

# Does Exchange Rate Risk Matter for Exports? A Case of Malaysia

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## ABSTRACT

*This paper attempts to estimate the impact of exchange rate risks on exports using Pesaran et al. (2001) bounds testing procedure to establish cointegration. The long run coefficients are estimated via the autoregressive distributed lag (ARDL) model. Results suggest that exchange rate risks depress exports in the long run with the impact of exchange rate misalignment being stronger than exchange rate volatility.*

**Keywords:** *Exchange rate risk, Exchange rate misalignment, Exchange rate volatility, Export, Malaysia*

## 1. Introduction

Along with other developing nations, Malaysia emulates a growth strategy based on export-orientation of industrial products. For decades, exports played an important role in the growth process for Malaysia by generating foreign exchange necessary to finance imports of machines and other investment goods which in turn, are vital towards capital formation. In the light of recent developments in the world market especially the rise of China as an export powerhouse, food and energy crisis and the vagaries of financial crises (the 1997 Asian financial crisis and 2008 sub-prime crisis), exports have somewhat been affected. Overtime, policies need to be reviewed to account for recent developments, the changing pattern of trade and the behaviour of macroeconomic policy variables which may assist the development of exports strategies.

In this paper, we focus on one macroeconomic policy variable – the real exchange rate risk. Specifically, the impact of exchange rate risks on exports in Malaysia is investigated. The objective of this study is to examine whether there is a long run relationship between exports and exchange rate risks and to quantify the intensity of such relationship. Increase in exchange rate risk is expected to depress exports, hence, undermining the competitiveness of Malaysia's exports. Exchange rate risks are demarcated into two distinct types – exchange rate misalignment and exchange rate volatility. Exchange rate misalignment is a deviation of the real exchange rate from its equilibrium exchange rate. The equilibrium exchange rate is a function of a set of fundamental variable encompassing productivity, government spending, net foreign assets and the degree of trade openness. Exchange rate volatility is captured using the GARCH (1,1) model due to its ability to capture time-varying attributes of the exchange rate movements especially in higher frequency data.

The next two sections provide a brief review of literature followed by an explication of the empirical model pertaining to this paper. The fourth section dwells on the method used to test the long and short run relationship between exports and its determinants. The penultimate section discusses the results and the final section concludes.

## 2. Review of Literature

The relationship between the real exchange rate and exports has been widely discussed especially with the inception of floating exchange rate regime in 1972. During this period, concern was mainly centered on the argument that floating exchange rate regime induces excessive exchange rate variability, hence increasing both risk and uncertainty. To assuage risk exposure, risk

averse market participants may retract investment and trade. This notional premise has ignited a large body of theoretical and empirical literature to estimate the impact of risk on export. Specifically, risk is captured by exchange rate volatility and more recently, misalignment of the exchange rate.

Majority of the literature concentrates on exchange rate volatility to represent risk. In empirical work, exchange rate volatility is captured using a variety of proxies. The most common proxy to estimate exchange rate volatility is to use the standard deviation of the growth of exchange rate with a moving average transformation (see for example Kenen and Rodrick, 1986; Bailey et al., 1987; Cushman, 1988; Koray and Lastrapes, 1989; Klein, 1990; Bini-Smaghi, 1991; Chowdhury, 1993; Daly, 1998; Arize, 1997; Aristotelous, 2001; and Wong and Tang, 2008). The second most popular method is based on the autoregressive conditional heteroscedasticity (ARCH) models and its extensions such as GARCH(1,1), EGARCH, T-GARCH and S-GARCH (see Kroner and Lastrapes, 1993; Caporale and Doroodian, 1994; McKenzie and Brooks, 1997). Other measures of exchange rate volatility include the standard deviation of the percentage change of the exchange rate or the standard deviation of the first differences of the logarithmic exchange rate (Frankel and Wei, 1993), the variance of the spot exchange rate around its predicted trend (Thursby and Thursby, 1987) and autoregressive integrated moving average (ARIMA) model (Asseery and Peel, 1991). In addition, Hooper and Kohlhagen (1978) use the absolute difference between the previous forward rate and the current spot rate over 13 weeks whilst Pereg and Steinherr (1989) rely on the percentage difference between the maximum and the minimum spot rate over  $t$ -years preceding the observation plus a measure of exchange rate misalignment. Rana (1981) uses a non-parametric measure using Gini's mean. On theoretical grounds, the impact of exchange rate variability is ambiguous (see for example Caballero and Corbo, 1989). Similarly, results based on empirical research are mixed.

More recently, a number of studies incorporate exchange rate misalignment to capture risks and at the same time, infer competitiveness of exports (for example Bryne et al., 2008). Studies normally start with the estimation of exchange rate misalignment and later, use misalignment as a variable in the export model. Sapir and Sekkat (1995) use real exchange rate, exchange rate volatility and exchange rate misalignment to observe their impact on export across different sectors and exchange rate regimes. Similarly, Sekkat and Varoudakis (2000) undertake similar measurements but applied to selected Sub-Saharan Africa (SSA) countries. They investigate the impact of both exchange rate volatility and exchange rate misalignment on disaggregated manufacturing sectors (textile, chemicals and metals) across the fixed and floating exchange rate regimes. Similarly, Mohamad (2003) found significant effects of misalignment on all export equations

(both aggregate and sectoral). Kumakura (2005) and Doraisami (2004) focused on electronic exports in Malaysia. Both studies found negative implications of exchange rate misalignment on electronic exports. Their point of departure is that exchange rate misalignment is proxied by the fluctuations between the dollar-yen exchange rates.

With similar notion, Cottani et al. (1990) and Ghura and Grennes (1993) and to some extent, Tuolaboe (2006) examined the impact of exchange rate misalignment on economic performance. Cottani et al. studied 24 countries (Argentina, Bolivia, Chile, Columbia, Jamaica, etc.) from 1960-1983. Ghura and Grennes examined 33 countries from SSA on annual basis from 1970 to 1987 and Tuolaboe limited his study to 14 SSA countries under the CFA zone between 1970-1996. All studies conclude that exchange rate misalignment has important negative effects on economic performance without segregating the impact of overvaluation and undervaluation. Another similarity with these studies is that the data are all annual.

### 3. Empirical Framework

Based on the foregoing discussion in the previous section, the standard export demand-based framework is augmented to include exchange rate misalignment which is consistent with the empirical work by Ghura and Greenes (1993). The main assumption postulated for this model is that exports of Malaysia are small compared to the world market. The regression is as follows:

$$\log X_t = \alpha_0 + \beta_1 \log Y_t + \beta_2 \log P_t + \beta_3 M_t + \beta_4 V_t + \mu \quad (1)$$

where  $X$  is the export volume,  $Y$  represents the world income,  $P$  is relative price,  $M$  denotes the exchange rate misalignment and  $V$  is the exchange rate volatility. Coefficients  $\beta_1$  and  $\beta_2$  represent the income and price elasticities of exports respectively. Assuming homogeneity in the export demand model, is expected to be positive since an increase in the world income is expected to increase the demand for Malaysia's export, *ceteris paribus*.

This model anticipates that prices should have inverse relationship with export demand. To reiterate, increase in prices are expected to make domestic goods relatively more expensive in comparison with foreign competitors. Hence, the expected sign for  $\beta_2$  is negative. This study hypothesizes that misalignment represent some form of risk hence,  $\beta_3$  is predicted to be negatively related to export demand. Finally, excessive exchange rate volatility ( $V$ ) is expected to depress exports hence the expected sign is negative.

#### 4. Estimation Method

To establish long run relationship, this study relies on the bounds testing procedure developed by Pesaran et al. (2001). This method offers several unique and useful features namely the ability to handle small samples and is relatively simpler compared to Johansen and Juselius (JJ) multivariate cointegration technique. Furthermore, the long run estimations are less sensitive to lag lengths compared to the JJ technique. Another attractive feature is that only the dependent variable must be integrated of order one or  $I(1)$  whilst the regressors are allowed to be either  $I(0)$  or  $I(1)$ . Ideally, the lag length is chosen via the two step estimation approach based on Pesaran and Shin (1999) where the lag orders of  $p$  and  $q$  are selected with reference to the Schwarz Bayesian criterion (SBC). The lag with the smallest SBC value yields the optimum lag. In practice, a major shortcoming of this procedure is the need to set the maximum lag orders of  $p$  and  $q$  a priori although the ‘true’ lag orders of the ARDL( $p,q$ ) model are unknown a priori (Pesaran and Shih, 1999). To avoid such potential bias, we adhere to four lags on each model given that the frequency of the data is quarterly. Four lags are considered appropriate and optimal for quarterly observations (see for example, Wong and Tang, 2008). Based on the theoretical model discussed in the previous section, the above equation takes the following form,

$$\Delta X_t = c_0 + \delta_1 X_{t-1} + \delta_2 Y_{t-1} + \delta_3 P_{t-1} + \delta_4 M_{t-1} + \delta_5 V_{t-1} + \sum_{i=1}^p \phi_i \Delta X_{t-i} + \sum_{j=0}^{q_1} \varpi_j \Delta Y_{t-j} + \sum_{l=0}^{q_2} \theta_l \Delta P_{t-l} + \sum_{m=0}^{q_3} \varphi_m \Delta M_{t-m} + \sum_{n=0}^{q_4} \psi_n \Delta V_{t-n} + \gamma D_t + \varepsilon_t$$

where  $\delta_t$  are the long run multipliers,  $c_0$  is the drift term,  $D$  captures the effect of 1997 Asian crisis and  $\varepsilon_t$  are the white noise error terms.

The bounds test is essentially a three-step procedure. The first step requires the estimation of equation (2) via ordinary least squares (OLS) to test for possible long run relationships amongst the variables. This procedure tests for joint significance of the coefficients of the lagged levels of the variables based on F-test such  $H_0 : \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$  against an alternative,  $H_1 : \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq 0$ . This test normalizes on  $X$ , that is  $[X / Y, P, M, V]$ . The approximate asymptotic critical values are adapted from Narayan (2005) where the lower value assumes the regressors are purely  $I(0)$  whilst the upper value denotes a purely  $I(1)$  regressors. If the F-statistics is above the upper critical value, the null hypothesis of no cointegration can be firmly rejected regardless of whether the variables are  $I(0)$  or  $I(1)$ . Likewise, if the test statistic falls below the lower critical values, then the null hypothesis of no long run relationship cannot be rejected. If the test statistic falls between the lower and upper critical values, then, the results become inconclusive. In

used to infer cointegration (Kremers et al., 1992).

The second step involves the estimation of the conditional long run ARDL (  $p, q_1, q_2, q_3, q_4$  ) model for  $X_t$  as follows:

$$X_t = c_0 + \sum_{i=1}^p \beta_i X_{t-i} + \sum_{j=0}^{q_1} \beta_2 Y_{t-j} + \sum_{l=0}^{q_2} \beta_3 P_{t-l} + \sum_{m=0}^{q_3} \beta_4 M_{t-m} + \sum_{n=0}^{q_4} \beta_5 V_{t-n} + \gamma D_t + \varepsilon_t$$

where all the variables are as previously defined. The final step is to obtain the coefficients of the short run dynamics by estimating the error correction model associated with the long run estimates, such that,

$$\Delta X_t = \mu + \sum_{i=1}^p \phi_i \Delta X_{t-i} + \sum_{j=0}^{q_1} \varpi_j \Delta Y_{t-j} + \sum_{l=0}^{q_2} \theta_l \Delta P_{t-l} + \sum_{m=0}^{q_3} \varphi_m \Delta M_{t-m} + \sum_{n=0}^{q_4} \psi_n \Delta V_{t-n} + \gamma D_t + \eta \text{ect}_{t-1} + \varepsilon_t$$

where  $\phi, \varpi, \varphi, \psi$  and  $\theta$  are the short run dynamic coefficients and  $\eta$  is the speed of adjustment.

## 5. Results and Discussion

The bounds test results in Table 1 clearly illustrate that the  $F$ -statistics in all models are greater than the upper bound critical values, indicating that all the lagged level of exports and its determinants in the models are jointly significant, hence, are cointegrated. We adopt three proxies to present prices where P1 is based on the real effective exchange rate (REER), P2 is the bilateral US/RM and P3 is calculated based on Cheng (2004). The use of these proxies is to test the sensitivity of the estimates towards changes in prices.

**Table 1:** Testing for the existence of long run relationship based on Bounds Test

Models	Dependent variable and regressors	Lags	Coefficients
Model 1:	X Y P1 M D	4	4.3900**
Model 2:	X Y P1 M V D	4	5.0559*
Model 3:	X Y P2 M D	4	5.7541*
Model 4:	X Y P2 M V D	4	5.0769*
Model 5:	X Y P3 M D	4	5.6473*
Model 6:	X Y P3 M V D	4	4.8817*

*Notes:* The  $F$ -statistics are compared with the critical bounds of the  $F$ -statistics for zero restriction on the coefficient of the lagged level variables calculated by Narayan (2005, p. 1988). \* and \*\* denote that the  $F$ -statistics are above the upper bound critical values at 1% and 5% significant level. The lag selection is based on Schwarz Bayesian criteria (SBC).

This study provides six models which incorporates different three proxies for price (P1, P2 and P3) and two proxies for exchange rate risk (M and V) to examine the impact of exchange rate on exports. Models 1, 3 and 5 separately examine the impact of exchange rate risk represented by exchange rate misalignment whilst models 2, 4 and 6 examines both risks together. The motivation for such separation is to enable us to capture the unique individual reactions within the confines of a parsimonious framework.

In the long run, all models (except Model 5) show that exchange rate misalignment has a negative and significant impact on exports at 5 and 10 percent significant level. For every one percentage point misalignment, exports contract between 0.37 to 0.43 percentage point. In line with previous empirical studies in Malaysia (Wong and Tang, 2008; Naseem et al., 2008), exchange rate volatility has significant negative impact on exports ranging between -0.18 to -0.13 percentage point for every one percent increase in volatility.

The coefficients of income elasticity are all significant at one percent significant level. Exports increase between 0.88 to 1.22 percentage point for every one percentage increase in foreign income. Despite using three different measures of price, all proxies for price are negative but insignificant. This implies that prices based on measures of exchange rates may not be the appropriate proxy for price in the case of Malaysia. However, we still succumb to these proxies due to unavailability of data on export and import prices, which could be a more appropriate proxy to represent prices.

As for the crisis dummy, all models except Model 1, show that the 1997 crisis has statistically positive impact on exports. This may be due to the depreciated ringgit as a result of the crisis which makes export cheaper, hence, relatively more competitive compared to other regions not affected by the crisis. Furthermore, a number of Malaysia's major trading partners such as the United States, United Kingdom, Germany, the Netherlands, France and Australia were not affected by the crisis. In fact, the crisis affected South East Asian region has benefited from the depreciated currency due to the crisis which deemed cheaper exports.

The lagged error correction terms ( $ecm_{t-1}$ ) in Table 3 are small, negative and significant in all six models which provide further evidence of cointegration. The coefficients of lagged error correction terms signify the speed of adjustment ranging between 0.23-0.28. This shows that the determinants variables are quick to response to deviations from the equilibrium. In the short run, the negative impact of misalignment on exports is also evident in all models. Diagnostic tests includes the LM test for serial correlation, Jarque-Bera (JB) test for normality, Ramsey RESET test for misspecification and test

for ARCH effect. In general, the models pass the diagnostic tests in the majority of cases.

**Table 2:** Long run coefficient estimates for Malaysia's export model : Dependent variable (Real Export)

Regressors / Model	1	2	3	4	5	6
<i>Y</i>	0.9822* (0.3186) [3.0826]	0.8838* (0.2410) [3.6671]	1.1127* (0.2445) [4.5504]	1.0625* (0.2629) [4.0423]	1.2220* (0.2385) [5.1227]	1.0832* (0.2520) [4.2977]
<i>PI</i>	-0.2542 (0.5655) [-0.4494]	-0.4193 (0.3830) [-1.0946]	-	-	-	-
<i>P2</i>	-	-	-0.1578 (0.2968) [-0.5317]	-0.1419 (0.3056) [-0.4642]	-	-
<i>P3</i>	-	-	-	-	-0.2482 (0.1640) [-1.5075]	-0.0612 (0.1483) [-0.4128]
<i>M</i>	-0.3726*** (0.2030) [-1.8358]	-0.3997** (0.1522) [-2.6260]	-0.3966** (0.1593) [-2.4891]	-0.4255** (0.1681) [-2.5313]	-0.0809 (0.2106) [-0.3842]	-0.4323** (0.1727) [-2.5037]
<i>V</i>	-	-0.0835*** (0.0485) [-1.7243]	-	-0.0756 (0.0664) [-1.1388]	-	-0.1307*** (0.0777) [-1.6822]
<i>D</i>	0.0169 (0.0497) [0.3393]	0.0727** (0.0303) [2.3942]	0.0696*** (0.03776) [1.8418]	0.0909** (0.0444) [2.0483]	0.0611*** (0.0336) [1.8190]	0.0794** (0.0368) [2.1541]
<i>C</i>	-0.6593 (2.1667) [-0.3043]	-0.0952 (1.6242) [0.0586]	-1.6966 (1.0953) [-1.5490]	-1.4763 (1.1753) [-1.2561]	-2.0779 (1.0768) [-1.9298]	-1.5571 (1.1245) [-1.3847]

Notes: \*, \*\* and \*\*\* denote 1%, 5% and 10% significant level. Standard errors and t statistics are in parentheses and brackets respectively.

**Table 3:** Unrestricted error-correction representation for the ARDL model

	Dependent variable (log real export)					
	Model 1		Model 2		Model 3	
	Coefficient	SE/T-stats	Coefficient	SE/T-stats	Coefficient	SE/T-stats
$ect_{t-1}$	-0.2299*	(0.0408) [-5.6295]	$ect_{t-1}$	-0.2842* (0.0393) [-7.2406]	$ect_{t-1}$	-0.2843* (0.0542) [-5.2449]
$\Delta Y$	-0.0379 (0.1942) [-0.1950]	$\Delta Y$	0.0731 (0.1987) [0.3678]	$\Delta Y$	0.1877 (0.2220) [0.8454]	
$\Delta PI$	-0.4413** (0.2067) [-2.1346]	$\Delta PI$	-0.2065 (0.2076) [-0.9945]	$\Delta P2$	-0.3158*** (0.1862) [-1.6962]	
$\Delta PI_{t-1}$	0.1707 (0.2142) [0.7971]	$\Delta M$	-0.1652* (0.0365) [-4.5219]	$\Delta M$	-0.1544* (0.0333) [-4.6213]	
$\Delta PI_{t-2}$	0.1441 (0.1851) [0.7783]	$\Delta M_{t-1}$	-0.1239* (0.0300) [-4.1272]	$\Delta M_{t-1}$	-0.1243* (0.0344) [-3.6053]	
$\Delta PI_{t-3}$	-0.6596* (0.1732) [-3.8093]	$\Delta M_{t-2}$	-0.0523 (0.0344) [-1.5175]	<i>D</i>	-0.0018 (0.0087) [-0.2105]	
$\Delta M$	-0.1324* (0.0352) [-3.7632]	$\Delta M_{t-3}$	-0.0815** (0.0352) [-2.3192]	<i>C</i>	-0.0009 (0.0042) [-0.2301]	
$\Delta M_{t-1}$	-0.1685* (0.0339) [-4.9738]	$\Delta V$	-0.0249** (0.0104) [-2.4009]			
<i>D</i>	0.0006 (0.0092) [0.0670]	<i>D</i>	0.0018 (0.0077) [0.2290]			
<i>C</i>	-0.0001 (0.0038) [-0.0276]	<i>C</i>	0.0007 (0.0034) [0.2198]			



**Table 3: Continued**

Dependent variable (log real export)								
Model 4			Model 5			Model 6		
	Coefficient	SE/T-stats		Coefficient	SE/T-stats		Coefficient	SE/T-stats
$ect_{t-1}$	-0.2659*	(0.0509)	$ect_{t-1}$	-0.2453*	(0.0469)	$ect_{t-1}$	-0.2525*	(0.0486)
		[5.2243]			[-5.2323]			[-5.1918]
$\Delta Y$	0.1487	(0.2217)	$\Delta Y$	0.0997	(0.2132)	$\Delta Y$	0.0856	(0.2084)
		[0.6704]			[0.4674]			[0.4108]
$\Delta P2$	-0.2380	(0.1953)	$\Delta P3$	-0.0829	(0.0865)	$\Delta P3$	-0.1781**	(0.0860)
		[-1.2187]			[-0.9579]			[-2.0717]
$\Delta M$	-0.1714*	(0.0378)	$\Delta M$	-0.1366*	(0.0332)	$\Delta M$	-0.1741*	(0.0368)
		[-4.5286]			[-4.1118]			[-4.7314]
$\Delta M_{t-1}$	-0.1430*	(0.0347)	$\Delta M_{t-1}$	-0.1776*	(0.0347)	$\Delta M_{t-1}$	-0.1376*	(0.0349)
		[-4.1028]			[-5.1197]			[-3.9374]
$\Delta V$	-0.0218***	(0.0125)	$\Delta M_{t-2}$	-0.0808**	(0.0399)	$\Delta V$	-0.0350*	(0.0121)
		[-1.7437]			[-2.0238]			[-2.8825]
$D$	-0.0003	(0.0088)	$\Delta M_{t-3}$	-0.0992**	(0.0405)	$D$	0.0052	(0.0085)
		[-0.0371]			[-2.4492]			[0.6150]
$C$	-0.0002	(0.0041)	$D$	0.0019	(0.0083)	$C$	-0.3535*	(-0.0713)
		[-0.0684]			[0.2330]			[-4.9597]
			$C$	0.0002	(0.0044)			
					[-0.0054]			

Notes: \*, \*\* and \*\*\* denote 1%, 5% and 10% significant level. SE represents the standard error. The lag order of the ARDL model is selected using Schwarz Bayesian criteria (SBC). Standard errors and t-statistics are in parentheses and brackets respectively. Models 1, 2, 7 and 8 use the REER (P1) as a proxy for price whilst Model 3 and 4 uses the bilateral US/RM to represent price. Models 5 and 6 use prices calculated as in Cheng (2004).

**Table 3: Continued**

Dependent variable (Real Export)						
Regressors / Model	1	2	3	4	5	6
$\overline{R}^2$	0.6726	0.6869	0.5750	0.5736	0.6679	0.5907
AR(2)	1.3064 (0.2795)	1.0334 (0.3633)	0.2757 (0.7601)	0.1697 (0.8443)	1.6400 (0.2037)	0.2495 (0.7801)
RESET(1)	0.7184 (0.4005)	0.3106 (0.7045)	1.0867 (0.3445)	1.4802 (0.2367)	0.6986 (0.5018)	1.002 (0.3738)
Normality(2)	0.6862 (0.5547)	2.2102 (0.3311)	0.9810 (0.6123)	2.2775 (0.3202)	2.0137 (0.3654)	4.2607 (0.1188)
Heteroscedasticity (1)	1.2197 (0.2942)	0.7607 (0.6959)	1.2071 (0.2964)	1.2304 (0.2892)	1.5378 (0.1446)	1.6255 (0.1231)

Notes: p-values are in parentheses.

## 6. Conclusion and Policy Implications

This paper presents an attempt to examine the impact of exchange rate risks on exports. Exchange rate risk is characterized by both exchange rate misalignment and exchange rate volatility. The prime reason for such categorization is to identify which of the two risks is more pronounced. We utilize the recently developed cointegration technique to test for long run relationships between exports, foreign income, prices and exchange rate risk. The bounds test procedure suggests there is one cointegration relationship between the stipulated variables. We present six models using different proxies for both price and exchange rate risk to ensure consistency of the results. The

robustness of the results is crucial to ensure accurate policy recommendation.

The key findings are as follows. We find that exchange rate risks in terms of exchange rate misalignment and volatility have negative impact on exports. Specifically, the impact of exchange rate misalignment on exports is greater than the impact of volatility on exports in the long run. These results are consistent across the majority of the models. Given the results, the government should minimize misalignments in the real exchange rate. That is, the real exchange rate should be consistent with the fundamental variables and that persistent deviations from the equilibrium exchange rate would have negative repercussions on exports in the long run. Naturally, the real exchange rate should be aligned towards the fundamental variables namely productivity, government spending, net foreign asset and the degree of trade openness. The authorities should also minimize the volatility of the exchange rate, albeit, the relatively smaller negative affect it exudes on exports.

Another interesting point to note is that real devaluation should not be used to promote exports in Malaysia due to the relatively low income elasticity of the export demand. As argued by Senhadji and Montenegro (1999), the success of any devaluation policy with the intention to promote exports lies crucially on the degree of income elasticity, where countries with higher income elasticity stand better chances of successful implementation of such policies.

Therefore, in the quest to expand Malaysia's exports, particular attention should be placed on the management of the real exchange rate to ensure that the risks exerted through misalignments and volatility are minimized. Failure to account for this vital factor may undermine the success of any policies geared at enhancing exports. In the light of the 10th Malaysia Plan, future studies should examine the impact of exchange rate risks on exports of high-technology products.

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## Appendix – Data Description

**Dataspán:** 1991Q1-2008Q3

### **Income (Y)**

World income (Y) is represented by the sum of gross domestic products of Malaysia's main trading partners:

$$Y_t = \sum_{i=1}^{15} w_i Y_t^n$$

where  $Y_t^n$  is the real gross domestic product of Malaysia's  $n^{th}$  trading partners.

$w_i$  is the trade share of Malaysia's major trading partners, with  $\sum_{i=1}^{15} w_i = 1$

Sources of data: IFS (CD-Rom, January 2009), DOTS (IMF, January 2009)

### **Relative Prices (P)**

Cheng (2004) defines relative price as the ratio of the price of Malaysia's export ( $P^x$ ) to the price of domestically produced goods in Malaysia's trading partners ( $P^w$ ) such that:

$$P = \frac{P^x}{P^w}$$

and

$$P^w = \exp \left[ \sum_{i=1}^{15} \ln(w_i P_i * E_i) \right]$$

where  $w_i$  is as defined above,  $P^x$  and  $P^w$  are proxied by Malaysia's and trading partners' CPI and  $E_i$  is the bilateral exchange rate between Malaysia vis-à-vis her trading partners. A relative price stated in this manner allows it to serve as a measure of competitiveness since it accounts not only competition with domestic producers but also with exporters of other countries (Bini-Smaghi, 1991).

Source of Data: IFS (CD-Rom, January 2009), DOTS (IMF, January 2009)

### ***Exports (X)***

Total exports are deflated using GDP deflator.

Source of data: Monthly External Trade Statistics, Department of Statistics (various issues), Monthly Bulletin of Statistics, BNM (various issues), Monthly Bulletin of Statistics, DOS (various issues).

### ***Exchange Rate Misalignment (M)***

Estimation is based on Sidek and Yusoff (2009).

### ***Exchange Rate Volatility (V)***

This variable is derived using GARCH(1,1).

Source of data: IFS (CD-Rom, January 2009)



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