E C O N O M I C S   B U L L E T I N

Do exports act as “engine” of growth? Evidence from Malaysia

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Abstract

For decades, the conventional wisdom for a developing nation striving to achieve an impressive economic growth has been to carve a niche in the global marketplace. However, empirical findings of various research studies on the “export-led growth” hypothesis do not provide a solid evidence to support this viewpoint. The current paper chooses one of the “East Asian Miracle” economies, Malaysia, to empirically examine whether exports act as the “engine” of growth. The results of the empirical analysis do not support the “export-led growth” hypothesis. Rather, they lead to a conclusion that there exists a “virtuous cycle” or mutually reinforcing relationship between Malaysia’s exports and GDP in the long run. The findings also detected unidirectional short run causality from GDP to exports, but not vice versa. This means that the increase in Malaysia’s export tends to be an effect, and not the cause, of the country’s output expansion.

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1. Introduction

A search for an "engine" that could propel economic development in poor countries has been on for several decades. Important questions for development economists and policymakers have been: What are the optimal ways for poor countries to break free from the "vicious circle" of poverty? How can developing nations ensure the much-needed economic growth?

The conventional wisdom has been that a country can attain economic success if it succeeds in finding a niche in the global marketplace.[1] Many of the developing countries have been trying to overcome the dismal economic situation by promoting international trade. These countries often viewed exports as the "engine" of economic growth. In recent decades, impressive success stories from a number of Asian countries offered some support for the export-led growth strategy. Japan was the first among Asian countries to actively promote export activities, which helped Japan achieve a remarkable economic performance in the 1960s. This strategy was repeated in the 1970s by the Asian Newly Industrialising Economies (NIEs) and, in the 1980s, by some of ASEAN countries.

Although quite a number of developing nations have adopted export-driven development strategies, a systematic empirical research on the relationship between a country's exports and its economic growth is still limited. Moreover, empirical support for the validity of the "export-led growth" hypothesis has been lacking (Giles & Williams 2000a, 2000b). To address this issue, the current study chooses one of the "East Asian Miracle" countries, Malaysia, as a case study to examine the relationship between the country's exports and its economic growth.[2] Malaysia is a Southeast Asian country and a member of ASEAN. Malaysia is an export-driven economy; the main bulk of its exports are electronic components, petroleum, Liquefied Natural Gas (LNG), and palm oil.

Figure 1 shows the relationship between the natural log of real exports and the natural log of Gross Domestic Product (GDP) in Malaysia for the period 1970-2004. Though a positive and upward relationship between exports and growth is in evidence, compared to the economic growth, Malaysia's exports experienced more fluctuations. Thus, during the 1970s, the amount of Malaysia's exports decreased twice, in 1970-1971, and in 1975. Other than this, exports steadily increased over the decade. In the 1980s, Malaysia's exports suffered another slump in 1981, but recovered rapidly from this downturn. From 1990 to 2004, the volume of exports grew steadily, except in the year 2001 when the amount of Malaysia's exports diminished.

As Figure 1 shows, Malaysia's economy grew steadily over the period 1970-2004. There has been an economic slowdown in the middle of the 1980s, and once again in 1998, when the country was seriously affected by the Asian financial crisis.

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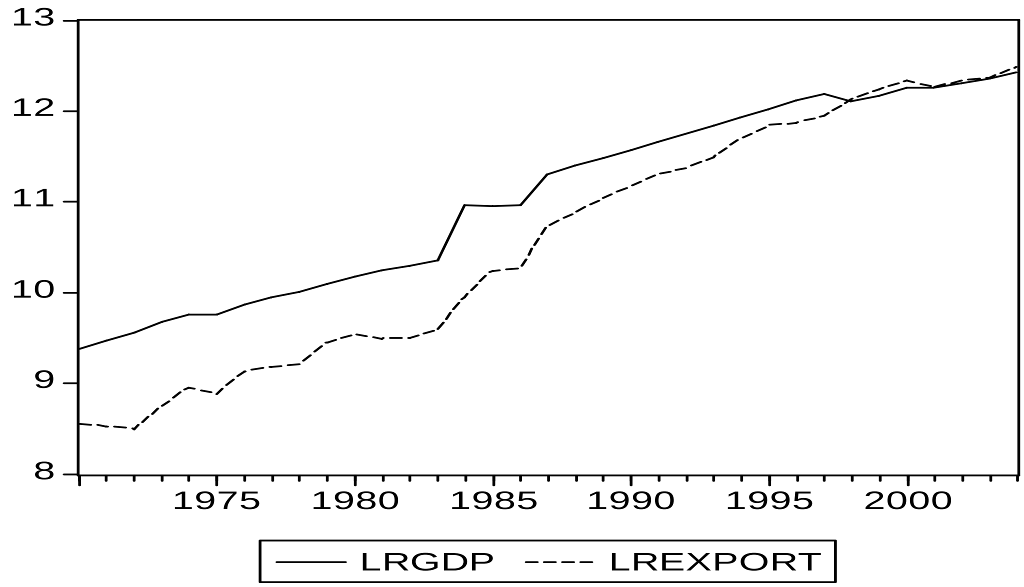
[1] As an example, the World Bank (1993) cited the "East Asian Economic Miracle".

[2] The World Bank (1993) identified Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand as eight East Asian nations with vibrant economic growth.

Figure 1: Exports and GDP in Malaysia from 1970 to 2004



Considering the importance of the relationship between exports and economic growth, the current study aims to examine whether the "export-led growth" (ELG) hypothesis is applicable to Malaysia. Three econometric analyses will be used for this purpose: (1) unit root test, (2) Johansen cointegration test, and (3) Granger causality test.

The paper consists of five sections. Following this Introduction, Section 2 briefly reviews some previous research studies on the ELG hypothesis. Section 3 discusses research methodology used in the current inquiry, while Section 4 reports and discusses the research findings. Section 5 concludes.

2. Literature Review

The starting point of the debate on the relationship between a country's economic performance and its exports can be traced back to the founding fathers of modern economic thought. Classical economists Adam Smith and David Ricardo emphasised the importance of international trade for a country's economic growth. They argued that a country could benefit considerably if it specialised in a certain commodity or product and then exported it to the foreign countries that lacked this commodity (Smith 1776; Ricardo 1817).

With the evolution of economic thought, several shortcomings of the classical theory of international trade became evident. First of all, the theory does not incorporate a perspective on the consequences of the deteriorating terms of trade, which became a central trade issue between the developed and developing nations. As Cypher and Dietz (1998, p.305) critically observed, "Especially for poor, less-developed nations, we show that the generalised argument in favour of free trade policy derived from (classical) trade theory cannot be sustained once one takes the long-term historical trend of the terms of trade into consideration".

Secondly, it is not always possible to spot in advance a country's comparative advantage. As a result, many developing countries are experiencing serious difficulties in finding their own niche in the global marketplace. This fact was noted by Hausmann and Rodrik (2002) who maintained that for developing nations economic development could become a trial and error process of discovering their strengths.

There is an abundant literature on the linkage between exports and economic growth. Early studies lend empirical support to the ELG hypothesis (Michaely 1977; Balassa 1978; Feder 1983; Ram 1985). However, these studies have been criticised because they employed cross-section data which are, methodologically, unable to establish causal relationship between the variables (Love and Chandra 2005). Some research studies employed time-series data and analysed Granger causal relationship between exports and economic development (Jung *et al.* 1985; Dodaro 1993). The results provided weak empirical evidence to support the ELG hypothesis. In Jung *et al.*'s (1985) research, out of 37 countries, causal relationship between exports and economic development was detected for four countries only.

Giles and Williams (2000a, 2000b) examined more than 150 papers on the topic and concluded that despite the extensive research, the evidence of the vigour of the "export-led growth" hypothesis is mixed and inconclusive. This inconsistence in empirical results may arise from differences in time periods, data or methodology. For example, Giles and Williams (2000a, 2000b) examined thirty six empirical works on the ELG hypothesis in South Korea. Eleven of these research studies estimated a form of aggregate production function model while 25 papers focused on the causality using a Vector Autoregressive (VAR) framework. Among the former, 8 inquiries reported a significant relationship between exports and economic growth in South Korea while the rest studies detected a non-significant relationship.

This means that the studies that employed the VAR framework reached contradicting results. However, all five studies that used the quarterly data reached the same conclusion (i.e. they detected a bi-directional causality between exports and growth). On the other hand, several studies focusing on the same time span (from the 1950s to the 1980s) but employing different research methods found non-causality relationship between the two variables (Giles & Williams 2000a, 2000b).

In the context of ASEAN countries, time series analysis that tested the ELG hypothesis showed mixed results. For example, a study by Ahmad and Harnhirun (1996) that tested the hypothesis for five ASEAN countries (i.e., Malaysia, Indonesia, Singapore, Thailand, and the Philippines) over the period 1966-1986, did not find a cointegrating relationship between exports and economic development. At the same time, Ahmad and Harnhirun's empirical findings indicated that economic growth had been causing the expansion of exports, and not *vice versa*.

For the Philippines, Amrinto (2006) used parametric and semi-parametric error correction model (ECM) to test the ELG hypothesis over the period 1981-2004. Results from the parametric ECM indicated that there was a unidirectional causality between the Philippines' exports and output in the short-run while findings from the semi-parametric ECM established a bilateral causality between the two variables.

In the Indonesian context, an empirical analysis to identify the determinants of economic growth during the period 1965-1992 was done by Piazolo (1996). The study included six variables (i.e., exports, government expenditure, population, capital formation, inflation, foreign investment) into the econometric model, and its results supported the existence of the ELG hypothesis for Indonesia.

To test the ELG hypothesis in the Malaysian context for the period 1960-2001, Keong, Yusop and Liew (2005) used the bounds test method to examine unidirectional causality from exports to growth, but they did not test unidirectional causality from growth to exports. The study detected a cointegrating relationship between the country's exports and economic growth as well as a short run causality from exports to economic growth.

3. Research Methodology

The main objective of this research is to investigate Granger causality between exports and economic growth in Malaysia. The study uses annual time-series data sets for the period 1970-2004. The main source of data is *Malaysia Economic Statistics –Time Series* published by the Department of Statistics, Malaysia (2006).

Three econometric tests are run in this study to analyse the regression model. Firstly, the unit root test is used to examine the stationarity of the data sets. The augmented Dickey-Fuller (ADF) unit root test (Dickey and Fuller 1979; Dickey and Fuller 1981) is used for this purpose. The ADF test is based on the following regression,

$$\Delta y_t = \mu + \beta t_{t-1} + \delta y_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta y_{t-i} + \varepsilon_t \quad (1)$$

where μ is constant, t is a linear time trend, β, δ and γ_i are slope coefficients, ε_t is the error term. The null hypothesis of non-stationary series could be written as

$$H_0: \delta = 0 \quad (2)$$

On the other hand, the one-sided alternative hypothesis of stationary series could be expressed by

$$H_1: \delta < 0 \quad (3)$$

The lag length, n, for the ADF test was chosen by minimizing the Akaike's information criterion. The AIC criterion is defined as

$$AIC(q) = T\ln(\frac{RRS}{n-q}) + 2q \quad (4)$$

where *T* is the sample size, *RRS* is the residual sum of squares, *n* is lag length, *q* is the total number of parameters estimated.

Secondly, this study employs cointegration test to examine the long-run movement of the variables. Only variables with the same order of integration can be tested for their co-integration. A standard test – Johansen cointegration test -- is used to check the long run movement of the variables (Johansen 1988; Johansen 1991). The test is based on the maximum likelihood estimation of the K-dimensional Vector Autoregression (VAR) of order *p*,

$$\Delta Z_t = \mu + \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + \ldots \Gamma_{k+1} \Delta Z_{t-p+1} + \pi Z_{t-1} + \varepsilon_t \quad (5)$$

where Z_t is a $k \times 1$ vector of stochastic variable, μ is a $k \times 1$ vector of constants, ε_t is a $k \times 1$ vector of error terms, π and $\Gamma_1 \ldots. \Gamma_{k+1}$ are $k \times k$ matrices of parameters. On the other hand, if the coefficient matrix π has reduced rank, $r < k$, then the matrix can be decomposed into $\pi = \alpha\beta'$.

Johansen cointegration test involves testing the rank of π matrix by examining whether the eigenvalues of π are significantly different from zero. There could be three conditions: 1) $r = k$, which means that the Z_t is stationary at levels, 2) $r=0$, which means that the Z_t is the first differenced Vector Autoregressive, and 3) $0<r<k$, which means there exists *r* linear combinations of Z_t that are stationary or cointegrated.

For example, if *r* is equal to 1, then the relationship between the variables could be written as

$$\begin{bmatrix} \Delta GDP_t \\ \Delta EX_t \end{bmatrix} = \begin{bmatrix} \mu_1 \\ \mu_2 \end{bmatrix} + \sum_{i=1}^{k-1} \begin{bmatrix} \Gamma_{i,11} \Gamma_{i,12} \\ \Gamma_{i,21} \Gamma_{i,22} \end{bmatrix} \begin{bmatrix} \Delta GDP_{t-i} \\ \Delta EX_{t-i} \end{bmatrix} + \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} \begin{bmatrix} \beta_1 \beta_2 \end{bmatrix} \begin{bmatrix} \Delta GDP_{t-1} \\ \Delta EX_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} \quad (6)$$

where GDP_t is the natural log of real Gross Domestic Product (GDP) in Malaysia in year *t*; EX_t is the natural log of real exports from Malaysia in year *t.* Vector β represent the *r* linear cointegrating relationship between the variables; the elements of α are known as the adjustment parameters.

The current study uses the Trace (Tr) eigenvalue statistic and Maximum (L-max) eigenvalue statistic (Johansen 1988; Johansen and Juselius 1990). The likelihood ratio statistic for the trace test is:

$$Tr = -T\sum_{i=r+1}^{p-2} \ln(1-\hat{\lambda}_i) \quad (7)$$

where $\hat{\lambda}_{r+1},........,\hat{\lambda}_p$ are the smallest eigenvalues of estimated $p-r$. The null hypothesis for the trace eigenvalue test is that there are at most *r* cointegrating vectors. On the other hand, the L-max could be calculated as:

$$L-\max=-T\ln(1-\hat{\lambda}_{r+1}) \qquad (8)$$

The null hypothesis for the maximum eigenvalue test is that *r* cointegrating vectors are tested against the alternative hypothesis of *r+1* cointegrating vectors. If trace eigenvalue test and maximum eignevalue test yield different results, the results of the maximum eigenvalue test should be used because the power of the maximum eigenvalue test is considered greater than the power of the trace eigenvalue test (Johansen and Juselius 1990). The order of VAR, *p*, in the error-correction model was chosen by minimizing the Akaike's information criterion.

Finally, this study uses Granger causality test to analyse the causality between exports and economic growth (Granger 1969). If both variables are integrated order zero, I(0), a standard Granger causality test with the lag length of *k* could be based on the following equations

$$GDP_t = c_1 + \alpha_1 GDP_{t-1}+..+ \alpha_k GDP_{t-k}+ \beta_1 EX_{t-1}+..+ \beta_k EX_{t-k} +\varepsilon_1 \qquad (9)$$

$$EX_t = c_2 + \alpha_1 EX_{t-1} +..+ \alpha_k EX_{t-k}+ \beta_1 GDP_{t-1}+..+ \beta_k GDP_{t-k} +\varepsilon_2 \qquad (10)$$

where c_1 and c_2 are constants; $\alpha_1.......\alpha_k$ and $\beta_1\ldots\ldots\beta_k$ are slope coefficients.

Granger causality could be examined by using the Wald test for the joint hypothesis

$$\beta_1= \beta_2 =\ldots\ldots\beta_k =0 \qquad (11)$$

The null hypothesis for equation (9) is that *EX* does not Granger cause *GDP*. On the other hand, the null hypothesis for equation (10) is that *GDP* does not Granger cause *EX*. The rejection of null hypothesis could indicate the causal relationship between the two variables. The lag length, *k*, was chosen by minimizing the Akaike's information criterion.

On the other hand, if both variables are integrated order one, I(1), and there is a cointegrating relationship between them, Granger causality test could be based on the following Vector Error Correction Models (VECMs)

$$\Delta GDP_t= c_1+\alpha_1\Delta GDP_{t-1}+..+\alpha_k\Delta GDP_{t-k}+\beta_1\Delta EX_{t-1}+..+\beta_k\Delta EX_{t-k}+\gamma_1 EC_{t-1}+\varepsilon_1 \qquad (12)$$

$$\Delta EXt = c_2 +\alpha_1\Delta EX_{t-1}+..+\alpha_k\Delta EX_{t-k}+\beta_1\Delta GDP_{t-1}+..+\beta_k\Delta GDP_{t-k}+\gamma_2 EC_{t-1}+\varepsilon_2 \qquad (13)$$

where Δ is difference operator; EC_{t-1} is the one-period lagged value of the error correction term; γ_1 and γ_2 are slope coefficients.

There is a great advantage to using Granger causality test based on the VECM rather than the standard one. The Granger causality test based on the VECM could identify both the short-run and the long-run causalities. The Wald test of the independent variables could be interpreted as the short run causal effect while the significant correction term (EC_{t-1}) could be interpreted as the long run causal effects.

Four types of causal relationship between exports and growth are possible:

(1) *Independence*: no causality between exports and economic growth, which could be interpreted as the independent relationship between exports and growth.

(2) *Exports-driven growth*: unidirectional causality from exports to economic growth, but not *vice versa*, which could be interpreted as support for the existence of the "export-led" output expansion.

(3) *Growth-driven exports*: unidirectional causality from economic growth to exports, but not *vice versa*, which could be interpreted as support for the existence of the "growth-led" export expansion.

(4) *Two-way causality*: unidirectional causality from exports to economic growth, and *vice versa*, which could be interpreted as a mutually reinforcing bilateral causality between exports and growth.

5. Empirical Results

The ADF unit root tests were employed to test stationarity of the time series data sets. Empirical results from the ADF test are shown in Table 1. As reported in the table, the obtained results indicate that both variables -- *GDP* and *EX* -- have unit roots in levels. Then, both time series become stationary in the first difference. In other words, *GDP* and *EX* variables are integrated of order one, I(1).

Table 1: ADF Unit Root Test

	Level		**First Difference**	
	Constant without trend	Constant with trend	Constant without trend	Constant with trend
GDP	2.050(0)	-1.878(0)	-4.003(1)**	-5.395(1)**
EX	3.174(0)	-0.923(3)	-4.059(0)**	-5.442(0)**

Notes: Figures in parentheses indicate number of lag structures
** indicates significance at 1% level

In the second stage of this study, Johansen cointegration test was used to test the long run movement of the variables. As Engle and Granger (1987) pointed out, only variables with the same order of integration could be tested for cointegration. Therefore, in the present research, both variables could be examined for cointegration.

First of all, the Akaike Information Criterion (AIC) was used to determine the optimal lag length selection while the maximum lag length was set for three (3). Table 2 shows that the optimal lag length for Johansen cointegration test is three (3), which minimises the AIC.[3]

Table 2: Optimal Lag Length Selection for Johansen Test (Maximum Lag Length=3)

Lag Length	AIC
0	47.828
1	41.858
2	41.935
3	41.597*

AIC denotes the Akaike Information Criterion
*indicates optimal lag length selected by the AIC

Secondly, the AIC was used again to determine the most appropriate model specification for Johansen cointegration test. As Table 4 reports, the best model specification is Model 3, and the number of cointegrating equations is one (1).

Table 3: Optimal Model Specification Selected by the Akaike Information Criterion

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Number of CEs = 0	41.695	41.695	41.715	41.715	41.164
Number of CEs = 1	41.044	41.868	40.839*	40.899	40.857
Number of CEs = 2	41.292	41.094	41.094	40.979	40.974

CE denotes cointegrating equation
*indicates optimal model specification selected by the AIC

Results of the cointegration tests are reported in Table 4 and Table 5. Both the Trace Eigenvalue test and the Maximum Eigenvalue test indicate one cointegrating equation. These findings indicate that there exists a long run relationship between the two variables (i.e., *GDP* and *EX*), which means that these variables are cointegrated.

Table 4: Johansen Cointegration Test (Trace Eigenvalue Statistic)

Eigenvalue	Trace statistic	5 percent critical value	1 percent critical value	Number of cointegrating equations
0.678	35.24	15.41	20.04	None**
0.002	0.06	3.76	6.65	At most 1

The result corresponds to VAR's with three lags
** indicates significance at 1% level

[3] Sewa (1978) argues that the Akaike Information Criterion can choose models with a higher order than the true model. However, Sewa points out that this bias could be negligible when the selected lag length is less than (N/10), where N equals the numbers of observation.

Table 5: Johansen Cointegration Test (Maximum Eigenvalue Statistic)

Eigenvalue	Max statistic	5 percent critical value	1 percent critical value	Number of Cointegrating equations
0.678	35.17	14.07	18.63	None**
0.002	0.06	3.76	6.65	At most 1

The result corresponds to VAR's with three lags
** indicates significance at 1% level

In other words, although the variables are non-stationary in levels, in the long run, they closely move with each other. Long run cointegration when the variables are normalised by cointegrating coefficients could be expressed as:

$GDP = 0.704\ EX$

This cointegrating vector equation indicates that there exists a positive long run relationship between *GDP* and *EX*. Based on the cointegrating relationship between the two variables, this paper proceeded to analyse the causal relationship between exports and economic growth in Malaysia. For this purpose the paper uses Granger causality test based on the VECM, which could help examine both the long run and short run casual relationships.

There are three steps in this analysis. Firstly, the Akaike Information Criterion is used to determine the optimal lag length for the causality test. As Table 6 shows, the optimal lag length for causality test of the "export-driven growth" hypothesis is two (2) which minimises the AIC. On the other hand, the optimal the lag length for causality test of the "growth-driven exports" hypothesis is three (3).

Table 6: Optimal Lag Length Selection for Causality Test (Maximum Lag Length=3)

"Export-driven growth" hypothesis Equation (12)		"Growth-driven exports" hypothesis Equation (13)	
Lag Length	**AIC**	**Lag Length**	**AIC**
1	20.933	1	20.843
2	20.829*	2	20.639
3	20.910	3	20.346*

AIC denotes the Akaike Information Criterion
*indicates optimal lag length selected by the AIC

Secondly, the "Export-driven growth" hypothesis was tested using Granger causality test which is based on equation (12). The results of the Wald statistics and t-statistics are reported in Table 7. The findings show that the error correction term (ECT_{t-1}) is statistically significant. This means that there exists long run Granger causality between *GDP* and *EX*. This long run Granger causality confirms the existence of the long run equilibrium relationship between exports and growth in Malaysia, as indicated in Johansen cointegration test. On the other hand, the Wald statistics indicate that there was no unilateral causality from exports to economic growth in Malaysia over short periods of time. In other words, Malaysia's export expansion does not "Granger cause" output expansion in the short run.

Table 7: Export-Driven Growth Hypothesis
Dependent Variable: Δ*GDP*

Variable	**Degree of Freedom**	**Wald Test Statistics**
ΔEX	2	2.525
	Coefficient	**t-statistics**
ECT_{t-1}	0.268	2.291*

The result corresponds to VAR's with six lags
* indicates significance at 5% level

Finally, the results of Granger causality test, which is based on equation (13), for the "growth-driven exports" hypothesis are reported in Table 8. The findings show that the error correction term (ECT_{t-1}) is statistically significant. This means that there is a long run Granger causality between Malaysia's exports and economic growth. On the other hand, in contrast to the findings reported in Table 7, the Wald test detected Granger causality between the variables in the short run. This means that there existed unilateral causality from growth to exports in Malaysia over short periods of time. In other words, according to the results, Malaysia's output expansion *does* Granger cause export expansion in short run.

Table 8: Growth-Driven Exports Hypothesis
Dependent Variable: Δ*EX*

Variable	**Degree of Freedom**	**Wald Test Statistics**
ΔGDP	2	35.063**
	Coefficient	**t-statistics**
ECT_{t-1}	0.621	6.040**

The result corresponds to VAR's with six lags
** indicates significance at 1% level

In a nutshell, empirical findings of the present study show that there is a long run relationship – and also long run causality -- between Malaysia's exports and economic growth. Thus, a mutually reinforcing two-way causality between exports and growth, which could be described as a "virtuous cycle", was detected in the context of the Malaysian economy over a longer period of time.

On the other hand, the results show that in the short run there has been unidirectional causality from Malaysia's GDP to its exports, but not *vice versa*. This means that Granger causality test did not provide empirical support to the "export-driven growth" hypothesis in the case of Malaysia. Instead, the test confirmed the existence of the "growth-driven exports" hypothesis.

As a conclusion, the findings of the current study indicate that there exists a "virtuous cycle" or a mutually reinforcing relationship between exports and Gross Domestic Product in Malaysia in the long run. Also, the findings reveal unidirectional short run causality from GDP to exports, but not *vice versa*. This means that the increase of exports is an effect – but not the cause -- of the country's output expansion. These findings do not provide empirical evidence to support the hypothesis that exports act as the "engine" of economic growth in Malaysia.

5. Conclusion

Malaysia is a dynamic economy that has been enjoying a rapid growth for several decades. International trade is usually seen as an important element in propelling the developing countries, such as Malaysia, towards the status of fully developed economies. The current study carried out an empirical analysis of the relationship between exports and economic growth in Malaysia. The results of the empirical analysis lead to a conclusion that there exists a long run relationship between the size of Malaysia's national income and the volume of the country's exports.

The analysis also detected unidirectional short run causality from GDP to exports, but not *vice versa.* This means that the volume of exports increased during the country's industrialisation process. However, the increase of export earnings did not cause the expansion of GDP in Malaysia. As the results show, the "export-led" growth hypothesis cannot be supported in the case of Malaysia. To conclude, the empirical findings do not support a proposition that exports acted as the "engine" of economic growth in Malaysia.

Findings of the current research encourage a closer look at other factors that may influence the pace of economic growth in Malaysia (i.e. domestic consumption, government expenditure, etc.). Future studies on this topic may want to incorporate other than the present study's variables in order to better capture the complexities of the process of economic growth in a developing country.

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