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Time Series Analysis of Exchange Rate Inflation and Interest Rate on Growth in Pakistan

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ABSTRACT
This study examines the dynamic linkages among real GDP, exchange rate, inflation rate, and real interest rate in Pakistan from 2000 to 2022 using World Bank data. A Vector Autoregression (VAR) model was applied after confirming stationarity with the Augmented Dickey-Fuller (ADF) test, and diagnostic checks confirmed model adequacy. The analysis, conducted in R and EViews, reveals significant interdependencies among the variables, indicating that past values hold predictive power for future outcomes. Impulse Response Functions (IRFs) highlight that real GDP responds positively to shocks in its own values and in the real interest rate, whereas the exchange rate and inflation exhibit notable fluctuations. Forecast accuracy was evaluated using RMSE, MAE, MAPE, and Theil's U, with results showing stronger predictive performance for real GDP compared to exchange rate and inflation. These findings emphasize the relevance of macroeconomic interactions for policy formulation, while also suggesting the need for methodological refinement to improve forecast precision, particularly for the exchange rate and inflation.

Keywords: Vector Auto regression (VAR), Economic Growth, Exchange Rate, Inflation Rate, Interest Rate.

INTRODUCTION
The economy of a country refers to the system of producing, distributing, and consuming goods and services, evaluated through indicators such as GDP, employment, inflation, and trade balances. Economic growth, defined as the increase in real GDP, is a key measure of economic health and is linked to higher incomes, employment opportunities, and improved living standards. Sustainable and inclusive growth is crucial to ensure benefits are widely shared without causing environmental or social challenges. Amartya Sen (1999) emphasizes that inclusive growth requires investments in education, healthcare, and social welfare, while Robert Solow's (1956)

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growth model highlights the critical role of technological innovation, alongside capital and labor, in driving long-term growth. International trade, the exchange of goods and services across national borders, is vital because no country can produce all the goods it needs. It contributes significantly to GDP through exports and imports but is more complex than domestic trade due to factors like currency, government policies, and legal systems. Organizations such as the World Trade Organization (WTO) were established to regulate and facilitate international trade, reflecting its growing economic, social, and political importance globally.

PAKISTAN EXPORTS

Exports play a vital role in boosting national economies, and Pakistan is no exception. The country exports a range of products, including manpower, cotton fiber, rice, cement, marble, textiles, and clothing. However, Pakistan's export performance has been weak over the past two decades. Dr. Ishrat Husain (2005) stresses the importance of diversifying exports and enhancing value-added components, while Shahid Javed Burki (2015) underlines the need to improve industrial competitiveness and strengthen regional market integration. According to World Bank data, Pakistan's share in global exports declined from 0.18 percent in 1990 to 0.13 percent in 2021. In contrast, neighboring countries improved significantly during the same period, with Bangladesh increasing from 0.06 to 0.19 percent, India from 0.61 to 1.65 percent, and Vietnam from 0.14 to 1.17 percent. This comparison highlights the urgency for Pakistan to reform and modernize its export sector to remain competitive in the global market.

PAKISTAN IMPORTS

Every country relies on imports to meet domestic needs, and Pakistan is no exception. Its major imports include petroleum products, edible oil, electronics, machinery, iron, steel, and chemicals. Scholars such as Hafeez Pasha (2020) and Hameed Khan (2018) highlight the importance of adopting import substitution policies and supporting local industries to reduce reliance on foreign goods and strengthen the economy. In 2023, Pakistan's imports amounted to about $55.8 billion, with oil and fuel making up the largest share, followed by electronics, machinery, and other items.

Table No. 1: Imported Products and Percentage of Total Imports

Mineral fuels and Oils	$19.3 Billion	27%
Electrical Equipment	$5.99 Billion	8.2%
Machinery	$5.88 Billion	8.1%
Iron and Steel	$4.59 Billion	6.3%
Pharmaceutical Products	$3.78 Billion	5.2%
Animal and Vegetable Oils	$3.60 Billion	4.9%
Plastics	$3.01 Billion	4.1%
Organic Chemicals	$3.00 Billion	4.1%

EXCHANGE RATE

The exchange rate reflects the value of one currency against another and is crucial for economic stability, trade, and fiscal policy. Keynes stressed the need for stable rates to support investment, while Friedman favored floating rates for monetary independence. Since May 1999, Pakistan has operated a market-based flexible exchange rate system, with rates determined by interbank supply and demand. Authorized dealers handle foreign exchange transactions for imports, services, and debt without State Bank approval, setting rates independently and providing forward cover as needed.

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Table 2 Currency Rates Pakistan Open Market (PKR) on 27/02/2024

Australian Dollar	**181**	**183.1**
Canadian Dollar	**207.1**	**209.1**
Japanese Yen	**2.1**	**2.18**
Saudi Riyal	**74.25**	**75.05**
Singapore Dollar	**207.15**	**209.15**
U.A.E Dirham	**76.1**	**76.8**

The exchange rate, which defines the value of one currency against another, is vital for economic stability, trade, and fiscal policy. While Keynes highlighted the role of stable exchange rates in fostering investment, Friedman argued for flexible rates to allow monetary independence. Since May 1999, Pakistan has followed a market-based flexible exchange rate system, where the rupee's value is determined by supply and demand in the interbank market. Under this system, authorized dealers manage foreign exchange transactions, with the State Bank of Pakistan overseeing but not directly intervening, except through policy measures.

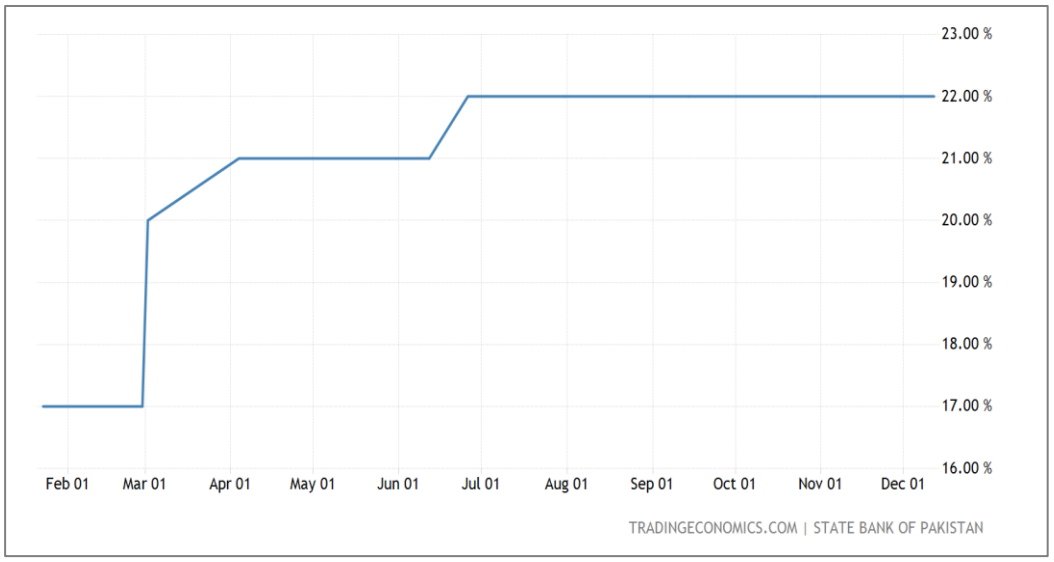

Figure No. 1 Pakistan's Interest Rate from 1992 to 2023

The Pakistan interest rate from 1992 to 2023 has increased rapidly over time rapidly which as shown in the table:

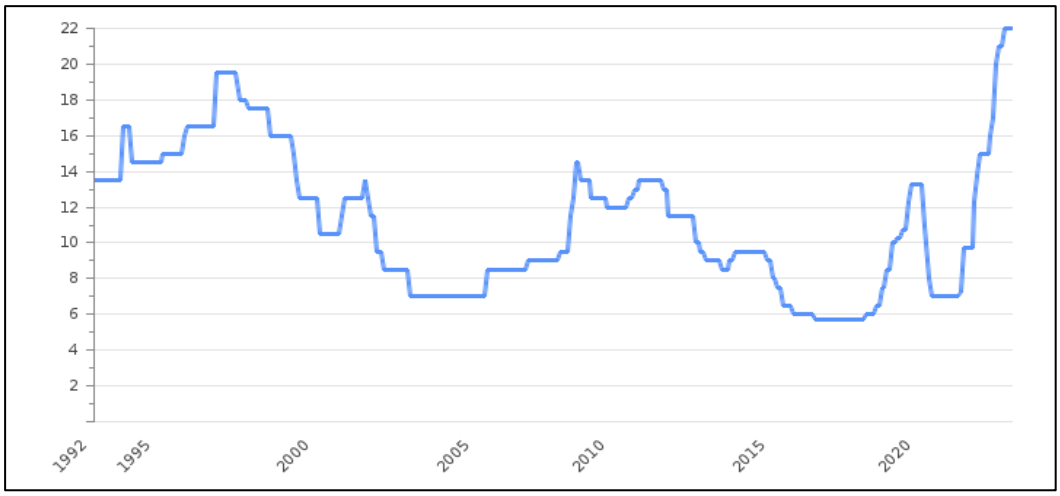

Figure No. 2: Inflation Refers to the Rate

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Inflation refers to the rate at which the general price level of goods and services in an economy increases over a specific period, typically expressed as a percentage. It reflects a decline in the purchasing power of money, meaning that more currency units are required to buy the same basket of goods and services. Inflation can arise from multiple factors, including rising production costs, expansionary monetary policies, or heightened consumer demand.

The most widely used measure of inflation is the **Consumer Price Index (CPI),** which is based on the cost of a representative basket of goods and services consumed by households. Government agencies track these costs over time through surveys, and the percentage change in CPI relative to a base year represents consumer price inflation. This indicator provides insight into cost-of-living changes and serves as a key guide for monetary policy. Economists have long debated the implications of inflation. Alan Greenspan (1980s) argued that inflation acts as a hidden tax on households and businesses by eroding the value of money. Earlier, John Maynard Keynes (1920s) warned that high inflation undermines economic stability and reduces investor confidence, potentially destabilizing entire financial systems.

LITERATURE REVIEW

Muhammad Ayyoub, et al (2011) re-examined the relationship between inflation and economic growth in Pakistan, focusing on whether inflation uniformly affects growth or behaves differently at varying levels. Using annual time series data from 1972–73 to 2009–10, they applied the Ordinary Least Squares (OLS) method. The study considered Gross Domestic Product Growth (GDPG) as the dependent variable, while Consumer Price Index Inflation (CINF), Trade Openness (OPNS), and Investment Growth Rate (INVG) served as independent variables. Their findings revealed that inflation negatively impacts GDP growth once it surpasses a certain threshold. Based on both descriptive and econometric analysis, the authors recommended that policymakers and the State Bank of Pakistan maintain inflation below 7% and ensure its stability to enable inflation's potential positive effects on economic growth.

Mwakanemela (2013) found inflation to negatively influence growth in Tanzania between 1990 and 2011, with no long-run co-integration established. Similarly, Hossin (2015) observed in Bangladesh (1961–2013) that while GDP growth could positively influence inflation, high inflation levels adversely affected economic growth. Madreporian (2016) provided evidence from Sri Lanka (1988–2015) of a long-run negative relationship, aligning with earlier models by Fischer (1979) and Easterly & Bruno (1998).

Majumder (2016) found that inflation, money supply, and remittances collectively supported long-run growth in Bangladesh (1975–2013), while N'dri (2017) showed inflation to be positively associated with long-term growth in Côte d'Ivoire, though short-run effects remained negative. Akter and Smith (2021) reported that in Malaysia (1961–2019), inflation had a short-run negative but long-run positive association with GDP, with bidirectional causality between the two variables. Likewise, Uddin (2021) identified a strong positive and significant relationship between inflation and growth in Pakistan (1990–2015), while Kunkuaboor et al. (2021) noted inflation's negative but insignificant impact on Ghana's growth during 1995–2019.

Adeniran et al. (2014), examining Nigeria (1986–2013), found exchange rates had a positive but insignificant impact on GDP, suggesting flexible exchange regimes may be beneficial for developing economies. Alasha (2020) similarly highlighted that exchange rate fluctuations directly influenced Nigeria's economic growth, concluding that a stable and efficient regime could enhance trade and production.

Harswari and Hamza (2017), studying 20 Asian countries (2006–2015), found interest rates had a significant negative effect on GDP and inflation, though the effect on FDI was insignificant. In Nigeria, Utile et al. (2018) concluded that interest rates had a generally negative and insignificant relationship with GDP, while Njie and Badjie (2021)

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reported no short-run impact in Gambia (1993–2017), though long-run associations existed between real interest rates, exchange rates, and GDP.

Adeleye et al. (2015) examined Nigeria (1988–2012) and found that total exports significantly contributed to economic growth, while imports and balance of payments had weaker effects.

Hussain and Haque (2017) investigated Bangladesh (1972–2014) and concluded that money supply plays a critical role in long-term growth. They emphasized adherence to rules such as the Taylor Rule to ensure consistent monetary policy and avoid inefficiencies.

Methodology

The study employs Secondary time series data, which is taken from sources such as the World Bank. The data contain annual observations of the exchange rate, Interest rate, Inflation rate, and Economic growth indicators, for a specified period 2000-2022, which is suitable for the analysis. The Vector Autoregressive (VAR) model is used for the analysis because of its ability to catch variations and interdependencies among multiple time series variables. The VAR model allows for multiple variables within a multivariate framework.

Model Specification

The VAR model is specified in the following way.

$$Y_{1,t} = a_{11}Y_{1,t-1} + a_{12}Y_{2,t-1} + a_{13}Y_{3,t-1} + a_{14}Y_{4,t-1} + \varepsilon_{1,t}$$

$$Y_{2,t} = a_{21}Y_{1,t-1} + a_{22}Y_{2,t-1} + a_{23}Y_{3,t-1} + a_{24}Y_{4,t-1} + \varepsilon_{2,t}$$

$$Y_{3,t} = a_{31}Y_{1,t-1} + a_{32}Y_{2,t-1} + a_{33}Y_{3,t-1} + a_{34}Y_{4,t-1} + \varepsilon_{3,t}$$

$$Y_{4,t} = a_{41}Y_{1,t-1} + a_{42}Y_{2,t-1} + a_{43}Y_{3,t-1} + a_{44}Y_{4,t-1} + \varepsilon_{4,t}$$

GDP Growth rate: $Y_{1,t}$

Exchange rate: $Y_{2,t}$

Interest rate: $Y_{3,t}$

Inflation rate: $Y_{4,t}$

Where:

a_{ij} Represents the coefficients of lagged variables

$\varepsilon_{i,t}$ Represent the error term.

Model Estimation and Diagnostic Testing:

In a Vector Autoregressive (VAR) model, the parameters, including the coefficient matrices A1, A2,…, Ap, are usually estimated through methods such as Ordinary Least Squares (OLS) or Maximum Likelihood Estimation (MLE). To ensure the model's adequacy and reliability, diagnostic tests are conducted, including checks for autocorrelation, heteroscedasticity, and residual normality, while stationarity tests such as the Augmented Dickey-Fuller (ADF) test are applied to confirm whether the variables are stationary at levels or require differencing. Once the VAR model is estimated and validated, impulse response functions (IRFs) and forecast error variance decomposition (FEVD) are employed to examine the dynamic responses of economic growth to shocks in key macroeconomic variables and to quantify their relative contributions to forecast uncertainty. Furthermore, the model is used for forecasting economic growth in relation to exogenous variables such as exchange rate, interest rate, and inflation, with forecast accuracy assessed using indicators like the Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE). Beyond prediction, the estimated coefficients and dynamic interrelationships identified by the VAR model provide meaningful insights into the influence of exchange rates, interest rates, and inflation on Pakistan's economic growth over time. To further examine the nature of the data, graphical techniques are applied to identify whether the variables are stationary or non-stationary, with the statistical outcomes summarized in the following Figure.

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The data in the table seems non-stationary, so for stationarity, we have to do the ADF (Augmented Dickey-Fuller) test, which will give us a constant mean and variance. The analysis for the ADF test is as under:

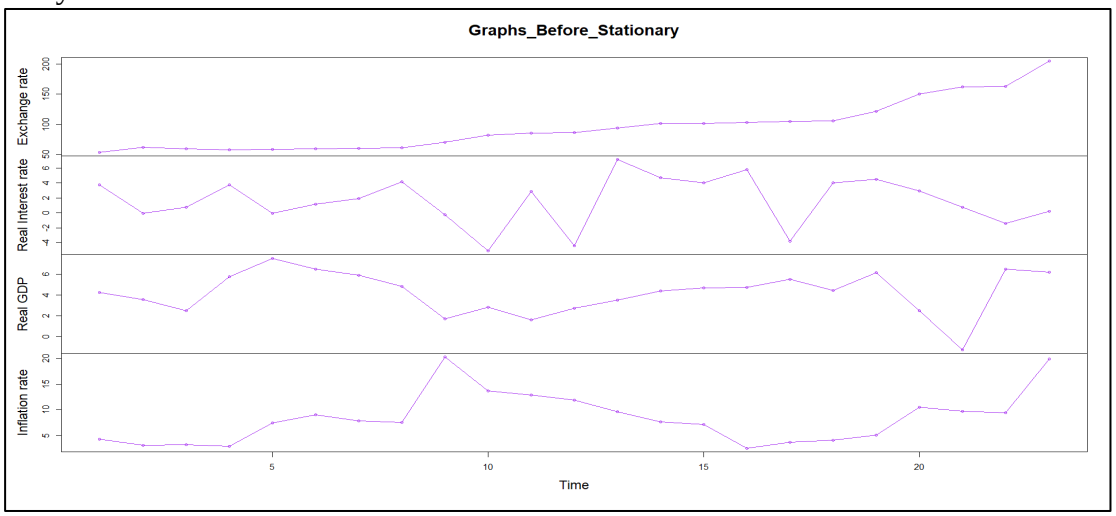

Figure No. 4 Graphs Before Stationary

4.1 Augmented Dickey-Fuller Test

Augmented Dickey-Fuller Test, data: diff (diff (diff (Data3$`Exchange rate`)
Dickey-Fuller = -3.7479, Lag order = 2, p-value = 0.03943, alternative hypothesis: stationary

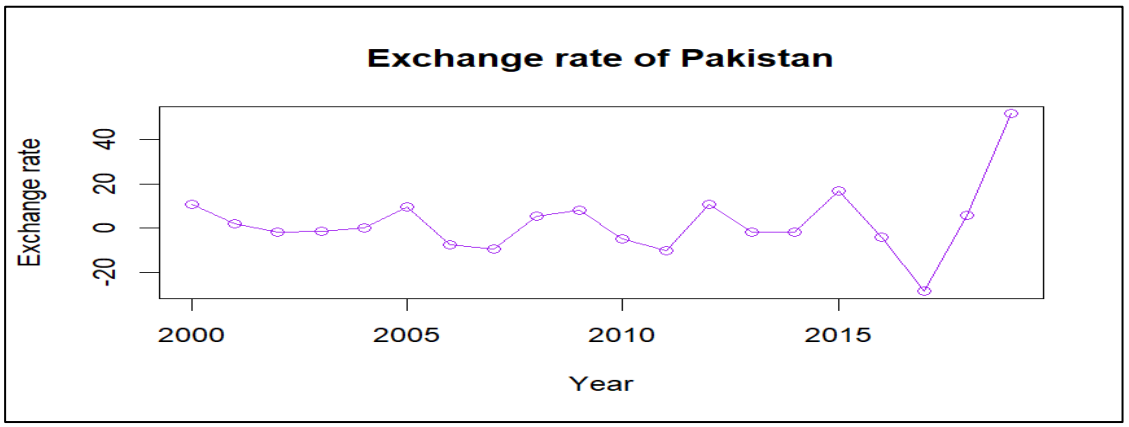

Figure No. 5 Graph of the Exchange Rate of Pakistan

The stationarity test gave a p-value of 0.03943 when the third difference of the exchange rate data was taken. The exchange rate data has reached stationarity at the third difference; according to this conclusion, since the p-value is below the conventional significance level of 0.05. As a result, the differenced series is now appropriate for time series analysis, and the null hypothesis of non-stationarity is rejected. Ensuring the dependability of ensuing econometric modelling and analysis depends on this change.

Real Interest Rate:

Augmented Dickey-Fuller Test
data: diff (diff (diff (Data3$`Real Interest rate`)))
Dickey-Fuller = -3.7485, Lag order = 2, p-value = 0.03939 alternative hypothesis: stationary

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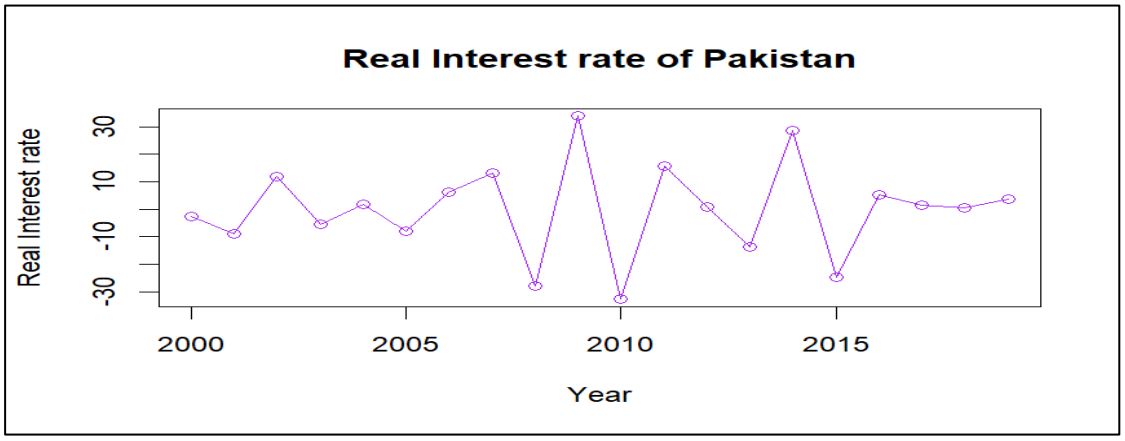

Figure No. 6 Graph of the Real Interest Rate of Pakistan

A stationarity test was conducted on the real interest rate series to verify the validity of my analysis. More differencing was required because the series was non-stationary at first. The p-value from the Augmented Dickey-Fuller (ADF) test was 0.03939 after calculating the third difference of the real interest rate. As the series has attained stationarity, the p-value is less than the 0.05 significance limit. Hence, it is safe to proceed with time series modelling and analysis using the third-differenced real interest rate data.

Real GDP:
Augmented Dickey-Fuller Test
data: diff (diff (diff (Data3$`Real GDP`)))
Dickey-Fuller = -3.6397, Lag order = 2, p-value = 0.04717
Alternative hypothesis: stationary

Figure No: 7 Graph of Real GDP of Pakistan

The third difference was taken in order to guarantee the stationarity of the actual GDP statistics. Using the third differenced series, the Augmented Dickey-Fuller (ADF) test produced a p-value of 0.04717, meaning that the unit root null hypothesis may be rejected at the 5% significance level. This attests to the data's attainment of stationarity, qualifying it for additional time series analysis.

Inflation rate:
Augmented Dickey-Fuller Test, data: diff (diff (Data3$`Inflation rate`)), Dickey-Fuller = -4.5442, Lag order = 2, p-value = 0.01, alternative hypothesis: stationary

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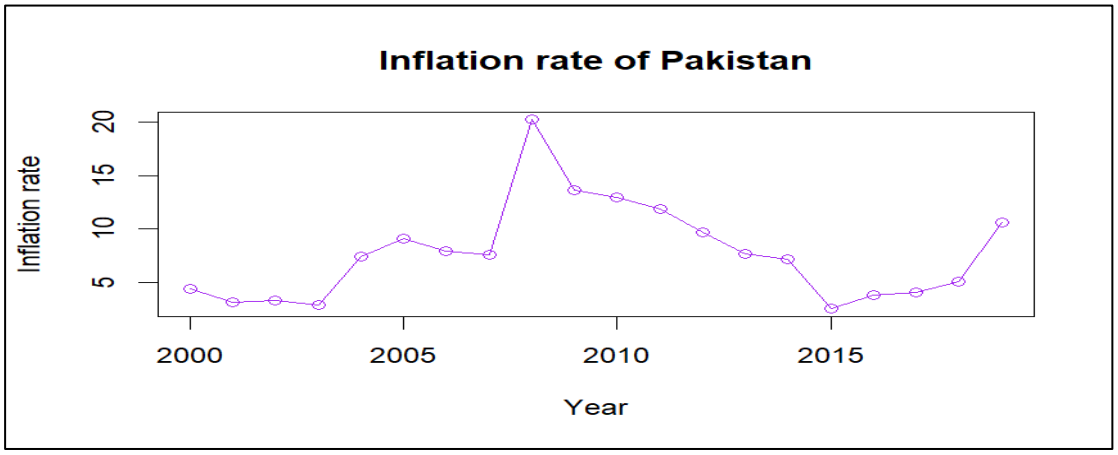

Figure No. 8 Graph of the Inflation Rate of Pakistan

The p-value that resulted from calculating the inflation rate's second difference was 0.01. The data has stabilized at the second difference, according to this result. The null hypothesis of non-stationarity can be rejected when the p-value is less than the standard cutoff of 0.05. This indicates that the series does not contain a unit root and can be used for additional time series analysis. Because our econometric models rely on the assumption of stationarity in the data, this transformation is essential to their validity and dependability.

Diagnostic tests

These tests are conducted to assess the adequacy and reliability of the model, including tests for autocorrelation, heteroscedasticity, and normality of residuals.

Autocorrelation

The following graphs of the autocorrelation function show the relationship between the Exchange rate, Interest rate, and Inflation rate.

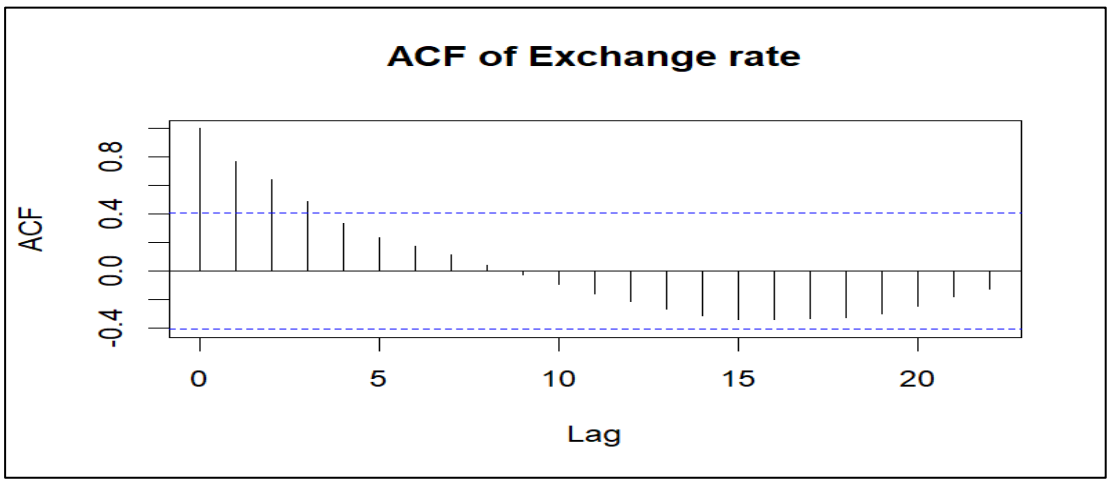

Figure No. 9 Graph of ACF Exchange Rate

The exchange rate shows a strong short-term autocorrelation, which decreases with time, according to the ACF plot. The exchange rate changes appear to have some persistence, based on the first positive correlations. The correlations, however, become less significant as the lags get longer, suggesting that the exchange rate data may be on the verge of a random walk process or that differencing is necessary to get stationarity.

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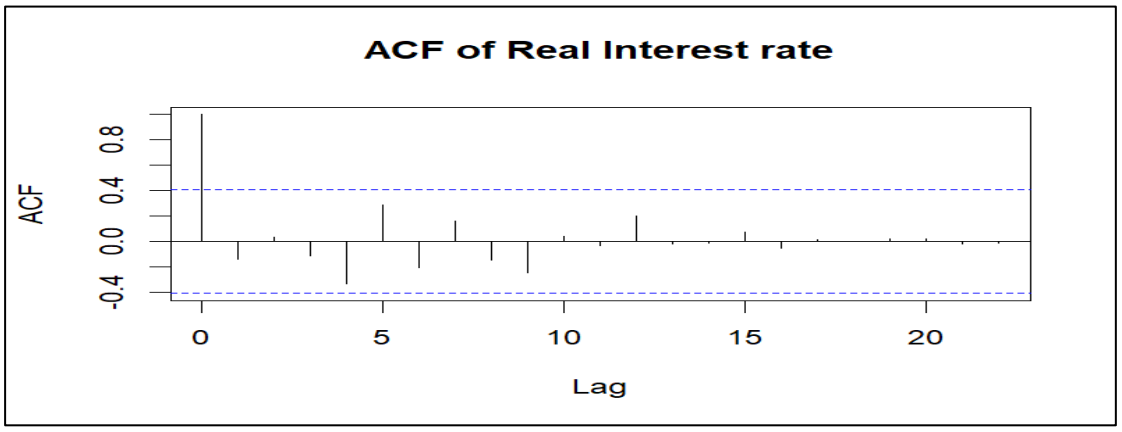

Figure No.10 Graphical Representation of Interest Rate The ACF plot indicates that the real interest rate has significant short-term autocorrelation at lag 1, but this correlation diminishes rapidly. The lack of significant autocorrelations beyond the first lag suggests that the real interest rate data may be approximately white noise or may need differencing to achieve stationarity. This is an important consideration for modeling and forecasting, as it implies that the real interest rate series has little memory beyond the immediate past value.

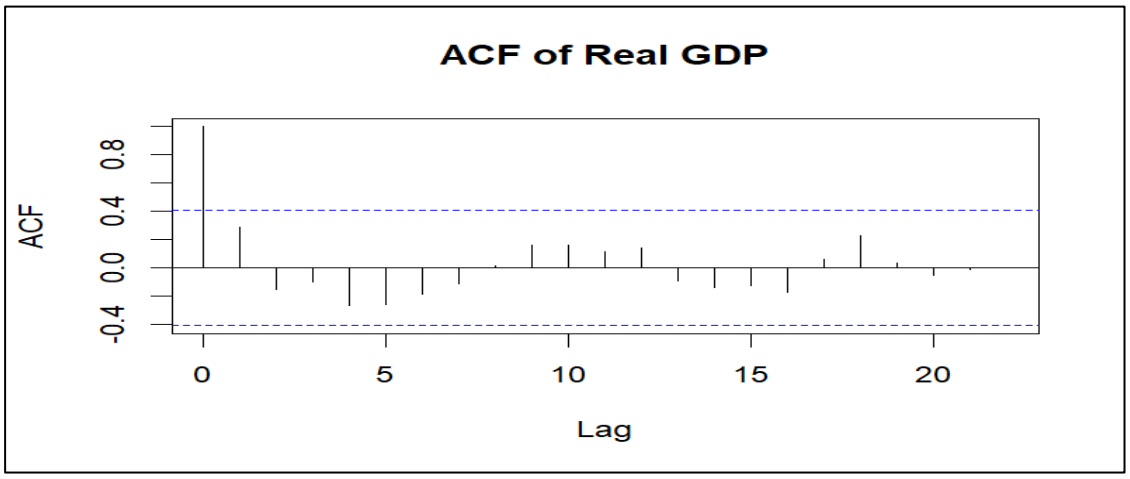

Figure No. 11 Graphical Representation of ACF and GDP

This pattern suggests that the real GDP data has a limited memory and may be approaching a stationary process or may need differencing to achieve stationarity. For time series modeling, this implies that using past values beyond the immediate previous ones may not significantly improve the accuracy of predictions.

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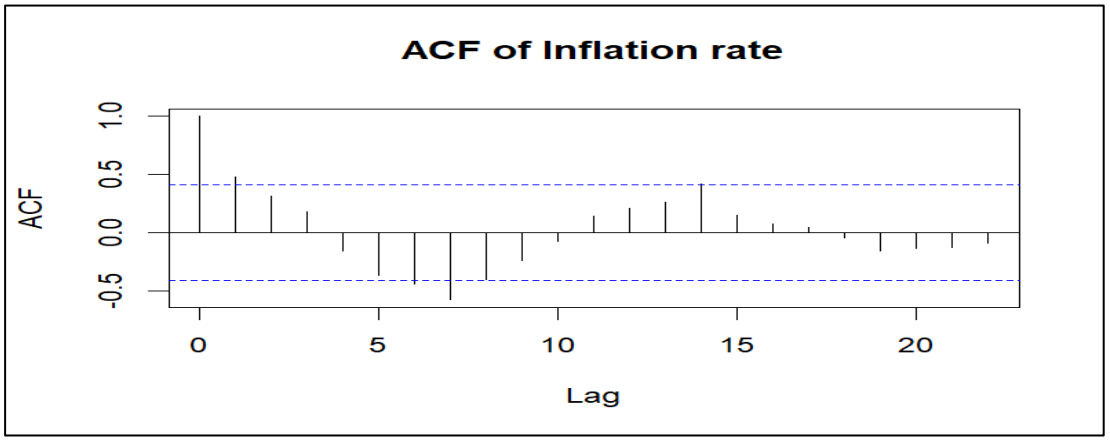

Figure No.12 Graphical Representation of ACF and Inflation Rate

The ACF plot indicates that the inflation rate in Pakistan shows significant autocorrelation up to several lags, with the strongest correlations at lag 1 and diminishing in strength thereafter. There are also some negative correlations at higher lags, indicating possible cyclical behavior in the inflation rate over the period analyzed.

Heteroscedasticity and normality of residuals

The Heteroscedasticity and normality of residuals are estimated and are shown by the following tables:

Table No. 3 VAR RESIDUAL HETEROSKEDASTICITY TESTS

VAR Residual Heteroskedasticity Tests (Levels and Squares)
Date: 06/25/24 Time: 11:50
Sample: 2000 2022
Included observations: 18

Joint test:

Chi-sq	df	Prob.
166.6683	160	0.3428

Individual components:

Dependent	R-squared	F(16,1)	Prob.	Chi-sq(16)	Prob.
res1*res1	0.719322	0.160175	0.9763	12.94779	0.6766
res2*res2	0.891838	0.515338	0.8173	16.05309	0.4493
res3*res3	0.711318	0.154001	0.9785	12.80373	0.6871
res4*res4	0.885218	0.482009	0.8310	15.93392	0.4576
res2*res1	0.991848	7.604396	0.2784	17.85327	0.3326
res3*res1	0.606423	0.096300	0.9947	10.91561	0.8147
res3*res2	0.817950	0.280812	0.9226	14.72310	0.5450
res4*res1	0.971181	2.106223	0.4993	17.48126	0.3551
res4*res2	0.895477	0.535456	0.8093	16.11859	0.4447
res4*res3	0.960642	1.525470	0.5700	17.29155	0.3670

Based on both the joint test and the individual component tests, there is no significant evidence of heteroscedasticity in the residuals of the VAR model. The residuals appear to have constant variance, supporting the reliability of the VAR model estimations.

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Normality Test

Table No: 4 VAR Normality Test of Orthogonalization

VAR Residual Normality Tests
Orthogonalization: Residual Correlation (Doornik-Hansen)
Null Hypothesis: Residuals are multivariate normal
Date: 06/25/24 Time: 11:51
Sample: 2000 2022
Included observations: 18

Component	Skewness	Chi-sq	df	Prob.*
1	-0.045077	0.009518	1	0.9223
2	0.247530	0.283946	1	0.5941
3	0.733714	2.306340	1	0.1288
4	-0.345926	0.548843	1	0.4588
Joint		3.148648	4	0.5333

Component	Kurtosis	Chi-sq	df	Prob.
1	2.518626	0.211595	1	0.6455
2	3.229337	2.075777	1	0.1497
3	2.652956	0.643525	1	0.4224
4	2.368150	0.023705	1	0.8776
Joint		2.954601	4	0.5655

Component	Jarque-Bera	df	Prob.
1	0.221113	2	0.8953
2	2.359723	2	0.3073
3	2.949865	2	0.2288
4	0.572548	2	0.7511
Joint	6.103250	8	0.6357

*Approximate p-values do not account for coefficient estimation

The p-values are all greater than 0.05, indicating that the residuals are approximately normally distributed. This supports the validity of the VAR model assumptions regarding normality of the residuals.

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Table No. 5 Vector of Autoregression Estimates

Vector Autoregression Estimates
Date: 06/25/24 Time: 11:46
Sample (adjusted): 2002 2019
Included observations: 18 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	REAL_GDP	EXCHANG...	INFLATION...	REAL_INT...
REAL_GDP(-1)	-1.163528	1.510121	-0.766102	1.314924
	(0.37776)	(0.97689)	(0.50012)	(0.71093)
	[-3.08008]	[1.54584]	[-1.53185]	[1.84958]
REAL_GDP(-2)	-0.985368	1.258159	-0.448003	0.053319
	(0.36643)	(0.94759)	(0.48512)	(0.68961)
	[-2.68912]	[1.32775]	[-0.92350]	[0.07732]
EXCHANGE_RATE(-1)	-0.188958	-0.224453	0.199428	-0.188755
	(0.10207)	(0.26396)	(0.13513)	(0.19210)
	[-1.85121]	[-0.85032]	[1.47577]	[-0.98259]
EXCHANGE_RATE(-2)	-0.020709	-0.839943	-0.170801	0.318208
	(0.19463)	(0.50331)	(0.25767)	(0.36628)
	[-0.10640]	[-1.66884]	[-0.66288]	[0.86875]
INFLATION_RATE(-1)	-0.062823	-0.452379	-0.654828	-0.080761
	(0.33149)	(0.85723)	(0.43886)	(0.62385)
	[-0.18952]	[-0.52772]	[-1.49212]	[-0.12946]
INFLATION_RATE(-2)	-0.068659	-0.716516	-0.044922	-0.371000
	(0.28024)	(0.72470)	(0.37101)	(0.52740)
	[-0.24500]	[-0.98870]	[-0.12108]	[-0.70345]
REAL_INTEREST_RA...	0.138579	0.202232	-0.262748	-1.154759
	(0.13421)	(0.34708)	(0.17769)	(0.25259)
	[1.03253]	[0.58267]	[-1.47872]	[-4.57175]
REAL_INTEREST_RA...	0.081063	0.023946	-0.253058	-0.630941
	(0.11171)	(0.28889)	(0.14790)	(0.21024)
	[0.72563]	[0.08289]	[-1.71104]	[-3.00103]
C	0.054568	1.373179	0.261313	-0.135268
	(0.79965)	(2.06792)	(1.05867)	(1.50493)
	[0.06824]	[0.66404]	[0.24683]	[-0.08988]
R-squared	0.869244	0.843216	0.759934	0.933346
Adj. R-squared	0.753017	0.703852	0.546542	0.874097
Sum sq. resids	100.9135	674.8601	176.8737	357.4193
S.E. equation	3.348524	8.659356	4.433129	6.301845
F-statistic	7.478844	6.050476	3.561209	15.75310
Log likelihood	-41.05592	-58.15810	-46.10647	-52.43773
Akaike AIC	5.561769	7.462011	6.122941	6.826415
Schwarz SC	6.006955	7.907197	6.568127	7.271601
Mean dependent	-0.364513	2.134195	0.007357	0.589319
S.D. dependent	6.737832	15.91225	6.583271	17.76029

Determinant resid covariance (dof adj.)	104626.4
Determinant resid covariance	6539.150
Log likelihood	-181.2336
Akaike information criterion	24.13707
Schwarz criterion	25.91781
Number of coefficients	36

The Akaike Information Criterion (AIC) and Schwarz Criterion (SC) are used for model selection, with lower values indicating better models. For instance, the real interest rate has the lowest AIC and SC values (3.402810 and 5.91781, respectively), suggesting a relatively better fit compared to the others. The VAR model reveals dynamic interdependencies among the real GDP, exchange rate, inflation rate, and real interest rate. Real GDP is significantly influenced by its own past values and the lagged values of the exchange rate, whereas the real interest rate is notably affected by past real GDP. The inflation rate and exchange rate show moderate influences from their respective lags and other variables in the system. The statistical measures such as R-squared, adjusted R-squared, F-statistics, AIC, and SC provide insights into the model's explanatory power and fit.

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TABLE 6: VAR Model - Substituted Coefficients

==========

REAL_GDP=-1.1635*REAL_GDP(-1)-0.9853*REAL_GDP(-2)-0.1889*EXCHANGE_RATE(-1)-0.0207*EXCHANGE_RATE(-2)-0.0628*INFLATION_RATE(-1)-0.0686*INFLATION_RATE(-2)+0.1385*REAL_INTEREST_RATE(-1)+0.0810*REAL_INTEREST_RATE(-2)+ 0.05456

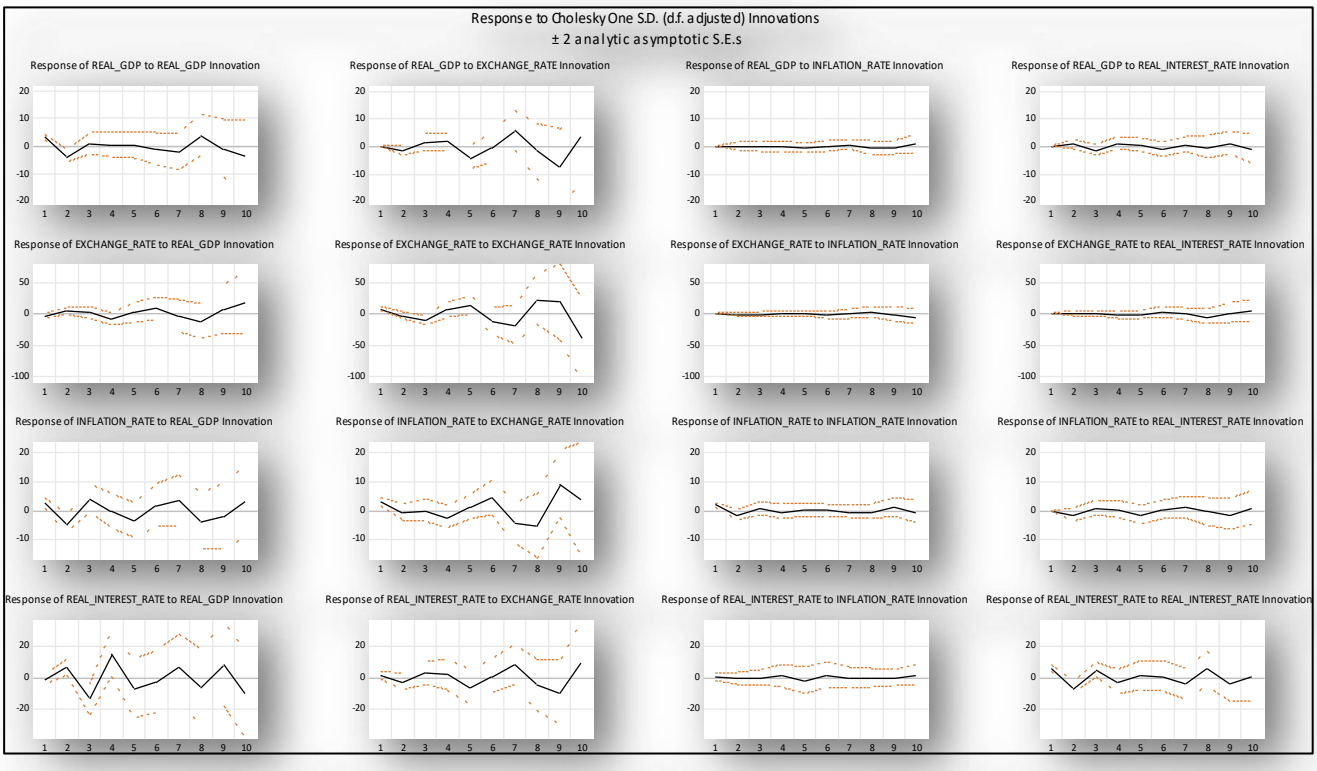
EXCHANGE_RATE=1.5101*REAL_GDP(-1)+1.2581*REAL_GDP(-2)-0.2244*EXCHANGE_RATE(-1)-0.8399*EXCHANGE_RATE(-2)-0.4523*INFLATION_RATE(-1)-0.7165*INFLATION_RATE(-2)+0.2022*REAL_INTEREST_RATE(-1)+0.0239*REAL_INTEREST_RATE(-2)+ 1.3731

INFLATION_RATE=-0.7661*REAL_GDP(-1)-0.4480*REAL_GDP(-2)+0.1994*EXCHANGE_RATE(-1)-0.1708*EXCHANGE_RATE(-2)-0.6548*INFLATION_RATE(-1)-0.0449*INFLATION_RATE(-2) -0.2627*REAL_INTEREST_RATE(-1) - 0.2530*REAL_INTEREST_RATE(-2)+ 0.2613

REAL_INTEREST_RATE=1.3149*REAL_GDP(-1)+0.0533*REAL_GDP(-2)-0.1887*EXCHANGE_RATE(-1)+0.3182*EXCHANGE_RATE(-2)-0.0807*INFLATION_RATE(-1)-0.3709*INFLATION_RATE(-2)-1.1547*REAL_INTEREST_RATE(-1)-0.6309*REAL_INTEREST_RATE(-2)- 0.1352

The VAR model reveals intricate dynamics between the four variables. Real GDP is largely driven by its own past values and past exchange rates. The exchange rate is heavily influenced by past GDP values and its own past values. The inflation rate responds primarily to past GDP and its own previous values. Finally, the real interest rate is significantly affected by past GDP, exchange rates, and its own lagged values. These relationships highlight the interdependencies and the complex nature of economic systems, emphasizing the importance of considering multiple factors when analyzing economic variables.

Impulse Response



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Real GDP is positively influenced by its own shocks and interest rate shocks, but negatively affected by exchange rate and inflation shocks. The exchange rate appreciates with positive GDP shocks and depreciates with inflation shocks. The inflation rate generally decreases with positive GDP and interest rate shocks but shows persistence with its own shocks. Finally, the real interest rate rises with positive GDP and inflation shocks, indicating the tightening of monetary policy in response to economic growth and inflationary pressures. These responses underscore the importance of considering the interplay between these variables in economic policy and forecasting.

Forecasting

The forecast evaluation indicates that the VAR model performs variably across different economic variables.

Table No: 6 FOECAST EVALUATION

Forecast Evaluation
Date: 06/25/24 Time: 12:15
Sample: 2000 2022
Included observations: 23

Variable	Inc. obs.	RMSE	MAE	MAPE	Theil
EXCHANGE_R...	20	122.3457	82.64250	1883.319	0.808731
INFLATION_RATE	20	38.97322	24.32091	1682.929	0.813051
REAL_GDP	21	22.33228	16.38626	826.6220	0.668732
REAL_INTERE...	20	38.28208	28.08009	1228.436	0.686082

RMSE: Root Mean Square Error
MAE: Mean Absolute Error
MAPE: Mean Absolute Percentage Error
Theil: Theil inequality coefficient

The model forecasts real GDP with the highest accuracy, as evidenced by the lowest RMSE, MAE, MAPE, and Theil's coefficient. In contrast, the exchange rate and inflation rate forecasts exhibit higher errors and less accuracy, reflected in their higher RMSE, MAE, MAPE, and Theil's coefficients. The real interest rate forecast accuracy lies between these extremes. These metrics underscore the importance of evaluating forecast performance across different variables to understand the strengths and limitations of the VAR model in predicting economic outcomes.

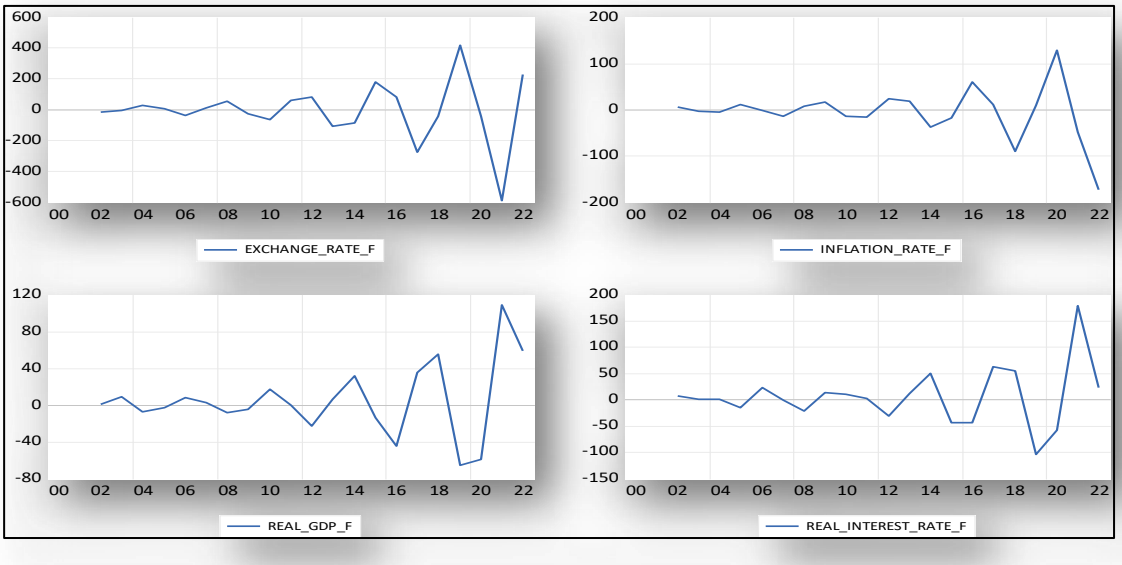

Figure No: 14 Exchange rate, Inflation Rate, Real GDP

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CONCLUSION

This study explored the dynamic linkages between real GDP, exchange rate, inflation rate, and real interest rate in Pakistan from 2000 to 2022 using a Vector Autoregression (VAR) model. The findings show strong interdependencies among the variables, with past values significantly influencing future outcomes. Impulse response analysis revealed that shocks to real GDP and real interest rates generally promote economic growth, while exchange rate and inflation shocks produce mixed effects over time. Forecast evaluation through RMSE, MAE, MAPE, and Theil's coefficient indicated higher accuracy for GDP predictions, whereas exchange rate and inflation forecasts were less reliable. Overall, the study highlights the importance of robust econometric modeling in policymaking and emphasizes the need for incorporating additional variables to improve forecasting accuracy. These insights provide a useful foundation for designing policies that foster sustainable growth and strengthen Pakistan's economic resilience.

References

Ayyoub, Muhammad, Imran Sharif Chaudhry, and Fatima Farooq. "Does Inflation Affect Economic Growth? The case of Pakistan." Pakistan Journal of Social Sciences (PJSS) 31.1 (2011).

Mwakanemela, Kenani. "Impact of inflation on economic growth: A case study of Tanzania." (2013).

Adeniran, J. O., S. A. Yusuf, and Olatoke A. Adeyemi. "The impact of exchange rate fluctuation on the Nigerian economic growth: An empirical investigation." International journal of Academic Research in Business and Social sciences 4.8 (2014): 224-233.

Adeleye, J. O., O. S. Adeteye, and M. O. Adewuyi. "Impact of international trade on economic growth in Nigeria (1988-2012)." International journal of financial research 6.3 (2015): 163-172.

Hossin, Md Shakhaowat. "The relationship between inflation and economic growth of Bangladesh: An empirical analysis from 1961 to 2013." International Journal of Economics, Finance and Management Sciences 3.5 (2015): 426-434.

Madurapperuma, Wasanthi. "Impact of inflation on economic growth in Sri Lanka." Journal of World Economic Research 5.1 (2016): 1-7.

Majumder, Shapan Chandra. "Inflation and its impacts on the economic growth of Bangladesh." American Journal of Marketing Research 2.1 (2016): 17-26.

N'dri, K. L. (2017). Inflation and economic growth in Côte d'Ivoire. Journal of Economic & Financial Studies, 5(02), 39-44.

Hussain, Mohammed Ershad, and Mahfuzul Haque. "Empirical analysis of the relationship between money supply and per capita GDP growth rate in Bangladesh." Journal of Advances in Economics and Finance 2.1 (2017): 54-66.

Harswari, M. H. A. B. N., and Sahibzada Muhammad Hamza. "The impact of interest rate on economic development: A study on Asian countries." International Journal of Accounting & Business Management 5.1 (2017): 180-188.

Utile, Bem Joseph, Agnes Ogwa Okwori, and Monica D. Ikpambese. "Effect of interest rate on economic growth in Nigeria." International Journal of Advanced Academic Research 4.1 (2018): 66-76.

Alasha, RUTH USHEBEKPE. "The impact of exchange rate fluctuations on economic growth in Nigeria." A Project Submitted in Partial Fulfillment of the Requirements for The Award of Bachelors of Science (B. Sc.) Degree in Economics. Department of Economics, Faculty of Management and Social Sciences Baze University, Abuja (2020).

Akter, Fouzia, and Daniel S. Smith. "Impact of inflation on GDP growth in Malaysian economy." International Journal of Innovative Science and Research Technology 34.2 (2021): 33-41.

Uddin, Ijaz. "Impact of inflation on economic growth in Pakistan." Economic Consultant 34.2 (2021).

Njie, Matarr, and Momodou Badjie. "The effects of interest rate on economic growth: Further insights from the Gambia." Journal of Economics and International Finance 13.2 (2021):

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ISSN Print: 3007-3146

Vol. 3 No. 10 (October) (2025)

100-105.

Kunkuaboor, Y. C., Adamu, M., Sommik-Duut, M., & Abdul-Seidu, F. (2021). The effect of inflation on economic growth in Ghana, 1995-2019: Post democratic analysis. World Journal of Advanced Research and Reviews, 12(3), 230-242.