developing countries because many developing countries are often highly dependent on relatively few primary commodities for their export earning. Unstable prices of their commodities may subject a developing country exporter to serious terms of trade shocks. Since the covariation in individual commodity prices is less than perfect, diversification into new primary export product is generally view as appositive development. The strongest positive effect are normally associated with diversification into manufactured goods, and its benefit include higher and more stable export earnings, job creation, and learning effects and the development of new skills and infrastructure that would facilitate the development of even newer export product. The export diversification index (*DX*) for a country is defined as:

$$DX_j = \left(sum\left|h_{ij} - x_i\right|\right)/2 \quad (2)$$

Where h_{ij} is the share of commodity *i* in the total exports of country *j* and x_i is the share of the commodity in world exports. The related measure used by UNCTAD is the concentration index or Hirschman (*H*) index, which is calculated using the shares of all three-digit products in a country's exports:

$$H_j = sqrt\left[sum\left(\frac{x}{X_t}\right)^2\right] \quad (3)$$

Where x_i is country *j*'s export in product *i* (at three digit classification) and X_t is country *j*'s total export. The index has been normalized to account for the number of three digit product that could be exported. Thus, maximum value of the index is 239 (the number of individual three digit products in SITC revision 2), and its minimum (theoretical value) is zero, for country with no export. The lower the index, the less concentrated are country's export.

RESULTS AND DISCUSSION

Unit Root Tests

In order to obtain credible and robust results for any conventional regression analysis, the data to be analyzed should be stationary. Hence, to test for stationarity, the Levin, Lin,& Chu, the *Im*, Pesaran and Shin W-stat, the *ADF* and *PP* tests are performed based on model with constant and no trend. Table 1-4 (see Appendix) reports group unit root tests statistics that examine the presence of unit roots (non-stationary) for all variables in each country. The Levin, Lin & Chu, the Im, Pesaran and Shin W-stat, the ADF and PP tests agree in classifying *DX, GDP, EMP* and *CAP* as *I*(1) variables, *i.e.*, they are non-stationary in level but become stationary after first differencing.

Cointegration Tests

In order to capture dynamic relationship among the observed variables, their cointegration relationship was tested trough multivariate methodology proposed by Johansen (1990) and Johansen and Juselius (1991). Johansen (1991) modeled time series as a reduced rank regressions in which they computed the maximum likelihood estimates in the multivariate cointegration model with Gaussians errors. The advantage of this technique is that it allows one to draw a conclusion about the number of cointegrating relationship among observed variables. Since all the data series in the model were integrated processes of order one or *I(1)*, the linear combination (cointegrating vectors) of one or more of these series may exhibit long run relationship. The maximum eigenvalue test and trace test was employed to established the number of cointegrating vectors. The results are presented in table 5 – 8 (see Appendix). The optimal lag length (*p*) is determined using Schwartz Information Criterion (*SIC*), which indicates an optimal lag length of one year.

In the case of Indonesia, Malaysia and Thailand, the result of trace test and maximum eigenvalue test both indicate that, there is one cointegrating vector at 5% level of significance. For Singapore, the result of trace test and maximum eigenvalue test both indicate that, there is two cointegrating vector at 5% level of significance.

Granger Causality Tests

As discussed above that there is co-integration between the variables, so the next step is to test for the direction of causality using the vector error correction model. Firstly, we present the traditional Granger causality results for each country as in table 9 – 12 (see Appendix). In case of Indonesia, the result in table 9 show that *GDP* does Granger cause *DX* at7% level of significance. So, there is exist unidirectional causality from *GDP* to Export Diversification. For Malaysia, the estimation result indicated that we reject the null hypothesis of "*GDP* does not Granger cause *DX*" and conclude that there is exists uni-directional causality between Economic Growth and Export Diversification at the 1% level of significance.

Table 11 & 12 show estimation result for Singapore and Thailand. The result indicate that we cannot reject both of the Ho of "GDP does not Granger cause *DX*" and the Ho of "*DX* does not Granger cause *GDP*" at 5% level of significance. Therefore, we accept the Ho, and conclude that *GDP* does not Granger cause export diversification and export diversification does not Granger cause *GDP*. In other word, we can say that both variables are independent.

Vector Error Correction Model

In order to check the stability of the model we have estimated the vector error correction (*VEC*) model. The results of *VEC* model are presented in Table 13 – 16 (see Appendix). For Indonesia, the results indicate that the error correction term for *GDP* bears the correct sign i.e. it is negative and statistically significant at 5 percent significant level, implying that there exist a long run causality running from export diversification to GDP.

Meanwhile, in case of Malaysia, coefficient of error term with export diversification as dependent variable is statistically significant, yet the sign is positive (not correct). This finding is in accordance with result of cointegration test implying that only one cointegration equation running in the long run.

For Singapore (table 15), we know that coefficient of error term with *GDP* as dependent variable is statistically significant, but the sign is positive (not correct).

Otherwise, coefficient of error term with export diversification as dependent variable is not significant. These results suggest that no long run relationship between export diversification and economic growth.

In case of Thailand, both of the coefficient of error term with GDP (DX) as dependent variable are not statistically significant, implying that no long run relationship between export diversification and economic growth, vice versa (table 16).

CONCLUSION

The paper tries to assess empirically, the relationship between export diversification and economic growth in selected ASEAN Economies (Indonesia, Malaysia, Singapore and Thailand) using annual data over the period 1989 to 2010. The unit root properties of the data were examined using group unit root test, such as: Levin, Lin and Chu *t* (assumes common unit root process), lm, Pesaran and Shin W-Stat, Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests (assumes individual unit root process) after which the cointegration and causality tests were conducted. The error correction models were also estimated in order to examine the short –run dynamics. The major findings include the following:

The unit root tests clarified that all variables (DX, GDP, EMP and CAP) are non stationary at the level data but found stationary at the first difference. Therefore, for all countries, the series were found to be integrated of order one. Furthermore, cointegration tests indicate that there exists a long run equilibrium relationship between exports diversification and GDP in all countries as confirmed by Johansen cointegration test results.

The Granger causality test finally confirmed that in case of Indonesia and Malaysia, there are exist uni-directional causality from GDP to export diversification. For Singapore and Thailand, the results show that there are no causal relationship between export diversification and economic growth.

REFERENCES

Agosin, M. P. (2007). Export diversification and growth in emerging economies, *Working Paper No.233.* Universidad de Chile: Departmento de Economia.

Al Marhubi, F. A. (2000). Export diversification and growth: an empirical investigation. *Applied Economics Letters, 7,* 559-562.

Amin Gutiérrez de Piñeres, Sheila, and Michael J. Ferrantino. (1997a). Export diversification and structural change: some comparisons for Latin America. *The International Executive,* Vol. 39 No. 4, July/August, 465-477.

Arip, Mohammad Aendy, Yee, Lau Sim and Abdul Karim, Bakri. (2010). Export diversification and economic growth in Malaysia, *MPRAWorking Paper* No. 20588.

ASEAN Development Bank. *Key indicator for Asia and Pacific*, (2011).

Engle, R. F., & Granger, C. W. J. (1987). Cointegration and error correction: representation, estimation, and testing. *Econometrica*, 55, 251-276

Hall, S. G. (1989). Maximum likelihood estimation of cointegrating vectors: An Example of Johansen's Procedure. *Oxford Bulletin of Economics and Statistics, 51*, 213-218.

Hesse, H. (2008). *Export diversification and economic growth, Working Paper No. 21.* the Commission on Growth and Development.

Herzer, D., & Lehmann, N. (2006). What does export diversification do for a growth? An Econometric Analysis. *Applied Economic Letters, 38*(15), 1825-1838.

International Monetary Fund. (2012). *World Economic Outlook Database*.

Johansen, S. and Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*.

Kenji, Y., & Mengistu, A. A. (2009). The impacts of vertical and horizontal export diversification on growth: an empirical study on factors explaining the gap between Sub-Sahara Africa and East Asia's Performances. *Ritsumeikan International Affair, 17*, 41.

Klinger, Bailey and Daniel Lederman. (2004): Discovery and development: an empirical exploration of "new" products. *Policy Research Working Paper* No. 3450, World Bank, November.

Krugman, P. (1980). Scale economies, product differentiation, and the pattern of trade. *The American Economic Review, 70*(5), 950.

Krugman, P., & Obstfeld, D. 2003). *International economics: theory and policy* (754, Trans. 6th ed.). Boston: Pearson Education, Inc.

Masih, A. M. M., & Masih, R. (1999). Are ASEAN stock market fluctuations due mainly to intraregional contagion effects?

Evidence Based on ASEAN Emerging Stock Markets, *Pacific-Basin Finance Journal, 7,* 251-282.

Michaely, M. (1977). Exports and growth: an empirical investigation. *Journal of Development Economics* 4: 49-53.

Moschos, D. (1989). Export expansion, growth and the level of economic development: an empirical analysis. *Journal of Development Economics,* 30: 93-102.

Toda, H. Y., & Phillips, P. C. B. (1993). Vector autoregression and causality. *Econometrica, 59*, 229-255.

World Bank. (2011). *The World integrated trade solution: Trade Indicator*.

APPENDIX

Table 1. Group unit root test results: Indonesia

Series: ***DX, GDP, EMP, CAP***

Method	Level		First difference	
	***t*-statistic**	**Prob**	***t*-statistic**	**Prob**
Null: Unit Root (assumes common unit root process)				
Levin, Lin & Chu t*	1.38054	0.9163	-8.51243	0.0000
Null: Unit Root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	2.81844	0.9976	-7.40062	0.0000
ADF	7.73178	0.4601	56.7549	0.0000
PP	8.41325	0.3942	56.7549	0.0000

Table 2. Group unit root test results: Malaysia

Series: ***DX, GDP, EMP, CAP***

Method	Level		First difference	
	***t*-statistic**	**Prob**	***t*-statistic**	**Prob**
Null: Unit Root (assumes common unit root process)				
Levin, Lin & Chu t*	-1.11401	0.1326	-4.82959	0.0000
Null: Unit Root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	1.02228	0.8467	-4.89022	0.0000
ADF	7.75127	0.4581	37.6187	0.0000
PP	10.5651	0.2276	123.700	0.0000

Table 3. Group unit root test results: Singapore

Series: ***DX, GDP, EMP, CAP***

Method	Level		First difference	
	***t*-statistic**	**Prob**	***t*-statistic**	**Prob**
Null: Unit Root (assumes common unit root process)				
Levin, Lin & Chu *t**	2.03497	0.9791	-5.04562	0.0000
Null: Unit Root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	1.20923	0.8867	-4.62690	0.0000
ADF	5.76144	0.4504	30.2135	0.0000
PP	4.45428	0.6154	30.1992	0.0000

Table 4. Group unit root test results: Thailand

Series: *DX, GDP, EMP, CAP*				
Method	Level		First difference	
	t-statistic	Prob	*t*-statistic	Prob
Levin, Lin & Chu *t**	-1.34370	0.0895	-6.46399	0.0000
Im, Pesaran and Shin W-stat	0.33412	0.6309	-5.77053	0.0000
ADF	18.3928	0.0185	44.0740	0.0000
PP	39.0924	0.0000	41.2199	0.0000

Table 5. Johansen cointegration tests: Indonesia

Ho	Eigenvalue	Trace		L_{max}	
		Stat	5% *CV*	Stat	5% *CV*
$r = 0$	0.682765	45.54770	47.85613	22.96226	27.58434
$r \leq 1$	0.467131	22.58544	29.79707	12.58959	21.13162
$r \leq 2$	0.242084	9.995853	15.49471	5.543660	14.26460
$r \leq 3$	0.199573	4.452193*	3.841466	4.452193*	3.841466

* denote rejection of the hypothesis at the 0.05 level

Table 6. Johansen cointegration tests: Malaysia

Ho	Eigenvalue	Trace		L_{max}	
		Stat	5% *CV*	Stat	5% *CV*
$r = 0$	0.818141	56.39197*	47.85613	34.09049*	27.58434
$r \leq 1$	0.492489	22.30147	29.79707	13.56476	21.13162
$r \leq 2$	0.326337	8.736718	15.49471	7.900492	14.26460
$r \leq 3$	0.040949	0.836226	3.841466	0.836226	3.841466

* denote rejection of the hypothesis at the 0.05 level

Table 7. Johansen Cointegration tests: Singapore

Ho	Eigenvalue	Trace		L_{max}	
		Stat	5% *CV*	Stat	5% *CV*
$r = 0$	0.942077	93.11025*	47.85613	56.97270*	27.58434
$r \leq 1$	0.766412	36.13754*	29.79707	29.08390*	21.13162
$r \leq 2$	0.210727	7.053644	15.49471	4.732864	14.26460
$r \leq 3$	0.109560	2.320780	3.841466	2.320780	3.841466

* denote rejection of the hypothesis at the 0.05 level

Table 8. Johansen Cointegration tests: Thailand

Ho	Eigenvalue	Trace		L_{max}	
		Stat	5% *CV*	Stat	5% *CV*
$r = 0$	0.916553	76.38329*	47.85613	49.67098*	27.58434
$r \leq 1$	0.500053	26.71231	29.79707	13.86506	21.13162
$r \leq 2$	0.339926	12.84725	15.49471	8.308081	14.26460
$r \leq 3$	0.203046	4.539165*	3.841466	4.539165*	3.841466

* denote rejection of the hypothesis at the 0.05 level

Table 9. Granger causality for Indonesia

Null Hypothesis	*F*-Statistic	Prob.
GDP does not Granger Cause *DX*	3.01597	0.0793
DX does not Granger Cause *GDP*	1.06480	0.3695
EMP does not Granger Cause *DX*	1.64810	0.2254
DX does not Granger Cause *EMP*	1.22905	0.3204
CAP does not Granger Cause *DX*	0.13425	0.8754
DX does not Granger Cause *CAP*	6.65131	0.0086
EMP does not Granger Cause *GDP*	0.34151	0.7161
GDP does not Granger Cause *EMP*	3.85788	0.0445
CAP does not Granger Cause *GDP*	0.29567	0.7483
GDP does not Granger Cause *CAP*	1.03967	0.3777
CAP does not Granger Cause *EMP*	2.14397	0.1517
EMP does not Granger Cause *CAP*	0.99266	0.3937

Table 10. Granger causality for Malaysia

Null Hypothesis	*F*-Statistic	Prob.
GDP does not Granger Cause *DX*	7.21723	0.0064
DX does not Granger Cause *GDP*	3.38096	0.0614
EMP does not Granger Cause *DX*	1.53117	0.2482
DX does not Granger Cause *EMP*	3.26980	0.0663
CAP does not Granger Cause *DX*	1.26801	0.3099
DX does not Granger Cause *CAP*	2.27514	0.1371
EMP does not Granger Cause *GDP*	0.08095	0.9226
GDP does not Granger Cause *EMP*	0.46893	0.6345
CAP does not Granger Cause *GDP*	0.53113	0.5986
GDP does not Granger Cause *CAP*	1.77218	0.2037
CAP does not Granger Cause *EMP*	1.08786	0.3621
EMP does not Granger Cause *CAP*	2.32784	0.1317

Table 11. Granger causality for Singapore

Null Hypothesis	F-Statistic	Prob.
GDP does not Granger Cause *DX*	1.66455	0.2224
DX does not Granger Cause *GDP*	0.03033	0.9702
EMP does not Granger Cause *DX*	4.40316	0.0313
DX does not Granger Cause *EMP*	1.40753	0.2753
CAP does not Granger Cause *DX*	0.00607	0.9940
DX does not Granger Cause *CAP*	0.44175	0.6510
EMP does not Granger Cause *GDP*	7.12420	0.0067
GDP does not Granger Cause *EMP*	6.81873	0.0078
CAP does not Granger Cause *GDP*	2.77988	0.0940
GDP does not Granger Cause *CAP*	1.20639	0.3267
CAP does not Granger Cause *EMP*	0.27677	0.7620
EMP does not Granger Cause *CAP*	0.91121	0.4232

Table 12. Granger causality for Thailand

Null Hypothesis	F-Statistic	Prob.
GDP does not Granger Cause *DX*	0.20142	0.8197
DX does not Granger Cause *GDP*	0.24089	0.7889
EMP does not Granger Cause *DX*	0.24266	0.7876
DX does not Granger Cause *EMP*	1.57467	0.2395
CAP does not Granger Cause *DX*	0.75143	0.4886
DX does not Granger Cause *CAP*	1.02536	0.3825
EMP does not Granger Cause *GDP*	2.70578	0.0992

GDP does not Granger Cause *EMP*	3.21703	0.0688
CAP does not Granger Cause *GDP*	2.04691	0.1637
GDP does not Granger Cause *CAP*	1.03142	0.3805
CAP does not Granger Cause *EMP*	4.14514	0.0369
EMP does not Granger Cause *CAP*	0.07895	0.9245

Table 13. Multivariate Granger causality tests based on *VECM*: Indonesia

Variables	*D(GDP)*	*D(DX)*	*D(EMP)*	*D(CAP)*
ECM	-0.837089*	-3.21E-05	-0.004431	-125.2820
	(0.08507)	(9.9E-05)	(0.01048)	(145.899)
	[-9.84034]	[-0.32401]	[-0.42286]	[-0.85869]
D(*GDP*(-1))	0.433721	-8.87E-05	0.009173	61.08693
	(0.12778)	(0.00015)	(0.01574)	(219.148)
	[3.39440]	[-0.59584]	[0.58280]	[0.27875]
D(*GDP*(-2))	0.433905	0.000387	0.015576	346.1866
	(0.10803)	(0.00013)	(0.01331)	(185.290)
	[4.01636]	[3.07488]	[1.17038]	[1.86835]
D(*DX*(-1))	212.8895	0.029009	-8.544325	-929034.5
	(244.096)	(0.28453)	(30.0690)	(418649.)
	[0.87215]	[0.10196]	[-0.28416]	[-2.21912]
D(*DX*(-2))	-208.3858	0.286727	6.301253	-533728.0
	(288.695)	(0.33651)	(35.5629)	(495141.)
	[-0.72182]	[0.85206]	[0.17719]	[-1.07793]
D(*EMP*(-1))	-35.88820	-0.003854	-0.761148	-4442.481
	(4.13899)	(0.00482)	(0.50986)	(7098.79)
	[-8.67076]	[-0.79888]	[-1.49285]	[-0.62581]
D(*EMP*(-2))	-32.21117	-0.005264	-0.004763	-2191.842
	(3.25034)	(0.00379)	(0.40039)	(5574.66)
	[-9.91010]	[-1.38950]	[-0.01189]	[-0.39318]
D(*CAP*(-1))	0.000745	1.70E-07	2.65E-05	0.019336
	(0.00018)	(2.1E-07)	(2.2E-05)	(0.30883)
	[4.13524]	[0.81010]	[1.19610]	[0.06261]
D(*CAP*(-2))	0.000672	3.46E-08	1.00E-05	-0.021338
	(0.00017)	(1.9E-07)	(2.0E-05)	(0.28533)
	[4.04006]	[0.17852]	[0.48984]	[-0.07478]

Notes: standard errors in () &*t*-statistic in []

Table 14. Multivariate Granger Causality Tests Based on VECM: Malaysia

Variables	*D*(*GDP*)	*D*(*DX*)	*D*(*EMP*)	*D*(*CAP*)
ECM	-0.106100	0.000351*	0.001219	10.02449
	(0.12197)	(8.5E-05)	(0.00329)	(37.0443)
	[-0.86990]	[4.15761]	[0.37007]	[0.27061]
D(*GDP*(-1))	0.947231	-0.001924	-0.003210	-69.70183
	(0.55322)	(0.00038)	(0.01494)	(168.023)
	[1.71222]	[-5.02057]	[-0.21479]	[-0.41484]

D(*GDP*(-2))	0.546984 (0.85742) [0.63794]	-0.001139 (0.00059) [-1.91661]	-0.006571 (0.02316) [-0.28370]	-4.607880 (260.416) [-0.01769]
D(*DX*(-1))	904.7039 (351.174) [2.57623]	-0.879051 (0.24330) [-3.61298]	-6.106484 (9.48572) [-0.64376]	-60882.36 (106659.) [-0.57082]
D(*DX*(-2))	-77.15913 (414.663) [-0.18608]	0.067723 (0.28729) [0.23573]	-5.020546 (11.2007) [-0.44824]	40322.15 (125941.) [0.32017]
D(*EMP*(-1))	-29.40748 (20.1452) [-1.45978]	0.038615 (0.01396) [2.76669]	-0.173311 (0.54415) [-0.31850]	2209.854 (6118.50) [0.36118]
D(*EMP*(-2))	-3.384447 (13.5038) [-0.25063]	0.006708 (0.00936) [0.71697]	-0.385816 (0.36476) [-1.05774]	-3700.354 (4101.37) [-0.90222]
D(*CAP*(-1))	0.000113 (0.00134) [0.08421]	-1.12E-06 (9.3E-07) [-1.21305]	3.03E-05 (3.6E-05) [0.83731]	0.124685 (0.40655) [0.30669]
D(*CAP*(-2))	0.000588 (0.00114) [0.51462]	-1.01E-06 (7.9E-07) [-1.27642]	4.36E-06 (3.1E-05) [0.14133]	-0.128248 (0.34720) [-0.36938]

Notes: standard errors in () &*t*-statistic in []

Table 15. Multivariate Granger Causality Tests based on *VECM*: Singapore

Variables:	D(*DX*)	D(*GDP*)	D(*CAP*)
ECM	0.011220 (0.06375) [0.17600]	209.6231 (36.8540) [5.68794]	4278.863 (9785.68) [0.43726]
D(*DX*(-1))	-0.061845 (0.34288) [-0.18037]	-470.3054 (198.215) [-2.37270]	-13026.79 (52631.2) [-0.24751]
D(*DX*(-2))	-0.211615 (0.34490) [-0.61356]	-464.3347 (199.379) [-2.32891]	47902.94 (52940.1) [0.90485]
D(*GDP*(-1))	-0.000469 (0.00054) [-0.86629]	-0.877098 (0.31266) [-2.80531]	47.32419 (83.0184) [0.57004]
D(*GDP*(-2))	0.000161 (0.00071) [0.22847]	-1.568638 (0.40849) [-3.84009]	28.58937 (108.465) [0.26358]
D(*CAP*(-1))	-1.22E-06 (2.9E-06) [-0.41443]	0.006795 (0.00170) [4.00388]	-0.034571 (0.45065) [-0.07671]
D(*CAP*(-2))	-1.04E-06 (1.8E-06) [-0.57498]	0.001237 (0.00105) [1.18164]	0.198290 (0.27790) [0.71354]

Notes: standard errors in () &*t*-statistic in []

Table 16. Multivariate Granger causality tests based on VECM: Thailand

Variables:	D(GDP)	D(DX)	D(EMP)	D(CAP)
ECM	0.785929	-0.000879	0.043637	0.344911
	(0.82828)	(0.00050)	(0.00938)	(1.46114)
	[0.94887]	[-1.76146]	[4.65124]	[0.23606]
D(*GDP*(-1))	-0.765429	0.001383	-0.061697	0.044245
	(1.56139)	(0.00094)	(0.01769)	(2.75439)
	[-0.49022]	[1.47003]	[-3.48849]	[0.01606]
D(*GDP*(-2))	-0.673741	0.000162	-0.001264	0.694222
	(0.63732)	(0.00038)	(0.00722)	(1.12427)
	[-1.05715]	[0.42128]	[-0.17510]	[0.61749]
D(*DX*(-1))	642.7876	0.123443	29.38906	587.9058
	(584.861)	(0.35236)	(6.62467)	(1031.73)
	[1.09904]	[0.35033]	[4.43630]	[0.56982]
D(*DX*(-2))	1312.402	-1.664573	66.07803	0.120507
	(1656.58)	(0.99804)	(18.7640)	(2922.32)
	[0.79224]	[-1.66785]	[3.52154]	[4.1e-05]
D(*EMP*(-1))	10.36249	-6.73E-05	-0.298477	-2.761696
	(12.3958)	(0.00747)	(0.14041)	(21.8671)
	[0.83597]	[-0.00902]	[-2.12580]	[-0.12629]
D(*EMP*(-2))	0.943376	0.012452	-0.456162	-3.930901
	(15.6535)	(0.00943)	(0.17731)	(27.6139)
	[0.06027]	[1.32039]	[-2.57273]	[-0.14235]
D(*CAP*(-1))	0.544919	-0.000380	0.018851	0.480540
	(0.45761)	(0.00028)	(0.00518)	(0.80725)
	[1.19081]	[-1.37804]	[3.63688]	[0.59528]
D(*CAP*(-2))	0.563680	-0.000676	0.019374	0.043864
	(0.59870)	(0.00036)	(0.00678)	(1.05614)
	[0.94151]	[-1.87351]	[2.85689]	[0.04153]

Notes: standard errors in () &*t*-statistic in []