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Revisiting the asymmetry between the exchange rate and domestic production in South Asian economies: Evidence from nonlinear ARDL approach

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Abstract

Purpose — The present study investigates the asymmetric effect of exchange rate changes on the domestic production of selected South Asian economies from 1980-2019.

Design/Method/Approach—The study introduces nonlinearity into the adjustment process by decomposing the exchange rate into depreciation and appreciation and relying on the Nonlinear ARDL approach to cointegration.

Findings — The findings show significant evidence of asymmetric effects of exchange rate changes on domestic production in the case of South Asian economies. Surprisingly, depreciation promotes economic growth while appreciation impedes it in almost all economies.

Practical Implications — The findings refute the notion of symmetry, indicating that depreciation and appreciation have different effects on South Asian economies. An undervalued exchange rate may provide short-term economic relief. The study recommends that a market-based equilibrium exchange rate is crucial for these economies.

Originality/Value — By using a Nonlinear ARDL approach to separate exchange rate appreciation and depreciation, this study adds to the body of knowledge about the relationship between exchange rate and growth, particularly in South Asia.

Keywords — Asymmetric effects; exchange rate volatility; domestic production; South Asia; nonlinear ARDL

Introduction

Fluctuations in the exchange rate tend to affect most macroeconomic variables. These variations in the exchange rate may affect income, trade, investment, foreign direct investment, and consumption. This link has been widely investigated by researchers (Ayubu, 2013; Bahmani-Oskooee, Iqbal, & Nosheen, 2016; Bahmani-Oskooee, Iqbal, & Salam, 2016; Bahmani-Oskooee & Kandil, 2007; J. Iqbal, Nosheen, Tariq, & Manan, 2015; Kandil & Mirzaie, 2008). The link between real exchange rate (REX) changes and domestic production/economic growth (EG) is no exception (Bahmani-Oskooee, Halicioglu, & Mohammadian, 2018; Bahmani-Oskooee & Miteza, 2006; Bahmani-Oskooee & Mohammadian, 2016). Theory predicts that the depreciation of domestic currency may stimulate net exports by making exports internationally more competitive and may, therefore, raise

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aggregate demand (Bahmani-Oskooee, Iqbal, & Khan, 2017; Bahmani-Oskooee, Iqbal, & Muzammil, 2017; Bahmani-Oskooee, Nosheen, & Iqbal, 2017; Dornbusch, Krugman, & Cooper, 1976). In contrast, depreciation may raise the cost of imported inputs and the cost of production as well. Thus depreciation or devaluation is supposed to contract the domestic production and aggregate supply (Bahmani-Oskooee & Hajilee, 2010). The final effect of depreciation and appreciation depends upon the interaction between aggregate demand and supply channels. Depreciation may result in contraction if the expansionary aggregate demand is less than aggregate supply. On the other hand, if aggregate supply declines less than the expansionary aggregate demand, then the depreciation will be expansionary (Bahmani-Oskooee et al., 2018). At this point, the individual experiences of countries will provide further evidence of expansionary or contractionary depreciation. The countries that experience contractionary depreciation tend to be dependent on imported inputs. The more export-oriented countries will gain benefit from the depreciation.

In recent years, the nexus between the exchange rate and EG is an extensively debated issue in the literature and is the central macroeconomic goal of economic policy agenda across the globe (Easterly & Levine, 1997; Fischer, 1992; Knight, Loayza, & Villanueva, 1993; Most & De Berg, 1996). Many other studies investigating the impact of exchange rate uncertainty on EG reported mixed findings (Ahmad, Hayat, Luqman, & Ullah, 2012; Akhtar & Malik, 2000; Ali & Anwar, 2016; Baron, 1976; Bini-Smaghi, 1991; Cushman, 1983; De Grauwe & Verfaille, 1988; Gros, 1987; Hasan & Khan, 1994; Hassan, Fausat, & Baba, 2016; Kandil, 2008; Kappler, Reisen, Schularick, & Turkisch, 2013; Khan, 1995; Kohler, Manalo, & Perera, 2014; Masih, Liu, & Pervaiz, 2018; Nawaz & Ghani, 2018; Yang, 1997). Numerous studies in recent years have provided compelling evidence regarding the effect of exchange rate uncertainty on the EG of developing economies (Algaeed & Algethami, 2022), Saudi Arabia (Khan, 2021), Bangladesh (An, Binh, & Cam, 2020), and ASEAN (Matthew et al., 2021).

The current study focuses on the South Asian region, which is home to 1.891 billion people. It makes up one-fourth of the world's population and must cope with several challenges in terms of poverty, energy demand, low saving rate, and macroeconomic stability (Devarajan & Nabi, 2006; Farrington & Clarke, 2006). The South Asian "region lags behind other countries in terms of many socio-economic factors compared to world standards, yet, in the past few decades, the region has emerged as a potential area for economic development and growth (Most & De Berg, 1996). The "region has registered an annual growth rate (average) of 5.4 % compared to the 3.1% growth rate of the world average in the last five decades (Bank, 2017).

Earlier studies that investigated the implications of exchange rate uncertainty for domestic output in South Asian economies (Ahmad, Ahmad, & Ali, 2013; Hamid & Mir, 2017; Hooy & Choong, 2010; Iqbal, Khan, & Nosheen, 2019; Iqbal, Nosheen, Panezai, & Salahuddin, 2021; Javed & Farooq, 2009; Nawaz, 2012; Shahbaz, Islam, & Aamir, 2012). However, these studies were based on the assumption of symmetry between the exchange and economic growth. The assumption of symmetry between the exchange rate and EG is either overly restrictive or overly simplified. However, in the recent period, many studies have reported evidence of asymmetric effects while estimating the impact of exchange rate changes on domestic output and other economic indicators (Bahmani-Oskooee & Bahmani, 2015; Bahmani-Oskooee & Fariditavana, 2015; Bahmani-Oskooee & Mohammadian, 2017; Chishti, Iqbal, Mahmood, & Azeem, 2020; Iqbal, 2020; Iqbal, Aziz, & Nosheen, 2020, 2022; Iqbal, Nosheen, & Rehman Panezai, 2021; Katrakilidis & Trachanas, 2012; Najibullah, Iqbal, & Nosheen, 2021; Nusair, 2017; Shin, Yu, & Greenwood-Nimmo, 2014).

This study interrogates the question of whether there is evidence of an asymmetric relationship between exchange rate and EG in the case of South Asian economies. The present study adds to the body of literature in several ways. First, the current study adds to the body of knowledge by addressing both the symmetric and asymmetric effects of exchange rates on the EG of South Asian economies by separating the exchange rate into appreciations (adverse shocks) and depreciations (positive shocks) because EG responds to shocks differently than the real exchange rate. Second, the study uses a consistent approach adopted by Granger & Yoon (2002); Hatemi-J, (2012); Najibullah, Iqbal, Nosheen, et al. (2021); Olaniyi (2019) to decompose exchange rate into appreciation and depreciation. This approach helps in separating the effects of positive changes from

the effects of adverse changes since economic agents in international markets tend to react differently to appreciation and depreciation. The method also aids in determining whether real depreciation or real appreciation, as well as their magnitudes, have different effects. Third, region-wise studies that examine the impact of exchange rates on EG tend to obscure the true relationship between the two variables because the results may differ from country to country due to differences in political, economic, and geographical structures. Thus, the current study investigates both the symmetric and asymmetric effect of exchange rates on EG for selected South Asian economies separately.

Method

Researchers have included different variables for examining the effect of the real effective exchange rate on domestic production. Based on data availability, the study covers a period from 1980 to 2019 using annual data for the selected five economies. Following Bahmani-Oskooee & Aftab, (2017); Bahmani-Oskooee et al. (2018), this study introduces two policy variables along with other control variables as below:

$$LnY_t = a + bLnM_t + cLnG_t + dLnREX_t + \varepsilon_t \quad (1)$$

In the given model, Y represents the real GDP for Pakistan, G denotes the real government spending of a country, M shows the real money supply by the country's central bank, and REX denotes the real effective exchange rate. The real effective exchange rate variable is defined so that a REX fall indicates devaluation. The positive coefficient of REX defines the contraction in the gross domestic product; however, the negative coefficient of REX means the expansion of domestic production. In the case of expansionary policies, we say that the estimates of b and c will be positive. We extend this equation by incorporating two more variables, i.e. oil prices and daily wage. The justification for including these two variables is that other studies have assumed perfect aggregate supply. The model takes the following form in the long run;

$$LnY_t = a + bLnM_t + cLnG_t + dLnREX_t + eLnOP_t + fLnW_t + \varepsilon_t \quad (2)$$

To introduce asymmetry in model, the real exchange rate is divided between depreciation (positive shock) and appreciation (negative shock) from equation-2. The real effective exchange rate is replaced with the notation POS and NEG, respectively. Both POS and NEG are the appreciations and depreciation of each country's currency as below:

$$POS_t = \sum_{j=1}^{t} \Delta lnREX_j^+ = \sum_{j=1}^{t} \max(\Delta lnREX_j, 0) \quad (3)$$
$$NEG_t = \sum_{j=1}^{t} \Delta lnREX_j^- = \sum_{j=1}^{t} \min(\Delta lnREX_j, 0)$$

By introducing these two variables POS and NEG, a new model is as below:

$$LnY_t = a + bLnM_t + cLnG_t + dLnPOS_t + eLnNEG_t + fLnOP_t + gLnW_t + \varepsilon_t \quad (4)$$

Model equation-(4) is no longer linear because it has two new time series variables in model, i.e. POS & NEG, which makes the adjustment process nonlinear. However, model (2) is said to be a linear ARDL model. After estimating (4), if cointegration is established between variables, it can be infered the four kinds of asymmetry. To begin with, short-run asymmetry is built up in the case of $\hat{a}_{4k}^{+} \neq \hat{a}_{4k}^{-}$ for all k. Secondly, long-run asymmetry is built up in case $\hat{\beta}_3^{+} \neq \hat{\beta}_3^{-}$. Finally, the dynamic multipliers pattern captures the adjustment asymmetry. It applies the Wald test for the concreteness of the results. However, adjustment asymmetry is judged by dynamic movements.

Results and Discussion

The present study investigates the impact of exchange rates on EG for selected South Asian economies such as Pakistan, India, Bangladesh, and Sri Lanka. For this purpose, the study applies both the linear and nonlinear ARDL model to show the symmetric and asymmetric effect of the exchange rate on the EG of South Asian economies. Since the present study is based on annual data, it allows the maximum three lags. The study follows Akaike's Information Criterion (AIC) for lag selection to determine the cointegration relationship among the variables. Results of the bound test are presented in table-1 through table 8, which indicate the outcome of the cointegration relation.

We also present the empirical results for each country based on the linear and the nonlinear ARDL. Each consists of three panels. Panel A provides the short-run coefficient estimates, and Panel B shows the long-run coefficient estimates, while in Panel C, we report diagnostic statistics.

We start by looking at the results of both the symmetric and asymmetric approaches. Tables 1–8 show that, in the cases of Pakistan, India, Bangladesh, and Sri Lanka, almost all independent variables have the expected signs based on the results that rely on the assumption of symmetry. The F-stat values confirm the presence of long-run cointegration both in the linear and nonlinear models for the selected countries.

In the case of the selected economies, the independent variable has almost expected signs. For example, government expenditure, real effective exchange rate, and real wage significantly impact the EG in the short run. While oil price and monetary policy do not have a significant impact on EG in the short run., However, other independent variables significantly impact EG in the long run, except for real wages and oil prices. The short-run and long-run coefficients of the effective exchange rate indicate that appreciation is helpful to the economy in the short run but in the long run, appreciated currency tends to negatively affect the competitiveness of exports which in turn has negative implications for EG. In the case of India, the real effective exchange rate has a significantly negative impact on EG in the short run, but in the long run, it has a positive and significant impact on EG in the case of India. In the case of Sri Lanka, the findings show that the real effective exchange rate has an insignificant impact on EG in the short run, but in the long run, it has a negative and significant impact on EG in the case of Sri Lanka. Other independent variables have expected signs, such as government expenditure, monetary policy, and oil prices. For example, government expenditure and monetary policy have a positive and significant impact on EG in the short and long run. However, in the case of oil prices, it has a significantly negative impact on EG both in the short and long run.

Similarly, in the case of Bangladesh, the independent variables come up with expected signs. However, an increase in oil prices has no significant impact in the short run, while in the long run, it tends to affect the economy of Bangladesh negatively, mainly because of an increase in production cost. The findings are in line with the studies by Aguirre & Calderón (2005); Dhasmana (2015); Rahman & Serletis (2009), which discovered that compared to appreciations, output responds favourably to exchange rate appreciation more so than depreciation.

Tables 2, 4, 6 and table-8 present the empirical results based on nonlinear ARDL for Pakistan, India, Sri Lanka and Bangladesh. The result indicates that when it allows the asymmetry in the empirical model, i.e., when the model desegregated the exchange rate variable into the positive and negative exchange rate, it indicates an irregular pattern, i.e., unlike the symmetric approach, the positive exchange rate tends to affect the EG positively in the short run but negatively in the long run. Similarly, the negative exchange rate tends to affect EG negatively in the short run but positively in the long run. Thus the empirical results indicate the evidence of asymmetric effect in the case of the exchange rate and growth relationship, which is confirmed by the Wald-S and Wald-L statistics in the selected four South Asian economies. The finding is in line with previous studies such as those Abbasi & Iqbal (2021); Bahmani-Oskooee et al. (2018); Bahmani-Oskooee & Baek (2020), who reported evidence of asymmetric results.

Regarding the validity of the results, the study presents the diagnostic tests for both linear ARDL and nonlinear ARDL-based models. It shows that all tests satisfy the standard validity conditions. For example, the ECM terms are negative and significant in both tables, which shows that both the linear and nonlinear models are stable. Similarly, The RESET, the Lagrange Multiplier (LM), and CUSUM and ($CUSUM^2$) test reported at the bottom of Panel C of table-1 through table-8 confirm that the model is correctly specified (e.g., as well as there is no autocorrelation problem. It also shows that the models are stable. The graphical representation of each test here will make the process cumbersome; therefore, it presents the symbol of 'S' for stable coefficients and the 'US' for unstable coefficients at 5% significance levels. While the Wald-S and the Wald-L indicate evidence of asymmetric effect both in the short and long run. The empirical results confirm the evidence of asymmetric results in the case of the selected four economies indicating that EG responds in a different way to changes in appreciation and depreciation. Overall results in the case

of all South Asian economies corroborate the findings of other studies of the region such as Ahmad et al. (2013); Hamid & Mir (2017); Hooy & Choong (2010); Javed & Farooq (2009); Nawaz (2012); Shahbaz et al. (2012).

Table 1. Estimates of Linear Model (Pakistan)

Panel A: Short-run Coefficient Estimates						
Lag Order	0	1	2	3		
ΔLnY		0.45**				
		(-2.85)				
ΔLnG	0.08**					
	(-2.53)					
ΔLnM	0.12					
	(-1.68)					
ΔLnREX	0.23**					
	(-3.44)					
ΔLnPO	0.09					
	(-1.48)					
ΔLnW	-0.07**					
	(-2.03)					
Panel B: Long-run Coefficient Estimates						
Constant	Trend	LNG	LnM	index	LNPO	LNW
3.61**	0.09	0.05**	0.71**	0.37*	0.18**	-0.04**
-4.65	(-1.56)	(-3.76)	(-3.11)	(-1.66)	(-2.47)	(-3.94)
Panel C: Diagnostics						
ECM-1		LM	RESET	R2	CUSTOM	(CUSUM)²
-0.36**		5.14	0.84	0.58	S	(S)
(-4.26)						

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Table 2. Full Information Estimates of Nonlinear Model (Pakistan)

Panel A: Short-run Coefficient Estimates							
Lag Order	0	1	2	3			
LnY		1.13**	0.05				
		(-4.14)	(-0.86)				
LNG	0.15	-0.07	1.16				
	(-0.49)	(-1.35)	(-2.71)				
LnM	0.15	0.024**	0.22**				
	(-1.23)	(-4.61)	(-2.51)				
LnW	-0.09*	0.18	-0.07**				
	(-1.85)	(-0.86)	(-2.42)				
LPO	0.04	-1.09**	0.54				
	(-1.03)	(-3.84)	(-1.40)				
POS	0.08*	0.30**	-0.19*				
	(-1.86)	(-2.5)	(-1.77)				
NEG	-0.53**	-1.3	0.05**				
	(-2.00)	(-1.25)	(-4.38)				
Panel B: Long-run Coefficient Estimates							
Constant	Trend	LNG	LnM	LnW	LPO	POS	NEG
3.73**	0.03**	0.01	0.22**	0.09**	0.06**	0.03**	0.41**
(-6.12)	(-7.63)	(-0.43)	(2.72)	(-2.32)	(-3.41)	(-4.63)	(4.90)
Panel C: Diagnostics							
ECM-1	LM	RESET	Adj-R square	CUSTOM	(CUSUM)²	Wald-S	Wald-L
-0.08**	2.59	0.55	0.6	S	(S)	9.08**	6.14**
(-3.34)							

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Table 3. Estimates of Linear Model (India)

Panel A: Short-run Coefficient Estimates						
Lag Order	0	1	2	3		
ΔLnY		0.36**				
		(-1.97)				
ΔLnG	0.06**					
	(-3.52)					
ΔLnM	0.03*					
	(-1.83)					
ΔLnREX	-0.14*					
	(-1.76)					
ΔLnPO	-0.16*					
	(-1.88)					
ΔLnW	-0.02					
	(-1.02)					
Panel B: Long-run Coefficient Estimates						
Constant	Trend	LNG	LnM	index	LPO	LnW
3.45**	0.02**	0.08**	0.33**	0.05**	-0.17**	-0.07
(-4.76)	(-5.22)	(7.82)	(4.11)	(3.81)	(-2.05)	(-0.97)
Panel C: Diagnostics						
ECM-1	LM	RESET	Adj-R square	CUSTOM	$(CUSUM)^2$	
-0.68**	6.58	0.67	0.67	S	S	
(-7.96)						

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Table 4. Full Information Estimates of Nonlinear Model (India)

Panel A: Short-run Coefficient Estimates							
Lag Order	0	1	2	3			
LnY		1.17**	0.09				
		(-4.06)	(-0.82)				
LNG	0.28**	-0.04	0.06				
	(-2.69)	(-0.14)	(-1.5)				
LnM	0.04	0.24**	0.01				
	(-1.35)	(6.32)	(-1.53)				
LnW	-0.01	0.01	-0.12				
	(-0.34)	(-0.11)	(-1.65)				
LPO	-0107**	-0.04**	-0.01				
	(-3.02)	(-2.87)	(-1.60)				
POS	0.15	0.23	-0.06				
	(-1.45)	(-1.40)	(-0.85)				
NEG	-0.42	-0.27	-0.14				
	(-1.01)	(-1.34)	(-1.33)				
Panel B: Long-run Coefficient Estimates							
Constant	Trend	LNG	LnM	LnW	LPO	POS	NEG
2.52**	0.02**	0.01*	0.33**	0.09**	0.06**	0.02**	0.71**
(-6.13)	(-5.6)	(1.82)	(3.53)	(-3.23)	(-4.70)	(5.62)	(-2.94)
Panel C: Diagnostics							
ECM-1	LM	RESET	Adj-R square	CUSTOMS	CUSTOM	Wald-S	Wald-L
-0.08**	3.49	0.44	0.7	S	S(S)	4.60**	9.08**
(-2.27)							

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Table 5. Estimates of Linear Model (Sri Lanka)

Panel A: Short-run Coefficient Estimates						
Lag Order	0	1	2	3		4
ΔLnY		0.26*				
		(-4.86)				
ΔLnG	0.18**					
	(-4.63)					
ΔLnM	0.14**					
	(-2.18)					
ΔLnREX	0.43					
	(-1.02)					
ΔLnPO	-0.17*					
	(-1.78)					
ΔLnW	-0.19					
ΔLnY	(-1.03)					
Panel B: Long-run Coefficient Estimates						
Constant	Trend	LNG	LnM	index	LPO	LnW
3.51**	0.17**	0.16**	0.91**	0.39*	-1.18*	-0.12**
(-2.56)	(-1.65)	(3.95)	(2.31)	(2.55)	(-1.93)	(-3.72)
Panel C: Diagnostics						
ECM-1	LM	RESET	Adj-R square	CUSTOM	(CUSUM)2	
-0.35**	6.12	0.82	0.62	S	(S)	
(-2.45)						

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Table 6. Full Information Estimates of Nonlinear Model (Sri Lanka)

Panel A: Short-run Coefficient Estimates							
Lag Order	0	1	2	3	4		
LnY		1.13**	0.16				
		(-2.12)	(-0.85)				
LNG	0.16**	0.19*	0.15*				
	(-2.27)	(-1.86)	(-1.94)				
LnM	0.16**	0.16**	0.15*				
	(-2.43)	(-2.51)	(-1.76)				
LnW	-0.17*	0.18	-0.19				
	(-1.86)	(-0.85)	(-1.24)				
LPO	-0.12	-1.07**	0.62				
	(-1.03)	(-3.82)	(1.22)				
POS	-0.18*	-0.30**	-0.17				
	(-1.85)	(-2.66)	(-1.69)				
NEG	0.63**	-1.3	0.16*				
	(2.14)	(-1.46)	(-2.38)				
Panel B: Long-run Coefficient Estimates							
Constant	Trend	LNG	LnM	LnW	LPO	POS	NEG
3.93**	0.13**	0.11**	0.44*	0.17*	-0.15**	0.13**	0.21**
(-5.14)	(-3.53)	(4.23)	(4.94)	(-4.34)	(-3.2)	(-2.53)	(2.71)
Panel C: Diagnostics							
ECM-1	LM	RESET	Adj- R-square	CUSTOM	CUSUM²	Wald-S	Wald-L
-0.18**	4.67	0.66	0.6	S	(S)	6.5**	7.08**
(-3.32)							

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Table 7. Estimates of Linear Model (Bangladesh)

Panel A: Short-run Coefficient Estimates						
Lag Order		0	1	2	3	4
ΔLnY			0.05*			
			(-1.76)			
ΔLnG	0.05**					
	(7.04)					
ΔLnM	0.07**					
	(2.63)					
ΔLnREX	-0.12*					
	(-1.95)					
ΔLnPO	-0.12					
	(-0.88)					
ΔLnW	-0.14					
	(-1.04)					
Panel B: Long-run Coefficient Estimates						
Constant	Trend	LNG	LnM	index	LPO	LnW
3.26**	0.14**	0.18**	0.03**	-0.16*	-0.16*	-0.19
(-2.95)	(6.44)	(4.84)	(5.11)	(-1.80)	(-1.86)	(-0.79)
Panel C: Diagnostics						
ECM-1	LM	RESET	Adj-R square	CUSTOM	$(CUSUM)^2$	
-0.08**	5.68	0.09	0.57	S	S	
(-9.75)						

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Table 8. Full Information Estimates of Nonlinear Model (Bangladesh)

Panel A: Short-run Coefficient Estimates							
Lag Order	0	1	2	3	4		
LnY		1.19**	0.17				
		(-2.05)	(-0.84)				
LNG	0.11**	0.12**	0.15**				
	(3.57)	(2.12)	(2.67)				
LnM	0.12**	0.42**	0.15**				
	(3.36)	(5.54)	(2.84)				
LnW	0.11*	0.11*	0.14				
	(1.82)	(1.81)	(1.56)				
LPO	-0.19*	-0.12*	-0.11				
	(-1.94)	(-1.89)	(-1.50)				
POS	-0.16**	-0.40**	-0.15				
	(-3.86)	(-3.21)	(-0.86)				
NEG	-0.24**	-0.43*	-0.32				
	(-2.01)	(-1.72)	(-1.48)				
Panel B: Long-run Coefficient Estimates							
Constant	Trend	LNG	LnM	LnW	LPO	POS	NEG
4.64**	-0.14**	0.11**	0.33**	-0.17	-0.15*	0.14**	0.19**
(5.13)	(-3.51)	(2.94)	(3.63)	(-1.43)	(-1.91)	(-2.54)	(5.72)
Panel C: Diagnostics							
ECM-1	LM	RESET	Adj- R-square	CUSTOM	$CUSUM^2$	Wald-S	Wald-L
-0.18**	3.27	0.22	0.4	S	S	2.5	7.08**
(-4.49)							

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Conclusion

Previous studies focused on the exchange rate and growth nexus were supposed to have a limitation: they all assumed a symmetric approach to cointegration. Hence the findings of these studies are supposed to have been masked by the restricted assumption. The present study, therefore, aims to investigate both the symmetric and asymmetric effect of exchange rate changes on the economic growth of the selected SAARC economies such as Pakistan, India, Sri Lanka, and Bangladesh. The empirical results confirm the asymmetric effect in two ways. First, in all the selected economies, it finds significant evidence that exchange rate changes behave differently in case of the short run as well as in the long run, which is in line with the findings of the previous studies as reflected in the J-curve phenomenon. However, the study also confirms the evidence of the asymmetric effect of exchange rate changes on economic growth in the case of all the selected economies. In all cases, positive and negative exchange rates tend to affect economic growth asymmetrically. These asymmetric effects may be due to different expectations of producers and consumers about appreciation and depreciation in terms of risk-taking behaviour. One thing which was found to be common is that in almost all the cases, the study found that expansionary fiscal and monetary policy has been beneficial to the respective economies in terms of economic boost and expansion. While in many cases, the study found that increasing oil prices affected economic growth in general in many cases. As a result was insignificant, at least in the short run, while the impact of real wages shows an insignificant impact in most cases. The results are important from a policy perspective that fiscal and monetary policy tools are crucial for economic growth. However, the exchange rate policy is sensitive to each country's situation, particularly the elasticity of exports and imports and the country's external position in terms of trade surplus and trade deficit. The findings have important policy implications. Although an appreciated currency appears to be politically appealing, it is expected to result in unnecessary import growth and a negative impact on export competitiveness, potentially leading to increased trade imbalances. While depreciation may appear to provide temporary relief in terms of economic growth. South Asia's developing economies must adhere to a market-based ER system that considers demand and supply considerations. The market-based exchange rate system is intended to protect the economy from external financial shocks and to keep the economy on a strong growth path. The study contributes to the debate that both appreciation/ overvaluation and depreciation/ undervaluation tend to end up in a different outcomes in terms of economic growth. Thus exchange rate policy needs to be used more prudently.

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APPENDIX: Data Definition and Sources"

"All data are annual for 1980-2019 and come from the International Financial Statistics of the IMF."

Variables:

GDP = index of real GDP in i^{th} South Asian economy (Pakistan, India, Sri Lanka, Bangladesh)
M = real money supply defined as real M3. The GDP deflator deflates nominal M3 figures in national currency.
G = real government spending. The GDP deflator deflates nominal data into national currency.
REX = real effective exchange rate. A decline reflects a real depreciation of the domestic currency.
PO = world crude oil (Petroleum) price index.
W = wage rate index for i^{th} selected South Asian country.

AppendixA1. Unit root tests based on ADF and Phillips-Perron unit root (PP) test

Pakistan					India			
Variable	Level.PP	Δ.PP	Level.ADF	Δ.ADF	Level.PP	Δ.PP	Level.ADF	Δ.ADF
lnY	--2.685	-3.808**	--1.904	-3.775**	--2.359	-3.539**	--2.207	-4.128**
lnM	-2.521	5.697**	-2.849	5.647**	-3.529	5.294**	-3.303	5.176**
LNG	--2.381	-5.381**	--2.691	-5.334**	--3.333	-5.000**	--3.119	-5.833**
lnREX	--3.363	-5.340**	--2.670	-5.293**	--3.308	-4.962**	--3.096	-5.789**
lnW	-2.687*	-3.105**	--0.776	-4.539**	-2.9618*	-4.443**	-2.900*	-4.683**
lnOP	--2.518	-5.691**	--2.845	-5.641**	--3.525	-5.288**	--3.299	-6.168**
lnPOS	-2.464**	-5.309**	-3.654**	-3.280**	--2.050	-3.074**	--2.918	-3.586**
lnNEG	-3.124*	-4.160**	-3.1002*	-5.478**	-3.1736**	-6.260**	-3.712*	-5.552**
Bangladesh					Sri Lanka			
	Level.PP	Δ.PP	Level.ADF	Δ.ADF	Level.PP	Δ.PP	Level.ADF	Δ.ADF
lnY	--2.022	-4.954**	--2.831	-4.635**	--2.649	-4.046**	--2.467	-4.194**
lnM	3.025*	5.412**	-4.235	5.935**	-3.963	6.053**	-3.691	6.274**
LNG	--2.857	-5.000**	--4.000	-5.550**	--3.743	-5.717**	--3.486	-5.926**
lnREX	--2.836	-6.947**	--3.970	-5.501**	--3.715	-5.673**	--3.459	-5.881**
lnW	-2.824*	-4.020**	-2.154*	-4.890**	-2.080*	-4.649**	-3.006*	-4.710**
lnOP	--3.022	-5.403**	--4.230	-6.927**	--3.958	-5.046**	--3.686	-5.267**
lnPOS	-3.022**	-5.404**	-3.231**	-6.928**	-3.959**	-5.046**	--3.687	-4.268**
lnNEG	-2.452	4.007**	-3.433	5.621**	-3.212	4.906**	-2.991	4.085**

Notes: Level ADF and Δ.ADF denote the level and first difference of the augmented Dickey-Fuller unit root test; Where Level PP and Δ.PP denote the level, and first difference of the Phillips-Perron unit root test; * and ** denote rejection of the null hypothesis of no unit root at 10% and 5% significance level, respectively. None of the variables is integrated of I(2).