9. THE EXPORTS PERFORMANCE OF PAKISTAN: EVIDENCE FROM THE ARDL COINTEGRATION ANALYSIS

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Abstract

The export performance is the most significant aspect to consider for the economic development of every country, even Pakistan. International trade, mainly export, is the main factor in boosting Pakistan's economic development. Therefore, this study finds a short-run & long-run association between export performance and Pakistan's export factors. This study used ARDL-Autoregressive Distributed lag and the data time series from FY1972 to FY 2021. The study has found a short-run and long-run association between factors of exports, including inflation rate, FDIs, exchange rate, GDP, interest rate, and export performance of Pakistan. The findings of the Granger causality check further discovered unidirectional causation between GDP and exports, FDI and exports, and real effective exchange rate & export performance in Pakistan on lag one. Similarly, on lag two, there is a one-way causal relationship between inflation rate and exports and two-way causation between export performance and FDI. Thus, from the results, it is acquainted that there must be much closer coordination with trading alliances to get sustainable export growth among countries.

Keywords: export performance; exchange rate; interest rate; fdi; inflation rate; GDP; ARDL modeling; Granger casualty method

JEL Classification: C22, E4, E31, F31

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1. Introduction

Export is the essential factor of international trade compared to imports as it is directly linked to the economy's growth. Numerous Asian economies, for instance, Taiwan, China, Malaysia, and South Korea, have gained economic growth by increasing their exports (Hassan et al., 2021; Kandil et al., 2017; Ali and Li, 2016). However, many emerging countries face the trade deficit problem in international trade because of increased imports as compared to their exports (Oe et al., 2019; Butt, 2016). Most economists recommend policies favoring exports with a flexible exchange rate (Fugazza and Molina, 2016). In international trade, policies such as removing trade barriers and quotas enhance the trade between emerging and developing economies (Hassan et al., 2022; Raza and Afshan, 2020). Countries like Vietnam, Bangladesh, India, and Cambodia adopted such policies and enhanced their economic growth, while some countries that failed to adopt such policies, such as Pakistan, could not sustain their economic development (Dalango, 2020; Ahmed et al., 2017). Pakistan has failed to use the international trade opportunity despite getting the GSP plus status from the European Union. The last three fiscal years show that exports of Pakistan register a downward trend (Iftekhar et al., 2017). Also, the remittances department has not shown any positive role in reducing the trade deficit of Pakistan (Ghauri et al., 2020; Hassan et al., 2016). Pakistan's foreign exchange quench is always in a hike to pay import bills. However, in Gulf Cooperation Council countries' fiscal consolidation, the remittances have decreased (Ahmed et al., 2018). Moreover, the recent disruptions of KSA and Qatar have further created problems for Pakistan by decreasing its labor demand (Joshua, 2019; Bostan et al., 2018). Looking at these situations, it is essential to adopt appropriate policies to earn foreign exchange and reestablish the stagnant export growth (Ghauri et al., 2020; Ahmed et al., 2018).

Today's modern world is always in a way to know about economic conditions leading to export performance and to find out the factors of export supply (Joshua, 2019; Hassan et al., 2017). In this regard, many studies have analyzed export performance and identified the critical factors leading to export performance (Ghuari *et al.,* 2020; Hussain et al., 2020; Jawaid et al., 2016). Many studies considered export supply function (ESF) on a cumulative level (Kunwar, 2019; Gupta et al., 2015), and the weak point of analyzing the ESF is that it does not give information regarding factors of export supply (Carrasco and Tovar-Garcia, 2020; Lupu *et al*., 2018; Mamoon *et al.*, 2017), whether they are constant or differ with exports classifications and whether the elasticity of export supply is different for each export category or not (Mdanat et al., 2018). Therefore, it is crucial to solve these queries. Firstly, strategies and technologies related to development must be identified for different export sectors, which may enable the country toward high-tech industrialization (Oliveira *et al.,* 2020). Secondly, export supply elasticity should be noted for every export category along with their respective factors to formulate relevant trade policies, including policies for export promotion (Oluwafemi and Laseinde, 2019). Thirdly, it is observed that subsidies and incentives for export are primarily relevant for export categories that have price elasticity higher than unity (Epaphra, 2016; Anagaw and Demissie, 2012). It will help the policymakers provide subsidies according to export categories. Thus, because of such issues, few studies analyzed the factors of exports in Pakistan (Jawaid *et al*., 2016; Javed et al., 2020; Salim, 2021).

Most of the studies like Iftekhar et al. (2016), Ghauri et al. (2020), Memoon et al. (2017), Salim (2021), and Malhotra and Kumari (2016) have standard features while analyzing export performance. They assessed the export supply function (ESF) on a macro level, not

on an individual or micro level, including all details and elements of export. However, the current study includes all export categories and all external and internal factors of export performance (Dalango, 2020; Hassan et al., 2016). Examining the factors of exports on a specific industrial level to formulate relevant policies is imperative as all sectors are covered in aggregate export performance. The studies used the neo-classical method to analyze the performance of export in Pakistan, which is determined by the nation's production capacity and profitability factor (Ahmed et al., 2017; Kalim and Hassan, 2014). The studies are based on market prices ignoring the domestic demand pressure in Pakistan. Moreover, the export performance function can create mounting biases in price elasticity if domestic pressure is ignored (Huang et al., 2014; Maryam and Hassan, 2013). Thus, regarding these issues, this study considers the export performance on a micro level, including all export categories and their factors. Specifically, the study includes the determinants such as foreign direct investment, interest rate, GDP, inflation rate and exchange rate in the export performance model.

Since export performance is considered an essential element of a country's development, this study analyzes determinants such as FDIs, exchange rate, interest rate, inflation rate, and GDP, and their impact on exports of Pakistan. Analyzing and controlling these determinants is essential for economic growth. If these determinants are high, the economy will grow, too (Ghauri et al., 2020; Jawaid et al., 2016). A country's export performance depends on FDIs, interest rate, GDP, exchange rate, and inflation rate, which are ultimately linked to economic development (Jawaid et al., 2016; Nnaji et al., 2013). Hence, this study will help future researchers and economists explore the country's economy. Furthermore, it will help the economists to make decisions regarding foreign relations of the country, to get more attached to those countries which help the economic development of Pakistan. This study will also benefit policymakers in making relevant policies regarding exports in the economy (Anagaw and Demissie, 2012; Salim, 2021). Moreover, this research has made its theoretical model based on a resource-based view (Huang et al., 2014; Nyeadi et al., 2014); to explore a relationship between GDP, exchange rate, FDIs, interest rate, inflations rate and the export performance of Pakistan.

The rest of the article has been divided into five sections: Section two consists of literature review, Section three comprises data and methodology, and Section four empirical findings of the study. Section five contains discussions and conclusions of the research study, and finally, Section six consists of policy implications.

2. Literature Review

The international trade and global demand influenced the export value. The rising world demand has impacted the export performance by looking at the demand side. Studies used different variables to measure world demand (Oluwafemi and Laseinde, 2019; Kalim and Hassan, 2014). This study used total imports of the world as a variable to measure world demand, which is also used in previous studies by Kunwar (2019), and Salim (2021). However, any country's exports could have negative and positive impacts. Developing economies' exports include raw materials and partially processed goods (Ghauri et al., 2020; Malhotra and Kumari, 2016). Apart from this, it is noticed that prices of goods have become unstable because of integration and globalization. This price instability has affected the developing nations' export division, causing poverty, trade deficit and economic crisis (Jawaid et al., 2016; Javed et al., 2020). Another research analyzed the prices of goods, including agricultural products and minerals, in developing economic regions such as Latin

America, South Asia, the Caribbean, and Sub-Saharan Africa (Mdanat et al., 2018; Oluwafemi and Laseinde, 2019). According to economic theory, export performance is surplus when domestic production exceeds domestic consumption. Therefore, export performance is determined by many factors related to demand and supply (Mamoon et al., 2017; Oliveira et al., 2020). In this regard, many economists gave weight to demand-side factors in export performance as the supply-side factors are more elastic (Nyeadi et al., 2014; Panda and Mohanty, 2015). On the contrary, economists supporting supply inelasticity suggested that less developed countries' exports are low due to ignoring the supply side of export in their economies (Javed et al., 2020; Thuy and Thuy, 2019).

2.1. The impact of inflation rate on exports

Another study by Ahmed et al. (2018) evaluated the fluctuations of commodity prices (CPI & WPI), their evolution, and their consequences on the economy of Pakistan. The study found that Pakistan must be responsive to decreasing global prices by shifting its exports and reducing subsidies on fuel and currency adjustments (Mamoon et al., 2017). Similarly, Pakistan must diversify its export division towards services, manufactured, and modern goods exports in the long run, so that value-added goods are not changed by price fluctuations and can increase foreign reserves (Salim, 2021). Another study by Hassan et al. (2016) determined the fluctuation of commodity prices and their impact on the country's exports and public finance. The study analyzed forty-one commodities consisting of food, energy and minerals from 1980 to 2008 in ninety developing nations and found that increase in prices caused enhancing tax on exports that lead to a soar in public finance revenue (Fugazza and Molina, 2016). However, decreasing commodity prices is not beneficial for developing economies that rely on exports. Joshua (2019) and Gupta et al. (2015) mentioned that increasing the prices of goods can stabilize the current account of developing and emerging countries. The increased prices increase the exports as producers enhance the manufacturing process (Kunwar, 2019).

2.2. The Impact of GDP on Exports

GDP is a supply-side factor that impacts exports. If a country increases its production level, it has a surplus that can be traded to other foreign countries to increase foreign exchange. GDP is a country's final goods and services production and it is a reason for export performance. The research studies of Oo et al. (2019), Ahmed et al. (2018), and Hassan et al. (2017) found that economic growth (GDP) has a cogent link with exports, including primary and manufactured exports; but they found insignificant relationship regarding relative prices on manufactured and primary exports of Pakistan. Ali and Li (2016), and Hussain et al. (2020) analyzed textile and clothing exports, and they concluded that these export categories were significantly related to export performance. The GDP of Pakistan has insignificant relation with goods exports on short term, and relative prices have a cogent relation with exports on short and long term (Raza and Afshan, 2020). A critical study carried out by Ahmed et al. (2017) suggested that the GDP of Pakistan had a significant relation to citrus fruits exports, and there is an adverse impact of domestic production of citrus fruits in Pakistan on its export performance. It can be said that there are various points of view in the studies related to factors of export performance in relation to export categories in Pakistan (Hassan et al., 2021; Štreimikienė et al., 2020).

2.3. The Impact of Exchange Rate on Exports

Numerous pieces of research were conducted to analyze the impact of exchange rate on exports, concluded with different outcomes (Hassan et al., 2022). Exports demand depends on exchange rate fluctuations (Javed et al., 2020; Nyeadi et al., 2014). A critical study suggested that if the exchange rate is appreciated, it negatively impacts export performance. A depreciated currency positively impacts exports (Dalango, 2020). Depreciation of currency enables exports to be affordable globally, increasing the demand for exports (Iftekhar et al., 2016). Depreciation of currency decreases foreign currency prices, but if a country imports more, its domestic currency price rises (Ghauri et al., 2020). Thus, the exchange rate may have negative and positive relations with exports (Bostan et al., 2018). Another study used the bound test method to find the influence of exchange rate instability in Vietnam from 2000 to 2004 and established that exchange rate uncertainty negatively influences exports on short term. However, depreciation has an affirmative influence on exports of Vietnam (Thuy and Thuy, 2019) [38]. A study conducted in eight East and Southeast Asian countries by Oo et al. (2019) suggested that the exchange rate for manufacturing and merchandising export performance is significant. However, the exchange rate has insignificant relation to transport and machinery export performance. According to Hassan et al. (2017), depreciation positively affects the export performance of Bangladesh and Pakistan but not India.

2.4. The Impact of Interest Rate on Exports

The interest rate is an imperative factor for the supply side of exports, and interest rate is an essential determinant of export performance (Olczyk and Kordalska, 2017). Performance comes on the supply side factor of export. Interest rate is considered one aspect of the economic development of a nation and it is determined by a ratio of money the financial institution deposits per annum (Ghauri et al., 2020; Sato, 2020). At the same time, Sonaglio et al. (2016) used the structuralist method to examine the influence of interest rate and exchange rate on exports of Brazil. The researchers established a significant and positive link between the exchange rate and exports, and the exchange rate has a cogent impact on the interest rate. According to Bostan et al. (2018) and Fasano-Filho et al. (2019), the interest rate and real exchange rate significantly influence the export performance of Romania. Using the OLS approach, they further found that the interest rate and exchange rate adversely impact Romania's imports and exports. Oo et al. (2019) used the ARDL approach in the ASEAN region from 2000 to 2015; and concluded an inverse influence of interest rate on the performance of exports for both long-run and short-run associations amid exports and interest rate. The study further concluded that the region's exports could increase with a stable interest rate.

2.5. The Impact of FDIs on Exports

Jawaid et al. (2016) suggested that FDIs are an additional supply-side factor that can influence a country's export performance. The FDI has influenced relatively more export-related sectors and can also enhance their exports. FDI plays a significant part in enhancing countries' export performance (Joshua, 2019; Hassan et al., 2017). FDI gives new and modern ways of production. It strengthens the quality and increases overall output, ultimately leading to an increment in the export division of the country (Kunwar, 2019; Wang et al., 2022). FDI also provides knowledge and skills for people, hence, increasing the human capital. All human, production, and quality formations lead to export performance (Ghauri et al., 2020). Many studies analyzed the relation between FDI and exports, displaying mixed views regarding FDI's influence on exports (Javed et al., 2020). Some researchers, like

Samantha and Haiyun (2018) and Hintošová (2019) suggested the insignificant, negative relation between FDI and exports, while the studies of Jawaid et al. (2016), Epaphra (2016), Anagaw and Demissie (2012) suggested that there was a positive influence of FDI on export performance. Malhotra and Kumari (2016) examined the distinction between the USA and Japan's FDIs in eight economies, including four ASEAN economies, for instance, Philippines, Thailand, Indonesia and Malaysia, and four emerging modernized regions such as Singapore and Taiwan, Hong Kong and Korea. The study found trade related FDI is of Japan and America's FDI is not inclined towards trade.

3. Data and Methodology

3.1. Sources of Data Collection

For the undertaken study, we used different variables, such as export performance (X) as an outcome variable. However, foreign direct investment (FDI), interest rate (CMR), inflation rate (CPI), an exchange rate (REER) and gross domestic products (GDP) are obtained from different Handbooks of statistics on Pakistan economy 2020, which the State Bank of Pakistan published during the fiscal year 1972 to 2021, as showed in Table 1.

Table 1. Data collection Source

Variables	Abbreviation	Frequency	SBP Publications
Export performance	X	Annual	Handbook of statistics on Pakistan Economy 2020
Inflation rate	CPI	Annual	Handbook of statistics on Pakistan Economy 2020
Interest rate	CMR	Annual	Handbook of statistics on Pakistan Economy 2020
Foreign direct investment	FDI	Annual	Handbook of statistics on Pakistan Economy 2020
Gross Domestic Product	GDP	Annual	Handbook of statistics on Pakistan Economy 2020
Real effective exchange rate	REER	Annual	Handbook of statistics on Pakistan Economy 2020

3.2. Export Performnace Function

We employed ARDL modeling time series to evaluate short-run and long-run relationships. Several pieces of research have been conducted to evaluate the export performance in diverse geographic areas, for instance (Jawaid et al., 2016; Anagaw and Demissie, 2012). Previous literature confirmed that several factors could influence export performance, for instance, FDIs, interest rate, exchange rate, employment, remittances, and inflation rate. Thus, we have taken the six most prominent factors and derived the fundamental model for the export performance function as in Eq. (1) and Eq. (2):

$$X = f(INF, CMR, REER, GDP, FDI)\ldots\ldots \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$X_t = \alpha + \beta_1 Inf_t + \beta_1 CMR_t + \beta_1 REER_t + \beta_1 Gdp_t + \beta_1 Fdi_t + \epsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

3.3. Summary of Operational Variables

We used export performance (X) as an outcome variable; however, inflation rate (CPI), real exchange rate (REER), GDP, FDIs and interest rate (CMR) were taken as independent variables. The details are reported in Table 2.

Table 2. Functional Indicators

Macroeconomic indicators	Abbreviation	Functional Indicators	Sign
Export performance	X	LX=Natural log (export value US$)	
Inflation rate	CPI	LCPI=Natural log (consumer price index)	(-)
Interest rate	CMR	LCMR=Natural log (Call money rate)	(-)
Real effective exchange rate	REER	LREER=Natural log (Real effective exchange rate)	(-)
Gross domestic products	GDP	LGDP=Natural log (C+I+S+G)	(+)
Foreign direct investment	FDI	LFDI=Natural log (foreign direct inflows)	(+)

3.4. Estimation Techniques

We used two techniques to evaluate the stationarities of time series data. We employed Philips-Perron (1988) and Augmented Dickey-Fuller (1981) approaches to assess the unit roots.

3.4.1. The Augmented Dickey-Fuller Approach

However, there are numerous methods for checking the unit root in time series. We employed two famous methods; the first is the Augmented Dickey-Fuller (1981). Eq. (3) is the general representation of this method:

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{i=1}^{n} \alpha \, \Delta y_t + e_t \qquad (3)$$

In Eq. (3), 'y' denotes the data time series with 'n' numbers of optimum lags in the 't' time. However, constant ‘αo’ and ‘e’ are known as the error terminology.

3.4.2. The Philips-Perron Approach

The second method we employed in this research was the Philips-Perron (1988); this is a more robust model than the ADF method. Therefore, we employed this method to assess the unit roots in time series. Eq. (4) is a mathematical representation of this model:

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + e_t \qquad (4)$$

Similarly, in Eq. (4), 'y' denotes the data time series with 'n' numbers of optimum lags in the 't' period. However, ‘αo’ signifies as constant and ‘e’ represents a white noise error.

3.4.3. The ARDL Modeling Approach

For the evaluation of short-run and long-run cointegration associations, we employed the ARDL technique amid macroeconomic indicators (Pesaran et al., 2001; Pesaran and Shin, 1999). Eq. (5) is the mathematical representation of the ARDL cointegration technique:

$$\Delta \mathrm{Y}_t = \alpha + \beta_1 Y_{t-1} + \beta_2 X_{t-1} + \sum_{i=1}^{k} \beta_{1i} \, \Delta \mathrm{Y}_{t-1} + \sum_{i=0}^{k} \beta_{2i} \, \Delta \mathrm{X}_{t-1} + \varepsilon_t \qquad (5)$$

In Eq. (5), the Wald measurement limit approximation is used to assess the presence of long-term association by setting a null hypothesis of β_1=β_2=0. In this modeling, we

compared a group of critical values from 4.93 – 5.73 with F-calculated values for lag one at a 5% significance level. According to Pesaran et al. (2001), if the F-calculated values are superior to the higher level, that exhibits the long-run association between the factors.

3.4.4 The ARDL Bound Testing Approach

The ARDL bound testing is the ideal approach for evaluating the relationship between the variables, which was proposed by Pesaran et al. (2001). Once the unit root of factors has been achieved, we can use the ARDL bound approach through an OLS technique. A unique characteristic of the bound testing approach is that it could be used for combination integration orders, for instance, I(0) or I(1) as independent factors simultaneously, which means the ARDL bound technique is free of integration orders the data time series. According to Ghauri et al. (2020), ARDL bound testing approach is suitable and fit for finite and short data time series. Pesaran et al. (2001) have proposed this technique with the composition of vector autoregression (VAR) for several 'p' orders. Hence, the ARDL bound testing approach could be written as Eq. (6):

$$Z_t = \mu + \sum_{i=1}^{p} \beta_i z_{t=i} + \varepsilon_t \qquad (6)$$

The VECM has been built up and written as Eq. (7):

$$\Delta Z_t = \mu + \alpha t + \lambda z_{t-1} + \sum_{i=1}^{p-1} \gamma_t \, \Delta y_{t-i} + \sum_{i=1}^{p-1} \gamma_t \, \Delta x_{t-i} + \varepsilon_t \qquad (7)$$

In Eq. (6) and Eq. (8), 'y' is referred to as a dependent factor, and 'z' is recognized as 'x' and 'y' vectors. However, $\boldsymbol{\gamma_{it}}$ is a grid vector that describes the variables' procedures in the 't' period. Similarly, Eq, (7) 'Δ' denotes as a prime distance operative, whereas, λ is known as a multiplier matrix for a long-term. Hence Eq. (7) might be expressed as Eq. (8):

$$\lambda = \begin{bmatrix} \lambda_{YY} & \lambda_{YX} \\ \lambda_{XY} & \lambda_{XX} \end{bmatrix} \qquad (8)$$

In Eq. (8), the transverse objects of the matrix are unobstructed; therefore, the selected procedure is supposed to order of integration zero or one. In Eq. (8), if λ_YY=0, 'Y' is subsequently studied as the order of integration one. If λ_YY<0,then 'Y' is called integrated zero order. According to Ghauri et al. (2020), the Wald method (F-calculated) exhibits variations in a long-term association with interrelated factors, and the Wald method might be used by limiting estimated long-term coefficients. Thus, the succeeding null hypothesis must be connected to invalid assumptions and options:

$$\boldsymbol{H_0 = \beta_1 = \beta_2 = \beta_3 = 0}$$

The above estimation provides the absence of long-run association, but on the contrary, the alternative hypothesis must be written as:

$$\boldsymbol{H_A \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq 0}$$

Therefore, the above estimation proves a long-run relationship in which we compare F-critical values with F-calculated values.

3.4.5 Granger Causality Test

For the examination of directionality, we employed Granger (1969) causality. This technique ascertains the causation of one macroeconomic indicator to another macroeconomic indicator in diverse data time series. Thus, Eq. (9) and Eq. (10) represent the Granger causality for two different data time series, 'X' and 'Y,' for testing pairwise variables:

$$Y_t = \sum_{n=1}^{p} A_n X_{t-p} + \sum_{n=1}^{p} B_n Y_{t-p} + CZ_t + E_t \quad (9)$$

$$X_t = \sum_{n=1}^{p} A_n Y_{t-p} + \sum_{n=1}^{p} B_n X_{t-p} + CZ_t + E_t \quad (10)$$

The two-time series 'X' and 'Y' are represented in Eq. (9) and Eq. (10), in which the 'E' white noise error is non-correlated with the period 't'. Both Eq. (9) and Eq. (10) are regression equations; it is assumed that in Eq. (9) the normal values of 'Y' are linked with the primary values of 'X' series. Similarly, Eq. (10) proposed that the existing readings of 'X' are linked with the preceding readings of the 'Y' time series.

4. Empirical Findings

4.1. Descriptive Analysis

The findings of Table 3 demonstrated the fundamental statistical hallmarks of macroeconomic indicators. The findings showed that the standard deviation real effective exchange rate (LREER) and interest rate (LCRM) are minimal as compared to other macroeconomic indicators, that LREER and LCMR are less volatile. However, foreign direct investment (LFDI) is the most volatile macroeconomic indicator. The Jarque-Bera normality test evaluates the normality patterns of individual time series. The findings of the Jarque-Bera test show that among all macroeconomic indicators, the H0 (null hypothesis) of LREER and LCMR of normality is rejected ($p<0.05$). According to Ahmed et al. (2017), the normality of variables is abolished after converting the time series into a natural logarithmic series. Thus, Table 3 also exhibited that the outcomes of Jarque-Bera test statistics, the rest of the variables behave normally since H0 is accepted. The empirical findings of Figure 1 demonstrated that the Jarque-Bera normality test also is employed to evaluate the residuals' normality of the given model. The outcomes are reported in section 4.2.

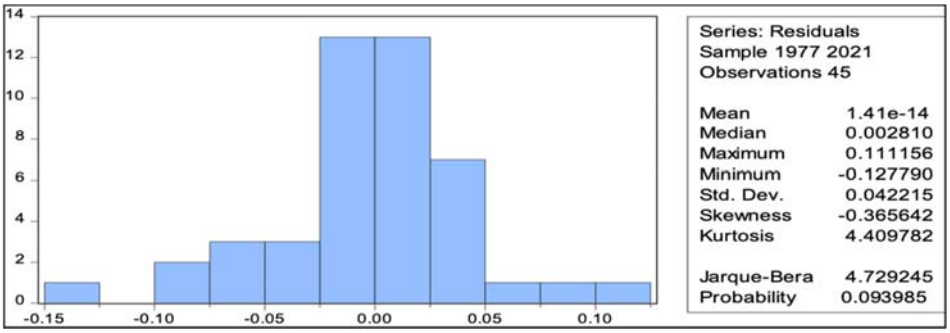
Table 3. Summary Statistics of variables

	LGDP	LCMS	LCPI	LFDI	LEER	LX
Mean	15.377	2.103	3.121	9.313	4.834	8.854
Median	15.434	2.163	3.270	10.003	4.686	9.026
Std. Dev.	0.676	0.338	1.130	2.829	0.297	1.051
Skewness	-0.224	-1.883	-0.107	-0.592	0.825	-0.460
Kurtosis	1.861	8.870	1.909	2.462	2.013	2.056
Jarque-Bera	3.056	99.289	2.523	3.452	7.550	3.550
Probability	0.217	0.000	0.283	0.178	0.023	0.169
Observations	49	49	49	49	49	49

4.2. Normality Diagnostic Test

Figure 1 demonstrates that the diagnostic techniques show that the error correction model does not experience non-normality. The results of Jarque-Bera and histogram normality proposed in the model's residuals are normally dispersed.

Figure 1. Histogram and Normality Test



4.3. Stationarity of Macroeconomic Indicators

We employed the Philips-Perron (1988) and Augmented Dickey-Fuller (1981) approaches to examine variables' stationarity and integration orders. The findings of Table 4 indicated that the unit root test is achieved for economic growth (LGDP), foreign direct investment (LFDI) and interest rate (LCMR) at levels. It means the order of integration of LGDP, LFDI and LCMR is I(0). However, other determinants, such as inflation rate (LCPI), export performance (LX) and real effective exchange rate (LREER), achieved unit root at first difference. Thus, Table 4 demonstrates that the integration orders of LX, LCPI and LREER are I(1). Since the stationarity of factors is a hybrid, i.e., I(0) or I(1), researchers have to employ the ARDL modeling method to check a short-term and long-term association among the macroeconomic indicators.

Table 4. Stationarity of Data Series (ADF & P.P tests of the unit root)

Variables	ADF test statistics				P.P. test statistics				Stationary Level
	at level		at 1st difference		at level		at 1st difference		
	Value	P-value	Value	P-value	Value	P-value	Value	P-value	
LGDP	-3.0758	0.0352			-3.0758	0.0352			I(0)
LCMS	-3.7946	0.0055			-3.3538	0.0178			I(0)
LCPI	-0.3724	0.9054	-4.8841	0.0002	-2.0467	0.2666	-4.9586	0.0002	I(1)
LEER	-0.7113	0.8340	-5.2088	0.0001	-0.8938	0.7818	-5.1806	0.0001	I(1)
LX	-2.3718	0.1549	-6.1141	0.0000	-2.6194	0.0961	-6.1141	0.0000	I(1)
LFDI	-4.4253	0.0049			-4.4055	0.0052			I(0)

Notes: MacKinnon [52] one-sided p-values: at 1% level: −3.4481, at 5% level: −2.8693, at 10% level: −2.5709.

4.4. ARDL Bound Testing

We used the ARDL bound approach to assess a long-term cointegration connection among export performance (LX) and other variables. For this purpose, we have to equate the F-critical with the F-statistic values proposed by Pesaran (1997). The ARDL bound testing approach suggested that if the F-critical value occurred higher than the upper bond, we would reject H0 and establish cointegration. On the contrary, if it stayed below the lower bond, then we would have to accept the H0 and conclude the nonexistence of cointegration, and if it occurred between a lower and upper bond, then outcomes would be indecisive.

Table 5 exhibited that the F-statistic value (4.57) was more significant than its consequent upper critical bond (3.79) at a 5% significance level. The result exhibited that the "No cointegration" of H0 was rejected and it was finally established that export performance (LX) has a long-term relationship with its factors; for instance, LREER, LCMR, LFDI, LGDP and inflation rate (LCPI). The findings also demonstrated that a term of error variance is homoscedastic. Moreover, the term of error follows features of normality, it is not serially correlated and functional shape of research is appropriately signified for the considered time series of the current research. The findings of Table 5 demonstrate that the outcomes regarding cointegration are robust. Table 5 verified a long-term association amid macroeconomic indicators and exports. Thus, now we have to interpret coefficients of short-term and long-term for a designated ARDL modeling.

Table 5. ARDL Bounds Test

Test Statistic	Value	K
F-statistic	4.57	5
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.50%	2.96	4.18
1%	3.41	4.68

4.5. The ARDL Cointegration Long-Run Relationship

Results of the ARDL approach regarding long-term coefficients are depicted in Table 6. The findings exhibited that except for LFDI, all other determinants, for instance, LGDP, LCPI, LCMR, and LREER, have a long-term association with exports (LX). The results of Table 6 demonstrate that LGDP and LCMR have both significant and positive impacts on exports (LX). However, the LREER and inflation rate (LCPI) exerted an affirmative and cogent influence on the performance of exports (LX). The increase in GDP and interest rate (LCMR) permits the Pakistani currency to escalate, which advances Pakistani exports. Thus, Pakistani exports decrease, establishing a negative association between LREER, inflation rate (LCPI), LFDI, and exports (LX). A decrease in the LCPI, LREER, and LFDI reduces the exports (LX) on long term. The error term's coefficient is −32.02, suggesting that around 32 percent of volatility is adjusted in the existing fiscal year.

Table 6. The ARDL Cointegrating and long-run relationship

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	2.9205	0.5219	5.5955	0.0000
LCMS	0.4735	0.1189	3.9830	0.0011
LCPI	-0.7519	0.2664	-2.8227	0.0123
LFDI	-0.0722	0.0464	-1.5569	0.1390
LEER	-0.4549	0.1404	-3.2404	0.0051
C	-32.0213	7.3293	-4.3689	0.0005

*Cointegration equation = LX – (2.9205*LGDP + 0.4735*LCMR – 0.7519*LCPI – 0.0722*LFDI – 0.4549*LREER – 32.0213)*

4.6. The ARDL Cointegration Short-Run Relationship

Table 7 exhibited a short-term link amid LFDI, LGDP, and export performance (LX). The findings demonstrated that the term lagged error correction for the measured export equation is significant and negative. Thus, it validated in Table 7 that there was a short-term association amid LFDI, LGDP, inflation rate (LCPI), LREER, and export (LX) in the Pakistani economy. However, the interest rate (LCMR) does not have a short-run association with exports (LX). The ARDL bond approach suggested a long-term association amid exports (LX) and other macroeconomic indicators because the ECM's measurement is statistically significant and negative.

Table 7. The ARDL cointegrating and short-run association

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LX(-1))	0.5609	0.2032	2.7598	0.0140
D(LX(-2))	0.5192	0.1878	2.7641	0.0138
D(LX(-3))	0.6673	0.1916	3.4827	0.0031
D(LGDP)	7.1761	1.4434	4.9717	0.0001
D(LGDP(-1))	3.9725	1.5060	2.6378	0.0179
D(LGDP(-2))	-1.4935	1.5176	-0.9841	0.3397
D(LCMR)	0.0747	0.0890	0.8397	0.4135
D(LCMR(-1))	-0.1059	0.1078	-0.9820	0.3407
D(LCMR(-2))	-0.0247	0.0902	-0.2741	0.7875
D(LCMR(-3))	-0.1072	0.0807	-1.3282	0.2027
D(LCPI)	0.2767	0.7433	0.3723	0.7145
D(LCPI(-1))	0.7588	1.0931	0.6941	0.4975
D(LCPI(-2))	0.5422	0.9626	0.5633	0.5811
D(LCPI(-3))	-1.0882	0.5807	-1.8740	0.0793
D(LFDI)	-0.1304	0.0418	-3.1241	0.0065
D(LFDI(-1))	-0.0538	0.0379	-1.4176	0.1755
D(LFDI(-2))	0.0476	0.0415	1.1474	0.2681
D(LFDI(-3))	-0.0388	0.0326	-1.1882	0.2521
D(LEER)	0.6823	0.3175	2.1487	0.0473
D(LREER(-1))	-0.7079	0.4899	-1.4451	0.1677
D(LREER(-2))	-0.2465	0.4767	-0.5171	0.6122
D(LREER(-3))	0.9445	0.3711	2.5453	0.0216
Cintiq(-1)	-1.2410	0.2635	-4.7096	0.0002

4.7 Breusch-Godfrey Serial Correlation LM and Heteroskedasticity Approaches

We also employed two investigative approaches: Breusch-Godfrey serial correlation L.M. and Heteroscedasticity techniques. The findings of the two diagnostic techniques are reported in Tables 8 and 9. The findings of both tests confirmed that the residual terms are serially independent. Similarly, the outcomes of the ARCH LM method intensely propose the nonexistence of heteroscedasticity in the residual terms of the model.

Table 8. Breusch-Godfrey Serial *Correlation* LM Test

F-statistic	0.8641	Prob. F(1,15)	0.3673
Obs*R-squared	2.4511	Prob. Chi-Square(1)	0.1174

Table 9. Heteroskedasticity Test: ARCH

F-statistic	3.5567	Prob. F(1,42)	0.0662
Obs*R-squared	3.4351	Prob. Chi-Square(1)	0.0638

4.8 The CUSUM and CUSUMSQ Model of Long-Run Stability

The recursive residuals of CUSUM and CUSUMSQ graphical methods examined the stability of a long-run model. Figure 2 of the cumulative sum technique discovers systematic variations from the regression coefficients. However, Figure 3 of the CUSUMSQ technique is proficient in examining the abrupt variations from the consistency of coefficients of regression (Brown et al., 1975). The findings of Figure 2 and Figure 3 exhibit that values of CUSUM and CUSUMSQ techniques lie within a 5% confidence interval. Finally, we concluded from the results that we did not have evidence of structural instability in the residuals' equation of exports in the case of Pakistan.

Figure 2. Graph of CUSUM, cumulative sum recursive residuals

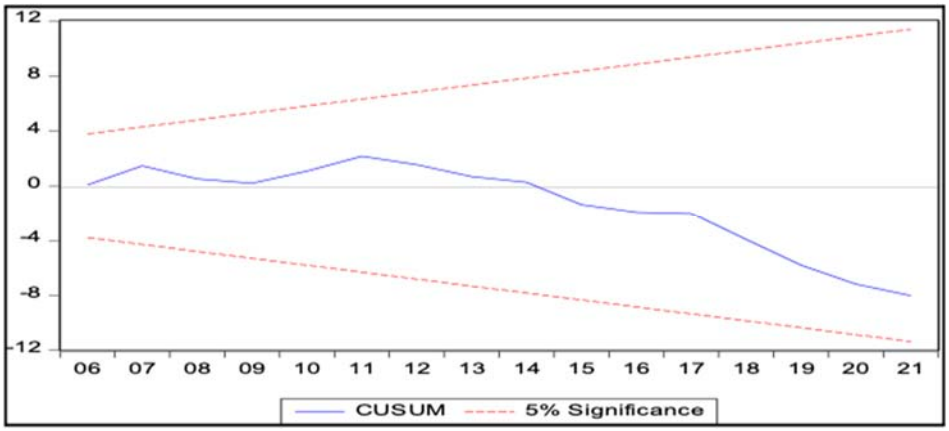
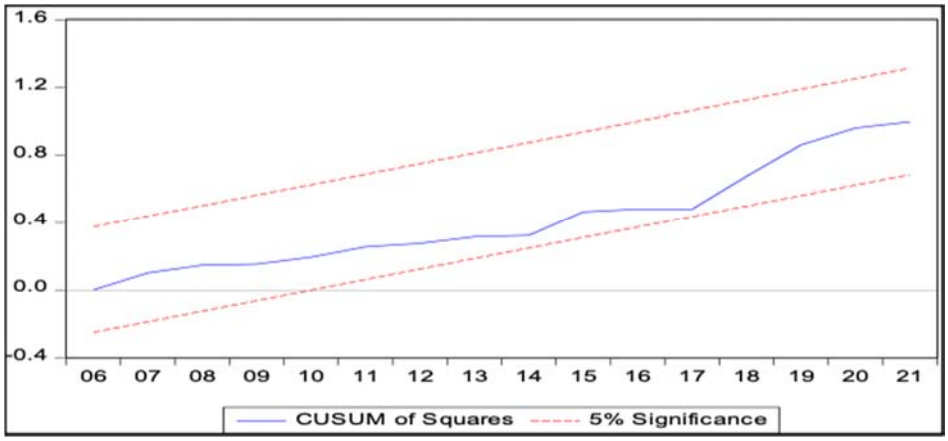


Figure 3. Graph of CUSUM, the cumulative sum of square recursive residuals



4.9. Granger Causality Technique

The Granger [51] causality technique effectively and robustly examines the directionality between the macroeconomic indicators. Thus, we analyzed causative association among the exports (LX), LREER, LCMR), LFDI, LCPI and LGDP on lags one and two. The findings of Table 10 demonstrated that Granger causality on lag one suggests one-way causation between LGDP and exports (LX), export performance (LX) and LFDI, and LREER and export performance (LX).

Table 10. Pairwise Granger Causality – Lag 1

Null Hypothesis:	Obs.	F-Statistic	Prob.
LGDP does not Granger Cause LX	48	2.8855	0.0963
LX does not Granger Cause LGDP		0.9043	0.3467
LCMR does not Granger Cause LX	48	2.5871	0.1147
LX does not Granger Cause LCMR		0.2078	0.6507
LCPI does not Granger Cause LX	48	0.4334	0.5137
LX does not Granger Cause LCPI		1.8990	0.1750
LFDI does not Granger Cause LX	48	2.5446	0.1177
LX does not Granger Cause LFDI		15.9464	0.0002
LREER does not Granger Cause LX	48	2.9236	0.0942
LX does not Granger Cause LREER		2.2175	0.1434

Similarly, the findings of Table 11 showed that the Granger causality suggested lag two, and outcomes demonstrated the unidirectional causation between export performance (LX) and inflation rate (LCPI) and LREER and export performance (LX). Table 11 further demonstrated bidirectional causation between LFDI and export performance (LX).

Table 11. Pairwise Granger Causality – Lag 2

Null Hypothesis:	Obs.	F-Statistic	Prob.
LGDP does not Granger Cause LX	47	1.9748	0.1515
LX does not Granger Cause LGDP		0.3689	0.6937
LCMR does not Granger Cause LX	47	1.1636	0.3222
LX does not Granger Cause LCMR		0.2386	0.7888
LCPI does not Granger Cause LX	47	1.5008	0.2347
LX does not Granger Cause LCPI		6.3748	0.0038
LFDI does not Granger Cause LX	47	4.0252	0.0252
LX does not Granger Cause LFDI		3.3769	0.0437
LREER does not Granger Cause LX	47	4.2729	0.0205
LX does not Granger Cause LREER		1.3682	0.2657

5. Discussions and Conclusion

The undertaken research assessed a short-term and long-term association amid exports of Pakistan and its influential factors, such as exchange rate, interest rate, inflation rate, economic growth (GDP), and FDIs. For this purpose, the data series from FY72 – FY21 was considered. We employed the ARDL modeling (Pesaran et al., 2001) to assess a long-term and short-run cointegration relation. This study also examined the causation of two variables using the Granger (1969) causality approach. The findings of the ARDL approach established a long-term association between economic growth (GDP), exchange rate, GDP, interest rate, inflation rate, and exports of Pakistan (Butt, 2013; Raza and Afshan, 2020; Ahmed et al., 2017). The findings further demonstrated that real interest rate and economic growth (GDP) exerted an affirmative and cogent influence on export performance. However, the exchange and inflation rates have a negative but significant influence on Pakistan's exports. The outcomes concluded that a rise in interest rate and economic growth (GDP) influence the Pakistani currency to appreciate and enhance Pakistan's exports (Oe et al., 2019; Dalango, 2020; Hassan et al., 2016). The negative association between exports performance, inflation rate, FDIs, exchange rate, and absolute efficiency resulted in a long-term decrease in Pakistan's export. The previous studies also confirmed the outcomes of this study, i.e., that an increase in FDI also enhances export performance (Oe et al., 2019; Bostan et al., 2018; Hassan et al., 2017; Jawaid et al., 2016; Thuy and Thuy, 2019).

The current research outcomes further demonstrated a short-run link between export performance and economic growth (GDP), FDIs and real practical exchange rates. The outcomes of this research confirmed the consistency of previous literature (Hassan et al., 2022; Jawaid et al., 2016). The CUSUM technique discovers systematic variations from the regression coefficients. However, graphs of the CUSUMSQ technique are proficient in examining the abrupt variations from the consistency of coefficients of regression (Brown, 1975). The graphical findings of CUSUM and CUSUMSQ methods lie within a 5% confidence interval. Finally, we concluded the nonexistence of structural instability in the residual's equation of export performance. These have confirmed previous research outcomes (Ghauri et al., 2020; Joshua, 2019; Jawaid et al., 2016). Finally, the findings demonstrated that Granger causality on lag one suggested one-way causation between gross domestic product (GDP) and export performance, export performance and FDIs, and real effective exchange rate and export performance. The preceding studies also exhibited unidirectional causality between export performance and FDIs, and exchange rate and export performance (Fugazza and Molina, 2016; Ahmed et al., 2018; Gupta et al., 2015).

The outcomes of lag two demonstrated the one-way causal association amid exports performance and exchange rate and inflation rate. Nevertheless, it is also established a two-way causal association between FDIs and exports. The previous literature also exhibited bidirectional causation between FDIs and exports (Ahmed et al., 2017; Kunwar, 2019; Samantha and Haiyun, 2018; Hintošová, 2019).

6. Policy Implications

This research postulates imperative policy implications; for instance, negative real effective exchange rate and inflation rate recommends vital determinants, which may increase the export performance of Pakistan. Thus, the depreciation of the Pakistani currency may enhance the exports of Pakistan, and a rise in interest rate may decrease the inflation rate, which may also improve the export performance of Pakistan. This study states a significant implication regarding interest rate, exchange rate, inflation rate, and foreign direct investments (FDIs) to Pakistan's economic managers and policymakers. The economic managers and policymakers may alter the strategies timely regarding the exchange rate, FDIs, and interest rate to get the maximum benefit concerning increased GDP and exports of Pakistan. Another essential function for boosting export performance is the GDP; the policymakers should make industry-friendly policies for both services and manufacturing sectors to enhance the gross domestic products (GDP) that augment Pakistan's export performance. The most critical determinant of export performance is the FDIs. The outcomes of the current research concluded a two-way causal relationship. Therefore, policymakers should provide a conducive working environment for local and international investors. They should provide extra incentives to foreign investors to bring their investments to small and large services and manufacturing sectors, improving Pakistan's export performance.

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