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Export-Led Growth Hypothesis : An Empirical Evidence of Malaysia

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ABSTRAK

Kertas ini mengkaji secara emprik hipotesis eksport menggalakkan pertumbuhan di dalam eksport Malaysia dan eksport ke negara Asia-Pasifik dan negara bukan di rantau Asia-Pasifik dengan mengguna model tiga-angkubah vektor autoregressi (VAR). Model ini diuji dengan menggunakan tiga prosedur ujian kesebaban; ujian kesebaban Granger, teknik Hsiao dan penguraian varians. Keputusan menunjukkan hipotesis pertumbuhan yang didorongkan oleh eksport disokong oleh dua daripada tiga siri yang diguna dan eksport negara Asia-Pasifik telah membantu Malaysia menikmati kadar pertumbuhan yang tinggi.

ABSTRAK

This paper empirically investigates export-led growth hypothesis in total Malaysian exports and exports to dynamic Asia-Pacific and non-Asia-Pacific countries by using a three-variable vector autoregressive (VAR) model. The model was subjected to three different causality test procedures; Granger's causality, Hsiao's technique and variance decomposition. The results indicate that export-led growth hypothesis is supported in two out of three series used and exports to Asia-Pacific countries have helped Malaysia to enjoy a high growth rate.

INTRODUCTION

The Malaysian economy has undergone major structural changes to realize a higher growth rate. Through the country's efforts which introduced various fiscal and export incentives, the manufacturing sector was pushed to the forefront as a source of growth. Diversification in agricultural sector has also introduced new economic activities which are conducive to development. However, it was not surprising to see the manufacturing sector's contribution to the economy supersede agriculture's share in 1987 as various government policies were deliberately set to promote the manufacturing sector. Beside the above factors, the government also realized that the import-substitution policy adopted in the 60's did not promote growth as expected and as a result the government has resorted to export expansion instead (Mohammed Yusoff, 1992). In addition, several neighbouring ASEAN countries have enjoyed a high growth rate due to export-expansion policy. Furthermore, studies done in 1960's and 1970's by NBER and OECD respectively[1] have concluded that a country which follows import-substitution policy will grow significantly less than that which adopted export-expansion policy. As a result, Malaysia and other ASEAN countries have enjoyed favourable economic growth[2].

There is no doubt that trade plays a very important role in the development of the Malaysian economy. However, Malaysian exports are vulnerable to increased protectionism in both developed and developing countries. This has led her exports to shift its direction towards a dynamic Asia-Pacific region. Ariff (1990) has noted a remarkable increase in trade flow to Asia-Pacific countries as well as to Asian NIEs in contrast to exports to the European Community which has been declining. Whether this increase is due to an outward-looking strategy is yet to be proven. This paper seeks to investigate empirically the evidence of export-led growth hypothesis in total of Malaysian exports and the direction of exports to both Asia-Pacific and non-Asia-Pacific countries.

There are a number of studies that have investigated the direction of causality in bivariate context[3] with very few on multivariate[4] frameworks which are either cross-country or time-series studies. However they have produced mixed results. In fact Sharma et. al (1991) has found that there were no two identical results between the five industrialized countries in their study. Hence, results based on individual country study is very important to help policy makers formulate prudent policy actions. Most of the previous studies based their results on contemporaneous correlations and regressions. A high correlation between two variables does not necessarily imply the existence of a causal relationship between them. In fact an observed high correlation between exports and growth is not surprising, as exports are a component of aggregate demand in Keynesian identity. Exports contribute to economic growth only through capital formation (Kavoussi, 1984). Therefore the direction of causation is difficult to judge. If export (X) expansion is found to cause growth (Y), then export-led growth is favourable. On the other hand, if reverse causality is found, the less developed countries have to achieve a threshold development before expanding their export sector (Michaely, 1977). Bidirectional causality indicates that exports and growth reinforces one another.

This study employs a vector autoregressive (VAR) technique to investigate the nature of causal relationship between exports (X) and growth (Y). To remove a spurious correlation, the direction of causation between exports and growth is investigated with the presence of a third variable (Z), capital formation. This paper is organized as follows. Section II describes the causal relationship among the variables included in the study; Section III presents the methodology employed; and Section IV describes the data and discusses the results which is followed by a brief summary and conclusion.

CAUSALITY: THEORETICAL ANALYSIS

There are two approaches to empirical investigation of the relationship between export expansion and economic growth. Ram (1985) has noted that exports can have a positive impact on economic growth due to better allocation of resources. Exports also can cause economies of scale and externalities and stimulate growth[5]. The other approach is based on a "two-gap" model of growth where increases in exports cause an increase in imported capital goods which in turn raises the growth rate of capital formation and thus stimulate growth (Voivodas 1973; Williamson 1978; Fajana 1979). While export expansion can lead to growth, it is also plausible that economic growth causes export expansion[6]. Recently, Helpman and Krugman (1985) has suggested bidirectional causality between exports and growth. According to this theory, the rapid growth leads to efficient allocation of resources according to comparative advantage and permits the exploitation of economies of scale. Once economies of scale is realized, the costs of exportable goods will decline and hence exports will be more competitive in the world market. Therefore the causal relationship may run in both directions and often tends to be self reinforcing[7]. This suggests that factors other than exports can also cause growth. In this study, capital is included as a third variable that could explain growth. Traditionally, on the basis of neoclassical growth theories, it is believed that capital stocks lead to output growth, which in turn leads to further capital formation via the acceleration process.

METHODOLOGY AND VAR SPECIFICATION

There have been a wide-range of studies in economics that used the Granger-causality (1969) tests[8]. The central theme of this test is that a variable

X is said to cause Y if Y is better predicted by using past values of X (which are contained in the information set that includes both X and Y) than by not using them. In order to draw a meaningful causal link between X and Y, one must consider as many factors as possible in the information set. These may include internal factors such as composition and direction of exports, investment activities and external factors such as economic growth of developed countries and so on. Most of the studies mentioned above used the Granger test in bivariate context. Extending the test to multivariate framework involves the inclusion of the new variables and the lags associated with them tend to exhaust the degree of freedom rather quickly. But as noted by Hsiao (1982) and Lüthkepohl (1982), exclusion of a third variable may lead to a spurious correlation. Hence in this paper, a multivariate framework is used to investigate causal relationship between export and growth in Malaysia. As noted by Sharma et al (1991), a VAR method has an advantage over other techniques because it considers all possible causal influences among the variables included in the system.

A specification of a three variable VAR model is given as

$$\begin{bmatrix} X_t \\ Y_t \\ Z_t \end{bmatrix} = \begin{bmatrix} \varphi_{10} \\ \varphi_{20} \\ \varphi_{30} \end{bmatrix} + \begin{bmatrix} \varphi_{11}^{l} & \varphi_{12}^{l} & \varphi_{13}^{l} \\ \varphi_{21}^{l} & \varphi_{22}^{l} & \varphi_{23}^{l} \\ \varphi_{31}^{l} & \varphi_{32}^{l} & \varphi_{33}^{l} \end{bmatrix} \begin{bmatrix} X_t \\ Y_t \\ Z_t \end{bmatrix} + \begin{bmatrix} \mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \end{bmatrix} \quad (1)$$

The entry $\varphi_{ij}^{l}(L)$ has the following interpretation. The superscript l indicates the optimal lag of variable j in equation i and L is a lag operator. φ_{io} (i = 1, 2, 3) and μ_{io}(i = 1, 2, 3) are constant and white noise error terms respectively. To test for prima-facie causation between i^{th} and j^{th} variables, zero restrictions on parameters are tested. For example, j^{th} variable prima-facie cause i^{th} variable if and only if $\varphi_{ij} \neq 0$, and the i^{th} variable is said to prima-facie cause j^{th} variable if $\varphi_{ji} \neq 0$. Hsiao (1982) has noted that if the j^{th} variable prima-facie causes the k^{th} variable and k^{th} variable prima-facie causes the i^{th} variable, then the j^{th} variable prima-facie causes the i^{th} variable indirectly. Thus, the model above accounts for both direct and indirect causal relationship in the variable of interest.

One of the main requirements in applying a Granger-causality test is the stationarity of the data, that is, the model has to be covariance stationary and the time series considered must be constant in both mean and autocovariances. There are several methods that can be used to achieve stationarity (e.g. Sims' filter, Hsiao's technique, first differencing, etc.).

Otherwise, drawing causal influences will present potential problems (Granger and Newbold 1974). Although several VAR studies have used non-stationary data directly, Ohanian (1988) has shown that the use of non-stationary series may lead to spurious inferences. In this study, a standard tool in time series analysis is used to convert the data into stationary time series. However, the issue of determining the optimal lag length in Model (1) is still elusive[9]. The sequential method suggested by Hsiao (1979, 1981) which combines Granger causality and Akaike's minimum final prediction error (FPE) is used to determine the optimal lag. Hsiao (1981) has noted that FPE balances the risk of bias from choosing a lower lag and against the risk of increased variance when a higher order is chosen. Furthermore this technique does not constraint the lag to be the same and it is also equivalent to applying an F-test with varying significant level. The procedure to determine the optimal lag length for each variable is outlined below.

i) Regress Y on its own lagged values up to the order m where m is fixed a priori, that is,

$$Y_t = \varphi_{10} + \sum_{l=1}^{m} \varphi_{11,l} Y_{t-l} + \mu_{1t} \quad t = 1,...n \tag{2}$$

ii) For each m, Final Prediction Error is given by FPE (1) = [(n + 1 + 1) / (n − 1 − 1)] / (SSR (1) / n)

where n is sample size, SSR is residual sum of square. FPE(1) which gives the minimum value is chosen to be the optimal lag length for Y. Let 1 in this case be q.

iii) Next, optimal lag length for other variables is determined. This is done by estimating

$$Y_t = \varphi_{10} + \sum_{j=1}^{q} \varphi_{11,j} Y_{t-l} + \sum_{l=1}^{v} \varphi_{12,l} X_{t-l} + \mu_{1t} \quad t = 1,...n \tag{3}$$

and

$$Y_t = \varphi_{10} + \sum_{j=1}^{q} \varphi_{11,j} Y_{t-l} + \sum_{l=1}^{v} \varphi_{13,l} Z_{t-l} + \mu_{1t} \quad t = 1,...n \tag{4}$$

For each (3) and (4), FPE (q, l) is calculated by
FPE(1) = [(n + q + l + 1) / (n − q − l − 1)] SSR (q, l) / n

The hypothesis of unidirectional causality between Y and X or Z, X or Z and Y, and test of independence is done using a standard likelihood ratio (LR) test[10].

Most of the data analysis using VAR technique is centred on variance decomposition and impulse response function which are generated from moving average representation of an autoregressive process. A VAR model involves a linear combination of past and current innovations of the variables in the systems. If the innovations are contemporaneously correlated, its variance can be decomposed. A standard way of doing this is to orthogonalize the μ_{it} in (1). Sims (1980, 1982) has noted that variance decomposition is useful in checking the causal influences in the system and in fact the strength of Granger-causality can be measured through this decomposition. It decomposes the variance due to the innovations in own variables as well as other variables. A variable is strictly exogenous if it accounts for 100 percent of its own innovation. On the other hand, if it only accounts for a small amount of innovation in other variables, then it is an indication of a weak prima-facie cause. For example, if growth is explained by only a small portion of the other variable's forecast error variance, then it is a case of weak prima-facie cause. As the result of a VAR variance decompotion is sensitive to the order of the variables, the specific gravity criterion described in step (iv) is used to guide the ordering of the variables. Hence there are three different ordering for variance decomposition.

ESTIMATION RESULTS

The annual data from 1960-1990 are used in this study. The data for GDP, total exports and capital formation are taken from The International Financial Statistics Yearbook (1990) and the data for the direction of exports are taken from Statistical Yearbook for Asia and the Pacific. The share of total exports, direction of exports and gross capital formation are then used to investigate the relationship between the variables. As causality testing requires stationary data, The Box-Jenkins technique was used to convert the data series into stationarity while Akaike's FPE was employed to determine the optimal lag for each series. For example, for total exports we found the optimal lags is 1. Optimal lags for total exports, exports to Asia-Pacific, exports to non-Asia-Pacific and capital formation are 2, 2, 2, and 1 respectively. Following Hsiao's technique, these are then treated as controlled variables while variables X and Z, Y and Z and X and Y are manipulated variables in equations Y, X and Z respectively (result is available from the author upon request). Based on this optimal lag we investigated Granger's causality in both bivariate and trivariate context, Hsiao's causality, and Sim's variance decomposition.

The variables are then ordered in each of the equations in the VAR model (1) based on the procedure described in previous section (step iv). The final VAR model is summarised in Table 1 and the results for bivariate and trivariate Granger tests are presented in Table 2. Table 3 summarized the direction of causality for the three test procedures employed while variance decomposition is reported in Table 4.

TABLE 1. Final Specified Models for the VAR

Variables	Non-Zero elements
Total exports	φ_{11}^{2} (L), φ_{22}^{1} (L), φ_{32}^{2} (L), φ_{33}^{1} (L)
Asia-Pacific	φ_{11}^{2} (L), φ_{21}^{2} (L), φ_{22}^{1} (L), φ_{31}^{2} (L), φ_{32}^{1} (L), φ_{33}^{1} (L)
Non-Asia Pacific	φ_{11}^{2} (L), φ_{22}^{1} (L), φ_{32}^{2} (L), φ_{33}^{1} (L)

For variance decomposition, the extent of causation is checked by using the following procedure (see Sharma et al. 1991). Prima-facie causality is defined as weak if forecast error variance (FEV) of one of the variables is between 1% to 5% in another variable and moderate if it lies between 6% and 14%. On the other hand, prima-facie causality is strong if FEV is between 15% and 24% and is considered very strong if FEV accounts for more than 25%.

From Table 2 we can see that both Granger's (in bivariate and trivariate contexts) and Hsiao's sequential method support export-led growth hypothesis in total exports and exports to Asia-Pacific countries. However, in the case of non-Asia-Pacific countries, export does not cause growth. Table 4 reveals that 10.02% of innovations in total exports explain growth while 27.53% of FEV in export to Asia-Pacific explain growth. These are rather moderate and strong respectively. This shows that export expansion to the dynamic Asia-Pacific region has helped Malaysia to maintain a favourable growth.

One of the very interesting findings of this study is that it appears that exports is the only exogenous variable since it is not caused by any

TABLE 2. Bivariate and Trivariate Granger Causality Results

Type of Exports	Hyphothesis	Likelihood ratio	Degrees of freedom
BIVARIATE			
Total Exports	φ^{1}_{12} (L) = 0	0.07	1
	φ^{2}_{21} (L) = 0	5.01**	2
Exports to AP	φ^{1}_{12} (L) = 0	0.64	1
	φ^{1}_{21} (L) = 0	14.79*	2
Exports to NAP	φ^{1}_{12} (L) = 0	0.05	1
	φ^{2}_{21} (L) = 0	1.38	1
TRIVARIATE			
Total Exports	φ^{1}_{12} (L) = 0	0.06	1
	φ^{1}_{13} (L) = 0	1.16	1
	φ^{2}_{21} (L) = 0	5.06***	2
	φ^{1}_{23} (L) = 0	0.05	1
	φ^{1}_{31} (L) = 0	2.09	1
	φ^{2}_{32} (L) = 0	8.83*	2
Exports to AP	φ^{1}_{12} (L) = 0	2.54	1
	φ^{1}_{13} (L) = 0	3.14***	1
	φ^{2}_{21} (L) = 0	14.85*	2
	φ^{1}_{23} (L) = 0	0.72	1
	φ^{1}_{31} (L) = 0	0.56	1
	φ^{2}_{32} (L) = 0	5.41**	2
Exports to NAP	φ^{1}_{12} (L) = 0	0.05	1
	φ^{1}_{13} (L) = 0	1.54	1
	φ^{2}_{21} (L) = 0	1.28	2
	φ^{1}_{23} (L) = 0	0.22	1
	φ^{1}_{31} (L) = 0	2.44	1
	φ^{2}_{32} (L) = 0	9.65*	2

*Significant at 1% level ** Significant at 5% level *** Significant at 10% level

TABLE 3. Bivariate, Trivariate and Hsiao's Sequential Causality Results

Total Exports			Exports to Asia-Pacific			Exports to Non-Asia-Pacific		
Biv.	Triv.	Sequ.	Biv.	Triv.	Sequ.	Biv.	Triv.	Sequ.
$Y \nrightarrow X$	$Y \nrightarrow X$	$Y \nrightarrow X$	$Y \nrightarrow X$	$Y \nrightarrow X$	$Y \nrightarrow X$	$Y \nrightarrow X$	$Y \nrightarrow X$	$Y \nrightarrow X$
$X \rightarrow Y$	$Z \nrightarrow X$	$Z \nrightarrow X$	$X \rightarrow Y$	$Z \nrightarrow X$	$Z \nrightarrow X$	$X \nrightarrow Y$	$Z \nrightarrow X$	$Z \nrightarrow X$
	$X \rightarrow Y$	$X \rightarrow Y$		$X \rightarrow Y$	$X \rightarrow Y$		$X \nrightarrow Y$	$X \nrightarrow Y$
	$Z \nrightarrow Y$	$Z \nrightarrow Y$		$Z \nrightarrow Y$	$Z \nrightarrow Y$		$Z \nrightarrow Y$	$Z \nrightarrow Y$
	$X \nrightarrow Z$	$X \nrightarrow Z$		$X \nrightarrow Z$	$X \rightarrow Y$		$X \nrightarrow Z$	$X \nrightarrow Z$
	$Y \rightarrow Z$	$Y \rightarrow Z$		$Y \rightarrow Z$	$Y \rightarrow Z$		$Y \rightarrow Z$	$Y \rightarrow Z$

TABLE 4. Forecast Error Variance Decomposition

Variables Explained	Steps Ahead	Explained by innovations in		
		Y	X	Z
Total exports				
Y	8	89.97	10.02	0.00
X	8	0.40	99.60	0.00
Z	8	19.21	1.29	79.48
Asia-Pacific exports				
Y	8	72.46	27.53	0.00
X	8	0.00	100.00	0.00
Y	8	15.91	3.66	80.42
Non-Asia Pacific exports				
Y	8	100.00	0.00	0.00
X	8	0.00	100.00	0.00
Z	8	19.82	0.00	80.18

other variables. It is also interesting to note that the three test procedures give identical results. Variance decomposition comfirmed Granger test as total exports only moderately caused growth at 10% significant level while exports to Asia-Pacific caused growth very strongly at 1% significance level.

In contrast to the neoclassical theory that growth in factor input causes output, capital did not account for any significant contribution to growth. Instead, growth lagged two periods causes capital formation and 19% of its innovations explained growth in capital. This is a strong causal relationship and in line with demand-led hypothesis. Since exports cause growth and growth causes capital formation, exports indirectly cause capital formation. However variance decomposition reveals that this causal relation is very weak as only 1.4% of innovations in exports explained capital.

SUMMARY AND CONCLUSION

This paper empirically investigates export-led growth hypothesis by employing annual Malaysian data. A VAR model was developed and was subjected to three different causality test procedures: Granger causality; Hsiao's sequential technique and variance decomposition. The results show that export-led growth hypothesis is supported in two out of three procedures used. Malaysia's efforts to move towards an industrialized nation by pursuing export-expansion strategy has led the country to enjoy a high growth rate. At the same time Malaysia has benefitted tremendously from favourable economic conditions and improved trade relations among Asia-Pacific countries.

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NOTES

1. See Little, I., Scitovsky, T. and Scott, M. *Industry and Trade in Some Developing Countries: A Comparative Study*. Bhagwati, J.N. *Foreign Trade and Economic Development: Anatomy and Consequences of Exchange*

Control Regimes, NBER, New York, 1978 and Krueger, A. *Foreign Trade Regimes and Economic Development: Liberalization Attempts and Consequences*, Ballinger, NBER, Cambridge Mass., 1978 are synthesis of the NBER Study.

2. See Ariff, M. and Hill, H. *Export-Oriented Industrialization: The ASEAN Experience*, Allen-Unwin, Australia, 1985, ch. 2 for an overview of export-expansion policy in ASEAN countries and Ariff, M. and Loong-Hoe, Tan, *The Uruguay Round ASEAN Trade Policy Options*, ISEAS, Singapore, 1988, p. 1., Seiji Naya and Ulrich Hiemenz "ASIAN NICs Changing Trade Patterns and Policy Issues: The Prospects for ASEAN and the ASIAN NICs", *Asean Economic Bulletin*, November 1985.
3. Jung, W.S. and P.J. Marshall (1985), "Exports, Growth and Causality in Developing Countries", *Journal of Development Economics*, 18, 1-12 and Kwan, A.C.C. and Cotsomitis, J.A (1990), "Economic Growth and Expanding Export Sector: China 1952-1985", *International Economic Journal*, Vol 5, No. 1, 105-116 and in the case of Malaysia study of Habibullah, Muzafar Shah and Yusoff, Mohammad B. (1990), "Exports and Economic Growth: A Case off Malaysia" *in Trade and Development in Malaysia* edited by Mohammed Yusoff et. al, Universiti Pertanian Malaysia, Serdang, 83-92.
4. Kunst and Marin (1989), Sharma et al (1991) and Abdullah, A. Zainuddin (1993).
5. Views shared by Tyler (1981); Feder (1983).
6. See Jung and Marshall (1985).
7. Kunst and Marin, 1989, and Jung and Marshall, 1985 did not support this hypothesis.
8. See sims (1972) money and income, public expenditures and national income Singh and Sahni (1984), Islam and Rafiquzzaman (1991) that investigate property tax and intermunicipal migration relationship in Canada.
9. Sims (1980) has noted that increasing the lag length will increase the number of parameters to be estimated by the square of the number of the variables and this will exhaust degrees of freedom rather quickly.
10. The likelihood ratio test is $-2 \ln l = -2\{LR - LU\}$ where LR is the loglikelihood function for restricted model and LU is the loglikelihood function for the unrestricted model. It has a χ^2 distribution with degrees of freedom equal to the number of restrictions under the null hypothesis.

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