Asymmetry Effect of Exchange Rate Changes on Domestic Production of South Asian Countries

By

Muhammad Yasir
PIDE2018FMPHILEAF2016

Supervisor

Dr. Farhat Mahmood
Dr. Hafsa Hina

Department of Business Studies
Pakistan Institute of Development Economics
Islamabad
2020

PAKISTAN INSTITUTE OF DEVELOPMENT ECONOMICS, ISLAMABAD

CERTIFICATE

This is to certify that this thesis entitled **"Asymmetry Effect of Exchange Rate Changes on Domestic Production of South Asian Countries"** submitted by **Mr. Muhammad Yasir** is accepted in its present form by the Department of Business Studies, Pakistan Institute of Development Economics (PIDE) Islamabad as satisfying the requirements for partial fulfillment of the Degree of Master of Philosophy in Economics and Finance.

Supervisor:

Dr. Farhat Mahmood
Lecturer / Coordinator,
PIDE, Islamabad

Co-supervisor:

Dr. Hafsa Hina
Assistant Professor,
PIDE, Islamabad

External Examiner:

Dr. Muhammad Tariq Majeed,
Associate Professor,
SOE, QAU, Islamabad

Head, Department of Business Studies:

Dr. Nadeem Ahmed Khan
Assistant Professor,
PIDE, Islamabad.

Date of Examination: December 24, 2020.

ACKNOWLEDGEMENTS

I am thankful to my Creator **Allah Subhana-Watala** to have guided me throughout this work at every step and for every new thought. Indeed, I could have done nothing without Your help and guidance. Whosoever helped me throughout the course of my thesis, whether my parents or any other individual was Your will, so indeed none be worthy of praise but You.

I feel great pleasure in expressing my gratitude and heartiest obligation to my respected supervisors **Dr. Farhat Mahmood** and Co-Supervisor **Dr. Hifsa Hina** for their sense of devotion, creativity, affectionate criticism and keen interest in my work. Their guidance helped me understand the techniques of the subject and their support and encouragement pushed me ahead to achieve this goal.

I would also like to pay special thanks to **Dr. Hifsa Hina** for her tremendous support and cooperation. Each time I got stuck in something, she came up with the solution. Without her help I wouldn't have been able to complete my thesis.

Words cannot express the deepest gratitude to my beloved **Dajee** and **Mour** whose love, cooperation and encouragement enabled me to stand at the position where I am today.

I feel great pleasure in expressing my thanks to my brothers **Ahmad Mujtaba**, **M. Ilyas** and **M. Zuhair** who are always there to encourage me.

I convey my thanks from the deepest of my heart to my caring and loving roommate friends **Arham, Asif Ullah** and **Farukh** for their cheerful and refreshing company. Also I would like say special thanks to my fellows specially **Asad**, **Hassan**, **Irfan**, **Sajjad Hussain** and **Sajjad Khan** for their support during course work.

Finally, I am pleased to express the feelings about my nieces **Afia**, **Amna** and nephew **Tariq** who always refreshes my mood and mind. I am deeply thankful and blessed for such a loving family.

Muhammad Yasir

ABSTRACT

Previous studies assumed symmetry effect of exchange rate change on domestic production and used linear ARDL model for estimation. However, this study test asymmetry, following the concept of partial sum by decomposing exchange rate in appreciations and depreciations variables. In this study, we have used nonlinear ARDL approach of Shin et al. (2014) to check asymmetry effect. Study conducted in South Asian countries except Afghanistan. From 1980-2019 time series data extracted from BP, Bruegel, IFS and WDI. The findings indicate that there is a short run asymmetry impact of exchange rate movement on domestic production, with the exception of Bhutan and Nepal. In long run exchange rate changes have asymmetry impacts on the economies of Bangladesh, Nepal and Pakistan only. Results are different for each economy, which shows exchange rate affect is country specific.

TABLE OF CONTENTS

List of Acronyms

2SLS: Two Stage Least Square

AD: Aggregate Demand

ADF: Augmented Dickey Fuller

AS: Aggregate Supply

AIC: Akaike Information Criterion

ARDL: Auto Regressive Distributive Lag

BP: British Petroleum

ECM: Error Correction Model

ER: Exchange Rate

IFS: International Financial Statistics

MPC: Marginal Propensity to Consume

MPS: Marginal Propensity to Save

NARDL: Nonlinear autoregressive distributive lag

OLS: Ordinary Least Square

REER: Real Effective Exchange Rate

VAR: Vector Auto Regressive

WDI: World Development Indicator

WITS: World Integrated Trade Solution

List of Tables

CHAPTER 01

INTRODUCTION

1.1 Background of the Study

Exchange rate(ER) is a currency's price compared to another currency. This shows the quote of the national currency with regard to foreign ones in a slightly different perspective. The link between foreign exchange markets and domestic production has attracted both policy-makers and producer's attention for the purpose to enhance world trade level and productivity. Worldwide exchange rates have fluctuated widely particularly after the breakdown of the fixed exchange rates regime in Bretton Woods. Changes in exchange rates affect nearly every macroeconomic parameter like the economic growth, employment, imports, exports, foreign direct investment, trade flow, price, consumption etc.

Early work on the impact of exchange rate variations on home production shows contractionary devaluations. Alexander (1952) concluded that income will move from labor to suppliers because of devaluation. That would result low marginal propensity to consume (MPC) of the producer's relative to the labor, resulting contractionary devaluation (reduction in domestic production). However, as a result of devaluation net exports may rise more than consumption decreases, rendering devaluations expansionary (increase in domestic production). Furthermore, in demand and supply context contraction or expansion of domestic production depends upon magnitude of demand and supply. If decrease in aggregate supply (because of rise in imported inputs expense) is greater than aggregate demand (AD) increase, devaluations will result contraction in economy and in the opposite case, it will result expansion in the economy. The final effects might be country-specific. To further elaborate this, we will discuss it in export orientated and import oriented context. Depending on whether a country is export-oriented or import-oriented, the relationship between exchange rates and the level of output can be either positive or negative. The depreciation of the home currency would favor an export-oriented country as depreciation makes exports cheaper. This would lead to a rise in productivity and an increase in the producer profits, thereby increasing production (a positive relationship). Whereas an import-oriented country is harmed by home currency depreciation,

as the expense of imported inputs is raised as a result of home currency depreciation. This would lead to a reduction in producers' profitability, thereby reducing production (a negative relationship).

There are many factors behind exchange rate movements and these factors indirectly or directly affect productivity of a country. The main factors that cause changes in exchange rates are inflation rates, interest rate, balance of payment, term of trade and government debt etc. Fluctuations in inflation are inducing moves in currency exchange rates. To elaborate more fall in inflation will result an appreciation in the value of currency. While higher inflation shows depreciation of currency. If we look upon interest rate, increase in interest rates of a country give lenders better returns relative to other countries around the world. So this increase in interest rate resulting to attract more foreign capital, which in response rise the value of currency of the country. Balance of payment have also significant effect on country exchange rate. The country's current account represents its trading balance and overseas investment revenue. This includes total transactions, comprising, imports, exports and debts. Deficit in current account causes fall in exchange rate, this deficit is due to greater imports of commodities than exports. Fall in exchange rate causes by deficit in current account, this deficit is the result of higher import of goods than export. These all are the factors that affect exchange, which further affect a country productivity.

According to Keynesian and Monetarist models, theoretically link between exchange rate and output shows the contractionary impact of devaluation on national production. Such a contractionary effect, is due to the trade deficit, differences in propensities to consume from wages and profits and positive response of government revenue to devaluation. By reducing both nominal and real money balances, the monetarist model also shows a similar impact. Apart from this Marshall–Lerner and j-curve also shows theoretical nexus between exchange rate and domestic production. If the condition of Marshall-Lerner is fulfilled, devaluation will stimulate net exports, hence increasing domestic production. The same relationship between exchange rate and domestic production further elaborated through J-curve which differentiates between the short-run and long-run impact of devaluation. Devaluation in the short run will worsen the trade balance according to the J-curve effect and boost the situation in the long run, resulting in an increase in net exports and hence domestic production. Diaz-Alejandro (1963) performs a theoretical analysis and concludes that if the nation is capable of transforming output and is

capable to substitute consumption, devaluation will have expansionary consequences. Similar study followed by Hanson (1983) by introducing the possibility of substitution in consumption and production has decreased the chances of contractionary devaluation.

The empirical relationship between domestic production and exchange rates has been explored in some studies (Bahmani-Oskooee & Miteza, 2006; Kappler et al. 2013; An et al. 2014 etc). After the same study Krugman & Taylor (1978) and Cooper (1971) find foreign exchange depreciation negatively impacts the output across supply and demand channels. Several researches by (Lizondo & Montiel, 1989; Alexander, 1952; Edwards, 1985) confirm the contractionary impact of depreciation on output via demand side channel. From the demand side, the contractionary hypothesis illustrates that income is redistributed from wage earners to profits earners because of depreciation or devaluation, resulting a decrease in economic activity. Similarly, Hirschman (1949) figure out that currency depreciation from an initial trade deficit lowers real national income and may lead to a reduction in aggregate demand. The same idea was established by Barbone and Rivera-Batiz (1987). Chaudhary, G. M et.al (2016) South Asian and South-East Asian region observed that relationship between exchange rate and exports is in more than half of the sample countries. Similarly, Lal, A. K., & Lowinger, T. C (2002) conduct study in South Asian region. The study confirms the presence of a correlation between nominal effective exchange rates and trade balances, both in the short and long run, which indirectly effect productivity level.

Many studies including (Alexander, 1952; Krugman& Taylor, 1978; Van Wijnbergen, 1986) point out the supply side hypothesis of contractionary output. According to the findings the depreciation causes imported inputs costly. Increasing cost of imported inputs thereby raises production costs. This increasing cost affects the supplier resulting in low output. Several studies in the area of empirical research have concentrated on examining the effects of various macroeconomic factors including money supply, government spending, exchange rate, wage rate, oil prices, inflation and interest rate etc on GDP. Bahmani-Oskooee & Mohammadian (2016); Hussain et al. (2019) and shahbaz et al. (2011) investigated the consequences of the different macroeconomic variables (exchange rate, government spending, money supply and oil prices etc) on GDP and they determine macroeconomic variables have significant effects on GDP.

1.2 Research Gap

This study is important in respect to differentiate between currency depreciation and appreciation effect. It will add to ER policy management to achieve desirable goals. The stabilization of development process has been the goal of the policy makers in a present day time. Industrial revolution brings many economic problems for many developing countries. Most of developing countries suffered from severe current account deficits, reduction in economic activity, and also ineffectiveness in exchange rate with the world. It is generally considered that devaluation tend to bring trade balance equilibrium in the economy (Nawaz, 2012).

Inconsistency between the results for the current topic is revealed by economic literature. Each country experience different results depending upon his current circumstances. Therefore, individual country analysis motivates the researchers to conduct an empirical analysis for each country separately. In the light of above discussion, we can say that the link between exchange rate and domestic production is a country specific and it cannot be generalized. It may depend upon the monetary and fiscal policies of each country. This becomes a source of motivation for researcher to empirically investigate the link between exchange rate and domestic production.

The available literature has concentrated on symmetrical impact of variations in the exchange rate on domestic production (as discussed earlier). Symmetrical impact means that if home currency appreciation hurts domestic production, then home currency depreciation will have to improve domestic production to the same degree. But this may not be valid, because appreciation and depreciation effects are not same on domestic production in terms of sign and magnitude. Changes in exchange rates can have asymmetric impacts on domestic production. Asymmetry means that change in exchange rates have a different effect on domestic production based on whether currencies appreciate or depreciate. The asymmetry may occur in different aspects that is sign asymmetry, magnitude asymmetry, short run asymmetry, long run asymmetry and significance level also matters in asymmetry analysis. Nawaz et al. (2012), Nag (1990), Ratha (2010), Aslam (2016) and Thapa (2002) from Pakistan, Bangladesh, India, Sri Lanka and Nepal respectively find symmetry effect of exchange rate on GDP. But in case of Afghanistan, Bhutan and Maldives there is no relevant study has been found. This leaves a research gap in literature. No previous research has been identified concerning the impact of

exchange rates on output of export-oriented and import-oriented economies. Here, we will investigate symmetry and asymmetry effect of exchange rate changes in each individual country of South Asia, except Afghanistan.

By filling out such a gap this study will separately analyze the impact of currency appreciation and currency depreciation. Annual time series data will be used over the period of 1980 to 2019 for South Asian countries, which include Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. Our independent variables included to the model are broad money (M2), government spending (G), real effective exchange rate (REER) and oil prices (OP). But the dependent variable is gross domestic product(GDP). The GDP of each country can react differently to changes in macroeconomic variables, such as after home currency depreciation, an export-oriented country will advantage from it, whilst any import-oriented country could be negatively affect. To measure the impact of variations in the macroeconomic indicators on GDP linear autoregressive distributive lag(ARDL) method to cointegration (Pesaran et al. 2001) and nonlinear autoregressive distributive lag(NARDL) method (Shin et al. 2014) have been used to analyze the association.

1.3 Objectives of Study

- To find symmetry effect of REER change on domestic production of South Asian countries
- To find asymmetry effect of REER change on domestic production of South Asian countries
- To investigate the effect of REER changes on export-oriented and import-oriented economies.

1.4 Research Questions

- Is there symmetry effect of REER change on domestic production of South Asian countries?

- Is there asymmetry effect of REER change on domestic production of South Asian countries?
- What are the effect of REER changes on export-oriented and import-oriented economies?

1.5 Significance of Study

GDP and exchange rate are considered the backbone of an economy. To improve economic activity exchange rate play an important role in economy through demand and supply channels. This study will assist to find out whether currency depreciation is contractionary or expansionary or country specific. The objectives of this study would help producer that how to take decision when there is currency depreciate or devalue, indeed it would also facilitate country in boosting economic activities. Furthermore, policy makers can implement a good policy while keeping in mind asymmetry behaviour of exchange rate. Doing so producer can offset the effect of supply and demand of produced goods. Attributed to these things the present study is very much important.

CHAPTER 02

LITERATURE REVIEW

2.1 Introduction

There is a lot of study available on exchange rate changes and its results. How these changes effect domestic economies? whether exchange rate changes effect are contractionary or expansionary on domestic production? These all are available in existing literature. Furthermore, literature also shed lights on symmetry and asymmetry impact of exchange rate variations on domestic production. But there is rare literature available related to asymmetric effect of exchange rate on home production, especially for the case of South Asian economies.

This section divided into three sub parts. Firstly, theoretical literature, secondly empirical literature and thirdly literature related to South Asian countries.

2.2 Theoretical Literature

The Mundell – Fleming model (Mundell, 1963) or generalized portfolio balance (Branson and Buiter, 1983) presumes that output is not set at full employment level and shows that the current account balance finds the exchange rate of equilibrium. In other words, the real exchange rate is linked to the relative output level, rather than considering it is fixed. The empirical result of this theory is the need to co-integrate the real exchange rate with the relative levels of home and foreign production.

A redistributive effect of devaluation explains the apparent paradox of improvement in the trade and reduction in output. Diaz-Alejandro (1963) conducts a study by considering a three-goods model including exportable, importable and home goods. If the country is able to transform production and possess an ability to substitute in consumption, devaluation will have expansionary effects. In contrast, devaluation may have redistributive effects and study concludes that due to transfer of income from labor to capitalist's devaluation causes reduction in real income because profit earners have higher (MPS).

Similar study further analyzed by Hanson (1983) to examines the effect of devaluation on output. He found there would be decrease in contractionary effect if substitute of consumption and production introduce. As per the given research if the elasticity is very low for the demand of imported inputs and imported consumer products and the trade deficit is very high devaluation will lead to a reduction in productivity. Studies from Latin America's Southern Cone, where the process of import substitution industrialization is modern and the elasticity of import demand is poor, indicates that high percentage of import inputs outcome contractionary devaluation. Further study showed when there is imbalance AD level in a country, and borrowing to escape recession, devaluation is neither appropriate nor realistic. Fiscal policy tool can remove this contractionary effect.

Furthermore, Solimano (1986) investigates the effect of devaluation on three macroeconomic variables i.e. productivity, employment and trade balance. The study utilizes the simulation with computable macroeconomic model. Finding shows that impact by devaluation is dependent on number of other factors. These factors include the extent of external trade elasticity's, the cost of traded good industries and assumption about the changes in nominal earnings in the economy. Impact of devaluation is contractionary due to inelastic imports of intermediate goods, low short run export elasticity's and that of manufacturing sector. Marshal-Lerner condition is not fulfilled because devaluation contracts the economy from start till the medium run.

Whenever AD imbalances the stabilization policies of devaluation then it introduces to manage demand management policy for the economy. Edwards (1986) studied the effect of devaluation from various angels for different time zone. He concluded that effect of devaluation varies from year to year and finally become neutral. It shows that contractionary devaluation is short run concept.

Kandil (2000) analyzed the effect of exchange rate fluctuation on exports, inflation and employment level. The paper's essential aim is to examine the asymmetry impact of exchange rate volatility on real production and price in twenty two developed economies. For that she used theoretical model to decompose exchange rate fluctuation in anticipated and unanticipated part. Study showed that unanticipated currency depreciation and appreciation result

significantly contraction in output growth. In contrast anticipated currency value will have contraction in output growth and prices inflation in both cases appreciation and depreciation.

2.3 Empirical Literature

Rajan and Shen (2001) took those twenty-five developing and emerging countries having fixed exchange rate pattern to find link between exchange rate volatility and output. They used panel data and also differentiate crisis period and normal period. The final result shows that devaluation have recessionary effects on output during crisis period. The same work extended by Chou and Chau (2001) to find relationship between exchange rate and output by using the data for crisis affected countries. They conduct research on five Asian financial crisis affected countries for the purpose to determine the stabilization effects of devaluation on output. For empirical result ARDL test used. Finding shows that in almost all financial crisis economies there is no long-run relationship between exchange rate and aggregate output but for one economy. Furthermore, devaluation has short-run worse effects on aggregate output. Reason of short run contractionary effect of devaluation is higher prices.

Barguellil et al. (2018) took 45 emerging and developing countries data from 1985 to 2015 to find the relationship between exchange rate volatility and economic growth. To check effect of the exchange rate regimes and the financial openness policies they perform empirical investigation and found negative effect of nominal and real exchange rate volatilities on economic growth. Further those countries they follow fixed exchange rate pattern will have negative effect of volatility.

Bahmani-Oskooee and Miteza (2003) conduct his research on the basis of previous studies. Some countries consider devaluation effect on economic growth as a short run concept. While some studies show contractionary effect of devaluation which is offset by expansionary effect offently. He divides the literature into four classes. The study finds the mixed results. He found that contractionary effect exists in both developed and developing countries. In the developing world, if one country will face contractionary effect, the other country would face expansionary effects. The same result would occur in developed country case. In short contractionary devaluation is country specific.

Kandil (2008) investigates the asymmetric impact of volatility in exchange rates on real output and price in developing countries. She used annual time series data for fifty developing countries from1960 to 2000 for empirical analysis. Her research is based on rational expectation theory that divides exchange rate movement into two parts that is, anticipated and unanticipated. Finding depict output supply will decline but export and money demand will improve if there is positive shock to exchange rate and unanticipated depreciation of domestic currency. Result shows supply is more than demand. In contrast output supply will increase but export and money demand will reduce if there is negative shock to exchange rate and unanticipated appreciation of domestic currency, demand are more than supply.

Among the recent studies, Dincer and Kandil (2011) conducted research in the light of the rational expectations theory for disaggregated data of Turkey. Monthly data used from 1996 to 2008 and divide data period in two parts that is from 1996/1 to 2002/12 and 2003/1 to 2008/5 to investigate impact on sectoral exports. Exchange rate movement decomposes in anticipated and unanticipated devaluation. The key objective of the study is to determine the asymmetric impacts of unexpected change in exchange rate on export sectors of Turkey. During period 2003 to 2008 unexpected currency appreciations have worse effect compare to earlier period, 1996 to 2002. But there is increase in export growth over time when unexpected currency depreciation occurs in the economy. On the other hand, anticipated appreciation has adverse effect on export growth of turkey. Randomness in fluctuations causes asymmetric effects. The depreciation of exchange rate is unable to increase the export of Turkey.

Kim et al. (2014) conducted research for sixteen countries belonging to 3 groups(Latin American countries, Asian countries and developed countries outside the G3. They used quarterly data 1973-2012 by utilizing the VAR model with restricted sign to address a shock in the exchange rate. The result shows the Latin American countries current account improved but output reduced as a result of devaluation. Furthermore, devaluation causes a fall in real output both in developed and developing countries.

Kamin and Roger (2000) picked a developed country to figure out the empirical impact of exchange rate on production. They used vector autoregressive (VAR) method and applied on Mexico country case. Their results showed that devaluation has contractionary effect which is

consistent with earlier studies of contractionary devaluation. After controlling spurious correlation and reverse causality contractionary effect were still existing.

Bahmani-Oskooee and Mohammadian (2016) conducts a study to examine Asymmetry effects of exchange rate changes on home production of Australia. They utilized time series data with REER and real GDP as the main variables of concern. They include measure of fiscal policy, monetary policy (M) and REER variable in the model as a determinant of domestic output of Australia. The study uses quarterly data and applied nonlinear (ARDL) model. Their findings indicate no long-run impact of Australian dollar depreciation on real GDP but contractionary effect is found in case of short run case, the results reveal that in the short run the impact of exchange rate change on Australian production is asymmetrical. In contrast appreciation of Australian currency have long-run worse effect on home production, while in case of depreciation this effect is does not exist, providing evidence of long run asymmetry effect.

Bahmani-Oskooee and Mohammadian (2018) conduct a research to find asymmetry effect of exchange rate change on home production of seven emerging economies. Previous study shows that there is only symmetry effect exist and can be find by linear ARDL method. But in this study nonlinear ARDL method utilized to find asymmetry effect of exchange rate change on home production and through partial sum appreciation and depreciation are separated. Except real effective exchange other independent variable that are incorporated in the model are real money supply, real government spending and oil prices. Results shows that appreciation of Czech Republic have worse effect on domestic production in long run while depreciation have no effect following fixed exchange rate regime. In contrast Hungry currency appreciation has positive impact on domestic production so that brought increase to domestic production in the long run. Because of lower cost imported inputs AS increase will greater than AD. Further result depict depreciation are expansionary and appreciation are contractionary for Russia, Estonia and Latvia.

2.4 Literature related to South Asian countries

Shahbaz, et al. (2012) used annual data for the period 1975-2008 to consider a long-term equilibrium link between real devaluation and real GDP growth for Pakistan. Further

independent variables included in model are money supply, government spending and foreign remittances. For empirical analysis he used ARDL method. Result showed money supply, government spending and foreign remittances have positive impact on domestic production. While worse effect found of devaluation of the currency on output growth. Devaluation causes import of input costlier that leads to increase cost of production which discourages investors and producers. And also exports of Pakistan are not too much competitive due to which devaluation showed little impact on export. Findings depict overall effect of devaluation is contractionary.

Zia and Mahmood (2013) conduct a study for Pakistan by using annual data. The model is made up of two sections, one is the flexibility of the exchange rate and the other is the depreciation of the exchange rate and the competitiveness of export prices. In the manufacturing sector of Pakistan, the findings indicate that despite of depreciation in real exchange rate, export prices are not increasing and this is the reason of slow growth in manufacturing sector in Pakistan.

Sometimes devaluation as a stabilization policy may prove to be a destabilizing for poor countries. Nag (1990) conducted a study for Bangladesh only. Study used a simple macroeconomic model. The research aims to determine the effect of the devaluation on macroeconomic variables. The study employs OLS and 2SLS techniques and found that the devaluation has expansionary demand-side effects. But these expansionary effects are offset by contractionary supply-side effects. The effects of devaluation are stag-flationary in nature, hence lowers current account deficit. Despite that it also reduces the import as well as export, consumption, investment and increases the price level.

Thapa (2002) analyzed the link between REER and GDP for Nepal. Real exchange rates affect economic activity in two ways, that is, aggregate demand and aggregate supply. According to traditional view GDP effect through AD channel. Further simplify, depreciation of real exchange rate increase international competitiveness of domestic production that leads to enhance net export level and hence GDP. While effect of real exchange rate through AS channel shows that cost of production increase due to depreciation which result redistribute of income shift from poor to rich and Increase the marginal propensity to save (MPS) of producers.

Both effects decline the AD which resulting economic contraction. Empirical analysis indicates that there is traditional view in Nepal.

Srinivasan & Kalaivani (2012) investigated empirically the impact of exchange rate fluctuations on India's real exports. They took annual time series data from 1970 to 2011 and using ARDL bounds testing method, results demonstrate that both short-term and long-term exchange-rate fluctuations have adverse impact on actual exports. Furthermore, real exchange rates have positive and significant long-run effects on real exports. This benefits depreciation to increase Indian real exports. In comparison, real exchange rates have an adverse and significant short-run effect on actual exports. That badly effect real export in India. They also find real export significantly and positively affected by GDP in long-run, but that effect is insignificant in short-run.

Hussain, et al. (2019) conducted research to find asymmetry impact of exchange rate changes on GDP in Pakistan. Two main objective of his study are 1) To examine the asymmetric effect of exchange rate depreciation and appreciation. 2) For testing short-run and long-run asymmetry apply more dynamic model of Shin et al. (2014). Their mainly concern is AD channel instead of AS channel. They took annual data from1972 to 2014 and applied both ARDL and NARDL method. Result shows that weak currency reduces GDP growth while strong currency boosts up the growth of GDP. Furthermore, asymmetric impact of the exchange rate on GDP observed in Pakistan, as well as short and long-term asymmetry in the economy prevail.

CHAPTER 03

METHODOLOGY

3.1 Introduction

This section of the study shows us the methodology for seeking the effect of variations in the exchange rates on South Asian countries' GDP whether they are export oriented or import oriented countries. To determine the effect of exchange rate variations on home production the most recent studies included factors in a model which affect AD such as a measure of fiscal policy and a measure of monetary policy in addition to the real exchange rate. Some studies ignore supply side but it is playing a key role in determination of domestic production. Oil prices are the supply side variable which helps us to find home production.

3.2 Theoretical Framework

Mills and Pentecost (2001) derived reduced form equation from traditional IS-LM model. The derived reduced form shows that output determine from exchange rate, money supply and wage rate. After modification, we added two important variables to function that is oil price and government expenditure, as given below:

$$GDP = f(G, M, REER, OP) \qquad (1)$$

Here G is a measure of fiscal policy, M is measure of monetary policy, REER is a real effective exchange rate, OP is an oil prices. According to previous study currency depreciation create competition which lead to raise export and hence encourages growth. Bahmani-Oskooee and Miteza (2006) used large set of panel data and applied the monetary policy, fiscal policy along with the stabilization policy of exchange rate. Results show to be an expansionary devaluation. Meade (1951) depreciation will harmfully effects output, if Marshal-Lerner condition failed.

Devaluation causes shift in demand and supply curves (Gylfson & Schmid, 1983). Final result determines from the size of shifts of curves. Devaluation of home currency makes exports

cheaper for foreign traders that increase the demand for domestic goods which causes an right shift in the AD curve and increases the production (Edwards, 1989; Frankel, 1988; Goldstein and Khan, 1985).

Hussain, et al. (2019) used linear ARDL method for symmetry effect of ER and nonlinear ARDL method for asymmetry effect of ER in Pakistan case and found that there is both symmetry and asymmetry effect of exchange rate on output. Similarly, Bahmani-Oskooee and Mohammadian (2018); Katrakilidis & Trachanas (2012) used non-linear ARDL to find long-run and short-run asymmetry.

3.3 Econometric Model

To convert the above function in growth form equation we will follow Thapa (2002) and Ratha (2010). The log transformed equation (1) can be represented as below.

$$\mathrm{LnGDP_t} = \beta_0 + \beta_1 \mathrm{LnM_t} + \beta_2 \mathrm{LnG_t} + \beta_3 \mathrm{LnREER_t} + \varepsilon_t \qquad (2)$$

Where,

GDP = Gross domestic product, give measurement of real output

M = is real money supply, give measurement of monetary policy

G = is real government expenditure, provide measurement of fiscal policy

REER = is the real effective exchange rate

ε = is an error term

Given association indicates depreciation leads the REER to decline. A positive coefficient of REER will depict contractionary depreciation, while a negative coefficient of REER will show an expansionary depreciation. If coefficient of M and G (β1 and β2) is positive, then monetary policy and fiscal policy will be expansionary respectively.

Bahmani-Oskooee & Magda Kandil (2011) and Hussain et al. (2019) did not consider the supply side variable and assumed AD are perfectly elastic. They focused only on demand side variable. Here incorporating most important factor which is oil prices, that are said to adversely

affect the AS (Bahmani-Oskooee and Mohammdian, 2016; Bahmani-Oskooee and Mohammadian, 2018). The long-run model thus takes the form of:

$$\mathrm{LnGDP_t} = \beta_0 + \beta_1 \mathrm{LnM_t} + \beta_2 \mathrm{LnG_t} + \beta_3 \mathrm{LnREER_t} + \beta_4 \mathrm{LnOP_t} + \varepsilon_t \qquad (3)$$

This equation only captures the long-run effects of exogenous factors. To determine short run effect, we rewrite equation (2) as an error-correction model (ECM) by following Pesaran et al.'s (2001) bounds testing approach as given below:

$$\begin{aligned}\Delta\mathrm{LnGDP_t} = \alpha_0 &+ \sum_{k=1}^{L1} \alpha_{1k} \Delta\mathrm{LnGDP} + \sum_{k=0}^{L2} \alpha_{2k} \Delta\mathrm{LnM_{t-k}} + \sum_{k=0}^{L3} \alpha_{3k} \Delta\mathrm{LnG_{t-k}} \\ &+ \sum_{k=0}^{L4} \alpha_{4k} \Delta\mathrm{LnREER_{t-k}} + \sum_{k=0}^{L5} \alpha_{5k} \Delta\mathrm{LnOP_{t-k}} + \beta_0 \mathrm{LnGDP_{t-1}} + \beta_1 \mathrm{LnM_{t-1}} \\ &+ \beta_2 \mathrm{LnG_{t-1}} + \beta_3 \mathrm{LnREER_{t-1}} + \beta_4 \mathrm{LnOP_{t-1}} + \varepsilon_t \qquad (4)\end{aligned}$$

Calculated coefficients attached to first differenced variables providing short-run results in above equation (4) ECM. While estimates of β_1–β_4 give long run effects. To capture long-run relationship cointegration will established and F test will apply for joint significance of lagged level variables (Pesaran et al, 2001).

In model (3) all exogenous variables have symmetric effects on home production. Focusing on the effects of the real exchange rate, symmetry means that if depreciation boosts output level, an appreciation should decline the output level with same proportion (Bahmani-Oskooee and Miteza, 2003). We follow Shin et al. (2014) nonlinear ARDL method to explore whether ER has symmetric or asymmetric effect on GDP. To split ΔLnREER in appreciation and depreciation, denote positive change by $\Delta\mathrm{LnREER}^+$ (currency appreciation) and negative change by $\Delta\mathrm{LnREER}^-$ (currency depreciation). Here we are creating two new parameters, one showing depreciation, denoted by NEG while the other indicating appreciation, denoted by POS respectively as a partial sum of negatives and positive variations.

$$POS_t = \sum_{j=1}^{t} \Delta \ln REERj^{+} = \sum_{j=1}^{t} \max(\Delta \ln REERj, 0)$$

$$NEG_t = \sum_{j=1}^{t} \Delta \ln REERj^{-} = \sum_{j=1}^{t} \min(\Delta \ln REERj, 0)$$

Now to gain new ECM, we incorporating two new variables that is NEG and POS to above equation (4).

$$\begin{aligned}\Delta LnGDP_t = {} & \alpha_0 \\ & + \sum_{k=1}^{L1} \alpha_{1k} \Delta LnGDP_{t-k} \\ & + \sum_{k=0}^{L2} \alpha_{2k} \Delta LnM_{t-k} + \sum_{k=0}^{L3} \alpha_{3k} \Delta LnG_{t-k} + \sum_{k=0}^{L4} \alpha_{4k}^{+} \Delta LnPOS_{t-k} \\ & + \sum_{k=0}^{L5} \alpha_{4k}^{-} \Delta LnNEG_{t-k} + \sum_{k=0}^{L6} \alpha_{5k} LnOP_{t-k} + \beta_0 LnGDP_{t-1} + \beta_1 LnM_{t-1} \\ & + \beta_2 LnG_{t-1} + \beta_3^{+} POS_{t-1} + \beta_3^{-} NEG_{t-1} + \beta_4 LnOP_{t-1} + \varepsilon_{t-1} \end{aligned} \quad (5)$$

Model (4) is linear model, but after adding POS and NEG parameters in model (5) it is now nonlinear ARDL model. This nonlinear model can be estimated using the Pesaran et al. (2001) bound test process. After establishing cointegration we can find four kind of asymmetry, which is given below:

1) Short-run asymmetry will be exist if $\widehat{\alpha}_{4k}^{+} \neq \widehat{\alpha}_{4k}^{-}$.

2) Short-run asymmetry effect is set up if $\sum \widehat{\alpha}_{4k}^{+} \neq \sum \widehat{\alpha}_{4k}^{-}$.

3) long-run asymmetry is built up in case $\widehat{\beta}_3^{+} \neq \widehat{\beta}_3^{-}$.

4) Dynamic multipliers pattern captures the adjustment asymmetry.

In first three cases Wald test can capture asymmetry while in the last case asymmetry can be detected by observing the adjustment pattern.

3.4 Variable Construction

Dependent Variable

- **Gross Domestic Product:** According to WDI Gross domestic product(GDP) is really the amount of value added by all resident producers including any product tax (less subsidies) which is not included in the output valuation. The data on GDP for all South Asian economies is taken from WDI. There are many factors that can affect GDP. Bahmani-Oskooee & Mohammadian (2018) and Thapa (2002) and many other use GDP as a dependent variable to check impact of different factors on GDP.

Independent variable

- **Government Spending**: All the expenditure done by government in a fiscal year is refer to government spending (G). It is the money spent out in different operations like social services, education, health and government payouts to bank. Government spending is tool of fiscal policy which is used by government in order to prevent destabilization in the economy. Hussain et al. (2019) use government spending variable to focus on AD side. If G increases AD will rise as a result domestic production will boost.

- **Broad Money Supply:** Broad money (M2) is the money in the form of bank deposits or any other deposits as well as coins and notes. Demand deposits, currency in circulation, time deposits, and resident's foreign income are all part of monetary asset (M2). Active monetary policy keeps liquidity in the money market. The monetary policy is a tool utilizes by central bank of every country in order to smooth the economy.

- **Real Effective Exchange Rate:** REER is the focus variable in this analysis. It is described as "a measure of a currency's value against the weighted average of foreign currencies divided by the deflator price". Similarly, previous variables Bahmani-Oskooee and Mohammadian (2017) and Hussain et al. (2019) use REER to focus AD side only.

- **World Crude Oil (Petroleum) Price**: We are using the oil price variable in the study to cause an effect on supply. The oil price (OP) is affecting the AD adversely (Bahmani-Oskooee & Mohammadian, 2018). Crude oil is nonrenewable source of energy. The price is settled by the supply and demand conditions. Beyond the traditional demand and supply conditions world crude oil price is settled by number of factors notably the geo politics. There are three traded benchmarks settled including the West Texas Intermediate (WTI), Dubai and Brent.

CHAPTER 04

ESTIMATION & RESULT ANALYSIS

4.1 Introduction

This chapter discusses the empirical findings of the study utilizing different econometric techniques. For understanding data and its importance, we will do first descriptive statistical analysis (Appendix D). Descriptive statistics are actually brief descriptive coefficients that summarize a given data set. Before employing an econometric model, it is important for the data to be stationary. We test the data stationarity by using Augmented Dickey Fuller(ADF) test. Findings are reported in below table 4.1 and 4.2. Section 4.4 deal with results of linear and nonlinear ARDL model, in which we find short run and long run estimates. The last section 4.5 deal with effect of REER changes in export-oriented and import-oriented countries.

4.2 Descriptive statistics

Normality: An evaluation of data normality is a requirement for certain statistical analyses, since normal data is an essential assumption of parametric research. There are two primary approaches, visually and numerically, for determining normality. But here we rely on numerical method.

After applying Jarque-Bera test we found that GDP of Bangladesh, India and Pakistan are normally distributed while in case of Bhutan, Maldives, Nepal and Sri Lanka there is no normality in data. Similarly, government consumption expenditure is normally distributed in Bangladesh India and Nepal while for remaining countries it is not normally distributed. Except Bangladesh, Pakistan and Sri Lanka Money supply is normally distributed for all other countries. In oil prices case all countries are normally distributed. REER of Bangladesh, India, Maldives, Nepal and Sri Lanka are normality distributed while in case of Bhutan and Pakistan there is no normality. (see Appendix D)

Skewness: Skewness is simply the asymmetry of the series around its mean. Money supply of all countries are right skewed while oil prices are left skewed. Similarly result for GDP shows that Bhutan and Maldives are left skewed while other remaining countries are right skewed. Government spending for Maldives, Nepal and Sri Lanka are left skewed and right skewed for

Bangladesh, Bhutan, India and Pakistan. For REER estimation shows that India, Nepal and Sri Lanka are left skewed in contrast Bangladesh, Bhutan, Maldives and Pakistan are right skewed.

Kurtosis: Kurtosis measures the flatness and peakdness in the series. All variables are leptokurtic in Bhutan, while in case of Bangladesh only money supply is leptokurtic and other variables are platykurtic. Maldives have only oil price platykurtic, Nepal have government consumption expenditure, Pakistan have GDP and Sri Lanka have REER, while other variables of these countries are leptokurtic. Oil prices and REER of India is leptokurtic while GDP, money supply and government spending are platykurtic (for complete empirical result see Appendix D).

4.3 Results of Unit Root Test

Before estimating LARDL and NARDL, we check for stationarity of the variables in each country case. We have used ADF test in order to be sure that none of the variable is integrated of order 2. In Table 4.1 and 4.2 ADF test result are shown. In both table we take p-values in consideration. We depict estimates at level {integrated of order 0 or I(0)} in table 4.1. While estimates at 1st difference {integrated of order 1 or I(1)} shown in table 4.2. All the variables of our interest are stationary at 1st difference at 5% level of significance except Pakistan and Bhutan. Pakistan GDP and REER are stationary at level, similarly Bhutan REER is also stationary at level. It is apparent that the majority of macroeconomic parameters have the property of being non-stationary at level and most of the variable become stationary at 1st difference. Therefore, ARDL (Pesaran et al., 2001) and NARDL (Shin et al., 2014) do not need testing the stationarity of the variables, the overall conclusion does not change.

Table 4. 1 Result of Unit Root test at level

Country	LnGDP	LnG	LnM	LnOP	LnREER
Bangladesh	0.3358	0.9998	0.9375	0.6063	0.8935
Bhutan	0.5786	0.7648	0.6845	0.7122	0.0408
India	0.9997	0.9855	0.6733	0.6962	0.3292
Maldives	0.8852	0.5997	0.64	0.7167	0.2846
Nepal	0.9377	0.8661	0.9859	0.6962	0.7604
Pakistan	0.0422	0.6214	0.8461	0.6962	0.0307

Sri Lanka	0.9866	0.7279	0.9815	0.6962	0.7064

Note: Here we are using p-value approach. The above estimate show probability values of variable at level.

Table 4. 2 Result of Unit Root test at 1st difference

Country	LnGDP	LnG	LnM	LnOP	LnREER
Bangladesh	0.004	0.0048	0.0015	0.0002	0.0065
Bhutan	0.0007	0.0000	0.000	0.0000	…
India	0.000	0.0047	0.0104	0.000	0.0092
Maldives	0.000	0.0004	0.0021	0.0010	0.0018
Nepal	0.000	0.000	0.000	0.000	0.0007
Pakistan	…	0.000	-0.0001	0.0000	…
Sri Lanka	0.001	0.000	0.0001	0.0004	0.0002

Note: The above estimate show probability values of variable at 1st difference.

4.4 Results of linear and nonlinear ARDL model

In this section we estimate linear ARDL (equation 4) and nonlinear ARDL model (equation 5). we select the optimum lag by using Akaike information criterion (AIC).

For each country estimates, results are shown in Table 4.3-4.9. Each table shows complete result of individual country that is: Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. Each table divide in two section. Section 1 of table 4.3-4.9 shows linear ARDL result, while section 2 of table 4.3-4.9 shows nonlinear ARDL results. For easiness every section of each table further divides into two panels. Panel A show short-run and long-run coefficient estimates, while panel B provide the diagnostic statistic.

In panel B F–statistic is used to test long run relationships existence, if it doesn't work then we will consider alternative test. ECM test will used as alternative to establish cointegration (Pesaran et al. 2001). The coefficient of ECM should fall between -1 and 0 in order to find and test the speed of adjustment back to equilibrium after a shocks occur (Banerjee, Dolado, and Mestre, 1998). We will use autoregressive conditional heteroskedasticity (ARCH) to check heteroskedasticity problem in series. We report Ramsey's RESET statistic to check the

misspecification, which is distributed as chi-square, however with one degree of freedom. To free the residuals from autocorrelation problem we depend on langrage multiplier(LM) statistics. The LM statistics are distributed as chi-square with two degrees of freedom and utilized for serial auto correlation. The last one test CUSUM and square of CUSUM is used for stability of short-run and long-run coefficient estimates, we apply the tests to each model and denote the stable estimates by "S" and unstable ones by "U." (Appendix E)

We will apply wald-test for asymmetry whenever we needed. In other word wald-test will only applied if both POS and NEG variable are significant.

Table 4. 3 Bangladesh linear and nonlinear coefficients estimates

1. Linear Model

Panel A:

Short run estimates			Long run estimates		
Variable	Coefficient	Probability	Variable	Coefficient	Probability
D(LNG)	0.110	0.005	LNG	1.072	0.019
D(LNM)	-0.019	0.199	LNM	-0.192	0.459
D(LNOP)	0.009	0.163	LNOP	0.191	0.021
D(LNREER)	-0.045	0.230	LNREER	0.258	0.057
			C	5.127	0.190

Panel B: Diagnostic

F	**ECM_{t-1}**	**ARCH**	**RESET**	**LM**	**CUSUM (CUSUM2)**
16.173**	-0.10 (0.157)	0.361	0.549	0.157	S(U)

2. Nonlinear Model

Panel A:

Short run estimates			Long run estimates		
Variable	Coefficient	Probability	Variable	Coefficient	Probability
D(LNG)	0.048	0.140	LNG	0.720	0.000
D(LNM)	-0.028	0.017	LNM	-0.165	0.146
D(LNOP)	0.015	0.005	LNOP	0.125	0.000
D(LNREER_POS)	0.100	0.003	LNREER_POS	0.573	0.0002
D(LNREER_NEG)	-0.284	0.000	LNREER_NEG	-0.436	0.173
			C	14.483	0.000

Panel B: Diagnostic

F	**ECM_{t-1}**	**ARCH**	**RESET**	**LM**	**CUSUM (CUSUM2)**	**Wald-S**
22.863**	-0.175	0.906	0.911	0.225	S(S)	0.0051
	(0.009)					

Note: Here in panel A and B we rely on P-values except F-statistic. The upper bound critical values of the F-test for cointegration are 4.01(3.52) at the 5% (10%) level of significance when there are four exogenous variables. The comparable figures when k = 5 in the nonlinear model are 3.79(3.35). In panel B inside parentheses is P-values of ECM, while negative value representing coefficient of ECM (value between 0 & -1).

In panel A short run coefficient estimates of linear model shows that in Bangladesh only government consumption expenditure is significant. Result shows if government consumption expenditure rises by 1%, GDP will increase by 0.11%. In long run government consumption expenditure, oil prices and REER are significant, while the coefficient of money supply is insignificant. Government consumption expenditure and oil prices have positive effect on GDP, which shows that 1% rise in G will improve GDP by 0.07%, similarly 1% rise in OP will increase GDP by 0.19%. REER adversely affect GDP. 1% rise in depreciation reduce GDP by 0.25%, so effect is contractionary. Our result is in line with Kamal, K. M. M. (2015), he conducted study for

Bangladesh and find that in the long run, currency devaluation has negative impact on output. To make these long run effect real we will apply bound test, which shows that F-statistic value is greater than upper bond value, we reject null hypothesis and accept that there is long run relationship exist.

In panel B, ECM measure the speed of adjustment to equilibrium after a shock occurs to economy, here its coefficient is insignificant. To test heteroskedasticity we apply ARCH test, its p-value are insignificant, so we accept null hypothesis which shows there is no ARCH effect. For model misspecification Ramsey's RESET is utilized. We accept null hypothesis that our model is not misspecified. Lagrange Multiplier (LM) statistics result is insignificant, since probability value 0.15 is greater than 0.05 significance level, so we accept null that there is no serial autocorrelation. Finally, for short-run and long-run coefficient estimates stability we apply CUSUM and square of CUSUM tests. Result depict all coefficient estimates are stable(S) in short run while in long run it is unstable(U).

In section 2 short run result of nonlinear model shows that except G all other variable has significant coefficients. Money supply adversely affect GDP, rise of 1% M reduce GDP 0.02%. In contrast OP improve GDP by 0.01% when there is 1% increase in OP. Finally, our main focused variable POS(appreciation) and NEG(depreciation) have significant and asymmetry effect. First, it is evident from the sign of both variable is different. Second, its coefficients size is not same. Third, significant value of wald-test support asymmetry. Appreciation have expansionary effect (because of positive coefficient) on GDP with 0.10% rise in it when appreciation rise by 1%. Similarly, depreciation have expansionary effect (because of negative coefficient) on GDP with 0.28% rise in it when depreciation increase by 1%. Significant result of wald-test support asymmetry. In long run government expenditure and oil prices have positive and significant effect on GDP. 1% increase in G and OP improve GDP by 0.72% and 0.12% respectively. Appreciation also shows significant effect towards GDP, which represent appreciation have expansionary effect on GDP. It seems Bangladesh is dependent on imported input, so strong currency will favor to produce more cheap goods. Many countries with real currency appreciation have had a better economic performance than those with real devaluations (Shafaeddin, 1995). In our result depreciation does not affect GDP. Again it is evident of asymmetry in long run. We establish

cointegration to make sure long run relationship. The calculated F-statistic 22.8 is significant, which shows long run relationship exist.

In panel B of nonlinear model depict coefficient of ECM_{t-1} (-0.175) is significant and its adjustment towards equilibrium is 17%. The other diagnostic ARCH, Ramsey's RESET and LM test result are insignificant. Which shows there is no heteroskedasticity problem, model is defined accurately, and the residuals are clear of autocorrelation. CUSUM and CUSUMSQ tests result shows all coefficient estimates are in short run and long run are stable.

Table 4. 4 Bhutan linear and nonlinear coefficients estimate

1. Linear Model

Panel A:

Short run estimates			Long run estimates		
Variable	Coefficient	Probability	Variable	Coefficient	Probability
D(LNG)	-0.077	0.255	LNG	-0.457	0.296
D(LNM)	-0.008	0.902	LNM	0.833	0.002
D(LNOP)	-0.004	0.844	LNOP	-0.025	0.842
D(LNREER)	0.058	0.460	LNREER	0.345	0.478
			C	13.447	0.007

Panel B: Diagnostic

F	**ECM_{t-1}**	**ARCH**	**RESET**	**LM**	**CUSUM (CUSUM2)**
2.122	-0.169 (0.008)	0.664	0.458	0.743	S(U)

2. Nonlinear Model

Panel A:

Short run estimates			Long run estimates		
Variable	Coefficient	Probability	Variable	Coefficient	Probability
D(LNG)	-0.071	0.309	LNG	-0.553	0.398
D(LNM)	-0.007	0.921	LNM	1.166	0.238
D(LNOP)	-0.017	0.610	LNOP	-0.139	0.688
D(LNREER_POS)	-0.084	0.776	LNREER_POS	-0.659	0.809
D(LNREER_NEG)	0.173	0.478	LNREER_NEG	1.350	0.630
			C	10.661	0.407

Panel B: Diagnostic

F	**ECM_{t-1}**	**ARCH**	**RESET**	**LM**	**CUSUM (CUSUM2)**
2.298	-0.128	0.739	0.552	0.461	S(U)
	(0.214)				

Linear model results of Bhutan show that, neither variable affect GDP in short run. All variable is insignificant. In long run only money supply positively affect GDP. 1% increase in money supply 0.83% increase in GDP. Similar result is evident by Hameed, D. (2010), which shows money supply positively affect GDP. For cointegration F-statistic give insignificant result, we consider alternative test. ECM have significant coefficient. Therefor long run relationship exist.

Diagnostic results show there is no evidence of serial autocorrelation, heteroscedasticity and misspecification. CUSUM test show the stability of short run parameter in linear model, while for long run CUSUMSQ does not support this.

All coefficient are insignificants both in short run and long run of nonlinear model.

Table 4. 5 India linear and nonlinear coefficients estimate

1. Linear Model

Panel A:

	Short run estimates		Long run estimates		
Variable	Coefficient	Probability	Variable	Coefficient	Probability
D(LNG)	-0.067	0.326	LNG	-1.171	0.615
D(LNM)	-0.039	0.658	LNM	2.063	0.372
D(LNOP)	-0.015	0.264	LNOP	-0.618	0.445
D(LNREER)	0.145	0.006	LNREER	0.651	0.441
			C	2.482	0.597

Panel B: Diagnostic

F	**ECM_{t-1}**	**ARCH**	**RESET**	**LM**	**CUSUM (CUSUM2)**
1.848	-0.057 (0.385)	0.863	0.207	0.199	S(S)

2. Nonlinear Model

Panel A:

	Short run estimates		Long run estimates		
Variable	Coefficient	Probability	Variable	Coefficient	Probability
D(LNG)	-0.052	0.443	LNG	-1.472	0.742

D(LNM)	-0.084	0.414	LNM	3.713	0.637
D(LNOP)	-0.022	0.102	LNOP	-1.134	0.661
D(LNREER_POS)	-0.071	0.525	LNREER_POS	-2.007	0.759
D(LNREER_NEG)	0.270	0.006	LNREER_NEG	2.045	0.684
			C	-31.561	0.760

Panel B: Diagnostics

F	**ECM_{t-1}**	**ARCH**	**RESET**	**LM**	**CUSUM (CUSUM2)**
2.016	-0.035	0.586	0.245	0.276	S(S)
	(0.645)				

In panel A linear estimates of India indicate that in short run only REER have significant effect on GDP. Result show depreciation reduce output level by 0.14% when there is 1% increase in depreciation. In long run case there is no relationship found between GDP and independent variable, all variable has insignificant coefficient. In panel B diagnostic result depict F-statistic and ECM_{t-1} are insignificant, which support insignificance of long run coefficients. There is no record of serial autocorrelation, heteroscedasticity and misspecification. CUSUM and square of CUSUM test show there is stability of parameter both in short run and long run in linear model.

Similarly, in nonlinear model only depreciation have short run significant effect on GDP. The coefficient with positive sign show contraction in domestic production. In other words, 1% rise in depreciation decline domestic production by 0.27%. Appreciation affect is insignificant, shows asymmetry. In that sense our result is in line with Augustine & Kumar (2020), they find that depreciation of India rupee causes more cost due to huge external debt, that result reduction in economic growth. In long run all variable are insignificant, which is again supported by F-statistic and $ECM_{t-1.}$ These two statistics negate the existence of long run relationship. Diagnostic results show we don't have heteroskedasticity problem and optimum model is correctly specified. Residuals are free of autocorrelation. Furthermore, to confirm that estimates of the short-term and long-term coefficients are stable, we apply CUSUM and CUSUMSQ tests. All coefficient estimates are stable.

Table 4. 6 Maldives linear and nonlinear coefficients estimate

1. Linear Model

Panel A:

Short run estimates			Long run estimates		
Variable	Coefficient	Probability	Variable	Coefficient	Probability
D(LNG)	0.219	0.014	LNG	0.528	0.069
D(LNM)	0.129	0.534	LNM	0.460	0.036
D(LNM(-1))	-0.799	0.003	LNOP	-0.115	0.507
D(LNOP)	-0.048	0.527	LNREER	-0.601	0.424
D(LNREER)	-0.756	0.045	C	5.697	0.095

Panel B: Diagnostics

F	**ECM_{t-1}**	**ARCH**	**RESET**	**LM**	**CUSUM (CUSUM2)**
1.699	-0.416 (0.013)	0.044	0.626	0.0001	S(U)

2. Nonlinear Model

Panel A:

Short run estimates			Long run estimates		
Variable	Coefficient	Probability	Variable	Coefficient	Probability
D(LNG)	0.295	0.034	LNG	0.602	0.004
D(LNG(-1))	-0.31	0.058	LNM	0.172	0.538

D(LNM)	0.224	0.481	LNOP	0.065	0.640
D(LNM(-1))	-0.605	0.076	LNREER_POS	0.418	0.559
D(LNOP)	-0.053	0.666	LNREER_NEG	-0.396	0.701
D(LNREER_POS)	0.338	0.588	C	6.688	0.167
D(LNREER_NEG)	-1.366	0.088			
D(LNREER_NEG(-1))	-1.166	0.092			

Panel B: Diagnostics

F	**ECM_{t-1}**	**ARCH**	**RESET**	**LM**	**CUSUM (CUSUM2)**
3.595	-0.808	0.021	0.195	0.0006	U(S)
	(0.006)				

Maldives linear results shows that government consumption expenditure, money supply and REER have short run significant effect on domestic production. with 1% rise in government consumption expenditure improve domestic production by 0.21%. In contrast money supply decline domestic production 0.79% when money supply rise by 1%. REER have expansionary effect on GDP, shows 1% rise in depreciation increase GDP by 0.75%. Only money supply and government consumption expenditure effect last into long run. Government consumption expenditure improve GDP 0.52%, while money supply improves it by 0.46%. To make sure this long run relationship we follow F-statistic and ECM_{t-1}. F-statistic give insignificant value while ECM_{t-1} support our long run relationship.

In panel B significant and negative coefficient estimate of ECM_{t-1} shows that the speed of adjustment towards equilibrium is 41% per year. ARCH and LM test results are significant, which shows there is heteroskedasticity problem and serial autocorrelation in residual. For model misspecification checking RESET test give favorable result and represent correctly specified model. Finally, CUSUM test support of coefficients stability, while CUSUMSQ test negate this.

In nonlinear case government spending have significant and positive short run effect on GDP. That shows GDP improve 0.29% when government spending increase by 1%. Money supply have adverse effect on GDP, while depreciation effect is positive. Thapa (2002) depreciation of real exchange rate increase international competitiveness of domestic production that leads to enhance net export level and hence GDP. The insignificant effect of appreciation and significant expansionary effects of depreciation signaling towards asymmetry. In long run only government spending positive and significant effect on GDP. Both F-statistics and ECM_{t-1} estimates support this long run relationship.

In nonlinear model diagnostic result shows that the equilibrium adjustment speed is 80 percent per year when the shock arises. Like linear case here is also ARCH effect and serial autocorrelation exist. No misspecification found in model. CUSUM test result shows that all coefficient estimates of short-run and long-run are stable, while it is unstable in case of CUSUMSQ test.

Table 4. 7 Nepal linear and nonlinear coefficients estimate

1. Linear Model

Panel A:

Short run estimates			Long run estimations		
Variable	Coefficient	Probability	Variable	Coefficient	Probability
D(LNG)	-0.014	0.786	LNG	-0.033	0.7881
D(LNM)	0.221	0.001	LNM	0.505	0.000
D(LNOP)	-0.008	0.358	LNOP	-0.019	0.3511
D(LNREER)	-0.065	0.055	LNREER	-0.149	0.013
			C	14.930	0.000

Panel B: Diagnostics

F	ECM_{t-1}	ARCH	RESET	LM	CUSUM (CUSUM2)
1.269	-0.438 (0.0008)	0.9117	0.1120	0.4047	S(S)

2. Nonlinear Model

Panel A:

Short run estimates			Long run estimates		
Variable	Coefficient	Probability	Variable	Coefficient	Probability
D(LNG)	-0.018	0.730	LNG	-0.038	0.7329
D(LNM)	0.190	0.009	LNM	0.394	0.0018
D(LNOP)	-0.002	0.796	LNOP	-0.005	0.7975
D(LNREER_POS)	0.076	0.576	LNREER_POS	0.158	0.5706
D(LNREER_NEG)	-0.163	0.100	LNREER_NEG	-0.337	0.0552
			C	17.020	0.000

Panel B: Diagnostics

F	ECM_{t-1}	ARCH	RESET	LM	CUSUM (CUSUM2)
1.515237	-0.484 (0.0005)	0.969	0.169	0.503	S(S)

In Nepal money supply have significant positive effect on GDP both in short run and long run. 1% increase in money supply rise GDP by 0.22% in short run while 0.50% in long run. Depreciation of currency have also significant and expansionary effect on GDP both in short and long run. Except these variable all other variables show insignificant effect towards GDP. Our ECM_{t-1} support this long run relation, while F calculated value does not support this.

Diagnostic tests indicate that we have no problem of heteroskedasticity and serial autocorrelation. Also the optimum model is correctly specified. Residuals are free from autocorrelation. In addition, to ensure that measures of short-term and long-term coefficients are stable, CUSUM and CUSUMSQ tests are applied. Result shows all coefficient estimates are stable.

In nonlinear model the relationship of money supply exists with GDP both in short-run and long-run. In short run GDP rise by 0.19%, while in long run it rise by 0.39% when money supply increase by 1%. In long run depreciation have significant expansionary effect on GDP, while appreciation have insignificant effect, which is strong evidence of asymmetry. It is supported by Thapa (2002), depreciation of the real exchange rate raises the foreign competitiveness of domestic output, which contributes to a rise in the amount of net exports and thus in GDP. In nonlinear case all other variable show insignificant results towards GDP. ECM_{t-1} gives significant result which support the long relationship of money supply and depreciation with GDP. Diagnostic tests supporting lack of heteroskedasticity and serial autocorrelation. Also that the optimum model is correctly specified and all of short-term and long-term coefficients are stable.

Table 4. 8 Pakistan linear and nonlinear coefficients estimate

1. Linear Model

Panel A:

Short run estimates			Long run estimates		
Variable	Coefficient	Probability	Variable	Coefficient	Probability
D(LNG)	0.012	0.367	LNG	0.122	0.321
D(LNM)	0.132	0.001	LNM	0.600	0.000
D(LNOP)	0.014	0.176	LNOP	-0.069	0.286
D(LNREER)	0.031	0.079	LNREER	0.299	0.277

				C	7.831	0.006

Panel B: Diagnostics

F	ECM_{t-1}	ARCH	RESET	LM	CUSUM (CUSUM2)
4.657	-0.106 (0.062)	0.940	0.982	0.788	S(S)

2. Nonlinear Model

Panel A:

Short run estimates			Long run estimations		
Variable	Coefficient	Probability	Variable	Coefficient	Probability
D(LNG)	0.005	0.687	LNG	0.030	0.687
D(LNM)	0.130	0.001	LNM	0.384	0.001
D(LNOP)	0.015	0.131	LNOP	-0.033	0.376
D(LNREER_POS)	0.091	0.032	LNREER_POS	0.473	0.022
D(LNREER_NEG)	-0.050	0.355	LNREER_NEG	-0.259	0.222
			C	17.410	0.0001

Panel B: Diagnostics

F	ECM_{t-1}	ARCH	RESET	LM	CUSUM (CUSUM2)
3.641*	-0.193 (0.016)	0.837	0.142	0.724	S(S)

Money supply have short run linear impact on GDP in Pakistan, that effect last into long run. Positive effect shows that in short run GDP increase 0.13% and in long run it increase 0.60% when money supply increase by 1%. Similarly, REER(depreciation) have short run contractionary effect on GDP. This contractionary affect may be due to reduction in domestic consumption is more than increase in net export. Another reason is that Pakistan economy is heavily dependent on imported inputs, so increase in input cost reduce the economy production. All other variable shows insignificant results towards GDP both in short run and long run. Significant values of F-statistics and ECM_{t-1} support the long run relationship of money supply with GDP.

All diagnostic test gives favorable results. Indicate, no heteroskedasticity, no serial autocorrelation, optimum model is correctly specified and all coefficient of short run and long run are stable.

Now we focus on nonlinear case, here money supply and appreciation(NEG) have expansionary effect on GDP in short run. Money supply improve GDP by 0.13%, while appreciation improve it by 0.09%, when M and appreciation of currency increased by 1%. Insignificant coefficient of depreciation(NEG) shows short run asymmetry. Appreciation of Pakistan rupee improve production because its production is dependent on imported inputs and other raw materials (Hussain et al. 2019) While depreciation of Pakistan rupee is not beneficial for the economy, because Pakistan is with higher external debt. It will cost more than advantage (Augustine & Kumar, 2020 and Gopinath, 2016). Depreciation have no effect to improve trade balance in 14 Asian economies which also include Bangladesh, Pakistan and Sri Lanka, it may be export do not respond as expected (Alemu & Jin-sang 2014). Similarly, money supply and appreciation effect last into long run. These both money supply and appreciation have expansionary effect on domestic production. Depreciation and all other variable have insignificant effect on domestic production, which support long run asymmetry. These long run results are supported by significant value of F-statistics and ECM_{t-1}.

Results shown in panel B of nonlinear model. There is no record of heteroskedasticity, serial autocorrelation and model miss-specification. All coefficient of short run and long run are stable.

Table 4. 9 Sri Lanka linear and nonlinear coefficients estimate

1. Linear Model

Panel A:

Short run estimates			Long run estimates		
Variable	Coefficient	Probability	Variable	Coefficient	Probability
D(LNG)	0.026	0.119	LNG	-2.79	0.863
D(LNM)	0.055	0.157	LNM	4.299	0.831
D(LNM(-1))	0.112	0.010	LNOP	-1.047	0.857
D(LNOP)	0.009	0.181	LNREER	-3.523	0.858
D(LNREER)	0.033	0.477	C	-0.467	0.992

Panel B: Diagnostics

F	**ECM_{t-1}**	**ARCH**	**RESET**	**LM**	**CUSUM (CUSUM2)**
1.715	0.009 (0.852)	0.721	0.513	0.279	S(S)

2. Nonlinear Model

Panel A:

Short run estimates			Long run estimates		
Variable	Coefficient	Probability	Variable	Coefficient	Probability
D(LNG)	0.022	0.17	LNG	0.168	0.297
D(LNM)	0.081	0.055	LNM	-0.145	0.668
D(LNM(-1))	0.119	0.006	LNOP	0.112	0.166
D(LNOP)	0.015	0.060	LNREER_POS	1.686	0.027
D(LNREER_POS)	0.225	0.087	LNREER_NEG	-0.610	0.165

D(LNREER_NEG)	-0.081	0.339	C	27.50	0.001

Panel B: Diagnostics

F	ECM_{t-1}	ARCH	RESET	LM	CUSUM (CUSUM2)
1.399	-0.133	0.708	0.849	0.623	S(U)
	(0.197)				

In short run only money supply has linear impact on domestic production of Sri Lanka, while in long run all coefficients are insignificant. Positive impact of money supply shows that 0.11% rise in GDP when there is 1% increase in money supply. Calculated value of F and probability value of ECM_{t-1} are insignificant which support that our long run results are irrelevant.

Panel B result of linear model shows there is no ARCH effect and serial autocorrelation in residuals. Furthermore, optimum model is correctly specified as well as short run and long run estimates are stable.

In section 2 short run result depicts that money supply, oil prices and appreciation of currency have positive significant coefficient. Expansionary effect of these variable depicts GDP increase by 0.11%, 0.01% and 0.22% when there is 1% rise in money supply, oil prices and appreciation of currency respectively. Like Bangladesh and Pakistan Sri Lanka is also dependent on imported inputs and raw materials. Currency appreciation does not negatively affect exports because the reduced imported input costs decrease the cost of exportable as a result of appreciation (Abeysinghe & Yeok, 1998). Depreciation have no relation with GDP, which is strong evidence of asymmetry. In long run appreciation(POS) have expansionary effect on GDP. While there is no relation found of depreciation (NEG) with GDP, which is the evidence of asymmetry in long run. After establishing cointegration test, F-statistic and ECM result negate the long run relationship.

Diagnostic reports show that there is no indication of heteroskedasticity, serial autocorrelation and misspecification. All variables are stable in short run and long run.

Summary of linear model results shows that currency depreciation has significant short run expansionary effect on output level of Maldives and Nepal economy. While in case of India and

Pakistan there is contractionary depreciation. In long run linear model result revealed that depreciation reduce output level in Bangladesh, but in case of Nepal depreciation has expansionary effect on output level. These results are supported by Kalyoncu et. al (2008), they found worst effect of depreciation on Finland, Germany and Turkey economy in short run while positive impact of depreciation found on output of Hungary and Switzerland. These all finding are on the bases of previous studies. Now we proceed towards nonlinearity in the model. In short run we found asymmetry effect in Bangladesh, India, Maldives, Pakistan and Sri Lanka while in long run asymmetry only exist in Bangladesh, Nepal and Pakistan. These asymmetries effects are evident either from same sign of coefficients or different in magnitude of coefficients or significance level of wald test both in short run and long run.

From all above discussion we are able, to conclude the economic reason of asymmetry effect of exchange rate changes. In our study we saw all countries have different result from each other. In more specific words, our outcome is country specific. Bahmani-Oskooee, M., & Mohammadian, A. (2018) conducted study for multiple economies and found that exchange rate is country specific. It could be because of each country follows its own specific exchange rate policy, monetary policy and fiscal policy etc. for example in case of India appreciation make worse the economy while depreciation have zero tolerance toward economy, which favors fixed exchange rate regime. In contrast in case of Pakistan and Sri Lanka appreciation have positive impacts on the economies while depreciation shows neutral impacts on the economies. It reveals that Pakistan and Sri Lanka depends more on imported inputs. Strong currencies will give the incentives to policy makers to increase domestic production in long run. Result of Bangladesh reveal, appreciation and depreciation of currency gives good response towards output level. It gives advantages to policy makers to rely on free floating exchange rate regime which causes asymmetry result in the economy. Similarly, monetary and fiscal policy effect each economy differently, the effect may be worse, good or independent. For example, money supply has significant positive long run impact on output level of Maldives, Nepal and Pakistan while in rest of the countries cases monetary policy does not affect economy. Similarly, government expenditure has good long run impact on Bangladesh and Maldives economy only.

4.5 Effect of REER changes in export-oriented and import-oriented countries

Export versus import background of the said region shows that export of India, Bangladesh, Sri Lanka and Maldives have highest share of its GDP compare to import. Export share of India is 18.9%, while import share is 21.8% of its GDP. In other words, we can say trade balance deficit is -2.9%. Similarly, Bangladesh export share is 15% while import share is 20% of its GDP, shows -5% trade balance deficit. Maldives and Sri Lanka trade balance deficit are -4.8% and -7.2% respectively. Rest of the countries that is Bhutan, Nepal and Pakistan import and trade deficit have the highest share of its GDP.

Now we will have to overview and compare world with our chosen countries. United States is on top for export partner share, which is 12.49% of the world. Similarly, share of exports of the world for India, Bangladesh, Pakistan, Sri Lanka, Nepal and Maldives are 2.02%, 0.31%, 0.29%, 0.11%, 0.06 and 0.01% respectively. (source: world integrated trade solution)

In case of import China have highest share of import, which is 14.57% of the world, following United States have 8.34% share import of the world. Now we focus on our selected countries import in which Maldives is on top with 9.42% share of the world import. Similarly, share of imports of Pakistan, India, Sri Lanka, Bangladesh, Nepal and Bhutan are 5.39%, 4.67%, 4.42%, 3.78%, 2.96% and 2.53% respectively. (source: WITS)

Here we cannot decide whether country is export or import oriented on the base of export and import comparison with the world. If we make it more specific and compare export and import as percent of GDP domestically, then we can reach to answer (paragraph 1). On this base we concluded that India, Bangladesh, Sri Lanka and Maldives would consider as an export oriented, while Bhutan, Nepal and Pakistan would consider as an import oriented country for further discussion.

4.5.1 REER changes effect in export-oriented economies

Different countries react differently to exchange rate appreciate and depreciate based on whether economy is export-oriented or import oriented. We will discuss all economies one by one here.

In nonlinear both appreciation and depreciation have short run expansionary effect on GDP of Bangladesh. This expansionary effect of depreciation is due to rise in export. WenShwo et. al

(2006) findings is in line with our results that depreciation improve export level of Asian countries. Here appreciation increase imports of Bangladesh, but higher coefficient of depreciation shows that Bangladesh is dependent on its export more than its import. Appreciation of Sri Lanka have significant long run and nonlinear effect on domestic production. Appreciation of currency will make possible to increase import inputs at lower cost. Sri Lanka imports may be consist on raw materials and other inputs, which is further used in production process. That results to increase overall production level and so export. Maldives results show depreciation have short run expansionary effect on economy in both linear and nonlinear model. More precisely, Maldives is dependent on its export, while less dependent on import. Its most export are tourism and fishing (world bank). Currency depreciation of India gave significant result for short run in both linear and nonlinear model case. This effect on economy is contractionary, which is clearly unfavorable. Results shows that, except India, these all countries export more as compare to import.

4.5.2 REER changes effect in import-oriented economies

In linear model Pakistan depreciation show contractionary significant effect towards domestic production in short run. The same effect exists in nonlinear short run case, which also shows asymmetry. A depreciation might affect the AD part of consumption and net exports. Depreciation causes inflation which resulting transfer income from labor (with high MPCs) to producers (with low MPC). This could reduce in aggregate consumption level. If this fall in consumption is greater than balanced by a rise in net exports, AD may fall. Further depreciation raises the expense of imported inputs, so it is expected that AS will decrease. Due to this reason, empirical research indicates that the overall effect of depreciation on domestic production is contractionary rather than expansionary. Similarly, in linear model there is expansionary effect of depreciation in short run and long run on Nepal economy. In nonlinear only long run expansionary effect of depreciation exist on domestic production. Finally, in Bhutan there is no significant effect found of exchange rate change on economy in either linear and nonlinear model.

CHAPTER 05

CONCLUSION & POLICY RECOMMENDATION

Output can effect by many factors which includes money supply, government expenditure, real effective exchange rate and world crude oil price. Real effective exchange rates are among the most frequently observed, examined and governmentally controlled economic indicators. The basic purpose of current study is to find the relationship between changes in exchange rate and domestic production both in short run and long run. The previous studies assumed symmetric effects. Similarly, past research ignored developing countries and focused only on developed economies because of easily accessibility to data. Moreover, in the current analysis, our goal is to measure the asymmetrical effect of ER changes on GDP in developing South Asian economies. First we apply linear ARDL approach of Pesaran et al. (2001) in seven developing countries and get new outcome with updated data. To test for possible nonlinear relationship between GDP and exchange rate we employed a recent developed technique of NARDL by Shin et al. (2014).

Results shows, except Bhutan and Nepal in all other countries cases there is short run asymmetry effect of exchange rate change on domestic production. In long run change in exchange rate have asymmetry effect on Bangladesh, Nepal and Pakistan economy only. The results are surprisingly different in each economy, which shows exchange rate affect is country specific. In our estimation depreciation show long run expansionary effect on Bangladesh and Nepal economy, while it does not affect any other country in long run. But in short run depreciation adversely affect India's domestic production, while it positively effects Maldives economy. Similarly, in long run currency appreciation have expansionary effect on Pakistan domestic production. Higher dependency of Pakistan on raw materials and other imported inputs suggest strong currency.

Study recommends some relevant points in the light of key findings. In long run policy makers of Bangladesh and Nepal should recommend depreciation of currency for long run economic growth. Pakistan's greater dependence on raw materials and other imported inputs suggests a strong currency. Similarly, for short run economic growth India should appreciate their currency while Maldives should depreciate its currency. Every country in our study must be viewed independently and every country should follow its own autonomous policy. In order to bring

further improvement regarding this study, the researchers are suggested to extend this study by considering large sample size and incorporate Afghanistan country in the selected region. Similarly, wage rate is also one of the key determinant of output level. Future work should also incorporate this variable in the study for the selected region.

REFERENCES

Abeysinghe, T., & Yeok, T. L. (1998). Exchange rate appreciation and export competitiveness. The case of Singapore. *Applied economics*, *30*(1), 51-55.

Alejandro, C. F. D. (1963). A Note on the Impact of Devaluation and the Redistributive Effect. *Journal of Political Economy*, *71*(6), 577-580.

Alemu, A. M., & Jin-sang, L. (2014). Examining the Effects of Currency Depreciation on Trade Balance in Selected Asian Economies. *International Journal of Global Business*, *7*(1).

Alexander, S. S. (1952). Effects of a Devaluation on a Trade Balance. *Staff Papers-International Monetary Fund*, *2*(2), 263-278.

An, L., Kim, G., & Ren, X. (2014). Is devaluation expansionary or contractionary: Evidence based on vector autoregression with sign restrictions. *Journal of Asian Economics*, *34*, 27-41.

Aslam, A. L. (2016). Impact of Exchange Rate on Economic Growth in Sri Lanka. *World Scientific News*, *54*, 252-266.

Augustine, B., & Kumar, L. (2020). Original Sin, Currency Depreciation and External Debt Burden: Evidence from India. *International Journal of Economics and Financial Issues*, *10*(3), 58-68.

Bahmani-Oskooee, M., & Miteza, I. (2003). Are devaluations expansionary or contractionary? A survey article. *Economic Issues Journal Articles*, *8*(2), 1-28.

Bahmani-Oskooee, M., & Miteza, I. (2006). Are devaluations contractionary? Evidence from panel cointegration. *Economic Issues*, *11*(1), 49-64.

Bahmani-Oskooee, M., & Mohammadian, A. (2016). Asymmetry effects of exchange rate changes on domestic production: evidence from nonlinear ARDL approach. *Australian Economic Papers*, *55*(3), 181-191.

Bahmani-Oskooee, M., & Mohammadian, A. (2018). Asymmetry effects of exchange rate changes on domestic production in emerging countries. *Emerging Markets Finance and Trade*, *54*(6), 1442-1459.

Barguellil, A., Ben-Salha, O., & Zmami, M. (2018). Exchange rate volatility and economic growth. *Journal of Economic Integration*, *33*(2), 1302-1336.

Chaudhary, G. M., Hashmi, S. H., & Khan, M. A. (2016). Exchange rate and foreign trade: a comparative study of major South Asian and South-East Asian countries. *Procedia-Social and Behavioral Sciences*, *230*, 85-93.

Cheung, Y. W., & Sengupta, R. (2013). Impact of exchange rate movements on exports: an analysis of Indian non-financial sector firms. *Journal of International Money and Finance*, *39*, 231-245.

Chou, W. L., & Chao, C. C. (2001). Are currency devaluations effective? A panel unit root test. *Economics Letters*, *72*(1), 19-25.

Constantinos, K., Ektor, L. A., & Emmanouil, T. (2012). Asymmetric effects of inflation on stock market prices: New empirical evidence using Greek data. *Journal of Applied Business Research (JABR)*, *28*(3), 325-332.

Dincer, N., & Kandil, M. (2011). The effects of exchange rate fluctuations on exports: A sectoral analysis for Turkey. *The Journal of International Trade & Economic Development*, *20*(6), 809-837.

Dornbusch, R., & Frankel, J. (1988). The flexible exchange rate system: experience and alternatives. In *International finance and trade in a polycentric world* (pp. 151-208). Palgrave Macmillan, London.

Edwards, S. (1985). Are devaluations contractionary?

Edwards, S. (1989). *Real exchange rates, devaluation, and adjustment: exchange rate policy in developing countries* (pp. 16-25). Cambridge, MA: MIT press.

Goldstein, M., & Khan, M. S. (1985). Income and price effects in foreign trade. *Handbook of international economics*, *2*, 1041-1105.

Gopinath, G. (2015). *The international price system* (No. w21646). National Bureau of Economic Research.

Hameed, D. (2010). Impact of monetary policy on gross domestic product (GDP). *Interdisciplinary journal of contemporary research in business*, *3*(1), 1348-1361.

Hanson, J. A. (1983). Contractionary devaluation, substitution in production and consumption, and the role of the labor market. *Journal of International Economics*, *14*(1-2), 179-189.

Hussain, I., Hussain, J., Ali Khan, A., & Khan, Y. (2019). An analysis of the asymmetric impact of exchange rate changes on GDP in Pakistan: application of non-linear ARDL. *Economic Research-Ekonomska Istraživanja*, *32*(1), 3094-3111.

Kalyoncu, H., Artan, S., Tezekici, S., & Ozturk, I. (2008). Currency devaluation and output growth: an empirical evidence from OECD countries. *International Research Journal of Finance and Economics*, *14*(2), 232-238.

Kamal, K. M. M. (2015). An ECM approach for long run relationship between real exchange rate and output growth: Evidence from Bangladesh. *Dhaka University Journal of Science*, *63*(2), 105-110.

Kandil, M. (2008). The asymmetric effects of exchange rate fluctuations on output and prices: Evidence from developing countries. *Journal of International Trade and Economic Development*, *17*(2), 257-296.

Kandil, M. M. E. (2000). *The asymmetric effects of exchange rate fluctuations: Theory and evidence from developing countries* (No. 0-184). International Monetary Fund.

Kamin, S. B., & Rogers, J. H. (2000). Output and the real exchange rate in developing countries: an application to Mexico. *Journal of development economics*, *61*(1), 85-109.

Khattak, N. U. R., & Tariq, M. (2012). Are Real Devaluations Contractionary? an Empirical Analysis for Pakistan. *Asian Economic and Financial Review*, *2*(1), 119.

Lal, A. K., & Lowinger, T. C. (2002). Nominal effective exchange rate and trade balance adjustment in South Asia countries. *Journal of Asian Economics*, *13*(3), 371-383.

Lizondo, J. S., & Montiel, P. J. (1989). Contractionary devaluation in developing countries: an analytical overview. *Staff Papers*, *36*(1), 182-227.

Mills, T. C., & Pentecost, E. J. (2001). The real exchange rate and the output response in four EU accession countries. *Emerging Markets Review*, *2*(4), 418-430.

Nag, N. C. (1990). Macroeconomic effects of currency devaluation: A case study of Bangladesh. *Philippine Review of Economics*, *27*(2), 150-170.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, *16*(3), 289-326.

Rajan, R. S. (2001). Are crisis-induced devaluations contractionary?

Ratha, A. (2010). Does devaluation work for India. *Economics Bulletin*, *30*(1), 247-264.

Shafaeddin, M. (1995). The impact of trade liberalization on export and GDP, growth in least developed countries. *UNCTAD Review*, *1995*, 1-6.

Shahbaz, M., Islam, F., & Aamir, N. (2012). Is devaluation contractionary? Empirical evidence for Pakistan. *Economic Change and Restructuring*, *45*(4), 299-316.

Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In *Festschrift in honor of Peter Schmidt* (pp. 281-314). Springer, New York, NY.

Solimano, A. (1986). Contractionary devaluation in the Southern Cone: The case of Chile. *Journal of Development Economics*, *23*(1), 135-151.

Srinivasan, P., & Kalaivani, M. (2012). Exchange rate volatility and export growth in India: An empirical investigation. *MPRA Paper*, *43828*.

Thapa, N. B. (2002). An econometric analysis of the impact of real effective exchange rate on economic activities in Nepal. *Economic Review: Occasional Paper*, *14*, 17-36.

Zia, U., & Mahmood, Z. (2013). Exchange rate depreciation and export price competitiveness: the case of Pakistani manufacturing industries. *Journal of the Asia Pacific Economy*, *18*(4), 529-542.

APPENDICES

Appendix A: Variables definition and unit

- ***GDP*** = Real gross domestic product, nominal GDP deflated by GDP deflator in local currency unit (LCU).
- ***M*** = Real money supply (M2), nominal M2 inflation adjusted by CPI in LCU.
- ***G*** = Real government spending, nominal G deflated by GDP deflator in LCU.
- ***REER*** = Real effective exchange rate.
- ***POS*** = Appreciation of home currency.
- ***NEG***= Depreciation of home currency.
- ***OP =*** World crude oil price index(US$).

Appendix B: Data Sources

1. Gross domestic product: World development indicator (WDI).
2. Money supply: World development indicator.
3. Government spending: World development indicator, only for Maldives it is collected from international financial statistics (IFS).
4. Real effective exchange rate: Bruegel
5. World crude oil price: British petroleum company (BP)

Appendix C: Data period

Serial No	Countries	Data Period
1	Bangladesh	1986-2019
2	Bhutan	1983-2019
3	India	1980-2019

4	Maldives	1990-2019
5	Nepal	1980-2019
6	Pakistan	1980-2019
7	Sri Lanka	1980-2019

Appendix D: Descriptive Statistics

Descriptive Statistics of Bangladesh

	LNGDP1	**LNG1**	**LNM1**	**LNOP1**	**LNREER1**
Mean	0.052816	0.064955	0.085109	0.041314	0.009863
Median	0.051580	0.064441	0.077474	0.073069	-0.002584
Maximum	0.078374	0.155213	0.337785	0.461036	0.144390
Minimum	0.023875	-0.003316	0.016642	-0.63592	-0.07783
Std. Dev.	0.013076	0.039264	0.054809	0.258850	0.051566
Skewness	-0.151073	0.696768	3.041147	-0.644255	0.624273
Kurtosis	2.605974	2.908552	14.85582	2.906396	2.929509
Jarque-Bera	0.339005	2.681670	244.1379	2.294899	2.150277
Probability	0.844085	0.261627	0.000000	0.317445	0.341250

Descriptive Statistics of Bhutan

	LNGDP1	**LNG1**	**LNM1**	**LNOP1**	**LNREER**
Mean	0.066517	0.061507	0.108407	0.017961	4.628967
Median	0.061330	0.046757	0.092946	0.013570	4.594760
Maximum	0.252285	0.610493	0.400268	0.461036	4.924299
Minimum	-0.0337	-0.171171	-0.047348	-0.647056	4.476319
Std. Dev.	0.046936	0.157729	0.110899	0.273081	0.122348
Skewness	1.706140	1.707177	0.767969	-0.705595	1.080526
Kurtosis	8.780878	6.864562	3.198327	3.036545	3.133348

Jarque-Bera	67.59330	39.88898	3.597658	2.989187	7.227222
Probability	0.000000	0.000000	0.165493	0.224340	0.026954

Descriptive Statistics of India

	LNGDP1	**LNG1**	**LNM1**	**LNOP1**	**LNREER1**
Mean	0.059110	0.064193	0.071845	0.010933	-0.006351
Median	0.059396	0.063397	0.077739	-0.02474	-0.001556
Maximum	0.091921	0.159482	0.139492	0.461036	0.126355
Minimum	0.010513	-0.007978	0.007108	-0.647056	-0.177476
Std. Dev.	0.017929	0.037844	0.033595	0.263430	0.061098
Skewness	-0.428435	0.235444	0.034670	-0.64684	-0.336514
Kurtosis	2.722706	2.705312	2.247063	3.150532	3.517203
Jarque-Bera	1.318065	0.501437	0.929049	2.756438	1.170755
Probability	0.517352	0.778242	0.628434	0.252027	0.556895

Descriptive Statistics of Maldives

	LNGDP1	**LNG1**	**LNM1**	**LNOP1**	**LNREER1**
Mean	0.069048	0.048670	0.100095	0.029866	0.013679
Median	0.068527	0.061363	0.090160	0.023425	0.013777
Maximum	0.364718	0.496266	0.289839	0.461036	0.157956
Minimum	-0.143806	-0.393446	-0.054578	-0.63592	-0.108709
Std. Dev.	0.085010	0.148426	0.073460	0.264603	0.056557
Skewness	1.022542	-0.088688	0.167794	-0.572954	0.138475
Kurtosis	7.664077	6.337107	3.482873	2.875670	3.458683
Jarque-Bera	31.33931	13.49436	0.417824	1.605345	0.346902
Probability	0.000000	0.001174	0.811467	0.448130	0.840758

Descriptive Statistics of Nepal

	LNGDP1	LNG1	LNM1	LNOP1	LNREER1
Mean	0.045189	0.059177	0.089366	0.010933	0.000586
Median	0.044645	0.061778	0.085194	-0.02474	0.002667
Maximum	0.092407	0.227295	0.233689	0.461036	0.091088
Minimum	-0.030226	-0.100457	-0.0036	-0.647056	-0.156796
Std. Dev.	0.022859	0.072016	0.054587	0.263430	0.054706
Skewness	-0.731714	-0.119426	0.449919	-0.64684	-0.627026
Kurtosis	4.918579	2.979363	3.356033	3.150532	3.631828
Jarque-Bera	9.461674	0.093398	1.521763	2.756438	3.204261
Probability	0.008819	0.954374	0.467254	0.252027	0.201467

Descriptive Statistics of Pakistan

	LNGDP1	LNG1	LNM1	LNOP1	LNREER1
Mean	29.40567	0.049715	0.062869	0.010933	4.802042
Median	29.40718	0.051049	0.064871	-0.02474	4.710894
Maximum	30.21599	0.392901	0.280807	0.461036	5.421502
Minimum	28.43228	-0.206094	-0.121496	-0.647056	4.509575
Std. Dev.	0.510453	0.096732	0.065685	0.263430	0.247064
Skewness	-0.189436	0.716552	0.430837	-0.64684	1.201645
Kurtosis	1.981867	6.138810	5.513091	3.150532	3.285400
Jarque-Bera	1.966901	19.34712	11.46943	2.756438	9.762087
Probability	0.374018	0.000063	0.003232	0.252027	0.007589

Descriptive Statistics of Sri Lanka

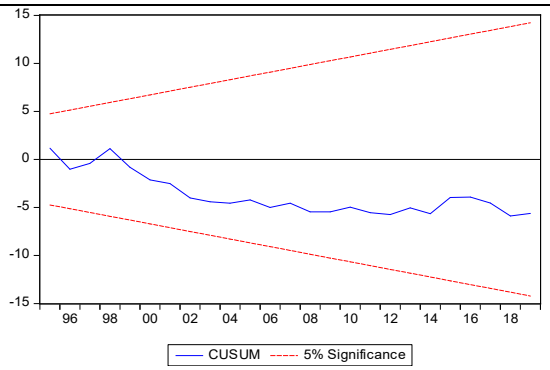
	LNGDP1	LNG1	LNM1	LNOP1	LNREER1
Mean	0.047587	0.050130	0.060757	0.010933	0.003991
Median	0.048416	0.052765	0.069236	-0.02474	0.002243
Maximum	0.087503	0.324045	0.340345	0.461036	0.087006
Minimum	-0.015575	-0.656563	-0.154172	-0.647056	-0.079398

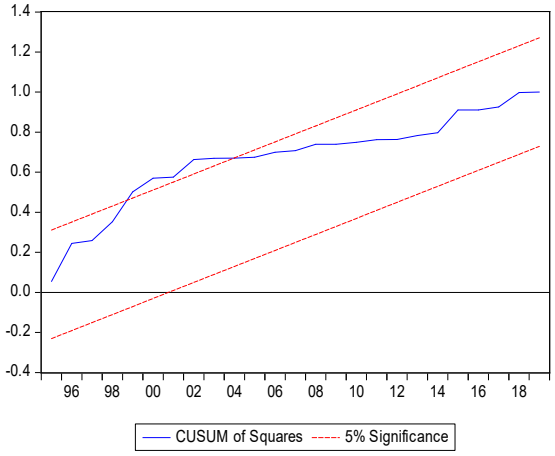
Std. Dev.	0.019066	0.147075	0.083970	0.263430	0.044429
Skewness	-0.642124	-2.614434	0.371640	-0.64684	-0.142813
Kurtosis	4.779099	15.02979	5.795004	3.150532	2.226499
Jarque-Bera	7.823539	279.5926	13.59233	2.756438	1.104816
Probability	0.020005	0.000000	0.001118	0.252027	0.575562

Appendix E: Figures

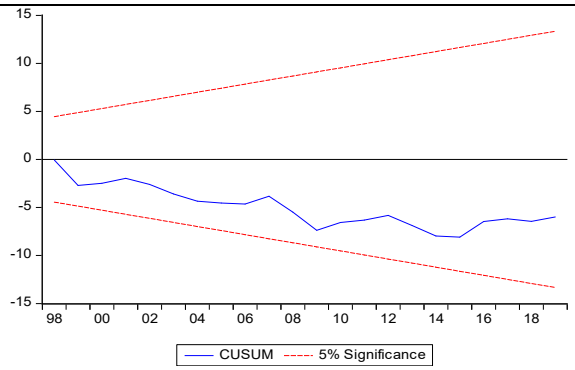
Bangladesh

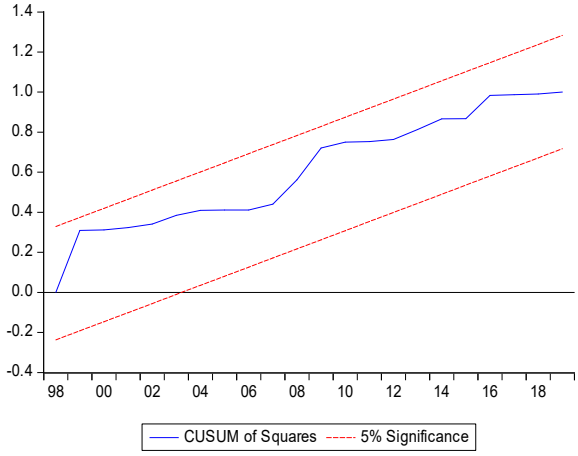
Linear ARDL





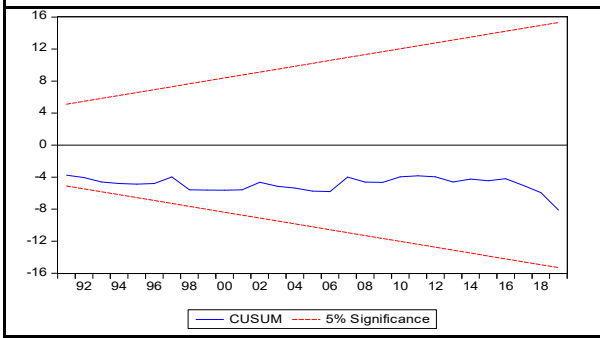
Nonlinear ARDL

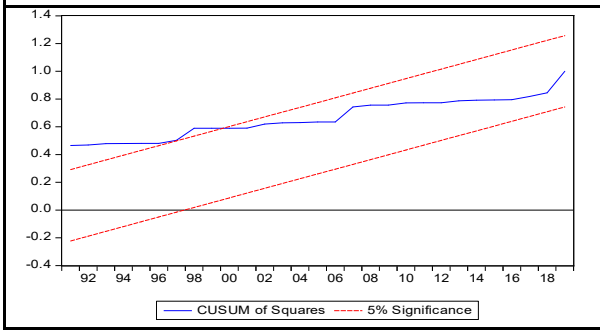




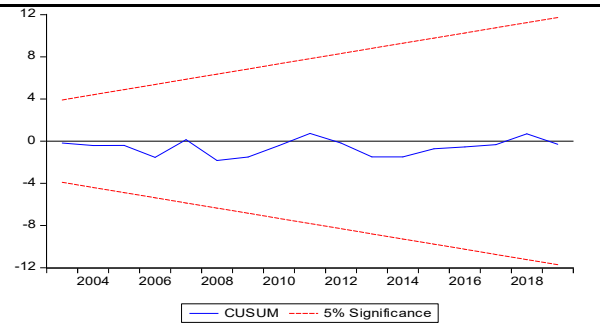
Bhutan

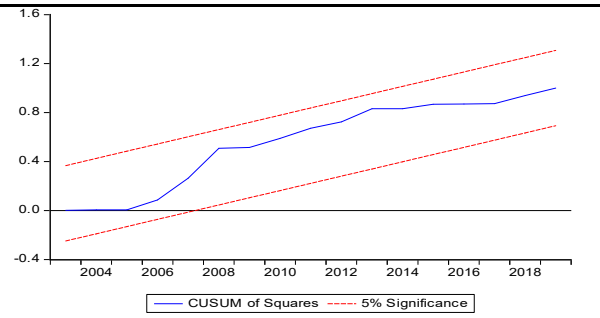
Linear ARDL





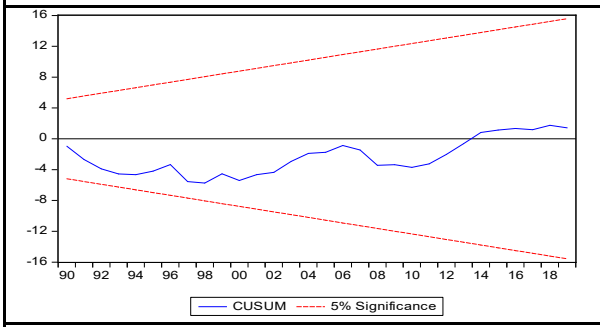
Nonlinear ARDL

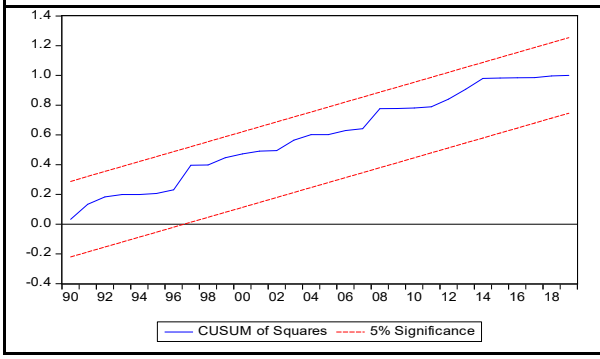




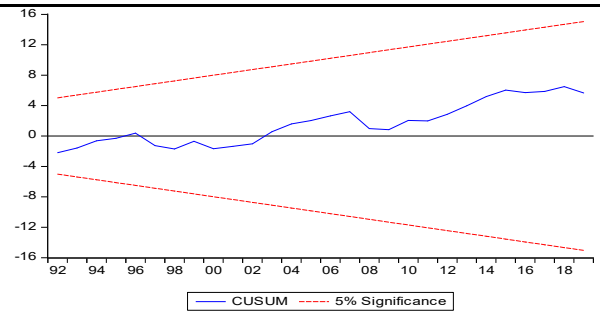
India

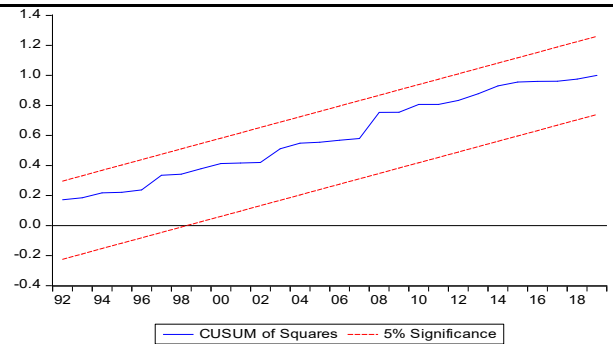
Linear ARDL





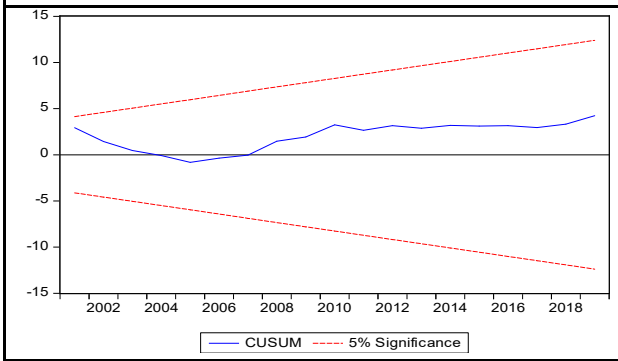
Nonlinear ARDL

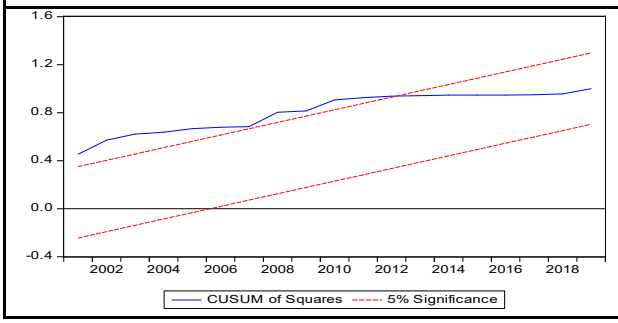




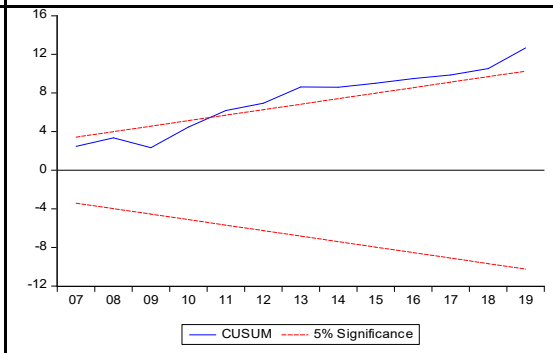
Maldives

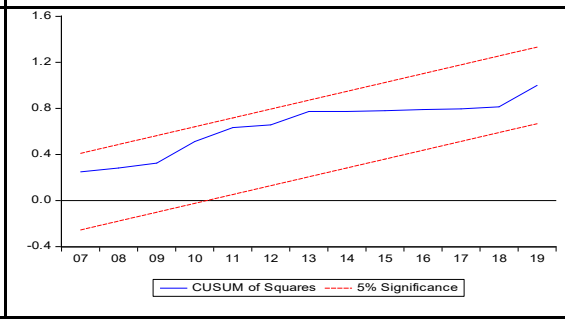
Linear ARDL





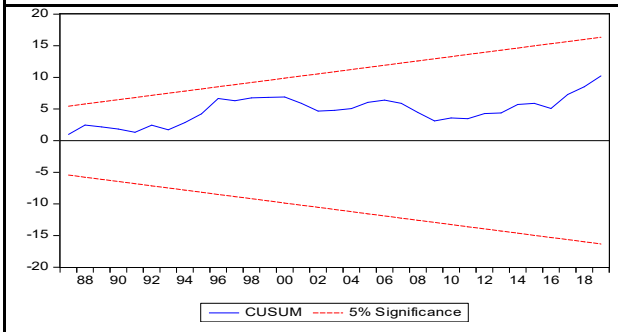
Nonlinear ARDL

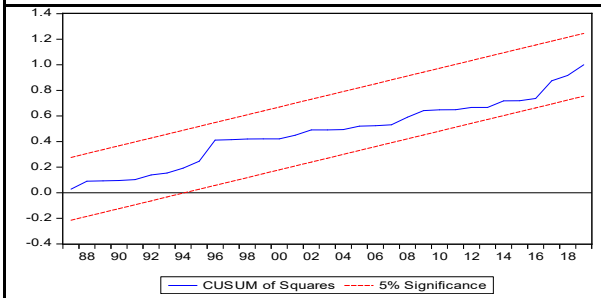




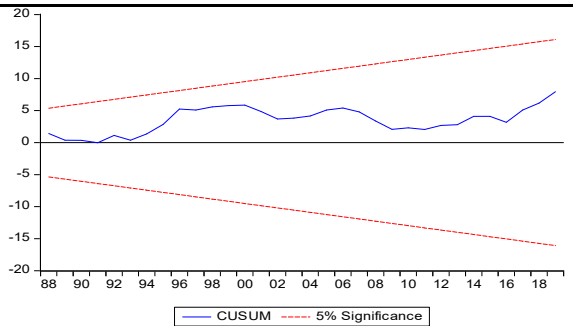
Nepal

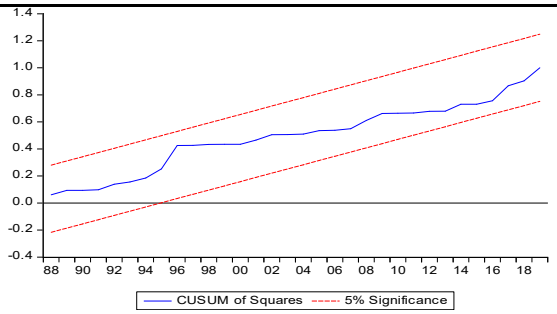
Linear ARDL





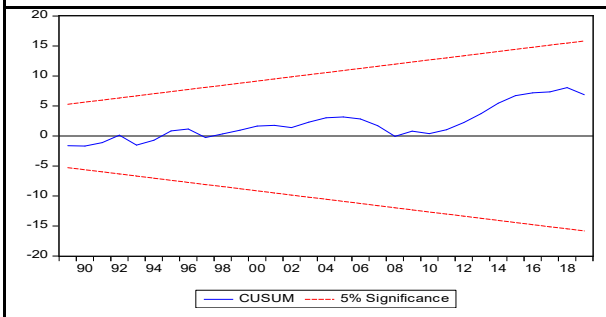
Nonlinear ARDL

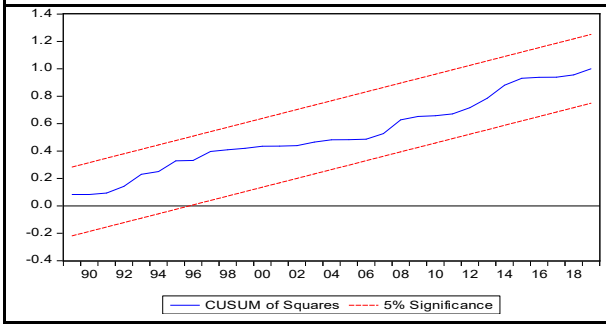




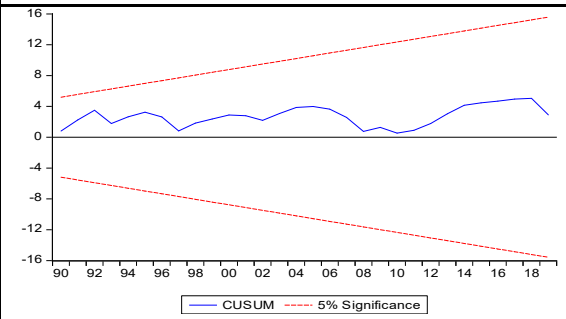
Pakistan

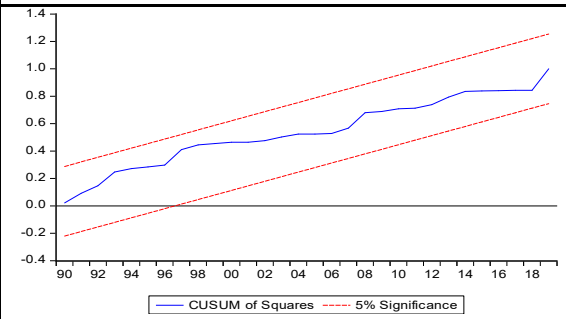
Linear ARDL





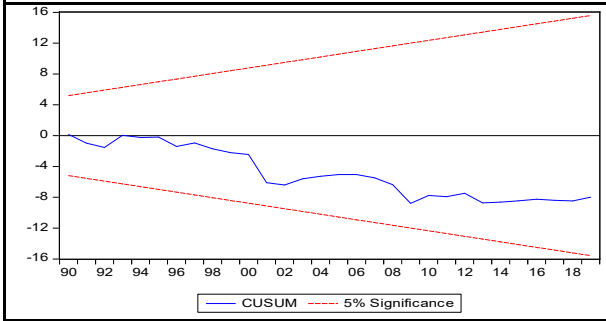
Nonlinear ARDL

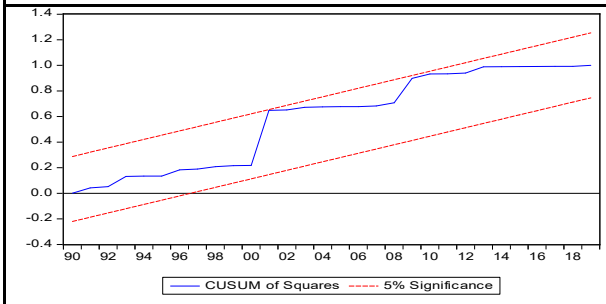




Sri Lanka

Linear ARDL





Nonlinear ARDL