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AN INVESTIGATION ON ASYMMETRIC IMPACT OF REAL EFFECTIVE EXCHANGE RATE ON THE SERVICES SECTOR OF PAKISTAN: A NEW INSIGHT FROM NON-LINEAR AUTOREGRESSIVE DISTRIBUTED LAG MODEL

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Abstract

Theobjective of this study was to analyze the nonlinear influence of real effective exchange rate (REER) on the services sector output of Pakistan.For estimation, nonlinear autoregressive distributed lag model (NARDL) is applied over time span of 1980-2021.The study used the services sector output as proxy of services sector (SOP) as a dependent variable while REER, foreign direct investment (FDI), financial development (FINDEV), government expenditure, trade openness, and remittances are used as independent variables.According to the results, a unit increase in appreciation cause 1.11 units to rise in the services sector output, while a 1 unitrise in depreciation caused0.64 units to decline in the services sector output. However, the impact of appreciation and depreciation on services sector output is asymmetric in sign and confirms the asymmetry with services sector output.The controlled variables including FINDEVhave positive impact on the services sector. Whereas government expenditure and FDI have a significant adverseeffect on services sector output in the long-term. Moreover, trade openness and remittances show a negative but insignificant effect on services sector output. Considering these findings, this research recommends that government should put effort into the appreciation of REER.

Keywords: Services sector; Real effective exchange rate; Nonlinear autoregressive distributed lag (NARDL); Pakistan.

JELCodes:C22, D51,E61, F31, F43

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1. Introduction

A key indicator of a country's trade potential and export competitiveness in global markets is the real effective exchange rate (REER), which is calculated as the average of a country's bilateral real exchange rates with each of its trading partners, weighted by each partner's relative trade share. Depreciation or devaluation of a country's currency is a crucial component of the stability and economic adjustment plans recommended by the International Monetary Fund (IMF) that have been used to increase the competitiveness of various emerging nations in the global market (Edwards 1986). If a country's REER decreases, it suggests that the imports of this country will become more expensive wheras export beome more cheaper, which would improve its balance of trade and increase domestic production. It is yet up to empirical research to determine whether real currency fluctuations have a beneficial or negative effect on domestic production. It is demonstrated that the effects of currency fluctuations vary by country and depends on the model's formulation, assessment methods, and study period (Bahmani-Oskooee & Miteza 2003). Exchange rate fluctuations and their effect on the economy are the main debate among macroeconomic policymakers after the plunge of the Bretton wood agreement 1971-193 in developing countries.

Since independence Pakistan has been managing the currency with the intention of improving the balance of payment. Therefore, Pakistan adopts different structures of exchange rate regimes. Such as from 1947 to 1982 Pakistan had a fixed exchange rate system in which significant devaluation occurs twice (in 1955 and 1972), followed by one revaluation in 1973 (Fiaz et al. 2021). The controlled exchange rate system was again adopted after the nuclear test in May 1998, which is retained since then. The exchange rate stability was seen in 2005-2006 after the 1998 incident (Mahmood and Al-khateeb 2017). The floating exchange rate in 1982 was 10.79 rupees per dollar and in 2010 it was almost 85 rupees per dollar. It means that since 1982 the correlation with the United States (US) dollar value of the Pakistan Rupee (PKR) is declining with time and depreciated almost 700% (Saeed et al. 2012). The exchange rate depreciation in Pakistan is increasing day by day, which become the main concern for policymakers (Bilawal et al. 2014). During the last two decades, the Pak rupee

depreciates from 58 rupees per dollar in 2001 to 167 rupees per dollar in 2020. Now it depreciates up to 250 rupees per dollar (GoP 2022) and this is the highest devaluation of the Pak rupee since independence. These uncertain variationsinthe exchange rate have a strong influence on the agriculture, industrial, and service sector of Pakistan. It is also worth noting that the growth of the agriculture and manufacturing sectors is not possible unless we focus on the development of service sector. The services sector is known as the main pillar of the development of all these sectors.

The services sector consists of a very wide range of economic activities; due to their heterogeneity and intangible characteristics it is very complex to exactly describe and measure services goods. According to the classification of the World trade organization (WTO 2010), services are of two fundamental types; one is transformation services and the other one is margin services. Transformation services consist of the production activity which alters the condition of goods whereas margin services deal with the events that facilitate the exchange of financial assets or products (Schmitz 2013). Melvin and Zhou (1989) described that the services sector has another dimension as inputs to economic production that they help and facilitate a transaction via space and time. The intermediate and final demands, which are produced and consumed by public and private markets are fulfilled by the services sector (Elfring 1988).

1.1 Stylized facts about the Services Sector of Pakistan

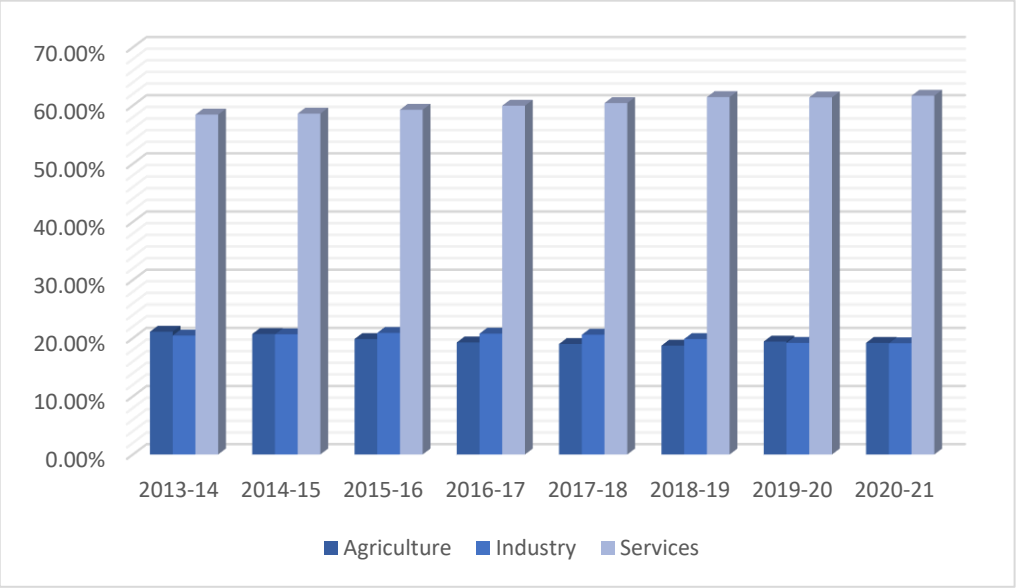
The services sector of Pakistan is extremely diversified therefore it is divided into four major sub-sectors (Ahmed and Ahsan 2011). These subsectors included production, distributive, social, and personal services. These four sub-sectors are further divided into different small sub-sectors.

The distributive sub-sectors include transport, communications, storage, and water transport. The distributive sector contains wholesale, retail, hotels, and restaurants. The production sub-sectors consist of financial institutions and insurance activities. These sub-sectors not only provide services to the consumer but also facilitate industrialists and the business communities by providing capital. Personal services contain entertainment and other recreation services. The social sub-sector includes defense administration, education, and health facilities.

Services sector is the major contributing sector in the GDP of Pakistan. It contributes almost 60% in the GDP, while 38.32% labor forces are linked with this sector. Through the export

of services 5.97$ billion were earned during FY21 (GoP 2021).The primary drivers of the Services sector's sizeable GDP contribution are advanced urbanization, the development of the public sector, and the sharply rising demand for intermediate and customer-focused services. The provision of services through commerce, company operations, banking, insurance, equipment maintenance, and other service subsectors is what drives economic growth (Soni and Parashar 2013). The sectoral contribution to Pakistan's GDP is depicted in Figure 1.

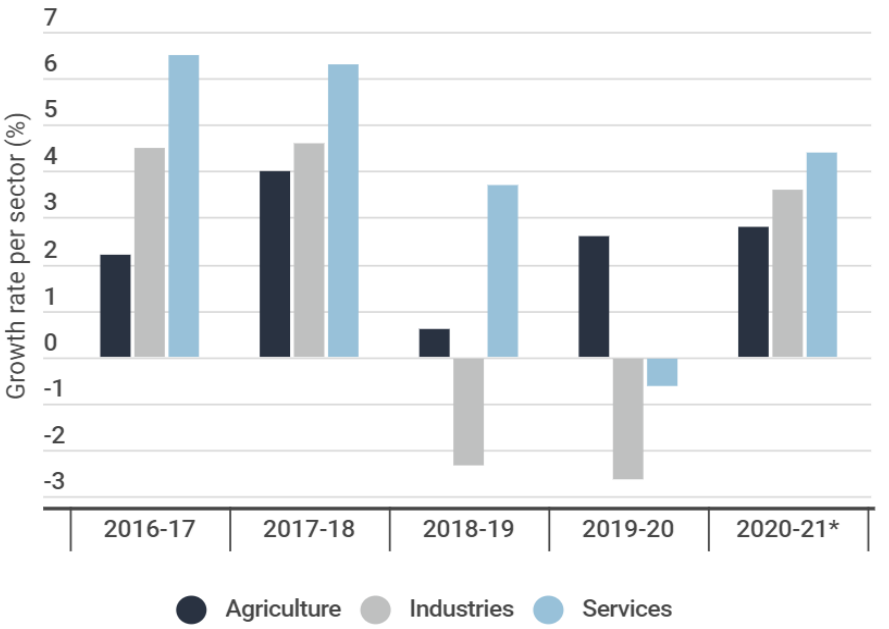
Figure 1: Sectoral Contribution to the GDP



Source: GOP, 2021

In 2021 services sector contributed almost 60% to the GDP of Pakistan, whereas Agriculture and manufacturing sector contributed 19.19 and 19.12 respectively (GoP 2021). Figure 2 shows that the Services sector growth rate is also higher than the other sectors services sector grew by 4.4% while the agriculture and manufacturing growth rate was about 2.8% and 3.6% respectively.

Figure 2: Sectoral growth in Pakistan



Source: GoP (2021)

The direct and indirect influence of the exchange rate on many services can be particularly noticeable because services now become internationally tradeable (Aizenman et al. 2018). The exchange rate can influence economic growth by the shift in the employment level and affecting the production in different sectors (Hussain et al. 2019). The appreciation and depreciation of currency may have an asymmetric effect on the economy due to the exit-entry decisions and to avoid a decline in profit of export-oriented firms (Knetter 1989). The exchange rate has asymmetric effects on exports and imports of the services sector, and it also affects the balance of trade (Chughtai et al. 2015). The economic agents react according to the negative and positiveuncertainty of the exchange rate (Kwasi 2018).

Despite its importance and role in the services sector, the real exchange rate is still out of focus from studies. The current study is one of the first to question this widely held belief and attempts to verify whether the exchange rate may have an asymmetric impact on the services sector in a emerging nation like Pakistan. The study believes that the impact of the Pakistani rupee's appreciation on the expansion of the services sector will differ from that of

its depreciation. In order to examine any potential asymmetric effects of REER adjustments on the services sector in the setting of a emerging country like Pakistan, the study uses a newly established Non-Linear A.R.D.L. technique by Shin et al. (2014). Comparing Pakistan's currency to others in South Asia with a similar level of development, it has remained more volatile. To the best of our knowledge, no research has looked into the asymmetric impact of REER on Pakistan's services industry. This study would be the first to analyze the asymmetric impact of REER adjustments on the services sector in Pakistan, and it is anticipated to contribute to the empirical literature on the topic of how to manage REER policy best in the instance of the services sector in order to achieve desired goals.

Despite REER, services sector output is determined by different factors. The factor we use inour study to investigate their impact on services sector are government expenditure, foreign direct investment, financial development, trade openness and remittances. Government spending aids in stabilizing economic growth. In Pakistan's situation, higher government spending may aid in the growth of the services sector and the whole performance of the nation. With the money collected via taxes, the government makes purchases. Despite a rise in the export percentage, the income from exports is still not as great as it should be (Fatima 2010). Both domestic progress and employment in the service industry can be boosted through trade in services. To benefit from trade, the export to import ratio must be higher (Mukherjee 2013). The capacities in developing economies have improved because to foreign direct investment (FDI). The service sector in Pakistan receives more FDI than other industries. Small and medium-sized businesses confront intense competition on global marketplaces, but they can thrive with the aid of cutting-edge technology and innovation. If businesses focus their financial resources on current products and services operations where the economy already has a competitive edge, greater financial growth may result in a concentration of services growth. However, financial development would be favorably correlated with diversification of services export if financing-dependent businesses used the financial resources to create more distinctive products and services (Agosin et al.2012). The Pakistani economy heavily depends on remittances from abroad. They contribute to the growth of foreign reserves. People transfer money to their families in

Pakistan, and this money is then invested in various service sector activities. Increased investment in the services sector is projected to boost its output and expansion.

Some Snippet from Past Literature

The link between the macroeconomic variables and real effective exchange rate, such as production, investment, and trade balance, is one of the most researched and discussed issues in monetary and financial economics (Stavarek 2013). According to Obstfeld and Rogoff (2001), there are six main mysteries in the subject of economics. For example, the exchange rate disconnect puzzle concerns the absence of a relation between macroeconomic indicators and exchange rates. The detrimental effects of a unwell managed exchange rate on the services sector have long been recognized by economists (Rodrick 2008). Several studies have discussed the importance of services sector in the GDP of an economy like Ahmadinejad and Pourfaraj (2021) described that the services sector is the dominant sector and has a large share in terms of size in GDP of Iran. His findings conclude that the services sector has a positive long-term effect on growth. The impact of the services and oil sector on economic growth is greater than the other sectors. Ahmed and Ahsan (2011) and Ajmair (2011) found the relationship between the services sector and the GDP of Pakistan. They argued that the services sector is the leading contributor to the GDP of Pakistan's economy. Higher growth in the services sector can provide a new dimension for the stability of Pakistan's economic growth. Alhowaish (2014) concluded that the 1% increase in the services sector will cause a 0.93% increase in the economic growth. Bandral (2009) found that the fastest-growing sector in Indiais theservices sector. This sector also contributes more to GDP than the other sectors. Her study further analyzed that the services sector has a higher growth rate and is a hub for FDI attraction. She concluded that to accelerate and maintain this growth it is necessary to properly addressed and reform the challenges faced by this sector. Uddin (2015) studied the causal relationship between all three economic sectors and GDP. His findings conclude that all sectors are strongly related to the GDP growth. However, the contribution of services sector to Bangladesh's GDP is higher and this share is increasing day by day. Moreover, the services industry has significant rolein the development of the other two sectors. He emphasized that due to the significant impact of the services sector on growth the policymakers should give priority to this sector.

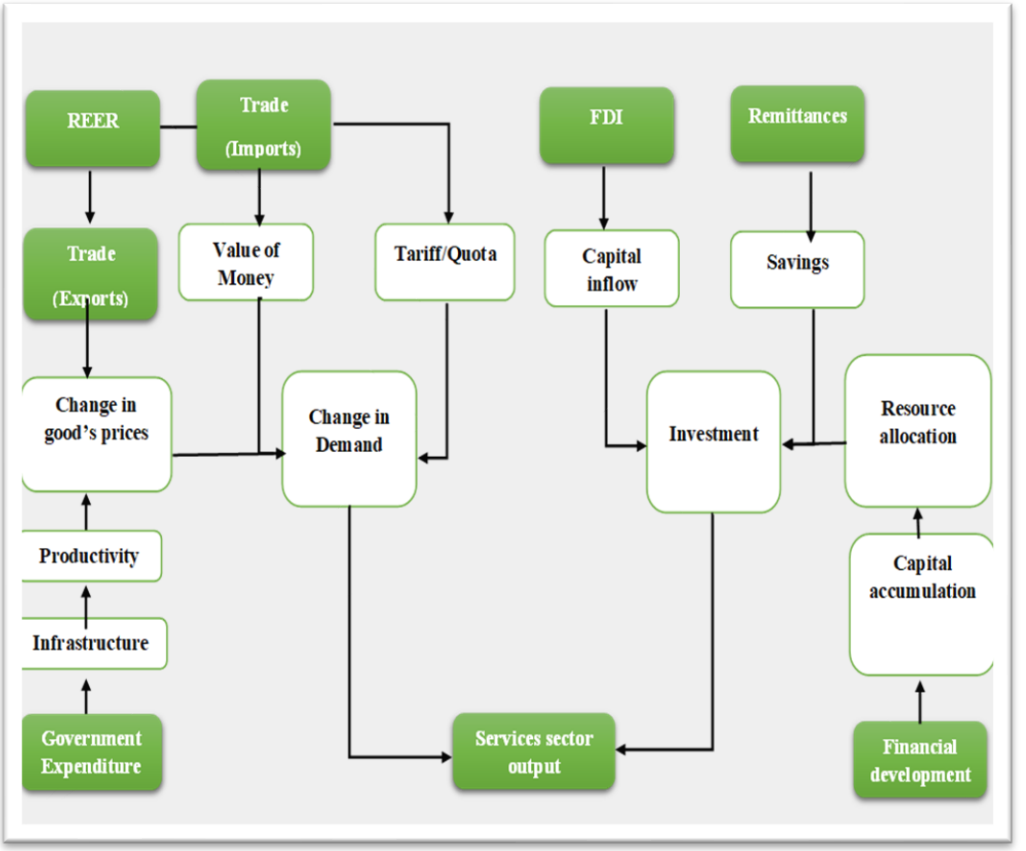
Ehigiator (2017) indicated that the services sector contributes almost 60% of the GDP of Nigeria in 2015 which is doubled as of 2013 which was about 30%. Agriculture and the industrial sector's percentage of GDP started to drop, and now the service sector is the biggest contributor. Further, the increase in the contribution of the services sector is also followed by the rise in per capita income. This increase in per capita income makes the economic life of the individuals better in Nigeria. The study revealed that informal firm's contributions were also taken into

statistical accounts which was early rarely accounted officially. The reforms and the elimination of FDI restrictions can cause more boost in the service sector as well as in GDP. On the other hand, some of available literature also assessed the relationship between services sector and real effective exchange rate for example, Aghion et al. (2005) explored the correlation between REER and the determinants of the services sector. His findings suggested that the REER volatility has an adverse effect on the determinants of the services sector like investment, employment, and financial development. Arbabian et al. (2020) analyzed that half of the import and export businesses in the services and industrial sector are affected asymmetrically by the REER volatility. The asymmetric effects vary from industry to industry. According to their research majority of services and manufacturing firms used REER volatility as a profitability factor, despite fluctuations in currency rate their business grows. Baggs et al. (2010) discovered a significant impact of REER on the service and industrial sector. However, the impact is similar qualitatively but different in magnitude. His findings suggest that the REER impact on profit is higher in industrial firms, whereas the impact on survival is higher in services firms. The impact on sales of both sectors is the same. Bahmani-Oskooee et al. (2012) studied that REER fluctuation has a substantial impact on most import and export businesses in the short run. However, industries have a minor share in trade affected by REER volatility both negatively and positively in the long run. Fung and Liu (2009) concluded that depreciation of currency and productivity are positively associated. The services firms with 10% higher depreciation had higher sales at 13.10%. Further, this devaluation causeboost in services exports, domestic sales, and total sales. Gnangnon (2021) argued that the devaluation of the currency encourages service export diversification and increases the total services exports for both developing and developed countries. His finding also emphasizes the important role of REER policies to promote diversified services exports in both the high-income and low-income nations. Hunegnaw (2017) found a significant positive impact of REER depreciation on manufacturing and services exports in long run. However, Short-run depreciation favors labor-intensive, low-skill, and medium-skill technology-intensive manufacturing exports while harming high-skill technology-intensive exports. His finding emphasizes on the provision of a favorable environment to enhance economic growth in the long run rather than continuous depreciation. Lotfalipour et al. (2013) concluded that the REER movement has a substantial negative impact on the investment. His

findings suggest that the fluctuation in the REER causes the decline in the investment and a stabilized REER attracts the producer to invest. The study also emphasizes using foreign reserves as a tool to control the REER supply and demand. Njindan (2017) used the GMM methodology to evaluate the influence REER rate in all three economic sectors. His findings conclude that REER exerts a positive impact on the performance of the industrial and agricultural sectors. However, the performance of the services sector was negatively affected by REER. Ojede (2015) analyzed the impact of REER on services and agriculture sector trade using the VAR model. His findings revealed that the impact of REER on agricultural exports is very small as compared to the services sector. The REER shocks are more consistent in services exports and services exports are more vulnerable to REER shocks. Sahin and Mohamed (2020) stated that there is an asymmetric effect of REER on stock prices and services. The research shows that appreciation of currency has adverseimpact on stock prices in the long run while devaluation does not show any significant impact. However, there is no effect of REER fluctuations found in the short run. Sahoo et al. (2019) found that REER fluctuation has a negative and significant effect on traditional exports, whereas the negative but insignificant impact on modern exports of services. The results of the co-integration technique suggest that there is no existence of asymmetric relation between REER and service exports. Further, their research indicates that services exports are more affected by demand and supply-side variables than REER.

Conceptual framework

Based on the literature review, the conceptual framework below has been created for the current research.



Source: Author own creation

Theoretical Framework

According to conventional theories like absorption, elasticities, and Keynesian, devaluation increase domestic production by increasing the aggregate demand's net export component. A key concept of international economics is the Marshall-Lerner (M-L) condition, which affirms that a currency depreciation or depreciation will only enhance a nation's trade balance if the total absolute value of that nation's export and import price elasticities is greater than one. As long as the (M-L) condition is met, a depreciation will increase the balance of trade, according to the elasticities approach. Devaluation increases output through switching and reducing expenditures, according to the absorption technique. The Keynesian method holds that devaluation boosts domestic industries' global competitiveness, which causes consumers to

switch their spending from imported goods to domestic ones, raising real domestic output. The 1970s saw a shift in focus from the demand side effects of depreciation to the supply side implications due to fluctuations in the pricing of raw commodities and oil. According to Diaz-Alejandro (1963), the redistributive impact of depreciation on capitalists and wage earners causes a contractionary effect. The model projected that devaluation decreased domestic output because it assumed that devaluation decreases workers' real pay rates while raising capitalists' real income and that workers' marginal propensity to spend is higher than capitalists' marginal inclination to consume. Diaz-Alejandro (1963)'s model was expanded by Wijnbergen (1986) by including the contractionary impact of depreciation via the aggregate supply mechanism. Additionally, Gylfason and Schmid (1983) proposed a macroeconomic model in which a lack of replacement on the supply and demand sides of the economy led to contractionary consequences after a decline in the value of the home currency. According to Agenor (1991), a real depreciation raised the relative cost of imported inputs denominated in local currency. As a result, domestic businesses decreased their need for both imported and local workforce, which decreased output.

Model and Methodology

This study make use of the annually time series data from 1980-2021. Services sector output (SOP) is used as dependent variable, while independent variablesinclude Real effective exchange rate (REER), Trade openness (TO), Government expenditure (GEX), Remittances (REM), Foreign direct investment (FDI), and financial development (FINDEV). Time series data is taken from World development indicators (WDI), and the Handbook of the State bank of Pakistan (SBP). We develop the following linear equation toassess the long-termassociation between the services sector and the controlledvariables which are mentioned above,the simple linear equation is as below:

$$SOP_t = \alpha_0 + \alpha_1 LREER_t + \alpha_2 TO_t + \alpha_3 GEX_t + \alpha_4 FINDEV_t + \alpha_5 FDI_t + \alpha_6 REM_t + \mu_t \quad \text{.....(1)}$$

The Nonlinear Autoregressive Distributive Lag (NARDL) model is applied to examine the asymmetric influence of REER on services sector in Pakistan. NARDL is the modernizedform of the Autoregressive Distributive Lag model ARDL of Pesaran et al. (2001). The asymmetric relationship between the variables was not captured by the ARDL model, which was used to evaluate the symmetric effect among the variables in both the short and long runs. The partial

sum of decomposition is applied on independent variables, to take asymmetric impact of long equilibrium and short run dynamic coefficients into account NARDL is created. NARDL model is used widely in the research of various fields including economics due to its simplicity and ease of interpretation (Cho et al. 2019).

The linear association between the Services sector output and Real effective exchange rate is indicated in the following ARDL equation:

Where (SOP) Services sector output, (REER) Real effective exchange rate, (TOT) Trade openness, (GEXP) Government expenditure, (FDI) Foreign direct investment, (REMMIT) Remittances, and (FINDEV) financial development.

we get the ARDL Cointegration model equation after respecifying the above equation above as follows.

$$SOP_t = \eta_0 + \sum_{i=1}^{q} \eta_1\ (SOP)_{t-1} + \sum_{i=0}^{q} \eta_2\ (REER)_{t-i} + \sum_{i=0}^{q} \eta_3\ (TOT)_{t-i} + \sum_{i=0}^{q} \eta_4\ (GEXP)_{t-i} + \sum_{i=0}^{q} \eta_5\ (FINDEV)_{t-i} + \sum_{i=0}^{q} \eta_6\ (FDI)_{t-i} + \sum_{i=0}^{q} \eta_7\ (REMMIT)_{t-i} + \lambda_1\ (SOP)_t \lambda_2\ (lnREER)_t + \lambda_3\ (TOT)_t + \lambda_4\ (GEXP)_t + \lambda_5 (FINDEV)_t + \lambda_6\ (FDI)_t + \lambda_7 (REMMIT)_t + \mu_t \ldots\ldots\ldots\ldots(2)$$

Where lag of independent variables is represented by q.

η represent theshort run Variables

λ represent the long run variables.

The analysis normally initiates with an examination at each variable's order of integration to make sure the estimation is accurate and that no variables is integrated of order greater than one (1). If this step is skipped, the bound test for cointegration will be invalid. The ADF unit root test was developed by Dickey (1979) to verify the stationary nature of time series data and to prevent a spurious regression. The variables in our model are a mixture of non-stationary variables integrated with order I (1) and stationary variables at level I (0). REER become stationary at level I(0) while all other variables become stationary at I (1) and there are no I(2) variables.

The bound test for cointegration within a NARDL unrestricted error correction model is used to examine cointegration between the variables after identifying the order of integration of the time series.If the variables are cointegrated, the analysis proceeds by estimating the shortrun

and long run asymmetryof the REER on output of the services sector by decomposing the REER into positive changes, REER_POS, and negative changes, REER_NEG as in equations (4) and (5). Where the REER_POS and REER_NEG denote the partial sum of REER processes that accumulate negative and positive changes, respectively.

$POS_t = \sum_{j=1}^{t} \Delta \ln REER_j^+ \sum_{j=1}^{t} max\ (\Delta \ln REER_j, 0)$……(4)

$NEG_t = \sum_{j=1}^{t} \Delta \ln REER_j^- = \sum_{j=1}^{t} min\ (\Delta \ln REER_j, 0)$……(5)

Since our study uses a nonlinear framework, there is a chance that nonlinear effects will appear in the time-series data. As a result, we construct the following nonlinear model, from which we get the asymmetric equationof error correction., as follows:

$$lnSOP_t = \eta_0 + \sum_{i=1}^{q} \eta_1\ (lnSOP)_{t-1} + \sum_{i=0}^{q} \eta_2\ (lnREER)^{+}_{t-i} +$$

$$\sum_{i=0}^{q} \eta_3\ (lnREER)^{-}_{t-i} + \sum_{i=0}^{q} \eta_4\ (lnTOT)_{t-i} +$$

$$\sum_{i=0}^{q} \eta_5\ (lnGEXP)_{t-i} + \sum_{i=0}^{q} \eta_6\ (lnFINDEV)_{t-i} + \sum_{0=1}^{q} \eta_7\ (FDI)_{t-i} +$$

$$\sum_{i=0}^{q} \eta_8\ (lnREMMIT)_{t-i} +$$

$$\lambda_1\ lnSOP_t \lambda_2\ (lnREER)^{+}_{t} \lambda_3\ (lnREER)^{-}_{t} + \lambda_4\ (lnTOT)_t + \lambda_5\ (lnGEXP)_t + \lambda_6 (lnFINDEV)_t +$$

$$\lambda_7\ (FDI)_t + \lambda_8 (lnREMMIT)_t + \mu_t$$ …… (6)

Where,

i = lag identity

t= time

η_0 = Intercept

λ = Long run coefficient

ln= log form

Results and Discussion

Unit Root Test

The analysis of time series requires that the time series data are consistent; that means they have zero mean and a predefined variance (Gujarati and Porter 2012). If a time series incorporates nonstationary variables, one might end up with a spurious regression. This is a

type of regression whose findings have a high R^2 and substantial t-statistics, but the findings do not make much “economic sense.” Before applying the NARDL model, the time series characteristic of stationarity of all the variables was tested employing the widely applicable

unit root tests Augmented dicky fuller test. Table 1 displays the findings of the unit root test,

Table 1: Unit Root Test Results

Variables	Level	1st difference	Decision
LSOP	-3.867	-1.441***	I(1)
LREER	0.823**	-5.592	I(0)
TOT	-0.217	-5.722***	I(1)
FDI	-0.218	-5.722***	I(1)
LREMMIT	2.199	-4.587***	I(1)
LGEXP	3.852	-4.609***	I(1)
LFINDEV	1.442	-4.020**	I(1)

level, and first difference for all variables. The results of ADF show that LREER is stationary at the level and the rest of the variables are stationary at 1st difference. This means that all dependent and independent variables are a mix of stationary. Therefore, we can further proceed to the ARDL technique as it is considered effective to better handle the variables with different orders of integration. Therefore, NARDL for the nonlinear relationship.

a:(***) Significant at the 1; (**) Significant at the 5%; % (*) Significant at the 10%and (no) Not Significant

Bound Test

Table 2 provides the findings of the NARDL bound test. The bound test suggests the existence of variables of order I(1), and there is no variable with the order I(2) because if any variables exist with the order I(2) then the computed F-stat will become invalid in the model as proposed by Pesaran et al. (2001). Table 2 provides information about upper and lower limits at various levels of confidence intervals. Model of this study is based on 95% confidence interval for model selection where K represents number of regressor in the model. The F-stat value of our bound result is 7.43, which is greater than the upper bound value of 3.9 that as a result indicates a long-term cointegration among the variables.

Table 2: Bound Test

F-Bound Test		Null Hypothesis: No levels of relationship		
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
F-statistic	7.43	10%	1.92	2.89
k	7	5%	2.17	3.21
		2.50%	2.43	3.51
		1%	2.73	3.9

Sort-run Results

Table 3 represent the findings for short-term asymmetric effects of REER on Services sector output. The coefficient of REER_POS with positive changes is showing positive and significant signs. Whereas the REER_NEG with a negative sign shows negative but insignificant effects on the SOP in the short term. The 1 unit rise in the REER_POS resulted in the increase of the services sector by 0.266 units. However, a 1 unit rise in REER_NEG will cause an 0.154-unit decrease in the SOP. The other variables including FDI, TOT and GEXP, and REMITT have negative but insignificant effects on the services sector. FINDEV shows favorable and significant effect on the services sector in the short run. 1 unit rise in the FINDEV increases SOP by 0.073 units. After one lag period FDI, LREER_NEG, and GEXP become significant. The outcomes at the level shows that the 1 unit rise in FDI, and TOT will likely to decline SOP by 0.004 and 0.456 units respectively. Whereas 1 unit increase in government expenditure and remittances will decrease SOP by 0.33 and 0.013 units respectively. The ECM model's findings demonstrate that the ECM coefficient has a negative and significant value (-0.238). Since the variables are cointegrated, as can be shown from the example above, the ECM value in the long-term should be negative and significant in the results. According to this valuef ECM , annual deviation adjustments amount to around 23%. This demonstrates stability and a slow rate of adjustment. In other words, the brief deviation's correction to the long run time path proceeds slowly since the ECM coefficient is low. In any case, the endogenous variables in the ECM model are the elasticities that show the short-term impact on output in the services sector. The ECM value (-0.238) shows that the prior year's shocks generate disequilibrium in comparison to the current year's long-run equilibrium.

Table 3: Short-run Results of NARDL

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.551	0.969	1.600	0.125
LSOP(-1)*	-0.238	0.086	-2.746	0.012
LFINDEV(-1)	0.121	0.042	2.863	0.009
LREER_POS**	0.266	0.137	1.934	0.067
LREER_NEG(-1)	-0.154	0.059	-2.590	0.017
LGEXP(-1)	-0.072	0.016	-4.380	0.000
LREMITT(-1)	0.009	0.012	0.775	0447
LTOT(-1)	-0.373	0.326	-1.146	0.265
FDI(-1)	-0.010	0.003	-2.841	0.010
D(LSOP(-1))	-0.337	0.190	-1.774	0.091
D(LFINDEV)	0.073	0.032	2.274	0.034
D(LREER_NEG)	0.053	0.057	0.944	0.356
D(LREER_NEG(-1))	0.199	0.063	3.159	0.004
D(LGEXP)	-0.039	0.025	-1.527	0.142
D(LREMITT)	-0.013	0.015	-0.897	0.389
D(LTOT)	-0.456	0.288	-1.580	0.129
D(LTOT(-1))	0.755	0.281	2.688	0.014
D(FDI)	-0.004	0.003	-1.517	0.144
D(FDI(-1))	0.008	0.000	2.374	0.027
ECM(-1)*	-0.238	0.024	-9.678	0.000

Long-run Results

Table 4represent the NARDL long run findings. The findings of NARDL shows the positive effects of REER appreciation. According to results 1 unit rise in currency value led to 1.11 unit increase in services sector output. A stronger domestic currency helps enterprises to acquire more modern technology in order to enhance production and, hence, profit from expanding the importation of raw materials and machinery needed in the services sector. The ability to buy less expensive raw materials supports an increase in service production. These

outcomesfall together with those of Johnson et al. (2012). The opposite will happen in cases of devaluation (Gotur1985; Medhora1990).

The production of the services sector is negatively impacted by the depreciation of REER. According to our findings, a unit decrease in currency value is likely to decrease services output by 0.64 units. This is because the inputs used in the services industry are primarily high-tech yet imported. This indicates that as the value of the PAK rupee declines, the cost of the inputs would rise. Therefore, to pay their input costs, service sector manufacturers would raise domestic prices, which will put pressure on domestic demand. According to research, this decline in demand will negatively impact the output of the services industry as studied by (Agenor1991; Iyke and Ho 2017). Therefore, the Pakistani services industry will suffer as a result of the rupee's decline. This is what our findings indicate.

The production of the services sector is negatively impacted by FDI, per long-term outcomes. SOP is projected to fall by 0.04 units for every unit increase in FDI. Inadequate law and order, political unrest and instability, direct and indirect regulatory barriers, implied policy instability, underdeveloped infrastructure facilities, low levels of human capital, and a lack of transparency have all contributed to Pakistan's alluring foreign capital policy regime receiving less favorable reactions than it might have. Pakistan and other developing countries can therefore enhance the FCI environment by taking the appropriate actions, such as managing economic activity, increasing domestic service, developing port, road, railway, and telecommunications facilities, increasing trade policy transparency, increasing labor market flexibility, setting an appropriate regulatory framework, and establishing a tariff structure. Additionally, it calls for the introduction of alternative management practices, labor training, skill development, and technology advancement. It has been established that the recipient economy's regional circumstances have a significant impact on how FDI affects the performance of the services sector. These factors also appear to be a prerequisite for encouraging both domestic and foreign investment. Therefore, if transition economies want to update their physical capital stock, they should demand that the appropriate economic environment be created. Results from earlier discussions show that FDI does not accelerate the

services sector’s growth, the government makes it possible to both attract FDI and accelerate the development of the services sector.

As expected, FINDEV has a favorable impact on the contribution of the service sectors. A one-unit rise in financial development results in a 0.51-unit increase in SOP. The availability of funding is critical to the services business. As a result, policy makers are encouraged to increase financing to the services sector in order to highlight its share to economic growth (Tahir et al. 2021)

The output of the services sector is significantly impacted negatively by government spending. The findings indicate that a 1 unit rise in GEXP will result in a 0.30 unit decrease in the SOP. The results are consistent with those of Bergh & Henrekson (2011), Bergh (2007), and Sjoberg (2003) who discovered a weak and substantial negative connection between GEX and SOP. The usage of expenditure in non-development activities in developing nations with distortion and reduced investment can be a negative effect of GEXP on SOP (Zareen and Qayyum 2015). Moreover, the GEXP in defense and interest repayment is also the reason behind less expenditure in the services sector. According to (PES, 2021-22) the current GEXP for FY 20-21 was 6,346 billion rupees while only 792 billion rupees were consumed on development activities. Our results are also concurredwith the study of (Ayen 2014).

Our study's long-term findings indicate that trade openness has a negative and considerable impact on the production of the services sector. SOP decreased by 1.57 units for every unit rise in trade openness. According to research, trade openness primarily exhibits negative signals (Candelon et al. 2007; Saborowski 2009). This could be a result of the efficient tradeable sector being more accessible through reduced tariff and non-tariff barriers, which in turn drives down the cost of comparable tradeable goods and boosts consumption. The underlying assumptions of the well-known H-O model of international trade can also be used to explain this unanticipated effect of trade openness on service output. The H-O model states that while the scarcity sector suffers from the trade, some sectors gain factors associated with abundance. In contrast to the manufacturing and agricultural sectors, the services sector is less concentrated in developing nations like Pakistan. This may help to

explain why trade openness has a negative impact on it. Our findings concur with those studied by Tahir et al. (2019).

Remittances on the other hand shows positive and strong impact on the services sector output. Our findings highlight that a unit rise in the REMMIT likely to increase SOP by 0.04 units. Our findings are supported by the empirical literature. Various studies found the positive impact of REMMIT on SOP, for instance Lucas, 2005 and Glytsos, 2002.

Leon-Ledesma and Piracha (2004) explains that REMMIT has a positive effect on the output productivity of the services sector like our results. They argued that the SOP is influenced by by REMMIT through consumption and investment channels. Osili 2004 stated that growth in revenue of remittances increased the investment by 3%. The inflow of remittance raises the living standards, that as a result increase the demand and investment for the services sector (Mim and Ali, 2012). According to (Dustmann and Kirchamp, 2002) SOP is affected by remittance through saving.Findings by Woodruff and Zenteno (2001) show that 20% of remittances are used to finance productive, quickly expanding microenterprises. Our resultsare consistent with these studies.

Table 4: Long-run Results of NARDL

Variables	Coefficients	Std. Error	Pro.
LFINDEV	0.511	0.119	0.000
LREER_POS	1.119	0.413	0.013
LREER_NEG	-0.649	0.123	0.000
LGEXP	-0.303	0.124	0.024
LREMITT	0.041	0.061	0.509
LTOT	-1.570	1.209	0.209
FDI	-0.044	0.016	0.015
C	6.519	3.470	0.075
R-squared	0.76382		
Adjusted R-squared	0.67947		
S.E. of regression	0.004425		
Sum squared resid	0.000548		

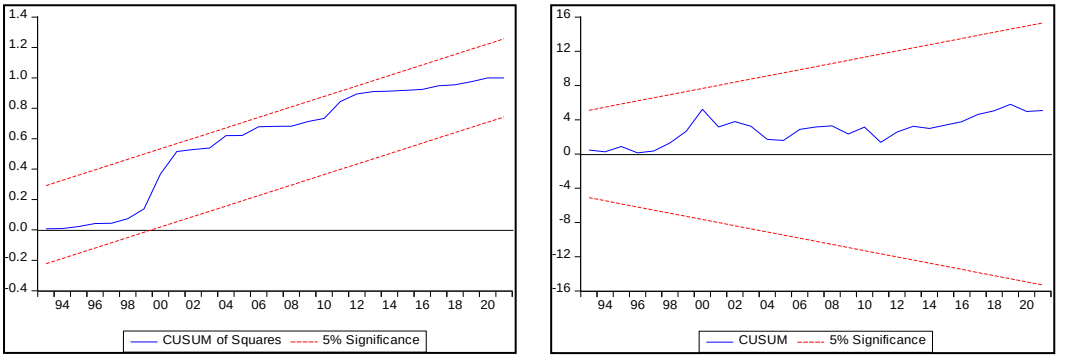
Stability Test

Brown et al.,(1975) initiallyintroduced CUSUM and CUSUMSQ test. The sum of recursive residuals is plotted in this test. The charts show two straight red lines with one blue line in

between them. The crucial linkages are represented by these red lines. We must reject all selected variables if the blue line crosses the red lines that mean our data is nonlinear. If the plotting of blue line remains with in the red lines, it indicates that data is linear.

the cumulative test determines whether the regression coefficient is changing unexpectedly, while the CUSUM test determines whether the coefficient of the variables is changing systematically or not (Bhatti et al. 2006). Figure 3 shows the CUSUM Square and CUSUM graphs. At a 5% level of significance, both plots are within the crucial lines, indicating that the model is stable. As a result, we must assume that the parameters are also stable because the blue line exists within the red line. CUSUM and CUSUM of squares are both within the crucial limits of 0.05%, indicating the model's structural integrity and overall quality of fit.

Figure 3: CUSUMSQ and CUSUM



Conclusion

In this study, the asymmetric effects of Pakistan's real effective exchange rate on the output of the services sector were examined. We used the annual time series data set for the years 1980 through 2021 for this purpose. The NARDL estimation method is used to examine the nonlinear relationship between REER and SOP. To prevent erroneous regression results, additional control variables (FDI, FINDEV, GEXP, TOT, and REMMIT) are also used. The NARDL data show that the REER has an asymmetric impact on the output of the services sector during variations. In the long run, the depreciation of real effective exchange rate has a

negative impact on theoutput of the servicewhile appreciation of REER is positively related to the services sector. The long-run data shows that 1 unit increase in REER appreciation (REER_POS), the services sector output increased by 1.11 units, whereas for 1 increase in REER depreciation (REER_NEG), the SOP falls by 0.64 units. The justification for the

beneficial effects of REER appreciation is when currency value is increased it resulted decline of prices for imported goods and the raw materials used as inputs in the services sector, and due to which the domestic cost of service sector production drops. On the other hand,the REER devaluation has a negative influence on SOP because the inputs utilized in the services industry are primarily high-tech and imported,and imports become more expensive because of the currency's decline, that forced domestic companies to increase their product prices. Due toincrease in price, domestic demand come under pressure, and overall demand decreased. The other controlled variables used in the model including FDI, TOT, and GOVEXP showsa negative impact on the services sector output whereas, FINDEV and REMMIT show positive relation with services sector output.

Policy recommendations

Long-term output in the services sector is found to be significantly influenced by the REER POS, REER NEG, FDI, FINDEV, GEXP, and TOT. While the SOP of Pakistan has a short-term relationship with REER POS and FINDEV. Therefore, based on the results of the investigation, the policy recommendation is that the government should try to prevent uncertain changes in the actual effective exchange rate. The production of the services sector has benefited more from the appreciation since it has apositive effect on the SOP. Therefore, to lessen the effect of depreciation on the productivity of the services, the government should work to raise the value of the rupee. Furthermore, due to significant imports, trade openness has a negative effect on the production of the services sector. Therefore, by subsidizing the services sector, providing financial support to exporters, and reducing imports, the government should help the services sector boost its exports. Export growth will contribute to accumulating foreign reserves.To enact our future services growth, it is important and relevant to boost the remittances and FDI to boost the production of services. Legislators should therefore encourage and facilitate to the extent possible the undisrupted flow of FDI and Remittances, as they contribute to stable economic development in Pakistan. The proper monitoring of investment and its expenditure can help in the growth of the services sector as well as overall

economic development. The productive incentives should be provided to the foreign investors, so they can enhance and reap their profit from the capital. The government should make visas and other travel facilities easier so more people can travel abroad to earn remittances.

Statements and Declarations

Ethics approval

This study follows all ethical practices of the institution.

Consent to participate

Not applicable.

Consent for publication

This is an original manuscript that has not been submitted to or is being considered for publication anywhere else.

Competing interests

The authors declare no competing interests.

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