CHAPTER 5

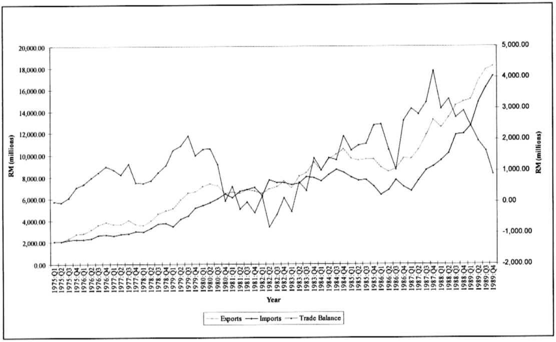
THE IMPACT OF THE US DOLLAR ON MALAYSIAN TRADE BALANCE

5.0 Overview of the Malaysian Trade Sector: 1975 – 2003

This section provides an overview of Malaysia's trade performance from 1970s until now. Malaysia's major trading partners include the Unites States, ASEAN and Europe. Singapore was Malaysia's leading trade partner followed by the United States and Japan. Malaysia's major export earnings were mainly from agricultural exports but since 1980s, the manufacturing sector became the leading contributor for export earnings. Figure 5.1 shows Malaysia's trade performances from 1975:1 until 1989:4. In 1970s, Malaysia's external trade was adversely affected by uncertainties in the world economic environment especially when Malaysia's trade balance declined in 1974 and 1975. However, in 1976, the economy recovered with an increase in exports although import growth was still moderate. Hence, trade balance improved quite significantly from 1978:1 to 1980:2.

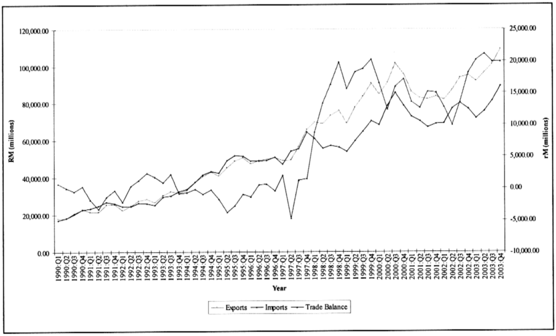
From 1980:3, Malaysia's net exports declined due to slower economic growth in major industrialised countries, which led to continuous trade deficits in 1981 and 1982. "Thus, following two years of deficits amounting to $29million and $1,199 million in 1981 and 1982 respectively, the merchandise account turned around to record a surplus of $1,631 million in 1983" (BNM 1983: 124). Malaysia's trade balance continued to grow in 1984 as exports responded strongly to improving economic conditions in major trading countries. However, after two years of growth, Malaysian exports declined quite substantially in 1985 and 1986 due to weak commodity prices.

Figure 5.1. Malaysia: Trade Performance, 1975:1 -1989:4



Source: Bank Negara Malaysia (various issues)

Figure 5.2. Malaysia: Trade Performance, 1990:1 -2003:4



Source: Bank Negara Malaysia (various issues)

Declining external demand, economic slowdown in major industrialised countries and excess global supplies of agricultural commodities were the major causes of weak commodity prices. Thus, in 1986, the manufacturing sector became the leading contributor to export earnings as exports of agricultural commodities declined. From 1987 until 1989, the growth of export and import sector increased as commodity prices improved and the aggregate demand from major industrialised countries increased.

But the expansion of the manufacturing sector led to increased imports of intermediate goods. Thus, higher growth in the import sector and a decline in external demand for exports led to a drop in merchandise surplus in late 1989. Although, Singapore, United States and Japan remained as Malaysia's major trade markets, the trade volume to these countries also declined. Malaysia suffered trade deficits from 1990:3 to 1992:1 as export growth was moderate in the early 1990s and imports continued to increase (Figure 5.2) .

Although economic growth in major industrial countries was still slow, total exports increased in 1993. But in 1994 and 1995, strong export and import growth led to a decline in trade balance. Malaysia once again suffered trade deficits from 1994:4 to 1996:1. In 1994, US became Malaysia's leading trade partner displacing Singapore for the first time since 1970s. However, in 1996, export growth began to slowdown due to a decline in both manufactured and agricultural exports. The decline in manufactured and agricultural exports was probably due to loss of export competitiveness and declining economic growth in the United States. Thus, Singapore became Malaysia's leading trade partner once more. However, Malaysia's trade balance continued to decline until the second quarter of 1997.

The 1997 financial crisis initially led to a decline in economic growth but the depreciation of the ringgit had some positive impact on Malaysia's trade. There was stronger growth in both the export and import sector and in the following three years, the performance of the trade account exceeded all expectations despite the recession. In 1998, the United States replaced Singapore's position as Malaysia's leading buyer and in 1999, trade surplus increased to RM 72.3 billion as "increased demand from industrialised countries and economic recovery in the region led to strong growth in manufactured exports. Total exports in US dollar terms registered an annual growth of 17.6 per cent to US$71.5 billion which exceeded export earnings recorded in the years before the Asian crisis" (BNM. 1999:43). In 2001, Malaysia's trade balance declined but improved in 2002 and 2003 due to higher manufactured exports (84.3 per cent and 82 per cent of gross exports in 2002 and 2003 respectively) although the export share to major trading countries were lower due to loss of export competitiveness.

5.1 Methodology

The primary objective of this analysis is to evaluate the impact of the RM/US$ bilateral exchange rate on Malaysia's trade. Thus, in this chapter, we would estimate both the export and import demand function for the period of 1975:1 to 2003:4 using the cointegration and error-correction method to analyse whether the US dollar has significant impact on Malaysia's trade performances.

5.1.1 Explanation of Variables

a. *Exports and Imports*

Malaysia's quarterly *Real Exports* and *Imports* are used in this analysis. The data for nominal exports and imports were collected from various issues of Bank Negara's Quarterly Bulletin and were deflated with Consumer Price Index (1995 base period) in order to obtain *Real Exports and Imports*. The Consumer Price Indices were collected from various issues of Bank Negara Quarterly Bulletin.

b. *Real Effective Exchange Rates*

The *Real Effective Exchange Rates* computed in the previous chapter are used in this analysis. An appreciation of the *Real Effective Exchange Rates* would lead to expensive exports in the world market and cheaper imports. A depreciation would increase price competitiveness and thus domestic exports would be cheaper in the world market.

c. *Domestic Income*

The *Index of Industrial Production* is used as a proxy for domestic income as quarterly data for real Gross Domestic Product are not available. *Index of Industrial Production* reflects the level of economic activity in the country and thus would have similar impact on Malaysia's trade as real GDP. The data for *Index of Industrial Production* were collected from International Financial Statistics website with 1995 base period.

d. *Foreign Income*

The *Index of Industrial Production* for major industrialised countries is used as a proxy for foreign income. The data for the *Index of Industrial Production* were also obtained from the International Financial Statistics website with 1995 base period.

5.1.2 **Model Specification**

Based on economic theory, the long run export and import demand functions are as given below:

a. *Export Demand Function*

The export demand function is given by equation 5.1:

$$\ln X_t = \alpha_0 + \alpha_1 \ln REER_t + \alpha_2 \ln FY_t + \epsilon_t \tag{5.1}$$

where (1) X – Real Exports at time *t*
(2) $REER_T$ – Real Effective Exchange Rates at time *t*
(3) FY – Foreign Income at time *t*
(4) ϵ – Error Term

The expected relationships between the dependent and explanatory variables are based on underlying economic theory. When the real effective exchange rate (REER) increases (depreciation) holding foreign income (FY) constant, real exports (X) would increase and thus they are positively related. The relationship between foreign income and exports is quite ambiguous. If an increase in foreign income increases exports, then the variables have a positive relationship. But if foreign countries are producing more import substitute goods, then the demand for Malaysian goods will decline resulting a negative relationship between the two variables (Bahmani-Oskooee 2001). A seasonal dummy variable reflecting a shift in the exchange rate regime: 0- 1975:1 to 1998:2 and 1- 1998:3 to 2003:4 is included in the export demand function.

b. *Import Demand Function*

The import demand function is given by equation (5.2):

$$\ln M_t = \beta_0 + \beta_1 \ln REER_t + \beta_2 \ln Y_t + \epsilon_t \qquad (5.2)$$

where (1) M – Real Imports at time *t*
(2) REER – Real Effective Exchange Rates at time *t*
(3) Y – Index of Industrial Production at time *t*

As before, the expected relationships between the dependent and explanatory variables are based on underlying economic theory. When the real effective exchange rates increase (depreciation) holding domestic income (Y) constant, real imports (M) would decrease and thus are negatively related.

However, the relationship between real imports and domestic income is not very clear. As theory implies, if growing economy imports more, then real imports and domestic income are positively related. But if domestic income increases by producing more import substitute goods, then the relationship would be negative (Bahmani-Oskooee 2001). As in the export demand function, a seasonal dummy variable reflecting a shift in the exchange rate regime: 0- 1975:1 to 1998:2 and 1- 1998:3 to 2003:4 is also included in the import demand function.

5.1.3 **Tests for Stationarity**

"A necessary but not sufficient condition for cointegration is that each variable in a particular model should be integrated of the same order (more than zero) or should contain a deterministic trend" (Masih and Masih 2004). Thus, the *Augmented Dickey-Fuller Test (ADF)* is used to determine the degree of integration of each variable used in this analysis. The test is based on the null hypothesis that a unit root exists in the time series. Enders (1995: 227) emphasised that for quarterly data analysis, it would best to begin the analysis with a lag length of 12 as it is assumed that 3 years is sufficiently long to capture the system's dynamics.

The ADF Test for each variable (with trend and without trend) was conducted using E-views 4.1 and the lag length for each variable were selected based on the Akaike Information Criterion (AIC)[17] with maximum lag length of 12. The null hypothesis for the ADF test is that the time series has a unit root and the critical values are based on the McKinnon (1996) one-sided p-values. The ADF test is used to test the levels and first difference relationship of each variable to determine whether they are of I(0) or I(1) variables.

5.1.4 **Cointegration Analysis**

"Cointegration analysis means looking for stable long run equilibrium relationships among nonstationary economic variables". (Onawofora 2003: 3). The presence of a cointegration relation forms the basis of the vector error correction model specifications. Before estimating the error-correction model, the Johansen (1991) maximum likelihood test was applied to determine whether the variables in question are cointegrated. "The Johansen procedure involves the identification of rank of 3 x 3 matrix Π in the specification given by:

$$\Delta X_t = \delta + \sum^{k-1} \Gamma_i \Delta X_{t-i} + \Pi X_{t-k} + \varepsilon_t \qquad (5.3)$$

where X_t is a column vector of three variables. If Π has zero rank, no stationary linear combination can be identified. In other words, the variables in X_t are noncointegrated. If the rank is *r*, there will now exist *r* possible stationary linear combinations" (Masih and Masih 2004).

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[17] AIC = T ln (residual sum of squares) + 2n.

"The Johansen test utilises two likelihood ratio (LR) test statistics for the number of cointegrating vectors: the trace [-T $\sum$ (1 – λ_I)] and maximum eigenvalue [-T log (1 – λ_I)] statistics. For the trace statistics, the null hypothesis is that there are at most r cointegrating relationship; for example, r = 0,1,2,3 is tested against a general alternative. Meanwhile, the maximum likelihood eigenvalue test (λ-max) is based on the comparison of H0 (r-1) against the alternative H1 (r). In general, the null hypothesis (H0: r = 0) is tested against an alternative (H1: r = 1) and so on" (Lau and Ahmad 2003). The Johansen trace test results reported in Table 5.3 to 5.6 shows results at selected lags that indicate the existence of cointegrating relationship between the variables.

5.1.5 **Vector Error Correction Model (VECM)**

"Engle and Granger (1987) suggests that if data are nonstationary but cointegrated, a useful econometric model for these time series would be an error correction model (ECM)" (Pattichis, Cheong, Meharis, Williams 2004: 889). The VECM has cointegrating relations built into its specifications that it restricts the long run behaviour of the endogenous variables to converge to their cointegrating relationships while allowing for short run adjustment dynamics.

"When the endogenous variables are cointegrated, then in the short run, deviations from this long run equilibrium will feed back on the changes in the dependent variable in order to force the movement towards the long run equilibrium" (Masih and Masih 2004). The cointegrating term is known as the error correction term since deviation from the long run equilibrium is corrected gradually through a series of partial short run adjustment. "If any of the lagged error correction terms are insignificant or eliminated from the VECM, it may affect the implied long run relationship and may also be a violation of theory. However, if any of the differenced short-run variables are insignificant, it does not involve such violations, as there are not many theoretical explanations about short run relationships" (Masih and Masih 2004).

Thus, in this analysis the VECM approach[18] is used as represented by the equation below:

$$\Delta X_t = \sum_{i=1}^{k-1} \Gamma_i \, \Delta X_{t-i} + \alpha\beta' X_{t-k} + \mu + \varepsilon_t \quad (5.4)$$

where, X_t is the vector of endogenous variables (for instance, in the export function, the endogenous variables are lnX, lnREER and lnY) which are presumed to be I(1), i represents the lag order, k is the maximum number of lag length, α is the vector of adjustment coefficients, β' is the vector of cointegrating relationships which is the long-run parameters, μ is the intercept term and ε_t is the error term which is assumed to be white noise.

VECM depends on the existence of cointegrating relations. Thus, before estimating the VECM functions, it is necessary to determine the long-run relationship between the endogenous variables in each model using the Johansen cointegration test. Thus, based on the Johansen tests, VECMs for the export and import functions mentioned above are specified as below:

[18] Masih and Masih (2004), Akbostanci (2002) and Onafowora (2003).

a) Export Demand Function

$$DlnX_{,t} = \alpha_0 + \sum_{i=0}^{l} \alpha_{1i}\ DlnX_{t-i} + \sum_{i=0}^{l} \alpha_{2i}\ DlnREER_{t-i} + \sum_{i=0}^{l} \alpha_{3i}\ DlnFY_{t-i}$$

$$+ EC(-1) + u_t \qquad (5.5)$$

where DlnX, $DlnREER_X$ and DlnFY are first differences of the logarithms of LnX, LnFY and LnREER. The symbol l represents the number of lags used for the equation. EC represents the error correction term and a dummy variable reflecting a shift in exchange rate regime is included in the model as an exogenous variable (DUM: 0 – 1975:1 to 1998:2 and 1 – 1998:3 to 2003:4).

b) Import Demand Function

$$DlnM_{,t} = \beta_0 + \sum_{i=0}^{l} \beta_{1i}\ DlnM_{t-i} + \sum_{i=0}^{l} \beta_{2i}\ DlnREER_{t-i} + \sum_{i=0}^{l} \beta_{3i}\ DlnY_{t-i}$$

$$+ EC(-1) + e_t \qquad (5.6)$$

where DlnM, DlnREER and DlnY are first differences of the logarithms of LnM and LnY). The symbol l represents the number of lags used for the equation. EC represents the error correction term and a dummy variable reflecting a shift in exchange rate regime is also included in this model as an exogenous variable (DUM: 0 – 1975:1 to 1998:2 and 1 – 1998:3 to 2003:4).

The choice of number of lags to include in the VECMs is based on the Akaike Information Criterion (AIC) and the Schwartz Bayesian Criterion (SBC)[19]. "The

[19] SBC = T ln (residual sum of squares) + n ln(T)
where n = number of parameters estimated (including the constant term)
T = number of usable observations

parsimonious model is selected based on the smallest value given by the AIC and SBC.

In order to determine whether the estimated VECMs are appropriate, several residual tests[20] such as the serial LM test and White heteroscedasticity test are conducted. In addition, the normality test is also conducted to determine whether the time series used are normally distributed.

- Autocorrelation LM Test

  E-views reports the multivariate LM test statistics for residual serial correlation. The test statistics is up to order *h*, which is computed using auxiliary regression of the residuals u_t against the right hand regressors and the lagged residual u_{t-h}. The null hypothesis is that there is no serial correlation of order *h* and the test statistics follows the chi-square distribution with k^2 degrees of freedom where *k* represent the number of regressors in the model.

- White Heteroscedasticity Test

  The White Heteroscedasticity test is conducted by regressing each cross product of the residuals on the cross products of the regressors and the joint significance of the regression is tested. In this analysis, the White Heteroscedasticity tests with no cross terms, which uses only the levels and the squares of the original regression is conducted. The test statistic follows the chi-square distribution with degrees of freedom *mn*, where $m = k(k + 1) /2$ is the number of cross – products of residuals in the system whereas *n* refers to the numbers of the common set of right-hand variables in the regression.

[20] Adapted from E-views 4.1 User Guide

- Normality Test

  The multivariate extensions of the Jarque-Bera residual normality test which compares the third and fourth moments of the residuals to those from the normal distribution is conducted. The Cholesky (Lutkepohl 1991) method is selected and the Jarque-Bera test statistics follows the chi-square distribution with two degrees of freedom.

5.2 **Results and Analysis**

5.2.1 *The Test for Stationarity*

The Augmented Dickey-Fuller test was conducted for all seven variables and the results are as given in Table 5.1 and 5.2. Table 5.1 shows the results obtained from the levels relationship of the variables with and without trend. The table also indicates that most variables are nonstationary in the levels relationship except for LnREERx, $LnREER_T$ and LnFY when a trend is included in the test.

Table 5.1. The Augmented Dickey-Fuller Test Results for the Levels Relationship

Variables	Intercept	Intercept and Trend
LnM	-0.919381 (0)	-1.763608 (0)
LnX	-1.235844 (1)	-3.123387 (0)
LnREERM	-1.589809 (11)	-2.12073 (11)
LNREERX	-0.784310 (4)	-3.449365 (0)**
LnREERT	-1.455980 (0)	-3.594715 (0)**
LnFY	-0.594004 (9)	-3.879899 (8)**
LnY	-0.627788 (11)	-1.975416 (10)

Note: 1) The number in parentheses is the optimal lag selected by the Akaike Information Criterion
2) ***Significant at 1% level
** Significant at 5% level
* Significant at 10% level

Table 5.2 shows the test results for the first difference relationship. The result shows that the null hypothesis of a unit root is rejected implying that the variables are stationary at the first differences and are of I(1).

Table 5.2. The Augmented Dickey-Fuller Test Results for the First Difference Relationship

Variables	Intercept	Intercept and Trend
LnM	-10.10407 (0)***	-10.09287 (0)***
LnX	-12.09921 (0)***	-12.12226 (0)***
LnREERM	-4.084173 (9)***	-4.074043 (9)***
LNREERX	-5.530008 (3)***	-5.553060 (3)***
LnREERT	-11.96066 (0)***	-12.01934 (0) ***
LnFY	-3.581219 (12)***	-3.524994 (12)**
LnY	-5.104926 (10)***	-5.096925 (10)***

Note: 1) The number in parentheses is the optimal lag selected by the Akaike Information Criterion
2) ***Significant at 1% level
** Significant at 5% level
* Significant at 10% level

5.2.2. *Test for Cointegration*

A cointegration test was conducted to determine whether the variables are cointegrated in the long run. Table 5.3 to 5.6 shows the results obtained from the Johansen (1991) tests for both the export and import demand functions. The test assumption is linear deterministic trend in data and a dummy variable reflecting a shift in the exchange rate regime (DUM: 0 - 1975:1 to 1998:2 and 1 – 1998:3 to 2003:4) is included in both the functions as an exogenous variable.

a) Export Demand

Based on the Johansen tests results given in Table 5.3 for export demand (using export weighted real effective exchange rates), the results suggest that for lag 4 and 8 there is at least one cointegrating relationship among the variables whereas at lag 9, 10, 11, and 12, the results imply that there are two cointegrating relationships among the variables.

Table 5.3. Johansen Cointegration Test (LnX LnREERx LnFY)

H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 4			
r=1	r>0	0.224300	39.38497	29.68	35.65	None**
r≤1	r>1	0.089205	11.19214	15.41	20.04	At most 1
r≤2	r>2	0.007366	0.820635	3.76	6.65	At most 2
H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 8			
r=1	r>0	0.217088	40.95359	29.68	35.65	None**
r≤1	r>1	0.123660	14.76698	15.41	20.04	At most 1
r≤2	r>2	0.005990	0.642835	3.76	6.65	At most 2
H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 9			
r=1	r>0	0.271437	53.59178	29.68	35.65	None**
r≤1	r>1	0.162708	20.02352	15.41	20.04	At most 1*
r≤2	r>2	0.011255	1.199754	3.76	6.65	At most 2
H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 10			
r=1	r>0	0.210647	40.90218	29.68	35.65	None**
r≤1	r>1	0.134943	16.06535	15.41	20.04	At most 1*
r≤2	r>2	0.008012	0.844616	3.76	6.65	At most 2
H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 11			
r=1	r>0	0.207523	47.09634	29.68	35.65	None**
r≤1	r>1	0.178951	22.90679	15.41	20.04	At most**
r≤2	r>2	0.022820	2.400799	3.76	6.65	At most 2

H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 12			
r=1	r>0	0.298077	63.37829	29.68	35.65	None**
r≤1	r>1	0.217462	26.92333	15.41	20.04	At most 1**
r≤2	r>2	0.016049	1.666465	3.76	6.65	At most 2

Note: r – represents the number of cointegrating relationships.
*(**) denotes rejection of the hypothesis at 5% (1%) significance level.

Similarly, for the export demand function using trade weighted real effective exchange rates, the Johansen test results (Table 5.4) reveal that at lags 4 and 8 that there exists at least one cointegrating relationship among the variables. However, lags 9, 10, 11, and 12 reveal that there are two cointegrating relationships among the variables.

Table 5.4. Johansen Cointegration Test (LnX LnREER$_T$ LnFY)

H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 4			
r=1	r>0	0.216050	37.75204	29.68	35.65	None**
r≤1	r>1	0.083942	10.73346	15.41	20.04	At most 1
r≤2	r>2	0.008982	1.001515	3.76	6.65	At most 2

H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 8			
r=1	r>0	0.212283	40.77524	29.68	35.65	None**
r≤1	r>1	0.123442	15.24324	15.41	20.04	At most 1
r≤2	r>2	0.010650	1.145695	3.76	6.65	At most 2

H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 9			
r=1	r>0	0.250615	48.52281	29.68	35.65	None**
r≤1	r>1	0.134363	17.94156	15.41	20.04	At most 1*
r≤2	r>2	0.024661	2.646843	3.76	6.65	At most 2

H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 10			
r=1	r>0	0.207742	41.97237	29.68	35.65	None**
r≤1	r>1	0.142298	17.52127	15.41	20.04	At most 1*
r≤2	r>2	0.013282	1.403968	3.76	6.65	At most 2

H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 11			
r=1	r>0	0.167909	38.03302	29.68	35.65	None**
r≤1	r>1	0.152801	18.91646	15.41	20.04	At most*
r≤2	r>2	0.015941	1.671231	3.76	6.65	At most 2

H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 12			
r=1	r>0	0.262707	52.56642	29.68	35.65	None**
r≤1	r>1	0.171845	21.17510	15.41	20.04	At most 1**
r≤2	r>2	0.016884	1.753941	3.76	6.65	At most 2

Note: r – represents the number of cointegrating relationships.
*(**) denotes rejection of the hypothesis at 5% (1%) significance level.

b) Import Demand

Based on Table 5.5 and 5.6, the Johansen test results for the import demand function imply there is at least one cointegrating relationship among the variables at lags 8, 9 and also at lag 12 (for import demand using trade weighted real effective exchange rates).

Table 5.5. Johansen Cointegration Test (LnM LnREER$_M$ LnY)

H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 8			
r=1	r>0	0.144162	29.92428	29.68	35.65	None*
r≤1	r>1	0.113645	13.26713	15.41	20.04	At most 1
r≤2	r>2	0.003348	0.358860	3.76	6.65	At most 2

H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 9			
r=1	r>0	0.143228	31.61023	29.68	35.65	None*
r≤1	r>1	0.130679	15.22441	15.41	20.04	At most 1
r≤2	r>2	0.003578	0.379920	3.76	6.65	At most 2

Note: r – represents the number of cointegrating relationships.
*(**) denotes rejection of the hypothesis at 5% (1%) significance level.

Table 5.6 Johansen Cointegration Test (LnM LnREER$_T$ LnY)

H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 8			
r=1	r>0	0.147839	31.56962	29.68	35.65	None*
r≤1	r>1	0.125184	14.45172	15.41	20.04	At most 1
r≤2	r>2	0.001320	0.141338	3.76	6.65	At most 2

H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 9			
r=1	r>0	0.165771	32.34689	29.68	35.65	None*
r≤1	r>1	0.114904	13.13464	15.41	20.04	At most 1
r≤2	r>2	0.001851	0.196357	3.76	6.65	At most 2

H0	H1	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
			Number of Lags = 12			
r=1	r>0	0.201894	30.09484	29.68	35.65	None**
r≤1	r>1	0.064366	6.866919	15.41	20.04	At most 1
r≤2	r>2	0.000139	0.014271	3.76	6.65	At most 2

Note: r – represents the number of cointegrating relationships.
*(**) denotes rejection of the hypothesis at 5% (1%) significance level.

5.2.3 *The Vector Error Correction Model*

The results obtained from the estimated VECM regarding LnX using LnREERx and $LnREER_T$ yields similar results. The same could not be said for LnM as the results contradict each other:

a) ***Export Demand (using export weighted Real Effective Exchange Rates)***

Based on AIC and SBC, the lag length of 8 was chosen with one cointegrating relationship. Table 5.7 shows the estimated long run relationship between LnX, LnREERx and LnFY.

Table 5.7. Normalised Cointegrating vectors: 1 Cointegrating Equation (LnX, LnREERx, LnFY)

LnX	LnREERx	LnFY
1.000000	-0.078440 (4.46060)	-7.442365 (0.74845)

Note: number in parantheses represents the standard errors of the coefficients

Table 5.7 shows the normalised cointegrating vectors for LnX, LnREERx and LnFY. The results from the table above can be interpreted as:

$$1.0LnX - 0.078440\ LnREERx - 7.442365\ LnFY = 0$$

and thus,

$$LnX = 0.078440\ LnREERx + 7.442365\ LnFY$$

Therefore, the cointegrating vectors have the correct positive sign which conforms to underlying economic theory. This implies that a depreciation of the ringgit against its trading partners improves the demand for exports in the long run. Similarly, an increase in foreign income also has a favourable impact on the demand for Malaysian exports as the coefficient of LnFY is positively related with LnX.

The results from the estimated VECM for LnX, LnREERx and LnFY are given in table 5.8. From table 5.8, it can be observed that the error correction term, EC(-1) is negative and statistically significant at 1 per cent significance level. Thus, this suggests the validity of a long run equilibrium relationship among the variables. The estimated value of -0.109806 implies that the system corrects its previous period's disequilibrium by 10 per cent each quarter.

In order to analyse the impact of LnREERx on LnX in the short run, we must focus on the lagged first difference terms of LnREERx. The coefficient of DLnREERx(-1) is negative but not significant, whereas the coefficient of DLnREERx(-2) is positive and significant at 5 per cent significance level which complies with the underlying economic theory that a depreciation improves export demand. The coefficients of LnREERx at lags 3 and 4 are negative but not significant. At lag 5 however, LnREERx is positively related with LnX and is significant at 1 per cent significance level. The coefficient of DLnREERx at lags 6, 7 and 8 are negative but once again not significant. Thus, in the short run, Malaysia's real effective exchange rates may have some positive impact on export demand just like in the in the long run.

However, the relationship between LnFY and LnX in the short run is quite mixed. The coefficient of DLnFY (-1) is positive and significant at 5 per cent significance level, which conforms to underlying economic theory. But the coefficient of DLnFY (-2) and DLnFY (-3) are negative and significant 10 per cent and 1 per cent respectively. However, at lag 4, the estimated coefficient of the LnFY is positive and significant at 1 per cent, which again complies with the theory. The coefficient of the LnFY is negative at lag 5 and is significant at 1 per cent significance level but is positive in lag 6 (insignificant at 1 per cent) and 7 (significant at 10 per cent). Finally at lag 8, the LnFY has a negative related with LnX and is significant at 1 per cent significance level.

The result shown by the dummy variable reflecting the shift in exchange rate regime is less encouraging because its estimated coefficient is negative and significant 5 per cent. This implies that even after the implementation of fixed exchange rates, export demand has been declining over the years.

Table 5.8. Vector Error Correction Model (LnX, LnREERx, LnFY)

Variables	Coefficients	Standard Error	T-statistics
EC (-1)	-0.109806	0.03091	-3.55295***
D(LnX (-1))	-0.019078	0.09926	-0.19220
D(LnX (-2))	-0.032771	0.10216	-0.32077
D(LnX (-3))	-0.177028	0.10064	-1.75903*
D(LnX (-4))	0.044150	0.09504	0.46456
D(LnX (-5))	-0.112630	0.09394	-1.19892
D(LnX (-6))	-0.045382	0.09334	-0.48621
D(LnX (-7))	0.119843	0.08910	1.34507
D(LnX (-8))	-0.007358	0.09020	-0.08158
D(LnREERx (-1))	-1.087527	0.97975	-1.11000
D(LnREERx (-2))	1.928533	0.97392	1.98018**
D(LnREERx (-3))	-1.530636	1.01028	-1.51506
D(LnREERx (-4))	-0.486656	1.01759	-0.47824
D(LnREERx (-5))	3.162668	0.99747	3.17071***
D(LnREERx (-6))	-0.835244	1.04939	-0.79593
D(LnREERx (-7))	-0.494795	1.03560	-0.47779
D(LnREERx (-8))	-0.334641	1.00782	-0.33205
D(LnFY (-1))	1.783429	0.74900	2.38107**
D(LnFY (-2))	-1.599643	0.81462	-1.96368*
D(LnFY (-3))	-2.422823	0.79209	-3.05878***
D(LnFY (-4))	2.419362	0.68850	3.51396***
D(LnFY (-5))	-3.390407	0.71740	-4.72598***
D(LnFY (-6))	0.515412	0.75168	0.68569
D(LnFY (-7))	1.416040	0.76161	1.85927*
D(LnFY (-8))	-3.470167	0.72895	-4.76052***
DUM	-0.046568	0.01973	-2.35979**
Constant	0.078079	0.01865	4.18708

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

R2 = 0.521208

F = 3.349513

- Test for Autocorrelation

Table 5.9. VEC Residual Serial Correlation LM Test (LnX, LnREERx, LnFY)

Lags	LM-Stat	Prob
1	21.42264	0.0109
2	13.25007	0.1516
3	12.64057	0.1796
4	20.65041	0.0143
5	13.56348	0.1387
6	9.654655	0.3792
7	4.155099	0.9009
8	10.65287	0.3003
9	8.918869	0.4448
10	8.760880	0.4596
11	12.67963	0.1776
12	4.912972	0.8418

Note: Probability from chi-square with 9 degrees of freedom

Null Hypothesis (H0): No serial correlation at lag order h

As can be observed from table 5.9, the critical chi-square value at 1 per cent significance level is 21.6660. Thus, null hypothesis of no serial correlation at lag order *h* cannot be rejected. Therefore, the estimated VECM does not suffer from serial correlation.

- Test for Heteroscedasticity

Table 5.10. VEC Residual Heteroscedasticity Tests: No Cross Terms (LnX, LnREERx, LnFY)

Dependent	Chi-square (53)	F(53,53)
res1*res1	58.59511	1.210521
res2*res2	54.24309	1.028170
res3*res3	54.66274	1.044432
res2*res1	54.40718	1.034498
res3*res1	49.34816	0.855968
res3*res2	63.84354	1.479351

Null Hypothesis (H0): No heterocedasticity

Table 5.10 shows the results obtained from White Heteroscedasticity test. At 5 per cent significance level, the critical F-statistic is 1.58 and thus null hypothesis of no heteroscedasticity cannot be rejected. Similarly, the critical chi-square value is 70.978, which also implies that the null hypothesis of no heteroscedasticity cannot be rejected. Thus, there is no problem of heteroscedasticity in the estimated VECM.

- Test for Normality

  At 1 per cent significance level, the critical chi-square value at two degrees of freedom is 9.21034. Thus, the null hypothesis of normal distribution for the individual components cannot be rejected but for the joint tests, the critical chi-square value at six degrees of freedom at the same significance level is 16.8119. Thus, the null hypothesis of normal distribution is rejected which implies that estimated VECM is not normally distributed.

Table 5.11. VEC Residual Normality Tests (LnX, LnREERx, LnFY)

Component	Jarque-Bera	Degrees of Freedom
1	6.875647	2
2	8.017376	2
3	4.376593	2
Joint	19.26962	6

b) ***Export Demand (using Trade Weighted Real Effective Exchange Rates)***.

The lag length of 9 was selected based on AIC and SBC which yields two cointegrating relationship between the variables as stated in table 5.12 and 5.13 below:

Table 5.12. Normalised Cointegrating vectors: 1 Cointegrating Equation (LnX, $LnREER_T$, $LnFY$)

LnX	$LnREER_T$	LnFY
1.000000	-13.06460 (7.01948)	-5.810632 (0.68232)

Note: number in parantheses represents the standard errors of the coefficients

Table 5.13. Normalised Cointegrating vectors: 2 Cointegrating Equations (LnX, $LnREER_T$, $LnFY$)

LnX	$LnREER_T$	LnFY
1.000000	0.000000	-7.196424 (0.38065)
0.000000	1.000000	-0.106072 (0.01737)

Note: number in parantheses represents the standard errors of the coefficients

Based on Table 5.12 and Table 5.13, it can be observed that the long run relationship between LnX and $LnREER_T$ and also LnFY is positive which complies with underlying economic theory.

The results of the estimated VECM for LnX, $LnREER_T$ and LnFY are given in table 5.14. The error correction term, EC_1 (-1) is negative and is statistically at 1 per cent significance level. Thus, the estimated value of -0.158164 implies that the system corrects its previous period's disequilibrium by 15 per cent each quarter. The estimated value of EC_2 (-1) is positive but not significant at 1 per cent significance level. The nonsignificance of the error correction term implies that short-term adjustment takes place through changes in the export demand and not through changes in exchange rates.

Real effective exchange rates does not seem to influence the demand for exports in the short run as most of the lagged first differences of $LnREER_T$ are not significant at 1 per cent significance level. This may probably the reason why the error correction term, EC2 (-1) is insignificant. However, DLnREERT (-5) is positive and significant at 10 per cent significance level, which complies with underlying theory.

As for the relationship between LnFY and LnM, the results obtained from the estimated VECM are quite mixed. The coefficient of DLnFY(-1) is positive and significant at 5 per cent significance level. However, the coefficient of DLnFY(-2) is negative although insignificant at 1 per cent. Similarly, the coefficient of DLnFY (-3) is also negative but significant at 1 per cent. The coefficient of DLnY(-4) is positive and insignificant whereas DLnFY(-5) is positive and significant at 5 per cent. DLnFY(-6) is negatively related with LnX but statistically insignificant whereas DLnFY(-7) is positively related with LnX and significant at 5 per cent. The result also reports that DLnFY negatively related with LnX at lag 8 and 9 and is significant at 1 per cent.

The VECM shows that the estimated coefficient of the dummy variable is negative and significant 5 per cent. Thus, export demand has been declining since the implementation of fixed exchange rates.

Table 5.14. Vector Error Correction Model (LnX, $LnREER_T$, LnFY)

Variables	Coefficients	Standard Error	T-statistics
EC_1 (-1)	-0.158164	0.03609	-4.38262***
EC_2 (-1)	1.485883	0.97713	1.52065
D(LnX (-1))	-0.180607	0.10299	-1.75358*
D(LnX (-2))	-0.037707	0.10408	-0.36229
D(LnX (-3))	-0.170709	0.10224	-1.66965*
D(LnX (-4))	-0.005272	0.10786	-0.04888
D(LnX (-5))	-0.089799	0.10387	-0.86453
D(LnX (-6))	-0.135702	0.10281	-1.31996
D(LnX (-7))	0.081644	0.10474	0.77952
D(LnX (-8))	0.093972	0.10043	0.93571
D(LnX (-9))	-0.026578	0.09766	-0.27214
D($LnREER_T$ (-1))	-0.918121	1.51282	-0.60689
D($LnREER_T$ (-2))	0.426275	1.47232	0.28953
D($LnREER_T$ (-3))	-1.852809	1.40853	-1.31542
D($LnREER_T$ (-4))	0.112818	1.37925	0.08180
D($LnREER_T$ (-5))	2.275164	1.35373	1.68066*
D($LnREER_T$ (-6))	-1.462900	1.34135	-1.09062
D($LnREER_T$ (-7))	-0.507197	1.34601	-0.37682
D($LnREER_T$ (-8))	-1.405303	1.32608	-1.05974
D($LnREER_T$ (-9))	-0.081238	1.27324	-0.06380
D(LnFY (-1))	2.274719	0.78363	2.90280**
D(LnFY (-2))	-1.024499	0.83788	-1.22273
D(LnFY (-3))	-3.669200	0.85843	-4.27432***
D(LnFY (-4))	1.349026	0.86275	1.56363
D(LnFY (-5))	-1.912874	0.89875	-2.12836**
D(LnFY (-6))	-0.969257	0.85468	-1.13406
D(LnFY (-7))	1.959366	0.80540	2.43279**
D(LnFY (-8))	-2.951073	0.80558	-3.66328***
D(LnFY (-9))	-2.674259	0.86827	-3.07998***
DUM	-0.067421	0.02600	-2.59346**
Constant	0.108259	0.02457	4.40680

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

R2 = 0.531989 F = 2.841753

- Test for Autocorrelation

Table 5.15. VEC Residual Serial Correlation LM Test (LnX, $LnREER_T$, LnFY)

Lags	LM-Stat	Prob
1	12.21090	0.2017
2	5.730816	0.7665
3	15.66567	0.0742
4	21.08147	0.0123
5	14.37449	0.1096
6	9.153889	0.4232
7	6.056374	0.7343
8	8.180234	0.5161
9	9.334068	0.4070
10	9.524686	0.3903
11	5.332889	0.8044
12	12.04192	0.2110

Note: Probability from chi-square with 9 degrees of freedom

Null Hypothesis (H0): No serial correlation at lag order h

From table 5.15, it can be observed that at 1 per cent significance level, the critical chi-square value is 21.6660. Thus, null hypothesis of no serial correlation at lag order h cannot be rejected. Hence, the estimated VECM is free from the problem of autocorrelation.

- Test for Heteroscedasticity

Table 5.16. VEC Residual Heteroscedasticity Tests: No Cross Terms (LnX, $LnREER_T$, LnFY)

Dependent	Chi-square (59)	F(59,46)
res1*res1	65.70155	1.271139
res2*res2	59.06720	0.981241
res3*res3	73.42268	1.757198
res2*res1	47.15838	0.624856
res3*res1	47.51321	0.633377
res3*res2	48.84400	0.666278

Null Hypothesis (H0): No heterocedasticity

At 5 per cent significance level, the critical F-statistic is 1.61 and thus null hypothesis of no heteroscedasticity cannot be rejected. Similarly, the critical chi-square value is 79.0819, which also imply that the null hypothesis of no heteroscedasticity cannot be rejected. Thus, there is no problem of heteroscedasticity in the estimated VECM.

- Test for Normality

  At 1 per cent significance level, the critical chi-square value at two degrees of freedom is 9.21034. Thus, the null hypothesis of normal distribution for the first component is rejected whereas the second and third component does not reject the null hypothesis of normal distribution.

Table 5.17. VEC Residual Normality Tests (LnX, $LnREER_T$, LnFY)

Component	Jarque-Bera	Degrees of Freedom
1	14.76200	2
2	4.669360	2
3	2.454510	2
Joint	21.88587	6

For the joint tests, the critical chi-square value at six degrees of freedom at the same significance level is 16.8119. Therefore, the joint test implies that estimated VECM is not normally distributed.

c) ***Import Demand (using the Import Weighted Real Effective Exchange Rates)***

Based on AIC and SBC, the lag length of 8 was chosen. Table 5.18 shows the long run relationship between LnM, $LnREER_M$ and LnY. The estimated relationship between LnM and $LnREER_M$ is as expected by economic theory as both variables are negatively related. Thus, if the ringgit depreciates, the demand for imports declines as imports become more expensive. LnY is positively related with import demand, which implies that an increase in domestic income increases the demand for imports.

Table 5.18. Normalised Cointegrating vectors: 1 Cointegrating Equation (LnM, $LnREER_M$, LnY)

LnM	$LnREER_M$	LnY
1.000000	23.94806 (6.39836)	-1.854696 (0.08166)

Note: number in parantheses represents the standard errors of the coefficients

The results from the estimated VECM for LnM, $LnREER_M$ and LnY are given in table 5.19. It can be observed that the error correction term, EC (-1) is negative and is statistically at 1 per cent significance level. The estimated value of -0.145305 implies that the system corrects its previous period's disequilibrium by 14 per cent each quarter.

The relationship between LnM and $LNREER_M$ is insignificant in the short run as all of the estimated coefficients of $LnREER_M$ are insignificant at 1 per cent significance level. As for the relationship between LnY and LnM, the results obtained from the VECM are quite mixed. The estimated coefficients of LnY are insignificant in the first two lags where the coefficient of DLnY(-1) is positive but negative for DLnY(-2). But DLnY(-3) has a negative relationship with LnM and is significant at 1 per cent. The coefficient of DLnY(-4) is positive and significant at 10 per cent which conforms to underlying economic theory. But at lag 5, the domestic income variable has a negative relationship and is significant at 1 per cent and but positive and insignificant at lag 6 and 7. Finally, DlnY(-8) is negatively related with LnM and is significant at 1 per cent significance level. Thus, in the short run, there may be a negative relationship between domestic income and the demand for imports, which is contrary to the estimated the long run relationship.

Finally, referring to the coefficient of the dummy variable, the estimated coefficient is negative but insignificant. Thus, since the implementation of the fixed exchange rates, import demand had been declining.

Table 5.19. Vector Error Correction Model (LnM, $LnREER_M$, LnY)

Variables	Coefficients	Standard Error	T-statistics
EC1 (-1)	-0.145305	0.03801	-3.82297***
D(LnM (-1))	0.134375	0.10139	-1.32537
D(LnM (-2))	0.074410	0.10134	0.73423
D(LnM (-3))	-0.065052	0.10007	-0.65008
D(LnM (-4))	-0.027463	0.10225	-0.26860
D(LnM (-5))	0.218905	0.10187	2.14880**
D(LnM (-6))	-0.055735	0.10328	-0.53967
D(LnM (-7))	0.039822	0.10822	0.36796
D(LnM (-8))	0.133720	0.11089	1.20585
D($LnREER_M$ (-1))	-1.004789	1.34213	-0.74865
D($LnREER_M$ (-2))	1.003989	1.39604	0.71917
D($LnREER_M$ (-3))	0.202320	1.38927	0.14563
D($LnREER_M$ (-4))	-1.184206	1.37828	-0.85919
D($LnREER_M$ (-5))	-0.113686	1.39605	-0.08143
D($LnREER_M$ (-6))	1.051173	1.37389	0.76511
D($LnREER_M$ (-7))	1.735485	1.39828	1.24116
D($LnREER_M$ (-8))	-0.666739	1.33887	-0.49799
D(LnY (-1))	0.847194	0.95938	0.88306
D(LnY (-2))	-1.254152	0.98968	-1.26723
D(LnY (-3))	-2.506126	0.93053	-2.69323***
D(LnY (-4))	1.459942	0.84744	1.72276*
D(LnY (-5))	-2.501133	0.87898	-2.84548***
D(LnY (-6))	0.200186	0.89284	0.22421
D(LnY (-7))	0.771211	0.89490	0.86178
D(LnY (-8))	-2.866512	0.84721	-3.38347***
DUM	-0.016627	0.02272	-0.73187
Constant	0.054188	0.02048	2.64572

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

R2 = 0.367477

F = 1.787602

- Test for Autocorrelation

Null Hypothesis (H0): No serial correlation at lag order h

At 1 per cent significance level, the critical chi-square value is 21.6660. Thus, based on table 5.20, the null hypothesis of no serial correlation at lag order h cannot be rejected. Thus, the estimated VECM does not suffer from serial correlation.

Table 5.20. VEC Residual Serial Correlation LM Test (LnM, LnREER$_M$, LnY)

Lags	LM-Stat	Prob
1	6.245964	0.7151
2	6.451716	0.6940
3	15.22211	0.0850
4	14.18551	0.1159
5	12.71498	0.1759
6	8.999828	0.4373
7	3.894481	0.9182
8	11.65059	0.2337
9	4.402195	0.8830
10	13.94792	0.1242
11	20.25597	0.0164
12	9.048631	0.4328

Note: Probability from chi-square with 9 degrees of freedom

- Test for Heteroscedasticity

Table 5.21. VEC Residual Heteroscedasticity Tests: No Cross Terms (LnM, LnREER$_M$, LnY)

Dependent	Chi-square (51)	F(51,55)
res1*res1	61.24176	1.443347
res2*res2	55.53725	1.163815
res3*res3	54.16037	1.105387
res2*res1	61.99328	1.485456
res3*res1	47.39125	0.857394
res3*res2	63.81707	1.593739

Null Hypothesis (H0): No heterocedasticity

At 5 per cent significance level, the critical F-statistic is 1.63 and thus null hypothesis of no heteroscedasticity cannot be rejected. Similarly, the critical chi-square value is 67.5048, which also imply that the null hypothesis of no heteroscedasticity cannot be rejected. Thus, there is no problem of heteroscedasticity in the estimated VECM.

- Test for Normality

At 1 per cent significance level, the critical chi-square value at two degrees of freedom is 9.21034. Thus, based on table 5.22, the null hypothesis of normal distribution for the first component is rejected but not for the second and third components. For the joint tests, the critical chi-square value at 6 degrees of freedom at the same significance level is 16.8119. Therefore, the joint test implies that the estimated VECM is not normally distributed.

Table 5.22. VEC Residual Normality Tests (LnM, $LnREER_M$, LnY)

Component	Jarque-Bera	Degrees of Freedom
1	14.15581	2
2	6.813099	2
3	2.509251	2
Joint	23.47816	6

d) ***Import Demand (using Trade-Weighted Real Effective Exchange Rates)***

The lag length of 12 was chosen based on AIC and SBC with one cointegrating relationship. Table 5.23 shows the relationship between LnM, $LnREER_T$ and LnY. The estimated long run relationship contradicts underlying economic theory as $LnREER_T$ is positively related with LnM and LnY is negatively related with LnM. This result contradicts the earlier result obtained using $LnREER_M$.

Table 5.23. Normalised Cointegrating vectors: 1 Cointegrating Equation (LnM, $LnREER_T$, LnY)

LnM	$LnREER_T$	LnY
1.000000	-123.2830 (45.5052)	1.990666 (1.01542)

Note: number in parantheses represents the standard errors of the coefficients

The results of the estimated VECM for LnM, $LnREER_T$ and LnY are given in table 5.24. It can be observed that the error correction term, EC (-1) is negative as expected by underlying theory and is statistically significant at 1 per cent significance level. The estimated value of -0.024069 implies that the system corrects its previous period's disequilibrium by 2 per cent each quarter.

The coefficients of the lagged first differences of $LnREER_T$ are mostly negative but not significant from lags 1 to 10. But at lags 11 and 12, $LnREER_T$ has a positive relationship with LnM, which is significant at 5 per cent and 1 per cent significance level respectively. As for the impact of LnY on LnM, most of the coefficients of the lagged first differences of LnY are negatively related with LnM but insignificant. However, at lag 7 and 12, the coefficients of LnY are positive and significant at 10 per cent and 1 per cent respectively. Thus, LnY may also have some positive impact on imports in the short run.

In analysing the relationship of the dummy variable with LnM, it can be observed that the estimated coefficient is negative and significant at 1 per cent significance. Thus, since the fixed exchange rate regime, import demand has been declining.

Table 5.24. Vector Error Correction Model (LnM, $LnREER_T$, LnY)

Variables	Coefficients	Standard Error	T-statistics
EC1 (-1)	-0.024069	0.00832	-2.89259***
D(LnM (-1))	0.001966	0.11691	0.01682
D(LnM (-2))	-0.096128	0.11535	-0.83339
D(LnM (-3))	-0.102182	0.11358	-0.89963
D(LnM (-4))	-0.089357	0.11925	-0.74935
D(LnM (-5))	0.133554	0.117763	1.13542
D(LnM (-6))	-0.101403	0.11536	-0.87899
D(LnM (-7))	-0.101000	0.11606	-0.87025
D(LnM (-8))	0.115553	0.11379	1.01550
D(LnM (-9))	-0.125496	0.11504	-1.09089
D(LnM (-10))	0.156153	0.11622	1.34362
D(LnM (-11))	-0.005457	0.11181	-0.04881
D(LnM (-12))	-0.00696	0.11280	-0.00617
D($LnREER_T$ (-1))	-2.916978	1.98223	-1.47156
D($LnREER_T$ (-2))	-2.269590	1.84940	-1.22720
D($LnREER_T$ (-3))	-2.299959	1.79583	-1.28072
D($LnREER_T$ (-4))	-1.355826	1.78800	-0.75829
D($LnREER_T$ (-5))	-0.052117	1.79463	-0.02904
D($LnREER_T$ (-6))	-1.598348	1.70822	-0.93568
D($LnREER_T$ (-7))	1.068536	1.69510	0.63037
D($LnREER_T$ (-8))	-0.299593	1.79042	-0.16733
D($LnREER_T$ (-9))	1.565179	1.69427	0.92381
D($LnREER_T$ (-10))	-0.591225	1.74545	-0.33872
D($LnREER_T$ (-11))	3.681340	1.70659	2.15713**
D($LnREER_T$ (-12))	5.529996	1.71192	3.23029***
D(LnY (-1))	-0.019506	0.23635	-0.08253
D(LnY (-2))	0.000423	0.23264	0.00182
D(LnY (-3))	-0.024002	0.21677	-0.11073
D(LnY (-4))	0.013368	0.21356	0.06259
D(LnY (-5))	-0.198611	0.21504	-0.92361
D(LnY (-6))	-0.223440	0.21142	-1.05686
D(LnY (-7))	0.353294	0.20995	1.68271*
D(LnY (-8))	-0.081415	0.19735	-0.41254
D(LnY (-9))	0.191493	0.19690	0.97252
D(LnY (-10))	-0.135432	0.19238	-0.70397
D(LnY (-11))	-0.159344	0.21389	-0.74498
D(LnY (-12))	0.654348	0.21236	3.08133***
DUM	-0.071528	0.03004	-2.38143**
Constant	0.053760	0.03225	1.66694

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

R2 = 0.531989

F = 2.841753

- Test for Autocorrelation

Table 5.25. VEC Residual Serial Correlation LM Test (LnM, $LnREER_T$, LnY)

Lags	LM-Stat	Prob
1	9.256721	0.4139
2	12.24695	0.1997
3	5.224780	0.8143
4	10.34656	0.3232
5	14.85328	0.0950
6	5.994585	0.7405
7	8.467298	0.4878
8	8.462655	0.4883
9	10.68159	0.2982
10	15.42749	0.0798
11	7.922760	0.5419
12	10.78754	0.2906
13	7.110495	0.6256

Note: Probability from chi-square with 9 degrees of freedom

Null Hypothesis (H0): No serial correlation at lag order h

At 1 per cent significance level, the critical chi-square value is 21.6660. Thus, based on table 5.25, the null hypothesis of no serial correlation at lag order h cannot be rejected. Thus, the estimated VECM does not suffer from serial correlation.

- Test for Heteroscedasticity

Table 5.26. VEC Residual Heteroscedasticity Tests: No Cross Terms (LnM, $LnREER_T$, LnY)

Dependent	Chi-square (75)	F(75,27)
res1*res1	82.47638	1.446699
res2*res2	70.85510	0.793527
res3*res3	74.36232	0.934797
res2*res1	76.12623	1.019784
res3*res1	60.95184	0.521846
res3*res2	72.57636	0.858789

Null Hypothesis (H0): No heteroscedasticity

At 5 per cent significance level, the critical F-statistic is 1.78 and thus, the null hypothesis of no heteroscedasticity cannot be rejected. Similarly, the critical chi-square value is 96.2051, which also imply that the null hypothesis of no heteroscedasticity cannot be rejected. Thus, there is no problem of heteroscedasticity in the estimated VECM.

- Test for Normality

Table 5.27. VEC Residual Normality Tests (LnM, LnREER$_T$, LnY)

Component	Jarque-Bera	Degrees of Freedom
1	4.151069	2
2	11.47807	2
3	2.075324	2
Joint	17.70446	6

At 1 per cent significance level, the critical chi-square value at two degrees of freedom is 9.21034. Thus, based on table 5.27, the null hypothesis of normal distribution for the first component and the third component cannot be rejected but not for the second component. For the joint tests, the critical chi-square value at six degrees of freedom at the same significance level is 16.8119. Therefore, the joint test implies that estimated VECM is not normally distributed.

5.3 Conclusion

"The error correction term is the short run adjustment coefficient that represents the proportion by which the long run disequilibrium in the dependent variable is corrected in each short period" (Hui-Chuan 2002). In all four cases, the error correction term has the expected negative sign and is statistically significant. Besides that, as shown in Hui-Chuan (2002), the speed of adjustment can be measured by (1 / coefficient of the error correction term). The results shows that apart from the import demand function using trade weighted real effective exchange rates, the speed of adjustment towards the long run equilibrium will take a long time[21].

In addition, the results from the Johansen cointegration test and the estimated VECMs, show that relationship between real effective exchange rates and Malaysian trade balance is quite significant especially in the long run. A depreciation of the ringgit against its trading partners increases the demand for Malaysian exports in the long run. Thus, the positive relationship between exports and real effective exchange rates in the long run would help improve the trade balance. The export weighted real effective exchange rates also seem to have a positive impact on the demand for exports in the short run (Table 5.8). However, the short run relationship between trade weighted real effective exchange rates and export demand is not really significant as can be seen in table 5.14. Therefore, the relationship between export demand and exchange rates is best explained by using the export weighted real effective exchange rates rather than the trade weighted effective exchange rates.

Similarly, the relationship between real effective exchange rates and demand for imports is best explained by the import demand function using import weighted real effective exchange rates. The long run negative relationship between import demand and import weighted real effective exchange rates imply that demand for imports declines when the real effective exchange rates depreciate as expected. In the short run, exchange rates do not seem to influence the demand for imports as can be observed from Table 5.19. However, by using trade weighted real effective exchange

[21] Speed of adjustment for:

- Export Demand (using LnREERx) = -9.107 and Export Demand (using $LnREER_T$) = -6.333
- Import Demand (using $LnREER_M$) = -6.882 and Import Demand (using $LnREER_T$) = -41.547

rates, the results show that demand for imports and real effective exchange rates in the long run are positively related which contradicts underlying economic theory. Thus, using trade weighted real effective exchange rates may not be the appropriate measure to explain the relationship between exchange rates and imports.

Based on this analysis, it has been found that in the long run both foreign and domestic income increases the demand for exports and imports respectively although the results for the short run relationship are quite mixed. However, by regressing import demand with trade weighted real effective exchange rates and domestic income, it has been found that an increase in domestic income leads to decrease in the demand for imports. The dummy variable reflecting the shift in the Malaysian exchange rate regime shows that the demand for both exports and imports has been of a declining trend since the implementation of fixed exchange rates, which in turn may lead to a decline in trade balance.

Finally, as mentioned in chapter 4, movements in the RM/US$ bilateral exchange rates influences the changes in Malaysia' real effective exchange rates. Thus, it could be concluded that the impact of the RM/US$ bilateral exchange rates on Malaysian trade balance is quite significant. The RM/US$ nominal bilateral exchange rate improves demand for exports since the estimated long run relationship (using export and trade weighted real effective exchange rates) proves that the exchange rates has a favourable impact on the demand for exports. Besides, the estimated import demand function (using import weighted real effective exchange rates) shows that both the variables are negatively related in the long run. Thus, in the long run, if exports exceed imports, then the RM/US dollar bilateral exchange rates would improve the trade balance.