
Examining the Contribution of Trade to GDP: A Case Study of Pakistan

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Abstract

International trade contributes a significant role in economic development of a country. A country that performs well in international trade signifies economic stability. Pakistan has maintained International economic relationships with other countries over the years. This study examined the association of Gross domestic product (GDP) with exports, imports and trade openness in the perspective of Pakistani economy from 1985 to 2023 by using Ordinary Least Square (OLS) method. Descriptive statistics, unit root test and correlogram of Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) were determined. The data has been evaluated using EViews software. The outcomes of the research revealed that all series Exports, Imports and Trade Openness have significant impact on GDP. Moreover, Imports and exports have positive effect on GDP while trade Openness has negative impact on GDP. All the series were stationary at first difference I(1) whereas Residuals were stationary at level I(0). Through which it was concluded that Cointegration exist. Overall OLS model was best fit. But CUSUM square showed that model was not stable and have some structure breaks. It is recommended that researchers should extend this study and remove structure breaks by using state space models, Markov Regime switching and threshold models.

KEY WORDS: Impact, Trade, Exports, Imports, Trade openness, GDP, Ordinary least square, Cointegration

Introduction

As reported by Oxford Advanced Learner Dictionary, Trade is described as "the activity in which individuals are buying and selling or exchanging products and services" Kumar (2009). International trade is either foreign trade or global trade. It refers to flow of commodities and services into and out of a country. International trade and economic development are interconnected as imports and exports constitute a significant amount of a country's GDP. Growth in International trade has a substantial impact on GDP growth in the world. Li et al. (2010). International trade refers to the exchange on commodities and services through boundaries. It is a system in which commodities and services are advertised, and moved in between two or more countries via import or export. Iqbal and Zahid (1998). Due to resource discrepancies, hardly any country can produce all the commodities required for consumption. Due to this reason, Global trade is important. According to the World Bank, worldwide exports as a percentage of GDP increased from 13% to 30 % just before the collapse of the economy in 1970. Worldwide exports as a percentage of GDP have been dropping over the last decade, surpassing their peak in 2008. Pettinger (2021)

Pakistan is one of the most significant economic nations in the world, with the seventh-largest population and the seventh nuclear power. It is also the 44th strongest economy, the 56th finest exporter, and the 50th biggest importer globally. Agency (2019). Pakistan's economic authorities need to address the persistent trade imbalance that has existed for the previous ten years. Foreign loans become trapped by a chronic trade imbalance, which gives foreign nations influence over domestic policy. Such influences must be lessened to preserve a nation's independence. Although Pakistan's economic trade openness has little effect on global trade, the country experiences low levels of diversity in its production and export sectors which creates unpleasant surprises and upheavals in international markets. As a result, economic output decreased over time. In 2016, Pakistan imported \$48.1 billion and exported \$24.2 billion, resulting in a \$23.9 billion negative exchange surplus. The GDP of Pakistan was \$278 billion. Yeo and Deng (2019)

Objectives

The motivational objectives of the study are:

- To determine the impacts of trade openness, exports, and imports on the economic expansion of Pakistan (GDP).
- To check which factors will have a substantial impact on the GDP of Pakistan
- To develop a suitable time series model to estimate and forecast GDP in Pakistan that will be useful for the future.
- To fit a simple OLS model and check the existence of cointegration.
- To examine the possible forecasting capacity of the model by using some statistical measures.

Literature Review

Awokuse (2008) explores the association between trade and economic growth in Argentina, Colombia, and Peru, using Granger causality tests and impulse response functions. It suggests that GDP growth had negative impact exports and imports. Bakari and Mabrouki (2017) looks at the relationship between exports, imports, and economic growth in Panama. Using data from 1980 to 2015, it discovered no direct link between exports and GDP growth. While, it demonstrated a substantial bidirectional causal link between imports and economic growth, implying that exports and imports are the key drivers of Panama's economic growth. Liu and Xiao (2018) examined the relationship between total foreign trade imports and exports and the GDP of 16 nations in 2012, using R for cluster analysis and SPSS for Pearson correlation coefficient evaluation. Imports and exports are crucial for a country's economic prosperity and global trade. A line chart was created to understand the relationship between two economic indicators and economic levels. Data from 1970-2016 was mapped to assess reliance on the international market. The total import and export volumes of higher and middle GDP countries were co-integrated. Okyere and Jilu (2020) looked at how exports and imports affected Ghana's economic growth from 1998 to 2018. The findings reveal that imports have no substantial impact on GDP growth, however, exports such as cocoa do. Currency and inflation rates are not Granger's causal elements. Velaj and Bezhani (2022) examine the impact of imports, exports, and fixed capital formation on Albania's GDP growth, using data from INSTAT from 2000-2020. Positive net export volume suggests exports positively influence GDP growth. The research indicates that Albania's net export volume was negative compared to the previous year's prices, indicating that its imports outpaced its exports. Ali et al. (2023) investigate the impact of international trading on Saudi Arabia's economy, with an emphasis on the reciprocal movement of exports, imports, and export-import components. Data variability and growth trends are determined using data from the SAMA website between 2002 and 2021. To investigate differences between distinct sets of variables, methods like as mean, standard deviation, coefficient of variation, index numbers, ANOVA, and post-hoc analysis are used. The analysis indicates a long-term association between Saudi Arabia's exports, imports, and GDP. Increasing non-mineral product exports while decreasing imports could boost the Saudi economy's growth, benefiting academics, researchers, and government officials. Lartey (2024) examines the impact of GDP, inflation, lending rate, and policy rate on unemployment in Ghana using time series data from 2000 to 2021, employing descriptive and inferential statistics and the R

statistical package. Multiple regression analysis shows that lending rates significantly impact Ghana's unemployment rate. The study suggests that the government should use monetary policy to lower interest rates, allowing firms and organizations to access financial services and invest in new projects.

Saidu (2024) examines the nonlinear relationship between oil prices, inflation, and GDP in eight African countries that buy oil from other countries. It uses econometric methodologies to analyze quarterly data from 1983 to 2020. Rising oil prices generally boost GDP, while lower prices and inflation may impact negatively. Similarly, it described that economic growth is a country's ability to meet its citizens' needs, with GDP being a key indicator. This study examines inflation, interest rates, and currency rates as supporting variables. Interest rates have a negative relation with GDP, while exchange rates have a positive relation. Inflation has minimal impact. In our study, we have used the simple regression technique OLS and checked the stationarity of series and residuals to find whether cointegration exists or not. We have also applied the LM test to check the heteroscedasticity and then find a forecast. The motivation behind our study is to start a dynamic modeling approach and to highlight its importance in modeling and forecasting in the absence of heteroscedasticity. I hope that our study will provide a better forecast.

Data Description and Methodology

The study examines the impact of international trade on Pakistan's GDP using data description and the unit root, with the augmented Dicky Filler's (1979) test used to confirm stationarity. Difference transformation and log difference transformation are used to convert series into stationary series. When the stationarity of data is confirmed, we estimate the model. In our analysis, we used the OLS where independent variables are Exports, Imports, and Trade openness while the dependent is GDP.

The linear regression model is shown as

$$GDP_t = Q_0 + Q_1 EXPR_t + Q_2 IMPR_t + Q_3 TOP_t + S_t$$

In the above model, GDP_t = Gross Domestic Product of Pakistan Per Capita in current U.S \$

$EXPR_t$ = Exports, million U.S \$

$IMPR_t$ = Imports, million U.S \$

TOP_t = Trade openness, U.S \$

Coefficient Q_0 is Intercept while Q_1 , Q_2 , and Q_3 are coefficients of independent variables. S_t is a disturbance term.

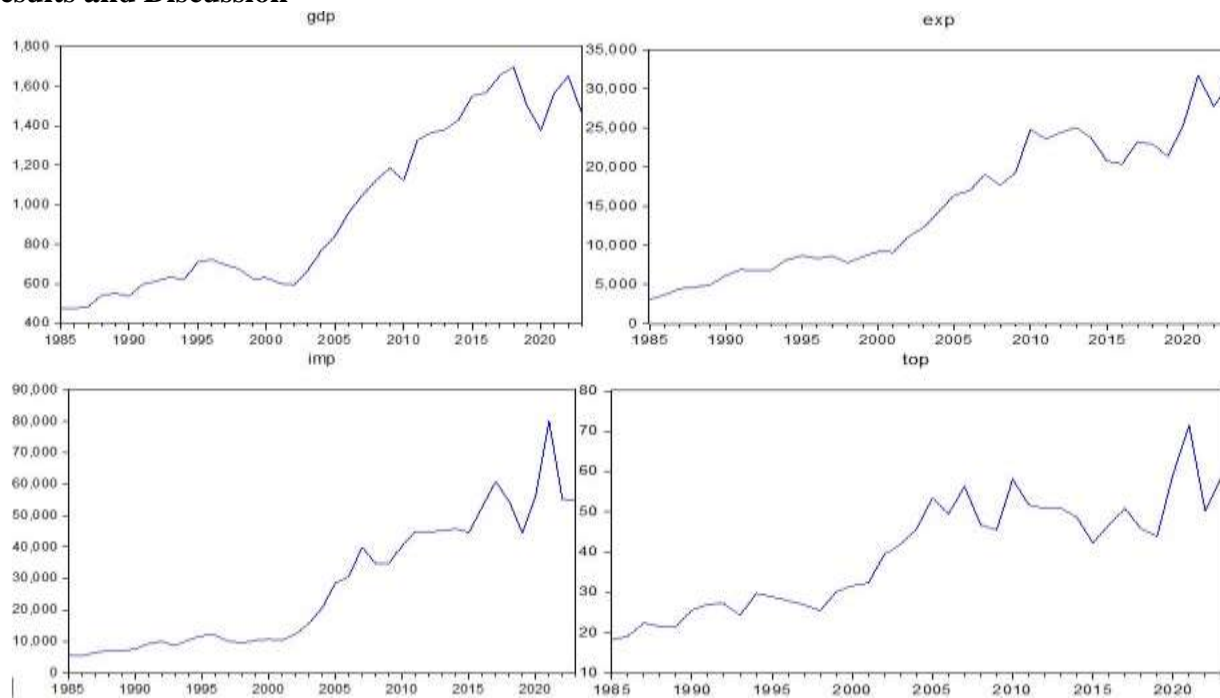
Diagnostic tests like the Unit Root, LM, ARCH, and CUSUM tests are used to assess the model's fit, residual stationarity, serial correlation, heteroscedasticity, and stability.

Data

This analysis employs annual data from the Pakistan Bureau of Statistics and the World Bank from 1985 to 2023, with GDP as the regressand variable and exports, imports, and trade openness as regressor.

We initiate our analysis by visual inspection of the series which were selected given below.

Results and Discussion



The above figures show the graphs of GDP_t , exports, imports, and trade openness. Figure 1 presents the plot of GDP_t . The plot shows the presence of a trend because GDP_t is continuously increasing. The presence of a trend indicates the non-stationarity of the series. Figure 2 illustrates the Plot of the $EXPR_t$ (Exports) series. This plot indicates that Exports are continuously increasing and an upward trend indicates that the series are non-stationary. Figure 3 illustrates the plot of the $IMPR_t$ (Imports) series, which shows a continuously increasing trend. The trend series refers to non-stationary. In Figure 4 the plot shows the TOP_t (Trade Openness) of Pakistan. There is a gradual increase and decrease in TO. This indicates a cyclic pattern due to the presence of cyclic fluctuation. These fluctuations refer to the nonstationary of the series.

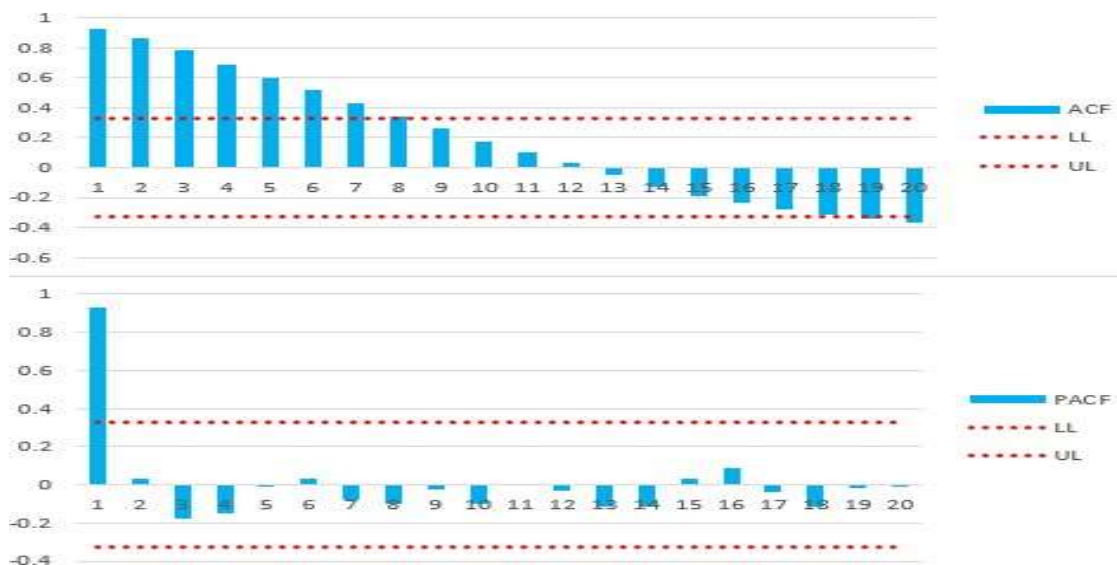


Figure 5: Correlogram of ACF and PACF of GDP_t

Figure 5 illustrates the correlogram of ACF and PACF of GDP_t . The values of ACF gradually declines to zero and PACF cut off at just lag one which is referring to the nonstationary of the series

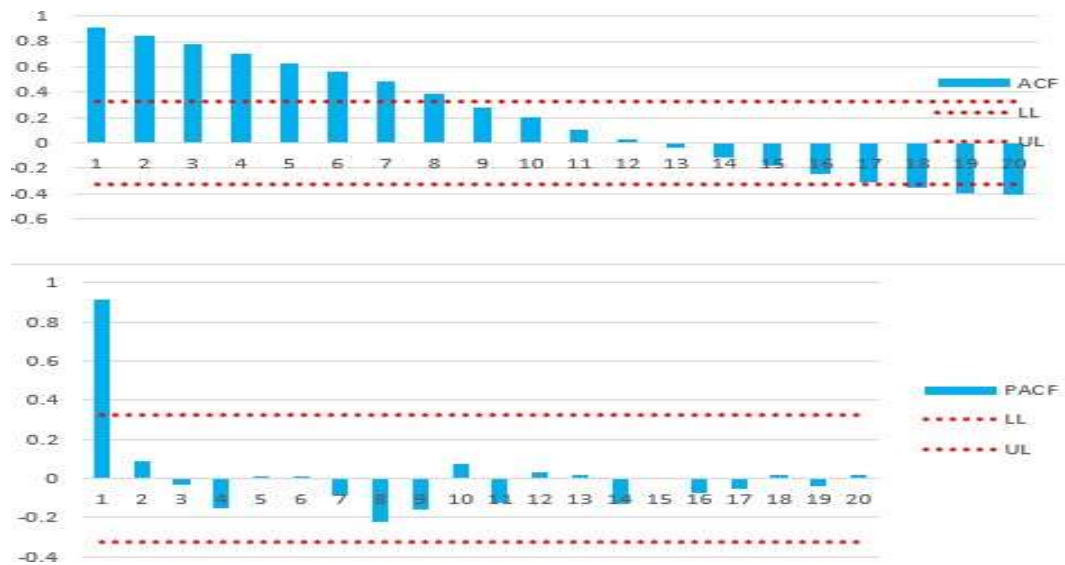


Figure 6: Correlogram of ACF and PACF of $EXPR_t$

Figure 6 illustrates ACF and PACF of Exports ($EXPR$)_t series. ACF shows a gradually decreasing pattern while PACF shows a sharp drop after 1st significant lag value. In ACF, values up to lag 8 values are outside the limit then some values are inside the limit but again lag 17 some values are outside of the limits which shows the significance of ACF values. In PACF after lag 1st, all the values lie within the interval. PACF just cuts off at lag with respect to both, the conclusion would be in favor of non-stationarity.

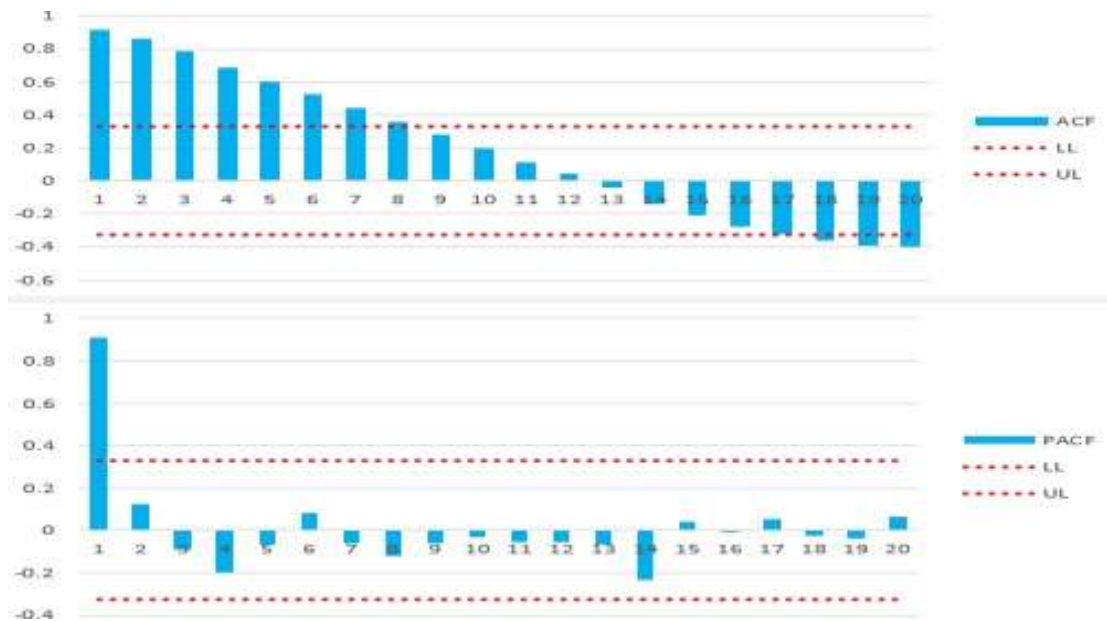


Figure 7: Correlogram of ACF and PACF of $IMPR_t$

Figure 7 presents the correlogram of ACF and PACF of ($IMPR$)_t. The ACF plot indicates a gradual decrease and simultaneously PACF has a sharp drop after 1st significant lag value. In ACF, the correlogram of all the values do not lie within the interval. In PACF after 1st lag, all the values lie within the interval. Both ACF and PACF indicate non-stationarity of the series

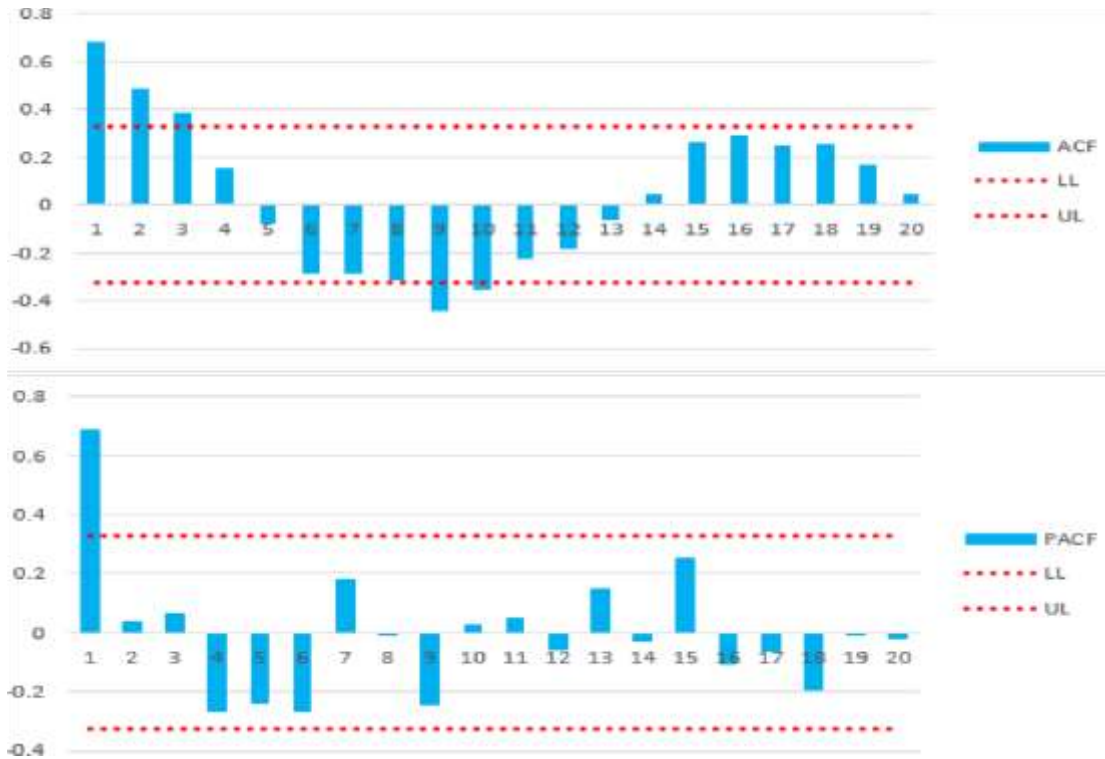


Figure 8: Correlogram of ACF and PACF of TOP_t

Figure 8 represents the correlogram of ACF and PACF of TOP_t (Trade Openness). The ACF plot indicates a gradual decrease and increase. In ACF, all the values do not lie within the limit values; in PACF, after the 1st lag value, all the remaining values lie within the limit values. Both ACF and PACF refers to the non-stationary.

Table 1: Unit Root Test at level

Augmented Dickey Filler Test	Intercept		Trend and Intercept		Without intercept	
	t-stat.	P-value.	t-stat.	P-value.	t-stat.	P-value.
GDP_t	-0.6325	0.8513	-1.7709	0.6989	1.48917	0.9639
$EXPR_t$	-0.2306	0.9257	-2.7193	0.2350	1.82025	0.9817
$IMPR_t$	1.1648	0.9973	-1.6876	0.7361	3.35066	0.996
TOP_t	-0.5588	0.8674	-3.64421	0.03941	1.878040	0.9837

Table 1 represents the unit root test for all series. In this test, ADF tests are applied to check the stationarity with and without intercept as well as including trend and intercept. The outcomes depict that for all conditions, the p-value is greater than 0.05 which shows that the statistical hypothesis is accepted at 5% alpha. So it is confirmed that for all three conditions, all series (GDP, Export, Import, and trade openness) are non-stationary. So it is confirmed that all concerned series, are non-stationary and have a unit root.

Table 2: The Unit Root Test 1st Difference

Augmented Dicky Filler	intercept		trend and intercept		without intercept	
	t-Stat.	P-value.	t-Stat.	P-value.	t-Stat.	P-value.
DGDP _t	-5.221335	0.0001	-5.077931	0.001	-4.60174	0.0000
DEXPR _t	-6.917050	0.0000	-6.861162	0.0000	-6.090438	0.0000
DIMPR _t	-8.706449	0.0000	-9.123941	0.0000	-7.011296	0.0000
DTOP _t	-7.447178	0.0000	-7.332845	0.0000	-6.750441	0.0000

Table 2 represents the unit root for the transformed series at I(1). In this test, ADF tests are employed to check the stationary with and without intercept including trend and intercept. The outcomes indicate that for above conditions, the p-value is less than 0.05 which shows that the statistical hypothesis is rejected at 5%. So it is confirmed, all concerned series are stationary and have no unit root.

Table 3: OLS Regression Results

Variable	Coefficient	S.E	t-Stat.	P-value
C	716.0822	56.50139	12.67371	0.0000
EXPR _t	0.035501	0.007607	4.666665	0.0000
IMPR _t	0.016520	0.002396	6.894914	0.0000
TOP _t	-18.66432	2.876048	-6.489573	0.0000
R-sq: 0.965030		Adj. R-sq : 0.962032		

The estimated model from the regression result is:

$$GDP_t = 716.0822 + 0.035501 EXPR_t + 0.016520 IMPR_t - 18.66432 TOP_t$$

Table 3 demonstrates that the regression model is significant at the 5% , with the t-statistic probability 0.000, suggesting accuracy. R-squared, a measure of the model's quality of fit, also indicates the best match for the given data. Maddala and Lahiri (2009)

Table 4: The Unit Root Test of Residuals

Augmented Dickey-Fuller	T-statistic	p-value
statistic	-3.866115	0.0060

critical values	1% level	-3.661661
	5% level	-2.960411
	10% level	-2.619160

Table 4 shows that residuals are stationary and t-statistics is higher than the critical value at 5 percent of significance level while the p-value of residual is less than 0.05 which depicts there is no unit root in the

residual series. Residuals are $I(0)$. Thus, there is a link or cointegration between GDP and the other variables being studied.

Normality Test

Table 5: Results of Jarque Bera Test

Skewness	-0.024604
Kurtosis	2.378981
Jarque-Bera test	0.614470
Prob-value	0.735478

The normality test from Table 5 shows that residuals are normally distributed (the probability of the JARQUE-BERA test value is not greater and the Probability value is higher than 5%). The confirmation of residual normality shows that our estimated regression model has realistic predictive power to predict.

Figure 9 illustrates the forecasted value of the model. The forecasted value of the model is closer to the actual value of the series which clearly shows the minimum chance of the error. Therefore, our fitted model is best for forecasting Pakistan GDP.

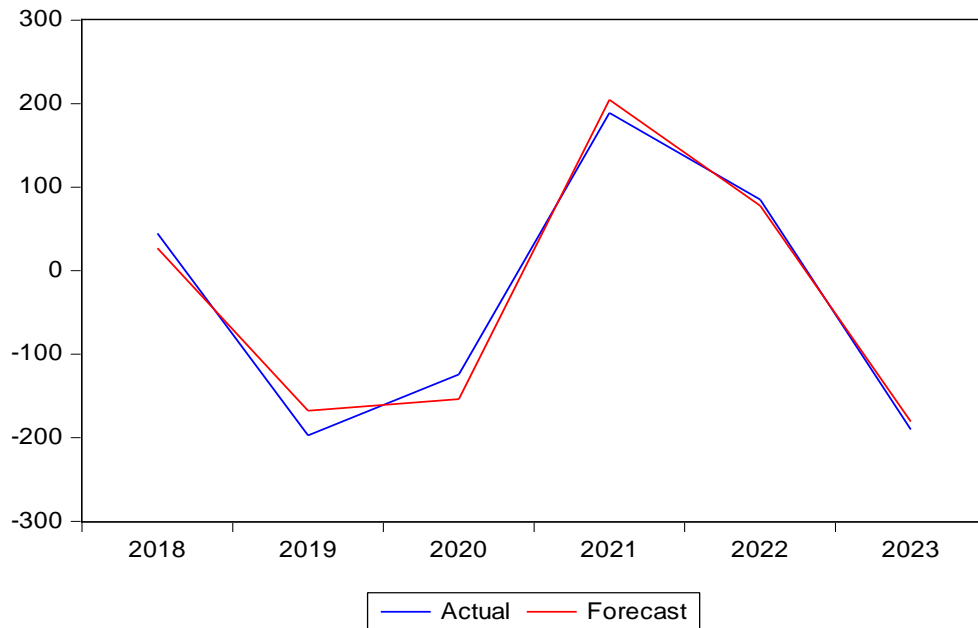


Figure 9: Forecasting Results

Cointegration

Overall results indicate that all the series are non-stationary at $I(0)$ but stationary at $I(1)$ while residuals from the regression are $I(0)$. Through these results, it can be concluded that the overall linear combination canceled out the stochastic trends in the two series. In this case, regression of two variables $EXPR_t$, and GDP_t would be meaningful. Thus it can be concluded that two variables are cointegrated. In economic point of view, variables are cointegrated if there exists a long-run association between them which may need different tests for further checking, such as the Engle-Granger (EG) or the Cointegrating Regression Durbin–Watson (CRDW) Test.

Cusum and Cusum Square Tests

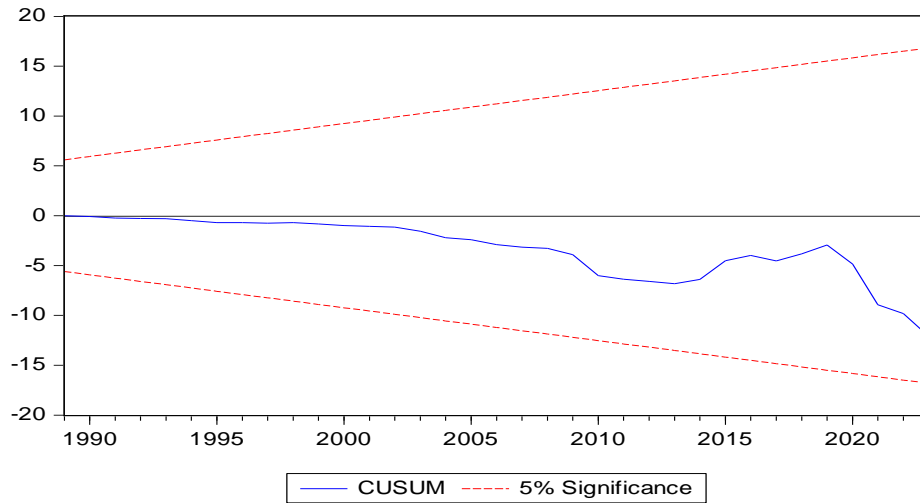


Figure 10: CUSUM Results

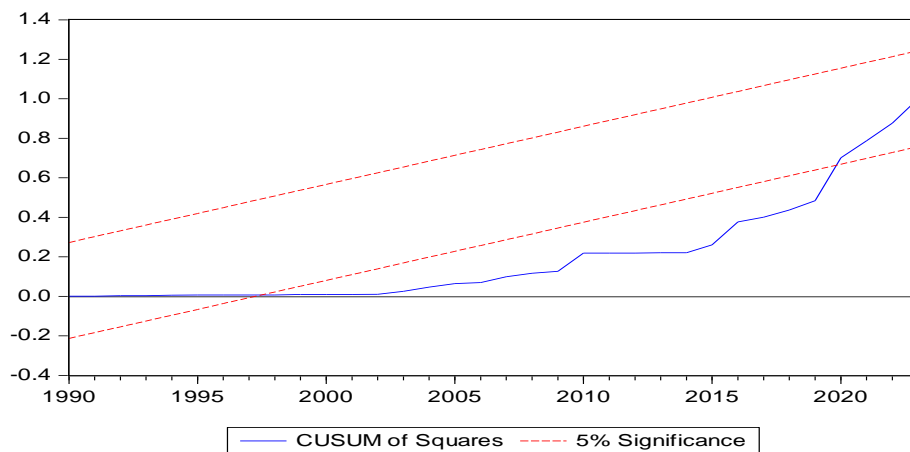


Figure 11: CUSUM Square Results

In Fig 10 and Fig 11, the CUSUM test results verified the stable impact of regressors on GDP while the CUSUM square test suggests instability and structural breaks in model, implying that the link between the variables may alter due to external shocks, policy change or including other variables.

Conclusion

OLS regression results show that all $EXPR_t$, $IMPR_t$ and TOP_t variables understudy have significant effects on GDP_t . $EXPR_t$ and $IMPR_t$ have a positive effect on GDP_t while TOP_t has a negative effect. This implies that GDP_t is explained by exports, imports, and trade openness. The effect of imports and exports on GDP_t in Pakistan was positive and statistically significant as well. The Adjusted R-square, R-squared was 0.96 and depicts that the overall model is best fit, but the CUSUM square shows the model is not stable and has some structure breaks in the variance. These structure brakes present in the models open the new door for future Research.

Recommendations

Based on the outcomes of this study, it is suggested that

- Researchers need to extend this study and remove structure brakes by using state space models, Markov Regime switching, and threshold models.

- Moreover, for suitable forecasting, the use of this model may further be extended with a non-normal distribution.
- To increase global market competitiveness, the government should boost regional export diversification, reduce foreign goods and services, and reduce imports, all while enhancing product quality in manufacturing industries.
- The Import-led Growth hypothesis applies to Pakistan, suggesting a positive link between imports and GDP. The government should improve its import policies by encouraging non-direct consumable imports for export.

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