

Cointegration & Granger Causality Test among Trade Openness and Economic Growth in Malaysia

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Abstract— Economic globalization has caused a reduction of barriers on international trade. It was believed that, the growth in trade would increase the nation's income. Thus, this empirical study is conducted to examine the short run and long run relationship between economic growth and trade openness. Furthermore, Foreign Direct Investment (FDI) was also investigated because it was believed that openness and economic growth influenced the flow of FDI. Statistical analysis of data had been gathered from 1974 to 2010. The methodology used was multivariate Vector Autoregressive (VAR) co-integration and causality tests. The estimation results indicate that there exists one co-integrating vector. Thus, it can be concluded that there is a long run equilibrium relationship among the variables. Not only does the result from Granger causality test show the existence of bidirectional causality between economic growth and foreign direct investment, and also, unidirectional causality or trade caused economic growth in Malaysia.

Keywords— Trade openness, foreign direct investment, economic growth, Johansen cointegration, Granger causality

I.INTRODUCTION

Malaysia was classified by The World Bank as a middle income country a few years after gaining independence from Britain in 1957. Since the independence, Malaysia had a population of just 7.4 million. This population had grown rapidly with the growth rate of about 1.7% annually; today Malaysia's current population is approximately 28.3 million.

Before, Malaysia's low income was thriving on agrarian economy which was heavily dependent on primary product such as rubber and tin. Over time, the economy had diversified beyond agriculture and primary commodities such as manufactured goods. Starting in the year 1970, Malaysia ushered a new phase of economic growth which rapidly rose from construction and manufacture. These industries were supported by the affirmative policies from the Malaysian government. With the introduction of Investment Incentives Act of 1968, Free Trade Zone Act of 1971 and Promotion of Incentives Act of 1986, all became the 'push factor' that drove the economy towards industrialization. Malaysia today is a middle income country with multi-sector economy based on servicing and manufacturing, and also, one of the world's largest exporters of semiconductor devices, electrical goods, solar panels, and information and communication technology (ICT) products.

Malaysia launched Vision 2020 in 1991 which focuses on achieving the status of a developed country by the year 2020. In order to achieve its vision, many policies especially relating on trade, aims to promote and safeguard Malaysia's interest in the international trade. Besides, the policies made are hopefully useful to spur the development of industrial activities as well as to further enhance Malaysia's economic growth towards the realization of vision 2020.

Malaysia's economy is growing and is relatively an open state-oriented market. It can also be classified as one of the 'Young Tigers' cub among Asia's Economy, after four Asian Tigers; Singapore, Hong Kong, South Korea and Taiwan. Apart from that, in terms of financial openness, Malaysia also ranks reasonably high, exceeding the median score of 2.03. (Source: BNM). Thus, Malaysia is the most financially open country in East Asia after Hong Kong, Singapore and Brunei. To ensure that the market remains open, Malaysia is committed to the trade liberalization process and negotiations through the rules-based on multilateral trading system under WTO. The multilateral trading system has contributed much to the stability and growth in international trade. Thus, Malaysia has always supported the role of the WTO in strengthening the multilateral trading system, and regarding WTO as the core of its external trade policy making.

It is very important for Malaysia to pursue their open trade policies so that it can attract the Foreign Direct Investment (FDI) that would lead to an impressive growth and continued economic transformation. Hence the trade policy is designed to promote and sustain economic growth, therefore Malaysia takes a global approach in both trade and investment relations. Malaysia continuously ties with other trading nations. At the same time, Malaysia is supportive of regional initiative like ASEAN, APEC and others, which would be able to strengthen their economy and provide a strong trading partner to Malaysia in such regional groupings.

Malaysia follows these four Tigers who are focused on developing goods for export to highly industrialized nation. Historically, Malaysia had faced economic downturn during 1997 – 1998 Asian financial crises. Malaysia learned a big lesson on several valuable strategies to its economic management, and with the lessons applied, brought about the economic resilience in 2008-2009 financial crises.

Malaysia's economy had been recorded as one of Asia's best with the growth in Real Gross Domestic Product (GDP) by an average of 6.5% annually since 1970 until 2010 even with its ups and downs due to the economic downturn. During the years 2000 to 2010 real GDP increased, even though in the year 2009, GDP experienced a significant reduction up to -1.6% from 4.8% the preceding year. Value of export and import has also been increasing from year to year, but it also experienced a slight decrease in 2009 with -16.6%. However, the decline in 2009 soon recovered in 2010 with real GDP growth of 15.6%, as well as the growth in

export and import which recorded a growth of 7.2% and 21.7% respectively.

The uncertainty of domestic and international economic condition has puzzled the effect of trade openness on Malaysian economic growth. Thus the purpose of this paper is to reinvestigate the relationship between trade openness and economic growth. The role of Foreign Direct Investment (FDI) will also be investigated.

II. EMPIRICAL EVIDENCE ON TRADE AND GROWTH

The issue of how developing countries accelerate their economic growth is very important. Most countries accelerate growth over years through their openness to trade with other countries. Trade played an important role towards economic growth including Malaysia since 1970. With openness to trade, countries can freely export or import goods with each other. Since export and import represent the country's openness, an increase in export may reflect the country's openness. Many economists argued whether trade openness leads to a faster growth or the growth had driven more export, it is still unsure, maybe both or none.

There are a number of studies using the econometric methodology; Co-integration and Granger Causality test sees the relationship between export and growth. These studies have been used extensively in literature such as Narayan and Prasad (2007) and Victor Ukpolo (1998). They found that there is evidence of export that leads to growth in the long run.

Meanwhile, there are also evidences that do not support that export leads to growth. As for Narayan, his study claimed that export leads growth only for Pakistan, Sri Lanka and Bhutan while the opposite is said to India, Nepal and Maldives, which reported that growth, leads to an increase in export; for Bangladesh, there's no relation between both export and growth. This is supported with the study from Konya (2000) and Chimobi (xxx) where it is reported that export performance has been the key driver for growth performance. Meanwhile, Darrat, A. (1986) argued that countries like Hong Kong, Korea, Singapore and Taiwan have an independent growth and export.

Kundu A. (2010) & Hye Qazi Muhammad Adnan (2011) agreed with the hypothesis that export led growth in his study towards the economy of India. Kundu concluded that there exist a long run relationship between income growth and export growth in India. While, Hye found another interesting factor to promote growth which is import. Import can also be a 'push factor' to economic growth in Tunisia.

There is also a study about relationship between openness and growth. Most literature conveys that more open countries have definitely experienced faster productivity growth in the long run. Frankel & et al (1996) urged that in promoting

growth, openness play a substantial role in many countries. Fully supported by Sebastian (1997), he concluded from his study that more open countries have indeed experienced faster productivity growth. Similar with Jin J. C. (2003) who agreed that free trade can stimulate economic growth.

This can be proven through studies undertaken by Andraz (2010), Jayachandran (2010) as well as Klasra (2009). They found that trade openness or export positively foster the growth in the long run. Hence, there is bi-directional causal relationship between Foreign Direct Investment (FDI) and growth in the short run. As from Jayachandran's case study of India, he presented that there is casualty between export and growth but no relationship from growth to export. Klasra (2009) found it true that openness leads to growth for Pakistan and the opposite for Turkey where growth drove openness.

According to Wooster & et al (2007), from their test about trade-growth relationship for EU, the result confirm that trade openness plays an important role for growth. Indeed, they show that intra-regional trade has had a lesser impact on growth rather than extra regional trade. This is likely due to the fact that extra-regional trade exposes countries to a larger and more diverse global market, which implies more possibilities for transfer of skills and technology. The global market also implies larger economic scale and greater competition leading to higher efficiency in production.

Indeed many more studies found the importance of openness towards economic growth such as, Nushiwat (2008), Rana Ejas Ali Khan & Rashid Sattar (2010). Nushiwat claimed that industrialized countries like United States, Western Europe and Japan's economic growth caused their exports to grow. The growth of exports, at later stages, contributed to the growth of the economy.

Most recently a literature explored by Shaheen Safana & et al (2011) checked the possible outcome of the relation between economic growth, financial development, and international trade. They revealed unidirectional cause from financial development to economic growth, from international trade to economic growth and from financial development to international trade. Thus, with the reference of the above literature, this paper aims to examine the short run and long run relationship and causes among economic growth, trade openness and Foreign Direct Investment in Malaysia.

III. METHODOLOGY

This paper uses the annual data for the sample period from 1974 to 2010. The multivariate model consists of three variables: real GDP, trade openness (the ratio between trade and GDP) and Foreign Direct Investment (FDI). All data were gathered from World Development Indicators and prices from the World Bank in 2010. As part of the empirical

design, our base estimating equation in log-linear form is specified as follows:

$$y_t = \beta_0 + \beta_1 OPEN_t + \beta_2 FDI_t + u_t \quad (1)$$

where, y = gross domestic product, $OPEN$ = trade openness and FDI = Foreign Direct Investment. The variables are converted into natural logs because if the variables are in logs, the first difference can be interpreted as growth rates. The expected signs of the parameters are positive. The error-term u is assumed to be independently and identically distributed. The subscript (t) indexes time.

Tests for Stationarity

The result from the Ordinary Least Square (OLS) regression is spurious if it was regressed with non-stationary data. Thus it is important to test the stationarity of the data. There are several tests that can be used to the stationary property of the series. In this paper, we employed Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) test. The basic Dickey-Fuller test is augmented by adding various lagged dependent variables as below:

$$\Delta y_t = (\rho - 1)y_{t-1} + \alpha_i \sum_{i=1}^m \Delta y_{t-i} + u_t \quad (2)$$

The lag (m) can be determined by Akaike criteria. The same criterion is used for Phillip-Perron test. This test proposes a unit root test which controls for higher order serial correlation in a time series.

Cointegration and Vector Error Correction Model

Ordinary Least Square (OLS) is not able to depict the long run relationship among the variables. This long run relationship is also known as co-integration. Engle-Granger co-integration test and Johansen Co-integration test are two mechanisms that can be applied to test the co-integration. However, when testing for multivariate co-integration, one of the approaches has been to test for co-integration using a Vector Autoregressive (VAR) approach. This assumes all the variables in the model are endogenous, although it is possible to include exogenous variables as well, these do not act as dependent variables. The main difference with the Engle-Granger approach is that it is possible to have more than a single co-integrating relationship. The test itself produces a number of statistics which can be used to determine the number of co-integrating vectors present. The number of co-integration using Johansen Co-integration test can only be determined if the series are non stationary. In this procedure, two tests namely Trace Statistic and Maximum Eigen value test will be used. However in some cases, the two tests may show different result. If that case happens, the trace statistics is preferred. The number of lags is determine by the sequential likelihood ratio (LR), Akaike information criterion

(AIC), Schwarz information criterion (SC), Final Prediction Error (FPE) and Hannan Quinn information criterion (HQ).

However, in the short run, the disequilibrium may happen due to shock in economic system. To solve this problem, Vector Error Correction Model (VECM) will be employed. A basic error correction model would appear as follows:

$$\Delta y_t = \chi_0 + \chi_1 \Delta x_t - \tau(u_{t-1}) + \varepsilon_t \quad (3)$$

where τ is the error correction term coefficient, which theory suggests should be negative and whose value measures the speed of adjustment back to equilibrium following an exogenous shock. The error correction term u_{t-1} , which can be written as: $(y_{t-1} - x_{t-1})$, is the residual from the co-integrating relationship in Equation (1).

Test for Granger Causality

However, if the long run relationship did exist, we do not know the direction of the causality, whether x led y or vice versa. Normally, Granger causality test is considered as a useful technique for determining whether one time series is good for forecasting the other. Furthermore the number of lags should be determined before running the test because the result is sensitive with the lag. The Granger Causality test (multivariate model) can be expressed as follows:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^m \beta_i \Delta Y_{t-i} + \sum_{j=1}^n \delta_j \Delta X_{t-j} + \sum_{k=1}^p \chi_j \Delta Z_{t-k} + v_t \quad (4)$$

where ΔY is change in GDP and ΔY_{t-i} and ΔX_{t-j} and ΔZ_{t-k} are changing or differenced lagged GDP, changing OPEN and changing FDI respectively. The Granger test assumed v_t to be serially uncorrelated with zero mean. The Granger F-statistic, tests the null hypothesis that lagged X and Z does not Granger-cause (predict) Y. The null is rejected if the χ_j coefficient and δ_j are significantly different from zero.

IV. RESULT AND DISCUSSION

Before we discuss further, the time series properties of the data used will be tested. To avoid spurious result, the data need to be stationary which means that the means and variances of the data series are constant over time and co variances depends only on the distance between the two time periods. Hence we can only study its behavior for the time period under consideration and it may be less practical value for forecasting. The first step of our empirical work is to know the degree of integration of each variable by using unit root test (ADF) and Phillips-Perron test. A result from both tests in Table 1 indicates that the t-statistics are statistically insignificant to reject the null hypothesis of non-stationary at 5 percent significance level. This indicates that these series are non-stationary at their level form. Therefore, these

variables contain a unit root process or they share a common stochastic movement.

TABLE I
RESULTS OF ORDER OF INTEGRATION TEST (1960-2010)

	Test for I(0) At Level			Test for I(1) First Difference		
	nGDP	lnFDI	lnOPEN	Δ lnGDP	Δ lnFDI	Δ lnOPEN
ADF Test	1.36	-0.35	0.42	-6.25*	-4.86*	-3.54*
PP Test	1.83	-0.32	1.40	-6.59*	-4.75*	-3.50*

Note: * indicates the rejection of the null hypothesis of non-stationary at 5 percent significance level.

Fig 1 visualized the series in level and first difference. INVEST in the diagram refers to FDI. From the figure, the series for GDP, FDI and OPEN appear to be trending upward or non-stationary. A remedy action if this problem occurred is by using first difference for each variable

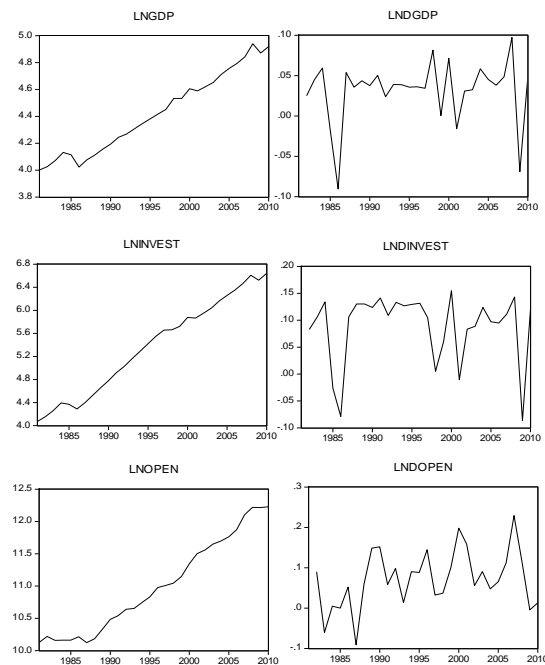


Figure 1: Data Series in Level and First Difference

The next step is to decide about the number of co-integrating vectors. For this purpose, the Johansen Co-integration method is used. It is important to determine the appropriate lag length since VAR is the multivariate generalization of autoregressive process. The number of lag can be determined by employing different criteria as shown in Table 2. Based on Akaike information criterion, the optimal lag of VAR to be used is one.

TABLE II
VAR LAG ORDER SELECTION CRITERION

Lag	FPE	LR	AIC	SC	HQ
0	8.41e-09	NA*	-10.08	-9.93*	-10.04*
1	7.92e-09*	16.39	-10.15*	-9.56	-9.99
2	1.02e-08	9.14	-9.94	-8.91	-9.66
3	1.44e-08	7.28	-9.71	-8.23	-9.32
4	3.05e-08	2.47	-9.18	-7.27	-8.67
5	3.62e-08	8.13	-9.45	-7.09	-8.82

FPE: Final prediction error, LR: sequential modified LR test statistic (each test at 5% level), AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

Table 3 shows the result of Johansen Co-integration Test. The result shows that the null hypothesis of no co-integration and hypothesis of two co-integrations are rejected by Trace statistics and Maximum Eigen value. It indicates that there is one co-integrating vector that exists. Thus, it can be concluded that there is a long run equilibrium relationship among GDP, FDI and OPEN.

TABLE III
RESULTS OF JOHASENS COINTEGRATION TEST

Hypothesised	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None *	0.772632	51.22060	29.79707	0.0001
At most 1	0.261304	12.70973	15.49471	0.1259
At most 2 *	0.169699	4.835144	3.841466	0.0279

Hypothesised	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.
None *	0.772632	38.51087	21.13162	0.0001
At most 1	0.261304	7.874584	14.26460	0.3916
At most 2 *	0.169699	4.835144	3.841466	0.0279

* denotes rejection of the hypothesis at the 0.05 level

*Trace and Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

Having examined that there exist a co-integration vector among the time series, the VECM can then be applied. The short run equation under the error correction framework is computed to include an adjustment mechanism from short run to long run equilibrium. In other words, it corrects for disequilibrium. Statistically, the ECM term is significant at 5 percent level, suggesting that 56 percent of the discrepancy between long term and short term is corrected in the next years.

TABLE IV
LONG RUN COEFFICIENT IN VECM

Eq.	lnΔGDP (-1)	C	lnΔOPEN (-1)	lnΔFDI (-1)	∑T
CointEq1	1.0000	0.0043	0.3001 (0.0437)	1300 (.0582)	-0.5633 (0.5389)
			[6.8700]	.2312]	[-3.4576]

Note: Standard errors in () & t-statistics in []

In order to determine which variable causes the other, pair-wise granger causality tests are used. Table 5 summarizes empirical results of Granger causality tests between three variables used in this study. Granger causality tests are very sensitive to the selection of lag lengths. In this purpose, the lag lengths are determined by Akaike Information Criteria (AIC). The result shows the existence of bidirectional causality between economic growth and foreign direct investment. For the case of trade openness and growth, the causality is unidirectional or it can be said that the trade openness Granger cause economic growth, but the economic growth does not Granger cause trade openness. However, there is no causality relationship between trade openness and Foreign Direct Investment.

TABLE V
GRANGER CAUSALITY TEST

Null Hypothesis:	F-Stat	Prob.
lnΔFDI does not Granger Cause lnΔGDP	4.9661	0.042
lnΔGDP does not Granger Cause lnΔFDI	5.2847	0.030
lnΔOPEN does not Granger Cause lnΔGDP	4.8722	0.049
lnΔGDP does not Granger Cause lnΔOPEN	0.5844	0.452
lnΔOPEN does not Granger Cause lnΔFDI	0.0657	0.800
lnΔFDI does not Granger Cause lnΔOPEN	2.1844	0.152

Lastly, the stability test runs to make sure all the analyzed results as discussed above are meaningful. VAR and VECM are said to be stable if the variables are less than 1 and lie inside the unit circle. In this analysis, there is no root lies outside the unit circle which means that VAR satisfies the stability condition.

V. CONCLUSION

The goals of this paper are to investigate the long run and short run relationship and causality between openness, Foreign Direct Investment and economic growth in Malaysia over the period from 1974 to 2010. The analysis starts with stationarity property examination of the underlying time series data. The estimated results confirmed that GDP, OPEN and FDI are non-stationary at the level data but stationary at the first differences. Hence, they are integrated of order one.

We next examined the existence of co-integration among the stationary variables. The Johansen co-integration test has been applied to examine the same. The estimated results declared that there is co-integration of order one and hence, showed the existence of long run equilibrium relationship between the variables. The result of the Granger- causality test finally confirmed that there exists bidirectional causality between Foreign Direct Investment and economic growth. A relationship between openness and economic growth is unidirectional which shows openness does lead to growth, but it does not happen inversely. The results also showed that there is no causality relationship between openness and Foreign Direct Investment.

The policy implication of this result is that foreign direct investment is considered as the policy variable to accelerate economic growth and economic growth could be used as the policy variable to generate foreign direct investment in the economy. To achieve a sustainable economic growth, it is crucial to undertake essential measures to strengthen investment and money flow into Malaysia instead of China. The trading block such as ASEAN or agreement with other countries should take opportunity to promote investment in the country by adequate infrastructure and increase investors' confidence. The promotion incentives should take into account the tax and non-tax components. The effort made by Malaysian Investment Development Authority (MIDA) should be praised, by including and providing information on the opportunities for investments in Malaysia economic growth escalated.

Our results also imply that within the Malaysian economy, there is evidence for open-led growth in the long run. It is clear that development and growth of the export and import sectors will positively affect the nation's growth. However, the focus on import should be stressed on the intermediate importation of raw products instead of finished products. While openness is necessary for economic growth, we must take into consideration that openness on the other hand can be affected by external factors such as exchange rate, terms of trade and external world instability. Thus, Malaysia has to remain flexible and respond quickly to changes in the global environment to maintain a stable growth.

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