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TRADE BALANCE IN THE PRESENCE OF STRUCTURAL BREAKS

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ABSTRACT

The main objective of this paper is to determine the long run relationship between trade balance and term of trade in Malaysia in the presence of structural breaks. The US and Japan are selected for the sample trading countries. The results from the unit root test and Johansen cointegration test show that there exist is long run relationship between trade balance and term of trade when the structural breaks points are taken into account. In addition, using the autoregressive distributed lag (ARDL) cointegration framework, the results confirm that a stable, long run relationship exists between trade balance and term of trade between Malaysia and her major trading partner, Japan. However, we failed to find any long run relationship between the variables for the US case.

Keywords: trade balance; structural breaks; net import; net export.

1. Introduction

The study on the relationship between trade balance and exchange rate movements is one of utmost important especially for a country like Malaysia whose economy is heavily depended on international trade. It is because if currency depreciation would improve the trade balance in the short run or long run, it may be desirable to accommodate to exchange rate depreciation to stimulate net exports and expand the economy. On the other hand if currency depreciation deteriorates the trade balance, then stability in exchange rate is suggested to be vital objective in a monetary and fiscal policy formulation. However, present empirical findings on the relationship between trade balance and exchange rate movements are still inconclusive (Bahmani-Oskooee and Niroomand, 1998, Bahmani-Oskooee and Ratha, 2004 and Narayan, 2004), and for Malaysia case, it is very limited. This has invited to interesting and on-going debate in the international economic literature.

This issue of responsiveness of trade balance to exchange rate fluctuations has been widely studied by testing Marshall-Lerner condition (Arize, 1990). In literature there are two approaches to study the validity of this condition. First is traditional approach. This method requires the estimation of both export and import demand model (Arize, 1990; Bahmani-Oskooee and Niroomand, 1998). According to traditional approach, Marshall-Lerner condition holds, i.e. the depreciation of domestic currency improves trade balance, only if the sum of the absolute values of imports and export demand price elasticity exceed unity (Gómez and Álvarez-Ude, 2006). Another approach that has been widely used to assess Marshall-Lerner condition is direct test as suggested by Haynes and Stone (1982). This approach tries to create a direct relationship between terms of trade and trade balance under the unconstrained distributed lag model. ML condition holds only if the sum of the estimated coefficients of terms of trade is non-negative i.e. escalation in terms of trade has enhanced trade balance (Arize and Ndubizu, 1992; Arize, 1994).

The aim of this study is to determine whether a long- and short-run relationship exists between the trade balance and the terms of trade.

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2. Theoretical consideration and model specification

A fluctuation of currency could improve, worsen or has no affect to trade balance depending on the size of the demand price elasticities for the country's export and imports. It is because depreciation in local currency makes foreign goods more expensive and reduces import spending. At the same time it will reduce price of domestic goods and may increase demand for export goods and hence raises export revenue. Theoretically, this situation can be explained using Marshall-Lerner condition. This condition suggest that

a. If the sum of export and import price elasticities greater than unity, then devaluation (appreciation) will improve (worsen) the trade balance,

b. If the sum of export and import price elasticities is less than unity, then devaluation (appreciation) will worsen (improve) the trade balance,

c. If the sum of export and import price elasticities is equal to unity, then devaluation (appreciation) will not affect the trade balance.

The long run specification model are given by:

$$lnTB_t = \alpha + \beta lnTOT_t + \varepsilon_t \quad (1)$$

where TB is trade balance (ratio of export to imports), TOT is term of trade (ratio of import price to export price), ε_t is error term.

If Marshall-Lerner condition holds, increase in the price of exports relative to the price of imports is expected to decrease the TOT and the TB. It is because imports are encouraged and exports are discouraged ($\beta < 0$).This condition also holds for the reverse ($\beta > 0$).

This condition says that, for a currency devaluation to have a positive impact in trade balance, the sum of price elasticity of export and imports (in absolute value) must be greater than 1. The principle is named for economists Alfred Marshall and Abba Lerner. As a devaluation of the exchange rate means a reduction on price of exports, quantity demanded for these will increase. At the same time, price of imports will rise and their quantity demanded will diminish.

The net effect on the trade balance will depend on price elasticities. If goods exported are elastic to price, their quantity demanded will increase proportionately more than the decrease in price, and total export revenue will increase. Similarly, if goods imported are elastic, total import expenditure will decrease. Both will improve the trade balance.

3. Data and Methodology

Empirical analysis was carried out using monthly data from 1995:01 to 2008:09. The trade balance (TB) is represented by the ratio of exports to imports and the term of trade (TOT) is the ratio of the import prices to the export prices, and all data measured in Ringgit Malaysia. All of these data were obtained from the Department of Statistics, Malaysia.

First, stationary tests which are Augmented Dickey–Fuller (ADF) (Dickey & Fuller, 1981), Phillips-Perron (PP) (Phillips & Perron, 1988) and unit root test with structural breaks are applied to determine the order of integration.

If there is a shift in the time series, it should be taken into account in testing for a unit root because the ADF test may be distorted if the shift is simply ignored. Saikkonen and Lutkepohl (2002) and Lanne et al. (2002) have proposed the following model:

A shift function, which is $f_t(\theta)'\gamma$, is added in the equation;

$$y_t = \mu_0 + \mu_1 t + f_t(\theta)'\gamma + e_t \quad (2)$$

where θ and γ are unknown parameters or parameter vectors and the errors e_t are generated by an AR(*p*) process.. And shift function is defined as;

$$f_t^{(1)} = d_{1t} = \begin{cases} 0, & t \prec T_B \\ 1, & T \geq T_B \end{cases}$$

The shift function, *ft* (θ)γ is a simple shift dummy variable with shift data $T_{B.}$ Saikkonen and Lutkepohl (2002) and Lanne et al. (2002) have proposed unit root tests based on estimating the deterministic term by the generalised least squares (GLS) procedure and subtracting it from the original series. Thereafter an ADF-type test is performed on the adjusted series.

Next, Johansen cointegration with structural break (Johansen et al. 2000) is performed in order to examine the impact any breaks on the cointegration relationship. Johansen (1998, 1991, 1992, 1994, 1995) has proposed likelihood tests if dependent variable is normally distributed. These tests are known as trace tests because of the special form of the test statistic. The distributions of the test statistics under their respective null hypotheses depend on the deterministic terms.

Considering the relatively small sample size, we also estimate the model using the autoregressive distributed lag (ARDL) cointegration test. We began by testing for the presence of a long-run relationship using the *F*-test to determine the joint significance of lagged levels of the variables involved. The *F*-statistics then compared with the bound critical value documented in Pesaran et al. (2001) and Narayan (2005).

4. Empirical Results

Stationarity (unit root) with structural break test results which is reported in Table 1 indicate that all series are nonstationary in log levels but stationary in log first differences.

Table 1 Unit Root Test Result

	Levels		**First Differences**	
	ADF	**UR with Str. Break**	**ADF**	**UR with Str. Break**
TB-JP	0.2396	-2.8405	-2.2126*	-1.8074
TB-US	-0.6840	-2.2007	-2.9091*	-2.8631*
TOT-JP	-1.5369	-1.9897	-2.9777*	-4.7345*
TOT-US	-1.9919*	-0.8898	-1.8522	-3.8885*

* denotes rejection of the null hypothesis at least 0.05 level

All variables are nonstationary in levels and integrated with same order *I*(1) according to the results from ADF and unit root with structural break tests.

Table 2 JJ Test Result

Variables	Lag Intervals	without break	with break
TB-JP, TOT-JP	2	26.25*	38.76*
TB-US, TOT-US	2	20.46	27.82*

* Indicate 1 cointegrating equation at the 0.01 level

The series for variable TOT-US has significant structural break and need to be taken into account in the analyses. To ignore it can cause spurious result. As indicated in Table 2, there are significant linkage between TB and TOT for Japan and US in the cointegration analyses when we include structural break. However, when we ignore the structural break in our analyses the relationship disappear for US. ECM test result reported in Table 3 reveal that no evidence for dynamic linkages is detected between TB and TOT for each sample countries.

Table 3 Estimation of Error Correction Model

	c β_1	ε_{t-1} β_s	Δy_{t-1} $\beta_{11}(1)$	Δy_{t-2} $\beta_{11}(2)$	$\Delta \chi_{t-1}$ $\beta_{12}(1)$	$\Delta \chi_{t-2}$ $\beta_{12}(2)$	*F*-stat.
With Japan	0.006	-0.16	-0.23	-0.01	-0.01	-0.01	
	0.38	-1.24	-1.22	-0.08	-0.95	-0.90	1.23
With Japan (SB)	0.009	-0.94	0.35	0.51	-0.05	-0.03	
	0.57	**-3.81**	1.44	2.28	-2.85	-1.98	3.22
With US	-0.01	0.007	-0.46	-0.30	-0.005	-0.009	
	-0.57	0.16	-2.89	-1.88	-0.49	-1.07	2.09
With US (SB)	-0.007	-0.09	-0.40	-0.27	0.009	-0.001	
	-0.23	-0.82	-2.14	-1.47	0.68	-0.12	2.09

The bound tests results are reported in Table 4. For Malaysia-Japan case, we find that there exists long run relationship between terms of trade and trade balance of the lag order one, two and three under the unrestricted trend model. However, we failed to established long run cointegration for the Malaysia-US case. The computed *F*-statistic was also compared with the critical values that account for small sample sizes provided by Narayan (2005).

Table 4 The Bounds Test Results

Model/			**Model without trend**					
Lag	1	2	3	4	5	6	C.V.[i]	C.V.[ii]
MS-US	1.5611	0.5270	0.7225	1.4130	1.6459	0.2974	5.73 (5%)	6.135 (5%)
MS-JP	2.4764	2.1912	1.3801	0.3996	0.1660	2.8737	4.78 (10%)	5.020 (10%)
Model/			**Model with trend**					
Lag	1	2	3	4	5	6	C.V.[i]	C.V.[ii]
US	4.3377	2.4953	2.3550	3.4605	4.3664	1.9261	7.30 (5%)	7.910 (5%)
Japan	7.4441[a,b]	7.7668[a,b]	7.4589[a,b]	4.3978	4.3622	5.3286	6.26 (10%)	6.640 (10%)

Note: MS-US and MS-JP represents Malaysia-US and Malaysia-Japan model, respectively. The superscript [a,b] denotes that the statistic lies above the upper bound, at least at 10% significance level based on (C.V.)[i] and (C.V.[ii]), respectively. Critical values, (C.V.)[i] are based on Pesaran et al. (2001) and (C.V.[ii]) are sourced from and Narayan (2005).

Using the ARDL approach, we obtained the long-run parameter estimates for terms of trade. As observed in Table 5, the result shows that the coefficient carry the expected signs (so called Marshall-Lerner condition holds) with reasonable magnitudes but statistically insignificant at usual significance level. The positive signs of the terms of trade parameter implies that the depreciation of Malaysian ringgit (that is, an increase in terms of trade) leads to an improvement in the bilateral trade with its major trading partners, in this case, Japan. The insignificant of the coefficient implies that the impact is relatively weak or small. This finding indicates that currency depreciation or devaluation in Malaysia will affect the bilateral trade balance. However, the magnitude is quite small.

Table 5 Long Run Estimates

Model	Lag	Coefficient		Diagnostic Test			
		TOT	*Intercept*	A: LM	B: RESET	C: JB	D: ARCH
MS-JP	AIC	0.0269	-0.1435	0.6914	0.9801	0.1663	0.3822
	(1,0)	(0.5230)	(-3.2149)	[0.7440]	[0.3290]	[0.9200]	[0.5400]

Note: MS-US and MS-JP represents Malaysia-US and Malaysia-Japan model, respectively. Figures reported in bracket ( ) and [ ] are *t*-ratio and p-value, respectively. The test statistics are: LM = Lagrange multiplier test for the autocorrelation; RESET = Ramsey's test for functional form misspecification, JB = Jarque-Bera test for normality of residuals; and ARCH = Engle's autoregressive conditional heteroscedasticity test.

Table 6 presents the error correction estimations for the Marshall-Lerner condition model based on the ARDL approach. The coefficients of the lagged difference are presented in the second column and the *t*-ratio indicating the significance level of the coefficients are shown in bracket. The error correction term represents the potential effects of departures from the long-run equilibria. The size and the significance of the error correction term in the equation show the tendency of the variable to restore equilibrium in the trade balance. Based on the results, the lagged error-correction term for Malaysia-Japan (-0.4298) carries its expected negative sign and is highly significant. The coefficients reveal that the speed of adjustment is rather high for the previous month's discrepancy between the actual and equilibrium value of *TB* is corrected each month. In other words, this means that the adjustment process to an exogenous shock is relatively high.

Table 6 Short Run Estimates

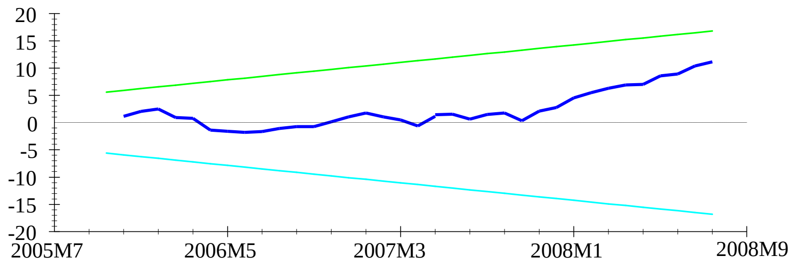
Variable	MS-JP
	AIC (1, 0)
ΔTB_{t-1}	-
ΔTB_{t-2}	-
ΔTOT_{t}	0.0116 (0.5220)
ΔTOT_{t-1}	-
ΔTOT_{t-2}	-
Intercept	-0.0617 (-2.0871)
ECM_{t-1}	-0.4298 (-3.0510)

Note: MS-US and MS-JP represents Malaysia-US and Malaysia-Japan model, respectively. Figures reported in bracket ( ) are t-ratio. Δ means the first difference and ECM_{t-1} is the error correction term.

Next, we assess the stability of the long-run relationship between trade balance and terms of trade. We relied upon the CUSUM and CUSUM-squared tests proposed by Brown et al. (1975) to test for constancy of long-run parameters. If the plot of the CUSUM statistics stays within the 5% significance level, then the estimates are said to be stable. The same applies to the CUSUM-squared statistics, which are based on the squared recursive residuals. As can be seen in Figure 1, the plot of the CUSUM and CUSUM-squared statistics stayed within the critical bounds indicating the stability in the model (for Japan case). These findings justify the stability of the model and we can conclude that the relationship between trade balance and terms of trade are stable for the Malaysia-Japan model.

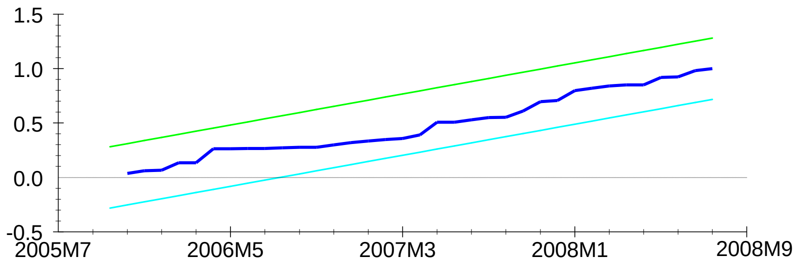
Figure 1 Plot of CUSUM and CUSUMSQ for Japan

Plot of Cumulative Sum of Recursive Residuals (CUSUM)



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ)



The straight lines represent critical bounds at 5% significance level

5. Conclusion

In this study, we examined the long run relationship between trade balance and term of trade for Malaysia and her major trading partner, the US and Japan. The this end, we use the method that take into account the structural break point, the Johansen cointegration with structural break test (Johansen et al. 2000). Our results failed to reject the null hypothesis that there is no long run relationship between trade balance and term of trade. The result holds for all the cases under investigation. This result indicate that the exchange rate movement plays an important role and have significant impact on the value of net import and export in Malaysia for the case where the US and Japan are the trading partner. Additionally, employing bounds cointegration testing approach as proposed by Pesaran et al. (2001, ARDL), we found that there exist a positive and significant long-run statistical equilibrium between trade balance and terms of trade for Malaysia-Japan case but not for Malaysia-US.

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