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BILATERAL J-CURVE BETWEEN PHILIPPINES AND TRADING PARTNERS: LINEAR AND NON-LINEAR APPROACH

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ABSTRACT

With the advent of econometric modelling, evolutions of research on J-curve has progressed from linear approach (LA) to non-linear approach (NLA) especially in the case of utilizing Autoregressive Distributed Lags (ARDL). This paper applying both approaches examined the case of Philippines and 9 of its largest trading partners. In linear ARDL approach, there are two countries found to be significant. However, using NARDL, evidence shows that three countries to be asymmetric in the short run while in the long run asymmetry effect in the case of Indonesia, Japan and Singapore.

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1. INTRODUCTION

Economists and policy makers understand that the role of exchange rate regime plays an important role in promoting trade balance. In theory, any devaluation or depreciation of exchange rate will promote trade competitiveness. Magee (1973) initiated the concept of J-curve from observing U.S. trade balance. He noted that devaluation of the U.S. dollar further worsens the trade balance before any recovery. As such, despite conforming to Marshall-Lerner condition (sum of import and export price elasticities greater than one trade balance will improve with devaluation), US trade balance deteriorates. The literature review of J-curve has evolved since Magee (1973). Bahmani-Oskooee and Ratha (2004); Bahmani-Oskooee and Hegerty (2010) furnish comprehensive synopsis of J-curve. With the advent of econometric modelling, evolutions of J-curve is shifting from applying linear approach (LA) model to non-linear approach (NLA) model. Concurrently, empirical analysis has developed from utilizing aggregate data (one country and the rest of the world) to bilateral trade data.

Focusing studies on the Philippines, Miles (1979); Himarios (1985); Bahmani-Oskooee and Malixi (1992); Bahmani-Oskooee and Alse (1994) and Lal and Lowinger (2002) utilized LA and aggregate data. For example, Miles (1979) utilized the Pooled Cross Section on 15 countries and did not find any evidence of J-curve. Himarios

(1985) employed time series Ordinary Least Squares on 10 countries and obtained evidenced trade balance improvement from exchange rate devaluation. Bahmani-Oskooee and Malixi (1992) conduct Time Series Almon lag structure on 13 countries[1] and discover no evidence of J-curve. Lal and Lowinger (2002) employed Johansen's cointegration technique and impulse response function they found evidence of the J-Curve except for Japan. One of the main arguments for these mixed results is aggregation bias[2].

Due to aggregation bias, empirical research evolved to bilateral data. However, studies in the case of Philippines are limited. One of the studies using bilateral data is Harvey (2013)[3]. He utilized linear ARDL model and found the real exchange rate coefficient is significant in the short-run with China as the sole partner significant in the long run. These studies have one common characteristic i.e. it is anticipated that exchange rate changes have symmetric effects on the trade balance, implying that if Philippines' peso depreciation will improves its trade balance while appreciation will deteriorate it, by an equivalent amount. Moreover, Bussiere (2013) revealed that import and export prices respond to exchange rate changes in an asymmetric manner. As such, prices of traded goods respond asymmetrically to exchange rate deviations.

Recently, Bahmani-Oskooee and Fariditavana (2015;2016) challenge the utilization of bilateral data using linear approach. They maintained by using a non-linear approach will ascertain whether short run and long run real exchange rate are symmetric or asymmetric[4]. They further shows that by applying the non-linear approach variation generate additional important result. As such, the aim of this paper is to expand the case of Philippines using asymmetric effects. This study will be using non-linear ARDL (autoregressive distributive lags) approach and the trading partners are selected from countries that constitute more than 60% of Philippines' trade[5]. Table 1 shows the Philippines net trade with its major trading partners.

Table-1. Philippines Trade Shares

Philippines major trading partners	Exports (USD)	Imports (USD)	Trade Shares (%)
Australia	451,203,247.00	853,220,456.00	1%
China, P.R.: Hong Kong	6,199,418,345.00	1,999,789,058.30	6%
China, P.R.: Mainland	6,393,072,934.00	11,915,232,637.00	14%
Indonesia	628,273,797.00	3,221,753,558.10	3%
Japan	12,381,197,312.00	7,022,949,791.00	15%
Korea, Republic of	2,511,561,946.00	4,770,560,116.30	6%
Malaysia	1,198,694,382.00	3,481,065,526.40	4%
Singapore	3,649,515,390.00	5,145,727,541.90	7%
United States	8,811,428,909.00	7,940,391,747.20	13%
World	58,646,400,114.00	73,354,573,721.30	100%

Source: Direction of Trade Statistics (2015).

Following introduction, this paper is arranged as follows, Section II presents the model and methodology. Section III informs the empirical results. Section IV is the conclusion of the study. Notes to tables (1-9), data and sources, and variables are presented in the Appendix.

[1] Brazil, Dominican Republic, Egypt, Greece, India, Korea, Mexico, Pakistan, Peru, Philippines, Portugal, Thailand, and Turkey

[2] Bahmani-Oskooee and Brooks (1999). argues that a country's trade balance could be improving with one trading partner and concurrently deteriorates with another. The same could be said of the real exchange rate.

[3] Using quarterly data 1973: I to 2011:IV

[4] Bahmani-Oskooee and Fariditavana (2016). argues that both appreciation and depreciation may not have the same effect. For example, appreciation may be significant while at the same time depreciation may not be significant creating asymmetric effects on exchange rates.

[5] The largest trading partners are Japan, China, mainland and USA. Philippines trade with Asian economies is about 50% of total trade.

2. THE MODELS AND METHODS

Following the model specification from Bahmani-Oskooee and Fariditavana (2015;2016) and Bahmani-Oskooee *et al.* (2016) the initial examination will be a log linear long run provision:

$$LnTB_{i,t} = a + b\, LnY_{PH,t} + c\, LnY_{i,t} + d\, Ln\, REX_{i,t} + \varepsilon_t \qquad (1)$$

As detailed in equation (1)[6], TB_i is Philippines' trade balance with its trading partners, i, It is defined as Philippines's imports from partner i over its exports to partner i. Y_{PH} is measured as Philippines' real income. Given that Philippines' economic growth will increase its imports, it is expected to be positively correlated with TB. However, Y_i is expected to be negatively correlated with TB since its trading partners' economic growth will promote Philippines exports. These income elasticities, however, can be negative and positive, respectively if a nation produces more of import-substitute goods as its economy grows[7]. REX[8] is the real bilateral exchange rate of the Philippines' Peso against the currency of partners i. It is expected to be positive since depreciation of the Philippines' Peso will improve trade balance. To assess the J-curve outcome, a short run analysis is required. As such, an error correction format modeling from Pesaran *et al.* (2001) is pursued . An error-correction model version of Autoregressive Distributed lag (ARDL) replaced equation (1) with equation (2).

$$\Delta LnTB_{i,t} = a' + \sum_{k=1}^{n} e_k\, \Delta\, Ln\, TB_{i,t-k} + \sum_{k=0}^{n} f_k\, \Delta\, Ln\, Y_{PH,K} + \sum_{k=0}^{n} g_k\, \Delta\, Ln\, Y_{i,t-k}$$

$$+ \sum_{k=0}^{n} h_k\, \Delta\, Ln\, REX_{i,t-k} + \beta_1 LnTB_{i,t-1} + \beta_2 LnY_{PH,t-1}$$

$$+ \beta_3 LnY_{i,t-1} + \beta_4 Ln\ REX_{i,t-1} + \mu_t \qquad (2)$$

The focus will be on REX where the short-run effects are judged by the estimates of h_k's and the long run effects by the estimate of β_2 - β_4 normalized on β_1.[9]. To verify cointegration, Pesaran *et al.* (2001) proposed applying F-test using their calculated critical F-values. In addition, the main benefit of using (Pesaran *et al.*, 2001) model is that there is no pre testing for unit roots even though these variables are I(1), I(0), or combination of both. Moreover, these are common properties for macro variables. The long run effect of real depreciation from devaluation is estimated indirectly from h_k is negative or not significant followed with β_4 positive and significant. Should the J-curve outcome is not observed, then Bahmani-Oskooee and Fariditavana (2015;2016) and Bahmani-Oskooee *et al.* (2016) argue it may be that the exchange rates are symmetric. They then adopt and adjusted model proposed by Shin *et al.* (2014) to consider the asymmetry effects on exchange rates. The approach is to isolate the ΔLn REX into negative (Peso depreciation) and positive (Peso appreciation) values. As such, there will be two variables generated and define as POS and NEG. These partial sum processes of positive and negative in ΔLn REX is specified as follows[10]:

[6] Equation (1) measure of the trade balance is unit free and it enables the model to be stated in the logarithmic form that matches macro data. Bahmani-Oskooee (1991).

[7] Refer to Bahmani-Oskooee (1986).

[8] Refer to Appendix, section II

[9] For details of normalization procedure see Bahmani-Oskooee and Tanku (2008).

[10] Other studies applying partial sum approach and non-linear are Bussiere (2013). Pal and Mitra (2016). and Nusair (2016).

$$POS = LnREX_t^+ = \sum_{j=1}^{t} \Delta LnREX_j^+ = \sum_{j=1}^{t} \max(\Delta LnREX_j, 0),$$

$$NEG = LnREX_t^- = \sum_{j=1}^{t} \Delta LnREX_j^- = \sum_{j=1}^{t} \min(\Delta LnREX_j, 0) \qquad (3)$$

As recommended by Shin *et al.* (2014) LnREX in equation (2) will be replaced by POS and NEG to as follows:

$$\Delta LnTB_{i,t} = \alpha' + \sum_{k=1}^{n1} e_k \Delta LnTB_{i,t-k} + \sum_{k=0}^{n2} f_k \Delta LnY_{t-k}^{PH} + \sum_{k=0}^{n3} g_k \Delta LnY_{t-k}^{i} + \sum_{k=0}^{n4} h_k \Delta POS_{t-k}$$
$$+ \sum_{k=0}^{n5} j_k NEG_{t-k} + \rho_0 LnTB_{i,t-1} + \rho_1 LnY_{t-1}^{PH} + \rho_2 LnY_{t-1}^{i} + \rho_3 POS_{t-1} + \rho_4 NEG_{t-1} + \psi_t \qquad (4)$$

The introduction of POS and NEG into Equation (4) creates non linearity. Shin *et al.* (2014) established a similar process developed by Pesaran *et al.* (2001) to evaluate a non-linear ARDL model. The premise to asymmetric effect of exchange rate will abide by the following outcome. Based on observation on (4), there is evidence of short-run adjustment asymmetry if ΔPOS and ΔNEG variable shows different lag orders. In addition, short run asymmetric effects will be ascertain from the sign and size of h_k is dissimilar than the size of J_k at each lag k. This is applied using Wald test to conclude if $\sum \hat{h}_k \neq \sum \hat{j}_k$. In the long run, asymmetric is confirm if $-\frac{\hat{\rho}_3}{\hat{\rho}_1} \neq -\frac{\hat{\rho}_4}{\hat{\rho}_1}$;which requires Wald test as well.

3. THE RESULTS

As outlined in model equations (2) and (4), evaluations are focused on 9 countries, Australia, China mainland, Hong Kong, China, Indonesia, Japan, South Korea, Singapore, Malaysia, and U.S.A. The empirical analysis will be using quarterly data 1981Q1-2015Q4. Following previous studies from Bahmani-Oskooee and Fariditavana (2015;2016) and Bahmani-Oskooee *et al.* (2016) a maximum 8 lags levied and applied Akaike Information Criteria (AIC) to identify optimal lags. The results are listed in Table 1-9. ARDL is the linear optimum model while NARDL is the non-linear model. Each table focus on short run and long run results with for both ARDL and NARDL models as well as diagnostics test. A dummy variable is included to account for the Asian Financial crisis 1998[11].

Conventional literature review shows that definition of the J-curve was initially determined on negative or insignificant effects of real exchange rate (REX) changes at lower lags followed by positive effects at higher lags such as the case of China (Table 2, Part A; Panel I and Panel II). However, the REX is not significant in the long run i.e. the real depreciation of REX only in the short run. Alternatively, using definition introduced by Rose and Yellen (1989) is observing insignificant short-run effects followed by significant and positive long-run effects of REX. Result on Indonesia is supported in this model (Table 4, Part A; Panel I and Panel II). As such, real depreciation of Indonesia rupiah has favorable influence on Indonesia's trade balance[12]. In addition to China, Japan and

[11] Using ARDL model countries affected from Asian financial crises are Indonesia, Japan and Korea. However, using NARDL, only Indonesia and Japan.

[12] Hong Kong has negative and significant coefficient in the long run. This may possibly be due to Indonesia's inelastic import demand from Hong Kong. Shifting to non-linear model, the result is similar. The result from non-linear model reveals that both appreciation and depreciation of peso will affect Philippines' trade balance with Hong Kong in the short run. In the long run, however, only appreciation affects the model. In the case of Hong Kong, appreciation has positive impact on Philippines –Hong Kong trade balance due to inelastic import demands

USA are respectively Philippines largest trading partners. However, there are no evidence exchange rate effects on trade balance with Japan and USA. To verify that these results are acceptable, diagnostic tests are required as well as the cointegration results (Part A; Panel III). Both in the case of China, mainland and Indonesia, F statistics are significant thus support cointegration with its upper bound of 3.52. When F statistics is not significant, such as Hong Kong and Japan, Shin *et al*. (2014) recommended an alternative approach. They recommended employing long run normalized coefficient estimates in equation (1) to generate error term or ECM. After which replacing the linear combination of lagged level variables, ECM_{t-1}, they estimate the specification after imposing the same lags. A significant negative coefficient not only supports cointegration but the size of coefficient measure the speed of convergence towards equilibrium. Since the sample is small, an alternative cointegration approach introduced by Banerjee *et al.* (1998) is applied. Diagnostics statistics shows that it is free from serial correlation with Lagrange Multiplier (LM) statistics of 9.48 with χ^2 with four degrees of freedom. The RESET test statistic is insignificant with a critical value of 3.84 at 5% level of significant. In addition, following Harvey (2013) a stability test for all coefficient estimates by applying CUSUM and CUSUMSQ test to the residuals of the optimal model. Stability of the coefficients are indicated with S for stability and NS for not stable. The result clearly shows majority of the residuals are stable. Will applying NARDL find additional partners from bilateral trade?

Following Bahmani-Oskooee and Fariditavana (2015;2016) they utilized similar definition introduced by Rose and Yellen (1989) with an extension towards applying POS or NEG variable. In the short run, both ΔPOS and ΔNEG convey at least one significant lagged coefficient in all models (Refer to all tables Part B, Panel I and II). As compared to the linear model, there are fewer cases of significant short run effect (only in the case of China, Hong Kong). This aspect shows an improvement in results from a non-linear model. Based on adjustment asymmetry that is ΔPOS and ΔNEG variables have coefficients in different sizes and magnitudes; it is observed in the case of Hong Kong[13], Indonesia and Singapore. Furthermore, to show short run asymmetry, Shin *et al.* (2014) advocate applying Wald-S statistics. They suggest that applying Wald-S test to verify whether the sum of short run estimates for ΔPOS are different from short run estimates for ΔNEG. Wald-S test reveals Indonesia and Singapore are significant. To evaluate long run effects that are significantly asymmetric, evidence show only in the case of Japan and Indonesia because Wald-L test is significant. However, based on Bahmani-Oskooee and Fariditavana (2016) J-curve definition, short run deterioration effects followed by long run significant positive estimation obtained from either NEG or POS, evidence shows only in the case of Indonesia and Singapore. In the case of Japan, real bilateral exchange rate has no effect on both short run and long run in the linear model. However, the non-linear model shows that exchange rate appreciation will affect Philippine's trade balance with Japan in the short run and appreciation of peso may continue to affect into long run. Moreover, Japan is the largest trading partners. These results further reflect Philippines bilateral trade balance with Asia. Based on traditional definition (linear model) Singapore's results shows that does any evidence of real bilateral exchange rate effect both in short run and long run. On the contrary, when exchange rates are divided between appreciations and depreciation of Peso (non-linear model), Singapore trade balance is affected from exchange rates both short run and long run.. Similar results in the case of Japan. Focusing on the long run results on income (ARDL model), it expected that Philippines income support positive and significant coefficient only in the case of Japan. Indeed, Japan is the second largest trading partners after China. Other countries, however, such as Australia, China, Hong Kong and Korea show negative coefficient. As such, imports from these trading partners decline as Philippines' economy grows. As indicated in the setup of this model, this may be due to substitution effect, import less from these partners as Philippines produce domestic substitutes. As suggested, trading partners income is expected to be negatively correlated with Philippines' trade balance since its trading partners' economic growth will promote Philippines exports. There is no evidence both from ARDL and NARDL to support this hypothesis.

[13] For example, in the case of Hong Kong, refer to Table 3, Part B, Panel I)

Diagnostics test as shown in Panel III (Table 1-9), with the exception of Australia and Malaysia, majority of NARDL models are cointegrated, residuals are free from serial correlation models are correctly defined and coefficients are stable. Based on the overall major trading partners, in linear model, Hong Kong is the only case where short run last into long run. However, in non-linear approach, in addition to Hong Kong, Japan and Singapore are the two additional cases in which REX last into long run.

4. CONCLUSION AND SUMMARY

With the advent of economic methodology, empirical research on J-curve has evolved since 1970's. It has progressed from focusing on linear model using aggregate data to non- linear model applying bilateral trade data.

Table-1. Philippines-Australia Models

ARDL
PART A
Panel I: Short Run Estimates

	Lags							
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB		-0.29 (3.06)*	-0.26 (2.74)*	-0.06(0.65)	0.16(1.87)^			
ΔLn Y_{PH}	-0.34(2.88)*							
ΔLn Y_{AUS}	4.74(1.92)^	-7.16 (2.79)*	-0.12(0.04)	2.27(0.90)	-1.01(0.39)	6.17(2.57)*		
ΔLn REX	0.17(1.06)							
Panel II: Long Run Estimates								
Constant	-32.29(1.54)							
Ln Y_{PH}	-1.79(2.53)*							
Ln Y_{AUS}	3.89(2.44)*							
Ln REX	0.89(1.12)							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	$\bar{R}^2$		
2.86	-0.19(3.11)	2.29	0.06	S	US	0.23		

NARDL
PART B
Panel I: Short Run Estimates

	Lags							
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB		-0.30 (3.02)*	-0.24 (2.41)*	-0.01 (0.06)	0.17 (1.98)^			
ΔLN Y_{PH}	-0.46(2.77)*							
ΔLN Y_{AUS}	5.81 (2.20)*	-5.54 (2.04)*	-0.32 (0.12)	-0.18 (0.07)	-1.03 (0.39)	6.87 (2.74)*		
ΔPOS	0.66(1.48)							
ΔNEG	-0.65 (0.59)	-0.06 (0.06)	0.83 (0.83)	-1.08 (1.06)	-2.29 (2.45)*	-1.48 (1.52)		
Panel II: Long Run Estimates								
Constant	-50.89(0.89)							
Ln Y_{PH}	-1.97(2.62)*							
Ln Y_{AUS}	4.83(1.94)^							
POS	2.84(1.70)^							
NEG	2.49(1.09)							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	$\bar{R}^2$	**WALD – S**	**WALD – L**
2.67	-0.23(3.26)	1.01	0.15	S	US	0.23	3.26 [0.07] ^	0.08 [0.78]

Refer to appendix for notes

Despite this growing progress in analysis of J-curve, results from majority of these researches have been mixed. This paper examines the effects of Philippines real exchange rate on its bilateral trade balance with 9 of its trading partners. Using the non-linear ARDL, an approach introduced by Pesaran *et al.* (2001) and Shin *et al.* (2014) the non-linear approach exhibits more an improvement in results where 3 countries, Indonesia, Japan and Singapore. Comparatively to application of L-ARDL, (results utilized the traditional as well as Rose and Yellen (1989) approach), we only observed the case of Indonesia and China. As such, the impact of peso appreciation and depreciation is more dominant in the NARDL methods. Indeed, the outcomes are consistent with Asian countries are the largest total trade.

Table-2. Philippines-China, mainland Models

ARDL
PART A
Panel I: Short Run Estimates

				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB		-0.27(2.07□*						
ΔLn Y_{PH}	-0.54(1.95)	0.77(3.52)*						
ΔLn Y_{CHN}	-0.02(0.09)	-0.39(2.07)*						
ΔLn REX	-0.44(1.17)	0.69(2.12)*						
Panel II: Long Run Estimates								
Constant	54.89(3.16)*							
Ln Y_{PH}	-2.21(3.44)*							
Ln Y_{CHN}	0.92(2.16)*							
Ln REX	-2.2□(1.31)							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**CUSM²**	$\bar{R}^2$		
5.30**	-0.26(3.49)	9.27	0.51	S	S	0.04		
NARDL **PART B** **Panel I:Short Run Estimates**								
				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB	-0.14(1.30)							
ΔLN Y_{PH}	-0.33(1.39)							
ΔLN Y_{CHN}	0.18(2.21)*							
ΔPOS	-1.68(1.17)							
ΔNEG	-0.40(0.37)	2.38(2.51)*						
Panel II: NARDL - Long Run Estimates								
Constant	-37.07(2.38)*							
Ln Y_{PH}	1.27(2.08)*							
Ln Y_{CHN}	0.38(2.11)*							
POS	-9.02(3.74□*							
NEG	-0.7□(0.40)							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**CUSM²**	$\bar{R}^2$	**WALD – S**	**WALD – L**
8.03**	-0.46(5.53)**	9.88	2.71	S	S	0.08	1.03[0.31]	15.42 [0.00] **

Refer to appendix for notes

Table-3. Philippines-Hong Kong Models

ARDL
PART A
Panel I: Short Run Estimates

				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB	-0.06 (0.59)	-0.12 (1.39)	0.23 (2.67)*					
ΔLn Y_{PH}	-0.28(3.64)*							
ΔLn Y_{HKG}	0.12(1.53)							
ΔLn REX	-0.17 (0.91)	-0.03 (0.14)	0.005 (0.02)	0.07 (0.38)	0.26 (1.36)	-0.49 (2.63)*	-0.21 (1.09)	0.31 (1.74)^
Panel II: Long Run Estimates								
Constant	10.48(2.17)*							
Ln Y_{PH}	-0.83(5.39)*							
Ln Y_{HKG}	9.36(1.59)							
Ln REX	-1.01(2.68)*							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	$\bar{R}^2$		
3.45	-0.34(4.16)**	3.91	0.40	S	S	0.29		
NARDL								
PART B								
Panel I:Short Run Estimates								
				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB		-0.05 (0.42)	-0.18 (1.88)^	0.20 (2.32)*				
ΔLN Y_{PH}	0.27(2.51)*							
ΔLN Y_{HKG}	0.16(1.47)							
ΔPOS	-0.16 (0.21)	-0.85 (1.21)	0.16 (0.24)	-0.52 (0.77)	1.69 (2.53)*	-1.49 (2.22)*		
ΔNEG	-0.88(2.39)*							
Panel II: Long Run Estimates								
Constant	7.95(0.82)							
Ln Y_{PH}	-0.75(2.86)*							
Ln Y_{HKG}	0.44(1.65)^							
POS	-2.71(3.00)*							
NEG	7.95(0.82)							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	$\bar{R}^2$	**WALD – S**	**WALD – L**
2.48	-0.35(3.85)*	4.67	0.04	S	S	0.26	1.48[0.22]	1.55[0.21]

Refer to appendix for notes

Table-4. Philippines-Indonesia Models

ARDL#
PART A
Panel I: Short Run Estimates

				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB		-0.19(1.99)*						
ΔLn Y_{PH}	-0.02(0.23)							
ΔLn Y_{INDO}	-0.58 (0.78)	1.63 (2.25)*						
ΔLn REX	0.32(1.41)							
Panel II: Long Run Estimates								
Constant	-29.59(3.18)*							
Ln Y_{PH}	-0.06(0.24)							
Ln Y_{INDO}	0.73(2.29)*							
Ln REX	2.14(3.78)*							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	$\bar{R}^2$		
7.07**	-0.39(4.48)**	3.75	0.04	S	S	0.22		

NARDL# **PART B** **Panel I: Short Run Estimates**								
				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB								
ΔLN Y_{PH}	-0.47(1.88)*							
ΔLN Y_{INDO}	-2.09 (2.75)*							
ΔPOS	2.52(1.97)*							
ΔNEG	-1.87 (1.52)	-2.89 (2.57)*	-0.28 (0.31)	-2.47 (2.74)*	-1.17 (1.32)	-1.96 (2.39)*	-1.62 (1.81)*	
Panel II: Long Run Estimates								
Constant	18.64(1.62)							
Ln Y_{PH}	-1.89(4.21)*							
Ln Y_{INDO}	1.09(5.61)*							
OS	4.74(4.00)*							
NEG	1.89(2.11)*							
Panel III Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	$\bar{R}^2$	**WALD – S**	**WALD – L**
12.16**	-0.70(7.49)**	7.44	0.02	S	S	0.21	4.86[0.03]*	3.72[0.05]*

Refer to appendix for notes

Table-5. Philippines-Japan Models

ARDL# **PART A** **Panel I: Short Run Estimates**								
				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB		-0.17(2.12)*						
ΔLn Y_{PH}	-0.13(3.19)*							
ΔLn Y_{JPN}	0.55(3.19)*							
ΔLn REX	-0.01(0.16)							
Panel II: Long Run Estimates								
Constant	-64.00 (2.90)*							
Ln Y_{PH}	0.68(3.82)*							
Ln Y_{JPN}	2.82(3.69)*							
Ln REX	-0.06(0.16)							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	$\bar{R}^2$		
3.24	-0.19(3.96)^	4.64	0.001	S	S	0.07		
NARDL# **PART B** **Panel I: Short Run Estimates**								
				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB								
ΔLN Y_{PH}	-0.24 (2.40)*							
ΔLN Y_{JPN}	1.27 (1.17)	-0.45 (0.43)	-2.30 (2.21)*	-0.92 (0.87)	-3.39 (3.10)*			
ΔPOS	-1.05(1.89)							
ΔNEG	-0.01(0.04)							
Panel II: Long Run Estimates								
Constant	-102.83 (3.32)*							
Ln Y_{PH}	-0.11(0.31)							
Ln Y_{JPN}	3.67(4.47)*							
POS	-1.12(1.86)^							
NEG	-0.03 (0.04)							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	$\bar{R}^2$	**WALD – S**	**WALD – L**
6.60**	-0.31(5.39)**	3.11	1.11	S	S	0.07	2.59 [0.11]	4.93 [0.03]*

Refer to appendix for notes

Table-6. Philippines-Korea Models

ARDL#
PART A
Panel I: Short Run Estimates

				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB		-0.15 (1.66)	-0.07 (0.73)	-0.25 (2.75)*	-0.12 (1.35)	-0.15 (1.76)^	-0.29 (3.92)*	
ΔLn Y_{PH}	-0.44(4.32)*							
ΔLn Y_{KRA}	-1.91 (2.29)*	-1.81 (2.20)*	-2.86 (3.57)*	-2.73 (3.34)*				
ΔLn REX	0.05(0.28)							
Panel II: Long Run Estimates								
Constant	0.93(0.14)							
Ln Y_{PH}	-1.08(5.42)*							
Ln Y_{KRA}	0.88(3.84)*							
Ln REX	0.13(0.28)							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	**$\bar{R}^2$**		
6.12*	-0.41(5.19)*	6.38	2.47	S	S	0.27		
<u>NARDL</u> **PART B** **Panel I: Short Run Estimates**								
				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB		0.12 (0.99)	0.16 (1.42)	-0.06 (0.52)	0.07 (0.72)	-0.06 (0.63)	-019 (2.12)*	0.14 (1.73)^
ΔLN Y_{PH}	-0.40(2.29)*							
ΔLN Y_{KRA}	-3.08(3.10)*	-3.14 (3.18)*	-4.42 (4.64)*	-4.24 (4.33)*				
ΔPOS	-1.19(0.92)	-0.18 (0.13)	-3.03 (2.25)*	-2.15 (1.53)	1.14 (0.80)	3.43 (2.39)*		
ΔNEG	0.61(0.50)	-1.57 (1.39)	0.32 (0.26)	-1.21 (1.16)	-2.11 (2.14)*	-1.94 (1.99)*	-2.46 (2.59)*	
Panel II: Long Run Estimates								
Constant	-27.83 (2.33)*							
Ln Y_{PH}	-0.57(2.14)*							
Ln Y_{KRA}	1.38(6.25)*							
POS	0.67(0.78)							
NEG	2.03(2.28)*							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	**$\bar{R}^2$**	**WALD – S**	**WALD – L**
7.72*	-0.70(5.79)*	15.27	3.25	S	S	0.26	3.93[0.05]*	3.63[0.06]^

Refer to appendix for notes

Table-7. Philippines-Malaysia Models

ARDL
PART A
Panel I: Short Run Estimates

				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB		-0.35 (3.16)*	-0.33 (2.89)*	-0.42 (4.06)*	-0.37 (3.35)*	0.12 (1.18)	-0.33 (3.39)*	
ΔLn Y_{PH}	-0.15(1.39)							
ΔLn Y_{MY}	0.73(2.17)*	0.33(0.95)	0.26(0.77)	0.68(1.99)*	0.48(1.39)			
ΔLn REX	-0.34(1.28)							
Panel II: Long Run Estimates								
Constant	187. (0.16)							
Ln Y_{PH}	12.88(0.16)							
Ln Y_{MY}	-17.41(0.16)							
Ln REX	31.15(0.16)							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	**$\bar{R}^2$**		

1.86	0.01(0.16)	6.47	0.89	S	S	0.17		
NARDL **PART B** **Panel I: Short Run Estimates**								
				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB		-0.33 (2.87)*	-0.28 (2.41)*	-0.40 (3.68)*	-0.41 (3.54)*	-0.07 (0.66)	-0.26 (2.46)*	
ΔLN Y_{PH}	-0.13 (0.63)	-0.09 (0.38)	-0.62 (2.59)*	-0.45 (2.23)*				
ΔLN Y_{MY}	0.88(2.43)*	-0.29(0.84)	0.08(0.24)	0.63(1.85)^	0.63(1.79)^			
ΔPOS	-1.63(1.25)	2.67(2.05)*						
ΔNEG	-0.84(0.81)							
Panel II: Long Run Estimates								
Constant	-522.61(0.41)							
Ln Y_{PH}	11.42(0.38)							
Ln Y_{MY}	9.75(0.44)							
POS	-85.69(0.41)							
NEG	-27.34(0.36)							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	$\bar{R}^2$	**WALD – S**	**WALD – L**
2.11	-0.03(0.39)	9.64	0.79	US	S	0.19	1.68[0.19]	1.20[0.27]

Refer to appendix for notes

Table-8. Philippines-Singapore Models

ARDL
PART A
Panel I: Short Run Estimates

				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB		0.02(0.22)	0.01(0.17)	0.21(2.52)*				
ΔLn Y_{PH}	-0.04(0.41)							
ΔLn Y_{SG}	-1.13 (1.00)	1.54 (1.42)	-1.90 (1.72)^					
ΔLn REX	0.02(0.06)							
Panel II: Long Run Estimates								
Constant	-5.90(0.74)							
Ln Y_{PH}	-0.16(0.41)							
Ln Y_{SG}	0.75(1.79)^							
Ln REX	2.09(1.50)							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	$\bar{R}^2$		
4.23*	-0.27(4.01)*	8.68	0.19	S	S	0.07		
NARDL **PART B** **Panel I: Short Run Estimates**								
				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB								
ΔLN Y_{PH}	-0.02(0.06)	0.85(1.98)*	0.33(0.82)	.29(3.25)	0.75(1.77)^	0.11(0.26)	1.05(2.52)	
ΔLN Y_{SG}	-2.39 (1.93)^	1.67 (1.35)	-2.94 (2.35)*					
ΔPOS	-5.47 (1.98)*	-2.74 (1.07)	-9.52 (3.77)*					
ΔNEG	1.88(1.68)^							
Panel II: Long Run Estimates								
Constant	-2.74(0.09)							
Ln Y_{PH}	-0.09(0.11)							
Ln Y_{SG}	0.27 0.46)							
POS	6.39(1.94)^							
NEG	6.40(1.71)^							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	$\bar{R}^2$	**WALD – S**	**WALD – L**
5.09*	-0.29(4.90)*	3.56	0.56	S	S	0.02	14.07[0.00]*	0.19[0.66]

Refer to appendix for notes

Table-9. Philippines-U.S.A. Models

ARDL
PART A
Panel I: Short Run Estimates

				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB		-0.23 (2.33)*	-0.22 (2.25)	-0.16 (1.76)^	0.21 (2.40)*			
ΔLn Y_{PH}	-0.03(0.56)							
ΔLn Y_{US}	-4.92(2.27)*							
ΔLn REX	0.02(0.21)							
Panel II: Long Run Estimates								
Constant	-6.75(0.28)							
Ln Y_{PH}	-0.15(0.54)							
Ln Y_{US}	0.37(0.39)							
Ln REX	0.11(0.21)							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	**$\bar{R}^2$**		
2.24	-0.21(2.87)	1.23	3.68	S	S	0.24		

NARDL
PART B
Panel I: Short Run Estimates

				Lags				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
ΔLn TB		-0.21 (1.97)*	-0.18 (1.82)^	-0.16 (1.70)^	0.24 (1.69)^			
ΔLN Y_{PH}	-0.07(0.97)							
ΔLN Y_{US}	-6.36 (2.66)*	4.21 (1.73)^	0.29 (0.12)	1.85 (0.76)	5.61 (2.43)*	-2.79 (1.29)		
ΔPOS	-0.68 (0.90)	-1.34 (1.94)^	-0.73 (1.29)	0.35 (0.47)	0.22 (0.35)	-1.08 (1.87)^	-1.90 (3.14)*	-1.62 (2.65)*
ΔNEG	0.09(0.14)							
Panel II: Long Run Estimates								
Constant	45.58(1.32)							
Ln Y_{PH}	-0.19(0.91)							
Ln Y_{US}	-1.44(1.21)							
POS	2.28(1.31)							
NEG	0.48(0.51)							
Panel III: Diagnostic Statistics								
F	**ECM_{t-1}**	**LM**	**RESET**	**CUSM**	**$CUSM^2$**	**$\bar{R}^2$**	**WALD – S**	**WALD – L**
4.68*	-0.34(4.23)*	9.98	0.84	S	S	0.35	13.12[0.00]*	1.99[0.16]

Refer to appendix for notes

Appendix

I. Notes to Tables 1-9:

a. PH-Philippines; Aus.- Australia; CHN-China; HKG-Hong Kong; INDO-Indonesia; JPN-Japan; KRA-South Korea; MY-Malaysia; SG-Singapore; U.S.- United States of America

b. ^, * indicate significance at the 10% and 5% levels respectively.

c. Numbers inside the parentheses next to coefficient estimates are absolute value of t-ratios.

d. The upper bound critical value of the F-test for cointegration when there are three exogenous variables is 3.77 (4.35) at the 10% (5%) level of significance. These come from Pesaran *et al.* (2001) Table CI, Case III, p. 300).

e. The critical value for significance of ECM_{t-1} is -3.47 (-3.82) at the 10% (5%) level when k =3. The comparable figures when k = 4 are -3.67 and -4.03 at 10%(5%), respectively. These come from Banerjee *et al.* (1998) Table 1).

f. LM is the Lagrange Multiplier statistic to test for autocorrelation. It is distributed as χ^2 with 4 degrees of freedom. The critical value is 7.98(9.48) at the 10% (5%) level.

g. RESET is Ramsey's test for misspecification. It is distributed as χ^2 with one degree of freedom. The critical value is 3.84 at the 5% level and 2.70 at the 10% level. .

h. Symbol, #, shows that dummy is significant during 1997 Asian financial crisis.

i. Wald test are distributed as χ^2 with 1 degree of freedom i.e. critical value is 2.70(3.84) at 10% (5%) significant.

II. Notes to data definition and Sources

Quarterly data over the period 1981I-2015IV are used to carry out the empirical analysis. Data obtained from the following sources:

a. Direction of Trade Statistics by the IMF.

b. International Financial statistics (IFS), IMF.

Due to limited data on certain variables, the periods are restricted to the following: China, mainland: 1996-2014, Indonesia: 1991-2015 and Malaysia 1991-2015

III. Variables

TB_i = Philippines trade balance with partner i is defined as Philippines's imports from partner i over her exports to partner i.

Y_{PH} = Measure of Philippines's income. It is proxied by index of real GDP.

Y_i = Trading partner i's income. This is also proxied by the index of real GDP in country i and the data come from source b. REX_i = The real bilateral exchange rate of the Philippines' Peso against the currency of partner i. It is defined as $REX_i = (P_{PH}. NEX_i/ P_i)$ where NEX_i is the nominal exchange rate defined as number of units of partner i's currency per Peso, P_{PH} is the price level in Philippines. (measured by CPI) and P_i is the price level in country i (also measured by CPI). Thus, a decline in REX reflects a real depreciation of the Philippines' Peso. All nominal exchange rates and price levels data come from source

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REFERENCES

Bahmani-Oskooee, M., 1986. Determinants of international trade flows: Case of developing countries. Journal of Development Economics, 20(1): 107-123. *View at Google Scholar*

Bahmani-Oskooee, M., 1991. Is there a long-run relation between the trade balance and the real effective exchange rate of LDCs? Economics Letters, 36(4): 403–407. *View at Google Scholar | View at Publisher*

Bahmani-Oskooee, M. and J. Alse, 1994. Short-run versus long-run effects of devaluation: Error-correction modeling and cointegration. Eastern Economic Journal, 20(4): 453-464. *View at Google Scholar*

Bahmani-Oskooee, M. and T.J. Brooks, 1999. Bilateral J-curve between US and her trading partners. Weltwirtschaftliches Archiv, 135(1): 156–165. *View at Google Scholar | View at Publisher*

Bahmani-Oskooee, M. and H. Fariditavana, 2015. Nonlinear ARDL approach, asymmetric effects and the J-curve. Journal of Economic Studies, 42(3): 519-530. *View at Google Scholar | View at Publisher*

Bahmani-Oskooee, M. and H. Fariditavana, 2016. Nonlinear ARDL approach and the J-curve phenomenon. Open Economies Review, 27(1): 51-70. *View at Google Scholar | View at Publisher*

Bahmani-Oskooee, M., F. Halicioglu and S. Hegerty, 2016. Mexican bilateral trade and the J-curve: An application of the nonlinear ARDL model. Economic Analysis and Policy, 50(C): 23-40. *View at Google Scholar | View at Publisher*

Bahmani-Oskooee, M. and S. Hegerty, 2010. The J- and S-curves: A survey of the recent literature. Journal of Economic Studies, 37(6): 580-596. *View at Google Scholar | View at Publisher*

Bahmani-Oskooee, M. and M. Malixi, 1992. More evidence on the J-curve from LDCs. Journal of Policy Modeling, 14(5): 641–653. *View at Google Scholar | View at Publisher*

Bahmani-Oskooee, M. and A. Ratha, 2004. The J-curve: A literature review. Applied Economics, 36(13): 1377-1398. *View at Google Scholar | View at Publisher*

Bahmani-Oskooee, M. and A. Tanku, 2008. Black market exchange rate vs. official rate in testing the PPP: Which rate fosters the adjustment process. Economics Letters, 99(1): 40–43. *View at Google Scholar*

Banerjee, A., J. Dolado and R. Mestre, 1998. Error-correction mechanism tests in a single equation framework. Journal of Time Series Analysis, 19(3): 267-283. *View at Google Scholar | View at Publisher*

Bussiere, M., 2013. Exchange rate pass-through to trade prices: The role of nonlinearities and asymmetries. Oxford Bulletin of Economics and Statistics, 75(5): 731–758. *View at Google Scholar | View at Publisher*

Direction of Trade Statistics, 2015. International monetary fund. Retrieved from http://www.imf.org/external/index.htm [Accessed November 2016].

Harvey, H., 2013. Exchange rate sensitivity in the Philippines: Does the J-curve exist? Asian Journal of Business and Management Science, 2(10): 51-61. *View at Google Scholar*

Himarios, D., 1985. The effects of devaluation on the trade balance: A critical view and reexamination of miles's (New Results). Journal of International Money and Finance, 4(4): 553–563. *View at Google Scholar | View at Publisher*

Lal, A.K. and T.C. Lowinger, 2002. The J-curve: Evidence from East Asia. Journal of Economic Integration, 17(2): 997-415. *View at Google Scholar | View at Publisher*

Magee, S.P., 1973. Currency contracts, pass through and devaluation. Brookings Papers on Economic Activity, 4(1): 303-325. *View at Google Scholar | View at Publisher*

Miles, M.A., 1979. The effects of devaluation on the trade balance and the balance of payments: Some new results. Journal of Political Economy, 87(3): 600–620. *View at Google Scholar | View at Publisher*

Nusair, S.A., 2016. The J-curve phenomenon in European transition economies: A nonlinear ARDL approach. International Review of Applied Economics, 31(1): 1-27. *View at Publisher*

Pal, D. and S.K. Mitra, 2016. Asymmetric oil product pricing in India: Evidence from a multiple threshold nonlinear ARDL model. Economic Modelling, 59: 314–328. *View at Google Scholar | View at Publisher*

Pesaran, M.H., Y. Shin and R.J. Smith, 2001. Bound testing approaches to the analysis of level relationship. Journal of Applied Econometrics, 16(3): 289-326. *View at Google Scholar | View at Publisher*

Rose, A.K. and J.L. Yellen, 1989. Is there a J-curve? Journal of Monetary Economics, 24(1): 53-68. *View at Google Scholar*

Shin, Y., B. Yu and M. Greenwood-Nimmo, 2014. Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework festschrift in honor of Peter Schmidt: Econometric methods and applications, Eds. by R. Sickels and W. Horrace: Springer. pp: 281-314.