RESEARCH

Uncovered interest rate parity phenomenon and determinants of domestic interest rates: an analysis of Pakistan and China economies

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Abstract

The core objective of this article is to explore the viability of uncovered interest parity and to reconnoiter major determinants of domestic interest rates of the Pakistan and China economies. It is imperative to study the interest rate parity that assistances to comprehend that exactly how exchange rate and domestic interest rate influence foreign interest rate of two economies in emerging trends in international trade. The World Development Indicators is main source of data gathering, and it ranges from 1980 to 2023 for the analysis of both models. This study considers two models, Engle–Granger causality has been applied in Model 1, to analyze the uncovered interest parity, and findings indicate that the exchange rate of each country has no effect on the interest rate of the other country. However, Model 2 investigates the main determinants of domestic interest rate and their long-run associations for Pakistan and China. To capture the long-run association, ARDL estimation technique has been deployed, and findings show the long-run relations and co-integration among the policy variables of both countries. In Pakistan, consumer price index and exchange rate hold positive linking with the domestic interest rate; however, output level is adversely correlated. The error correction term is 91%, confirming the rapidity of equilibrium adjustment when a shock occurs. Regarding the Chinese economy, consumer price index and exchange rate have a negative impact on China domestic interest rate. The results of the error correction model indicate an 80% speed of convergence in the long run. This study suggests that improvement in productivity and exchange rate may assist both economies to experience steady exchange rate and interest rate.

Keywords Interest rate, Economic, Exchange rate, Pakistan, China

Introduction

International trade has been a primary avenue for promoting long-term economic growth. The viable trajectory for economic growth relies on the cross-country volume of trade. The uncovered interest rate parity has a profound implication in international finance and unfolds the dynamics of exchange rate and domestic interest rate in foreign exchange market. It explains the differential in interest rates of two economies which is theoretically equal to the anticipated change I the exchange rate between their respective currencies. The real exchange rate is primarily indomitable through the net exports. The interest rate parity based of the main assumption of rationality that investors intends to maximize the profit.

Interestingly, it asserts that when the projected transformations in exchange rate are adjusted, investor receives same rate of return when investing in domestic and foreign assets. The stability in exchange rate proposes an increase in the specialized products either industrial or agricultural depending upon the comparative advantage of a specific economy to earn foreign exchange earnings. Evcim and Yesilyurt [6] found that there is space for

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interactions among the countries, and the spillover effect of the technology is profound.

A cross-border trade contributed magnificently in Gross Domestic Product. International trade proved to be a continuous source of marinating international reserves to a desirable level.

The countries, which failed to emerge as a competitive, experienced serious exchange rate issues. In reality, developing countries witness serious issues in regard of trade deficits which further worsen the exchange rate stability. Since a long time, the expansion in globalization, together with economic connectivity between Pakistan and China, has helped the Pakistani economy to see a major increase in export volume [13].

It is important to note here that the major exports of Pakistan to China markets are textile, apparel, cereal, leather, sugar, mineral fuel, beverages, salt, and fishery foodstuffs whereas main broad category of imports of China to Pakistan are food, consumer durables, raw material, and Telecom. Pakistan exported 2.2% to China in 2002 whereas its exports share amounted to 11% in 2021. Along with the bilateral trade agreements, Pakistan is also engaged with China through other commercial contracts. On the other hand, a significant trend in China's exports to Pakistan can be observed. China's export share to Pakistan is reported to be 14% in 2002, and now export share of China has surged to 28% [24]. China exported goods to Pakistan wroth of $24.24 billion dollars in 2021 whereas it was recorded $4.2 billion in 2006. China export volume traded to Pakistan was comparatively higher than the imports from Pakistan. On the other side, domestic interest rate holds a significance in accelerating the available credit for the investment requirement of the country. All countries attempt to maintain trade balance through investment channel. Investing either in export oriented or import substitution industries assist them to secure handsome volume of foreign exchange revenues.

Interestingly, interest rate and exchange rate also interconnected while dealing with cross-border trade. This relationship offers a foremost role in the economic cooperation among the countries for a sustainable development process integration of money and capital market within the nations encourages streams of the financial inflows. The magnitude of lending and borrowing across the countries is driven by the major factors of interest rate and exchange rate. Classical economic theory explains that lower country's interest rate results financial capital outflows in short term which further causes deficits in the balance of payment. Such situation can be handled appropriately through depreciating the currency of a country to increase the exports. The foreign exchange earnings will accelerate the international reserves conditions of the country [1].

Another theory known as the, basic transfer theory, also emphasis that when the country's interest rate is lesser than change of growth in the foreign borrowing then country will gain foreign exchange [3]. This paper is an effort to look at the bond within the interest rate and exchange rate of Pakistan and China by considering two models. First model focuses on the relations of interest rate of Pakistan and Exchange rate of China, and interest rate of China with exchange rate of Pakistan economy will be investigated in second model; it explores the determinants of interest rate of both countries of Pakistan and China, respectively.

Since the Pakistan has a long history of carrying out trade with China; therefore, the novelty of this study is measurement of uncovered interest parity of two countries Pakistan and China and also to explore the key determinants of the domestic interest rates of both countries. It is worth considering a behavioral change of exchange rate of one country determining the interest rate of another country. This study will explore that behavior of foreign interest rate determined through expected exchange rate particularly with China since the Pakistan trade volume is unprecedented with the China. The research mainly focuses on the components of the uncovered interest rate parity that is indomitable by domestic interest rate and exchange rate also with emphasis on the bases of domestic interest rate of Pakistan and Chinese economies. This study moves around the two research questions; how does uncovered interest rate parity exists between Pakistan and China; secondly, what are the determinants of domestic interest rate of Pakistan and China.

Literature review

Reviewing the theoretical and empirical literature, assistances for a batter comprehension provide a technical grounds for carrying out research regarding interest rate and exchange rate association. As Pakistan trade volume is substantial with the China comparing with other countries, therefore, it is very important to explore the dynamics of exchange rate and interest rate of both economies. Since the both economies have experienced government interventions in determining the interest rate and exchange rate which further create discrepancies in expected exchange rate and domestic rate of interest. Therefore, examining the interest rate parity may have profound implications.

Meese and Rogoff [21] find that the nonexistence of stable linkages between real rate of interest and real exchange rate that indicates a shock affects the

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fluctuations of real exchange rate. Nonlinear relationship has also been found amid interest rate and exchange rate.

Seleem [29] concludes that the disagreement appears to develop in theories of flexible-price and sticky-price monetary models, where the association among interest rates and currency rates differs.

Engel et al. [7] explored that nominal interest rate of the USA and other countries holds substantial bearing on the exchange rate. Kim and Ratti [17] inferred that drastic change in the interest rate discourages the level of investment which further deteriorates the trade and so do exchange rate. In Thailand, Korea, and Philippines, exchange rate is statistically and significantly related to interest rate caused by the one standard deviation shock.

Hnatkovska et al. [10] determined that appreciation is the currency and is observed firstly and then depreciation followed by the surge in the nominal interest rate. Ahmed and Mazlan [2] unfolded the fact that interconnection of exchange rate and interest rate varies country by country meaning depends on the degree of involvement of their economic and financial activities.

Liu and Wu [19] debated that comparing impact of the policy of China, the influence of the USA monetary policy on exchange rate and policies regarding interest rate of China is abundant.

Xu et al. [31] underscored a long term along with short-term single directional causal connections exchange rate and interest rate range between China and the USA.

Ismailov and Rossi [14] experimented on industrialized countries using 3-month interest rates; the results also demonstrated that statistically significance on intercept and the coefficient position is either negative, close to zero, or overly large in comparison with one. Moreover, deviations from the UIRP hypothesis come about as a result of uncertainty. Adequate forecasting assists the investors to soar up its profit on the financial assets. As the expectations regarding the appreciation increase, investors tend to hoard assets in dollars. Shortly, international capital will flow in country, increasing country's supply of capital and causing interest rates to fall [16].

Nyiputen and Ugbaka [22] inferred by applying Toda–Yamamoto test, the UIP hypothesis had no effect on investment in the USA. Based on the specific findings, it was suggested, among other things, that the US dollar be devalued in relation to the Chinese Yuan and the currencies of major trading partners in order to reduce interest rate differentials and encourage trade, investment, and economic growth between China and the US and other significant trading partners.

Lothian and Wu [20] concluded that large interest rate differentials provide much better forecasting potential for currency fluctuations than minute interest rate differentials by undertaking an ultra-long-term series data for a number of countries.

Ali et al. [3] concluded that foreign interest rate is affected by way of the exchange rate of those economies which are highly integrated in financial transactions with each other and witness gain in exchange reserves.

Schmitt-Grohé and Uribe [28] highlighted that new Keynesian's open economy idea, a perpetual upsurge in interest rate, generates depreciation of nominal and real exchange rate as well as a divergence from uncovered interest rate parity in contradiction of the contractionary policy of country.

Inoue and Rossi [12] drew two major conclusions first, as domestic monetary policy tightens, the domestic currency appreciates. Second, monetary contraction in the USA generates tenacious divergence from uncovered interest rate parity in favor of financial assets. The adverse association between interest rate and exchange rate exists for large-scale economies [22].

Tan et al. [30] attempted to explore that interest rate and economic growth nexus in Malaysia, Singapore, and Thailand. The findings show a negative linkage between interest rates and level of output. Fiaz and Khurshid [9] drew a conclusion that output level affects the interest rate adversely particular when economy faces variation in the growth rate.

di Giovanni and Shambaugh [5] found that high international interest rates leave an effect with contraction on domestic annual real GDP growth, but that this effect is concentrated in countries with fixed exchange rates. The report then investigates the possible pathways via which major-country interest rates influence other economies. In comparison with other possibilities, such as a trade effect, effect of international interest rates on domestic interest rates is the most likely channel. According to [23], interest rate behavior is vital for growth of economy following the links between interest rates and investment and growth and investment. Thus, boosting economic growth in Nigeria requires the formulation and execution of financial policies that increase investment-friendly interest rates. In all three countries, the interest rate differential had a statistically insignificant negative relationship with the exchange rate disparity in both the short and long run [4].

Sanchez [27] explained that rise in interest rates likely prevents the contractionary effect of devaluation, irrespective of how strong or mild the latter effect is. Responding to an adverse net export shocks, interest rate is projected to scramble in contractionary to depreciation situations and plummet in expansionary depreciation cases.

Iwuagwu [11] found that although bilateral exchange rates are a better predictor of interest rate parity

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deviations than the wide dollar index at the individual nation level, other financial variables are more influential overall.

Notwithstanding the above literature, dynamics of the exchange rate has been investigated whereas impact of predictable discrepancy in the exchange rate and interest rate on foreign interest rate between two potential trade partners has not been captured. After reviewing the theoretical and empirical literature, this research is an attempt to make the examination of uncovered interest rate parity which is relationship between interest rates and exchanges rate of two countries Pakistan and China. Since the Pakistan economy is reported to have larger trade deficit with China, the main inspiration behind this research is to investigate the dynamics of the interest rate parity puzzle of these two economies. This work will prove to be a profound addition in the extant literature by identifying the viability of interest rate parity between two potential trade partners Pakistan and China which has not already been discussed along with the identification of components of domestic interest rate by comparing Pakistan and China.

Theoretical background

Since the financial investment function of country and international linkages are interconnected; thus, it also causes oscillations in the currency value. Keynes [15] is first to suggest systematic interest rate parity premise, which states that differential of interest rates across the nation state is linked to their spot and future exchange rates [18]. This disparity specifies that yield of short-run interest rate on a domestic investment likely be same as short-run interest rate return on extraneous investment transformed into foreign currency on spot rate and purchased back in domestic currency in forward rate. From uncovered interest parity (UIP) condition, arbitrage occurs when the choice between domestic and international debt holdings balances.

$$i_t^f = i_t - E\Delta er_{t+1} + \delta_t \tag{1}$$

Equation states that interest rate on the foreign debt i_t^f is supposed to be a function of local interest rate i_t anticipated disparity in exchange rate $E\Delta er_{t+1}$ and δ_t risk premium associated with time variations. Here, risk premium is assumed to be zero. The difference on return on the investment of two countries encourages the arbitrage activities provided that forward exchange rate gets table at a specific point of time. When interest rate in one country is higher than other country, then it will cause increase in exchange rate, and it will face depreciation in currency in the future when comparing with spot exchange rate. Whereas, decrease in the local interest rate results decline

in local asset's income. The households and business class will expose off their local currency assets and will be encouraged to buy foreign currency, it will ultimately lead to devalue the domestic currency.

Along with the determination of foreign interest rate, factors contributing in determination of domestic interest rate are parallel imperative. The classical viewpoint of interest rate is it works like a catalyst accumulating the savings in an economy. It is worth mentioning here that interest rate is a function of saving and investment simultaneously and equilibrium rate plays a key role in economic and financial activities.

This study is segmented in two models, in first model, Pakistan and China for the analysis of interest rate parity to measure the causality within rate of interest and exchange rate, whereas in second model, impact of exchange rate on interest rate is empirically investigated. The World Development Indicator (WDI) is the source of all policy variables. Data are time series and annually in nature and does not contain any sensitive information. This international source of data is conveniently available and can be approached through internet globally.

Methodology

This study takes into account two models for the empirical evidence of the proposition constructed above. Time series data ranging from 1980 to 2023 have been analyzed for the both models. In the first model, the co-integration approach is applied to assist obtaining the causality among the variables of the models. This approach adequately serves to analyze the causal connections in the policy variables.

Engle and Granger [8] explored the two-step integration method, which was in fact an advancement of Granger model, introduced in 1981. This approach states that two different time series are independently cointegrated. This particular approach is suitable to examine the causality among the policy variables. Since the two directional relationships between the variables have serious implications and important for analysis and policy implication. This particular technique assists to examine that how past values of other variables impact the determination of another variable. The formulation of Engle and Granger causality is expressed as follows:

$$Y_t = \sum_{j=1}^{p} A_{11j} Y(t-j) + \sum_{k=1}^{p} A_{12j} X(t-j) + \varepsilon_t \tag{2}$$

$$X_t = \sum_{j=1}^{p} A_{21j} Y(t-j) + \sum_{k=1}^{p} A_{22j} X(t-j) + \varepsilon_t \tag{3}$$

In Eqs. (2) and (3), p indicates the observations of the model of extreme number of lagged, A matrix covers the involvement of every single lagged observation to the predicted value of the Y_t and X_t whereas ε_t and ϵ_t reflect the error terms.

Model 2 investigates long-run relation among domestic interest rate (DIR), exchange rate (ER), consumer price index (CPI), and economic growth (Y). These model assistances to explore that how exchange rate, CPI, and output level effect the volatility in interest rate. This model would be separately applied for the economies of Pakistan and China. To achieve the purpose, this study applies autoregressive distributive lag model (Henceforth, ARDL) estimation technique, since the ARDL technique is adequate assessing long-run association among indicators. ARDL estimations technique assistances to investigate the short-term as well as long-term analysis of the policy variables. To measure impact of the contributing factors of interest rate, following model will be estimated separately for Pakistan and Chinese economy:

$$LnDIR_t = \delta_0 + \delta_1 LnER_t + \delta_2 LnCPI_t + \delta_3 LnY_t + \varepsilon_t \tag{4}$$

In Eq. (4), δ_0 is an intercept, whereas the responsiveness of the exchange rate (ER), consumer price index (CPI), and level of output (Y) with respect to interest rate is indicated as $\delta_1, \delta_2,$ and δ_3, respectively.

For a small sample size, ARDL bound estimation technique is adequate to avoid spurious findings. Irrespective of order of any integration, the ARDL can be conveniently applied unlike Johansen co-integration, Johansen maximum likelihood method, etc. Within the general-to-specific framework, the unrestricted model of ECM with acceptable lags captures the data generation process [25]. Hence, this study takes the bound testing method of and analyze error correction model mentioned beneath:

$H_1 =$ There is existence of uncovered interest parity between Pakistan and Chinese economies.

$$H_1 : \mu \neq 0$$

$H_0 =$ There is no existence of uncovered interest parity between Pakistan and Chinese economies.

$$H_0 : \mu = 0$$

$H_2 =$ There is long-run connection among domestic interest rate (DIR), exchange rate (ER), consumer price index (CPI), and economic growth (Y).

$$H_2 : \rho \neq 0$$

H_0: There is no long-run connection among domestic interest rate (DIR), exchange rate (ER), consumer price index (CPI), and economic growth (Y).

$$H_0 : \rho = 0$$

H_1, H_2 and H_0 represent the alternate and null hypothesis, respectively, whereas μ indicates the existence of uncovered interest parity between Pakistan and China, and ρ reflects the long-run relations among the policy variables.

Results and discussion
Model 1
Having applied the Granger causality to investigate the uncovered interest parity for Pakistan and China economies in Model 1 addressing the first research question. The findings delineate that uncovered interest parity remain clamped for Pakistan and China. Neither the Chinese exchange rate effect the domestic interest rate of Pakistan nor the China local interest rate is impacted by the Pakistan exchange rate. The underlying theory behindhand the nonexistence of uncovered interest parity between Pakistan and China economy is, as their

$$\begin{aligned}
\Delta LnDIR_t = {}& \beta_0 + \sum_{n=1}^{I1} \theta_n \Delta LnDIR_{t-n} + \sum_{n=0}^{I2} \gamma_n \Delta LnER_{t-n} + \sum_{n=0}^{I3} \mu_n \Delta LnCPI_{t-n} \\
& + \sum_{n=0}^{I4} \pi_n \Delta LnY_{t-n} + \varphi_1 LnDIR_{t-1} + \varphi_2 LnER_{t-1} \\
& + \varphi_3 LnCPI_{t-1} + \varphi_1 LnY_{t-1} + \rho_t.
\end{aligned} \tag{5}$$

Thus, we can investigate the measured values to see if there exists any short-run symmetry or asymmetry among exchange rate and additional independent variables. Furthermore, investigation of Eq. (5) also provides an idea regarding prevalence of long-run relations midst policy variables. The following hypothesis of research will be tested:

money and capital markets are not highly integrated, and volume of trade from China is more relative to Pakistan. These consistency of the results are well aligned with the judgments of [4, 22] and [20]. The null hypothesis is accepted followed by the findings of Table 1.

Though these two economies are indulged in carrying on huge volume of goods and services trade, capital

Table 1 Findings of the Granger causality

Null hypothesis	Obs	F-statistic	P value
DIRC does not Granger cause DIR	30	1.889	0.172
DIR does not Granger cause DIRC		0.309	0.737
ER does not Granger cause DIR	30	0.639	0.536
DIR does not Granger cause ER		0.375	0.691
ERC does not Granger cause DIR	30	0.279	0.759
DIR does not Granger cause ERC		0.848	0.440
ER does not Granger cause DIRC	30	0.055	0.946
DIRC does not Granger cause ER		0.172	0.843
ERC does not Granger cause DIRC	30	0.145	0.866
DIRC does not Granger cause ERC		3.463	0.047
ERC does not Granger cause ER	30	0.004	0.997
ER does not Granger cause ERC		3.046	0.066

Table 2 Results of the ARDL Bound Test

Test statistics	Values	K
F-statistics	7.12	3
Critical value bounds		
Significance	I0 bound	I1 bound
10%	2.72	3.77
5%	3.23	4.35
2.50%	3.69	4.89
1%	4.29	5.61

Table 3 Long-run coefficient of ARDL (2, 3, 4, 3)

Variables	Coefficients	Std. errors	t-statistics	Probability
ER	0.0657	0.0212	3.1055	0.0061
CPI	0.6531	0.0819	7.9701	0.021
LNY	− 3.2154	1.0421	− 3.0855	0.0064
C	8.0246	24.9817	3.2033	0.0049

Table 4 Error correction representative of ARDL

Variables	Coefficients	Std. errors	t-statistics	Probability
D(DIR(− 1))	0.5490	0.1657	3.3129	0.0039
D(ER)	0.1595	0.0478	3.3397	0.0036
D(CPI)	0.0212	0.0773	0.2746	0.7868
D(CPI(− 1))	0.0664	0.1076	0.6167	0.5451
D(CPI(− 2))	− 0.3013	0.1114	− 2.7061	0.0145
D(LNY)	2.3462	4.3129	0.5440	0.5931
CointEq(− 1)	− 0.9135	0.2009	− 4.5468	0.0002

mobility is not taking place that much across the borders which further implies foreign interest rate is inelastic that is why the undermine theory does not exists between these two economies.

Model 2

This Model 2 examining the second research question, is segmented further into two analyses. First analysis moves around the Pakistan economy, which examines the long-run associations of the main determinants of domestic interest rate.

Analysis of Pakistan economy

ARDL bound test's findings depict assuring long run ties amid policy variables. Since the F-statistic value 7.1 is higher comparing to critical F value 3 which endorses long-run association of variables. Findings of bound test are depicted in Table 2 beneath.

Hence, long-run relation exists midst variables, succeeding phase comes to calculate long-run estimates of model. Table 3 reflects long-run estimates of ARDL, results show that exchange rate holds positive and significant connection with domestic interest rate. The

depreciation leads to more exports and producers mounts the demand for money, and it further causes rise in interest rate. The results are similar to the findings of Sanchez [27] and Nyiputen and Ugbaka [22]. Consumer price index is positively and significantly allied with domestic interest rate. Since the inflation serves as an attractive force for the local producers. Higher the inflation encourages the current producing units of the economy to demand for money to produce more so it results increase in interest rate and results have the similarity with the findings of [26]. The level of output is adversely associated with interest rate which implies that higher revenues halt the producers to demand more money and resultantly it reduces as output increase, and findings are found to be consistent with the study of [30].

Since the variables of are cointegrated, traditional theory confirms the possibility of error correction. The results portrayed in Table 4, reveal error correction of the model. The finding shows that in case, when any shock deteriorates the equilibrium in short run, policy variable gets stable in long run with the speed of approximately 91%.

Cumulative sum (CUSUM) along with cumulative sum of squares (CUSUMQ) tests are used to analyze the model's stability in both the short and long run. Figure 1 depicts the representation of CUSUM and SUSUMQ tests, with no validation of structural break in the model and a 5% level of significance. Based on these findings, this attempt significantly supports the model's stability as well as the validity and reliability of the computed coefficients.
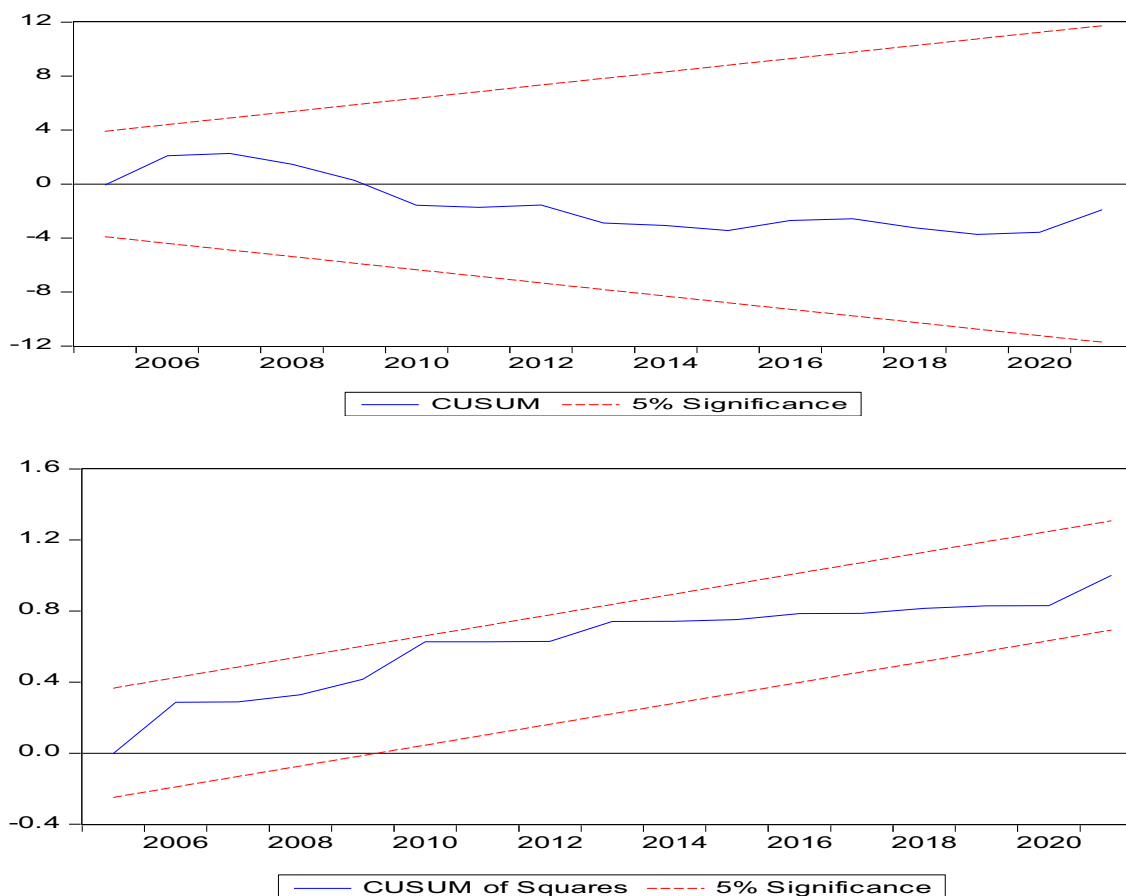
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Fig. 1 CUSUM test and CUSUMS

Table 5 Results of the ARDL Bound Test

Test statistics	Values	k
F-statistic	6.13	3
Critical value bounds		
Significance	I0 bound	I1 bound
10%	2.72	3.77
5%	3.23	4.35
2.50%	3.69	4.89
1%	4.29	5.61

Table 6 Long-run coefficient of ARDL (2, 3, 3, 0)

Variables	Coefficients	Std. errors	t-statistics	Probability
CPIC	− 0.2175	0.0241	− 9.0012	0.0098
ERC	− 0.0488	0.0140	− 3.4627	0.0032
YC	0.0911	0.3245	0.9645	0.3491
C	8.1574	1.1874	6.8697	0.0091

Analysis of China economy

The ARDL bound test findings show that policy variables are cointegrated in long run. Because F-statistic value 6.13 stands more than the threshold F value 3, the long-run association of the variables is supported. Table 5 shows the results of bound test as given below:

As a result of long-run link between variables, subsequent process is to commute the model's long-run estimations. Table 6 demonstrates the long-run coefficients

of the ARDL, the findings explain that consumer price index adversely affects the domestic interest rate. High inflation causes fear from point of view of household's future spending's so do lower accessibility of loanable funds which further declines the interest rate, a similar conclusion was also drawn [3]. Domestic interest rate is negatively and substantially affected by the exchange rate, as depreciation results more local production, and it further increases the interest rate followed by the mounting demand for a loanable funds [22]. The output level positively influences the domestic interest rate but insignificant too. The optimal level of output/income emboldens

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the investors to meet the business requirement from the internal financing rather dependence on the capital markets; hence, it does less likely effect the domestic interest

rate, the results appear to have consistence as per the findings [9].

As the model's variables are cointegrated, conventional theory confirms the possibility of error correction. The findings in Table 4 reflect the model's error correction. The study indicates that when a shock vitiates equilibrium in short run, policy variables get stabilized in terms of equilibrium in long run by 80%. It means that policy variable will get the stability path at the speed of 80%, in long run (Table 7).

To assess the model's stability in the short and long run, CUSUM and CUSUMQ tests are valid. Figure 2 portrays CUSUM and CUSUMQ tests with no structural break validation in the model and a 5% level of significance. Depending upon these findings, the model's stability, as well as the validity and reliability of the estimated coefficients, is considerably supported.

Table 7 Error correction representative of ARDL

Variables	Coefficients	Std. errors	t-statistics	Probability
D(DIRC(−1))	0.1042	0.1429	0.7295	0.4762
D(DIRC(−2))	−0.1249	0.1223	−1.0181	0.3237
D(DIRC(−3))	−0.2978	0.1391	−2.1398	0.0481
D(CPI_C)	−0.1023	0.0268	−3.7832	0.0016
D(CPI_C(−1))	0.0263	0.0207	1.2923	0.2147
D(ERC)	−0.0125	0.0133	−0.9416	0.3607
D(YC)	0.0098	0.0013	1.5016	0.1527
CointEq(−1)	−0.8087	0.1716	−4.71318	0.0002
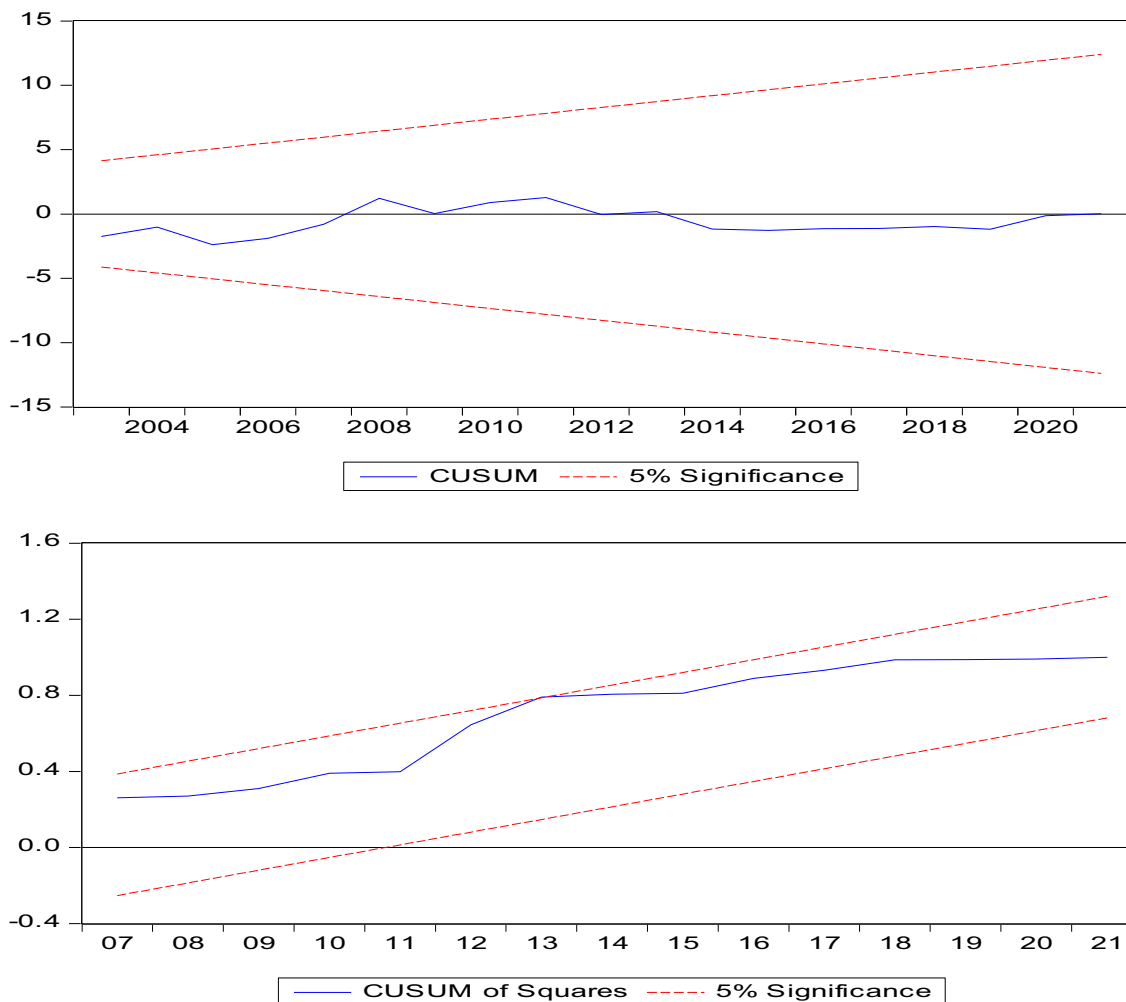
Fig. 2 CUSUM test and CUSUMS

Conclusion

The foremost aim of study was to measure the uncovered interest parity for the countries Pakistan and China, and study also investigates determining factors of the domestic interest rate of Pakistan and Chinese economies, separately. In Model 1, results of the Granger causality unfold fact that major premise of uncovered interest parity does not exist for both countries. Pakistan and China are heavily indulged in across the border trade but as far as capital mobility is concerned, it is not substantial. Model 2 explains the main determinants of domestic interest rate of both economies, Pakistan and China. For both countries, determinants of domestic interest rates hold the long-run relation and cointegrated as well. In case of Pakistan, consumer price index and exchange rate interlinked with the domestic interest rate positively whereas output level in negatively correlated. Error correction term is 91% which confirm the speed of adjustment of equilibrium when any shock takes place. Pertaining to the Chinese economy, consumer price index and exchange rate adversely impact the domestic interest rate of China. The findings of the error correction model signify 80% speed of convergence in long run in case of shock appears in short term. The findings of CUSUM and SUSUMQ tests corroborate validity, stability, and reliability of models in the case of Pakistan as well as China analysis. The novelty of this research is that the huge volume of trade not necessarily imply the existence of interest rate parity, and determinants of domestic interest rate may go beyond the traditional determinants. The findings of the study help the decision makers to expand and strengthen the financial markets which will further reduce the riskiness for the potential investors when considering the uncovered interest parity phenomenon. This research also proposes that policy makers of both countries need to concentrate to upsurge the level of output which further assures the sustainable trajectory for stable exchange rate and interest rate level. Another profound implication of this work is that while designing the prudent policy for the sustainable economic growth, policy makers need to consider the nonlinear associations of the policy indicators. The findings are very supportive in a sense that potential investors may reduce capital losses in present time through market driven interest and exchange rate. This research does not take into account the regime analysis. Particularly analysis may get different interpretation when considering the administered and market-oriented interest rate and exchange rate mechanism, and it would be a lynchpin area of research for well-reputed journals of the time followed by its diversified aspects. These two different strategies may lead to dissimilar analysis keeping in view Pakistan and China economy. Therefore, the potential researchers may carry on their research for regime analysis which will provide a policy pathway while designing the prudent policy.

Abbreviations

ARDL	Autoregressive distributed lag model
UIP	Uncovered interest rate parity
GDP	Gross domestic product
WDI	World Development Indicators
DIR	Domestic interest rate
ER	Exchange rate
CPI	Consumer price index
CUSUM	Cumulative sum
CUSUMQ	Cumulative sum of squares

Author contributions
MSA and IA led the conceptualization, guidance, and execution of the experiments with IA focusing on analysis, design, and writing, MF contributed to data collection, analysis, utilization of analysis tools, and in providing supporting material. All authors read and approved the final manuscript.

Availability of data and materials
The data used in the manuscript are secondary and obtained from the World Development Indicator (WDI) https://databank.worldbank.org/.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
The authors guaranteed that this manuscript is not published or not under consideration with any other journal, and the manuscript is original and is their own work.

Competing interests
No potential conflict of interest was reported by the authors.

References
1. Abel AB, Bernanke BS, Rabasco E, Toharia L (2004) Macroeconomía. Pearson Educación, Madrid
2. Ahmed HFT, Mazlan NS (2021) The impact of interest rate on exchange rate within ASEAN Countries: evidence from linear and nonlinear ARDL frameworks. Glob J Emerg Mark Econ 13(1):7–34
3. Ali MS, Mujhid S, Nasir A, Shah SAA, Ali MD (2021) Basic transfer concept and external debt thresholds measures of selected South Asian economies. Multicult Educ 7(1):302–311
4. De Silva WAM, Weerasinghe WDJD (2023) Assessing the applicability of uncovered interest parity in the South Asian frontier financial markets. South Asian J Finance 3(2):99–111
5. Di Giovanni J, Shambaugh JC (2008) The impact of foreign interest rates on the economy: the role of the exchange rate regime. J Int Econ 74(2):341–361. https://doi.org/10.1016/j.jinteco.2007.09.002
6. Evcim N, Yesilyurt ME (2023) Spatial interaction and economic growth: a case of OECD countries. Future Bus J 9(1):1–10

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7. Engel C, Lee D, Liu C, Liu C, Wu SPY (2019) The uncovered interest parity puzzle, exchange rate forecasting, and Taylor rules. J Int Money Finance 95:317–331
8. Engle RF, Granger CWJ (1987) Co-integration and error correction: representation, estimation, and testing. Econom J Econom Soc 55:251–276
9. Fiaz A, Khurshid N (2022) Revisiting the macroeconomic variables and economic growth nexus: a Markov regime-switching approach. Econ J Emerg Mark 14:101–112
10. Hnatkovska V, Lahiri A, Vegh CA (2013) Interest rate and the exchange rate: a non-monotonic tale. Eur Econ Rev 63:68–93
11. Iwuagwu CA (2023) The US dollar and covered interest rate parity deviations: oil price channel. Available at SSRN 4385223
12. Inoue A, Rossi B (2019) The effects of conventional and unconventional monetary policy on exchange rates. J Int Econ 118:419–447
13. Irshad MS, Xin Q, Hui Z, Arshad H (2018) An empirical analysis of Pakistan's bilateral trade and trade potential with China: a gravity model approach. Cogent Econ Finance 6(1):1504409
14. Ismailov A, Rossi B (2018) Uncertainty and deviations from uncovered interest rate parity. J Int Money Finance 88:242–259
15. Keynes JM (1923) A tract on monetary reform. Cosimo Classics
16. Khoa BT, Huynh TT (2022) Predicting exchange rate under uirp framework with support vector regression. Assessment 12:13
17. Kim J-K, Ratti RA (2006) Economic activity, foreign exchange rate, and the interest rate during the Asian crisis. J Policy Model 28(4):387–402
18. Liu T, Lee C (2022) Exchange rate fluctuations and interest rate policy. Int J Finance Econ 27(3):3531–3549
19. Liu W, Wu H (2010) Evaluation on mutual effect of interest rate and exchange rate between China and US: an empirical study on the basis of covered interest rate parity theory. World Econ Study 2:32–37
20. Lothian JR, Wu L (2011) Uncovered interest-rate parity over the past two centuries. J Int Money Finance 30(3):448–473
21. Meese R, Rogoff K (1988) Was it real? The exchange rate-interest differential relation over the modern floating-rate period. J Finance 43(4):933–948. https://doi.org/10.2307/2328144
22. Nyiputen IR, Ugbaka MA (2023) Does the theory of uncovered interest rate parity hold in practice between China and USA? Int J Multidiscip Innov Res 3(1):64–76
23. Obamuyi TM (2009) An investigation of the relationship between interest rates and economic growth in Nigeria, 1970–2006. J Econ Int Finance 1(4):93
24. Pakistan Econmic Survey 2021. (2022). Pakistan economic survey 2021–22. https://www.finance.gov.pk/survey/chapter_22/EconomicSurvey2021-22.pdf
25. Pesaran MH, Shin Y, Smith RJ (2001) Bounds testing approaches to the analysis of level relationships. J Appl Econom 16(3):289–326
26. Rose PS, Marquis MH (2008) Money and capital markets: financial institutions and instruments in a global marketplace. McGraw-Hill/Irwin. https://books.google.com.pk/books?id=KocgAQAAMAAJ
27. Sanchez M (2008) The link between interest rates and exchange rates: do contractionary depreciations make a difference? Int Econ J 22(1):43–61
28. Schmitt-Grohé S, Uribe M (2022) The effects of permanent monetary shocks on exchange rates and uncovered interest rate differentials. J Int Econ 135:103560
29. Seleem N (2013) The impact of policy-induced changes in nominal interest rates on the exchange rate: lessons learned in Egypt. Citeseer
30. Tan C-T, Mohamed A, Habibullah MS, Chin L (2020) The impacts of monetary and fiscal policies on economic growth in Malaysia, Singapore and Thailand. South Asian J Macroecon Public Finance 9(1):114–130
31. Xu ZM, Lai JY, Zhang CY (2016) Revisiting causal link between interest rate differential and exchange rate of China and the United States: frequency domain approach. J Wuhan Univ 69:74–83

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