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Comprehensive Approach to the J-Curve Theory between Malaysia and its Major Three Asian Trade Partners

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Abstract

Among many theories on the impact of exchange rate movements on trade balance, the J-Curve Theory gained most of the attention. The theory claims that the impact of exchange rate on trade is time-dependent. This current study criticizes the literature on the theory because of its incomprehensiveness and its inability to examine whether the impact of exchange rate depreciation is more related to the nature of trade commodities or due to the circumstances of bilateral trade relations. This study investigates the J-Curve Theory between Malaysia and each of China, Singapore, and Japan for 20 trade sectors over the period 1987-2016. We find that the impact of exchange rate movements on trade balance is largely dependent on the nature of traded sectors as well as the trade partner-specific economic circumstances.

***Keywords**:* Malaysia, Exchange rate, Trade balance, J-Curve theory, Comprehensive Approach

1. Introduction

As initially noted by Magee (1973), the J-Curve phenomenon indicates that trade balance is likely to worsen in the short run as a prompt response to currency devaluation. However, in the long course, the trade balance recuperates to a higher level as against its initial level when depreciation happened. This order of variations in trade balance over time could be equated to the capital letter J.

During the short run, the value effect strikes quickly by altering the prices of traded commodities. The imports value rises because of currency depreciation due to payments in domestic currency, hence, the net exports fall, triggering a worsening of the trade balance. Nonetheless, the value effect then causes the trade balance to enhance in the long run by altering the trade volumes. It is triggered concurrently through a blend of two impacts. First, the domestic market begins to offset the comparatively high price of imports by using up domestic production. Second, the exports begin to rise, considering their newly elevated price-competitiveness in the global markets.

The J-Curve theory has spanned the majority of the latest empirical literature regarding the association between trade balance and exchange rate changes because of its capability of assessing other old methodologies indirectly, while offering an innovative approach to the matter. According to the Marshall-Lerner Condition, which asserts that for a currency depreciation to have a positive impact on trade balance, the demand elasticities for exports and imports should surpass unity in absolute terms (Marshall & Groenewegen, 1923), a long-run enhancement of the trade balance based on the J-Curve analysis could suggest the condition is satisfied (Bahmani-Oskooee & Wang, 2008).

As specified ahead in section 3, the probable theory concerning the J-Curve has undergone three phases of improvement. While previously conducted studies employed the collective trade information concerning a country and its trade partners, aggregation bias and exogeneity prompted several researchers to analyse the trade information in a bilateral context. To achieve further bias reduction, vast amounts of literature have assessed the J-Curve in the bilateral context analysing trade at a disaggregated scale such as commodity-level or sector-level.

Nevertheless, even after witnessing several improvements, the J-Curve remains among the most widely debated subjects in this domain. In the context of the J-Curve, the crucial question that persists is stated next. Fluctuations in exchange rates affect trade balance but not homogenously considering many bilateral relations in the context of development and structure of the economy. Along the same lines, similar effects may not produce homogenous effects for commodities. Detailed research should be performed at a sector-level in the context of the J-curve of a country and its primary trading partners so that policymakers can use the results as a reference during monetary policy formulation.

To handle the new viewpoint, a new phase concerning the improvement of the J-curve analysis may be started. Using this process, the effects of exchange rate fluctuations may be captured in the context of the trade balance specific to the primary bilateral associations of a nation and several commodities, which facilitates new bidirectional correlations at sector-level and trading partners. If with a specific partner, there is a more pronounced impact of REX depreciation compared to the others, it may be understood that the effects are primarily due to the aspects of the sector.

In this context, this study examines as a case study the J-Curve framework in the context of Malaysia and its three primary Asian trade partners. The study uses data between 1987 and 2016 and utilises an integrated approach comprising the empirical technique of ARDL and ECM. The study considers 20 distinct sectors in which there have been imports or exports concerning Malaysia and its trading partners.

The remainder of the paper is structured as follows. Section 2 highlights Malaysia's economy. Section 3 tracks and appraises the studies on J-Curve. Section 4 introduces the research methodology and approach. The outcomes of the empirical tests are presented in Section 5 and section 6 offers a brief summary of the study.

2. Malaysia in the Context of the Study

The economy of Malaysia is highly promising as shown by its rapid economic growth. In each decade from 1961 to 2016, the economy's average economic growth mounted 6.5%, 7.9%, 6%, 7.2%, 4.6% and 5% respectively (World Development Indictors, 2016). According to figures obtained from the World Bank from 1987 to 2016 as shown in Graph 1, if someone looks at the GDP growth rate trying to perceive how Malaysia's economy performed in comparison with the average of the whole world, it can be noticed that Malaysia has performed better in 28 out of 30 years. (World Development Indictors, 2016).

As can be seen from the graph above, Malaysia's rate of growth in Gross Domestic Product had been subjected to multiple dips, however, the strongest are two. First, the Asian Financial Crisis (1997-1998), which was initially caused by the free floating of the Baht of Thailand (Corsetti, Pesenti, & Roubini, 1999). Malaysia recovered from the crisis faster than many of the other countries hit by the crisis through fixing the exchange rate and imposing strict capital controls over the financial system (Ali, Dhakir, et al, 2019). Dhakir Abbas, et al, 2019 Second, the Global Financial Crisis, which started in the US and spread around the world. The crisis was triggered by the bursting of a speculative bubble in the US housing market in 2008 (Athukorala, 2010). However, Malaysia also managed to recover from the crisis through monetary expansion, characterized by low inflation, strong balance of payments, and healthy banking system. A noteworthy feature of the adjustment process was the remarkable stability of the exchange rate, following a mild depreciation in the first two quarters of 2009 (Goh, Lim, & Sua, 2012). From Malaysia's responses to the two major economic crises discussed above, it can be noticed that monetary policy has played a central role.

On Malaysia's monetary policy, the stated policy of the central bank (Bank Negara Malaysia) is to maintain stability for the exchange rate that reflects the Malaysian Ringgit's real value without setting neither preplanned depreciation nor appreciation. The value of the ringgit generally tracks a basket of currencies in which the weight of each currency is mainly determined by the scale of bilateral trade. Which makes the de jure exchange rate regime "managed float" (Bank Negara Malaysia, 2008). However, the central bank still intervenes in the foreign exchange market to ensure stability for the Ringgit against its major trade partners. This stability has improved the overall climate for foreign direct investment and promoted export-oriented industries, the policy that can push Malaysia closer to its stated plans of the New Economic Model (Bahmani-Oskooee & Harvey, 2010).

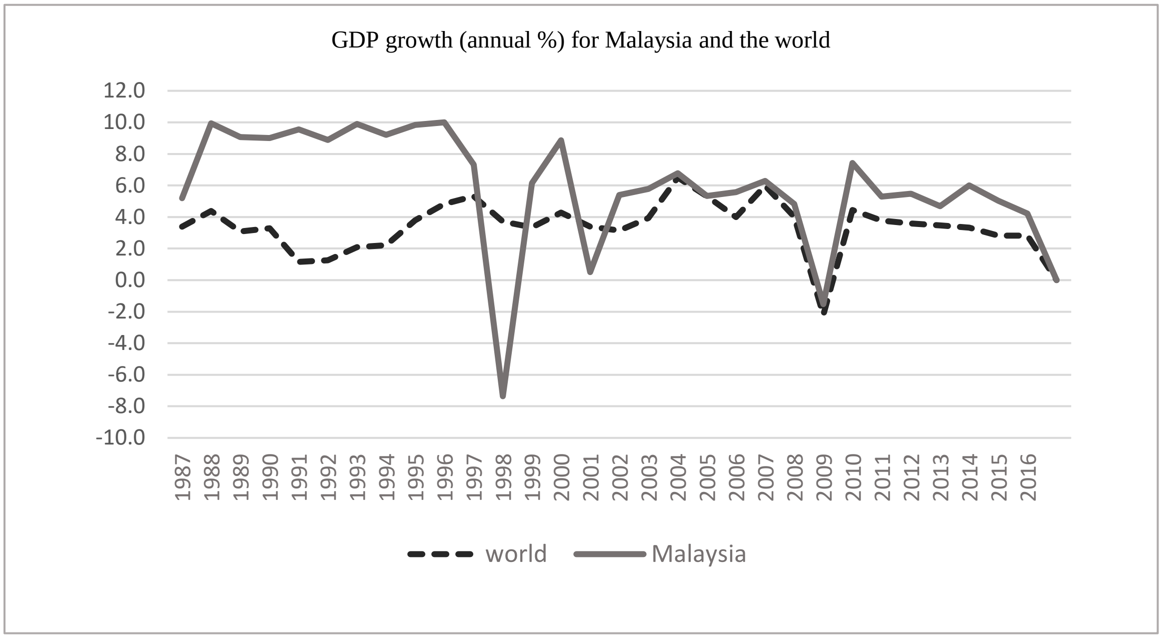


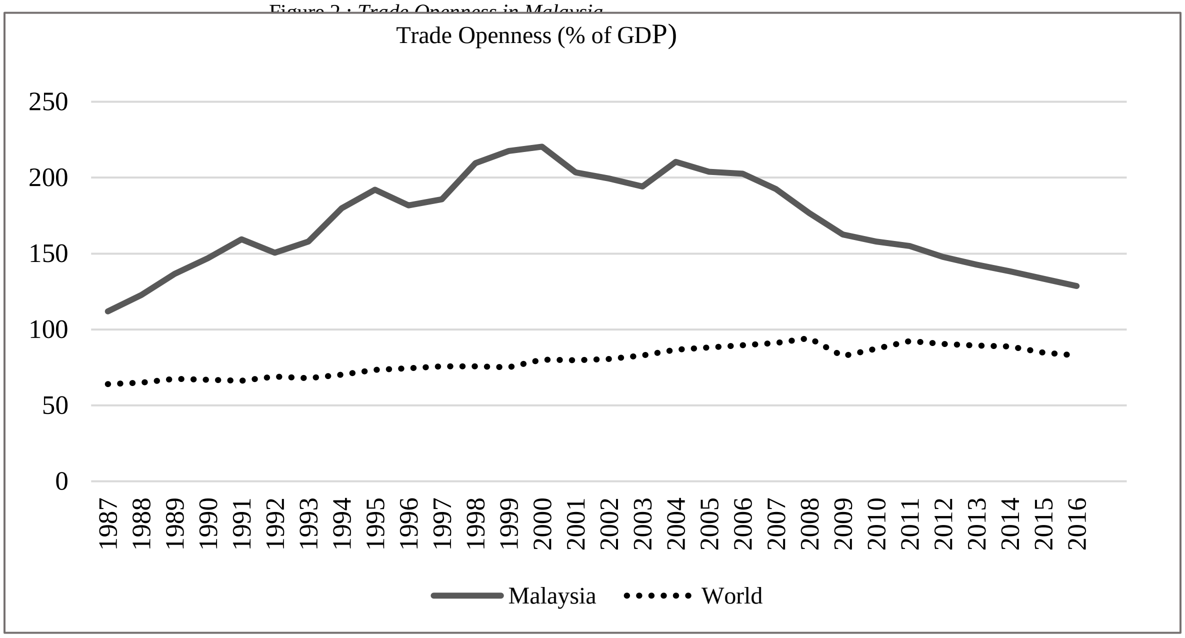
Figure 1: Malaysia's economic growth compared to the world's average

Source: World Development indicators, World Bank

The central bank maintains healthy foreign exchange reserves, these reserves mounted $ 96.4 billion as of 30 November, 2016. This position is claimed to be sufficient to finance 8.3 months of retained imports and is 1.2 times the short-term external debt (Bank Negara Malaysia, 2016).

Malaysia’s economy is largely exports-drive as Trade Openness shows. This index is defined as the sum exports and imports of a country divided by the Gross Domestic Product. Therefore, the index is unit free and, thus, comparable among countries (World Development Indictors, 2016). Graph 2 depicts Malaysia’s trade openness for the period of this study and compares it with the average of the whole world.

Figure 2 : *Trade Openness in Malaysia*



As clearly reflected from the graph, Malaysia's trade openness is very high as compared with other countries. In fact, out of 248 countries and entities classified by the World Bank Development Indicators Database, Malaysia was ranked as the world's 19th most open trading economy for the year 2016. This illustrates very clearly that Malaysia's policymakers are highly interested in stimulating an export-driven growth of the economy, which also shows the centrality of trade to economic growth. The high trade openness and freedom in Malaysia highlights the significance of assessing the impacts of REX on trade in this study. This is because REX movements are expected to have a stronger impact on trade in a an open country where higher levels of trade openness leads to changes in price levels, thus, changes in REX (Pula & Skudelny, 2010).

To shed the light on Malaysia's trade partners, Graph 3 ranks the partners in their order of significance for the year 2016. The partners are sorted based on the sum of imports and exports with Malaysia. The data is reported by Malaysia following the Standard International Trade Classification, Revision 1, the World Bank.

It can be observed that Malaysia's top ten trade partners are responsible for as high as 69.5% of its overall trade with the whole world. Furthermore, the major three Asian trade partners only are responsible for nearly 36.8%. It should be stated, however, that the differences among the top three Asian trade partners are not very substantial with 16.2, 12.5, and 8.1 for trade with China, Singapore, and Japan, respectively.

Given the centrality of trade and monetary policy to Malaysia's economy, many studies tried to examine the impact of exchange rate on trade dynamically, i.e. the J-Curve Theory.

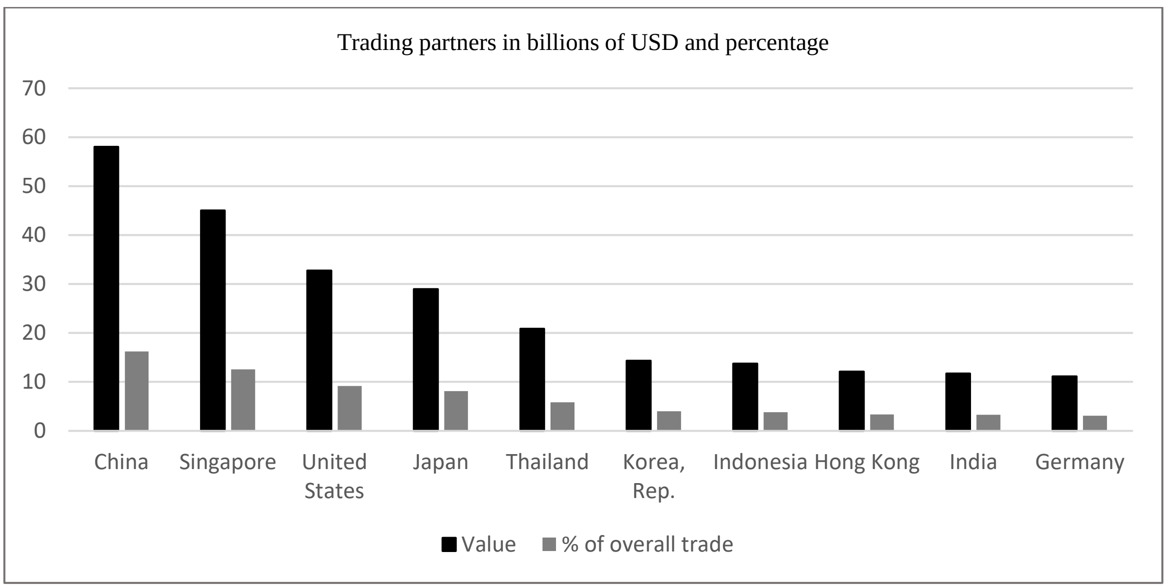


Figure 3: Malaysia's key trading partners in 2016
Source: Standard International Trade Classification, Revision one,
World Integrated Trade Solution, the World Bank. www.wits.worldbank.org

3. Literature Review

Previous studies concerning the J-curve theory used trade information at an aggregate level, which comprises a country's trade with all its trade partners to assess the general relationship between a nation's trade balance and the magnitude of currency devaluation (Ali, Dhakir, et al., 2014). Bahmani-Oskooee and Alse (1994) examined the characteristics of the J-Curve by using error-correction modelling and cointegration on two sets of nations (of which 19 are developed, while 22 are not), which includes Malaysia. This study employed aggregated bilateral trade data at quarterly intervals in the period between 1971 and 1990. Out of the sample total of 20 countries where the cointegration method may be used, only six countries produced relevant results that highlighted that trade balance is cointegrated with real effective exchange price. For a majority of the nations, these two variables were determined to be non-cointegrated, thereby highlighting that currency devaluation may not exert persisting effects on the trade balance in the context of Malaysia.

Both studies employed aggregated data and had the aggregation bias challenge. To handle this challenge, Baharumshah (2001) and Onafowora (2003) rely upon a cointegrating vector error correction model (VECM) while the data was disaggregated at the bilateral level. Baharumshah (2001) determined that the J-curve exerts no effects on bilateral trade levels between Malaysia and Thailand or between the US and Japan, which is in contrast to Onafowora (2003), who proposed that the J-curve effect exists in the context of Malaysia's trade balance with the US and Japan. Wilson's(2001) research was based along the same lines, where disaggregated bilateral data were employed to assess the association between the real exchange rate and the bilateral trade balance concerning Singapore, Korea and Malaysia trading with the US and Japan. Using the general Autoregressive Distributed Lag model, no strong evidence was found regarding J-curve theory in the case of Malaysia.

The Autoregressive Distributed Lag (ARDL) technique was formulated by Pesaran et al. (2001) who used recent empirical research to validate cointegration analyses. Bahmani- Oskooee and Cheema (2009) examined the short-term and long-term effects of REX depreciation on Pakistan's trade balance with its partners, one of which is Malaysia. The authors employed disaggregated bilateral data and used the bounds testing technique for cointegration. They determined that a depreciation of the rupee/ringgit exerted no significant short- or long-term effects on the bilateral trade balance between the two countries.

Bahmani-Oskooee and Harvey (2010) modified the bounds testing technique of cointegration and error-correction modelling. They subsequently employed disaggregated bilateral trade data, where an assessment was conducted concerning Malaysia and its fourteen biggest trading partners to evaluate the short- and long-term effects of currency devaluation on the trade balance. The results highlighted that the j-curve is present only for the Malaysia-Germany trade scenario.

By the inquiry of literature on the J-Curve in Malaysia on sector level, this current study finds two research papers only, namely Soleymani, Chua, and Saboori (2011) and Bahmani-Oskooee and Harvey (2012). Although Soleymani et al. (2011) worked on trade balance directly, defined as the ratio of Malaysia's exports of commodity i to China over her imports of the same commodity from China, while Bahmani-Oskooee and Harvey (2012) worked on exports and imports seperately, both studies employed the Autoregressive Destributed Lag (ARDL) approach to cointegration and Error Correction Model (ECM) to estimate the short run effects. The same models once adopted by bahmani 2007-2008 as shown in eq 3.15.

Soleymani et al. (2011) investigated the short-run effects and long-run effects among 53 industries to determine the ringgit/yuan's depreciation on the trade balance for each industry and used quarterly trade data over the period 1993Q1-2009Q4. Based on the bounds testing approach and error-correction modelling, results showed that depreciation of ringgit has short-run effects of majority of the industries on the trade balance. Only 11 of the 53 industries had favourable long-run effects while J-curve phenomenon only exists in 10 industries. Bahmani-Oskooee and Harvey (2012), considered 101 industries that are export from US to Malaysia and 17 industries imported from Malaysia. While majority of the industries showed short-run sensitivity to the real bilateral exchange rate, short-run effects lasted into the long run almost in half of the industries in both group. The study covers the period of 1971-2006 using annual data.

4. Methodology

Due to trade data availability, this study extends from 1987 to 2016. The 20 sectors reported in Appendix A are retrieved from the SITC Trade Data Classification as reported by Malaysia. The same trade sectors are traded between Malaysia and each of its major three trading partners. All the data used in this study are from the World Bank.

This study applies the cointegration technique advanced by Pesaran and Shin (1998) and Pesaran, Shin, and Smith (2001), known as the Autoregressive Distributed Lag (ARDL) approach. The main advantage of the ARDL procedure lies in the fact that it can be applied irrespective to whether the regressors are I(0) or I(1). In turn, this avoids the pretesting problems associated with standard cointegration analysis, which require the classification of the variables as either I (1) or I (0).

Following Rose and Yellen (1989), Bahmani-Oskooee and Brooks (1999), and Bahmani-Oskooee and Bolhasani (2008) the trade balance model employed here involves the real exchange rate and two scale variables (one for Malaysia and the other for her partner X).

Since the same theory is going to be tested in this study between Malaysia and each of its partners, the estimation model of the J-Curve Theory would be stated only once to save space (Ali, Dhakir, et al, 2015).

However, the script [x] in the model indicates whether the trade partner is China, Singapore or Japan. The following modified formulation is adopted, where the long-run model takes the following form:

$$lnTB_{xi,t} = \alpha + \beta\ lnY_{ma,t} + \gamma\ lnY_{x,t} + \varphi lnREX_{xi,t} + \mu_t \qquad [1]$$

where TB_i is a measure of the trade balance of commodity i defined as the ratio of Malaysia's exports of commodity i to Country X over her imports of the same commodity from Country X (Ex/Imp). Yma pertains to Malaysia's real income. Since an increase in Malaysia's economic growth is expected to increase the imports of commodity i, estimate of β is expected to be negative. Estimate of γ is expected to be positive if increase in the real income of Country X denoted by Yx encourages an increase in Malaysia's export of commodity i to Country X.

If an increase in production of import substitute goods arises, it can cause increase in nominal income and the income of Malaysia positive which leads the positive and coefficient of real income of country X be negative (Bahmani-Oskooee, 1986)

Finally, REX is the real Ringgit/X's currency exchange rate, defined as:

$$REX = \frac{P_x * NEX_i}{P_{ma}} \qquad [2]$$

where NEX_i is the nominal bilateral exchange rate defined as the number of Malaysia Ringgits per country X's currency. P_x is Country X's price level measured by CPI and P_{ma} is Malaysia's price level, also measured by CPI. REX is defined in a way that an increase reflects an appreciation of the X currency or a depreciation of Ringgit. An improved trade balance of industry i will result to an estimate of φ and is expected to be positive if real depreciation of Ringgit is to increase Malaysia's export of commodity i. To infer the J-curve effect in the short-run, short-run dynamics into 1 must be included. Pesaran et.al (2001) expresses the equation in an error-correction modelling format which was introduced into the economics literature by Phillips in 1954 and has been modified by Hendry in 1980, as in equation 3:

$$\Delta LnTB_{xi,t} = \alpha + \sum_{k=1}^{n_1} \emptyset_k \Delta lnTB_{xi,t-k} + \sum_{k=0}^{n_2} \beta_k \Delta lnYma_{t-k} + \sum_{k=0}^{n_3} \gamma_k \Delta lnYx_{t-k} + \sum_{k=0}^{n_4} \varphi_k \Delta lnREX_{xi,t-k} + \delta_1 lnTB_{xi,t-1} + \delta_2 lnYma_{t-1} + \delta_3 lnYx_{t-1} + \delta_4 lnREX_{xi,t-1} + \mu_t \qquad [3]$$

Pesaran and Shin (1998) show that for the error correction specification in Equation 3 there is no need to test for unit roots as long as all the variables involved are either I(0) or I(1) or a combination of the two.

Existence of the J-curve, which is a short-run phenomenon, can be inferred by looking at the coefficients on $\Delta lnREX_{i,t-k}$. A pattern of negative coefficients followed by positive ones would provide support for presence of the J-curve. The long-run effects can be inferred by looking at the coefficient on the linear combination of lagged level variables in 3.4 after normalizing the coefficients δ_1 through δ_4 on δ_1. Denoting this linear combination by $ECM_{i,t-1}$, a negative and significant coefficient on $ECM_{i,t-1}$ would be one way to confirm co-integration among the variables in 3.

Using this specification offers a direct way to examine the cointegration between the variables specified in Equation 4.2. In Equation 4.4, lagged-level variables indicate that the variables are cointegrated under specific conditions. To justify retaining the lag magnitude of logs of level parameters, the researcher must determine if the coefficients deviate significantly from zero. Put differently, the null hypothesis H0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ is validated against the alternate hypothesis H1: $\delta_1 = \delta_2 = \delta_3 = \delta_4 \neq 0$. Pesaran et al. (2001) have specified the appropriate critical F-values applicable to the test by employing the standard F-test to evaluate collectively the significance of lagged-level parameters having new critical values. The values of the lower and upper bounds were specified. Critical values for the lower bound work with the assumption that the integrated variables are first order (I). Hence, if the calculated F-statistic exceeds the critical value for the upper limit, the null hypothesis assuming no cointegration should be rejected. Accepting the null hypothesis would, therefore, offer information against co-integration. On the other hand, its rejection provides information that favours co-integration.

5. Results and Discussions

5.1 Cointegration

To assess whether the variables of equation 3 are cointegrated, the author first imposes two lags on each of the lagged level variables. This practice, is done in line with many studies in the literature, including Bahmani-Oskooee and Wang (2008). However, since the lag structure of trade with each of Malaysia's trade partners and sectors might be different in time, the author optimizes the lags of each regression following the General to Specific Approach. The results are presented in Table 1.

Table 1: Cointegration at optimal lags by sector a

Flow [b]	CHN-MYS	SGP-MYS	JPN-MYS
26	C	NC	C
28	C	NC	C
42	C	NC	NC
51	C	NC	NC
55	C	C	NC
58	C	C	C
59	NC	NC	NC
62	C	C	C
63	C	NC	NC
64	C	C	C
65	C	C	C
66	C	C	C
67	NC	NC	C
68	C	C	C
69	C	NC	C
71	NC	C	C
72	C	C	NC
73	C	C	C
82	C	NC	C
89	C	C	NC

[a] *C is cointegrated, NC is not cointegrated.* [b] *the upper bound F-Test critical value for cointegration testing is 4.15*

On optimal lags, very strong support is given to the hypothesis that trade balance, REX, Malaysia's GDP, and partner's GDP tend to move in the same direction in the long-run. This fact implies the presence of a strong long-run relation; therefore, we proceed with our empirical results.

5.2 Short-Run Effects

When estimating the short-run, the author manages to optimize the lag structure in order for a regression to pass all diagnostic tests, including a negative and significant ECTt-1. Tables from 1 to 6 in Appendix B provide the detailed results of all diagnostics. In summary, unlike the results presented in the previous section, the methodology of Kremers et al. (1992) provides much stronger support for cointegration for almost all sectors (negative and significant ECTt-1). Additionally, very little support is found for other diagnostic tests. The investigated tests include misspecification RESET test, heteroscedasticity White Test, autocorrelation LM Test, and stability CUSUM/CUSUMQ Tests. The estimated effects of REX on trade balance in the short-run are reported in Tables 2, 3 and 4.

Table 2: Short-run estimation output of REX: Malaysia-China trade [a]

Code	ΔREX	ΔREX-1	ΔREX-2	Overall

26	1.76 (1.1)	-0.16 (-0.88)	0.07 (0.48)	
28		0.01 (0.44)		
42	-0.3 (-0.9)	-0.05 (-1.52)	0.67 (2.22)*	0.67
51	-1.17 (1.36)	-1.58 (1.38)	-1.39 (1.15)	
55	-0.85 (1.68)	-0.78 (1.9)	2.46 (1.33)**	2.46
58	0.41 (11.2)*	-0.06 (10.15)	-0.58 (8.94)	0.41
59	1.29 (0.69)	-0.94 (-0.48)	-1.44 (-0.84)	
62	-0.11 (14.26)	-0.03 (13.2)	1.41 (11.76)	
63	-1.12 (1.82)	0.4 (242.54)	-0.01 (1.67)	
64	-1.05 (1.46)	-0.83 (1.37)	-1.8 (1.24)	
65	0.55 (0.23)*	-0.23 (0.32)	-0.27 (0.23)	0.55
66	2.94 (2.58)*			2.94
67	3.04 (2.95)	-1.7 (2.65)	-2.85 (2.51)	
68	0.4 (1.49)*	-0.22 (2.16)	-2.76 (1.87)	0.4
69	1 (0.92)	-0.24 (0.78)	0.26 (0.63)	
71	2.49 (1.54)	2.03 (1.37)		
72	0.04 (2.65)**	-0.4 (2.44)	-1.73 (1.54)	0.4
73	-0.22 (-7.49)*	-0.12 (-4.49)*	-0.59 (-2.48)*	-0.93
82	0.01 (5.45)*		-0.51 (-1.79)**	-0.5
89	-0.71 (0.42)	0.08 (0.37)	0.16 (0.32)	

[a] * indicates significance at 5% level, ** 10% level

Table 3: Short-run estimation output of REX: Malaysia-Singapore trade [a]

Code	**ΔREX**	**ΔREX-1**	**ΔREX-2**	**Overall**

26	-1.67 (2.08)	-2.54 (2.38)	-0.94 (2.38)	
28		0.46 (1.61)		
42	0.95 (1.9)**	0.15 (2.66)*	-0.16 (-3.01)*	0.94
51	0.07 (0.36)	-0.45 (0.44)	0.39 (0.45)	
55	1.14 (2.69)*			1.14
58	0.14 (0.11)	-0.15 (0.14)	-0.22 (0.14)	
59	-0.21 (-0.73)	0.1 (0.34)	-0.27 (-0.91)	
62	0.42 (0.74)			
63		-0.12 (-0.62)		
64	-0.12 (0.74)	0.45 (0.83)	-1.26 (0.79)	
65		-0.66 (-0.52)		
66	3.54 (1.48)			
67	-2.8 (2.43)	2.64 (2.66)	-1.68 (2.5)	
68		-0.36 (-2.03)**		-0.36
69		-0.15 (-0.29)	-0.75 (-1.7)	
71	-0.96 (-1.29)	-0.31 (-3.47)*	-0.41 (-0.48)	-0.31
72	0.01 (0.26)	-0.13 (0.29)	-0.88 (0.3)*	-0.88
73		-0.8 (-1.82)**	0.96 (2.24)*	0.16
82	0.49 (15.95)*	-0.43 (22.06)**	0.12 (16.6)	0.6
89	-1.06 (0.79)	1.97 (0.98)**	-0.08 (1.05)	1.97

*[a] * indicates significance at 5% level, ** 10% level*

Table 4: Short-run estimation output of REX: Malaysia-Japan trade [a]

Code	**ΔREX**	**ΔREX-1**	**ΔREX-2**	**Overall**
26	-0.17 (11.27)	2.41 (11.91)	0.29 (10.84)*	0.29

28	-0.35 (4.6)	-0.2 (375.31)	0.58 (4.11)	
42	-0.47 (-2.32)*			-0.47
51	0.01 (0.97)	0.94 (0.94)	-0.68 (-0.72)	
55	-0.01 (14.31)	-0.4 (11.37)	-0.15 (13.77)	
58	3.11 (6.31)	-2.06 (4.42)	-0.08 (5.17)	
59	-0.13 (19.98)	0.1 (16.63)	-0.51 (19.6)*	-0.51
62	0.14 (8.16)	2.15 (8)	-0.37 (8.81)	
63		0.62 (0.02)		
64	-0.47 (15.32)	-2.42 (11.91)	0.1 (12.56)	
65	-0.14 (27.57)	-0.12 (25.14)	-0.86 (25.63)	
66	-0.99 (-0.65)			
67	-0.79 (-1.98)**			-0.79
68	-0.18 (-2.37)*		-0.19 (-2.78)*	-0.37
69	-0.53 (-1.81)**			-0.53
71	0.44 (11.16)	-0.54 (11.93)	-0.7 (10.91)	
72	-0.46 (3.22)	-1.2 (2.65)	1.54 (3.1)	
73	0.2 (0.29)			
82		0.2 (1.21)		
89	-0.26 (29.74)	-1.37 (31.02)	-0.65 (32.53)**	-0.65

[a] * indicates significance at 5% level, ** 10% level

Out of the 60 investigated regressions, 24 carry a significant REX. This indicates that 40% of the sectors are affected by the movements of REX in the short-run. Most importantly, as one of the advantages of the comprehensive approach followed in this study, i.e. different trade partners and sectors, the results show that the relation between REX and trade balance depends to a large extent on the trading partner as shown in Table 5.

Table 5: Short-run effect of REX on trade balance: Results summary

Partner	Positive REX	Negative REX
CHN	7	2
SGP	5	3
JPN	1	6

On average, the effect of REX on TB in the short-run is highly country-dependent. Where the majority of sectors in the case of Malaysia's trade with each of China and Singapore suggest that REX depreciation improves Malaysia's bilateral TB in the short-run, the relation with Japan (in line with the J-Curve Theory) shows that depreciation worsens TB in the short-run.

Where the country effect is observable, there is merely no support for the sector effect. That is, we cannot claim that some trading sectors respond in the same manner to changes in REX regardless the trading partner.

5.3 Long-Run Effects

The long-run effect of REX on TB is captured through estimating the lagged level variables of equation 3. Each regression is specified through optimizing the two lags imposed on each variable following the General to Specific Approach. Tables 6 lists the estimation results for REX only to save space.

Table 6: Long-run estimation output: Malaysia-China trade [a]

Code	CHN-MYS	SGP-MYS	JPN-MYS
26	-0.11 (-0.03)*	1.68 (1.19)	-0.26 (-0.01)
28	-0.44 (-0.06)*	-0.09 (-0.32)	-0.95 (-0.22)*
42	-1.08 (-0.33)*	0.57 (0.08)	2.7 (0.72)
51	-0.41 (-0.12)	0.19 (0.85)	-0.18 (-0.02)
55	1.69 (1.16)	-0.56 (-2.75)*	0.21 (0.01)
58	-0.34 (-0.18)**	0.67 (3.11)*	0.29 (0.01)
59	-0.03 (-3.82)*	0.63 (1.1)	0.46 (0.12)
62	-0.55 (-0.02)	-1.78 (-2.99)*	-0.17 (-0.02)**
63	-0.2 (-0.08)	0.93 (0.34)	0.45 (0.02)*
64	0.58 (0.17)**	0.01 (0.02)	0.24 (0.02)
65	0.93 (3.73)*	0.03 (0.02)	-0.36 (0)
66	3.82 (1.85)**	-0.81 (-0.26)*	-0.38 (-0.01)**
67	1.62 (0.96)	-0.41 (-0.22)*	0 (-0.03)
68	3.82 (4.9)*	-2.97 (-0.93)	-0.06 (0)
69	-0.36 (-0.94)	0.24 (1.07)	0.13 (0.02)*
71	-1.51 (-0.03)	2.79 (4.77)*	-0.31 (-0.31)
72	-2.1 (-1.16)	-0.09 (-0.11)	0.04 (0.01)
73	-0.56 (-0.19)**	-0.5 (-0.15)	-0.02 (-0.02)*
82	-0.95 (-0.3)	-0.48 (-0.06)	0.14 (0.02)*
89	1.04 (1.1)	-0.5 (-0.08)	0.4 (0.01)

[a] ** indicates significance at 5% level, ** 10% level*

Out of the 60 investigated regressions, 23 carry a significant REX, i.e. 38.3% of the sectors are affected by REX movements in the long-run.

Unlike the short-run estimation results, Table 6 suggests the presence of sector effect in the J-Curve Theory where sectors 28, 62, 64, and 73 are all affected in the same way by REX depreciation regardless the trade partner. As shown in Table 7, the country effect is not prevalent in the long-run.

Table 7: Long-run effect of REX on trade balance: Results summary

Partner	Positive REX	Negative REX
CHN	4	6

SGP	2	4
JPN	3	4

Although the J-Curve Theory suggests that REX depreciation improves bilateral trade balance in the long-run, this notion finds little support as compared with the opposing argument. In fact, both arguments are merely supported. This fact puts more stress on the point of view that the J-Curve Theory is a rarely supported phenomenon.

6. Concluding Remarks

This study criticized the international literature on the J-Curve due to incomprehensiveness reflected in not examining the J-Curve over different sectors and countries at the same time. Therefore, it was not possible in the previous studies to question whether some sectors are affected by the depreciation of REX due to their own nature or due to the nature of the whole bilateral trade relation. Accordingly, this study aimed to assess the effect of exchange rate depreciation on Malaysia's trade with its major three trade partners and across 20 trade sectors.

After assuring that variables are cointegrated and the econometric tests passed the diagnostics, the study proceeded to investigate the short-run effects of REX on TB. 40% of the sectors were affected by the movements of REX in either direction. The results reveal that the country effect is present in the J-Curve Theory, i.e. different trade relations have different reactions to REX movements. For the case of Malaysia's trade with Japan, most of the sectors showed negative response to Malaysia's REX depreciation, while China and Singapore showed that the opposite effect is more prevalent. Comparatively, 38.3% of the sectors were affected by REX in the long-run. The empirical estimates show that some sectors respond in a certain manner to REX depreciation because of their nature and regardless the trade partner.

Future research on the impact of REX on TB are invited to extend this study by including more sectors and trade partners in their empirical analysis. This practice might help more in capturing the country and sector effects in the J-Curve analysis.

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Appendix A: Investigated Trade Sectors

Investigated trade sectors

Sector code	Definition
26	Textile fibres, not manufactured
28	Metalliferous ores and metal scrap
42	Fixed vegetable oils and fats
51	Chemical elements and compounds
55	Perfume materials, toilet & cleansing
58	Plastic materials, etc.
59	Chemical materials and products, n.e.s
62	Rubber manufactures, n.e.s.
63	Wood and cork manufactures
64	Paper, paperboard and manufactures
65	Textile yarn, fabrics
66	Non-metallic mineral manufactures
67	Iron and steel
68	Non-ferrous metals
69	Manufactures of metal, n.e.s
71	Machinery, other than electric
72	Electrical machinery, apparatus
73	Transport equipment
82	Furniture
89	Miscellaneous manufactured articles

Appendix B: Diagnostic Tests

Table 1: Diagnostic tests: Malaysia-China [a]

Code	Adj. R2	ECT $_{(t-1)}$	RESET	LM F value	CUSUM	CUSUMQ	Heteroscedasticity
26	0.64	(-0.5)*	(1.61)	(0.07)	S	S	(0.85)
28	0.67	(-1.64)*	(13.12)*	(2.76)**	S	S	(2.61)**
42	0.63	(-0.57)*	(0.33)	(0.37)	S	S	(0.48)
51	0.79	(-0.61)*	(0.36)	(0.25)	S	S	(0.95)
55	0.76	(-1.32)*	(1.58)	(1.64)	S	S	(1.64)
58	0.8	(-0.67)*	(1.1)	(0.58)	S	S	(1.97)
59	0.48	(-0.56)**	(0.63)	(0.06)	S	S	(0.98)
62	0.53	(-1.16)*	(4.1)**	(1.15)	S	S	(1.1)
63	0.7	(-1.15)*	(1.29)	(1.04)	S	S	(2.08)
64	0.7	(-0.55)*	(1.42)	(0.6)	S	S	(0.84)
65	0.8	(-1.5)*	(1.09)	(2.45)	S	S	(1.22)
66	0.79	(-0.68)*	(3.06)	(2.85)**	S	S	(1.86)
67	0.64	(-0.99)**	(0.53)	(0.83)	S	S	(0.31)
68	0.84	(-1.14)*	(2.46)	(0.21)	S	S	(1.07)
69	0.65	(-1.43)**	(0.58)	(0.74)	S	S	(1.39)
71	0.53	(-0.78)*	(0.02)	(2.37)	S	S	(2.02)
72	0.75	(-0.62)**	(0.16)	(1.88)	S	S	(1.75)
73	0.95	(-2.7)*	(12.07)*	(0.07)	S	S	(1.83)
82	0.82	(-0.33)	(0.28)	(0.68)	S	U	(0.22)
89	0.66	(-1)*	(0.27)	(0.08)	S	S	(0.24)

[a] ** indicates significance at 5% level, ** 10% level*

Table 2: Diagnostic tests: Malaysia-Singapore [a]

Code	Adj. R2	ECT $_{(t-1)}$	RESET	LM F value	CUSUM	CUSUMQ	Heteroscedasticity
26	0.53	(-0.98)**	(0.41)	(0.5)	S	S	(0.12)
28	0.51	(-0.93)*	(0.05)	(8.02)*	S	S	(0.31)
42	0.76	(-0.81)*	(0.3)	(0.43)	S	S	(0.24)
51	0.69	(-1.26)*	(2.35)	(1.62)	S	S	(1.08)
55	4.12	(-1.41)*	(4.12)**	(0.69)	S	S	(0.51)
58	0.73	(-0.79)*	(0.32)	(1.51)	S	S	(0.26)
59	0.43	(-0.55)*	(2.48)	(0.32)	S	S	(0.24)
62	0.81	(-0.94)*	(3.02)	(1.48)	S	S	(0.59)
63	0.26	(-0.52)*	(0.81)	(0.77)	S	U	(0.68)
64	0.69	(-0.57)**	(0.1)	(2.33)	S	S	(1.98)
65	0.44	(-0.68)*	(0.03)	(2.23)	S	S	(0.16)
66	0.79	(-0.67)*	(3.09)	(1.76)	S	S	(0.14)
67	0.7	(-0.68)**	(0.07)	(0.04)	S	S	(0.75)
68	0.35	(-0.62)*	(2.66)	(0.15)	S	U	(0.85)
69	0.85	(-1.04)*	(0.37)	(2.7)	S	S	(0.7)
71	0.72	(-0.96)*	(1.86)	(0.54)	S	S	(0.33)
72	0.77	(-0.36)*	(0.59)	(0.43)	S	S	(0.78)
73	0.83	(-1.75)*	(3.16)	(0.03)	S	S	(0.3)
82	0.65	(-0.59)*	(0.01)	(2.34)	S	S	(0.59)
89	0.71	(-0.66)*	(0.09)	(0.13)	S	S	(0.27)

[a] ** indicates significance at 5% level, ** 10% level*

Table 3: Diagnostic tests: Malaysia-Japan [a]

Code	Adj. R2	ECT $_{(t-1)}$	RESET	LM F value	CUSUM	CUSUMQ	Heteroscedasticity
26	0.91	(-0.78)*	(1.87)	(0)	S	S	(0.78)
28	0.79	(-0.63)*	(2.5)	(0.8)	S	S	(0.66)
42	0.54	(-0.37)	(0.31)	(0)	S	S	(1.18)
51	0.59	(-1.07)*	(0.94)	(0)	S	S	(0.49)
55	0.53	(-0.67)**	(0.87)	(0.2)	S	S	(0.54)
58	0.57	(-0.35)*	(0)	(0.67)	S	S	(0.78)
59	0.62	(-0.49)**	(0.41)	(0.88)	S	S	(1.7)
62	0.86	(-0.56)**	(0.67)	(1.46)	S	S	(0.94)
63	0.5	(-0.37)	(1.76)	(2.29)	S	S	(0.52)
64	0.72	(-1.11)*	(0.05)	(0.26)	S	S	(0.73)
65	0.71	(-0.82)**	(0.04)	(0.13)	S	S	(0.19)
66	0.46	(-0.76)*	(3.69)**	(0.07)	S	S	(0.74)
67	0	(-0.24)	(0.81)	(0.04)	S	S	(1.43)
68	0.84	(-0.28)*	(51.81)*	(0.55)	S	S	(2.42)**
69	0.55	(-0.23)	(1.62)	(0.57)	S	S	(0.31)
71	0.78	(-0.54)*	(0.38)	(0.94)	S	S	(0.73)
72	0.75	(-0.57)*	(0.54)	(1.25)	S	S	(1.27)
73	0.58	(-0.59)*	(0.24)	(0.16)	S	S	(0.7)
82	0.65	(-0.22)**	(0.12)	(0.8)	S	S	(2.07)
89	0.71	(-0.96)*	(0.22)	(0.46)	S	S	(0.64)

[a] ** indicates significance at 5% level, ** 10% level*