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Exports and Economic Growth under Structural Change: A Co-integration Analysis of Evidence from Malaysia

by
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Abstract
A number of studies have tried to establish a causal link between export expansion and economic growth. Empirical studies of the relationship have pursued two different approaches—one set has used inter-country statistical comparisons and the second set has focused on the economic performance of individual countries. Our contribution to the work is to recognize that structural changes will, over time, change the sources of growth and this will affect the export-growth relationship. We use country case study approach focusing on Malaysia, a country with one of the world's highest sustained growth rates over the past 3 decades. Malaysia has also had a long history of commodity trade but has been successful, in the last 2 decades in diversifying and shifting its export base toward manufactured goods.

We use VAR analysis of Malaysian quarterly trade and GDP growth to test for the presence of export-led growth from 1965 to 1996. Trade data are disaggregated into primary and manufactures exports and causality tests are applied to the entire period as well as two subperiods—the 1965-80 period when policy emphasis was on import substitution and the 1981-96 period when government policies strongly favored export-led growth. Statistical tests confirmed export-led growth for the full period and for the earlier years up to 1980 but tests on the 1981-96 period revealed a reversal of the causal relationship with growth causing exports. Results also show that primary exports apparently have had a stronger direct impact on Malaysian economic growth than manufactures.

The explanation for this paradoxical result showing weakening support for export-led growth after Malaysia shifted to an export-oriented development strategy lies with the structural changes associated with the industrialization. Unlike primary commodity exports, for which value-added is derived primarily from domestic sources, Malaysian manufactures exports rely heavily on imported raw materials and equipment. As manufactures increase as a proportion of Malaysia's exports, the export-led causality relationship weakens. The interaction among trade and growth variables becomes more complex.

These empirical results not only provide insight into how the Malaysian trade-growth relationship has evolved, they also help explain the inconsistent and, frequently, conflicting results found in the literature. The empirical tests for export-led growth may be effective in capturing the trade–growth interaction at early and intermediate stages of development, but as a nation's economic structure becomes more complex, causality tests on aggregate trade and growth variables will likely fail capture these complicated interrelationships. Future empirical studies of the export-led growth hypothesis need to consider how to incorporate a broadening of the export base and a diversification of the economic structure into the measurement of trade-growth relationships.

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I. Introduction

There is an ongoing debate in the literature about the relationship between export expansion and economic growth. The theoretical case for the link between trade and economic growth, first proposed by Ricardo in 1817, argues that trade permits each country to specialize in the production of the products in which it has a comparative advantage and the result is that every nation achieves a higher level of national wealth than it could without trade. Recent empirical work on the linkage between growth and trade, however is less convincing, primarily because the issue is not whether a country should trade but whether policies to promote trade expansion will increase growth. The *a priori* reasoning favoring export expansion policies is discussed by Bhagwati (1978) and Kruger (1978). The arguments generally maintain that export expansion contributes to economic growth by increasing the rate of capital formation and enhancing the growth of factor productivity.

Empirical studies of the relationship between exports and economic growth have pursued two different approaches. One set of studies have used inter-country statistical comparisons to investigate the relationship between export expansion and economic growth.[1] The second approach is characterized by a number of case studies, which have examined the effects of trade strategies on the economic performance of individual countries.[2]

Our contribution to this work is to recognize that economic growth involves structural changes in the economy which will, over time, change the composition of exports as a nation's comparative advantage and terms of trade shift to a different mix of exports and imports. The relative importance of internal and external sources of growth will change as part of this process and this will potentially change the relationship between export expansion and economic growth.

We use a country case study approach focusing on Malaysia, a country with one of the world's highest sustained growth rates over the past 3 decades. Malaysia's experience is particularly useful because: (1) like many developing countries with a colonial history, it has a long history of primary commodity trade; (2) government policy emphasis shifted

[1] See Michaely (1977), Balassa (1978), Tyler (1981), Feder (1982), Jung and Marshall (1985), Chow (1987), Hsiao (1987), and Bahmani-Oskooee and Alse (1993).

[2] See Kwan and Cotsomitis (1991), Serletis (1992), Henriques and Sadorsky (1996), and Doraisami (1996)

from one of import substitution during the first ten years following independence in 1957 to one which began to favor export expansion starting in 1971; and (3) three decades averaging 7.5 percent growth annually make Malaysia a country whose experience with exports and growth is worth careful study.

We wish to determine whether a relationship exists between exports and economic growth for Malaysia and, if it does, the extent to which this relationship is significantly affected by the commodity composition of trade. We investigate the export-led growth hypothesis for Malaysia by constructing a vector autoregression (VAR) in order to test for Granger (1969) causality between the exports and economic growth. We examine the causal relationship between aggregate exports and real income growth as well as the causal relationship between exports disaggregated into primary and manufacturing components and real income growth. We also seek to determine whether the change in policy emphasis and the subsequent rapid increase in the relative size of the manufacturing sector produced the same causal relationships for shorter sub-periods as for the entire post-independence period.

This paper is organized as follows. In the following section we provide a brief overview of exports in the Malaysian context. Section III reviews previous empirical studies which seek to determine the linkage between exports and growth. We then present the methodology, the data, and the results in section IV and our conclusions and policy implications are in section V.

II. Exports in the Malaysian Context

Malaysia, as a small economy, has always been trade oriented. This was the case in the colonial period, but it is equally true of the present. At independence in 1957 the Malaysian economy was heavily reliant on the so-called twin pillars of rubber and tin which together accounted for some 75 percent of export earnings. Exports generated almost half of national income. Manufacturing accounted for only 8 to 9 percent of national output, including processing of primary products, and employed about 10 percent of the labor force.

Malaysia pursued policies favoring import substitution during the 1960s gradually shifting to a more outward-oriented strategy in the 1970s as a way to move towards industrialization. The success of this policy shift has dramatically changed the commodity composition of Malaysian exports during the last two decades. Natural rubber and tin, have become relatively less significant over time. Even as late as 1970, these two commodities jointly contributed as much as 53 percent of the country export earnings; by 1996, their combined share had fallen to 2.1 percent. The decline in the relative importance of natural rubber and tin has been eclipsed by the emergence of other exports, especially manufactures, palm oil and petroleum products. From a total of Ringgit Malaysia (RM) 185 billion in gross exports in 1995, Malaysia exported RM 148 billion in manufactures, RM 10 billion in palm oil and another RM 10 billion in petroleum products.

Export-oriented industrialization was the vehicle for achieving the twin objectives—alleviation of poverty and restructuring of employment and the ownership of assets—of the New Economic Policy (NEP) launched in 1971. Although the foundation of an export-incentive policy had already been established in the 1968 Investment Incentive Act, export expansion became the central element in Malaysia's industrial development from 1970 onwards. In Malaysia, the promotion of manufactured exports takes place along two distinct lines. First, various incentive measures were introduced to stimulate domestic manufacturers to export part of their production and second, Export Processing Free Zones (EPFZs) were established to speed up exports more directly.

The principal export incentives available to domestic industries fall into four categories. First, an export allowance is given to companies that provides a deduction from taxable income. Second, an accelerated depreciation allowance is available to modernizing industries, which export at least 20 per cent of their production. Third, promotional expenses for exports are deductible from taxable income. Fourth, various export-financing facilities are in operation that provide domestic exporters with credit facilities at preferential rates of interest.

EPFZs were set up, starting in 1972, for industries producing exclusively for the export market and, most notably, to attract foreign investment. In addition to low-cost infrastructural facilities, industries located within an EPFZ enjoy the previously mentioned export incentives, minimum customs formalities and a complete free-trade regime.

The recession of 1980s revealed one of the inherent weaknesses in relying on primary commodity exports. Commodity prices tend to be very volatile and often move together in the same direction. Consequently, foreign exchange earnings also tend to fluctuate wildly. When Malaysia experienced negative growth for the first time in 1986--brought on by a collapse of commodity prices--the government responded by providing attractive incentives for promoting foreign investment emphasizing production of manufactured goods for export. These policies were in addition to a set of policy incentives, already in place, which focused on promoting export-led growth.

Consequently, we see a growing emphasis on exports coupled with a movement away from primary commodities and their products. This led to an increasing dependence on imports of capital goods and manufacturing inputs to support the growth of the manufacturing sector. A key implication of this change is the growing dependence of Malaysian exports on imports which had not been the case when Malaysia was exporting mostly primary commodities in the years prior to 1980. This increase in the interdependence of exports and imports is one of the key empirical results of our study. Before we look examine those results, we will first review previous empirical work which has sought to find evidence of the linkage between exports and economic growth.

III. Previous Empirical Studies

Early empirical studies of the export-led growth hypothesis by Emery (1967), Michaely (1977) and Balassa (1978) used a production function-type framework to test the hypothesis that export orientation raises total factor productivity (TFP) through its favorable effects on the efficiency of resource allocation, capacity utilization, and technological change. All of these studies included exports as an additional argument of the production function. Subsequently, Tyler (1981) used a sample of 55 middle income developing countries, including Malaysia, to show that export performance along with capital formation were significant determinants of inter-country differences in GDP growth rates. He also found that using the growth rate of manufactured exports yielded results similar to those obtained using the growth rate of total exports.

Feder (1982) used an alternative formulation of the export variable that basically, weights the export effect by its size in GNP. He also differentiates between productivity in the export and non-export sectors. Making estimates for broader as well as for narrower groups of semi-industrial countries for the 1964-73 period, Feder obtained results which show that "…marginal factor productivities are significantly higher in the export sector…." (p.59).

Kavoussi's (1984) analysis of low- and middle-income countries shows that export expansion is associated with economic performance and that one important cause of this association is the favorable impact of exports on TFP. Although export expansion does not appear to affect factor productivity in primary industry-oriented middle-income countries, growth rates of exports and GNP were positively correlated. His results indicate that if primary exports contribute to economic growth in more advanced developing countries, they do so mainly through the acceleration of the rate of capital formation.

Jung and Marshall (1985) and Dodaro (1993) question the validity of the empirical results that are based on regression models which implicitly or explicitly assume that the direction of causality runs from exports to growth. They argue that the reverse could be the case and they hypothesize that a growing economy will acquire and accumulate human and non-human capital as technology is transferred from abroad. This may ultimately give rise to unbalanced growth. That is, the domestic market is not large enough to absorb the output produced which forces producers to rely on exports. Both studies employ Granger causality tests and both find only weak evidence to support the export expansion hypothesis. Only four of the 37 countries in the Jung and Marshall study had causation running from exports to growth. Dodaro using a sample of 87 countries, also found weak support for the export expansion hypothesis. His results for Malaysia, however, indicated a significant export-led growth relationship, but even stronger support for the alternative hypothesis that GDP growth promoted export growth.

Bahmani-Oskooee and Alse (1993) point out that Granger causal inferences are invalid if the series used are cointegrated. Because earlier studies did not test for cointegration and did not establish that the economic time series were stationary, the results are

questionable. In addition, they argue, reliance on annual data may result in the absence of causation due to temporal aggregation. They use quarterly data from 1973 to 1988 and employ cointegration and error-correction modeling to test the export-led growth hypothesis. For their sample of nine countries—which includes 4 Southeast Asian countries including Malaysia--they find that there is a long-run positive relationship between real exports and real output in developing countries and that the growth of one is reinforced by the growth of the other. That is, there is bi-directional causality. They conclude that, "The most important policy implication of our finding is that any export promotion policy will contribute to economic growth in LCD's and visa versa…" (p.541)

A subsequent study by Jaleel and Harnhirun (1996) focused on ASEAN countries using a similar methodology but using annual data from 1966 to 1988. Their results find no support for the export-led growth hypothesis and, instead, support the conclusion that it is ""economic growth …[which] causes exports to grow in all member countries of ASEAN…." (p. s415). Dutt and Ghosh (1996), to their credit, try to sort out the mess. They use cointegration and a complete error correction model formulation of the causality test on annual data (1953-1991) for 26 low-, middle- and high-income countries. They argue that an annual time series—rather than quarterly or monthly data—is the appropriate unit for measuring the link between growth and exports. Their findings are mixed, with the results of a few countries supporting the export-led growth hypothesis, and others exhibiting growth-led exports, bi-directional causality and no causality. They conclude that the causality structure between growth and exports is economy specific and "…attempts at generalizations are inappropriate…" (p.178).

Most of the studies that have examined the export expansion hypothesis have employed a cross-country approach. Taking countries as a group assumes that these groups have some common characteristics. In reality, as Dutt and Ghosh have argued, individual characteristics of each country may result in substantial differences within the group.

A few studies have focused on Malaysia as an individual case study of the export-led growth hypothesis. Muzafar and Mohammed (1990) extrapolated quarterly data up to 1987 to examine the export-led growth hypothesis. With single equation technique, they found that export growth simulates GNP growth. Their findings support an export-led growth strategy. Doraisami (1996) studied Malaysian case over the period from 1963 to 1993, using a multivariate estimation methodology with annual data. Doraisami's findings provide strong support for a bi-directional relation between exports and national output and a positive long-run relationship between exports and growth.

More recently, Ghatak et. al. (1997) studied the export-led growth hypothesis for Malaysia for the period 1955 to 1990, using cointegration and causality testing with annual data based on Hsiao's synthesis of the Granger test. They examined the relationship between aggregate exports, disaggregated exports (manufacturing, fuel and non-fuel primary products), real GDP and non-export GDP. They found that aggregate exports Granger cause real GDP and non-export GDP. For the disaggregated exports, they found that manufactured exports contributed significantly to the existing exports and GDP compared with traditional (non-fuel primary) exports, In fact, they found a

significant negative causal relationship between traditional exports (non-fuel primary exports) and both GDP and non-export GDP.

These 3 sets of inconsistent results were due to application of different econometrics techniques and to the type of data used. Although Muzafar and Mohammed used quarterly data, their sample was only up to 1987, a period after which the composition of exports has changed tremendously following the collapse of primary commodity markets in 1986.

Economic growth is a dynamic process. Even if exports are the initial generator of growth, the development process will change relative factor scarcities, stimulate the emergence of new markets and ultimately modify the relationship between exports and growth. Our approach seeks to address the inconsistencies in the Malaysian empirical work and, at the same time, clarify aspects of the debate in the broader literature by examining the role of structural change on export-led growth hypothesis. To do so, we break the export variable to three categories; total, primary commodity, and manufactures exports to account for the effect of change of export composition on growth. We also employ a multivariate estimation methodology using quarterly rather than annual data. This gives us a larger set of observations and allows us to determine whether the absence of causality in some previous studies and the bi-directional relationship in the Doraisami study were due to temporal aggregation.

We also seek to account for structural change in the Malaysian economy over the period from 1965 to 1996 as Malaysia shifted from import-substitution policy to export expansion policy. During the export expansion phase, policy-makers chose to narrow the focus on certain commodity and industrial sectors. To examine the importance of this policy shift on Malaysia's economic growth; we narrow the focus to two subsamples: the first, from 1965:1Q to 1980:4Q and the second, from1981:1Q to 1996:4Q in addition to the full sample.

IV. Methodology and Empirical Results

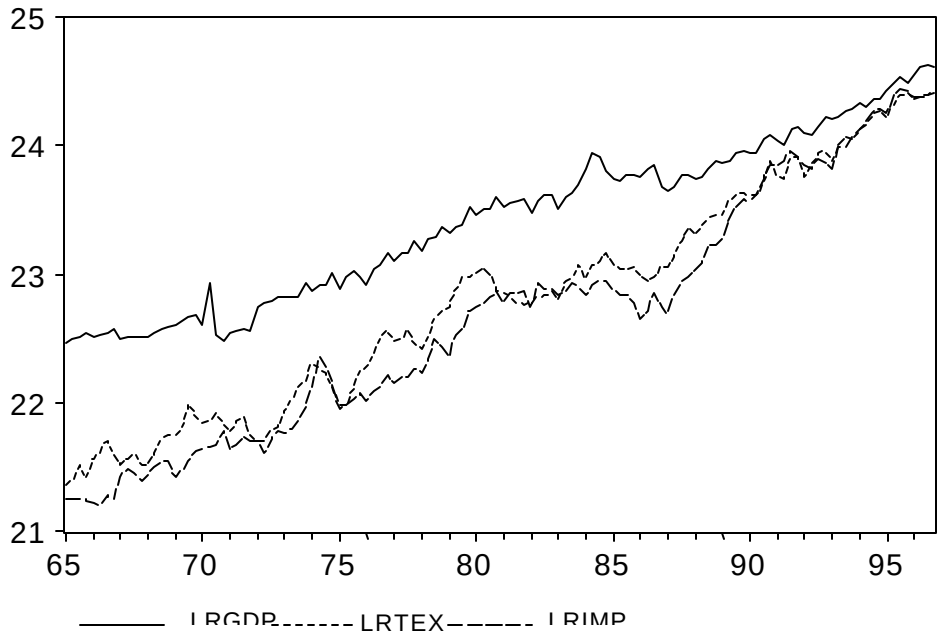
Our investigation of the relationships between Malaysian exports and economic performance variables begins with an examination of the integration properties of the data, undertaking a systems co-integrating analysis and examining Granger causality tests based on vector error-correction model. In order to check the stability of the GDP, exports and imports relationships, our analysis is performed over two subsamples in addition to the full sample. The first period, (1965:1Q- 1980:4Q), was chosen coincide with a time frame during which primary exports were dominant component of Malaysian exports. The second period, (1981:1Q -1996:4Q), is a period of heavy industrialization and a surge in manufactures exports.

The Data

The data are quarterly Malaysian series on real Gross Domestic Product (GDP), real exports, and real imports. Export data are broken down into two additional series—total

value of primary commodity exports, and the total value manufactures exports. Quarterly data on all variables are available from 1965:1Q to 1996:4Q. Data definitions and sources

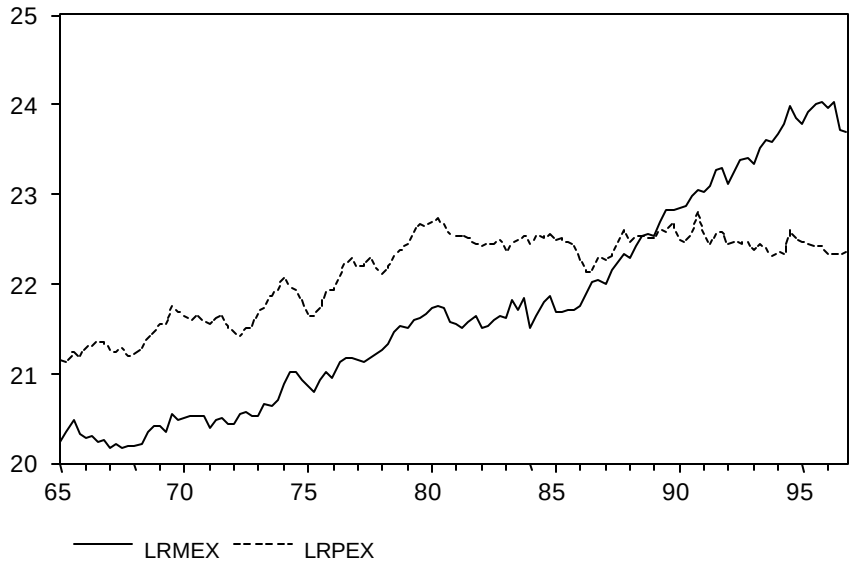
FIGURE 1: Plot of Malaysian quarterly GDP, Exports and Imports



are listed in the data appendix.

Plots of the key series are shown in figures 1 and 2. Figure 1, shows the three primary series. It shows a persistent upward movement in GDP throughout the 30-year period

FIGURE 2: Plot of quarterly Primary and Manufactures exports



with a brief interruption in 1971 and a period of a lower growth between 1984 and 1988. The export and import series trend upward but are much more volatile than the GDP

series. In the first half of the eighties, the growth in both imports and exports slows and then starts to move up again after 1987.

The two series do not track each other very closely prior to 1990 as Malaysia exported mostly primary commodities and imported consumer and capital goods. After 1990, they move in tandem reflecting the growing importance of the linkage between imported inputs for manufacturing and manufactures exports, which we expect to see, reflected in our subsequent empirical results.

We can see these shifts in trade composition in Figure 2 which compares the growth in real manufactures exports (LRMEX) and real primary commodity exports (LRPEX). The manufactures exports series exhibits an upward trend especially during the second half of the period after 1986 while the primary commodity series trends upward until 1980, but

flattens out and begins to decline thereafter. The primary commodity series also shows greater volatility reflecting possible linkage to world price fluctuations as well as possible effects of trade policy.

Integration Properties of the Data

We carry out a univariate analysis to investigate the stationarity properties for each of the five time series. We use the Augmented Dickey-Fuller (ADF) t-tests (Dickey and Fuller 1979) and Phillips and Perron (1988) $Z(t_\alpha)$ tests to test for the presence of a unit root for the individual time series and their first differences are shown in Table 1. The table is divided into 3 sections with the top section showing the full time period (1965 to 1995) and the middle and bottom sections showing the series for the 1965-80 and the 1981-1995 subperiods respectively. A lag length was selected for ADF tests to ensure that the residuals were white noise.

For each of the 3 time periods, we first consider the levels of the series of the five variables, namely, the natural logarithms of (a) real GDP (LRGDP), (b) real total exports (LRTEX), (c) real total imports (LRIMP), (d) real primary commodities exports (LRPEX), and (e) real manufactures exports (LRMEX). It is obvious from the ADF test that none of the variables represents a stationary process. The Phillips and Perron (PP) test is consistent with ADF test [3].

Next, we compute ADF and PP tests using the first difference of LRGDP, LRTEX, LRIMP, LRPEX, and LRMEX. These results indicate that all series for all 3 time periods are individually significant at the 1 percent level. As differencing once produces stationarity, we conclude that each of the series is integrated of order 1($I(1)$).

[3] The test for deterministic trend developed by Stock and Watson (1989) was conducted for all the five variables. All variables in level appear to have a time trend. For details see Campbell and Perron (1991).

Table 1. Unit Root tests

Test Statistic	LRGDP	LRTEX	LRIMP	LRPEX	LRMEX
		Panel A. ADF Tests and PP Tests			
		Variable t = 1965:1Q- 1996:4Q			
t_μ	0.53	-0.16	0.25	-1.98	0.29
$Z(t_\mu)$	0.18	-0.31	0.23	-2.06	0.35
		First Difference			
t_μ	-10.30***	-9.13***	-4.71***	-5.61***	-4.28***
$Z(t_\mu)$	-15.86***	-10.71***	-10.85***	-11.35***	-11.95***
		Panel B. ADF Tests and PP Tests			
		Variable t = 1965:1Q- 1980:4Q			
Test Statistic	**LRGDP**	**LRTEX**	**LRIMP**	**LRPEX**	**LRMEX**
t_μ	1.00	-0.58	0.51	0.12	0.16
$Z(t_\mu)$	2.24	-0.73	1.41	-0.72	0.08
		First Difference			
t_μ	-3.37***	-4.42***	-3.98***	-5.50***	-4.24***
$Z(t_\mu)$	-15.03***	-6.40***	-8.43***	-6.27***	-7.65***
		Panel C. ADF Tests and PP Tests			
		Variable t = 1981:1Q –1996:4Q			
Test Statistic	**LRGDP**	**LRTEX**	**LRIMP**	**LRPEX**	**LRMEX**
t_μ	0.71	-0.38	-0.22	-2.38	-0.31
$Z(t_\mu)$	0.74	1.46	0.51	-3.04	-0.06
		First Difference			
t_μ	-4.92***	-5.75***	4.20***	-3.84***	-6.95***
$Z(t_\mu)$	-7.68***	-10.67***	-8.00***	-13.11***	-10.68***

*** denotes that a test statistic is significant at the 1 per cent level of significance. The lag lengths in the ADF tests (t_μ) range from one to four, are chosen based on AIC and BIC criteria. The truncated lag for PP tests ($Z(t_\mu)$) was obtained based on a Newey-West adjustment with lag four, and the conclusions are robust for an adjustment with lags two to six.

Systems Cointegrating Analysis

We begin the analysis with a congruent statistical system of unrestricted reduced forms represented by equation (1)

$$y_t = m + \sum_{t=1}^{p} \prod_t y_{t-t} + e_t, , e_t \sim \mathrm{IN}(0, \Omega), , t = 1, ..., T, \qquad (1)$$

Where y_t is an (n×1) vector of I(1) and/or I(0) variables and m is an (n×1) vector of constants.

Letting $\Delta y_t = y_t - y_{t-1}$, a convenient reparameterization of (1) is given by:

$$\Delta y = m + \sum_{t-1}^{p-1} \bar{\prod}_t \Delta y_{t-t} + \bar{\prod} y_{t-p} + e_t \qquad (2)$$

where both $\bar{\prod}_t = \sum_{i=1}^{t} \prod_i - \mathrm{I}$ and $\bar{\prod} = \sum_{t=1}^{p} \prod_t - \mathrm{I}$ are of dimension n×n.

This is the VAR approach that Johansen (1988,1991) and Johansen and Juselius (1990) used to investigate the cointegrating properties of a system.

The lag length, p, must be chosen to ensure that the errors are white noise. Since ε_t is stationary, the rank, r, of the "long-run" matrix $\bar{\prod}$ determines how many linear combinations of y_t are stationary. If r = n, all y_t are stationary, while if r = 0 so that $\bar{\prod}$ = 0, Δy_t is stationary as are all linear combinations of $y_t \sim$ I(1). For 0< r< n there exist r co-integrating vectors, meaning r stationary linear combinations of y_t. If this is the case, $\bar{\prod}$ can be factored as $\alpha\beta'$, where both α and β are n×r matrices. The cointegrating vectors of β are the error correction mechanisms in the system, while α contains the adjustment parameters. This result is known as Granger's representation theorem (Engle and Granger, 1987). Johansen and Juselius (1990) provide a full maximum likelihood procedure for estimation and testing within this framework. The Johansen procedure was originally derived under the assumptions of normal errors and an optimal lag length, p, for the VAR shown in equation (2).

The co-integrating rank, *r*, can be formally tested with two statistics. The first is the maximum eigenvalue test. Denoting the estimated eigenvalues as $\hat{l}_i$, i =1,2,...,*n*, the maximum eigenvalue test is given by

$$l_{\max} = -\mathrm{T}In(1 - \hat{l}_{r+1}) \qquad (3)$$

where the appropriate null is $r = g$ co-integrating vectors against the alternative that $r \leq g+1$. The second statistic is the trace test and is computed as

$$Trace = -T \sum_{i=r+1}^{n} In(1 - \hat{l}_i) \qquad (4)$$

where the null is $r = g$ against the more general alternative $r \leq n$.

Information criteria such as Akaike's (1974) AIC and Schwarz's (1978) were applied to unrestricted VAR models in order to determine the appropriate order of the VAR. A VAR with lag length $p = 4$ demonstrated white-noise residuals. Consequently, a VAR with lag length $p = 4$ was chosen.

We use three different sample periods with two different combinations of variables to construct five unrestricted VAR models. Model 1, is a VAR for the entire period from 1965:1Q to 1996:4Q using the variables for growth, exports and imports (LRGDP, LRTEX and LRIMP respectively). Then we use the same variables for Model 2 and Model 3 for the periods 1965:1Q to 1980:4Q and 1981:1Q to 1996:4Q, respectively. This will allow us to compare the results for two subperiods to determine if there has been a change in the relationships between economic growth and trade for Malaysia. Models 4 and 5 are VAR models with a breakout of primary and manufacturing exports. Model 4 tests for the presence of relationships among the series for growth (LRGDP), primary exports (LRPEX) and manufactures exports (LRMEX) for the first half of the period (1965:1Q to 1980:4Q) and Model 5 tests for relationships for the same series for the second half of the time period (1981:1Q to1996:4Q).

We present the results of Johansen's tests for cointegration for the three sample periods with VAR lag length $p = 4$ in Table 2. The top panel of the table shows the results of the cointegration test for Model 1. Given that there are three variables in the model (n = 3), there can be a maximum of two cointegrating vectors, so that r could be equal to 0, 1, or 2. The values of the test statistics (λ_{max} and trace), however, indicate that the null hypothesis of no ($r = 0$) cointegrating vector can be rejected at the 5 percent level over the period 1965:1Q -1996:4Q. Further test results indicate that the null of $r = 1$ cannot be rejected. Consequently, Malaysian growth, exports and imports are co-integrated. The estimated normalised coefficient of this cointegrating relationship (the βs) are significantly different from zero for all the variables.

The values of the test statistics for Model 2 indicate that the null hypothesis of no cointegrating vectors (r=0) can be rejected at the 5 percent level over the first subperiod 1965:1Q-1980:4Q. Consequently, growth (LRGDP), exports (LRTEX) and imports (LRIMP) are cointegrated. The same result holds true in Model 3 which covers the second subperiod (1981:1Q to 1996:4Q).

For Model 4, shown in the middle panel of the table, both λ_{max} and trace test statistics indicate that a cointegration rank of one is present in the period 1965:1Q -1980:4Q. Therefore, growth, manufactures exports and primary exports areco-integrated. Also the estimated normalised coefficient of this cointegrating relationship (the βs) are significantly different from zero. For Model 5, in the bottom panel of the table, both λ_{max} and trace test statistics indicate that a cointegration rank of zero ($r = 0$) cannot be rejected at the 5 percent level over the period 1981:1Q -1996:4Q. This implies that LRGDP, LRMEX and LRPEX are not co-integrated. Hence growth, manufactures exports and primary exports have no tendency to move together in the long-run time frame for the most recent time period (1981:1Q to 1996:4Q).

Table 2 . Tests for cointegration using the Johansen procedure

Model 1: LRGDP = *f*(LRTEX, LRIMP) Sample period 1965:1Q 1996:4Q , p = 4[a]				
Eigenvalues:	0.1952		0.0853	0.0008
			---test statistics---	
Hypothesis[b]	r = 0		r ≤ 1	r ≤ 2
λ max test	26.710	*	10.966	0.0984
Trace test	37.795	**	11.082	0.1058
Cointegrating equation[c]:				
lrgdp = -1.543 lrtex + 0.746 lrimp - 5.142				
(-5.55) (2.909)				
Model 2: LRGDP = *f*(LRTEX, LRIMP) Sample period 1965:1Q 1980:4Q , p = 4				
eigenvalues:	0.353		0.129	0.050
			---test statistics---	
Hypothesis[b]	r = 0		r ≤ 1	r ≤ 2
λ max test	25.776	*	8.190	3.042
Trace test	37.009	**	11.233	3.042
Cointegrating equation[c]:				
lrgdp = -0.894 lrtex + -0.193 lrimp - 7.343				
(-6.63) (1.415)				
Model 3: LRGDP = *f*(LRTEX, LRIMP) Sample period 1981:1Q 1996:4Q , p = 4				
	0.268		0.145	0.0013
			---test statistics---	
Hypothesis[b]	r = 0		r ≤ 1	r ≤ 2
λ max test	19.969	*	10.054	0.0869
Trace test	30.111	**	10.141	0.0868
Cointegrating equation[c]:				
lrgdp = -0.945 lrtex + 0.317 lrimp - 9.145				
(-6.419) (2.44)				
Model 4: LRGDP = *f*(LRMEX, LRPEX) Sample period 1965:1Q 1980:4Q , p = 4				
eigenvalues:	0.3884		0.2457	0.0075
			---test statistics---	
Hypothesis[b]	r = 0		r ≤ 1	r ≤ 2
λ max test	29.008	*	16.635	0.4440
Trace test	46.098	**	17.087	0.4450
Cointegrating equation[c]:				
lrgdp = 0.847 lrmex - 1.721 lrpex - 2.964				
(1.15) (-2.052)				
Model 5: LRGDP = *f*(LRMEX, LRPEX) Sample period 1981:1Q 1996:4Q , p = 4				
eigenvalues:	0.2516		0.0990	0.0018
			---test statistics---	
Hypothesis[b]	r = 0		r ≤ 1	r ≤ 2
λ max test	18.548		6.672	0.1150
Trace test	25.339		6.789	0.1150

[a] The lag length *p* was chosen based on Akaike information criteria(AIC) and Schwarz information criteria(BIC). [b] r is the hypothesized number of cointegrating vectors. Critical values are taken from Table 1 of Osterwald-Lenum(1992) under the assumption that there is a linear trend in the data. [c] The coefficients of the co-integrating equation are βs, the estimated coefficients of the cointegrating vectors normalised on lrgdp level measures. Numbers in parentheses below βs are t- test statistics for H_0: $\beta_i = 0$.

**,* denote that a test statistics is significant at the 5 percent, and the 10 percent levels of significance, respectively.

These results suggest that a long-run relationship between GDP, exports and imports over the entire period (1965:1Q- 1996:4Q) and a long-run relationship between GDP, primary commodities exports and manufactures exports over the first subperiod (1965:1Q-1980:4Q) cannot be rejected in both cases. However, the absence of a long-run relationship between GDP, primary commodities exports and

manufactures exports in the recent period reflects a weakening influence of exports on Malaysian economic growth. Primary exports have a much smaller share of total exports in this period and therefore do not have a strong influence on national economic growth. Manufactures exports are large enough to affect growth but do not have a strong growth-stimulating effect because they depend heavily on imported inputs.

Granger Causality Tests

Economic theory is ambiguous on whether exports cause growth or are a result of growth. Analysis of the Granger causality structure of the variables will at least help establish what these relationships are and possibly how they have evolved over the past 30 years of rapid Malaysian economic development.

According to a theorem developed by Sims, Stock, and Watson (1990), such an analysis is simple if the variables are cointegrated, because the standard F-statistics for the hypothesis $\Pi_{ijt} = 0$, $\tau = 1,2,...., p$ in the level VAR have asymptotic F-distributions in spite of the fact that they are obtained within the framework of an I(1) system. For the purpose of analysing the Granger causality structure, we apply the regression shown in equation (2). If cointegration is detected, the relevant error-correction term (ECT) obtained from cointegrating regression must be included in the standard causality test to avoid the problem of misspecification.

Cointegration tests for Models 1, 2, 3 and 4 suggest a long-run relationship, but they do not indicate the direction of this relationship. We apply Granger causality tests to analyse the causality structure of the variables considered. The t-statistic on ECT and probability values for various F-statistics on the lagged independent variables are presented in Table 3. The t-statistics indicate the existence of long-run causality, while the significance of F-statistics indicate the presence of short-run causality.

Three sets of information are contained in Table 3—(1) the statistical significance of short-run causal relationships (F-statistics in columns 2-4), (2) the statistical significance of long-run causal relationships (t-statistics in parentheses in column 5), and (3) the rate of adjustment to deviations from the long-run equilibrium implied by the cointegrating equations contained in the estimated values of the ECT of the dependent variables. (column 5). We discuss the causal results for both the short run and long run relationships for each of the models first and then we will review and interpret the meaning of the rates of adjustment.

Causality Results

The t-statistics shown in parentheses in column 5 of Table 3 for Model 1 indicate that, for the entire study period from 1965 to 1996, total exports (LRTEX) were statistically significant (at the 1 percent level) long term cause of Malaysian economic growth (LRGDP). This provides strong evidence supporting the export-led growth hypothesis for Malaysia. The results also show a unidirectional long-run casual relationship running from total imports to GDP (statistically significant at 5 percent) which shows that imports were also a cause of growth. The short term relationships for Model 1, reflected in the F-statistics, show a strong two-way relationship between imports and exports as well as a two-way relationship between exports and growth. There is also a weak causal relationship from imports to growth. All together, the results for Model 1 indicate that the Malaysian economy is one with strong trade linkages in the short and long run and lends strong support for the export-led growth hypothesis.

When we test for the presence of these causal relationships in the two subperiods, we get a clearer picture of how these relationships have changed over time. The significance levels of the both the short and long run relationships for Model 2 (for the 1965- 1980) period are almost identical to the Model 1 results. The major exception is that imports are not a long run cause of economic growth. Model 3 (for 1981 - 1996), in contrast, shows a unidirectional long-run casual relationship running from GDP to exports and from total imports to GDP and both relationships are statistically significant at the 1 percent level. However, there is no significant causal relationship from exports to GDP. These findings supports the growth-driven export hypothesis over the 1980-1996 time frame and indicates imports also figure prominently in Malaysia's economic growth over the last 15 years. None of the short run causal relationships are significant for Model 3.

The results of the first three models show that, although the variables for Malaysia support the export-led growth hypothesis for the full period of 31 years, this relationship was strongest in the first half of the period. With economic growth and a shift in government policy emphasis toward development of manufacturing, the evidence for the last half of the period actually supports the alternative growth-led hypothesis. We also see an increased role for imports in the later period that shows up in the causal relationships for the full period.

Disaggregation of exports into primary and manufactures components adds another piece to the puzzle. Model 4, which tests for the causal relationships between primary and manufactures exports and economic growth for the 1965 -1980 period, shows that primary exports (LRPEX) were a statistically significant long run cause of economic growth (LRGDP). This indicates the important role that primary commodity exports played in promoting Malaysia's economic growth during this early period.

Table 3. Granger causality results based on Vector Error-Correction Model

Model 1: LRGDP = *f*(LRTEX, LRIMP) 1965:1Q- 1996:4Q (p = 4)

	F-statistics of Independent Variables[a]			
Dependent Variable	ΔLRGDP	ΔLRTEX	ΔLRIMP	
				ECT_{t-1}[b]
ΔLRGDP	--	0.025**	0.069*	-0.092
				(-1.677)
ΔLRTEX	0.043**	--	0.009***	0.156***
				(2.796)
ΔLRIMP	0.193	0.003***	--	-0.133**
				(-2.331)

Model 2: LRGDP = *f*(LRTEX, LRIMP) 1965:1Q- 1980:4Q (p = 4)

	F-statistics of Independent Variables[a]			
Dependent Variable	ΔLRGDP	ΔLRTEX	ΔLRIMP	
				ECT_{t-1}[b]
ΔLRGDP	--	0.010 **	0.003 **	0.178
				(-0.961)
ΔLRTEX	0.097 *	--	0.009 ***	0.708 ***
				(4.592)
ΔLRIMP	0.640	0.033 **	--	0.104
				(0.639)

Model 3: LRGDP = *f*(LRTEX, LRIMP) 1981:1Q- 1996:4Q (p = 4)

	F-statistics of Independent Variables[a]			
Dependent Variable	ΔLRGDP	ΔLRTEX	ΔLRIMP	
				ECT_{t-1}[b]
ΔLRGDP	--	0.73	0.176	-0.292 ***
				(-2.753)
ΔLRTEX	0.901	--	0.834	0.035
				(0.269)
ΔLRIMP	0.013	0.171	--	-0.383 ***
				(-2.584)

Model 4: LRGDP = *fLRMEX*, LRPEX) 1965:1Q- 1980:4Q (p = 4)

	F-statistics of Independent Variables[a]			
Dependent Variable	ΔLRGDP	ΔLRMEX	ΔLRPEX	
				ECT_{t-1}[b]
ΔLRGDP	--	0.311	0.046 **	0.014
				(0.178)
ΔLRMEX	0.726	--	0.862	0.058
				(0.065)
ΔLRPEX	0.271	0.822	--	0.388 ***
				(-2.331)

Model 5: LRGDP = f(LRMEX, LRPEX) 1981:1Q- 1996:4Q (p = 4)

	F-statistics of Independent Variables[a]			
Dependent Variable	ΔLRGDP	ΔLRMEX	ΔLRPEX	
				ECT_{t-1}[b]
ΔLRGDP	--	0.086 *	0.566	
ΔLRMEX	0.340	--	0.277	
ΔLRPEX	0.113	0.383	--	

[a] The F-statistics tests the joint significance of the lagged values of the independent variables. The figures show the significance level. [b] ECT_{t-1} denote the error-correction term. Numbers in parentheses below ECT_{t-1} are t-statistics for H_0: $\alpha_i = 0$. ECT_{t-1} is not included in the sample period(1981:1Q-1996:4Q) model because the null hypothesis of zero cointegrating vector is not rejected at the 5 percent critical value.

***, **, and * indicate that a test statistics is significant at the 1 percent, 5 percent, and 10 percent levels of significance, respectively.

Since the hypothesis of no cointegration was not rejected over the period 1981-1996, the Granger causality of the variables LRGDP, LRMEX, and LRPEX in Model 5 can only be analysed using the difference VAR (VAR in first differences). As Toda and Phillips (1993) show, if the process is not cointegrated, causality tests in difference VARs are asymptotically similar. Thus the results in Table 3 indicate that there is a short-run causal relationship running from manufactures exports to GDP which is significant at the 10 percent level. This lends support to the increasing role of short term changes in manufactures exports on growth during recent years and is consistent with the increasing share of manufactures exports in total exports during last decade. None of the other causal linkages in Model 5 are statistically significant.

Rates of Adjustment

Estimation of the vector error-correction (VEC) model generates estimates of the α which can be interpreted as the short term adjustment factor or as the proportion of the current disequilibrium that is reflected in the movement of the dependent variable in any one period. However, estimation of the VEC necessitates prior knowledge of the cointegrating parameters β. The estimates of β to be used in VEC are obtained from the normalised cointegrating vectors derived from the Johansen procedure (in table 2).

The αs in Table 3 are the estimated values of the ECT of the dependent variables which adjust to deviations from the cointegrating relationship. As noted above for Model 1, the coefficient of the ECT with total exports and total imports as dependent variables are statistically significant αs. Accordingly, the observed change in exports of 15.6 percent, reflects an adjustment in each period which is needed to correct for past deviations in exports from the level implied by the cointegrating relationship. The coefficient for imports has a similar interpretation. Because changes in exports and imports are a causes of changes in GDP, these α coefficients are an indication of how quickly economic growth responds to changes in trade.

In Model 2, the coefficient of the ECT with total exports as dependent variables are a statistically significant α which shows that 70 percent of the deviation of LRTEX from the long-run cointegrating equation equilibrium is corrected each period. This shows that economic growth in the early period was very responsive to changes exports. Much of this response for this period can be attributed to primary commodity exports as shown in the results for Model 4. For the later period (1981 to 1996) shown in Model 3, economic growth adjusts to the deviation of imports and the previous period's GDP and exports have no influence. This implies that Malaysia's shift away from dependence on primary commodities and concurrent development of an export-oriented manufacturing sector, actually reduced the dependence of the economy on exports while increasing its dependence on imports. This result is quite plausible given the high import content of many manufactured exports compared with primary commodities.

V. Conclusions and Policy Implications

The central objective of our study is to test empirically the export-led growth hypothesis for an economy undergoing major structural changes. We have analyzed the existence of this relationship using a cointegration framework. The results of the tests for cointegration indicate that: economic growth (LRGDP), total exports (LRTEX), and total imports (LRIMP) were cointegrated, implying that there exists a long-run (or steady-state) relationship between them.

The Granger causality results from the VEC analysis are summarized in a simplified form in Table 4 to allow us to highlight the key findings. The evidence from the VEC model suggests that the export-led growth hypothesis for the full period (Model 1) and for the 1965-80 period (Model 2) cannot be rejected. These are consistent with the findings of 3 previous studies by Muzafar and Mohammed (1990) and Doraisami (1996), and Ghatak et al. (1997). The results also support Bahmani-Oskooee and Alse's (1993) conclusions that export growth in developing countries will contribute to economic growth.

Table 4. Summary of Key VEC Analysis Results

Long/ short run	Variable	Causal Relation	Variable	ECT	Stat. Sig.†
	Model 1: 1965:Q1 to 1996:Q4 Aggregate Exports				
LR	Exp	→	GDP	.156	***
LR	Imp	→	GDP	.133	**
SR	Exp	«	IMP		***
SR	Exp	«	GDP		**
SR	Imp	→	GDP		*
	Model 2: 1965:Q1 to 1980:Q4 Aggregate Exports				
LR	Exp	→	GDP	.708	***
SR	Same relationships as Model 1				
	Model 3: 1981:Q1 to 1996:Q4 Aggregate Exports				
LR	GDP	→	Exp	-.282	***
LR	Imp.	→	GDP	-.383	***
	Model 4: 1965:Q1 to 1980:Q4 Disaggregated Exports				
LR	Pri. Exp	→	GDP	.388	***
SR	Pri. Exp	→	GDP		**
	Model 5: 1981:Q1 to 1996:Q4 Disaggregated Exports				
SR	Mfg. Ex	→	GDP		*

* SR= Short run; LR= Long run. † ***= .01%; **= .05%; *=.1%

For the 1981-96 period, however, we find that growth causes exports and imports cause growth showing that the relationship between exports, imports and growth have changed over the 30-year period. The Malaysian economy still has strong trade linkages, but, since 1981, imports rather than exports have become a source of growth. It is an apparent paradox that support for the export led growth hypothesis is weakest in the period when export expansion and the export orientation of Malaysian policy is the greatest. We will have more to say about this after we summarize the short run results and the findings for the other two models in Table 4.

The short run causal results for the first two models show considerable interaction among exports, imports and growth but, for the 1981-96 period (Model 3), there are no statistically significant short run relationships. This implies that the change in the mix of traded goods and services and the diversification of the economy have made short term changes in one of the 3 variables less likely to have an immediate effect the other two.

Analysis of the role of primary and manufactured exports for the two periods in models 4 and 5 reinforce the aggregate results. Primary exports have significant growth generating effects in the long and short run for the 1965-1980 period (Model 4). The results for period 1981 to 1996 indicate that manufactures exports, primary commodity exports and GDP are not cointegrated and, consequently, the hypothesis of long-run equilibrium relationship between them must be rejected. The short run results, however, show a positive relationship running from manufactures exports to GDP. Thus, our evidence suggests that as Malaysia broadened its export base to include a growing proportion of manufactures, there is a weakening of the export-led growth linkage.

These results differ in a number of significant ways from the Ghatak et. al.—the only other work which attempts to disaggregate the effect of exports on GDP for Malaysia. Ghatak et. al. show that the export-led growth for Malaysia was driven by exports of manufactures rather than by traditional (i.e., primary non-fuel) exports while our findings indicate the opposite for the 1965-80 period and only a weak short term influence of exports of manufactures on growth in the 1981-96 period. Although our definition of primary exports includes fuel, this is unlikely to be a sufficient explanation of the very different results. Also a factor, the Ghatak et. al. study covers an earlier time period (1955 to 1990) in Malaysia's economic development and uses annual data. Despite these difference, we still find the Ghatak et. al. result showing exports of manufactures to be a significant determinant of Malaysian economic growth up to 1990 to be counterintuitive, given the dominance of primary exports in Malaysia's trade until the mid-seventies. [4]

The explanation of our own somewhat paradoxical result, that show a weakening of support for the export-led growth after Malaysia shifted to an export-oriented development policy, lies with the structural changes associated with the industrialization of the Malaysian economy. Unlike primary commodity exports, for which value-added is derived primarily from domestic sources, Malaysian manufactures exports rely heavily on imported raw materials and equipment. As manufactures increase as a proportion of Malaysia's exports, the relationship between exports, imports and economic growth changes. This coupled with heavy public spending on infrastructure development—also dependent on imported machinery—likely accounts for the role of imports as a driver of Malaysia's economic growth which we find in the 1981-1995 period.

Export-driven development, as we have noted earlier, was only the vehicle for achieving the objectives set forth in the 1971 New Economic Policy of alleviating poverty and re-structuring employment national assets. Policies to expand and broaden the export base were accompanied with domestic measures to redistribute income through investment in

[4] Ghatak et. al. do not explain how they deal with the separation of Singapore from Malaysia in 1965. The importance of manufactures in economic growth may reflect the presence of Singapore in the first 10 years of their time series.

education, government land development schemes and infrastructure. These measures helped assure a broad-based participation in the nation's economic growth leading to the emergence of a wide array of indigenous service and manufacturing enterprises, a growing number of which are focused on the domestic market.

The Malaysian experience over the last 30 years is similar to Douglass North's description of a "successful economy", which

> …grows because the initial developments from the export industry lead to a widening of the export base and growth in the size of the domestic market. Growing demand in the domestic sector leads to an ever widening variety of residentiary industries…. In response to profitable opportunities in the economy, there is an inflow of labor and capital to augment the domestic increase. Changing factor proportions, along with the cost reducing consequences of social overhead investments and improved skills, training and knowledge that come from diversion of capital into investment in education, lead to a [further] broadening of the export base. [p.6-7]

Thus, the development process itself leads to a growing complexity and variety of economic activity that, in turn, changes the sources of a nation's economic growth. The weakening empirical support for the export-led growth hypothesis does not imply the failure of export-oriented policies. Instead, is entirely consistent with an increasingly diversified economy with rising incomes and expanding internally-generated sources of growth.

Our empirical results have not only given us insight into how the Malaysian trade-growth relationship has evolved but also help explain the inconsistent and, frequently, conflicting results found in the literature related to the export-led growth hypothesis. . The empirical tests for export-led growth may be effective in capturing the trade–growth interaction at early and intermediate stages of development, but as a nation's economic structure becomes more complex, causality tests on aggregate trade and growth variables will likely fail to fully capture these complicated interrelationships. Both cross-country studies which include country samples encompassing a wide range of levels of development as well as single country studies covering a long time period of economic growth may be inconclusive or misleading because they fail to account for differing (or changing) economic structures. Future empirical studies of the export-led growth hypothesis need to consider how to incorporate a broadening of the export base and a diversification of the economic structure into the measurement of trade-growth relationships.

Data Appendix

1. Total exports in million of current Malaysian Ringgit.
2. Primary commodity exports are in million of current Malaysian Ringgit and include: (i) Major agricultural commodities: Palm oil, Rubber, Saw logs, Sawn timber, and cocoa; and (ii) Major minerals: Crude oil, Natural gas, and Tin.

3. Manufactures exports are in million of current Malaysian Ringgit include: Electronics, electrical products, textile and footwear, manufactures metal, wood products, Transport equipment and chemicals.
4. GDP is in million of current Malaysian Ringgit.
   Annual data are available from 1965 through 1996. Source of data is the Department of Statistics Malaysia, and the National Bank of Malaysia (Bank Negara Malaysia). Quarterly GDP series will be extrapolated from annual using the method described by Tseng and Corker (1993). This method assumes that for every year, the fourth quarter of GDP is 25 percent of annual GDP for that year. Then by using the industrial production index, which is available on quarterly basis, the other three quarters of GDP can be obtained. This will be calculated as follows:
   (i) First quarter GDP for year t would be:

$$Q_{1t} = [\, IPX_{1t} / IPX_{4(t-1)}] \times Q_{4(t-1)}$$

   where IPX_{1t} = first quarter of industrial production index.
   $IPX_{4(t-1)}$ = fourth quarter (of the previous year) of industrial production index.
   $Q_{4(t-1)}$ = fourth quarter (of the previous year) of GDP.
   (ii) Second and third quarters:

$$Q_{2t} = [\, IPX_{2t} / IPX_{1t}] \times Q_{1t}$$

   and

$$Q_{3t} = [\, IPX_{3t} / IPX_{2t}] \times Q_{2t}$$

   where IPX_{2t} and IPX_{3t} are the second and third quarters, respectively.
5. All values in current Malaysian Ringgit are converted to real terms using the consumer price index (CPI, 1990 = 100).

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