

DYNAMIC LINKAGES AMONG EXPORTS, MANUFACTURING AND AGRICULTURAL OUTPUTS IN MALAYSIA

Mohd Ismail Omar Hattab, Mohd Mahyudin Ghazali Md Hadzir and
Mohd Uzir Mahidin¹

ABSTRAK

Kertas kajian ini telah menguji arah aliran perhubungan antara sektor pertanian, pembuatan dan eksport dalam tempoh 1987 hingga 2012. Ujian punca unit, Prosedur Johansen, Model Autoregresif Vektor (VAR) dan Model Pembetulan Ralat Vektor (VECM) telah dilakukan sebagai asas pada data set sebenar. Semua pembolehubah mendapati tidak pegun pada peringkat pertama. Ujian punca unit menampakkan bahawa semua pembolehubah tersebut adalah (I (1)). Prosedur Johansen dikendalikan untuk melihat hubungan jangka panjang dan jangka pendek antara pembolehubah tersebut. Keputusan ujian Model VECM menunjukkan bahawa pada jangka pendek mendapati sektor eksport mempengaruhi sektor pembuatan dan pertanian. Manakala sektor pembuatan mempengaruhi eksport dan sektor pertanian mempengaruhi pembuatan pada jangka panjang. Sebaliknya sektor pembuatan dan pertanian bersama boleh mempengaruhi sektor eksport pada jangka panjang. Keputusan kajian ini mengesahkan perkara yang sama melalui analisis intervensi seperti fungsi impulse response dan variance decomposition.

Kata kunci: VAR, VECM, Sektor Pertanian dan Pembuatan, KDNK, Jumlah Eksport, Malaysia.

ABSTRACT

Direction of causality between agriculture, manufacturing, and export has been tested in this paper covering the period 1987 to 2012. Stationarity, co-integration, vector autoregressive (VAR) modeling and error correction tests have been performed as fundamental groundwork on real-term datasets. Datasets are found to be stationary at first difference. We conclude these variables are integrated of order one (I (1)). The results of causality tests in VEC model show where in the short run export causes manufacturing and agriculture. Meanwhile, manufacturing does Granger cause export and agriculture Granger cause manufacturing in the long run. On the other hand, manufacturing and agriculture jointly can influence the export in the long run. The results of this study confirm the same that has been reinforced through the VAR modeling and intervention analysis such as impulse response function and variance decomposition.

Keywords: VAR, VECM, Agricultural and Manufacturing Sector, GDP, Total Export, Malaysia.

¹ Mohd Ismail Omar Hattab is currently Assistant Director of Industrial Production and Construction Statistics Division, Mohd Mahyudin Ghazali Md. Hadzir is former Assistant Director of Industrial Production and Construction Statistics Division and Mohd Uzir Mahidin is Deputy Chief Statistician of Social and Demography Programme.

1. INTRODUCTION

Policy makers and academics have shown interest to study the possible relationship between international trade and economic growth. Increasing GDP is the main target of any economy in the world. Therefore, the question arises, whether the country should promote exports to accelerate economic growth or focus on economic growth to generate international trade. Due to these contradictions, economic came up with different views concerning the role of export on growth. In many literatures, the export-led growth and growth driven export hypotheses have become a debate for researchers and policy makers alike for almost three decades.

The export-led growth hypothesis generally reflects the relationship between export and economic growth. Several studies have established a positive relationship between export expansion and economic growth such studies include Balasa (1978); Feder (1982); Arnade and Vasavada (1995); Fosu (1996); Thornton (1996); and Perry Sadorsky (1996) while other researchers such as Al-Yousif (1999); Henriques and Sadorsky (1996); and Harnhirun (1996) have found contrasting evidence that export is cause by economic growth. While yet others demonstrate that there exists a bi-directional relationship between these variables such that export cause economic growth and economic growth cause export such as Dutt and Ghosh (1994); Thornton (1997); and Shan and Sun (1998). Meanwhile Khalafah and Webb (2001) in the study of case of Malaysia found that bi-directional causality.

Due to the above-mentioned studies, it is contradicting that which one cause another one therefore most of developing countries are still in dilemma whether to open up their economies to promote international trade or whether they should concentrate on economic activities, which will lead to the growth of international trade.

As mentioned above many studies have been done about export-led growth but this study intends to take a logical further step to investigate the same issue for two sector of Malaysian economy namely, agriculture and manufacturing sectors. The reason is that, majority of papers surveyed focus on broad macroeconomic data nevertheless there is ground for attention to less aggregated variable. Thus, this paper attempts to further investigate the causality relationship between total export, agriculture (GDP) and Manufacturing (GDP) from 1987 to 2012 in the Malaysia economy. In doing so, the paper employs a variety of analytical tools, including unit root tests, co-integration analysis and Granger causality tests with vector auto regression (VAR) and vector error correction (VEC) analyses. Since these findings will have economic policy implications on Malaysia, economic policy this paper expected to make contribution to the empirical literature.

Since on average agriculture and manufacturing sector contributed 38.8% to Malaysian GDP and more than 81.8% to total export (DOSM, 2009-2012), it seems to be reasonable to study the relationship between GDP produced by these key sectors and total export. If for examples agriculture GDP and total export are co integrated, then they share a long run equilibrium relationship. This, in turn has important macroeconomic implication, since any economy policy which effect total export will also have an impact on the agricultural sector in the long run and vice versa.

Thus, the stress in this paper is mainly on establishing the existence and direction of Granger causality and co-integration between agriculture GDP, manufacturing GDP, and total exports, rather than on explaining the determinants of these relationships. Hence, GDP output not only contributed by manufacturing output but also by agriculture output.

Identification of causality can help policy makers to obtain a better insight into the economic growth in Malaysia and to formulate effective economic policies and development strategies and decide whether economic growth or to focus on the growth of agriculture and manufacturing sector which in turn will result in increasing international trade. The rest of this paper is organised as follows, literature review; data and methodology; empirical results; finally, the conclusion and policy implication.

2. LITERATURE REVIEW

There are empirical studies on this subject such as in Iran and Tanzania but there is not such research had been done directly addressing the causality between total exports, agricultural GDP and manufacturing GDP in Malaysia.

Nicolaus Herman Shombe (1998), analysing the causality relationship between major sectors namely agriculture GDP, manufacturing GDP, and exports in Tanzania. In both sectors, there is Granger causality where agriculture causes both exports and manufacturing. Meanwhile, Leila Vaezi and Reza Moghaddasi (2009) studied the relationships between total exports with agriculture GDP and manufacturing GDP in Iran. There found that manufacturing causes both exports and agriculture. However, export does not cause any of agriculture GDP and Manufacturing GDP. There is also that agriculture GDP does not cause export and manufacturing GDP. In other countries, there are empirical studies similar to this subject and we will focus on some literatures and theories about the relation of agriculture, manufacturing, export, and economic growth.

The theoretical arguments have supported by many empirical studies concerning the impact of export on economic growth. Khalafa and Webb (2001) using quarterly data from 1965 to 1996 investigated the relationship between exports and economic growth in Malaysia. Using co-integration and Granger causality tests, they found the export-led growth hypothesis was valid that export in Malaysia leads to economic growth. Most of these studies conclude that there is a positive relationship between exports and economic growth, for examples, Balassa (1978 and 1985), Jung, and Marshall (1985). Young and Bethune (2002) found that export growth is positive contributor to economic development in low-income countries as well as middle-income countries.

Various studies have been addressing the important issue of export composition. Crespo-Cuaresma and Worz (2003), Fosu (1990), Greenaway, Morgan and Wright (1999), Srinivasan and Bhagwati (2001), Fouad (2003) analysis for Egypt argue that exports of manufacturing products are less sensitive to the cyclical change in the international market compare to exports of raw and intermediate goods.

Chow (1987), studied exports and manufacturing development in eight export oriented newly industrialised countries, found causality between exports and manufacturing GDP growth in Mexico, causality between these variables for Brazil, Hong Kong, Israel, Korea, Mexico, Taiwan, Singapore, but didn't find causality in the case of Argentina. Kovacic and Djukic (1990) concluded that in Yugoslavia real aggregate GDP, manufacturing GDP and real exports have not co-integrated, but manufacturing GDP causes exports. McCarville and Nadozie (1995) found that the relationship between export growth and GDP growth in the Mexican case. Biswal and Dhawan (1998) showed that total exports, manufactured exports, and real GDP of Taiwan are co-integrated, and that there is causality among these variables. Khan and Saqib (1993) established positive relationships between real GDP, real exports, real manufactured exports, and real primary exports in a study for Pakistan. Rashid (1995) found no significantly positive export/economic growth effect while studying growth in real GDP, exports, real investments, industrial production, imports, and agriculture for India. Pomponio (1996) found little evidence in causal results in manufactured export and economic growth in China.

In study of Arnade and Vasavada (1995), they concluded that there is no causality between real agricultural output and agricultural exports in India. Analysis Shan and Sun (1998), found evidence for one-way causality running from manufacturing growth to export growth for Australia. In a similar study, Shan and Sun (1998) concluded causality between exports and real manufacturing output for China. Sentsho (2000) also found two-way directional causality between export of manufacturing and economic growth for Botswana. Azam, Fosu and Ndung'u, (1999) showed relationship between export and mainly sectors i.e. agriculture and manufacture growth. In studies of Dodaro (1991) they specified complex relationship between mainly sectors of GDP i.e. agriculture and manufacture and export growth.

Given this arguments several analysts have examined this relations particularly the causality between the two economic indicators. Todaro (1989) findings show that without agricultural development, manufacturing would stultify, or if it succeeded, would create such severe internal imbalances in the economy that the problems of widespread poverty and unemployment become more pronounced. Lewis (1954) and Hirschman (1958) explained economic growth by emphasizing the role of Agriculture and manufacturing. The basic economy model marks the agricultural sector as merely the basis of an economy.

The sectoral growth study carried out in Ghana and Zimbabwe concludes that the importance of Agricultural sector is apparent. It has an overall positive impact on manufacturing growth in Ghana. In Zimbabwe, industry also has a positive impact on growth in the agricultural sector. This finding supports the existence of positive growth link between agriculture and industry (Blunch and Verner, 2006). For every two countries, there are significant long run sectoral relationships among manufacturing and agriculture sector.

In Malaysia, similar study had been done such as Keong, Yusop and Liew (1998) found that export Granger cause economic growth in both short run and long run in Malaysia. Nur Zaimah Ubaidullah (2013) studied a causal analysis on the contribution of agriculture sector on economic growth found that causal relationship exists between agriculture and economic growth using vector error correction model.

Meanwhile, in study by Hylmee Matahir (2012) on the empirical investigation of the nexus between agriculture and industrial sectors in Malaysia shows that agriculture and industrial sector are co-integrated in the long run. In addition, the causal relationship shows that there is a one-way causality direction from industrial to agriculture sectors in both the short run and long run using Johansen and Juselius (1990) co-integration procedure.

The literature review has served to show that export can be engine of economic growth. Traditionally, it has been assumed that exports are exogenous to domestic output but this could be an inappropriate assumption because output can also affects exports. This means that economic growth can lead to an increase in export; therefore, by using this argument we study if the export of products of major sectors can lead to economic growth by analysing the causality relationship between major sector namely agriculture, manufacturing and export.

The main objective of this study is to investigate the causal relationship between manufacturing GDP, agricultural GDP, and total exports in Malaysia using data from 1987 to 2012 with appropriate time series techniques. Hence, objective of this paper is to produce an additional empirical evidence for economic growth in Malaysia. Moreover, the findings can shed important light on issues relating to the macroeconomic implications, since any economic policy, which affects on one of these sectors will also have impact on another sector in the long run.

The structure of the paper is as follows. Section 2 the previous empirical research work on the economic growth export-manufacture-agriculture relationship and looked in detail at the relevant economic theories and the methodological issues, the long run and short run relationship and the causality patterns of the key variables. Section 3 outlines the empirical methodologies and also describes and analyses the data used in the study. Section 4 highlight the empirical analysis, reports and discuss of results. Finally, Section 5 summarises the main results with conclusions and policy implications.

3. DATA & METHODOLOGY

The objective of this study is to identify the causal relationship between manufacturing GDP, agricultural GDP, and total export for the case of Malaysia. The annual times series data on total exports, and two sectors of GDP, which is manufacturing, and agricultural over the period 1987 to 2012 at current prices are utilised in this research. The data of Malaysia is obtained from Department Statistics of Malaysia (DOSM). All data series transformed to natural logarithms before further analysis, so that the first differences can interpreted as growth rates as well as to reduce the variation in time-series data sets.

The data series are denoted as LAGR (log of agricultural GDP), LMANF (log of manufacturing GDP), and LEXP (log of total exports). To study the relationship between manufacturing GDP, agriculture GDP, and total exports, The selections of the key variables are based on the theoretical framework of previous studies, as discussed by Nicolaus Herman Shombe (1998) found that and Leila Vaezi and Reza Moghaddasi (2009). Furthermore, the classical economic theories by Adam Smith

and David Ricardo, who argued that international trade plays an important role in economic growth and that there are economic gains from specialisation. These theoretical arguments have been supported by many empirical studies concerning the impact of export on economic growth

The Johansen co-integration test has conducted on the following pairs of variables: export and manufacturing GDP; export and agriculture GDP; manufacturing GDP and agriculture GDP; exports, manufacturing GDP, and agriculture GDP. Under Johansen and Juselius (1990), procedure for estimating the number of co-integrating relationships the following equations has applied:

$$\begin{bmatrix} EXP_t \\ AGR_t \\ MANUF_t \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} + \begin{bmatrix} \beta_{1,1}(L) & \beta_{1,2}(L) & \beta_{1,3}(L) \\ \beta_{2,1}(L) & \beta_{2,2}(L) & \beta_{2,3}(L) \\ \beta_{3,1}(L) & \beta_{3,2}(L) & \beta_{3,3}(L) \end{bmatrix} \begin{bmatrix} EXP_t \\ AGR_t \\ MANUF_t \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \end{bmatrix} \quad (1)$$

Where, $LEXP$ is total exports, $LMANUF$ is manufacturing GDP and $LAGR$ is agriculture GDP. Meanwhile ε_t are the error terms, β_1 and β_2 is the coefficient, and α_0 are the intercept. The equation (1), (2), (3), and (4) will be tested using Malaysia datasets for the causality relationships between total exports, manufacturing, and agriculture.

This paper uses Granger causality test as define by Granger (1998), which takes into consideration the time series properties of the data to examine the incidence of causality and Johansen and Juselius (1990), procedure for estimating the number of co-integrating relationships in these sectors. The E-Views econometrics software package is used to analyse the data and develop results in this study. The following procedures will be adopted:

Step 1: Stationary Test

Stationary of a series is an important phenomenon because it can influence its behavior. Study by Granger & Newbold (1974), If x and y series are non-stationary random processes (integrated), then modeling the x and y relationship as a simple OLS relationship as in equation 5 will be generate a spurious regression.

$$Y_t = \alpha + \beta X_t + \varepsilon_t \quad (2)$$

This study utilised two tests on the individual stochastic structure, that are the Augmented Dickey-Fuller test (5) suggested by Engle and Granger (1987), and the Philips-Perron test (6) recommended by Philips-Perron (1988) which have been frequently used for time series data.

$$\Delta X_t = \lambda_0 + \lambda_1 T + \lambda_2 X_{t-1} + \sum \lambda_i \Delta X_{t-i} + \varepsilon_t; \quad i = 1, 2, 3..., k \quad (3)$$

The hypothesis tested:

$H_0: \lambda_2 = 0$ (contain a unit root, the data is not stationary)

$H_1: \lambda_2 < 0$ (do not contain a unit root, the data is stationary)

$$\Delta X_t = \eta_0 + \eta_1 T + \eta_2 X_{t-1} + v_t; \quad (4)$$

The hypothesis tested:

$H_0: \eta_2 = 0$ (contain a unit root, the data is not stationary)

$H_1: \eta_2 < 0$ (do not contain a unit root, the data is stationary)

Step 2: Selection of Lag Length

The first step in co-integration analysis is selecting an appropriate lag for variables. The three most common information criteria are the Akaike (AIC), Schwarz-Bayesian (SBIC) and Hannan-Quinn (HQ) in VAR models (Lutkepohl (1991). Study by C. Mitchell Dayton (2003), the best subsets selection using Information Criteria is the smallest value of AIC or SBIC. In this study, we used the optimal lag selection suggested by Akaike Information Criterion (Greene (2000, p. 795-796) with two lags.

Step 3: Co-integration Test

To perform co-integration test, this study utilises the Johansen and Juselius (1990) Co-integration test, which involves three steps. First, determine the order of integration for each of the variables under observation. Second, estimate co-integrating regression with vector autoregression (VAR) model. Finally, if the times series are co-integrated, then construct the error-correction modeling (ECM). To carry out the Johansen and Juselius test, we first formulate the VAR model:

$$y_t = \Gamma_1(L)y_{t-1} + \Gamma_2(L)y_{t-1} + \dots + \Gamma_p(L)y_{t-1} + \varepsilon_{t-p} \quad (5)$$

Where $y_t = [LEXP_t, LMANUF_t, LAGR_t]$ is a column vector and $\Gamma_i(L)$ with $i = 1 \dots, p$ is a lag operator. ε is the white noise residual of zero mean and constant variance. According to Greene (2000, p. 795-796) the order of the model p must be determined in advance using Akaike's Information Criterion (AIC) and Schwarz Bayesian Criteria (SBC), then we can test the null hypothesis that there are r or fewer cointegration vectors using the following two likelihood ratio tests statistics:

(a) Trace Test

$$\tau_{trace} = -N \sum_{i=r+1}^M \ln[1 - (r_i^*)^2] \quad (6)$$

Where N is the total number of observation, M is the number of variables and r_i^* is the i correlation between i -th pair of variables. τ_{trace} has a chi-square distribution with $M - r$ degrees of freedom. Large values of τ_{trace} give evidence against the hypothesis of r or fewer cointegration vectors.

(b) Maximal Eigenvalue Test

The second test statistic is the maximal eigenvalue test, which evaluates the null hypothesis $H_0: r = r_0$ against $H_A: r = r_0 + 1$,

$$\tau_{max} = -T \ln(1 - \lambda_{r+1}) \quad (7)$$

In the test, the null hypothesis of r cointegrating vectors is tested against the alternative of $r + 1$. Nevertheless, Johansen and Juselius (1990) suggest that the maximal 1 co-integration vectors eigenvalue test is more powerful than the trace test. Granger (1983) showed that if two variables are cointegrated, then they have an error correction representation (ECM).

Step 4: Granger Causality Test

Next, after the Johansen and Juselius Co-integration Test, we proceed to Granger causality in Vector Autoregression (VAR) environment. Suppose that there are two time series x_t and y_t . When the past and present value of y_t provides some useful information to forecast x_{t+1} at time t , it is said that y_t Granger causes x_t (Granger, 1969). According to Granger (1988), co-integration is concerned with long-run equilibrium. On the other hand, Granger causality is concerned with short-run forecastability. These two different concepts can be considered in an error correction model (ECM).

Suppose that x_t, y_t are both $I(1)$ variables and they are co-integrated such that $z_t = x_t - \beta y_t$ is $I(0)$. When $x - \beta y = 0$ can be consider as long-run (steady-state) equilibrium. As we have seen VAR model in equation (7), this co-integrated system can be written in the form of ECM as follows:

$$\Delta x_t = \gamma_1 z_{t-1} + \text{lagged}(\Delta x_t, \Delta y_t) + \varepsilon_{1,t} \quad (8)$$

$$\Delta y_t = \gamma_2 z_{t-1} + \text{lagged}(\Delta x_t, \Delta y_t) + \varepsilon_{2,t} \quad (9)$$

Where one of $\gamma_1, \gamma_2 \neq 0$ and $\varepsilon_{1,t}, \varepsilon_{2,t}$ are finite order moving-averages. In the ECM, we can find that Δx_t , or Δy_t (or both) must be Granger caused by z_{t-1} which is itself a function of x_{t-1}, y_{t-1} . Thus, either x_{t+1} is Granger caused by y_t or y_{t+1} by x_t . This implies that for a pair of series to have an attainable equilibrium, there must be some Granger causation between them to provide the necessary dynamics. Note that if the lagged Δx_t and Δy_t have none zero coefficients then there is causality in both directions.

4. EMPIRICAL RESULTS

Stationary Test

In order to determine the maximal order of d , this paper employs a standard Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test for the stationary of the series. Table 1 presented the results of the stationarity test at level and first difference. From the result, it found that we fail to reject the null hypothesis of nonstationary and suggest that no variables have co-integrated at level. However, at first difference, all the variables are stationary at 5 per cent significant level as we reject the null hypothesis of nonstationary. The results clearly indicate that all variables are stationary in order $I(1)$.

Table 1: ADF and PP Tests for Unit Roots

Variable	Augmented Dickey-Fuller Test		Test Phillips-Perron Test	
	Level	First Difference	Level	First Difference
LEXP	-3.0689	-5.9303*	-3.0397	-6.1804*
LMANF	-2.4674	-6.1629*	-2.2078	-10.7543*
LAGR	0.9206	-7.0764*	-0.9074	-7.5567*

Note: * denote significant at 5% level using t-stat approach.

Lag Selection

The next step is to determine the number of the optimal lag order of the VAR model. There are several methods to select the lag length of a VAR. All criteria add a penalty to the one-step ahead MSE, which depends on the sample, size, the number of variables and the number of lags.

Table 2: Selection the Optimal Lag Length

Lag	<u>LEXP, LAGR</u>		<u>LEXP, LMANUF</u>		<u>LMANUF, LAGR</u>		<u>LEXP, LMANUF, LAGR</u>	
	AIC	SC	AIC	SBIC	AIC	SC	AIC	SBIC
Lag 1	-3.469	-2.978*	-4.763	-4.272	-3.775	-3.284*	-6.548	-5.665*
Lag 2	-3.628*	-2.937	-5.248*	-4.557*	-3.861*	-3.170	-6.992*	-5.659
Lag 3	-3.534	-2.641	-4.901	-4.009	-3.413	-2.521	-6.882	-5.096

Note: * indicates the lowest value of Akaike information criterion (AIC)

The SBIC suggested one lag while AIC suggested two lags (Table 2). In the previous study by Nicolaus Herman Shombe (1998) and Leila Vaezi and Reza Moghaddasi (2009) are uses a lag selection criterion which recommendation by AIC. Here we conclude that the optimal lag selection is two lags as suggested by the AIC. We then perform co-integration test.

Co-integration Test

Here, we conclude that the optimal lag selection is two lags. Therefore, in our study we used two lags as suggested by the AIC. We then perform co-integration Maximum likelihood test with the two variables, which are exports, manufacturing GDP, and agriculture GDP at level as suggested by Johansen (1988), and Johansen and Juselius (1990) with two lag lengths. Johansen suggests two statistic tests to determine the co-integration rank namely λ_{trace} and λ_{max} . The results of analysis are reported in table 3.

Table 3: Co-integration Rank Test

Co-integration Test	H ₀	H ₁	LEXP LAGR	LEXP LMANUF	LMANUF LAGR	LEXP LMANUF LAGR
Trace Statistic	r = 0	r = 1	9.718088	23.13135*	16.50595*	36.09559*
	r ≤ 1	r = 2	0.051328	3.141419	0.158748	13.84340
	r ≤ 2	r = 3				0.135798
Max-Eigen Statistic	r = 0	r = 1	9.666760	19.98993*	16.34720*	22.25219*
	r ≤ 1	r = 2	0.051328	3.141419	0.158748	13.70761
	r ≤ 2	r = 3				0.135798

* denotes rejection of the hypothesis at the 5% level.

Both trace and max eigenvalue is rejecting at 5% level that is at least one vector is co-integrated. However, pair wise export and agriculture are not co-integrated. This indicates that the export, manufacturing GDP and Agriculture GDP have a long run relationship at least 1 rank. According to Engle and Granger (1987), co-integrated variables must have an error correction representation in which an error correction term (ECT) must be incorporated into model. As mentioned earlier, co-integration between variables cannot indicate the direction of Granger causality relationship. It can only be seen by using the VECM framework. Therefore, in order to determine the direction of causality, modified Wald Test was being employ.

Granger Causality Test

Granger-causality statistics examine whether lagged values of one variable helps to predict another variable. Granger Causality test has been conducted using VAR and VECM provides a framework to study short run and long run causal relationship as well as the direction of the causality between the variables.

Short Run Causality:

Table 4: Granger Causality Wald Tests (VECM Model)

The null hypothesis is the coefficients on the lags of variable are equal to zero	Chi-square (χ^2)
LMANUF → LEXP	4.556005
LEXP → LMANUF	20.49929*
LAGRI → LMANUF	2.726808
LMANUF → LAGRI	0.328000
LMANUF, LAGRI → LEXP	6.408182
LEXP, LAGRI → LMANUF	20.91782*
LMANUF, LEXP → LAGRI	10.40565*

Note: * indicate significance at the 5% levels and (→) donate the direction of causality.

A result in table 4 shows that LMANUF does not cause LEXP but LEXP causes LMANF. There is one way causality exists between manufacturing GDP and export.

Meanwhile, LAGRI does not cause LMANUF and LMANUF does not cause LAGRI. Hence, there is no causality exists between Manufacturing GDP and Agricultural GDP. Furthermore, LMANUF and LAGRI do not cause LEXP. LEXP & LAGRI together Granger cause LMANUF and LMANUF & LEXP cause LAGRI in the short-run.

For statistical reason, we also run the residual serial correlation LM tests for all variables (Table 5). There is no serial correlation exists at lag order for most of the variables.

Table 5: VEC Residual Serial Correlation LM Tests

Lags	LEXP, LAGR		LEXP, LMANUF		LMANUF, LAGR		LEXP, LMANUF, LAGR	
	LM-Stat	Prob	LM-Stat	Prob	LM-Stat	Prob	LM-Stat	Prob
1	5.440	0.245	0.802	0.938	0.690	0.953	5.405	0.798
2	5.848	0.211	1.345	0.854	3.297	0.509	5.669	0.773
3	2.792	0.593	1.462	0.833	2.389	0.665	3.479	0.942
4	3.519	0.475	1.932	0.748	1.678	0.795	4.456	0.879
5	8.880	0.064	8.292	0.081	6.510	0.164	16.155	0.064
6	3.455	0.485	7.447	0.114	0.986	0.912	16.291	0.061
7	16.585	0.002*	0.672	0.955	3.913	0.418	17.005	0.049*
8	11.148	0.125	2.795	0.593	11.988	0.017*	9.254	0.414
9	6.024	0.197	1.650	0.800	0.332	0.988	11.925	0.218
10	6.029	0.197	4.622	0.328	7.145	0.128	8.088	0.525
11	3.840	0.428	4.853	0.303	8.434	0.077	8.389	0.496
12	2.674	0.614	4.794	0.309	4.535	0.339	7.317	0.604

Note: * denotes rejection of the hypothesis at the 5% level.

Due to the absence of co-integration between Export and Agriculture, we tested causality by using VAR (unrestricted model) (Table 6).

Table 6: Granger Causality (VAR model)

Null Hypothesis:	Obs.	F-Statistic	Prob.
LAGRI does not Granger Cause LEXP	24	0.08058	0.9229
LEXP does not Granger Cause LAGRI		4.93983	0.0187*

*indicates significant at the 5% level

The result in table 6 shows that LAGRI does not cause LEXP. Meanwhile LEXP causes LAGRI. Hence, there is one-way causality exists between agriculture GDP and export. This is theoretically plausible.

Long Run Causality:

VECM Granger Causality provides a framework to study long run causal relationship as well as the direction of the causality between the variables. So the equation of

error correction model (ECT) for three endogenous variables such as export, manufacturing GDP, and agriculture GDP as follows:

$$\Delta \text{LEXP} = 0.186 + 0.525\Delta \text{LEXP}(-1) - 1.031\Delta \text{LMANUF}(-1) + 0.094\Delta \text{LAGRI}(-1) - 0.939\Delta \text{ECT}(-1) * \quad (10)$$

$$\Delta \text{LMANUF} = 0.154 - 0.874\Delta \text{LMANUF}(-1) - 0.091\Delta \text{LAGRI}(-1) - 0.969\Delta \text{LEXP}(-1) + 0.719\Delta \text{ECT}(-1)$$

$$\Delta \text{LAGRI} = 0.208 + 0.208\Delta \text{LAGRI}(-1) - 10.943\Delta \text{LMANUF}(-1) + 10.6129\Delta \text{LEXP}(-1) - 0.045\Delta \text{ECT}(-1)$$

According to equation (10), the result shows that the error correction term with ΔLEXP as dependent variable is significant at 5% level. Therefore, in the long term, manufacturing GDP and agriculture GDP does Granger causes export. The speed of adjustment of disequilibrium is 93.9%, which is very high. Meanwhile the error correction term with ΔLMANUF and ΔLAGRI are not significant at 5% level. Therefore, the agriculture GDP and total export do not Granger causes the manufacturing GDP and also the manufacturing GDP and total export do not Granger causes the agriculture GDP. Here, we can conclude that there is long run one-way causality between Manufacturing GDP and agriculture GDP with total export, which the direction being from both manufacturing and agriculture to total export.

The overall findings the directional causality for long term as follows:

- i. There is unidirectional causality exists from manufacturing to total export but total export does not significant to explain manufacturing in the long term;
- ii. In the long term, agriculture does Granger causes manufacturing but manufacturing does not Granger cause agriculture; and
- iii. Manufacturing and agriculture jointly does Granger causes export; the agriculture and total export both does not Granger causes the manufacturing; and the manufacturing and total export jointly does not Granger causes the agriculture.

Intervention Analysis

Wald test and F-test in VAR model can describe as causality test within the sampling period. Those tests will only determent the degree of endogeneity or exogeneity of dependents variables in the estimated period. They do not provide the indicator for the dynamic nature of the system. Therefore, in this study also uses impulse response function and variance decomposition as an additional check of the causality test's findings as followed by Order.D and L.Fisher (1993), Cholesky type of contemporaneous identifying restrictions is employed to draw a meaningful interpretation.

Impulse Response Function (IRF)

According to James H. Stock (2001) the Impulse responses trace out the response of current and future values of each of the variables to a one-unit increase in the current value of one of the VAR errors, assuming that this error returns to zero in subsequent periods and that all other errors are equal to zero. The implied thought

experiment of changing one error while holding the others constant makes most sense.

Therefore, in this study we uses the impulse response functions of export, manufacturing and agriculture corresponding to equation 1, 2, and 3 for the VAR system and in response to impulses transmitted through the channels are presented in Figures 1, 2, and 3 respectively.

Figure 1: Impulse Response Export and Agriculture

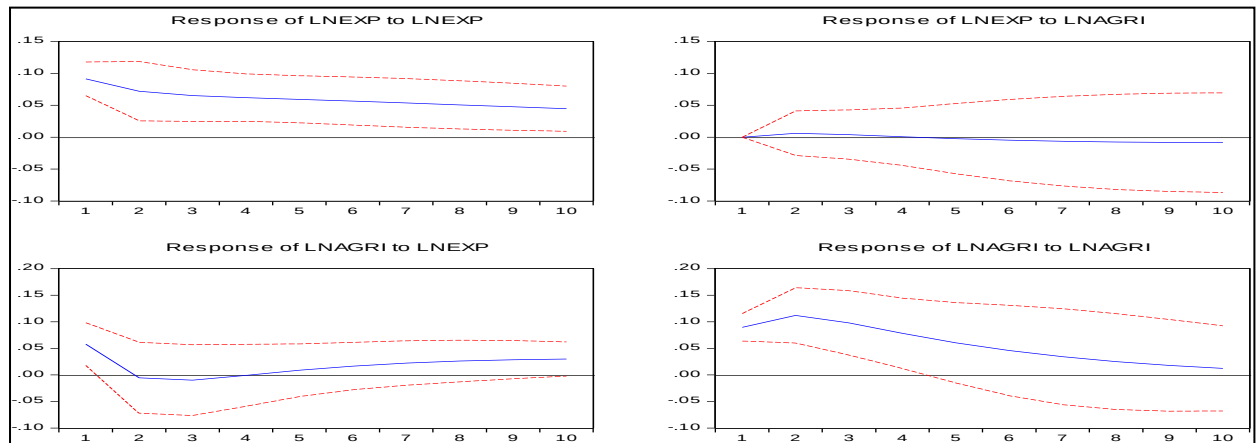
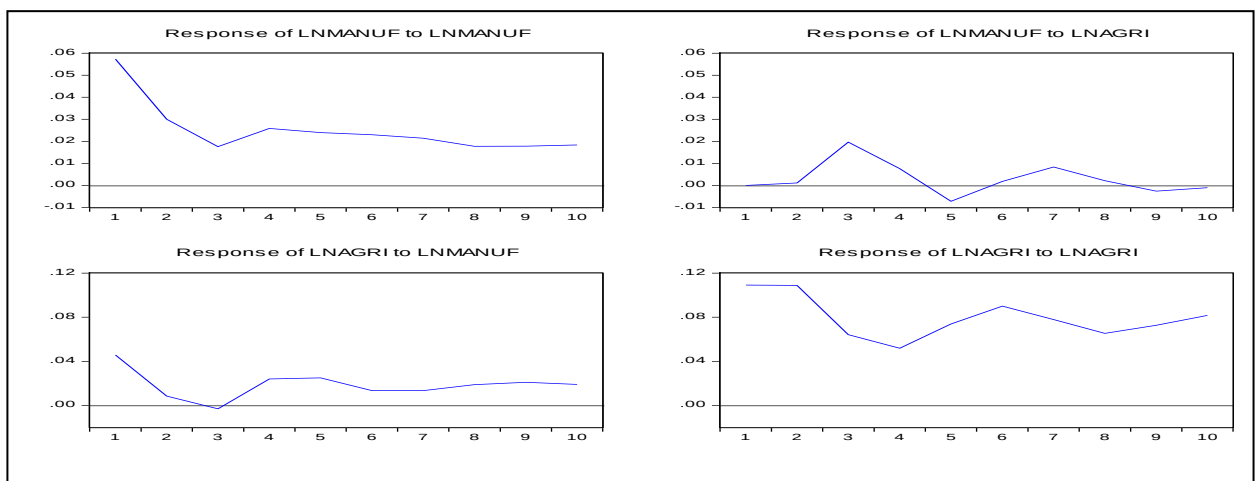


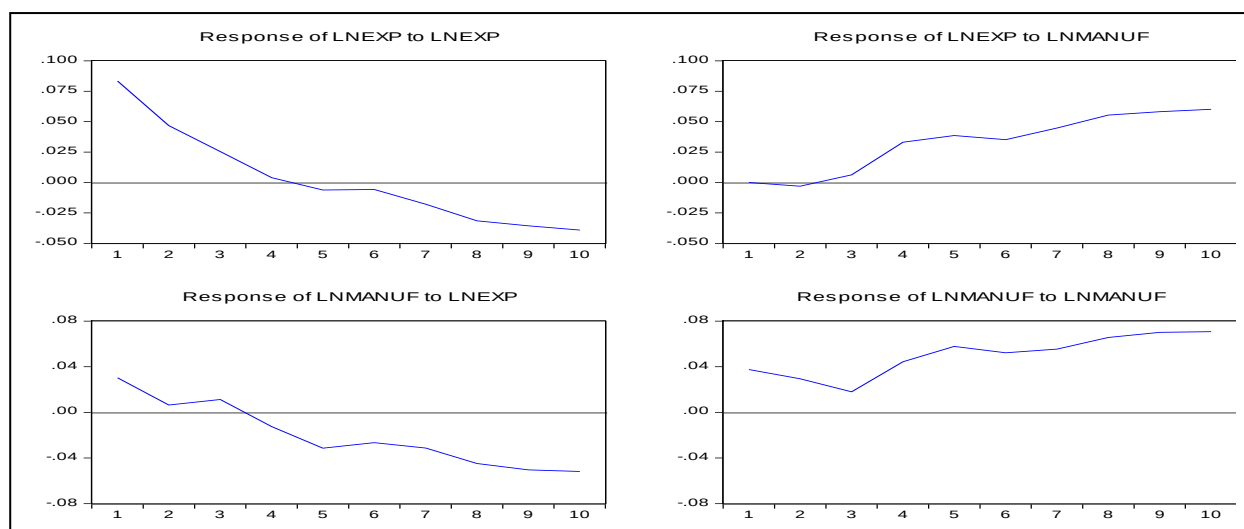
Figure 1 show that in the initial response of export to a unit shock in agriculture is neutral. In the response of agriculture to a unit shock in export negative for the short period than positive in the long period and can be consider as significant. It is proven that export Granger cause agriculture.

Figure 2: Impulse Response Manufacturing and Agriculture



Similarly, figure 2 demonstrates that the response of manufacturing to a unit shock in agriculture is touched the base line at $t=2$ and exhibited damps ups and down until period 9 and collapse on the base line for $t > 9$. On the other hand, the response of agriculture to a unit shock in manufacturing is positive and rise above base line at $t=4$ then oscillations around the long run equilibrium level for $t > 6$. The finding shows that agriculture Granger cause manufacturing in the long term.

Figure 3: Impulse Response Export and Manufacturing



Meanwhile, Figure 3 show that in the initial response of export to a unit shock in manufacturing is neutral until $t=3$. Then rise above the base line at $t = 5$ and exhibited damped oscillations above base line at $t > 5$. Here, we conclude that the response of export is positive and manufacturing Granger cause export in the long term. While in the response of manufacturing to a unit shock in export exhibited a sharp decline at $t = 2$ and remained above the base level at $t = 3$ for the short period. Then immediate a sharp decline below base line at $t=5$ and continue decline below base line at $t > 6$. So, the response of manufacturing is negative. Therefore, findings show that the short run causality exists from export to manufacturing.

Overall findings of impulse response function above show similar results as in our study that:

- i. Unidirectional causality exists between export and agriculture in the short run. Exports does Granger cause agriculture and agriculture does not Granger cause exports;
- ii. Agriculture does Granger causes manufacturing in the long run meanwhile manufacturing does not Granger cause agriculture either in short run nor long run. There is one way directional causality exists in the long run; and
- iii. Export does Granger cause manufacturing in the short run while manufacturing can explain exports in the long run.

Variance Decomposition (VDC)

The variance decomposition or forecast error decomposition is the percentage of the variance of the error made in forecasting a variable due to a specific shock in error term at a given horizon. It has been shown that how shocks to one endogenous variable may affect the other endogenous variables in the VAR model through impulse response functions. In this section, with the help of variance decomposition, efforts have been made to separate the variations in an endogenous variable into

some component shocks. The forecast error variance decomposition (FEVD) tells us the proportion of the movement in a sequence due to its own shocks versus shocks of other variables.

(a) Variance Decomposition for Export and Agriculture

Table 7: Variance Decomposition Export and Agriculture

Variance Decomposition of LNEXP:				Variance Decomposition of LNAGRI:			
Period	S.E.	LNEXP	LNAGRI	Period	S.E.	LNEXP	LNAGRI
1	0.0914	100.0000	0.0000	1	0.1067	29.5166	70.4834
2	0.1166	99.7192	0.2808	2	0.1548	14.1433	85.8567
3	0.1336	99.6937	0.3063	3	0.1834	10.3688	89.6313
4	0.1473	99.7462	0.2538	4	0.1993	8.7776	91.2224
5	0.1588	99.7589	0.2411	5	0.2085	8.2027	91.7973
6	0.1687	99.7085	0.2915	6	0.2141	8.3763	91.6237
7	0.1772	99.6068	0.3932	7	0.2180	9.1243	90.8757
8	0.1844	99.4721	0.5279	8	0.2209	10.2784	89.7216
9	0.1907	99.3207	0.6793	9	0.2235	11.6820	88.3180
10	0.1960	99.1644	0.8356	10	0.2258	13.2027	86.7973

The variations decomposition of responses of export to shocks transmitted through both export and agriculture channels are given in the table 7. Variations in export were mainly due to export shocks took the dominant role in explaining variations in export ($t > \infty$). The contribution of export shocks variations in export was about 99% while that of agriculture was at about 1%. Meanwhile, the variations decomposition of responses of agriculture to shocks transmitted through export and agriculture channels are given in the table 7. Agriculture shocks and exports shocks were generated short run variations for the agriculture response. For example, at $t=1$ period, at least 70% of the short run constituted the variance decomposition were due to agriculture shocks while export shocks to this account never exceeded 30% level. Therefore, for $1 < t \leq 10$, the contribution of agriculture shocks to total variations never fell short of 70% level. Therefore, variance decomposition analysis confirms that causality running from agriculture to export is 'weak'. On the other hand, export shocks contributed significantly to the constitution of agriculture profile. Consequently, causation running from export to agriculture was stronger and dominant. Therefore, the direction of causality (export Granger caused agriculture) has been reinforced through the VAR modeling and intervention analysis also.

(b) Variance Decomposition for Export and Manufacturing

Table 8 shows that variations in export were mainly due to export shocks in the early part of projections periods ($t \leq 3$). Shocks transmitted through manufacturing, assumed greater role in explaining variations in export since $t > 5$ periods. Manufacturing shocks became the dominant factor behind short run variations in export since $t > 6$ and the contribution of manufacturing shocks to total variations in exports was about 53 % while that of export was at about 47% at $t=10$. Therefore, the direction of causality manufacturing Granger caused exports in the long run is

significant. Meanwhile, the variations decomposition of responses of manufacturing to shocks transmitted through export and manufacturing were generated short run variations for the manufacturing response. For example, at $t=1$ period, at least 40% of the short run constituted the variance decomposition were due to exports shocks while manufacturing shocks was about 60% level. Therefore, the contribution of exports shocks to total variations is significant in the short run exists causality from export to manufacturing. Therefore, the direction of causality between export and manufacturing has been reinforced through the VAR modeling.

Table 8: Variance Decomposition Export and Manufacturing

Variance Decomposition of LNEXP:				Variance Decomposition of LNMANUF:			
Period	S.E.	LNEXP	LNMANUF	Period	S.E.	LNEXP	LNMANUF
1	0.083364	100.0000	0.000000	1	0.048178	39.50720	60.49280
2	0.095634	99.89528	0.104725	2	0.056849	29.66233	70.33767
3	0.099148	99.50067	0.499326	3	0.060672	29.50017	70.49983
4	0.104612	89.52394	10.47606	4	0.076161	21.39538	78.60462
5	0.111670	78.87795	21.12205	5	0.100670	21.98700	78.01300
6	0.117242	71.80019	28.19981	6	0.116447	21.63319	78.36681
7	0.126758	63.40145	36.59855	7	0.132692	22.21818	77.78182
8	0.141878	55.54987	44.45013	8	0.154707	24.75776	75.24224
9	0.157411	50.25155	49.74845	9	0.177179	27.00205	72.99795
10	0.172976	46.70802	53.29198	10	0.197674	28.56960	71.43040

(c) Variance Decomposition for Manufacturing and Agriculture

Table 9: Variance Decomposition Manufacturing and Agriculture

Variance Decomposition of LNMANUF:				Variance Decomposition of LNAGRI:			
Period	S.E.	LNMANUF	LNAGRI	Period	S.E.	LNMANUF	LNAGRI
1	0.0573	100.0000	0.0000	1	0.1184	14.9288	85.0712
2	0.0647	99.9674	0.0326	2	0.1610	8.3414	91.6586
3	0.0698	92.0640	7.9360	3	0.1734	7.2301	92.7699
4	0.0749	92.0588	7.9412	4	0.1825	8.2453	91.7547
5	0.0789	92.0286	7.9714	5	0.1985	8.5615	91.4385
6	0.0822	92.6060	7.3940	6	0.2184	7.4498	92.5502
7	0.0854	92.1855	7.8146	7	0.2322	6.9234	93.0767
8	0.0873	92.4520	7.5480	8	0.2420	6.9810	93.0190
9	0.0891	92.6755	7.3246	9	0.2535	7.0446	92.9554
10	0.0910	92.9623	7.0377	10	0.2670	6.8599	93.1401

The variations decomposition of responses of manufacturing to shocks transmitted through both manufacturing and agriculture channels are given in the table 9. The variations in manufacturing were mainly due to manufacturing shocks took the role in explaining variations in manufacturing at $t \leq 2$ period. The contribution of manufacturing shocks variations in manufacturing was about 99.97% while that of agriculture was at about 0.03% at $t=2$ period. Therefore, variance decomposition

analysis confirms that causality running from agriculture to manufacturing is 'weak' in the short run. While Since $t > 3$ the agriculture shocks is significant to explain the variation in manufacturing in the long run. Meanwhile, the variations in agriculture were mainly due to agriculture shocks early part of projections periods $t = 1$. Agriculture shocks became the dominant factor behind the variations in agriculture since $t > 2$ and the contribution of agriculture shocks to total variations in agricultures was about 93% while that of manufacturing was at about 7% at $t = 10$. Therefore, there is manufacturing does not Granger caused agriculture in the short run and long run, which that has been reinforced through the VAR modeling and intervention analysis also.

5. CONCLUSION AND POLICY IMPLICATION

For the reason of important of agriculture, manufacturing and exports in the Malaysian economy, this paper aims to investigate a causal direction between manufacturing GDP and agriculture GDP with total exports. As it has been seen in literature, theories and empirical studies, growth of manufacturing and exports are an important factor to achieve economic development even for developing countries.

Results of this study confirm the same that, in the short run export causes manufacturing and agriculture. Meanwhile, manufacturing does Granger cause export and agriculture Granger cause manufacturing in the long run. On the other hand, manufacturing and agriculture jointly can influence the export in the long run. The results of this study confirm the same that has been reinforced through the VAR modeling and intervention analysis such as impulse response function and variance decomposition.

Thus, there has important policy implication that continuing promoting manufacturing and agriculture will influence the exports and vice versa in both short and long-term. Furthermore, Malaysia has large potential in improving its agriculture sector as well as manufacturing sector. As the country consider agriculture and manufacturing as the back born of its economy, major policies are required for the agriculture sector to contribute more in the economic growth as well as manufacturing sector to achieve the desirable economic growth. Hence, these two sectors with exports could be the catalyst to achieve the government's new ETP programme in achieving a high income country.

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