Determinants of Bilateral Trade between Malaysia and the United States of America: An ARDL Analysis

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ABSTRACT

Trade balance, exchange rate, domestic income and foreign income are among the factors which determine a country's economic growth. In this study, an empirical analysis was conducted to investigate the determinants of the Malaysian bilateral trade balance with USA in the short- and long-runs by using the Autoregressive Distributed Lag (ARDL) framework. This study used quarterly data from 1997 to 2016. The study found that domestic income, foreign income and real effective exchange rate affect the bilateral trade balance in both the short- and long-terms. This shows that these variables are strongly significant in determining the trade balance. The study concluded that encouraging exports and controlling imports are deemed important. This is also important to increase the inflow of money to contribute to a positive trade balance in the long-term so that we can boost the domestic economy.

Keywords: trade balance, economic growth, real effective exchange rate, USA, ARDL.

INTRODUCTION

The trade sector in Malaysia is one of the major contributors to economic growth. The top export products from Malaysia are electrical and electronic products, petroleum products, chemicals and chemical products, palm oil and liquefied natural gas (LNG), while the top import products are electrical and electronic products, machinery equipment and parts, chemicals and chemical products, petroleum products and transport equipment. The trade sector contributed approximately RM 135 billion in the early part of 2017.

The United States of America (USA) is one of Malaysia's major trading partners. The bilateral relationship between Malaysia and USA was established a long time ago, *i.e.* during the early 1970s when many American companies invested in Malaysia. Some

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companies such as ConocoPhillips, Hess and Murphy Oil and Exxonmobil invested in developing Malaysia's energy resources.

The trade balance of a country is determined by such factors as exchange rate, domestic income, foreign income and other monetary and fiscal policies. However, this study focuses on exchange rate, domestic income and foreign income. The relationship between trade balance and exchange rate is called a 'J-curve', which indicates a process whereby currency devaluation will lead to a decline in trade balance for a short period, but will eventually improve over a longer period. This phenomenon is believed to be detrimental for a country's trade balance in the short-term, but will improve in the long-term.

Therefore, the main objective of this study was to establish the determinants of the Malaysia – USA bilateral trade balance in the long- and short-terms using the Autoregressive Distributed Lag (ARDL) framework and Error Correction Model (ECM). In addition, this study set out to determine the existence of the J-curve effect in the bilateral trade balance of Malaysia and USA.

LITERATURE REVIEW

Many studies have been conducted separately on trade balance and exchange rate. However, there appears to be a lack of studies on the relationship between exchange rate and trade balance. For example, a study conducted by Shao (2008) indicated that the effect of exchange rate on the trade balance between Japan and the USA cannot be determined. Despite appreciation of exchange rate, in the short-term it may reduce the balance of trade; however, in the long-run, there is no real relationship between the two. Shao (2008) also added net foreign asset as a variable for determining trade balance. This is related to the 'valuation channel' where net foreign assets are found to be important for the external adjustment process.

In addition, Duasa (2007) stated that there is no evidence to support the theory of a Marshall-Lerner or J-curve in the long-term for Malaysia. Only income and money supply affect trade balance but not exchange rate.

Meanwhile, Šimáková, and Stavárek (2014) studied the effect of exchange rate on trade flow in the industrial rank of the Czech Republic. The purpose of their study was to analyse the relationship between the two in the short- and long-terms, using a VECM model. Depreciation seemed to improve the industrial trade balance in the Czech Republic.

Some studies using a non-linear ARDL model indicated that the rising peso affected Mexico's trade balance. In addition, the impact of the peso is different compared with the effect of depreciation on the support effect of changes in real exchange rate asymmetry; however, it is different for each country (Bahmani-Oskooee *et al*., 2016). A study found that the conventional approach of a currency devaluation to improve trade balance does not produce similar results in every country. A study conducted by Hsing (2008) concluded that results from only a few Latin American countries such as Chile, Ecuador and Uruguay support the J-curve theory.

METHODOLOGY

Data and Methodology

This study uses quarterly data, starting from the first quarter of 1997 until the first quarter of 2016. The data were gathered from the Thomson Reuters Datastream, World Development Indicators (WDI) and from the World Bank. The study adopted the approach of Bahmani-Oskoee and Hegerty (2011) by modelling trade balance (TB) as a function of real gross domestic product of Malaysia (GDP), foreign income that is the real gross domestic product of USA (GDPF) and real effective exchange rate (REER). All variables were transformed into natural logarithms.

The study expected Malaysian GDP to increase imports and reduce the trade balance while US income will increase Malaysian exports and boost the trade balance. Appreciation in REER will decrease the trade balance. However, following the J-curve theory is only effective in the long-run while the opposite is true in the short-run. A recent study on cointegration and an ECM incorporated the ARDL approach of Pesaran *et al*. (2001) which includes the short-run (differenced) variables and long-run level in the same equation:

$$\Delta Lntb_t = \alpha_o + \sum_{i=1}^{p}\beta_1\Delta Lntb_{t-i} + \sum_{i=0}^{p}\beta_2\Delta Lngdp_{t-i} + \sum_{i=0}^{p}\beta_3\Delta Lngdpf_{t-i} + \sum_{i=0}^{p}\beta_4\Delta Lnreer_{t-i} + \Omega Lntb_{t-1} + \Omega_2 Lngdp_{t-1} + \Omega_3 Lngdpf_{t-1} + \Omega_4 Lnreer_{t-1} + \varepsilon_t \quad \text{Equation (1)}$$

where:

tb = Malaysian trade balance with USA defined as the ratio of export value (*X*) to import value (*M*) (*X*/M)
gdp = real gross domestic product of Malaysia
gdpf = real gross domestic product of USA
reer = real effective exchange rate
Δ = first difference operator
p = the optimal lag length.

The ARDL approach usually does not involve pre-testing of the variables, which means it does not require all variables to be I(0) or I(1). The null hypothesis for

the unit root test is not stationary; Ho: $\delta = 0$ (not stationary or has unit root) against the alternative hypothesis, H1: $\delta \neq 0$ (stationary or does not have unit root). However, the unit root test for ARDL ensures that there is no variable which is stationary at the second difference.

With ARDL, there is a possibility that different variables have a different optimal lag length, which is not possible for the usual cointegration test. The F-test is used to test for cointegration, or in other words the existence of a long-run relationship. The null hypothesis is H_O: $\Omega_1 = \Omega_2 = \Omega_3 = \Omega_4 = 0$ (does not co-integrate) versus H_1: $\Omega_1 \neq \Omega_2 \neq \Omega_3 \neq \Omega_4 \neq 0$ (co-integrated or has a long-run relationship). Two sets of critical bounds for the F-statistics were generated by Pesaran *et al.* (2001): the lower critical bound (LCB) and the upper critical bound (UCB). If the F-statistics is less than LCB, it indicates no cointegration or no long-run relationship between the studied variables. However, if the F-statistics is greater than UCB, it means that there is cointegration or a long-run relationship between the variables. If the F-statistics is between LCB and UCB, the cointegration test is considered to be inconclusive.

If there is evidence of the existence of a long-run relationship, the orders of lags in the ARDL model will be selected by either the Akaike Information Criterion (AIC) or Schwarz-Bayesian Criterion (SBC) or R^{-2}. The following long-run model is estimated:

$$Lntb_t = \alpha_o + \sum_{i=1}^{p}\Omega_1 Lntb_{t-i} + \sum_{i=1}^{p}\Omega_2 Lngdp_{t-i} + \sum_{i=1}^{p}\Omega_3 Lngdpf_{t-i} + \sum_{i=1}^{p}\Omega_4 Lnreer_{t-i} + \varepsilon_t \quad \text{Equation (2)}$$

The ARDL specification of the short-run dynamics can be derived by using the ECM in the following form:

$$\Delta Lntb_t = \mu + \sum_{t=1}^{n}\beta_1 \Delta Lntb_{t-i} + \sum_{t=0}^{n}\beta_2 \Delta Lngdp_{t-i} + \sum_{t=0}^{n}\beta_3 \Delta Lngdpf_{t-i} + \sum_{t=0}^{n}\beta_4 \Delta Lnreer_{t-i} + \lambda ECT_{t-1} + \varepsilon_t \quad \text{Equation (3)}$$

where ECT_{t-1} is the error correction term.

Empirical Results

Prior to testing for cointegration, the first step was to examine data stationarity, and consequently the existence of unit root, by using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests (*Table 1*). These unit root tests ensure that all variables are stationary at level and/or after the first differencing, and that there is no variable that needs to be integrated twice.

Based on the results, all the variables were significant at level and/or after first difference. From the results, Lntb, Lngdp and Lngdpf were stationary at first difference while Lnreer was stationary at level. Thus, the cointegration test that is also known as bound testing could proceed.

The next step was to estimate the long-run relationships among the variables. SBC was used to determine the optimum number of lags for this study. The calculated F-statistics for the cointegration are shown in *Table 2*.

Based on *Table 2*, the F-statistics value of 6.3436 is higher that the UCB value at 1% level of significance (*i.e.* 5.61). This indicates that the null hypothesis of no cointegration is rejected at 1%. Thus, there was a cointegration between the variables, meaning that long-run relationships among the variables existed.

After the cointegration test, the long-run estimation was conducted, and the results of the long- run estimation is shown in *Table 3*.

The results of the long-run estimation show that all

TABLE 1. UNIT ROOT TESTS

		ADF		PP	
		Intercept	Trend and intercept	Intercept	Trend and intercept
Lntb	I(0)	-2.351	-2.920	-2.315	-2.920
	I(1)	-9.477***	-9.617***	-9.420***	-9.545***
Lngdp	I(0)	-0.419	-3.641**	-0.513	-2.673
	I(1)	-9.153***	-6.115***	-6.072***	-6.039***
Lngdpf	I(0)	-2.118	-2.289	-2.556	-2.492
	I(1)	-5.602***	-5.858***	-5.594***	-5.884***
Lnreer	I(0)	-4.555***	-4.373***	-4.498***	-4.346***
	I(1)	-6.201***	-6.239***	-6.201***	-6.240***

Note: Significant at *10% level; ** 5% level; *** 1% level.
ADF - Augumented Dickey-Fuller.
PP - Phillips-Perron.

independent variables provided significant impact to trade balance, and this suggests that all three variables were determinants of the Malaysian trade balance. As *Table 3* shows, the Malaysian GDP yielded a negative and significant effect on trade balance in the long-run. An increase in income promoted the importation of products and reduced the trade balance. Even if the Malaysian GDP increased, the dependency of Malaysia on US products was still high and this will increase the imports and reduce the trade balance.

US GDP, however, yielded a positive and significant effect on Malaysian trade balance. As US GDP increased, the demand for Malaysian export products rose in tandem, and this will increase the trade balance in the long-run. When the demand of export products increased, it increased the trade balance and provided positive returns.

For this study, a negative and significant impact from REER on trade balance was found. This suggests that the J-curve existed in the long-run in this case, showing that appreciation of the Ringgit will produce a negative effect on the trade balance in the long-run. As the Malaysian currency appreciated, export prices will be higher and the demand for import products will increase as they will be relatively cheaper. Thus, this decreased the trade balance in the long-run.

The results from ECM for this study are shown in *Table 4*. All the variables are significant including ECT.

Based on *Table 4*, the ECT coefficient is significant, negative and less than one. This supports the premise that a long-run relationship existed. The ECT term also indicates the speed of adjustment by which two consecutive quarters adjust back to equilibrium. In addition, 45% of the deviation in the long-run was associated with Lntb

Other determinants such as Δlngdp and Δlnreer had a negative and significant impact on Lntb. This indicates that in the short-run, an increase in Malaysian GDP and REER will worsen the trade balance. As the Malaysian currency appreciated, the import products will be relatively cheaper, thus the demand for imports will increase, leading eventually to a deteriorating trade balance. However, when the US GDP increased, the Malaysian trade balance will improve. This is because the foreign demand for Malaysian products will grow, promoting exports from Malaysia; hence, there would be a positive effect to the trade balance.

Finally, to test the model, diagnostic checking must be done. The diagnostic tests are given in *Table 5*.

To test for normality, the Jarque-Bera diagnostic test was utilised. It represents the null hypothesis (which is the residual that is normally distributed) tested against the alternative hypothesis (which is the residual that is not normally distributed). The result indicates that the null hypothesis was not rejected, which means that the residual was normally distributed.

For autocorrelation, the LM test was used. The null hypothesis in this case assumes that there is no autocorrelation, while the alternative hypothesis states that there is autocorrelation. The result shows that the null hypothesis was not rejected, implying that there was no autocorrelation. For heteroscedasticity, using the ARCH test, the null hypothesis is that the heteroscedasticity does not exist, while the alternative hypothesis assumes that heteroscedasticity exists. The null hypothesis was not rejected at the 1% level of probability, implying that there was no heteroscedasticity problem in the model.

Finally, to test for misspecification in the model, the RAMSEY Reset Test was utilised. The null hypothesis states that there is no misspecification problem while the alternative hypothesis states that misspecification exists. With the value of 2.3315, the null

TABLE 2. BOUND TESTING

	Value	Lag	Significant level (%)	Critical value	
				I(0)	I(1)
F-statistics	6.3436***	4	10	2.72	3.77
			5	3.23	4.35
			2.5	3.69	4.89
			1	4.29	5.61

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

TABLE 3. LONG-RUN MODEL

	Independent variable		
	Lngdp	Lngdpf	Lnreer
Dependent variable: Lntb	-0.996*** (-4.6397)	3.207*** (3.0779)	-1.530** (2.0038)

Note: t-statistics are in parentheses.
***Significant at 1% level. **Significant at 5% level.

TABLE 4. ERROR CORRECTION MODEL	
Dependent variable: $\Delta Lntb_t$	
Independent variable	**Coefficient**
ECT_{t-1}	-0.4494*** (-5.472)
$\Delta Lngdp$	-0.4476*** (-3.085)
$\Delta Lngdpf$	1.4416** (2.332)
$\Delta Lnreer$	-0.6878** (-2.166)

Note: t-statistics in parentheses.
***Significant at 1% level.**Significant at 5% level.

TABLE 5. DIAGNOSTIC TESTS	
Dependent variable: $\Delta Lntb_t$	
Diagnostic test	**Result**
Normality (Jarque-Bera)	3.4724 (0.1762)
Autocorrelation (LM test)	0.9490 (0.6361)
Heteroskedasticity (ARCH)	0.0235 (0.8781)
Misspecification (RAMSEY Reset)	2.3315 (0.1313)

Note: p-value in parentheses.

hypothesis was not rejected at the 1% level of probability. Thus, there was no misspecification problem, and the model is acceptable.

CONCLUSION

Briefly, in the long-run, the determinants of the Malaysian bilateral trade balance are GDP, GDPF and REER. In the short-run, domestic income, foreign income and REER cause a significant impact on the trade balance. This shows that GDP, GDPF and REER affect the trade balance in both short- and long-runs.

The statistical significance of the variables shows that GDP, GDPF and REER play important roles in determining the long-run behaviour of Malaysia's bilateral trade balance with USA. However, the results of this study do not support the J-curve theory as REER has the same effect on the trade balance in both the short- and long-runs.

Therefore, the study found that encouraging exports and controlling imports are important. Both are vital for increasing the inflow of money to contribute to a positive trade balance in the long-term in order to boost the domestic economy.

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