EXCHANGE RATE MISALIGNMENT AND CAPITAL INFLOWS: AN ENDOGENOUS THRESHOLD ANALYSIS FOR MALAYSIA

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ABSTRACT

This study presents an attempt to investigate the impact of exchange rate misalignment on capital inflows in Malaysia. Specifically, a precise threshold value is estimated to examine when exchange rate misalignment suppresses capital inflows. To pursue these objectives, this study relies on the endogenous threshold analysis as of Hansen (1996, 2000). Results suggest that misalignment in terms of currency overvaluation, has a negative and significant effect when overvaluation is more than 15 percent. This estimate is consistent and robust despite the changes in the choice of explanatory variables.

Keywords: Exchange rate misalignment, Capital inflows competitiveness, Threshold effect.

INTRODUCTION

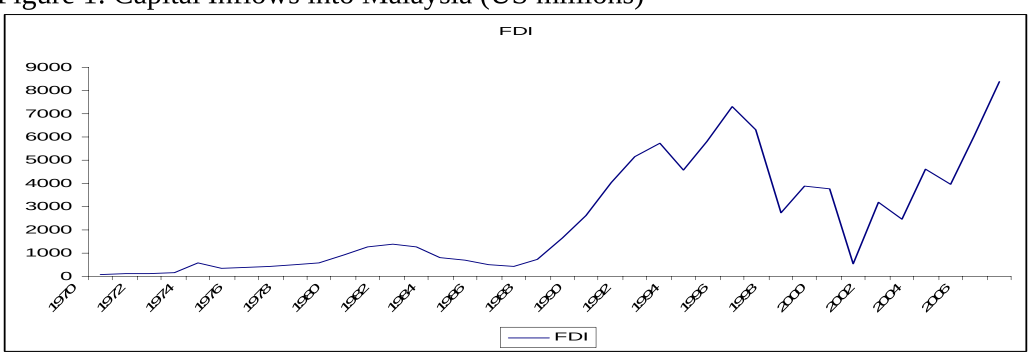
Foreign direct investment (FDI) has served as an important engine of growth via skills and technology transfer, creation of employment opportunities and expanding the capital stock in Malaysia. Since the 1997 Asian financial crisis, Malaysia is no longer the top 10 host for FDI. In fact, the rate of growth of FDI has dramatically decrease compared to that of the early 1990s. This is partly due to reverse investment (Mat Zin, 1999) and declining dependence on FDI to finance growth. However, this may also indicates the declining competitiveness of Malaysia in attracting FDI which warrants empirical research since it would be vital to investigate which factors that contributed to the deterioration of competitiveness. Since early 1980s, real exchange rate misalignment has become a standard concept in international macroeconomic theory and policy (Razin & Collins, 1997). Hence, this study focuses on exchange rate misalignment as an indicator of capital inflow competitiveness in the case of Malaysia. Malaysia provides an interesting case as it is one of the largest recipients of FDI amongst its ASEAN counterparts. Another advantage of undertaking a single country study is the ability to delineate the assumption that countries are similar in terms of social, cultural, economic and political background (Sun et al., 2002). Therefore, only relevant economic determinants are accounted for to suit the Malaysian environment.

The objective of this paper is to investigate the empirical relationship between capital inflows and exchange rate misalignment. Whilst existing literature focuses on the role of exchange rate, this study takes a step further to examine the impact of exchange rate misalignment on capital inflows. Specifically, we estimate a threshold value at which misalignment begins to significantly affect capital inflows. To the best of our knowledge, no published study has attempted to estimate a threshold value for exchange rate misalignment in Malaysia. Hence, this study intends to fill this gap. Based on the endogenous autoregressive threshold (TAR) model developed by Hansen (2000), we split the sample into high and low misalignment regimes. Results suggest that exchange rate misalignment due to overvaluation is detrimental to the influx of capital inflows. The next section provides a brief overview of FDI in Malaysia followed by a brief explication of the theoretical model and review of literature. The fourth section spells out the method pertaining to the objective. The penultimate section provides results and discussion and the final section concludes.

CAPITAL INFLOWS IN MALAYSIA: RECENT TRENDS AND INCENTIVES

The essence of export oriented-growth nexus somewhat depends on the inflow of foreign capital into the country. In the past, foreign direct investment has been the one of the major conduit for technology transfer, job creation and export-led growth to this country. To pursue this line of interest, the Malaysian government has designed various policies spanning the gamut of industrial specific incentives, taxation, and intellectual property protection to infrastructure support. The company tax rate for example has been reduced from 33 percent in 1987 to 27 percent in 2007 and 26 percent in 2008. Other tax incentives such as the investment tax allowance, tax relief for companies with pioneer status or high technology industries has continued until today with more industries be given the relevant status to reap the benefits of the incentives. Most recently, the government has liberalized *bumiputera* equity requirements for 27 sectors to further boost competitiveness.

Figure 1: Capital Inflows into Malaysia (US millions)



Source: UNCTAD (2009) Notes: The components of FDI are equity capital, reinvested earnings and other capital (mainly intra-company loans). Data on FDI flows are on a net basis (capital transactions´ credits less debits between direct investors and their foreign affiliates). Net decreases in assets (FDI outward) or net increases in liabilities (FDI inward) are recorded as credits (recorded with a positive sign in the balance of payments), while net increases in assets or net decreases in liabilities are recorded as debits (recorded with a negative sign in the balance of payments). Hence, FDI flows with a negative sign indicate that at least one of the three components of FDI (equity capital, reinvested earnings or intra-company loans) is negative and not offset by positive amounts of the remaining components. These are instances of reverse investment or disinvestment.

With reference to Figure 1, there was a surge in foreign direct investment (FDI) into Malaysia in the late 1980s and this trend continued until the onset of the 1997 Asian financial crisis. Another acute slump in the influx of FDI occured in 2001 when the economy was in a slight recession but picked up again in 2002 thereafter. With the recent burgeoning world recession following the American sub-mortgage crisis, it is expected that FDI will contract again (IMF, 2009).

To capture a more vivid impact of misalignment on capital inflows, this study employs quarterly data from Bank Negara Malaysia (BNM – the central bank of Malaysia) instead of the UNCTAD data which are annual. Foreign capital inflows or investment inflows comprises three items: (i) equity investment, (ii) loans and (iii) real estate. Investment consists of equity investment in Malaysia by non-residents, loans obtained from non-residents and purchase of real estate in Malaysia by non-residents but excludes retained earnings (Source: Bank Negara Malaysia, Glossary, Monthly Bulletin Statistics January, 2009, p. 186-187). This study resorts to a specific measure of FDI, that is, foreign investment inflows. Data starts from 1991:Q1-2008:Q3, partly dictated by availability.

THEORY AND REVIEW OF LITERATURE

In this study, we rely on the portfolio balance approach to model the determinants of foreign capital inflows. This model has been successfully tested by Goh (2005) for Malaysia. Branson (1968) postulates that the proportion of foreign assets (K^f) in a given stock of wealth is a function of the domestic and foreign interest rates (i and i^*), the measure of exchange rate expectation or risk (e) and the stock of wealth (w) expressed as:

$$\frac{K^f}{w} = f(i, i^*, e, w) \qquad (1)$$

Darby et al. (1999), augment this concept of exchange rate risk (e) into exchange rate volatility and exchange rate misalignment. Since this study focuses on the role of exchange rate misalignment, we substitute e with misalignment. Expressing the above equation at level yields,

$$dK^f = \alpha_0 + \alpha_1 i + \alpha_2 i^* + \alpha_3 e + \alpha_4 Y + \alpha_5 Z + \varepsilon \qquad (2)$$

Focusing on Z, the literature suggests a number of variables that determines capital flows. The enigmatic relationship between FDI and exchange rate nexus has been widely examined and most of the discussions root back to the work of Kohlhagen (1977), Cushman (1985), Froot and Stein (1991), Goldberg (1993) and Darby et al. (1999).

The effect of exchange rate is less straightforward (Benassy-Quere et al., 2001). The mechanisms that exchange rate affects capital inflows can also be viewed via the wealth effect channel and the relative production cost channel (Xing, 2006). A devaluation of the currency of the host country makes local cost of production lower in terms of foreign currency, hence leading to higher returns from export-oriented industries. As for the wealth effect, a devaluation makes local asset cheaper which motivates investors to acquire more. Kohlhagen (1977) static model postulates that following depreciation in host countries, MNEs will increase their production capacity. In a two period dynamic model, Cushman (1985) suggests that adjusted expected real depreciation lowers the production cost which leads to increase in FDI flows. Similarly, Goldberg (1993) illustrates how sectoral profitability, location effects, and portfolio and wealth effects are important factors that determine investment and their links with exchange rates. In her theoretical model, the direction of investment effects triggered by exchange rate movements is ambiguous, therefore, warrants empirical research. On contrary, in an imperfect information framework, Froot and Stein (1991) show that appreciation induces wealth effect of foreign investors, thus encouraging foreign investors to acquire more local assets. Empirically, there is quite a consensus that a depreciation of the exchange rate in the host country leads to a reduction of the FDI (Klein and Rosengren, 1994; Dewenter, 1995).

There is however, a dearth of studies that empirically examine the relationship between FDI and exchange rate misalignment. Empirical attempts include Benassy-Quere et al. (2001) who advocate the benefits of depreciation may be offset by excessive volatility of the exchange rate. Blonigen (1997) illustrates how currency depreciation induces foreign firm to acquire firm-specific assets when markets are segmented. Hasnat (1999) study the impact of misalignment on FDI for five developed nations on annual data ranging from 1976-1995. All of these studies use misalignment as a control variable or a counterpart for exchange rate variability and is measured by a deviation from the purchasing power parity (PPP) values. Furthermore, most of these studies are based on the experiences of industrialized economies using panel data analysis framework. In short, a prolonged misalignment may affect long term business decisions as it affects costs. If the exchange rate is overvalued relative to the estimated equilibrium level, investors may acquire more domestic assets for future capital gains in host country currency terms (Barrell and Pain, 1996). On the other hand, persistent overvaluation may reduce cost competitiveness of production in the host country, especially for export oriented products.

Other traditional determinants of FDI can be demarcated into at least two categories – micro and macro determinants. The list of micro-determinants spans from market size, growth, labour costs, host government policies, tariffs to trade barriers. The macro-determinants include market size (Chakrabarti, 2001; Farrell et al., 2004; Kravis and Lipsey; 1992), openness (Edwards, 1990; Gastanaga et al. 1998; Hausmann and Fernandez-Arias, 2000; Aseidu, 2002), rate of inflation (Bajo-Rubia and Sosvilla-Rivero, 1994; Urata and Kawai, 2000), government budget, taxes (Gastanaga et al., 1998; Wei, 2000) and infrastructure (Wheeler and Mody, 1992; Urata and Kawai, 2000). Financial deepening is also another catalyst for FDI (Borensztein et al., 1998). Liquid liability, private credit and M3 serve as proxies. Increase in money supply fuels inflation which increases the cost of production in the host country rendering a negative relationship. However, increments in money supply supported by growth or higher productivity indicate increase in future purchasing power which can benefit market-seeking FDI. Finally, the degree of misalignment is computed based on the difference between the actual and the hypothetical equilibrium exchange rate. Accordingly, the estimation of the hypothetical equilibrium exchange rate relies on the theory advocated by Edwards (1994). This theory postulates that the real exchange rate is a function of several fundamental variables which includes the

Balassa-Samuelson effect, trade openness, net foreign assets and government spending. Details are provided in Sidek and Yusoff (2009).

METHODOLOGY AND DATA

The question of when does misalignment begin to significantly affect capital inflows necessitate the existence of a non-linear relationship between these two variables. Thus, if such non-linear relationship exists, then it is possible to estimate an inflexion point, or a threshold value, at which the sign of misalignment may change or become significant. In the non-linear time series modelling, the threshold autoregressive model (TAR) is more popular since it offers a relatively simple specification, estimation and interpretation compared to other non-linear models. The origins of TAR models roots back to Tong (1980) where the main idea is to approximate a general non-linear autoregressive structure by a threshold autoregession with a small number of regimes. Hansen (1996, 2000) derives the asymptotic distribution of the ordinary least squares (OLS) estimates of the endogeneous threshold parameters which is used in this study.

This section explains how equation (2) is estimated to incorporate threshold effect. According to Hansen (2000), threshold estimation is the act of splitting the sample into two regimes when the threshold value is unknown. One necessary precondition is that the threshold variable must be a continuous variable. In this study, the threshold estimation is carried out by splitting the sample into high misalignment and low misalignment regime. Since misalignment is a continuous variable, TAR model would be appropriate to engender the threshold value. Formally, the two-regime threshold regression model takes the form:

$$y_t = \theta_1^{'} x_t + e_t, \qquad q_t \le \gamma, \tag{3}$$

$$y_t = \theta_2^{'} x_t + e_t, \qquad q_t > \gamma, \tag{4}$$

where q_t is the threshold variable which is used to split the sample into two regimes, γ is the threshold value which is unknown and must be estimated, y_t denotes the dependent variable (capital inflow), x_t represents a vector of explanatory variables and e_t is the error term assumed to be white noise and i.i.d. Note that if the threshold value is greater than the threshold variable, equation (3) is estimated and vice versa. This allows the regression parameters to change with respect to q_t. In order to write equations (3) and (4) in a single equation, a dummy variable is used which is defined as $d(\gamma) = \{q_t \le \gamma\}$ where {.} is the indicator function, with *d=1* when $q_t \le \gamma$ and *d = 0*, if otherwise; and set $x_t(\gamma) = x_t d(\gamma)$, such that (3) and (4) becomes:

$$y_t = \theta' x_t + \delta_n^{'} x_t(\gamma) + e_t \tag{5}$$

where $\theta = \theta_2$ and $\delta = \theta_1 - \theta_2$. Equation (5) allows all the regression parameters θ, δ_n and γ to be estimated and switch between the two regimes. The least square (LS) technique is used to estimate γ through minimization of the sum of squared errors function. To implement this, the model is expressed in matrix notation, hence, equation (5) is expressed as:

$$Y = X\theta + X_{\gamma}\delta_n + e \tag{6}$$

Define,

$$S_n(\theta,\delta,\gamma) = (Y - X\theta - X_{\gamma}\delta)'(Y - X\theta - X_{\gamma}\delta) \tag{7}$$

as the sum of squared error function. By definition the least squares estimators $\hat{\theta},\hat{\delta},\hat{\gamma}$ which is also the MLE when e_t with i.i.d. , jointly minimize equation (7). This minimization process requires γ to be restricted to a bounded set $[\underline{\gamma},\bar{\gamma}] = \Gamma$. The concentrated sum of squared errors function is written as:

$$S_n(\gamma) = S_n(\hat{\theta}(\gamma),\hat{\delta}(\gamma),\gamma) = Y'Y - Y'X_{\gamma}^{*}(X_{\gamma}^{*'}X_{\gamma}^{*})^{-1}X_{\gamma}^{*'}Y \tag{8}$$

where $\hat{\gamma}$ is the value that minimizes $S_n(\gamma)$. As $S_n(\gamma)$ takes values that is less than n, $\hat{\gamma}$ is uniquely described as:

$$\hat{\gamma} = \arg\min S_n(\gamma) \quad \text{with } \gamma \in \Gamma_n \tag{9}$$

Focusing on the objective of this section, the first step is to examine whether there exist a threshold effect in the model. This requires the examination between the linear model vis-à-vis the two-regime model, equation (5). The null hypothesis of no threshold effect is tested against an alternative hypothesis where threshold effect is present. Since TAR models have a non-standard distribution, Hansen (1997, 2000) develops a standard heteroscedasticity-consistent Langrange Multiplier (LM) bootstrap method to calculate the asymptotic critical value and the *p*-value.

The second step is to examine whether the derived threshold value (γ) is statistically significant. This is done by differencing the confidence interval region based on the likelihood ratio statistic $LR_n(\gamma)$. Based on Hansen (2000), let C represent the desired asymptotic confidence interval (in this study at 95%) and $c = c_{\xi}(C)$ be the *C*-level critical value and set $\hat{\Gamma} = \{\gamma : LR_n(\gamma) \le c\}$. Assuming homoscedasticity, $P(\gamma_0 \in \hat{\Gamma}) \to C$ as $n \to \infty$, therefore, $\hat{\Gamma}$ is the asymptotic *C*-level confidence region for γ. If the homoscedasticity condition is not fulfilled, then a scale likelihood ratio statistics of the residual sum of squared errors is defined as:

$$LR_n^{*}(\gamma) = \frac{LR_n(\gamma)}{\hat{\eta}^2} = \frac{S_n(\gamma) - S_n(\hat{\gamma})}{\hat{\sigma}^2\hat{\eta}^2} \tag{10}$$

and the adjusted confidence region becomes $\hat{\Gamma}^{*} = \{\gamma : LR_n^{*}(\gamma) \le c\}$ such that $\hat{\Gamma}^{*}$ is robust whether or not the heteroscedasticity condition holds. Simulation is set at 1000 replications as suggested by Hansen (2000). Also, $LR_n^{*}(\gamma)$ is not normally distributed hence, the valid asymptotic confidence intervals of the estimated threshold values in the no-rejection areas defined as $c(\alpha) = -2\ln(1 - \sqrt{1-\alpha}$, where α is a given asymptotic level; and the no- rejection region of the confidence interval is $1-\alpha$. If $LR_1(\gamma_0) \leq c(\alpha)$, than the null hypothesis of $H_0: \gamma = \gamma_0$ cannot be rejected. In addition, to examine the possibility of a second threshold value, the same exercise is repeated. Specifically, the empirical model to be tested which is based on equation (2) is defined as follows:

$$K_t = \alpha_t + \beta_1 Mis_t + \beta_2 R_t + \beta_3 M3_t + \beta_4 Z_t + \varepsilon_t \qquad (11)$$

where K is capital inflows, *Mis*, *R* and *M3* denote exchange rate misalignment, interest differentials and financial deepening, and *Z* represents the other control variables. Table 1 summarizes the description of data, measurement and sources used in this study.

Table 1: Determinants of Capital Inflows (1991Q1-2008Q3)

Variable	**Description**	**Measurement**	**Source**
I	Foreign investment	Total foreign investment inflow as a percentage of GDP	BNM
M3	Money supply	M2 as a percentage of GDP	IFS
D	Government deficit	The difference between revenue and expenditure as a percentage of GDP	BNM
R	Interest differential	The difference between Malaysia and US 3-month T-Bill rates	IFS
T	Taxation	Government corporate tax revenue as a percentage of GDP	BNM
LL	Liquid Liability	Log International liquidity: banking institution liability, line. 7b.d	IFS
INFRA	Infrastructure	Log of spending on infrastructure as a percentage of GDP	BNM

IFS: International Financial Statistics, IMF, UNCTAD: United Nations Conference on Trade and Development, BNM: Bank Negara Malaysia Monthly Statistical BulletinDOS: Department of Statistics, Malaysia (various issues).

RESULTS AND DISCUSSION

Prior to time series analysis, we test for unit roots in order to avoid spurious regression. Three versions of unit root testing, namely the ADF, PP and KPSS tests are employed to examine whether the variables are stationary on level or otherwise. Table 3 indicates that the order of integration are mixed for a majority of variables. However, this study proceeds to examine the threshold effect by including lagged variables for *I(1)* variables in the OLS estimation. Moreover, equation (2) derived from the theory requires estimations at level.

Table 2: Unit root test

	ADF		**PP**		**KPSS**		**Order of Integration**
	Level	**1st Diff**	**Level**	**1st Diff**	**Level**	**1st Diff**	
I	-3.7029*	-7.9812*	-3.5286*	--14.00208	0.9008*	0.2305	*I(0)/I(1)*
M3	-1.2741	-10.0951*	-1.3334	-10.4699*	1.0229*	0.3588***	*I(1)*
D	-1.6297	-19.7087*	-8.8219*	-27.3774*	0.3649*	0.0894	*I(0)/I(1)*
R	-4.5405*	-3.8179**	-2.6509	-7.0649*	0.0711	0.0471	*I(0)/I(1)*
INFRA	-2.2527	-4.5270*	-3.5053*	-27.7776*	0.2234*	0.0813	*I(0)/I(1)*
LL	-3.0805	-6.5500*	-2.4386	-6.7355*	0.1073	0.0607	*I(0)/I(1)*
MIS	-3.8075**	-9.7442*	-3.8076**	-9.8483*	0.0662	0.0577	*I(0)*

*Note: *, ** and *** denote significance at 1%, 5% and 10% significant level. p-values are in parentheses. For ADF and PP test the null is no unit root (H_0: Variable is stationary) whilst the null for the KPSS is the existence of unit root (H_0: Variable is not stationary).*

The baseline regression constitutes the exchange rate misalignment, interest differential and a measure of financial development, M3. We present four additional models with different variables added to the baseline regression, namely liquid liability, government budget deficit, and infrastructure for sensitivity analysis. Hansen (2000) theoretical construct allows for two threshold effects, hence, the first step is to investigate the possible existence of such an effect. Prior to that, a threshold variable needs to be selected. Since the aim of this section is to examine at what percentage exchange rate misalignment actually hurts capital inflows, the appropriate threshold variable is the exchange rate misalignment.

Upon choosing the appropriate threshold variable, the next step is to observe any evidence of a threshold effect and whether there exist one or more threshold by employing the heteroscedasticity-consistent Lagrange-multiplier (LM) test for a threshold based on Hansen (1996). To test γ under the null hypothesis of no threshold effect, *p*-values are calculated using a bootstrap analog which generates the dependent variable from the distribution $N(0,\hat{e}_t^2)$, where $\hat{e}_t$ is the OLS residuals from the estimated threshold model. With 1000 bootstrap replications, the *p*-values for the baseline threshold models (Table 3) using misalignment strongly suggest the existence of threshold effect at 0.000. Subsequently, this suggests that there is a sample split based on the effect of exchange rate misalignment.

Table 3: Threshold Effects for the baseline model

	Model 1
First Sample Split	
F-Stats	51.4045
Bootstrap P-Value	0.000
Threshold Estimates	-15.0260%
95% Confidence Interval	-15.446% , -9.8360%
Second Sample Split	
F-Stats	16.2171
Bootstrap P-Value	0.2890

Note: H_0: No threshold effect. The threshold is based on the minimized sum of squared residuals.

Figure 2 illustrates the graph of the normalized likelihood ratio sequence $LR_n^*(\gamma)$ as a function of the threshold in exchange rate misalignment. The estimated γ is the value which minimizes these graphs which range at $\hat{\gamma}$=15.02-15.44%. The dotted lines on the graphs present the 95% critical values. For example, in model 1, the asymptotic 95% confidence interval set $\hat{\Gamma}^* = [-15.03\%, -9.84\%]$ where $LR_n^*(\gamma)$ crosses the dotted lines. The results suggest that there is ample evidence for a two-regime specification. Also, it is worth noting that 41 of the 71 observations fall into the 95% confidence interval, hence, requires an examination of the possible existence of a second sample split. Results in Table 3, show that second sample split renders insignificant bootstrap *p*-value thus, indicating no further regime split.

Figure 2: First Sample Split – Confidence Interval Construction for Threshold

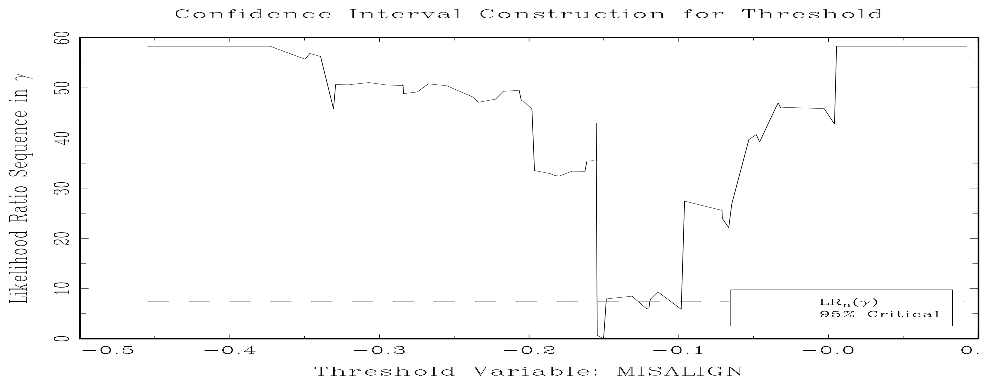


Table 4 presents the results for baseline regression. For comparison purposes, this study provides the linear OLS model without the threshold effect and a two-regime model which accommodates the threshold effect. Basically, the variables confer the correct signs in line with the prediction of the theory. Misalignment has a negative and significant effect on capital inflows in regime 2. Interest differential is expected to confer a negative effect. Results indicate that interest differentials only affects capital inflows negatively in the regime 1 but is insignificant in the regime 2. Similarly, M3 has significant effect in both regime but is positive in the regime 1 but the sign switches in regime 2. Hence, splitting the sample gives a more indepth view of the effects of these basic variables on investment inflows. To reiterate, sample splitting allows the examination of whether the significant effect is present in both regimes or otherwise.

The results show that below the threshold value of 15%, exchange rate misalignment may be negative but are not statistically significant. However, above the 15% threshold level, misalignment exerts both negative and significant impact on capital inflows. A 1% increase in misalignment (overvaluation) suppresses capital inflows by approximately 1.19%. The negative effect of exchange rate misalignment on capital inflows is consistent with the findings of Hasnat (1999). Barrel and Pain (1996) argue that an apparent currency misalignment persistent over some length of time may affect investment inflows decisions. A reasonable explanation is that the relative production costs may be higher as a result of such misalignment. If the ringgit is thought to be overvalued relative to its estimated equilibrium level, then foreign production may be discouraged by the prospect of future capital loss in home currency terms.

Another issue which emerges after the 1997 financial crisis is that capital inflows must be managed since reversals are likely to cause severe damage to the economy. Reinhart and Reinhart (1998) calls for greater exchange rate flexibility which is meant to introduce two-way risks, therefore, discouraging speculative capital inflows. It is, however, only possible in the context of *de facto* peg or a tightly managed float. Furthermore, the effectiveness of this policy depends on how much policymakers are willing to allow the exchange rate to fluctuate. A large band denotes greater flexibility but risks having large nominal appreciation which connotes possible overvaluation of the currency. The result of this study suggests that overvaluation is detrimental to capital inflows if this band exceeds 15%. Hence, policymakers should keep exchange rate fluctuations well below this 15% threshold.

Table 4: Baseline regression results on the effect of misalignment on capital inflows (1991:Q1-2008:Q3). Dependent variable is capital inflows.

Model 1	**Linear Model**	**Threshold Model**	
	OLS without threshold	**Regime 1 ≤ 15.0259%**	**Regime 2 > 15.0259%**
Misalignment	-0.4267**	-0.3186	-1.1955**
	(0.2115)	(0.2573)	(0.5712)
Interest Differential	-0.0250***	-0.0438*	-0.0261
	(0.0131)	(0.01533)	(0.0193)
M3	0.2964*	0.2644*	-0.5560*
	(0.0391)	(0.0516)	(0.1240)
Constant	3.0468*	2.5394*	6.7313*
	(0.2779)	(0.2593)	(0.6099)
No. of Observations	71	42	29
R^2	0.3664	0.6484	0.4218

*Notes: *, ** and *** denote 1%, 5% and 10% significance respectively. Standard errors in parentheses.*

Interest rate differential are consistently negative and significant in all specifications and in both regimes in majority of the threshold model. This stresses the role of interest rates in attracting capital inflows into Malaysia. Although the impact may be small, it is significant and the authorities should ensure that interest rates are kept at certain levels to maintain competitiveness of Malaysia as destination for capital investment. In this paper, the estimated impact of a 1% change in interest differential is expected to subdue foreign investment by 0.04 percentage point in the first regime and 0.03 percentage point in the second regime. The proxy for financial deepening, M3 is statistically significant in all models and in both regimes. Again, this signifies the importance of financial development in attracting capital investment into Malaysia. Interestingly, M3 is positive during the periods of low misalignment regime (regime 1) but becomes negative at higher misalignment regime (regime 2). During low misalignment, a 1% increase in M3 is expected to draw in 0.3 percentage point more investment inflow into Malaysia. This shows that in the lower regime, financial depth acts as an impetus to capital inflows. However, the situation reverse with 0.6 percentage point lower investment inflows is expected with a 1% increase in misalignment in the second threshold regime. Montiel (1999) explicitly explains this phenomenon where capital inflows increase reserves which then prompt an increase in the monetary base, M2 and M3. Such increases fuels further increments in domestic demand leading to real appreciation. Thus, any overvaluation of the currency may eventually have negative ramifications on capital inflows.

Sensitivity analysis

To check for the sensitivity of the estimated threshold value, Table 6 -7 and Figure 3 represents four other models which use different variables in addition to the baseline regression. The addition of taxes yields insignificant results without drastically changing the threshold value. Other additional variables such as government budget deficit and liquid liability are only significant in one of the two regimes[1]. With the inclusion of additional variables, the estimated magnitude of each regressors differ slightly but maintains the same sign and significance level. For example a 1%

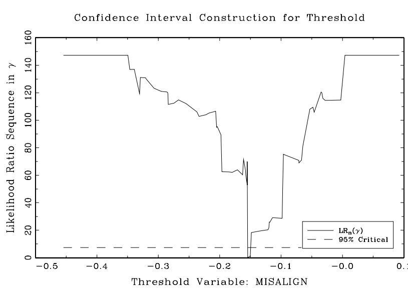
[1] Inclusion of other variables namely openness, real effective exchange rate, bilateral rates between Malaysia and US, inflation, volatility and lagged variables of *I(1)* regressors yield mostly insignificant results, hence not are reported. Results are available upon request.

increase in misalignment (overvaluation) suppresses capital inflows by 1.11-1.55 percentage point. The estimated impact of a 1% change in interest differential is expected to deter foreign investment by 0.04-0.05 percentage point in the first regime and 0.02-0.06 percentage point in the second regime. Similarly, during low misalignment, a 1% increase in M3 is expected to draw in 0.2-0.3 percentage point more investment inflow into Malaysia. An estimated 0.49-0.67 percentage point lower investment inflows is expected with a 1% increase in M3 in the second threshold regime.

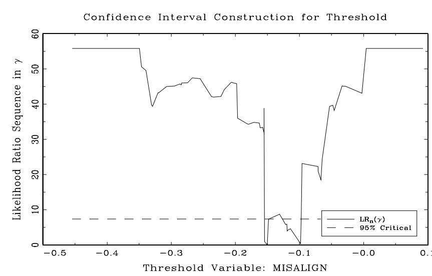
In view of the results, it seems evident that the exchange rate policy has important effect in attracting foreign capital inflows into Malaysia. Specifically, misalignment in terms of overvaluation should be kept lower than 15 percent to ensure that capital inflows remained unhurt.

Figure 3: Sensitivity Analysis: First Sample Split - Confidence Interval Construction for Threshold

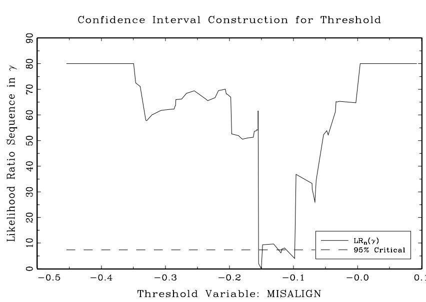
Model 2



Model 3



Model 4



Model 5

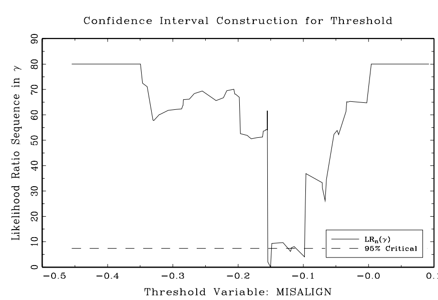


Table 5: Sensitivity Analysis: Threshold Effects

	Model 2	**Model 3**	**Model 4**	**Model 5**
		First Sample Split		
F-Stats	71.1442	45.9364	53.3722	53.3722
Bootstrap P-Value	0.000	0.000	0.000	0.000
Threshold Estimates	-15.4461%	-15.0260%	-15.0260%	-15.0260%
95% Confidence	-15.446%, -	-15.446%, -	-15.446%, -	-15.446%, -
Interval	15.025%	9.836%	0.0984%	0.0984%
		Second Sample Split		
F-Stats	16.4917	19.7585	22.9710	22.9710
Bootstrap P-Value	0.5310	0.3800	0.2420	0.2420

Note: H_0: No threshold effect. The threshold is based on the minimized sum of squared residuals

Table 6: Sensitivity Analysis for threshold estimates (1991:Q1-2008:Q3).

Model 2	**Linear Model**	**Threshold Model**	
	OLS without threshold	**Regime 1 ≤ 15.4461%**	**Regime 2 > 15.4461%**
Misalignment	-0.4278***	-0.3497	-1.5593*
	(0.2216)	(0.4143)	(0.3135)
Interest Differential	-0.0250***	-0.0462*	-0.0599*
	(0.0134)	(0.0153)	(0.0131)
M3	0.2966*	0.2732*	-0.5609*
	(0.0414)	(0.0488)	(0.0744)
Liquid Liability	-0.0029	-0.0634	1.1843*
	(0.1709)	(0.1932)	(0.2615)
Constant	2.9780*	2.5259*	6.1799*
	(0.2713)	(0.2593)	(0.3135)
No. of Observations	71	41	30
R^2	0.3842	0.6503	0.5986
Model 3	**Linear Model**	**Threshold Model**	
	OLS without threshold	**Regime 1 ≤** 15.0260%	**Regime 2 > 15.0260%**
Misalignment	-0.4472**	-0.3800	-1.1171***
	(0.2038)	(0.2460)	(0.6229)
Interest Differential	-0.0254*	-0.0505*	-0.0237
	(0.0126)	(0.0140)	(0.0221)
M3	0.2844*	0.2521*	-0.5391*
	(7.4922)	(0.0472)	(0.1477)
Deficit	-0.7655*	-0.7380*	-0.1841
	(0.3059)	(0.3099)	(0.7174)
Constant	3.0308*	2.5835*	6.6452*
	(0.2674)	(0.2445)	(0.7337)
No. of Observations	71	42	29
R^2	0.4285	0.6829	0.4230
Model 4	**Linear Model**	**Threshold Model**	
	OLS without threshold	**Regime 1 ≤ 15.0260%**	**Regime 2 > 15.0260%**
Misalignment	-0.2852	-0.2582	1.2490**
	(0.2181)	(0.2720)	(0.5612)
Interest Differential	-0.0275**	-0.0419*	-0.0311
	(0.0128)	(0.0165)	(0.0204)
M3	0.3208*	0.2796*	-0.5489*
	(0.0401)	(0.0583)	(0.1245)
Tax	2.1899**	0.1283	0.1260
	(1.0761)	(0.1457)	(0.1720)
Constant	3.0274*	2.2463*	6.5027*
	(0.4383)	(0.4806)	(0.7227)
No. of Observations	71	42	29
R^2	0.3665	0.6516	0.4300
Model 5	**Linear Model**	**Threshold Model**	
	OLS without threshold	**Regime 1 ≤ 15.0260%**	**Regime 2 > 15.0260%**
Misalignment	-0.3780***	-0.4495***	-1.3190**
	(0.1977)	(0.2602)	(0.6059)
Interest Differential	-0.0203	-0.0433*	-0.0308
	(0.0123)	(0.0152)	(0.0212)
M3	0.2941*	0.2388*	-0.6093*
	(0.0365)	(0.0479)	(0.1406)
Infrastructure	3.0729*	0.0474**	-0.0382
	(3.3373)	(0.0228)	(0.0392)
Constant	3.0709*	2.5698*	7.0433*
	(0.2569)	(0.2346)	(0.7173)
No. of Observations	71	42	29
R^2	0.4091	0.6815	0.4384

*Notes: *, ** and *** denote 1%, 5% and 10% significance respectively. Standard errors in parentheses.*

CONCLUSION

The objective of this chapter is to examine the impact of exchange rate misalignment on capital inflows. Results provide evidences of the negative impact of misalignment on capital inflows. To reiterate, overvaluation of the ringgit signals that Malaysia is less competitive vis-à-vis other countries. In addition, this paper also estimates a specific threshold value; that is the degree of misalignment after which it begins to hurt capital inflows. By employing a recent technique by Hansen (1996, 2000), this study splits the sample into high misalignment and low misalignment regimes. This study shows that misalignments hurt capital inflows in the high misalignment regime or when misalignment is greater than 15 percent. This study also confirms the work of Goh (2005) who suggests that the portfolio balance model can capture the determinants of capital inflows in Malaysia. In particular, the results suggest that interest differential is an important determinant albeit, small, hence, policies should be directed into maintaining a certain level of competitive interest rates. Furthermore, it is evident that financial deepening plays an important role to attract capital inflows. Finally, it is important that the Malaysian authorities continue to intervene the exchange rate and to keep overvaluation at its minimum.

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