



## Macroeconomic determinants of the real exchange rate in Pakistan

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### ARTICLE INFO

#### Article history:

Received 25 February 2023

Received in revised form

16 June 2023

Accepted 18 June 2023

#### Keywords:

Macroeconomic determinants

Real exchange rate

ARDL methodology

Long run determinants

### ABSTRACT

This research endeavors to comprehensively examine the macroeconomic determinants that influence the real exchange rate in Pakistan over an extended temporal horizon. By employing quarterly data spanning from the first quarter of 1980 to the fourth quarter of 2020, this study employs the autoregressive distributed lag (ARDL) methodology to discern both immediate and enduring determinants of the real exchange rate. The findings distinctly reveal that variables such as money supply, trade openness, workers' remittances, and productivity collectively constitute the long-term determinants of the real exchange rate in the context of Pakistan. Specifically, an augmentation in money supply and an escalated level of economic openness manifestly contribute to the reduction of the real exchange rate, whereas an inflow of remittances and heightened productivity exhibit the propensity to elevate the real exchange rate over an extended duration. This exploration underscores the imperative for proactive engagement by the nation's monetary authorities within the foreign exchange market, with the overarching objective of preserving the currency's value at a state of equilibrium and, thereby, ensuring the holistic integrity of the economy.

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### 1. Introduction

The exchange rate stands as a pivotal determinant of economic growth within a nation. However, it is imperative to delineate the discernible disparity between nominal and real exchange rates. The nominal exchange rate serves as a quantifier of a nation's currency potency in the foreign exchange market, devoid of the consideration of the price variance prevailing between the participating nations. Conversely, the real exchange rate engages in a comprehensive assessment, capturing the proportional relationship between the purchasing power of currencies while concurrently integrating the prevailing price levels. Notably, the real exchange rate occupies a central locus in the purview of policymakers due to its intrinsic adjustment for inflationary dynamics (Seraj and Coskuner, 2021).

In the contemporary milieu of globalization, the real exchange rate garners heightened attention,

assuming a pivotal role within the sphere of international trade. Beyond a mere quantitative measure, the real exchange rate assumes the mantle of a pivotal determinant, shedding light on the economic competitiveness of a nation. This elucidation assumes distinct pertinence in unraveling the intricate dynamics of trade inflows and outflows within the international market.

The real exchange rate emerges as a dynamic macroeconomic facet, imbued with the capacity to reverberate across various dimensions of an economy's framework. This influence encompasses the equilibrium of trade, the contours of capital movements, the amplitude of investment endeavors, and the overarching trajectory of economic growth (Raza and Afshan, 2017). The imperative nature of the real exchange rate, attributed to its functions in allocation and enhancing competitiveness, underscores the International Monetary Fund's advocacy for developing and emerging economies to maintain their actual real effective exchange rates proximate to the equilibrium real exchange rate. Consequently, the exchange rate assumes a pivotal locus of concern for monetary authorities in both developed and developing nations. Sustaining the exchange rate at the equilibrium threshold serves as a strategic mechanism to invigorate economic growth. To illustrate, in the context of developing countries, an intentional overvaluation of the

exchange rate can yield a substantial enhancement in export activities. This augmentation in exports not only contributes to the accumulation of foreign reserves within an economy but also fortifies its overall resilience and vitality (Bhat et al., 2017). The influence of the exchange rate extends to the profitability of business endeavors, as a steady exchange rate engenders heightened foreign direct investment within an economy, attributed to the reduced risk and diminished uncertainty associated with economies characterized by exchange rate stability. A stable exchange rate not only nurtures investment prospects but also cultivates a propitious international economic milieu, thereby fostering the augmentation of a nation's exports.

In recent years, the global landscape has been confronted with an array of economic challenges, including escalating inflation across not only oil prices but also food prices. This inflationary pressure has wielded a direct impact on the prevailing interest rates within economies, consequently instigating oscillations in the exchange rate. Raza and Afshan (2017) conducted a study that yielded the finding that inflation exerts a substantial and affirmative influence on the exchange rate. In alignment with the trajectories observed in numerous developing economies, the Pakistani rupee has displayed a recurrent and descending pattern over the past few decades. This, in turn, engendered a fluctuating trajectory characterized by downward movement. This pattern of exchange rate fluctuation has engendered a confluence of consequences, rendering Pakistan's exports relatively costlier and its imports comparatively more economical within the global market. As a consequence, this has culminated in the exacerbation of the trade balance's deterioration, as established by Saeed et al. (2012). In light of these dynamics, it is incumbent upon policymakers to proactively manage the exchange rate with precision, aimed at sustaining the competitiveness of exports in the international arena and ameliorating the precarious state of the trade balance.

In the pursuit of upholding the substantive import of the exchange rate and ensuring its proximity to the equilibrium level, it becomes essential to acquire a comprehensive comprehension of the determinants or factors that exert an influence on the real exchange rate. In accordance with prevailing paradigms of exchange rate analysis, an array of macroeconomic variables are posited as instrumental in shaping the trajectory of the exchange rate. However, the realm of real exchange rate determinants, particularly within the context of Pakistan, lacks a robust consensus. This lacuna underscores the exigency for a cohesive framework that delineates the precise determinants of the real exchange rate pertinent to Pakistan.

In this endeavor, the theoretical constructs put forth by Elbadawi (1994), which expound upon the fundamental determinants of the real exchange rate, are employed as the conceptual foundation. This framework is aptly applied to the Pakistani context,

with the intent of deciphering the multifarious factors that exert influence over the real exchange rate within the nation. This endeavor is poised to facilitate the effective management of the exchange rate, thereby engendering equilibrium, and ultimately bolstering the stability of the economic landscape.

Literature had shown a number of factors that determines the exchange rate in Pakistan. Hyder and Mahboob (2006) showed trade openness, government consumption, capital inflows, remittances, terms of trade and total factor productivity affect the exchange rate in Pakistan. Hussain (2009) found productivity of tradable, terms of trade, government consumption, and capital inflows as determinants of the exchange rate in Pakistan. Saeed et al. (2012) showed debt, stock of money, political instability, and foreign reserve balance as determinants. Bashir and Luqman (2014) found terms of trade, price level, trade restrictions, and workers' remittances as determinants. Bhat et al. (2017) found foreign debt, domestic interest rate, real income, and money supply as factors affecting the exchange rate in Pakistan. Raza and Afshan (2017) showed terms of trade, trade openness, economic growth, money supply, and inflation rate as determinants of the exchange rate in Pakistan.

In the pursuit of enhancing the economic trajectory of Pakistan, it becomes imperative to meticulously manage the exchange rate, ensuring its alignment with the equilibrium level. In service of this objective, a thorough exploration of the determinants influencing the real exchange rate, as well as the sources catalyzing its fluctuations, emerges as a critical imperative. This study is thus motivated by the intention to comprehensively examine the intricate macroeconomic factors that underpin the dynamics of the real exchange rate in Pakistan, both in the immediate and protracted time horizons. The subsequent delineation of this study is structured in a systematic fashion. The second section delves into an exposition of pertinent antecedent scholarship, providing an intellectual lineage that informs the present investigation. Section three is dedicated to elucidating the employed methodology and the corpus of data instrumental in facilitating the study's analytical pursuits. The ensuing fourth section entails a comprehensive analysis of the derived results, offering a holistic understanding of the intricate determinants at play. The culmination of this endeavor is encapsulated in section five, wherein conclusions are drawn and cogent policy recommendations are proffered, thereby contributing to a deeper comprehension of the mechanisms influencing the real exchange rate and engendering a potential course of action for policy practitioners.

## 2. Literature review

Qayyum et al. (2004) investigated the exchange rate misalignment in Pakistan from 1982Q1 to

2002Q4 using purchasing power parity approach. Results revealed that exchange rate and prices were strongly co-integrated and Pakistani currency was undervalued throughout the sample period. [Dufrenot and Yehoue \(2005\)](#) analyzed the behavior of real exchange rates for 64 developing countries from 1979 to 2002 using panel co-integration and common factor analysis. Results indicated that for low-income countries productivity, terms of trade, and openness were strong common factors affecting exchange rate, while middle-income countries have less common factors in determining exchange rate. [Hyder and Mahboob \(2006\)](#) estimated the equilibrium real effective exchange rate and exchange rate misalignment for Pakistan from 1978 to 2005. Results indicated that trade openness, government consumption, and capital inflows depreciated the exchange rate, while the increase in remittances and the improvement in terms of trade and total factor productivity appreciated the exchange rate in Pakistan.

[Kemme and Roy \(2006\)](#) undertook an empirical investigation, utilizing monthly data spanning from January 1995 to December 2001, to compute equilibrium exchange rate misalignments for both Poland and Russia. Their analytical approach entailed the application of the Dynamic Ordinary Least Squares (DOLS) methodology. The findings illuminated a positive nexus between the productivity of tradable goods and exchange rate appreciation, alongside the discernible phenomenon of high inflation rates engendering overvaluation of exchange rates. Their study ventured into a comparative analysis, revealing a higher degree of exchange rate flexibility in Poland relative to Russia.

In a similar vein, [Tensay \(2006\)](#) embarked on a meticulous inquiry, employing the DOLS technique, to gauge the extent of exchange rate misalignment in Ethiopia within the temporal span from 1970 to 2003. The outcomes underscored the influence of diverse determinants on exchange rate dynamics. Specifically, the terms of trade and external aid were associated with a negative impact on the exchange rate, while the commercial policy stance and the investment-to-GDP ratio exhibited a favorable influence on the exchange rate trajectory in Ethiopia.

Delving into the intricacies of the equilibrium exchange rate and its misalignment, [Hussain \(2009\)](#) conducted an extensive investigation encompassing the years 1960 to 2007, within the context of Pakistan. The study encompassed a wide array of variables and their interactions. The longitudinal analysis illuminated significant insights. Notably, the long-term trends indicated that the productivity of tradable goods and terms of trade exhibited a propensity to devalue the real exchange rate, while government consumption and capital inflows demonstrated a proclivity to appreciate the exchange rate.

[Elhendawy \(2012\)](#) studied exchange rate misalignment in Saudi Arabia from 1980 to 2009. Results indicated that an increase in net foreign assets and government expenditure depreciated the

real exchange rate, while GDP growth and gross capital formation appreciated the exchange rate in the long run. [Saeed et al. \(2012\)](#) analyzed the determinants of exchange rates in Pakistan from January 1982 to April 2010 using the autoregressive distributed lag (ARDL) approach. Results showed that debt and stock of money showed a positive and significant impact on the exchange rate, while political instability and foreign reserve balance had a negative impact on the exchange rate in Pakistan. [Gan et al. \(2013\)](#) estimated the long run exchange rate and its misalignment for China using quarterly data from 1999 to 2007. Results showed money supply, productivity, government spending, and openness had a significant impact in determining the RMB, while the actual exchange rate was quickly adjusted towards its long run equilibrium level.

[Kia \(2013\)](#) studied the determinants of real exchange rates in Canada from 1970 to 2010. Findings showed that the interest rate, money supply, commodity price, and US debt had a negative and significant impact on the exchange rate in the short run, while shocks due to money supply and interest rate are permanent. [Bashir and Luqman \(2014\)](#) studied the determinants of real exchange rates in Pakistan using time series data from 1973 to 2013. Results showed that terms of trade and price level depreciated the real exchange rate, while trade restrictions and workers' remittances appreciated the real exchange rate of Pakistan in the long run. [Tariq et al. \(2016\)](#) studied domestic and foreign drivers of exchange rates in Pakistan using data from 1973 to 2008. Results showed that both domestic and foreign variables i.e. domestic inflation, domestic interest rate, trade balance, remittances, US interest rate, and US inflation influence the real exchange rate in Pakistan.

[Yue et al. \(2016\)](#) estimated the equilibrium RMB exchange rate and its misalignment by using quarterly data from 1994 to 2012. Results showed that the RMB exchange rate rose 45 percent from 1994 to 2012 due to trade policy, official intervention, and relative technological progress. [Bhat et al. \(2017\)](#) studied the determinants of real exchange rate movements in South Asian countries using panel data from 1998 to 2012. The results of FMOLS suggested that foreign debt, domestic interest rate, and real income had a significant positive impact, while money supply had a negative and significant impact on the exchange rate. [Toulaboe \(2017\)](#) investigated the existence and size of currency misalignments in seven developing Asian countries from 2000q1 to 2013q4. Results showed that long run coefficients of all fundamental variables were statistically significant except government consumption which was negative for China, Malaysia, and Japan.

[Raza and Afshan \(2017\)](#) studied the determinants of exchange rates in Pakistan by using the time series data from 1972 to 2013. Results showed a significant negative association of exchange rates with terms of trade, trade openness, and economic growth, while money supply and inflation rates had a

positive and significant effect on exchange rates in the long run. [Comunale \(2019\)](#) studied the role of economic fundamentals in explaining long run movements in the real effective exchange rate and its misalignments in the EU from 1994 to 2012. Results showed that the coefficients of GDP, terms of trade, openness, and net foreign assets were extremely different across groups and the transfer theory did not always hold.

In conclusion, the existing body of literature furnishes substantial evidence regarding the array of factors that exert influence on the real exchange rate in Pakistan and analogous developing nations. Notably, this study contributes a novel dimension by employing the most contemporary dataset from Pakistan. It endeavors to discern the determinants of both long-run and short-run dynamics of the real exchange rate, utilizing the ARDL approach within the framework of an equilibrium real exchange rate model.

### 3. Methodology and data

The study follows the model of [Elbadawi \(1994\)](#) and includes a set of fundamental variables that determine the real equilibrium exchange rate. These determinants include the money supply, government consumption expenditure, productivity, trade openness, remittances, terms of trade, and FDI. The study utilizes the following model for estimation:

$$LREER = f(LMS, LPROD, LTO, LREM, LTOT, LGCEXP, LFDI) \quad (1)$$

where, LREER is the real effective exchange rate, LMS is money supply, LPROD is productivity, LTO is trade openness, LREM is remittances, LTOT is terms of trade, LGCEXP is government consumption expenditure and LFDI is foreign direct investment. All the variables are in log form.

The study uses time series data and utilizes Augmented Dickey Fuller (ADF) and Phillips Perron (PP) unit root tests ([Dickey and Fuller, 1981](#); [Phillips and Perron, 1988](#)) to avoid the problem of stationarity. After stationarity tests, the co-integration between variables is checked, other methods required the variables to have the same order of integration ([Engle and Granger, 1987](#); [Johansen and Juselius, 1990](#)) methods required the variables to have the same order of integration. However, [Pesaran et al. \(2001\)](#) ARDL model is

applicable to variables having mixed order of integration. The specification of the ARDL model is as follows:

$$\Delta Y_t = \delta_0 + \sum_{i=1}^k \Delta \alpha_i Y_{t-1} + \sum_{i=1}^k \Delta \beta_i X_{t-i} + \varphi_1 Y_{t-1} + \varphi_2 X_{t-1} + \varepsilon_t \quad (2)$$

where, Y is the dependent variable, X represents the explanatory variable,  $\varphi_1$  and  $\varphi_2$  are the long run coefficients, while  $\alpha$  and  $\beta$  represent the short run dynamics.

The investigation is conducted employing a quarterly time series dataset spanning the period from the first quarter of 1980 to the fourth quarter of 2020 in Pakistan. The quantification of the exchange rate is accomplished through the utilization of the real effective exchange rate index, sourced from the "International Financial Statistics" issued by the IMF. The measurement of money supply entails calculating the ratio of broad money in relation to the GDP. Trade openness is gauged as the proportion of total trade vis-à-vis GDP. Government consumption expenditure is ascertained through the ratio of general government final consumption expenditures in proportion to the GDP. FDI is computed as the ratio of net capital inflows relative to the GDP. The measurement of productivity encompasses the real GDP per capita. Remittances are represented by the ratio of workers' remittances in percentage terms with respect to the GDP, and these data are sourced from the "World Development Indicators" disseminated by the World Bank. The terms of trade are quantified by calculating the ratio of the export value index to the import value index, extracted from the "Handbook of Statistics" published by the State Bank of Pakistan. It should be noted that while the real effective exchange rate data is available on a quarterly basis, the remaining variables are annual, and their conversion into quarterly frequency is carried out utilizing the Denton method ([Denton, 1971](#)).

### 4. Results

The results of ADF and PP unit root tests in [Table 1](#) show that exchange rate, productivity, remittances, FDI, and government consumption expenditure are integrated into order one, while money supply, terms of trade, and trade openness are integrated into order zero.

**Table 1:** Results of ADF and PP unit root test

Variables	Augmented Dickey Fuller (ADF)		Phillips-Perron (PP)		Order of integration	
	At level	At 1 <sup>st</sup> difference	At level	At 1 <sup>st</sup> difference	ADF	PP
LREER	-1.8974	-9.7552***	-1.8412	-9.7420***	I(1)	I(1)
LGCEXP	-1.8710	-2.7200***	-1.4548	-4.0951***	I(1)	I(1)
LTOT	-1.9571**	-	-1.3007	-4.3302***	I(1)	I(1)
LTO	-3.1700**	-	-3.0989**	-	I(0)	I(0)
LMS	-3.4187**	-	0.6065	-4.4257***	I(0)	I(1)
LPROD	-0.2792	-3.7901***	0.6288	-3.9563***	I(1)	I(1)
LREM	-1.9619	-4.5452***	-1.5586	-4.5564***	I(1)	I(1)
LFDI	-2.4771	-4.7310***	-1.9695	-4.9011***	I(1)	I(1)

\*\*\*, \*\*, and \* show significance at 1%, 5%, and 10% level respectively

The study uses a general to specific approach to obtain determinants of real exchange rate in Pakistan. For that purpose, four models are estimated in which insignificant variables are

removed from the model one by one. The results of the ARDL bounds test are reported in Table 2 and long run dynamics are reported in Panel A of Table 3.

**Table 2: Results of bounds test**

Dependent variable: LREER	F-statistics	1 percent critical values bound test		Co-integration exist
		I(0)	I(1)	
Model-I $F_{(LREER LMS,LPROD,LTOT,LTOT,LGCEXP,LREM,LFDI)}$ (1, 0, 0, 1, 1, 0, 0, 0)*	3.9615	2.73	3.9	Yes
Model-II $F_{(LREER LMS,LPROD,LTOT,LTOT,LGCEXP,LREM)}$ (1, 0, 0, 1, 1, 0, 0)*	4.3745	2.88	3.99	Yes
Model-III $F_{(LREER LMS,LPROD,LTOT,LTOT,LREM)}$ (1, 0, 0, 1, 1, 0)*	4.9606	3.06	4.15	Yes
Model-IV $F_{(LREER LMS,LPROD,LTOT,LREM)}$ (1, 0, 0, 1, 0)*	5.0657	3.29	4.37	Yes

\*: The model is not suffering from serial correlation, heteroscedasticity, and specification error

Model-I comprises all the variables outlined in accordance with the theoretical framework expounded in the preceding section. The outcome of the bounds test for Model-I indicates the existence of a long-run relationship among the variables, substantiated by both the lower and upper bounds falling beneath the threshold of the F-statistics. The protracted temporal dynamics of Model-I reveal that money supply and trade openness exert a negative and substantial influence on the real exchange rate, whereas productivity and remittances exhibit a positive and significant impact. In contrast, terms of trade, government consumption expenditures, and

FDI exhibit insubstantial effects on the real exchange rate. Consequently, FDI is excluded from Model-II. The outcome of the bounds test for Model-II reaffirms the presence of a long-run relationship among the variables. The long-run coefficients in Model-II ascertain that money supply, productivity, trade openness, and remittances remain significant determinants of the real exchange rate, bearing consistent signs with those observed in the previous model. However, terms of trade and government consumption expenditure fail to establish statistically significant correlations with the real exchange rate.

**Table 3: Long run and short run dynamics of determinants of real exchange rate**

Variables	Model-I	Model-II	Model-III	Model-IV
<b>Panel A: Long run dynamics</b>				
LMS	-0.8492* (0.4383)	-0.8450* (0.4282)	-0.7505** (0.3730)	-0.6639** (0.2699)
LPROD	5.4424* (3.2036)	5.4050* (3.1002)	4.7222* (2.6901)	4.1475** (1.8804)
LTO	-1.6453** (0.7642)	-1.6448** (0.7619)	-1.5699** (0.7307)	-1.4729** (0.5876)
LREM	0.2818** (0.1158)	0.2826** (0.1147)	0.2729** (0.1128)	0.2385** (0.0964)
LTOT	0.3018 (0.4464)	0.2937 (0.4137)	0.2794 (0.4108)	----
LGCEXP	0.1874 (0.3022)	0.1843 (0.2948)	----	----
LFDI	-0.0046 (0.0889)	----	----	----
C	-46.2261 (30.3572)	-45.8507 (29.2696)	-39.7936 (25.7255)	-34.4668* (17.9745)
<b>Panel B: Short run dynamics</b>				
ECT(-1)	-0.0604*** (0.0099)	-0.0604*** (0.0099)	-0.0599*** (0.0099)	-0.0608*** (0.0108)

\*\*\*, \*\*, and \* show significance at 1%, 5%, and 10% level respectively

The findings from the long-term dynamics analysis of Model-IV reveal that money supply and trade openness exert a substantial and adverse effect on the real exchange rate in Pakistan. Conversely, productivity and remittances exhibit a positive and noteworthy influence on the real exchange rate. A larger money supply corresponds to reduced interest rates, leading to a depreciation in the value of the currency and, consequently, an elevation in the exchange rate. The negative association is confirmed by Gan et al. (2013), Kia (2013), and Bhat

et al. (2017). The negative sign of trade openness implies that as trade restrictions are reduced or the degree of openness is increased, domestic prices of importables fall which leads to high demand for foreign currency than local currency so, the real exchange rate is depreciated. The negative association between trade openness and the real exchange rate is in line with the findings of Dufrénot and Yehoue (2005), Gan et al. (2013), and Raza and Afshan (2017). High productivity means the economy is growing and leads toward a stronger

currency which makes the exchange rate increase. The positive association between productivity and the real exchange rate is supported by the findings of Dufrenot and Yehoue (2005), Elhendawy (2012), and Gan et al. (2013). The positive sign of workers' remittances implies that remittances come in foreign currency in Pakistan therefore as remittances increase the supply of foreign currency also increases relative to its demand which leads to an increase in the exchange rate. The positive sign of remittances is in line with the findings of Hyder and Mahboob (2006) and Bashir and Luqman (2014).

Short run dynamics of all the models are presented in panel B of Table 3. The value of ECT for all the models is negative and significant which shows the speed of adjustment towards long-run equilibrium and the negative sign shows convergence in the short run.

Table 4 presents the outcomes of diagnostic examinations. The outcomes of the Breusch Godfrey LM test, Breusch-Pagan-Godfrey test, and the Ramsey RESET test collectively indicate the absence of serial correlation, heteroscedasticity, and model misspecification in any of the models.

**Table 4:** Results of diagnostic tests

Models	Test	Statistics(P value)	Null hypothesis
Model-I* F <sub>(LREER LMS,LPROD,LTO,LTOT,LGCEXP,LREM,LFDI)</sub>	Breusch Godfrey serial correlation LM test	1.7852 (0.1528)	No serial correlation
	Heteroscedasticity test: Breusch-Pagan-Godfrey	1.4448 (0.1667)	No heteroscedasticity
	Ramsay RESET test	3.9956 (0.1476)	No misspecification
	Breusch Godfrey serial correlation LM test	1.7856 (0.1527)	No serial correlation
Model-II* F <sub>(LREER LMS,LPROD,LTO,LTOT,LGCEXP,LREM)</sub>	Heteroscedasticity test: Breusch-Pagan-Godfrey	1.4633 (0.1671)	No heteroscedasticity
	Ramsay RESET test	2.8838 (0.1592)	No misspecification
	Breusch Godfrey serial correlation LM test	1.7960 (0.1507)	No serial correlation
	Heteroscedasticity test: Breusch-Pagan-Godfrey	1.6043 (0.1285)	No heteroscedasticity
Model-III* F <sub>(LREER LMS,LPROD,LTO,LTOT,LREM)</sub>	Ramsay RESET test	0.1514 (0.6977)	No misspecification
	Breusch Godfrey serial correlation LM test	2.2152 (0.1129)	No serial correlation
	Heteroscedasticity test: Breusch-Pagan-Godfrey	1.9444 (0.1775)	No heteroscedasticity
	Ramsay RESET test	0.4521 (0.5024)	No misspecification
Model-IV* F <sub>(LREER LMS,LPROD,LTO,LREM)</sub>			

\*: The model is not suffering from serial correlation, heteroscedasticity, and specification error

## 5. Conclusion

The real exchange rate holds considerable significance as a gauge of an economy's competitiveness. To uphold the real exchange rate at an equilibrium level, comprehending its underlying determinants is imperative. This study employs a general-to-specific approach to delve into the macroeconomic determinants of real exchange rate within Pakistan's context. Leveraging quarterly data spanning from 1980Q1 to 2020Q4 for Pakistan, the study employs an ARDL methodology to scrutinize both long-run and short-run relationships. The model incorporates various variables as potential determinants of the real effective exchange rate, including money supply, productivity, trade openness, workers' remittances, government consumption expenditure, terms of trade, and FDI. The ARDL outcomes lead to the gradual elimination of insignificant variables from the model. Ultimately, Model-IV reveals the long-run determinants of the real exchange rate in Pakistan: money supply, productivity, trade openness, and workers' remittances. The findings underscore that money supply and trade openness exert negative and significant influences on the real exchange rate, whereas productivity and workers' remittances exhibit positive and significant impacts on the real

exchange rate within Pakistan's long-run framework. The management of the money supply emerges as a pivotal consideration, as elevated money supply diminishes currency value, necessitating prudent decisions in adjusting the money supply to uphold the real exchange rate. Furthermore, heightened trade openness augments the price of importables, leading to a decrease in the real exchange rate. The influx of remittances contributes to bolstering foreign reserves and enhancing the real exchange rate. Additionally, an expanding GDP augments the real exchange rate positively. Sustaining the real exchange rate at an equilibrium level holds the key to maintaining economic stability. To achieve this, diligent control of the determinants of the real exchange rate is paramount. Monetary authorities must intervene in the foreign exchange market to ensure the currency's value remains aligned with the equilibrium level, thereby safeguarding the overall health of the economy.

## Compliance with ethical standards

## Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## References

- Bashir F and Luqman A (2014). Long run determinants of real exchange rate: An econometric analysis from Pakistan. *Pakistan Journal of Commerce and Social Sciences*, 8(2): 471-484.
- Bhat KU, Hussain CM, and Shah AZ (2017). Determinants of real exchange rate movements in South Asian countries: An Empirical evidence. *Pakistan Business Review*, 18(4): 1048-1062.
- Comunale M (2019). Long-run determinants and misalignments of the real effective exchange rate in the EU. *Scottish Journal of Political Economy*, 66(5): 649-672. <https://doi.org/10.1111/sjpe.12206>
- Denton FT (1971). Adjustment of monthly or quarterly series to annual totals: An approach based on quadratic minimization. *Journal of the American Statistical Association*, 66(333): 99-102. <https://doi.org/10.1080/01621459.1971.10482227>
- Dickey D and Fuller W (1981). The likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica*, 49(4): 1057-1072. <https://doi.org/10.2307/1912517>
- Dufrénot G and Yehoue EB (2005). Real exchange rate misalignment: A panel co-integration and common factor analysis. IMF Working Paper No. 05/164, International Monetary Fund, Washington, USA. <https://doi.org/10.5089/9781451861839.001>
- Elbadawi IA (1994). Estimating long-run equilibrium real exchange rates. In: Williamson J (Ed.), *Estimating equilibrium exchange rates*: 99-133. Peterson Institute for International Economics, Washington, USA.
- Elhendawy EO (2012). Real exchange rate misalignment in Saudi Arabia. *International Journal of Economics and Finance*, 4(12): 98-104. <https://doi.org/10.5539/ijef.v4n12p98>
- Engle RF and Granger CW (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica: Journal of the Econometric Society*, 55(2): 251-276. <https://doi.org/10.2307/1913236>
- Gan C, Ward B, Ting ST, and Cohen DA (2013). An empirical analysis of China's equilibrium exchange rate: A co-integration approach. *Journal of Asian Economics*, 29: 33-44. <https://doi.org/10.1016/j.asieco.2013.08.005>
- Hussain S (2009). Misalignment of real exchange rate with its equilibrium path: Case of Pakistan. *SBP Research Bulletin*, 5(2): 1-14.
- Hyder Z and Mahboob A (2006). Equilibrium real effective exchange rate and exchange rate misalignment in Pakistan. *SBP Research Bulletin*, 2(1): 237-263.
- Johansen S and Juselius K (1990). Maximum likelihood estimation and inference on cointegration--with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, 52(2): 169-210. <https://doi.org/10.1111/j.1468-0084.1990.mp52002003.x>
- Kemmer DM and Roy S (2006). Real exchange rate misalignment: Prelude to crisis? *Economic Systems*, 30(3): 207-230. <https://doi.org/10.1016/j.ecosys.2006.02.001>
- Kia A (2013). Determinants of the real exchange rate in a small open economy: Evidence from Canada. *Journal of International Financial Markets, Institutions and Money*, 23: 163-178. <https://doi.org/10.1016/j.intfin.2012.09.001>
- Pesaran HM, Shin Y, and Smith RJ (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3): 289-326. <https://doi.org/10.1002/jae.616>
- Phillips PC and Perron P (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2): 335-346. <https://doi.org/10.1093/biomet/75.2.335>
- Qayyum A, Khan MA, Khair-u-Zaman, and Saqib OF (2004). Exchange rate misalignment in Pakistan: Evidence from purchasing power parity theory. *The Pakistan Development Review*, 43(4): 721-735. <https://doi.org/10.30541/v43i4Ipp.721-735>
- Raza SA and Afshan S (2017). Determinants of exchange rate in Pakistan: Revisited with structural break testing. *Global Business Review*, 18(4): 825-848. <https://doi.org/10.1177/0972150917692210>
- Saeed A, Awan RU, Sial MH, and Sher F (2012). An econometric analysis of determinants of exchange rate in Pakistan. *International Journal of Business and Social Science*, 3(6): 184-196.
- Seraj M and Coskuner C (2021). Real exchange rate effect on economic growth: comparison of fundamental equilibrium exchange rate and Balassa-Samuelson based Rodrik approach. *Journal of Applied Economics*, 24(1): 541-554. <https://doi.org/10.1080/15140326.2021.1977083>
- Tariq M, Iqbal J, Jan S, and Malik KZ (2016). Determinants of the real exchange rate: Evidence from Pakistan economy. *Journal of Applied Environmental and Biological Sciences*, 6(4S): 175-190.
- Tensay TM (2006). Measuring the real exchange rate misalignment of Ethiopia: A dynamic OLS approach. *Ethiopian Journal of Economics*, 15(2): 29-47. <https://doi.org/10.4314/eje.v15i2.39820>
- Toulaboe D (2017). Real exchange rate misalignment of Asian currencies. *Asian-Pacific Economic Literature*, 31(1): 39-52. <https://doi.org/10.1111/apel.12173>
- Yue LH, Qiang J, and Kai TY (2016). Determination of renminbi equilibrium exchange rate, misalignment, and official intervention. *Emerging Markets Finance and Trade*, 52(2): 420-433. <https://doi.org/10.1080/1540496X.2016.1110448>