THE EFFECT OF NOMINAL EXCHANGE RATE DEPRECIATION ON TRADE IN ELEVEN DEVELOPING COUNTRIES

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ABSTRACT

This study examined the effect of nominal exchange rate depreciation on the trade balance in 11 Asian-African countries between 1980 and 2019, and within the context of an exogenously determined single structural break. The countries had persistently experienced both nominal exchange rate depreciation and upward trends in trade in goods. Using the Chow test to frame the discussion, these countries were found to be facing structural changes associated with external factors such as the commodity price crisis in South Asia and the global financial crisis. The time-series autoregressive distributed lag (ARDL) approach with bounds test for cointegration and

error-correction mechanism (ECM) was also applied for the analysis. The results of the study showed a long-term cointegration between the trade in goods and other variables included. Specifically, the nominal exchange rate depreciation positively affected the trade in goods in both the long-run and short-run in most of the Asian-African countries studied. There was a positive relationship between trade and foreign direct investment in the short-run, but this relationship mostly became insignificant in the long-run. Gross domestic product had a significant impact on trade performance in goods in both the long-run and short-run in all countries studied.

Keywords: Nominal exchange rate depreciation, trade in goods, structural break, autoregressive distributed lag.

INTRODUCTION

The way the exchange rate affects the balance of trade has been a fundamental issue in economics. In general, the economic rationale behind this study was whether the nominal exchange rate depreciation would provide 11 Asian-African countries between 1980 and 2019 with a competitive edge in obtaining favorable effects, or instead exposed them to unfavorable contract trade in goods. To put things into perspective, the study had assumed the postulates of the elasticities approach, which comprised the Bickerdike-Robinson-Meltzer (BRM) condition, the Marshall-Lerner (ML) theory, and J-curves theoy in its attempt to understand and explain the issues to be addressed, and thus attain the objective of the study.

To start the discussion, the statistics of nominal exchange rate changes and trade in goods over the past four decades in developing countries have been summarized in Figure 1 and Figure 2. As shown in Figure 1, the selected developing countries recorded a nominal exchange rate deprecation in most cases during the period 1980-2019. The nominal exchange rate depreciation in Ghana, Swaziland, and Tunisia was much lower than in other countries. In the case of Indonesia, the exchange rate depreciation during the period of 1980-1996 was narrower than

those from 1997 until 2019. Nigeria experienced a narrow exchange rate depreciation from 1980 to 1993, and it was relatively stable from 1994 to 1998. The Nigerian Naira plunked in 1999 and deteriorated from 2000 to 2019.

Figure 1

The Official Exchange Rate Per USD
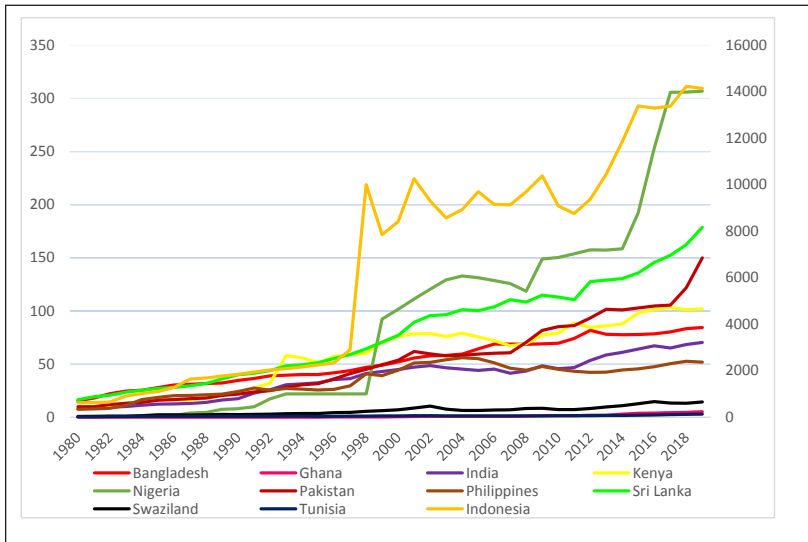
Note: The data for Indonesia involved larger units (in thousand) as shown on the right-hand axis, and data for other countries are indicated in the left axis.

Bangladesh experienced exchange rate depreciation during the period 1980-2012, but the rate was relatively stable from 2013 to 2019. India recorded an exchange rate depreciation during the period 1980-2002, it appreciated during the period of 2003-2008, but slightly depreciated in recent years. As for Pakistan, the exchange rate depreciated from 1980 to 2001, but appreciated in 2002 and 2003. It depreciated again in the following years. Sri Lanka recorded an exchange rate depreciation during the period 1980-2019, except in 2005, 2008, and 2011.

However, trade in goods showed an increasing trend in almost all countries except Indonesia, India, and Nigeria. A steady goods trade

performance was demonstrated by Bangladesh, in which the goods trade value had increased persistently over the period. The goods trade had also greatly increased between 1980 and 2019 for India, but slightly declined in 2009, and promptly rebounded to reach a peak level by 2011. The trade in goods collapsed during the period 2012-2015. It achieved a greater volume in 2018, but declined in 2019.

Figure 2

Trade in Goods of Selected Developing Countries in USD.
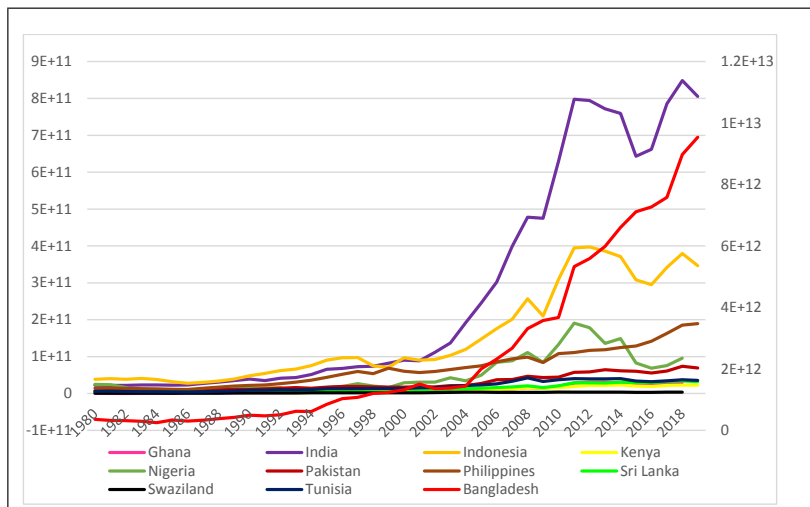
Note: The data for Bangladesh involved a larger amout (in trillion) as shown in the right-hand axis, and data for other countries in the left-hand axis.

The upward trend in the trade in goods was also experienced by the Philippines and Pakistan. Nigeria also showed an upward trend in trade in goods during the period of 1980-2011. However, a decline was observed between the year 2011 and 2016. It had rebounded in recent years. It was quite similar in the case of Indonesia. The country had experienced a downward trend in 2012 and 2015, but rebounded between the year 2016 and 2018. It declined again in 2019. In terms of goods trade performance, the countries mentioned generally fared better than others. Indeed, the countries outperformed Sri Lanka and the countries from Africa, namely Kenya, Nigeria, Swaziland, and Tunisia. The five countries had shown a flat upward trend during the

period 1980-2019.

In summary, the main objective of this study was to examine the short-run effect and long-run effect of the nominal exchange rate depreciation on the volume in the trade in goods. The paper is organised as follows. Section 2 presents a brief review of previous studies which had highlighted the linkage between exchange rate depreciation and trade. Section 3 describes the data, model, variables, and method of analysis. The empirical findings is presented in Section 4. The conclusions and implications of the study are provided in the final section.

LITERATURE REVIEW

The roles of the exchange rate are often associated with international trade. Auboin and Ruta (2011) were of the view that changes in the exchange rate had substantial effects on the economy. It could affect the structure of output and investment, influence labour market and prices, which in turn could lead to changes in domestic absorption and external trade. Two other studies also held similar views. Nicita (2013) posited that the exchange rate played a pivotal role in a country's trade performance, particularly, when exchange rate fluctuation would bring about repercussions on international trade, the balance of payments, and overall economic performance. In Helleiner (2011), it was argued that the exchange rate was more important than trade policies in influencing the amount of trade in a country, at least in the short to medium-term period.

Theoretically, an exchange rate fluctuation will bring about changes in the relative price of exportable and importable goods, thus a country's trade volume. The elasticities approach has claimed that a change in the exchange rate will affect the trade balance, which depends on the import and export supply, demand elasticities, and the initial volume of trade. The study by Ali et al. (2014) has suggested, though implicitly, the idea that the elasticities approach provided a focus on the issues of responsiveness of trade (both in terms of volume and values) to changes in the exchange rate. Moreover, the ML theory could explain the circumstances under which a change in the exchange rate of a

country's currency would lead to an improvement or worsening of a country's balance of payments. Particularly, the ML condition has stated that an exchange rate depreciation would only lead to an improvement in the balance of payments if the sum of demand elasticity for imports and exports was greater than one. Meanwhile, Magee (1973) described the J-curve phenomenon as a J-pattern trend in which a country's trade balance would initially worsen following a period of exchange rate depreciation, it would then gradually recover and finally improve on its previous performance.

The concept of the J-curve posits that trade balance will worsen in the short-run. This is because by assuming that the volume of import will remain stable, the price of importable goods will become more expensive due to the exchange rate depreciation. An exchange rate depreciation may increase exports and reduce imports, and thus leading to an improved trade balance. A surplus in trade balance would take place for some time ahead, until a certain period through the J-curve pattern (Bahmani-Oskooee, 1985; Krugman & Baldwin, 1987). The exchange rate depreciation would lead to a change in spending from foreign to domestic goods, thus, improving the trade balance (Krueger, 1983; Himarios, 1985).

According to Bahmani-Oskooee (2001) and Kandil and Mirzaie (2003), the exchange rate depreciation was a way to gain global competitiveness in domestic industries and improve the trade balance. In a similar vein, Dooley et al. (2003) noted that some Asian countries kept their exchange rate deliberately undervalued as a part of export stimulation and economic growth strategy. By maintaining the exchange rate depreciation, developing countries could divert the spending in buying importable goods to buying domestic goods, and it, in turn, would stimulate trade and improve the trade balance.

In the study reported here, aggregate data, trade and other variables were in terms of the US dollar, and the nominal exchange rate of the respective country was relative solely to the US dollar. The sum of trade in goods was the dependent variable when examining the impact of the nominal exchange rate on trade. A substantial justification for

applying trade volume in goods was explained by the UNCTAD (2016) as due to nominal factors, e.g. principally the fall and rise in the price of commodities and the overall appreciation of the US dollar against the currencies of the developing countries. In other words, the trade volume in goods reflected the resilience of the nominal exchange rate depreciation with respect to the global economic environment. Thus, the volume of exports and imports would adjust to changes in exchange rates, the adjustment denoted the resilience of the nominal exchange rate changes. In Pritchett (1991), it was his theoretical explanation on structural-adjusted trade intensity that the trade volume could be estimated as a function of size and other structural characteristics.

In the context of the 11 developing countries, resilience was illustrated by their pivotal roles as suppliers for commodities markets, such as raw materials, primary agricultural products, manufacturing, and natural and mineral products. Apart from this, the developing countries were also the buyers of consumer goods, intermediate and capital goods used in the industrialisation and growth processes. Having experienced persistent exchange rate depreciation the 11 developing countries provided a suitable case study to examine the link between exchange rate depreciation and trade volume.

The present study has assumed that exports and imports responded simultaneously to changes in NEXR, the inclusion of FDI effects, and the structures for growth-generating. Finally, the period between 2005 and 2012 was chosen because of the following reasons: the global commodity price crises during 2005-2010, the world financial crisis of 2007-2009, and the Arab Springs of 2009-2010.

METHODOLOGY

The examination of the effect of exchange rate depreciation on trade is based on the model developed by Miles (1979), Bahmani-Oskooee (1985), and Rose and Yellen (1989). However, the present study has made some modifications in line with the arguments made in the last two paragraphs in the previous section.

This study has hypothesized that trade (TR) depends on the nominal exchange rate depreciation (NEXR), foreign direct investment (FDI), gross domestic product (GDP), and dummy variable (DUM). The study acquired aggregate data from the respective countries. The dependent variable, trade was the sum of the exports and imports of goods, not including services. It was measured by deducting trade (as a percentage of GDP) to trade in services (as a percentage of GDP), then multiplying it with nominal GDP. The NEXR was measured using the local currency units per the US dollar (USD). The other two variables, the FDI was measured using the net inflow of the FDI. The GDP was represented by the sum of value added by all its producers. All data was quoted from the World Bank Indicator and all variables were in the logarithmic form to obtain the elasticities of each variable. The model is shown in Equation (1):

$$TR_t = \alpha_0 + \alpha_1 lnNEXR_t + \alpha_2 lnFDI_t + \alpha_3 lnGDP_t + \varepsilon_t \qquad (1)$$

An identifying structural break was conducted before estimating the models. It was because, as Narayanan and Smyth (2006) has argued, the existence of structural break in time-series analysis would distort the long-run equilibrium relationship between the dependent variable and independent variables, thus resulting in a misleading conclusion. The Chow test was applied, testing the null hypothesis of structural stability against the alternative of a one-time structural break specified in advance. The Chow F-statistic is written as Equation (2):

$$F = \frac{(RSS_p - (RSS_1 + RSS_2))/k}{(RSS_1 + RSS_2)/(N_1 + N_2 - 2k)} \qquad (2)$$

where RSS_p = the sum of squared residuals from the combined data, RSS_1 = the sum of squared residuals from the first group data, and RSS_2 = the sum of squared residuals from the second group data. N_1 and N_2 indicate the number of observations in each group and k is the total number of parameters. This study rejected the null hypothesis of no break, i.e., the null hypothesis was rejected if the calculated F-value was greater than the F-critical value.

The autoregressive distributed-lag (ARDL)-bound test method was specified with the Akaike Information Criterion (AIC) lag-length. The process encompassed two steps. The first step was to consider the existence of a long-run relationship, in which the constant trend of the ARDL model was specified. The ARDL bound test was appropriate in cases where the nature of the stationarity of the data was not clear. The bound testing procedure was conducted to draw conclusive inference without knowing whether the variables were integrated as zero or one, $I(0)$ or $I(1)$, respectively (Pesaran et al., 2001). Having the dummy variable, the ARDL-bound test model is written as Equation (3):

$$\Delta lnTR_t = \alpha_0 + \beta_1 lnTR_{t-1} + \beta_2 lnNEXR_{t-1} + \beta_3 lnFDI_{t-1} + \beta_4 lnGDP_{t-1}$$

$$+ \beta_5 DUM_{t-1} + \sum_{i=1}^{\rho} \beta_6 lnTR_{t-i} + \sum_{i=0}^{q} \beta_7 lnNEXR_{t-i} + \qquad (3)$$

$$+ \sum_{i=0}^{r} \beta_8 lnFDI_{t-i} \sum_{i=0}^{s} \beta_9 lnGDP_{t-i} \sum_{i=0}^{t} \beta_{10} DUM_{t-i} \, \varepsilon_{t-i}$$

where. α_0 is a constant, and β_1 is an intercept; the terms $\beta_2, \beta_3, \beta_4,$ and β_5 represent the coefficient of long-run of the model respectively, the term (p, q, r, s, t), is the optimum lag-length, *DUM* is dummy (*DUM*=0 for pre-structural change period and *DUM*=1 for post-structural change period), and ε_{t-i} is the error-term.

In order to capture the cointegration among *TR, NEXR, FDI, GDP,* and *DUM*, the null hypothesis, which stated that there was no long-run relationship: $H_0 \; : \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \; 0$ was tested against an alternative hypothesis $H_1: \alpha_1 \neq \; \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \; \neq 0$ implying the existence of cointegration. If the generated value of t statistic was signifcant (higher than the upper bound), the study would reject H_0 in favor of H_1, capturing the long-run relationship between observed variables. The second step was to derive the Error-Correction Mechanism (ECM) approach for estimating both short-run and long-run effects of the dependent variable on explanatory variables. The ECM integrated the short-run dynamics with the long-run equilibrium without losing long-run information and avoided a spurious relationship resulting from non-

stationary time series data. Thus, the ARDL-ECM model is written as Equation (4):

$$\Delta lnTR_t = \alpha_0 + \sum_{i=1}^{\rho} \omega_1 \Delta lnTR_{t-i} + \sum_{i=0}^{q} \omega_2 \Delta lnNEXR_{t-i} + \sum_{i=0}^{r} \omega_3 \Delta lnFDI_{t-i} +$$

$$\sum_{i=0}^{s} \omega_4 \Delta lnGDP_{t-i} + \omega_5 DUM_t + \lambda_i ECT_{t-i} + \varepsilon_t \tag{4}$$

where, Δ indicates the current value of the dependent variable (TR) as related to the past value of itself and simultaneously the past values of other regressors, α_0 is the intercept, the terms $\omega_1, \omega_2, \omega_3, \omega_4$ and ω_5 represent the long-run dynamics of the model in respect of the ARDL (*p, q, r, s, t*) lag-lenght, *DUM* is dummy, and *ECT* is the error correction-term.

In the ARDL method, the term λECT_{t-i} is replaced with $NEXR_{t-i}$; FDI_{t-i}; and GDP_{t-i}. Next, it replaces the long-term ($\Delta NEXR_{t-i} + \Delta FDI_{t-i} + \Delta GDP_{t-i}$) with the residuals λECT_{t-i} to revert the estimated model into error correction model. When the ARDL model included the same lagged levels as in the error correction model, it as implies that all the long-run variables (the X_{it-1}) are specified and not restricted. The significance of the ECT show the evidence of causality in at least one direction. The negative coefficient of λ_i indicates the speed of adjustment, i.e., the rate at which the model corrected its previous years of disequilibrium toward the long-run equilibrium. Finally, the study also employed diagnostic tests to ascertain the robustness of the estimated model.

RESULTS AND DISCUSSION

Table 1 shows the structural break in Bangladesh, India, Pakistan, and Sri Lanka. It was determined during the period 2005-2010, when South Asia suffered terms-of-trade shock due to the global commodity price crises, and concomitantly corresponded with the world financial crisis of the period between 2007-2009. Indonesia and the Philippines experienced the structural break associated with the global financial crisis in this period. Meanwhile, Nigeria and Swaziland were facing a structural break in relation to the gradual effect of the Arab Springs beginning at the end of 2010. Similarly, a structural break was detected in 2004 and 2007 for Kenya and Tunisia, respectively.

Table 1

Chow-test for Structural Break

Country	Structural break	F-Stats	Prob*	Log likelihood ratio	Prob*
Bangladesh	2007	2.66	0.06	8.47	0.04
Ghana	2012	4.33	0.01	12.94	0.00
India	2010	7.32	0.00	19.93	0.00
Indonesia	2009	8.71	0.00	22.48	0.00
Kenya	2002[a]	4.67	0.00	13.67	0.00
Nigeria	2012	4.00	0.02	12.10	0.00
Pakistan	2008	2.31	0.09	7.40	0.06
Philippines	2008	13.83	0.00	31.76	0.00
Sri Lanka	2005	17.14	0.00	36.85	0.00
Swaziland	2010	2.86	0.05	9.16	0.03
Tunisia	2007	6.94	0.00	19.10	0.00

Note: [a] It is out of the time-frame set, following the political violence and crisis of governance in Kenya during the early 2000s. * indicates statistically significant at 5 percent level of significance.

Table 2 summarizes the lag lenght selection for Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SIC).

Table 2

Optimum Lag-Length for Trade Balance

Bangladesh			Ghana		
Order of lag	AIC	SIC	Order of lag	AIC	SIC
0	2.68	2.91*	0	2.23	2.45
1	2.66	2.93	1	2.22	2.48
2	2.69	2.99	2	2.12*	2.44*
3	2.58*	2.94	3	2.16	2.52

(continued)

	India			Indonesia	
0	8.31	8.53	0	6.47	6.69
1	7.94	8.21*	1	6.36*	6.63*
2	7.99	8.30	2	6.38	6.69
3	7.92*	8.28	3	6.39	6.75
	Kenya			Nigeria	
0	1.46	1.68*	0	7.37	7.60
1	1.51	1.78	1	7.42	7.69
2	1.50	1.82	2	7.47	7.78
3	1.33*	1.69	3	7.07*	7.43*
	Pakistan			Philippines	
0	4.06	4.28*	0	4.73	4.95
1	4.09	4.36	1	4.59*	4.86*
2	4.01*	4.33	2	4.62	4.93
3	4.02	4.38	3	4.67	5.03
	Sri Lanka			Swaziland	
0	2.69	2.91	0	-1.59	-1.36
1	2.59*	2.86*	1	-2.45*	-2.18*
2	2.62	2.94	2	-2.43	-2.12
3	2.68	3.04	3	-2.37	-2.01
	Tunisia				
0	1.03	1.26			
1	0.76*	1.03*			
2	0.82	1.14			
3	0.79	1.15			

Note: * denotes the lowest value on AIC and SIC that fulfills the maximum lag length.

Table 3 reports the optimal ARDL model for each country and the result of F-statisic of bound test for cointegration. The results showed that the value of F-statistic exceeded the upper bound at 5 percent and 10 percent significance level, indicating the long-run cointegration relationships between TR and NEXR for all countries.

Table 3

Optimal Model and Result of Bound Test for Cointegration

Optimal Model	Country	*F*-statistic
(1, 4, 4, 4, 4)	Bangladesh	4.72*
(1, 3, 1, 1, 1)	Ghana	6.11*
(1, 2, 2, 5, 5)	India	9.14*
(1, 1, 2, 2, 1)	Indonesia	3.32**
(1, 5, 3, 5, 5)	Kenya	4.82*
(2, 4, 4, 4, 4)	Nigeria	6.68*
(1, 1, 1, 5, 3)	Pakistan	5.44*
(1, 3, 3, 3, 3)	Philippines	4.89*
(1, 1, 4, 2, 4)	Sri Lanka	15.97*
(1, 1, 0, 0, 2)	Swaziland	5.71*

Notes: * and ** denote statistically significant at 5 percent and 10 percent level of significance. The lower and upper bound values were tabulated by Pesaran et al. (2001).

Next, Table 4 shows the coefficient of long-run relationship. The coefficient of NEXR was positive and statistically significant in seven out of 11 countries. In the long-run, the NEXR affected positively TR in Bangladesh, Ghana, India, Kenya, Pakistan, Swaziland, and Tunisia. The impact of NEXR on TR was negative in Sri Lanka and insignificant in Indonesia, Nigeria, and the Philippines.

Related to the impact of FDI in the long-run, it was statistically insignificant in determining the trade in goods in most countries, excluding Nigeria, Pakistan, Philippines, and Swaziland. The GDP was positive and statistically significant at 5 percent level of significance in influencing the trade in goods in all countries, except Kenya and Pakistan. Meanwhile, the contribution of the dummy variable was negative in Ghana, India, Philippines and Sri Lanka.

Table 4

Results of the ARDL Long-Run Coefficient

	Bangladesh				Ghana		
Variable	Coefficient	SE	t-Stat	Variable	Coefficient	SE	t-Stat
LNEXR	0.99	0.52	1.90**	LNEXR	0.20	0.06	3.08*
LFDI	0.03	0.05	0.64	LFDI	0.06	0.07	0.89
LGDP	0.56	0.12	4.60*	LGDP	0.73	0.16	4.59*
DUM	0.34	0.10	3.36*	DUM	-0.53	0.25	-2.13*
	India				Indonesia		
LNEXR	0.27	0.14	1.92**	LNEXR	0.20	0.20	0.99
LFDI	-0.03	0.05	-0.65	LFDI	0.01	0.08	0.13
LGDP	1.88	0.15	12.68*	LGDP	0.71	0.31	2.31*
DUM	-1.15	0.21	-5.58*	DUM	0.24	0.29	0.84
	Kenya				Nigeria		
LNEXR	0.32	0.17	1.90**	LNEXR	-0.39	0.31	-1.24
LFDI	-0.12	0.16	-0.77	LFDI	1.08	0.52	2.09*
LGDP	0.33	0.32	1.04	LGDP	0.57	0.26	2.25*
DUM	1.21	0.34	3.56*	DUM	0.44	0.65	0.67
	Pakistan				Philippines		
LNEXR	0.28	0.13	2.10*	LNEXR	-0.64	0.71	-0.90
LFDI	0.19	0.06	3.36*	LFDI	0.25	0.12	2.03**
LGDP	0.10	0.22	0.44	LGDP	1.09	0.32	3.35*
DUM	0.65	0.15	4.30*	DUM	-0.97	0.46	-2.08*
	Sri Lanka				Swaziland		
LNEXR	-0.18	0.10	-1.84**	LNEXR	0.33	0.15	2.24*
LFDI	0.09	0.07	1.33	LFDI	0.16	0.09	1.74**
LGDP	1.27	0.16	8.15*	LGDP	0.35	0.20	1.75**
DUM	-0.95	0.13	-7.30*	DUM	0.03	0.18	0.17
	Tunisia						
LNEXR	0.90	0.30	3.02*				
LFDI	-0.06	0.08	-0.71				
LGDP	0.65	0.18	3.64*				
DUM	0.23	0.11	2.22*				

Note: * and ** denote statistically significant at 5 percent and 10 percent level of significance, respectively.

With regard to the issue of short-run relationships, see Appendix 1 which shows the estimation results of the coefficient of short-run and error-correction term for each country. In sum, the study found negative signs of the coefficient of the error-correction term in all countries. The impact of the NEXR on TR was positive and statistically significant at a 5 percent level of significance, indicating that the NEXR influenced TR positively in the short-run in Bangladesh, Ghana, India, Indonesia, Nigeria, Pakistan, and Sri Lanka. The coefficient of the NEXR was negative and statistically significant in Kenya, the Philippines, Swaziland, and Tunisia.

The error correction term shows a negative sign and statistically significant at a five percent level for each country. A negative coefficient of the ECT implied that the speed of adjustment of the dependent variable was corrected from the disequilibrium. For example, in the case of Indonesia, the coefficient of -0.36 indicated a low-speed of convergence to equilibrium, e.g. the trade balance was corrected for about 36 percent every year to converge to long-run equilibrium. The coefficient of the ECT was as follows: -0.64, -0.89, -0.47, -0.58, -0.63, -0.89, -0.25, -0.78, -0.31, and -0.51, for Nigeria, Bangladesh, Ghana, India, Kenya, Pakistan, the Philippines, Sri Lanka, Swaziland, and Tunisia, respectively. These coefficients indicated a low-speed of convergence in the Philippines, and Swaziland. A moderate-speed of adjustment for Ghana, India, and Tunisia. Meanwhile, a high-speed convergence for Nigeria, Bangladesh, Kenya, Pakistan, and Sri Lanka.

From the estimation results of the short-run and long-run relationships, the trade volume in goods in Kenya, Swaziland, and Tunisia, was deteriorating in the short-run and improving in the long-run later. The impact of the nominal exchange rate depreciation on the trade was positive in the long-run and short-run for three South Asia countries, namely Bangladesh, India, Pakistan, and Ghana. However, in the case of Sri Lanka, the exchange rate had a positive and significant effect in the short-run, but a negative effect in the long-run. Furthermore, the study only found short-run relationships in Indonesia, Nigeria, and the Philippines. In the

short-run, the effect of the nominal exchange rate depreciation on the trade balance was positive in Indonesia and Nigeria, but there was a negative effect in the Philippines.

The above empirical findings were in line with what what was espoused by the elasticities approach, ML theory, and J-curve theory, which helped to explain the link between the trade balance and nominal exchange rate depreciation. According to the findings of the present study, the nominal exchange rate depreciation was able to explain the trade volume. The essence of the difference in these results was the way the trade variable was determined.

The findings of this study were also corroborated in earlier studies in the context of the J-curve phenomenon. The existence of a positive long-run equilibrium relationship between trade balance and exchange rate depreciation were consistent with ealier studies which mainly focused on the Asian-African countries. Among others these were studies by Bahmani-Oskooee (2001) for eleven middle eastern countries including Tunisia; Lal and Lowinger (2002) for Bangladesh, India, and Pakistan; and Caporale, et al. (2012) for Kenya. In the case of the Philippines, the present study found that real exchange rate depreciation impacted negatively the trade balance at two lags, but there was insignificant result in the long-run. By using the ARDL method and quarterly data, Harvey (2013) showed that the trade balance deteriorated before impoving in the long-run. In the case of Nigeria, this study showed that there was no long-run relationship between the trade balance and exchange rate, but the study found a positive short-run relationship among the variables. This evidence was in line with the findings in Danmola (2013) and Onakoya and Johnson (2018).

Furthermore, in the case of Ghana, the impact of the exchange rate changes on the trade balance was varied in the short-run, but positive in the long-run. The empirical evidence in this study provided robust support for the findings in previous studies by Bhattaraj and Armah (2013) and Iyke and Ho (2017). Finally, Rose and Yellen (1989) concluded that the depreciation of the nominal

exchange rate did not necessarily lead to an increase in the trade balance, which was in this stufy found in the case of Sri Lanka.

In the context of the present study, the researchers were looking at the nominal exchange rate as one of the determining variables for international trade. The empirical evidence strongly pointed to the conclusion that the nominal exchange rate was a determinant of trade. Specifically, in the policy context, for the majority of countries, policymakers should maintain the nominal exchange rate depreciation as a part of trade strategy and liberalise foreign trade for the sake of the economic benefit of the country.

The study justified the use of diagnostic tests and CUSUM/CUSUMSQ in pursuing the stability of the model. Table 6 shows diagnostic tests for the ARDL model in developing countries. The result of the Lagrange Multiplier test shows the estimated model has no serial autocorrelation. The Breusch-Pagan showed there was no heteroscedasticity occurring in the data, indicating the error term was homogenous in nature. The Jarque–Bera test found that the residuals of the estimated models were normally distributed.

Table 6

Diagnostic Tests for the ARDL Model in Developing Countries

Test/Hypothesis	Country	F-Statistic	Prob*
Breusch-Godfrey Serial Correlation LM test H_0: No serial correlation	Bangladesh	0.06	0.95
	Ghana	2.98	0.07
	India	1.90	0.19
	Indonesia	2.10	0.15
	Kenya	1.76	0.23
	Nigeria	2.36	0.15
	Pakistan	0.90	0.42
	Philippines	0.78	0.47
	Sri Lanka	0.46	0.64
	Swaziland	1.57	0.23
	Tunisia	7.69	0.01

(continued)

Test/Hypothesis	Country	F-Statistic	Prob*
Breusch-Pagan-Godfrey Heteroskedasticity test H_0: No heteroscedasticity	Bangladesh	1.13	0.46
	Ghana	0.91	0.54
	India	1.85	0.11
	Indonesia	0.47	0.90
	Kenya	0.27	0.95
	Nigeria	0.91	0.54
	Pakistan	0.92	0.56
	Philippines	1.37	0.26
	Sri Lanka	0.56	0.87
	Swaziland	0.57	0.79
	Tunisia	0.49	0.93
Jarque-Bera Normality Test H_0: Normal distribution	Bangladesh	1.08	0.58
	Ghana	1.19	0.55
	India	1.89	0.38
	Indonesia	8.49	0.02
	Kenya	1.52	0.47
	Nigeria	15.33	0.01
	Pakistan	1.80	0.41
	Philippines	0.09	0.95
	Sri Lanka	7.84	0.02
	Swaziland	4.82	0.09
	Tunisia	0.88	0.64

Note: * denotes statistically significant at 1 percent level of significance.

Subsequently, both CUSUM and CUSUMQ show the time-series was lying well within the 0.05 critical lines, indicating the parameter of the model was stable. For a graphical description, the CUSUM and CUSUM-SQ for each countries are provided in Appendix 2 and Appendix 3, respectively.

CONCLUSION

The present study has examined the impact of the exchange rate depreciation on international trade for a number of Asian-African developing countries. The ARDL model in the form of an unrestricted error-correction model was robust in explaining the nominal exchange

rate depreciation as the determinant of trade. The study found that the nominal exchange rate depreciation had a significant positive impact on the trade balance in most countries in the long-run. The negative sign of the coefficient of the error-correction term in all countries supported the model convergence from the short-run toward the long-run, i.e. the existence of a long-run equilibrium relationship between trade balance and the independent variables. The CUSUM/ CUSUMSQ parameter stability tests confirmed the estimated models were stable over the period of the study for the respective countries.

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Appendix 1

Result of ARDL short-run coefficient

Variable	Bangladesh			Variable	Ghana			Variable	India			Variable	Indonesia		
	Coefficient	SE	t-Stat		Coefficient	SE	t-Stat		Coefficient	SE	t-Stat		Coefficient	SE	t-stat
C	7.95	1.36	5.86*	C	2.17	0.38	5.69*	C	-15.03	1.97	-7.65*	C	1.53	0.37	4.13*
D(LNEXR)	2.28	0.53	4.33*	D(LNEXR)	0.34	0.10	3.46*	D(LNEXR)	0.76	0.28	2.74*	D(LNEXR)	1.39	0.28	5.03*
D(LNEXR(-1))	1.96	0.72	2.74*	D(LNEXR(-1))	-0.16	0.08	-1.98**	D(LNEXR(-1))	0.65	0.31	2.13*	D(LFDI)	0.06	0.03	2.26*
D(LNEXR(-2))	1.91	0.76	2.52*	D(LFDI)	0.19	0.06	3.13*	D(LFDI)	0.02	0.01	1.64	D(LFDI(-1))	0.03	0.02	1.61
D(LNEXR(-3))	1.22	0.57	2.16**	D(LFDI(-1))	-0.02	0.03	-0.65	D(LFDI(-1))	-0.04	0.02	-2.45*	D(LGDP)	1.80	0.24	7.42*
D(LFDI)	-0.03	0.01	-2.53*	D(LGDP)	0.66	0.11	6.13*	D(LGDP)	1.66	0.26	6.49*	D(LGDP(-1))	0.44	0.14	3.17*
D(LFDI(-1))	0.00	0.02	0.22	D(LGDP(-1))	0.05	0.10	0.47	D(LGDP(-1))	0.91	0.25	3.59*	D(DUM)	-0.14	0.06	-2.18*
D(LFDI(-2))	0.02	0.01	1.71	ECT	-0.47	0.08	-5.99*	D(LGDP(-2))	-0.40	0.16	-2.49*	ECT	-0.36	0.08	-4.50*
D(LFDI(-3))	0.06	0.01	3.70*	-	-	-	-	D(LGDP(-3))	-0.38	0.15	-2.56*	-	-	-	-
D(LGDP)	2.89	0.50	5.78*	-	-	-	-	D(LGDP(-4))	-0.29	0.14	-2.10*	-	-	-	-
D(LGDP(-1))	1.58	0.67	2.37*	-	-	-	-	D(DUM)	-0.20	0.06	-3.14*	-	-	-	-
D(LGDP(-2))	1.54	0.50	3.06*	-	-	-	-	D(DUM(-1))	0.49	0.08	5.92*	-	-	-	-
D(LGDP(-3))	-0.56	0.30	-1.90**	-	-	-	-	D(DUM(-2))	0.47	0.08	5.92*	-	-	-	-
D(DUM)	0.04	0.06	0.63	-	-	-	-	D(DUM(-3))	0.41	0.08	4.82*	-	-	-	-
D(DUM(-1))	-0.18	0.08	-2.30*	-	-	-	-	D(DUM(-4))	0.27	0.08	3.53*	-	-	-	-
D(DUM(-2))	-0.18	0.07	-2.75*	-	-	-	-	ECT	-0.58	0.08	-7.61*	-	-	-	-
D(DUM(-3))	-0.17	0.06	-2.68*	-	-	-	-	-	-	-	-	-	-	-	-
ECT	-0.89	0.15	-5.95*	-	-	-	-	-	-	-	-	-	-	-	-
R²	0.90			R²	0.84			R²	0.93			R²	0.88		
Adj R²	0.76			Adj R²	0.79			Adj R²	0.88			Adj R²	0.85		
F-stat	6.47			F-stat	19.53			F-stat	17.40			F-stat	23.89		
Prob(F-stat)	0.00			Prob(F-stat)	0.00			Prob(F-stat)	0.00			Prob(F-stat)	0.00		
DW-stat	2.18			DW-stat	2.08			DW-stat	2.41			DW-stat	2.50		

Kenya

Variable	Coefficient	SE	t-stat
C	9.83	1.74	5.66*
D(LNEXR)	0.65	0.59	1.10
D(LNEXR(-1))	-2.03	0.53	-3.81*
D(LNEXR(-2))	-1.06	0.39	-2.73*
D(LNEXR(-3))	-1.28	0.38	-3.38*
D(LNEXR(-4))	1.46	0.36	4.01*
D(LFDI)	-0.01	0.02	-0.60
D(LFDI(-1))	0.05	0.02	2.52*
D(LFDI(-2))	0.04	0.02	2.64*
D(LFDI(-3))	1.73	0.66	2.61*
D(LGDP)	-1.82	0.55	-3.32*
D(LGDP(-1))	-1.10	0.41	-2.69*
D(LGDP(-2))	-1.19	0.40	-2.96*
D(LGDP(-3))	1.08	0.45	2.41*
D(DUM)	-0.04	0.15	-0.28
D(DUM(-1))	-0.91	0.23	-3.98*
D(DUM(-2))	-0.82	0.20	-4.20*
D(DUM(-3))	-0.53	0.17	-3.08*
D(DUM(-4))	-0.63	0.20	-3.19*
ECT	-0.63	0.11	-5.73*
R^2	0.91		
Adj R^2	0.78		
F-stat	7.53		
Prob(F-stat)	0.00		
DW-stat	2.55		

Nigeria

Variable	Coefficient	SE	t-stat
C	-8.32	1.23	-6.74*
D(LNEXR)	-0.24	0.13	-1.91**
D(LFDI)	0.64	0.17	3.89*
D(LGDP)	0.97	0.17	5.83*
D(LGDP(-1))	0.93	0.19	5.00*
D(LGDP(-2))	0.66	0.16	4.04*
D(LGDP(-3))	-0.10	0.08	-1.25
D(LGDP(-4))	-0.82	0.14	-6.07*
D(DUM)	-0.75	0.13	-5.91*
D(DUM(-1))	-0.61	0.11	-5.47*
D(DUM(-2))	2.96	0.33	9.02*
ECT	2.04	0.30	6.84*
	0.88	0.29	3.04*
	0.46	0.29	1.55
	-0.41	0.21	-1.96**
	-1.03	0.21	-4.83*
	-0.68	0.21	-3.16*
	-0.84	0.21	-3.94*
	-0.64	0.10	-6.75*
R^2	0.92		
Adj R^2	0.82		
F-stat	9.29		
Prob(F-stat)	0.00		
DW-stat	2.73		

Pakistan

Variable	Coefficient	SE	t-stat
C	14.23	2.50	5.70*
D(LNEXR)	1.05	0.27	3.85*
D(LNEXR(-1))	0.09	0.03	2.76*
D(LNEXR(-2))	0.89	0.19	4.64*
D(LFDI)	0.71	0.18	3.88*
D(LFDI(-1))	0.84	0.22	3.83*
D(LFDI(-2))	0.78	0.19	4.12*
D(LGDP)	0.30	0.20	1.53
D(LGDP(-1))	0.03	0.08	0.39
D(LGDP(-2))	-0.49	0.10	-4.81*
D(DUM)	-0.26	0.08	-3.24*
D(DUM(-1))	-0.89	0.15	-5.74*
D(DUM(-2))			
ECT			
R^2	0.81		
Adj R^2	0.71		
F-stat	8.66		
Prob(F-stat)	0.00		
DW-stat	1.86		

Philippines

Variable	Coefficient	SE	t-stat
C	-1.13	0.22	-5.13*
D(LNEXR)	-0.57	0.25	-2.31*
D(LNEXR(-1))	-0.45	0.25	-1.79**
D(LNEXR(-2))	-0.87	0.27	-3.28*
D(LFDI)	0.03	0.01	2.17*
D(LFDI(-1))	-0.03	0.02	-1.39
D(LFDI(-2))	-0.03	0.02	-1.80**
D(LGDP)	0.24	0.34	0.72
D(LGDP(-1))	-0.71	0.35	-2.02**
D(LGDP(-2))	-1.05	0.34	-3.04*
D(DUM)	-0.09	0.06	-1.64
D(DUM(-1))	-0.02	0.06	-0.24
D(DUM(-2))	0.20	0.07	2.95*
ECT	-0.25	0.05	-5.47*
R^2	0.86		
Adj R^2	0.78		
F-stat	10.32		
Prob(F-stat)	0.00		
DW-stat	2.38		

Sri Lanka Variable	Coefficient	SE	t-stat	Swaziland Variable	Coefficient	SE	t-stat	Tunisia Variable	Coefficient	SE	t-stat
C	-6.09	0.62	-9.86*	C	3.34	0.55	6.03*	C	4.68	0.81	5.78*
D(LNEXR)	0.68	0.22	3.02*	D(LNEXR)	-0.65	0.11	-6.10*	D(LNEXR)	-0.41	0.40	-1.01
D(LFDI)	0.04	0.02	2.73*	D(DUM)	-0.02	0.06	-0.35	D(LNEXR(-1))	-0.59	0.30	-1.97**
D(LFDI(-1))	0.00	0.02	0.03	D(DUM(-1))	-0.13	0.06	-2.09*	D(LNEXR(-2))	-0.98	0.29	-3.31*
D(LFDI(-2))	0.00	0.02	-0.28	ECT	-0.31	0.05	-5.81*	D(LNEXR(-3))	-0.99	0.31	-3.18*
D(LFDI(-3))	0.06	0.02	4.15*					D(LFDI)	0.00	0.01	0.20
D(LGDP)	1.58	0.14	11.24*					D(LGDP)	0.58	0.38	1.53
D(LGDP(-1))	0.51	0.12	4.35*					D(LGDP(-1))	-0.32	0.30	-1.06
D(DUM)	-0.14	0.04	-3.56*					D(LGDP(-2))	-0.41	0.32	-1.29
D(DUM(-1))	0.46	0.07	6.76*					D(LGDP(-3))	-0.15	0.30	-0.50
D(DUM(-2))	0.38	0.06	6.22*					D(LGDP(-4))	0.58	0.15	3.72*
D(DUM(-3))	0.28	0.06	4.73*					D(LGDP(-5))	0.35	0.19	1.81**
ECT	-0.78	0.08	-9.83*					D(DUM)	0.15	0.05	2.87*
								D(DUM(-1))	0.11	0.05	2.27*
								D(DUM(-2))	-0.11	0.05	-2.07**
								D(DUM(-3))	0.06	0.05	1.35
								ECT	-0.51	0.09	-5.71*
R^2	0.93			R^2	0.83			R^2	0.93		
Adj R^2	0.89			Adj R^2	0.81			Adj R^2	0.87		
F-stat	24.46			F-stat	32.76			F-statistic	14.67		
Prob(F-stat)	0.00			Prob(F-stat)	0.00			Prob(F-stat)	0.00		
DW-stat	2.29			DW-stat	1.11			DW-stat	1.68		