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TIME SERIES ESTIMATION OF MALAYSIA'S EXPORT AND IMPORT DEMAND: A DYNAMIC OLS METHOD

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ABSTRACT

This paper examines the long-run relationship of export and import demand of Malaysia using time series analysis techniques that address the problem of non-stationarity. Specifically, the dynamic OLS method and the Johansen Maximum Likelihood are employed to estimate the price and income elasticities. The price and income elasticities for export demand are –0.35 and 0.20 respectively. While the price and income elasticities for import demand are –1.24 and 0.90 respectively. Obviously, the Marshall-Lerner conditions are easily met as the sum of the price elasticities of export and import demand is greater than one, suggesting that appreciations (depreciations) in exchange rates can worsen (improve) the current account in a period of one year.

ABSTRAK

Artikel ini mengkaji hubungan jangka panjang permintaan eksport dan import menggunakan analisis siri masa yang mengambil kira masalah ketidakpegunan. Secara spesifik kaedah OLS dan kaedah Johansen Maximum Likelihood digunakan untuk mengira keanjalan harga dan pendapatan. Keanjalan harga dan pendapatan untuk permintaan eksport ialah –0.35 dan 0.20 masing-masing. Sementara keanjalan harga dan pendapatan bagi permintaan import ialah –1.24 dan 0.90. Dengan jelas keadaan Marshall-Lerner dapat dipenuhi dengan mudah di mana jumlah keanjalan harga dan permintaan eksport dan import adalah lebih besar daripada satu, ini bermakna peningkatan nilai (penurunan nilai) kadar pertukaran akan memburukkan (memperbaiki) akaun semasa dalam tempoh satu tahun.

INTRODUCTION

The purpose of this paper is to estimate the price and income elasticities of Malaysia's demand for exports and imports. The cointegration analysis is used in which the dynamic OLS (DOLS) and the Johansen VAR model are employed. The role of elasticities is becoming increasingly important in dealing with the debt crisis in developing countries [Cline (1984), Dornbush et al. (1995)]. The effectiveness of a trade policy [1], is also dependent upon the size of the income and price elasticities in both exports and imports. With knowledge of these elasticities, an appropriate policy can be designed to respond to the problems faced by a country.

This study can be justified as follows: i) it differs from most of earlier studies, which used a static long run regression - the estimated parameters in the static long run OLS are subject to bias in small samples since lagged terms are ignored. This study uses a dynamic OLS to avoid this problem. ii) By adopting the cointegration method, the problem of spurious regression is avoided as variables involved in both export and import demand are non-stationary in their levels. Besides that, the maximum likelihood approach is also employed to confirm results obtained from the dynamic OLS method. iii) The findings of this study provide the empirical evidence for Malaysia that suggests that the exchange rate policy is effective to correct the trade balance deficit as the Marshall-Lerner condition is met.

LITERATURE REVIEW

The issue of price and income elasticities has been discussed by economists for many years, either theoretically or empirically. Among the leading authors on this issue are Prebisch (1950), Singer (1950), and Nurske (1959). All of them have stated that the price and income elasticities of export demand for the less developed countries (LDCs) are relatively small. On the other hand, others [Balassa (1971,1988), Bhagwati (1974, 1988), Khan (1974), Riedel (1984,1989)] have stated the irrelevance of this view as countries such as the newly industrialised economies (NIEs) have achieved great success due to the implementation of outward-oriented development strategies. These two different views can be explained by a shift in trade compositions i.e. from primary commodity to manufacturing goods.

Generally, the literature has provided a wide range of estimates for the elasticities value; the elasticities dispersion turns out to be important as it leads to uncertainty in the balance of payment prediction for the debt rescheduling agreement, and also to the ongoing development plan of developing countries.

Empirical studies by Bond (1985), Cline (1984), Goldstein and Khan (1982), Muscatelli (1994), Muscatelli, et al. (1995a), Marquez and McNeilly (1988), and

O'Neill and Ross (1991) have supported the conventional view, which states that the price elasticities of demand for the newly industrialised countries' (NICs) exports are small. However, the world income elasticity of demand for the NIC's exports is significant and high. On the other hand, others [Riedel (1984, 1988, 1989), Athukorala and Riedel (1996)] have criticised the conventional approach, and have found that income elasticities are insignificant and the price elasticities of export demand are infinite.[2]

ANALYTICAL METHODS AND DATA

Long-Run Export and Import Equations

$$\log Q_{xt}{}^{d} = a_0 + a_1 \log (Px/Pw)_t + a_2 \log Yw_t + a_3 \log Gci_t + ux_t \qquad (1)$$
$$a<0,\ a_2>0,\ a_3>0$$

$$\log Q_{mt}{}^{d} = b_0 + b_1 \log (Pm/GP)_t + b_2 \log Yb_t + vm_t \qquad (2)$$
$$b_1<0,\ b_2>0$$

Where;

Q_x	=	Export of goods
Px	=	Price of exports
Pw	=	Price of world exports
Yw	=	A scale variable
Gci	=	Export composition index
Q_m	=	Import of goods
Pm	=	Price of home country imports
GP	=	General price level
Yb.	=	Real income of home country
$u_x, v_m,$	=	Error terms

Following the same model that is frequently found in the literature, the quantity demanded is a function of relative price and income.[3] These are the two important independent variables in demand for export and import equations. The prices of exports and imports are assumed to be exogenous, which follows from the small country assumption. The simultaneity bias also disappears, as prices and the disturbance term, will no longer be correlated in the equation. The commonly used log linear functional form is employed instead of the linear one as it implies that the elasticities are constant.[4]

Equation (1) is the demand for exports, which is dependent upon the relative price of exports with respect to world price (Px/Pw), the scale variable (Yw) which captures world demand conditions and the export composition index (Gci).[5] Homogeneity in price is assumed to hold in the long run so that demand depends only on relative prices and the scale variable. The choice of scale variable may vary; some authors use (trade weighted) world income as a scale variable [Khan (1974), Goldstein and Khan (1978), Aspe and Giavazzi (1982), Marquez and Mc Neilly (1988)] while others, e.g. Muscatelli et al. (1995b), use trade weighted imports of the country's export destination as a scale variable. In this study, world income is used as a scale variable. The coefficients a_1 and a_2 are the price and income elasticities of foreign demand for home country exports and are expected to be negative and positive respectively.[6] The coefficient a_3 is expected to be positive.

Equation (2) is the import demand, which depends on the relative price of imports with respect to the general price level (Pm / GP), and the real income of the home country (Yb). The coefficients b_1 and b_2 are expected to be negative and positive respectively.[7]

The study uses annual data for the period of 1963-1995. The description and the computations of these variables are given in the Appendix.

INTEGRATION AND COINTEGRATION TESTS

The Dickey-Fuller (DF) and an Augmented Dickey-Fuller (ADF) test are used in this study to test for integration levels. These are both t tests and rely on rejecting the hypothesis that the series is a random walk in favour of stationarity. By using MICROFIT 4.0 version, data is tested to see whether all variables are non-stationary. The DF / ADF test for the unit roots for both export and import equations for Malaysia are shown in table 1.

The most widely used procedure is the Engle-Granger (EG) type of static long run regression. However, the estimated parameters in the static long run OLS are subject to bias in small samples since the lagged terms are ignored (see Banerjee et al.). One way to correct this problem is to include dynamic components (i.e. differences and lagged) to the cointegrating regression. [see, Phillips and Loretan (1991), Saikkonen (1991), Charemza and Deadman (1992), Cuthbertson et al. (1992)].

The dynamic OLS (DOLS) can be applied. The potential of simultaneity bias and small sample bias among regressors is dealt with the inclusion of lagged and leading values of the first differences of the I(1) variables [see Phillips and Loretan (1991) and Saikkonen(1991)]. The robust standard errors facilitate valid inference to be made upon the coefficients of the variables entering as regressors in levels.

Based on this model, the long run export demand and import demand equations are as follows;

Long-Run Export Demand

Z=(a0, a1, a2, a3), X=[1, (px/pw), (Yw), (Gci)]

$$Qx_t^d = z'x_t + \sum_{j=-m}^{j=m} \alpha_j \Delta(px/pw)_{t-j} + \sum_{j=-n}^{j=n} \beta_j \Delta Yw_{t-j} + \sum_{j=-p}^{j=p} \lambda_j \Delta Gci_{t-j} + ux_t$$

Long-Run Import Demand

Z=(b0, b1, b2,), X=[1, (pm/gp), (Yb)]

$$Qm_t^d = z'x_t + \sum_{j=-j}^{j=j} \delta_j \Delta(pm/gp)_{t-j} + \sum_{j=-k}^{j=k} \eta_j \Delta Yb_{t-j} + vm_t$$

Table 1
The DF / ADF Test for Unit Roots (Export and Import)

Variables	Levels		1st Differences	
	DF	ADF(1)	DF	ADF(1)
Q_x^d	-1.4475	-1.3313	-5.3404	-4.6957
Px/Pw	-1.8852	-2.3029	-4.5316	-4.9740
Yw	-3.0719	-3.1144	-6.1905	-4.9352
Gci	-2.2639	-1.9793	-6.2593	-8.5296
Q_m^d	-0.5268	-0.5636	-4.9922	-4.9714
Pm/Gp	-1.3794	-1.9296	-4.2710	-3.3686
Yb	-1.4940	-2.0916	-3.9630	-3.9443

Notes to table: All variables are in log.
Variables are as follows; total export index (Q_x^d), relative price (Px/Pw), a weighted (by the share of exports) average of the trade partners GDP (Yw) and export composition index (Gci). Variables are as follows; total import index (Q_m^d), relative price (Pm/Gp) and the real income (Yb). Critical value is –3.551. All econometric computations have been carried out by Microfit 4.0 Version [see Pesaran and Pesaran (1997)]. In most of the cases, the intercept terms are included in the relevant DF and ADF equations. An augmentation of one seems sufficient to secure lack of autocorrelation of the error terms, however, in some cases, no augmentation was necessary.

Since an investigation of the short run dynamics is also of interest in this analysis as a comparison to long-run estimations, and important for several other factors of modelling, the VECM is also employed in facilitating inferences regarding the short run.

As demonstrated by Engle and Granger (1987), once a number of variables are found to be cointegrated, there always exists a corresponding error-correction representation which implies that changes in the dependent variable are a function of the level of disequilibrium in the cointegrating relationship, which is captured by the error correction term, as well as changes in other explanatory variables.

The general vector error-correction for export demand with:

Z = (a0, a1, a2, a3); X = [1, (px/pw), (Yw), (Gci)]

$$\Delta Qx_t^{\,d} = \sum_{j=1}^{j=l}\phi_j\,\Delta Qx_{t-j}^{\,d} + \sum_{j=0}^{j=m}\alpha_j\,\Delta(px/pw)_{t-j} + \sum_{j=0}^{j=n}\beta_j\,\Delta(Yw)_{t-j} + \sum_{j=0}^{j=p}\lambda_j\,\Delta Gci_{t-j} + \sum_{j=1}^{r}ux_i\,(Qx_{t-1}^{\,d} - Z'X_{t-1}) + \varepsilon_j$$

And the general Vector error-correction for import demand with:

Z = (b0, b1, b2); X = [1, (pm/gp) (Yb)]

$$\Delta Qm_t^{\,d} = \sum_{j=1}^{j=l}\phi_j\,\Delta Qm_{t-j}^{\,d} + \sum_{j=0}^{j=j}\delta_j\,\Delta(Pm/gp)_{t-j} + \sum_{j=0}^{j=k}\pi_j\,\Delta Yb_{t-j} + \sum_{j=1}^{r}uv_i(Qm_{t-1}^{\,d} - Z'X_{t-1}) + \varepsilon_j$$

When the variables are cointegrated, then in the short term, deviations from this long-term equilibrium will feed back on the changes in the dependent variable in order to force the movement towards the long-term equilibrium. In other words if the dependent variable is driven directly by this long-term equilibrium error, then it is responding to this feedback. The short-term effect is reflected by the significance tests of the 'differenced' explanatory variables.

The second main method, due to Johansen (1988, 1991) and Johansen and Juselius (1990), is a system-based approach which enables one to determine the number of existing cointegrating relationships in the variables.

The Johansen (1991) method is the most widely used procedure for estimating multivariate cointegrating systems. Assume that the vector of variables Z has the following VAR representation;

$$Z_t = \sum_{i=1}^{k} A_i Z_{t-j} + \varepsilon_t$$

where Z_t consists all n variables of the model and e_t is a vector of random errors. This model can be reformulated into a vector error-correction (VECM) form as follows;

$$DZ_t = \sum_{i=1}^{k-1} G_i DZ_{t-i} + PZ_{t-k} + e_t$$

where $G_i = -(I - A_1 - .... - A_i)$ $(i= 1....,k-1)$
$P = -(I - A_1 - .... - A_k)$

Johansen (1988, 1991) based a test for cointegration on the rank of the P matrix. When the P matrix has a full rank equal to n, then it can be shown that **Z** must be stationary. If the rank of P is zero, then P is a null matrix and there is no cointegration. If the rank of P is equal to r<n then P can be written as the product of two matrices, a and b, i.e. P = ab in which the cointegrating space is defined by b and the adjustment factors are defined by a. This parameterization separates out the short run adjustment and long run equilibrium. The P matrix contains information on the long run relationship; P = ab where a is the speed of adjustment to disequilibrium, and b is a matrix of the long run coefficients.

The Johansen approach provides direct estimates of the cointegrating vectors and allows testing the numbers of cointegrating vectors. In a VAR model explaining N variables there can be at most r = N-1 cointegrating vectors. Generally, the statistical properties of the Johansen approach are much better and the cointegrating test is of high power compared to the Engle-Granger method.

In practice, the Johansen approach also has a few disadvantages. First, if the sample size is small, the estimates obtained for cointegrating vector b may not be well determined. Second, if the cointegrating vector is not a unique one, there will be an identification problem and it may be difficult to disentangle economically meaningful cointegrating vectors. As a consequence, a strategy is to use both approaches and to compare the results.

ESTIMATION AND RESULTS

Since the time series data is used, the issue of nonstationarity can be a major problem for the empirical econometrics analysis where most macroeconomic time series are subject to some type of trend. As can be seen in table 1, none of the calculated values are less than the critical values. All variables are I(1) in levels but stationary in first differences. Since all variables in export and import demand equations are integrated of order one, we can proceed with the estimation for the long run relationship.

The OLS Residual-Based Test

Table 2 reports the ADF residual based test results for cointegration for the export demand equations. Charemza and Deadman (1992)- Table 2, provide approximate critical values for the cointegration test for 30 observations with m=3 at 5% level of significance which are -3.71 (lower bound) and –3.50 (upper bound). Specifically, one would reject the null hypothesis of no cointegration if the value were below –3.71; and would not reject the null if the value were above –3.50. Values between –3.71 and –3.50 lie in the inconclusive region. Therefore, based on the test statistics, the null hypothesis of no cointegration for the corresponding residual obtained from the long run export demand equation can be rejected at 5% level of significance.

Table 2
ADF Residual-based Test for Cointegration The Long-Run Export and Import Equations.

	Test Statistics		Critical Values			
	DF	ADF(1)	5%		10%	
			U	L	U	L
Exports*	-4.24	-4.33	-3.50	-3.71	-3.16	-3.33
Imports**	-2.99	-3.69	-3.15	-3.31	-2.80	-2.96

Notes to table:
*The critical values are obtained from Charemza and Deadman (1992) with 30 numbers of observation and m=3. **The critical values are obtained from Charemza and Deadman (1992) with 30 numbers of observation and m=2. One also can refer to other sources of critical value tables i.e. MacKinnon (1991), Engle & Granger (1987, Table II and III), Engle and Yoo (1987).

For the import demand equation, one can reject the null hypothesis of no cointegration at 5% level of significance. Accordingly, all variables involved in the equations are cointegrated, or, in short, the long run relationships among variables are not spurious. This is shown in Table 2.

The CRDW is used to see whether all the variables are cointegrated. Engle and Yoo, provide a CRDW critical value for n=50; the two variables case is 0.78 at 5 percent level of significance and 0.69 at 10 percent level of significance.[8] By looking at the CRDW test statistics, the value of CRDW for Malaysia's export demand is 1.42, which is larger than the 5% critical values and therefore the null of no cointegration is rejected.

The DOLS

The dynamic OLS parameter estimates of the long-run export demand with all variables in levels, along with their approximate asymptotic standard errors are presented in Table 3. Based on the results obtained, both the long run income and price elasticities have correct signs as anticipated. The long run price and income elasticities are –0.35 and 0.21 respectively. The coefficient for the export composition index is 1.69.

Table 3
The DOLS Export and Import Demand Equations (Long Run)

	Px/Pw	Yw	Gci	Ser	R^2
Exports	-0.35	0.21	1.69	0.05	0.99
	(0.0646)	(0.0621)	(0.1715)		
	Pm/Gp	**Yb**		**Ser**	**R^2**
Imports	-1.24	0.90	-	0.24	0.93
	(0.858)	(0.1169)	-		

The price and income elasticities in the import demand equations are correctly signed and are significant. The long run price and income elasticities are –1.24 and 0.90 respectively. Result for import demand equation that shows the correct sign for both the income and price elasticities can be seen in table 3.

The Short Run Elasticities (ECM)

The vector error-correction model estimates the short-run parameters. As can be seen from table 4, (for both exports and imports equations), the coefficients appear to have the predicted signs and for most cases they are statistically significant. Based on the results, several points can be made. First, the statistical significance and magnitude of the error correction term indicating that the relative price, income and export composition index do, as a component of the long-run cointegrating relationship through the lagged error correction term, jointly influence export demand over the long-term. Second, the error correction term is significant with an adjustment coefficient of –0.53839 (i.e. Export demand), indicating that in the case we are off the long-run demand curve, overall demand adjusts to its long-run equilibrium level with about 53.8% of the adjustment taking place within the first year.

The sign of the error correction term coefficient indicates that changes in the demand adjust in an opposite direction to the previous period's deviation from equilibrium. If the error correction term is not significant, this implies that in this estimated model, any short-run adjustment to long-term equilibrium is primarily through the other variables in the system and not through the channel of export demand. The error correction model estimates provide a quantitative assessment of the short-run price and income elasticity of export and import demand.

The diagnostic tests for both export and import demand for all countries are also acceptable. For example, the p-value for the LM-F test of the null of no autocorrelation for Malaysia's export demand is 0.62; therefore we do not reject the null of no autocorrelation. There is also no evidence of non-normality or functional misspecification.

Table 4
The Short-run Estimated Export and Import Demand (ECM)

Export

$$\Delta lQx_t^d = 0.014 - \underset{(0.0883)}{0.1735}\Delta(lpx/lpw)_t + \underset{(0.1579)}{0.329}\Delta lyw_t - \underset{(0.1949)}{0.1803}\Delta lGci_t + \underset{(0.1344)}{0.181}\Delta lQx_{t-1}^d$$

$$-\underset{(0.1165)}{0.538}U_{t-1} + \varepsilon_t$$

R^2	= 0.71		
S. E of Regression	= 0.06		
DW- Statistic	= 2.03		
F stat (5,25)	= 12.23		
LM- F (1,24)	= 0.246 (0.62)	RESET –F (1,24)	= 0.229(0.64)
Normality CH-SQ(2)	= 1.973 (0.37)	Heteroscedasticity F-(1,29)	= 0.003(0.96)

Import

$$\Delta lQm_t^d = -3.744 - \underset{(0.599)}{1.219}\Delta(lpm/lgp)_t + \underset{(0.356)}{1.188}\Delta lyb_t + \underset{(0.178)}{0.454}\Delta lQm^d_{t-1} - \underset{(0.1894)}{0.750}U_{t-1} + \varepsilon_t$$

R^2	= 0.48		
S. E of Regression	= 0.18		
DW- Statistic	= 2.14		
F stat (4,25)	= 5.77		
LM- F (1,24)	= 1.35 (0.26)	RESET –F (1,24)	= 1.53 (0.23)
Normality CH-SQ(2)	= 31.72	Heteroscedasticity F-(1,28)	= 0.20 (0.66)

Further evidence on cointegration is found by applying the Johansen Maximum Likelihood approach. Information from the unrestricted VAR model in Microfit 4 was used to determine the order of the VAR. The Schwarz Bayesian Criterion (SBC), and the Akaike Information Criterion (AIC) were used to determine the optimal lag length which is k = 2. The log-likelihood ratio statistics were then used for testing zero restrictions on the coefficients of a subset of deterministic/exogenous variable; the presence of an intercept could not be rejected.

The results of the Johansen-Juselius cointegration tests for both exports and imports are shown in Table 5. The trace statistics and the eigenvalue (maximum) test show that there exists only one cointegrating relationship.

The Johansen likelihood ratio statistics were used to determine the number of cointegrating vectors r. Both the maximal eigenvalue and the trace tests were used, testing the null hypothesis of r cointegrating vectors for $r = 0$, followed by $r \leq 1$ and $r \leq 2$.

Table 5
The Johansen Maximum Likelihood
Cointegration Test – Exports and Imports

EXPORTS: Cointegration with Unrestricted Intercepts and No Trends in the VAR (k=2)

Eigenvalue	λ_{max}	λ_{Trace}	$H_0 = r$	$H_A = P\text{-}r$	Critical Value	
					95% L-max	95% trace
0.70729	39.31401	55.1817	0	1	27.42	48.80
0.26291	9.7613	15.8678	1	2	21.12	31.54
0.15325	5.3231	6.1064	2	3	14.88	17.86
0.0241842	0.78339	0.78339	3	4	8.07	8.07

IMPORTS: Cointegration with Unrestricted Intercepts and No Trends in the VAR (k=2)

Eigenvalue	λ_{max}	λ_{Trace}	$H_0 = r$	$H_A = P\text{-}r$	Critical Value	
					90% L-max	90% trace
0.51084	22.17	27.83	0	1	19.02	28.78
0.15299	5.14	5.67	1	2	12.98	15.75
0.016594	0.52	0.52	2	3	6.5	6.5

For the export demand equation, the maximal eigenvalue test (l-max test) indicates that the null hypothesis of zero cointegrating vectors is rejected at 95% critical value. [See Pesaran and Pesaran, Microfit 4 (1997)]. The trace test confirms that there is only one cointegrating relationship among the variables. However, based on the choice of the number of cointegrating relations using model selection criteria, both the Akaike Information Criteria (AIC) and the Hannan-Quinn Criteria (HQC) select one cointegrating relationship. For the import demand equation, the maximal eigenvalue test and the trace test, indicate that the null hypothesis of zero cointegrating vectors is rejected at 90% critical value.

The price and income elasticities of export demand are all correctly signed. The long run price and income elasticities are –0.35 and 0.20 respectively. They are both statistically significant. The export composition index also has the predicted sign and is also significant with the value of 1.71. A restriction is imposed on the export composition index (GCI) that a4 = 0, obviously, the x^2 is statistically significant, and therefore the null hypothesis of no relationship between the export demand and the export composition index is rejected.

For the import demand equations, the price and income elasticities are correctly signed and significant (see table 6). These results suggest that both relative price and real income are crucial in determining import demand.

The Johansen results for both exports and imports are sufficiently close to the DOLS results. Results for both methods are shown in table 6. Previous empirical studies on exports demand supported the conventional view, which states that the price elasticities of exports demand are small. Results from both the DOLS and Johansen are in line with this conventional view. The low price and income elasticities of exports demand can be explained by the aggregate data used in this study.

Table 6
Results for DOLS Method and the Johansen VAR Approach

Country	Variables	Exports		Variables	Imports	
		DOLS	Johansen		DOLS	Johansen
Malaysia						
	(px/pw)	-0.35	-0.35	(pm/gp)	-1.24	-2.19
		(0.0646)	(0.056)		(0.858)	(0.734)
	Yw	0.21	0.20	Yb	0.90	1.02
		(0.0621)	(0.053)		(0.1169)	(0.096)
	Gci	1.69	1.70			
		(0.1715)	(0.1473)			

SUMMARY AND POLICY IMPLICATIONS

Based on the analysis, one can observe the existence of cointegration among variables for both export and import demand. The results for export and import demand are reasonably good and both the price and income elasticity of export and import demand, have correct signs as anticipated. The inclusion of the export composition index in the export demand equation lowers the value of the price elasticity. The commodity type effects are implicitly captured by the income and price effects if they are not included in the equation. However, non-price competition such as quality and marketing strategy should also be included in the export demand model to give accurate estimations. Meanwhile, the inelasticity of export demand is expected, as the bulk of the country's exports are in the form of strategic raw materials used for industrial purposes. In other words, the income elasticity, which is less than one, can be explained by the aggregate data used in this study, i.e. the inclusion of data on agricultural goods and food. The price elasticity differs across the commodity group where the price elasticity of manufactured goods is higher than that of agricultural products. Similarly, it applies to the income elasticity of demand.

Based on the results obtained, two important implications for policy considerations can be drawn. Firstly, foreign income is a significant variable in the export demand equation, suggesting that foreign disturbance in the form of fluctuation in foreign economic activities is likely to be transmitted to Malaysia. Secondly, the Marshall-Lerner conditions are met. For example, the estimates obtained are –0.35 and –1.24 for the price elasticities of export and import demand respectively. The sum of these is –1.59, therefore the Marshall-Lerner conditions are satisfied easily, suggesting that appreciations (depreciations) in exchange rates can worsen (improve) the current account in a period of one year.

APPENDIX

The Computation of the Variables of Export and Import Demand

All data required for the estimation were gathered and verified from various issues of the International Financial Statistics, and the World Tables of the World Bank. The trade share statistics used to compute the foreign variable were taken from the United Nations Yearbook of International Trade Statistics. The data is defined as below, and they are in the indexes of the base year 1990. All data is expressed in US dollar.

Qx = Index of the volume of exports (1990=100) calculated by using the following formula:

Qx = EXUS / Px

Where EXUS and Px are exports in US dollars and export price index in US dollar term respectively.

Qm = Index of the volume of imports (1990=100) calculated by using the following formula;

Qm = IMUS / Pm

Where IMUS and Pm are imports in US dollars and import price index in US dollar term respectively.

Pw = index of the world export price (1990=100) calculated by using the method of Houthakker and Stephen (1969) and Goldstein and Khan (1978).

where;

$$PW_j = \sum^{i} a_{ji} PMX_i$$

$$\sum_{i} a_{ji} = 1;\ i = 1,\ldots\ldots\ldots,5$$

Each country's export partners are; Japan, the US, UK, Germany, and Netherland. a_{ji} is the weight of market i in exporter j's (i.e. Malaysia) exports to five main export markets. PMx is the US dollar based import price index in export market i (1990=100).

Yw = the trade-weighted 'world' real income, calculated as a weighted average of real incomes of five major export partners of each country. Express as an index (1990=100) facing the country.

$$YW_j = \sum^{i} a_{ji} Y_i$$

$$\sum_{i} a_{ji} = 1;\ (i = 1,\ldots\ldots\ldots,5)$$

(Same as defined earlier)

GCI = The export composition index

The index is constructed as follows. The exports good is divided into four groups ($C_1,\ldots C_4$).

C = Total exports of agricultural products and crude material.

C_2 = Total exports of traditional manufacturing sectors .

C_3 = Total exports of scale intensive sectors.

C_4 = Total exports of specialised supply and science based sectors.

Following Muscatelli et al. (1995b) the export composition indexes is constructed using the formula below. The index GCI lies over interval (0,1). The weights chosen are a_1=0, a_2=0.33, a_3=0.67, a_4=1, over the interval (0,1).

$$GCI_t = \frac{\sum_{i=1}^{4} a_i c_{it}}{\sum_{i=1}^{4} c_{it}}$$

ENDNOTES

1. For defining and measuring trade strategy see Liang (1992) and the references therein.

2. Based on their study on Hong Kong's total exports of manufactures and South Korea's exports of machinery.

3. For a detailed description of the variables and data sources, see Appendix.

4. For choices of functional form (i.e. linear vs. log-linear) see Khan and Ross (1976) and Boylan et al. (1980).

5. The world price and income indices facing a country, are calculated using a similar method to that used by Houthakker and Stephen(1969) and Goldstein and Khan (1978). Further details see Appendix.

6. These signs are expected according to economic theory. The higher the price of a country's exports relative to other countries, *ceteris paribus*, the smaller the demand for the country's exports. The higher the level of foreign income, *ceteris paribus*, the larger the foreign demand for the country's exports.

7. Similarly, these signs are expected based on economic theory. The higher the import price relative to the domestic price, *ceteris paribus*, the smaller the demand for imports. The higher the real income of the country, the higher the demand for imports.

8. One can also see Engle & Granger (1987) - CRDW critical values for n=100, the two variable case.

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