

## A Co-Integration between External Remittances, Physical Capital, and Economic Development of Pakistan An Empirical Investigation from ARDL Approach

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Article Info	Abstract
<p><b>Article History</b></p> <p>Received: May 11, 2021</p> <p>Accepted: August 26, 2021</p> <hr/> <p><b>Keywords :</b> External Remittances, physical capital, Inflation rate, Pakistan</p> <p><b>DOI:</b> 10.5281/zenodo.5271625</p>	<p><i>Purpose: To assess the impact and Co-integration between external remittances, physical capital, and inflation rate, and Pakistan's economic development. Methodology: The paper offers an observational investigation of time series data from 1974 to 2019 with an ARDL approach to checking the Co-integration, of external remittances, physical capital, inflation rate, and Pakistan's economic development. Findings: According to the ADF and PP unit root test, several variables are integrated at the level, whereas some on at the 1st difference. Moreover, the result has shown that there is, in the long run, a direct and important relationship between external remittances, physical Capital, and economic development, as well as inflation rate, which are inverse and statistically negligible concerning Pakistan's rate of development. On the other hand, there is an indirect and statistically significant correlation between external remittances and Pakistan's economic development in the short period. Furthermore, the current review is free from Autocorrelation, Heteroskedasticity.</i></p>

### Introduction

Remittance has been a significant stream of foreign exchange receipts in Pakistan since 1970. Pakistan has received substantial amounts of remittances over the last four centuries, but variations in the influx of remittances can also be noticed. The remittances effect on economic growth is optimistic through boosting BOPs, dipping the current-account deficit, and reducing external borrowing. The influx of remittances also boosts economic growth by inter-exchange demand, rising domestic consumption and investment, refining skills, and external liabilities (Iqbal, Z., Sattar, A. 2005).

Global remittances could fascinate significant discussions between scholars, decision-makers and investigators concerning their prospective effects on the development of developing countries. Several studies have considered numerous foundations for advancement, such as the use of additional workers in productivity, the implementation of modern equipment's, international assistance, foreign direct investment, and investment earnings (Lewis, W. A. 1954; Solow, R. M. 1956; Denison, E.F., 1954).

External remittances have been acknowledged in developing countries as an imperative and a steady source of overseas income. In particular, emerging nations use remittances to their gain by spanning the break of the Balance of Payments and therefore mention inflation problems that are part of the description of economic development schemes. Correspondingly, it is valuable for a labor-surplus nation to identify its specific amendment scheme with esteem to the leakage assets for concern expenses and the upward response to imports. It also helps employers to take care of their relatives during financial disasters and natural catastrophes (Orozco, M. 2003; Ratha, D. 2007). In the 1980s, Anwar, T. (2004) perceived the effects of social and economic remittances on housing and investigated that increasing remittance growth had resolved the problem of poverty and enhance economic growth to some degree.

The ultimate objectives of the current paper are the Co-integration, of external remittance, physical capital, inflation rate, and economic development. In this context, the analysis considered economic development to be an dependent variable, whereas external remittances, physical capital, and inflation rate to be an independent variable. In Pakistan, economic development is boosted by external remittances, FDI, domestic consumption, physical and human capital, and exchange rate. Also, these factors play a significant role in the maintenance of Pakistan's financial zone.

The remaining paper would be structured as normal. Segment 2 contains a review of literature. Segment 3 shall comprise the methodology. Analytical findings have been identified in Section 4. Although, section 5 concludes the analysis.

### 1.1 Problem statement

High migration rates indicate a country's poor economic conditions, and high worker remittances raise the question of whether these remittances are actually driving economic growth and development.

### 1.2 Research problems

1. Is Pakistan's economic development substantially influenced by external remittances, physical capital, and inflation rate?
2. Are occurs Long-run and short-run Co-integration between external remittances, physical capital, inflation rate, and Pakistan's economic development.

### 1.3 Objectives of the Study

1. To assess the impact of external remittances, physical capital, and inflation rate on Pakistan's economic development.
2. To explore the Co-integration between external remittances, physical capital, inflation rate, and Pakistan's economic development.

## 2. Literature Review

Al-Khathlan, K. (2012) carried out an ARDL model and an ECM test for co-integration of workers' remittances and real GDP in Pakistan from 1976-2010. The outcome has demonstrated that employer remittances and FDI have been optimistic about economic development in the short and long term. The gross fixed capital accumulation effect is strong and substantial on the economic growth throughout the short period, whereas the position of the financial flow is adversely affected in the longer term.

Shahzad, S. J. H., Abbasi, F., Rehman, M. U., and M. Zakaria, M. (2014). The relation between external remittances, FDI, exports, and the national performance in South Asia from 1989 to 2011 was investigated. The study shows that such factors have a long and short-term relationship. Furthermore, the study used by FMOLS and DOLS, which analyses the effect of FDI, remittances, and exports is affirmative and hence the importance of labor on GDP is negative.

Vikram (2005) addressed the different processes by which remittances may have influence on economic activity. The study does not explicitly affirm the short-term viability for consumption efficiency; however, the long-term global influence of such flows appears to be vague.

Sami, J. guy. (2016) studied the role of growth rates and remittances in boosting the banking sector in Fiji from 1980 to 2010. The study used bound tests and predicts the long period connection between the growth rate, remittances, and advancement of the banking sector. While the ECM suggests that global growth along with remittances are responsible for the success of the banking sector.

Arif, U., Javid, M., & Qayyum, A. (2012) reviewed the inflow of remittances, elimination of poverty, and economic growth in Pakistan from 1973 to 2007 with the ARDL method. The overall tally confirmed a long-term co-integration for both productivity expansion & inflow remittance. Besides, the study considered the shock of remittances on poverty reduction to also considerably greater, as the role of remittances is very critical in improving economic development and reducing poverty.

Azam, M., Haseb, M., & Samsudin, S. (2016) evaluated the international remittance effect from 1990-2014 over poverty remission in 39 countries worldwide. The research used the FMOLS which suggests that poverty remission was the source of rising revenue. Moreover, the influence of global remittances on alleviating poverty is optimistic and statistically important. Similarly, foreign assistance and debt on poverty have good effects, both of which must be a constructive cause of poverty spread.

The Study discovered that the majority of the findings were dependent on the effect of foreign remittances and other control variables with economic growth in Pakistan as well as other countries after reviewing the above-mentioned literature (Adamu, P. A. 2013, Al Khathlan, K. (2012), Mbah, S., & Amassoma, D. 2014, & Nwaogu, U. G., & Ryan, M. J. (2015)). However, in this analysis, firstly the study takes external remittances with physical capital and inflation rate for the finding of impact and relationship with economic development of Pakistan that has never been observed together in a single prior study. Secondly, whereas several previous studies widely used econometric models such as Granger causality, Johansen Co-integration model, and Vector error correction model (VECM). In this paper, the researcher uses ARDL bounds testing approach to show the temporal linkages among external remittances, physical capital, inflation rate, and economic development in Pakistan to fill up some of the gaps that currently exist. Thirdly, according to the literature, none of these models accurately captured where and when there is a substantial variation in the results, and whether the model is stable or not. As a result, the current analysis used the Chow test for Structure Break and the CUSUM test proposed by Brown et al. (1975) for stability with some other models for this reason.

### 2.1 The Hypothesis of the Study

H<sub>10</sub>: External remittances have an adverse influence on Pakistan's economic development.

H<sub>11</sub>: External remittances have an optimistic influence on Pakistan's economic development.

H<sub>20</sub>: There seems to be no Co-integration between Pakistan's external remittances, physical capital, inflation rate, and economic development.

H<sub>21</sub>: There seems to be Co-integration between external remittances, physical capital, inflation rate, and Pakistan's economic development.

### 2.2 Theoretical Framework and Empirical Model

Remittances support the neo-classical theory of Smith(1776) and Ravenstein(1889). They assumed that people migrate from poor to rich economies due to income and resource differences. The Altruistic motive, Self-Interest, and Tempered-Altruism are three key reasons behind remittances, according to Lucas and Stark (1985). In the Cobb-Douglas production function, the Solow(1956) model portrays the relationship between aggregate inputs and outputs.

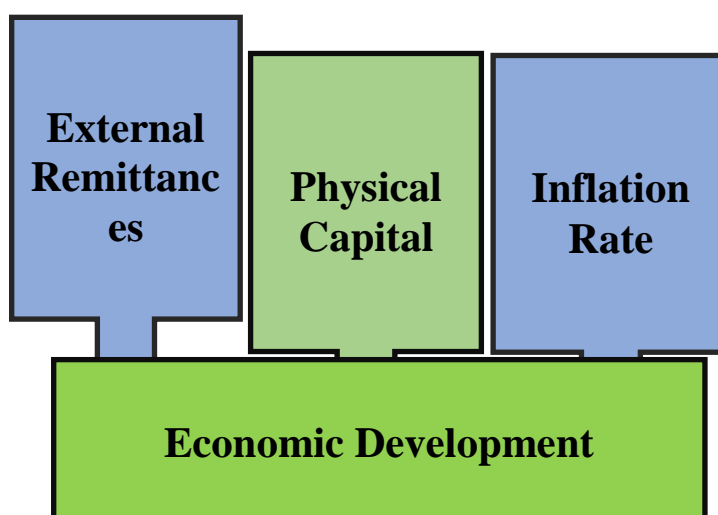
$$Y = AL^{1-\alpha} Kp^\alpha$$

Many causes are cited by Solow (1956) and Barro (1991; 1996) that influence the economy's growth. Remittances and other influence factors have all been shown to have a close relationship with economic growth in the literature.

$$ED_t = \beta_0 + \beta_1 EREM_t + \beta_2 PC_t + \beta_3 CPI_t + \mu_t$$

Higher economic growth is encouraged by an acceptable amount of remittances. According to literature, depending on how remittances are incorporated into the economy, they can be both positively and negatively associated with growth. (Ravenstein, E. G.1889; Lucas, R. E., & Stark, O. 1985; Glytsos, N. P. 2005; Azam *et.al.*,2016; Abbas *et.al.*,2017; Muhammad *et.al.*,2020).

### 2.3 Conceptual Framework



#### 3.1 Data Collection Sources and Units Measurement of the Included Variables.

Variables	Symbol	Measurement of unit	Source
<b>Economic Development</b>	ED	GNP per capita	WBI
<b>Remittances</b>	EREM	External Remittances	WBI
<b>Physical Capital</b>	PC	Gross Capital Formation	WBI
<b>Inflation Rate</b>	CPI	Inflation	WBI

#### 3.2 Estimation Methodology and Structure Variables

The ARDL Bound test as well as the ECM test is often used to identify the Co-integration between such variables. The dependent variable is seen as economic development. External remittances, Physical capital, and inflation rate are considered to be independent variables which focus on the analysis of secondary time series results from 1974 to 2019.

$$ED = (EREM, PC, CPI)$$

$$ED_t = \beta_0 + \beta_1 EREM_t + \beta_2 PC_t + \beta_3 CPI_t + \mu_t$$

*ED* = Economic Development  
*EREM* = External Remittances  
*PC* = Physical Capital  
*INF* = Inflation Rate  
 $\mu_t$  = Disturbance Error

$\beta_0, \beta_1, \beta_2$  &  $\beta_3$  are parameters

#### 3.3 Unit root test

The ADF unit root test is based on the following regression

$$\Delta Y_t = \beta_0 + X_t \sigma + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \dots + \beta_\rho Y_{t-\rho} + \lambda_t$$

**3.4 The ARDL Co-integration Approach**

The Co-integrated approach of the ARDL is based on calculating a basic Unregulated Error-Correction Model (UECM) that can be expressed as observers: ED is an explained variable, while the explanatory variables as an ER, PC, and CPI.

$$\Delta Ln(ED) = \beta_0 + \beta_1 \sum_{j=1}^k \Delta Ln(ED)_{t-j} + \beta_2 \sum_{j=0}^k Ln(EREM)_{t-j} + \beta_3 \sum_{j=0}^k Ln(PC)_{t-j} + \beta_4 \sum_{j=0}^k Ln(CPI)_{t-j} + \omega_1 \Delta Ln(LED)_{t-j} + \omega_2 LnED_{t-j} + \omega_3 LnEREM_{t-j} + \omega_4 LnPC_{t-j} + \omega_5 CPI_{t-j} + \mu_t$$

“∑” reveals the error correction process. There as well as “ω” illustrates a long-term partnership The following long-term model has predicted that after the existence of co-integration interaction.

$$\Delta Ln(ED)_t = \beta_0 + \beta_{1j} \sum_{j=1}^{\rho} \Delta Ln(ED)_{t-j} + \beta_{2j} \sum_{j=0}^{\rho} Ln(EREM)_{t-j} + \beta_{3j} \sum_{j=0}^{\rho} Ln(PC)_{t-j} + \beta_{4j} \sum_{j=0}^{\rho} Ln(CPI)_{t-j}$$

The Schwarz Bayesian Criterion (SBC) and all the other criteria are used to evaluate long-term relationships. The error correction model (ECM) is generated from the ARDL as follows.

$$\Delta Ln(ED)_t = \beta_0 + \sum_{j=1}^{\rho} \beta_{1j} \Delta Ln(ED)_{t-j} + \sum_{j=0}^{\rho} \beta_{2j} Ln(EREM)_{t-j} + \sum_{j=0}^{\rho} \beta_{3j} Ln(PC)_{t-j} + \sum_{j=0}^{\rho} \beta_{4j} Ln(CPI)_{t-j} + \lambda ECM_{t-1} + \mu_t$$

That as  $ECM_{t-1}$  is the error correction term, estimated at

$$ECM_t = Ln(ED)_t - \beta_0 - \sum_{j=1}^{\rho} \beta_{1j} \Delta Ln(ED)_{t-j} - \sum_{j=0}^{\rho} \beta_{2j} Ln(EREM)_{t-j} - \sum_{j=0}^{\rho} \beta_{3j} Ln(PC)_{t-j} - \sum_{j=0}^{\rho} \beta_{4j} Ln(CPI)_{t-j}$$

The model's short-run dynamics and the speed of adjustment from short-run disequilibrium to long-run equilibrium are indicated by the given equation coefficients.

**4. Estimation Results**

**4.1 Unit Root test**

$H_0$  = Unit root Exist

$H_1$  = Unit root not Exit

**Table: 4.1.1 ADF unit root test results**

Variables	Level	1 <sup>st</sup> Difference
ED	-5.61661 <sup>abc</sup> Integrated	11.72810 <sup>abc</sup> Integrated
EREM	-1.482922 Not-Integrated	5.552705 <sup>abc</sup> Integrated
PC	-3.278499 Not-Integrated	-7.818562 <sup>abc</sup> Integrated
CPI	-6.455098 <sup>abc</sup> Integrated	-6.931671 <sup>abc</sup> Integrated

Source: Author Note “a” for 1%, “b” for 5% & “c” for 10%

**Table: 4.1.2 Critical values of ADF test of ARDL approach**

Variables	1%		5%		10%	
	Level I(0)	1 <sup>st</sup> Differences I(1)	Level I(0)	1 <sup>st</sup> Differences I(1)	Level I(0)	1 <sup>st</sup> differences I(1)
ED	-4.175640	-4.180911	-3.513075	-3.515523	-3.186854	-3.188259
EREM	-3.584743	-4.180911	-2.928142	-3.515523	-2.602225	-3.188259
PC	-4.175640	-4.180911	-3.513075	-3.515523	-3.186854	-3.188259
CPI	-3.588507	-4.180911	-2.929734	-3.515523	-2.603064	-3.188259

Source: Author

The table showed the result of the ADF test in which the ED and CPI are stationary at a level of 1%, 5%, and 10% instead of EREM and PC. Afterward, the study goes to check again the stationary and assume that all the indicators are integrated with the first difference.

**Table: 4.1.3 PP unit root test results**

Variables	Level	1 <sup>st</sup> Difference
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ED	-17.96294 <sup>abc</sup> Integrated	-5.654527 <sup>abc</sup> Integrated
EREM	-1.710559 Not- Integrated	-5.590302 <sup>abc</sup> Integrated
PC	-3.261406 <sup>abc</sup> Integrated	-8.014131 <sup>abc</sup> Integrated
CPI	-2.184313 Not-Integrated	-6.942607 <sup>abc</sup> integrated

Source: Author Note "a" for 1%, "b" for 5% & "c" for 10%

Table 4.1.4 Critical values of PPtest for ARDL approach

Variables	1%		5%		10%	
	Level	1 <sup>st</sup> Difference	Level	1 <sup>st</sup> Difference	Level	1 <sup>st</sup> Difference
ED	-4.175640	-4.180911	-3.513075	-3.515523	-3.186854	-3.188259
EREM	-4.175640	-4.180911	-3.513075	-3.515523	-3.186854	-3.188259
PC	-4.175640	-4.180911	-3.513075	-3.515523	-3.186854	-3.188259
CPI	-4.175640	-4.942607	-3.513075	-3.515523	-3.186854	-3.188259

Source: Author

The PP outcome has shown that EREMAND CPI are not integrated at the level, while ED as well as PC are stationary at the level. After this, the analysis goes towards the first difference and reveals that all the factors are integrated at the first difference. Based on the integration of certain variables at the level, while some of the first difference under the ADF and Phillip Perron test, the ARDL model under bound test will be used.

#### 4.2 Lag Selection Criteria

Endogenous variables: ED, EREM, PC, CPI

Table 4.2.1: Lag Selection Criteria

LAG	LOGL	LR	PPE	AIC	SC	HQ
0	-354.8215	NA	309.5948	17.08674	17.25223	17.14740
1	-272.3966	145.2248	13.15334	13.92365	14.75111*	14.22694*
2	-255.7419	26.17168	13.03904	13.89247	15.38190	14.43841
3	-247.6451	11.18125	20.11096	14.26881	16.42021	15.05739
4	-215.9252	37.76181*	10.64712*	13.52025*	16.33362	14.55146

Source: Author

The structure of all variables, Lag 4 is chosen to be equivalent to economic growth, foreign remittances, physical capital, and inflation rate. The study is now demonstrating the ARDL bound co-integration test for lag 4 selection criteria.

#### 4.3 ARDL Model

##### 4.3.1 The Bound Test

$H_0$  = No Co-integration exist

$H_1$  = Co-integration exist

Table 4.3.1: The Bound Test Result

Model	ARDL	F-statistics
ED = f(EREM, PC, CPI)	ARDL (1,4,4,0)	18.78654*** Co-integration
EREM = f(ED, PC, CPI)	ARDL (4,2,4,1)	5.040458*** Co-integration
PC = f(EREM, CPI, ED)	ARDL (1,4,4,0)	6.228439*** Co-integration
CPI = f(EREM, ED, PC)	ARDL(1,4,0,4)	5.024016*** Co-integration
Critical Value	lower bound value I (0)	Upper bound value I (1)
1%	2.37	3.2
2.5%	2.79	3.67
5%	3.15	4.08
10%	3.65	4.66

Source: Author

The outcome demonstrated that the F-statistics value is greater than most of the upper values at 1%, 5% & 10% that illustrated the long-term Co-integration between ED, EREM, PC, and CPI under the ARDL Bound test model.

#### 4.4 Long Run estimate

Table 4.4.1: The Long Run estimate

Dependent variable (GDP)				
Independent variable	Coefficient	Std. Error	T-statistics	Probability
EREM	0.790360	0.157995	5.002449	0.0000
PC	0.229911	0.143000	3.444219	0.0018
CPI	-0.088805	0.143900	-0.617132	0.5420
Constant	0.408633	2.393534	0.170724	0.8656

Source: Author

The result showed a long-term forecast model for the effect of external remittances, physical capital, and inflation rate on the economic development. The result suggests that external remittances and, physical capital, have direct but statistically substantial consequences on economic development in the long-term. This means that any change in these variables will have a direct effect on Pakistan's economic development. While inflation rate is negative, but statistically insignificant correlated with the development of Pakistan's economy.

#### 4.5 Error correction Mechanism for selected ARDL Model

$H_0$  = series is not integrated

$H_1$  = series is integrated

Table 4.5.1: Error correction Mechanism for selected ARDL Model

Variables	Coefficient	Std. Error	T-statistics	Probability
ED(-1)	1.52127	0.244448	6.223318	0.0000
ED (-2)	2.17679	0.7859032.7698050.0097		
D (EREM)-0.787230	0.215730	-3.649149	0.0010	
D (EREM (-1))	-0.788340	0.198305-3.9754080.0004		
D (EREM (-2))	0.088230	0.193519	0.455926	0.6518
D (ERM (-3))	0.980640	0.221047	4.436357	0.0001
D (PC)	2.176790	0.78590	2.769805	0.0097
D (CPI)	0.231823	0.200851	1.154205	0.2578
D (CPI (-1))	0.831138	0.179267	4.636320	0.0001
D (CPI (-2))	0.535495	0.197918	2.705634	0.0113
D (CPI (-3))	0.544237	0.166600	3.266467	0.0028
CointEq(-1)*	-1.29010	0.124784	-10.33871	0.0000
R-squared	0.880347			
Adjusted R-squared	0.815919			
Durbin-Watson stat	1.858321			

Source: Author

The short-term dynamic coefficients for the long term correlation developed in the ECM equation. The findings indicate that the coefficients of ECM are significantly negative. Precisely, the ECM's approximate coefficient is 1.29%, indicating a sluggish speed of change to long-run balance from the past decade. The findings indicate that the impact of external remittances remains negative and substantial, leading 78%, respectively, to economic development. In the short run, that greater scale of remittances will largely improve economic development. The value of  $R_2$  shows that an 88% change in ED is explained by changes of EREM, PC & CPI indicating the presence of fitness in the model. The frequency of Durbin-Watson is 1.858321, which is equivalent to 2. This ensures the model is free from the issue of autocorrelation.

#### 4.6 Breusch-Godfrey Serial Correlation LM test and Heteroskedasticity

$H_0$  = Data is Homoscedastic and no auto-correlation

$H_1$  = Data is Heteroscedastic and auto-correlation

Table: 4.6.1 End results of Breusch-Godfrey Serial Correlation LM test and Heteroskedasticity

	Prob (F-statistics)	Prob (Obs*R-squared)
<b>Breusch-Godfrey Serial Correlation LM Test:</b>	0.5216	0.3722
<b>Heteroskedasticity Breusch-Pagan-Godfrey</b>	0.0520	0.0780

Source: Author

#### 4.7 The Ramsey Reset Test

$H_0$  = the variables are jointly insignificant

$H_1$  = the variables are jointly significant

Table: 4.7.1 Result of Ramsey Reset Test

	Value	Df	Probability
F-statistics	0.002112	(1, 28)	0.9637

Source: Author

#### 4.8 The Normality Test

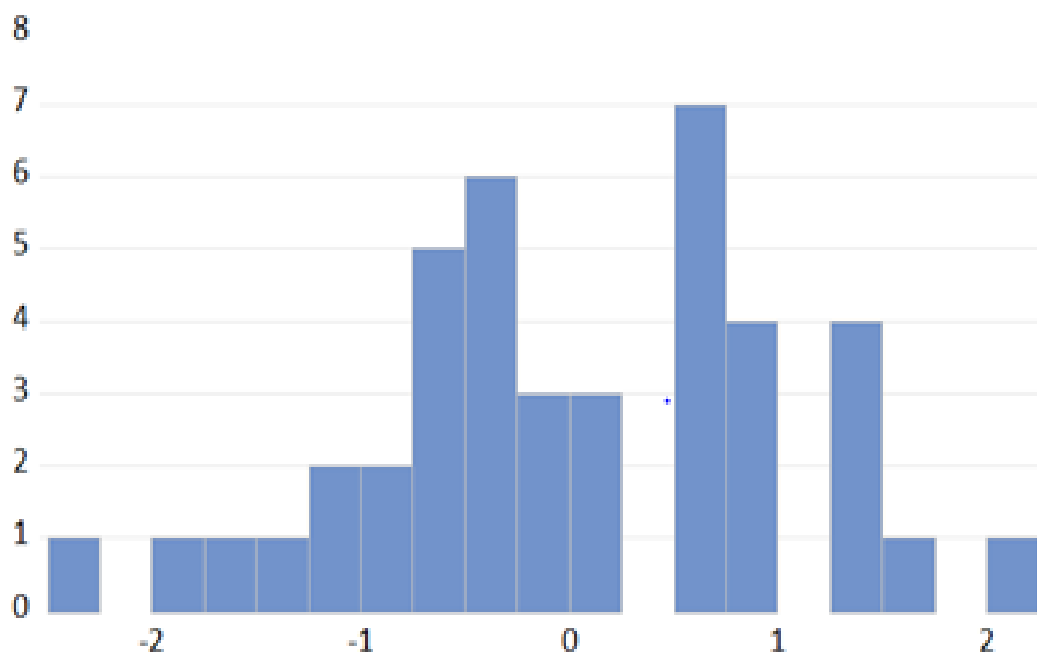
$H_0$  = Normality exists

$H_1$  = Normality didn't exist

Table: 4.8.1 the Normality Test

Jarque-Berra value = 0.303692	Probability = 0.859120
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Source: Author



The findings of the diagnostic test reveal that our model is free from Serial Correlation and Heteroscedasticity. The functional form is up to the mark and the expectation of normality is thus confirmed.

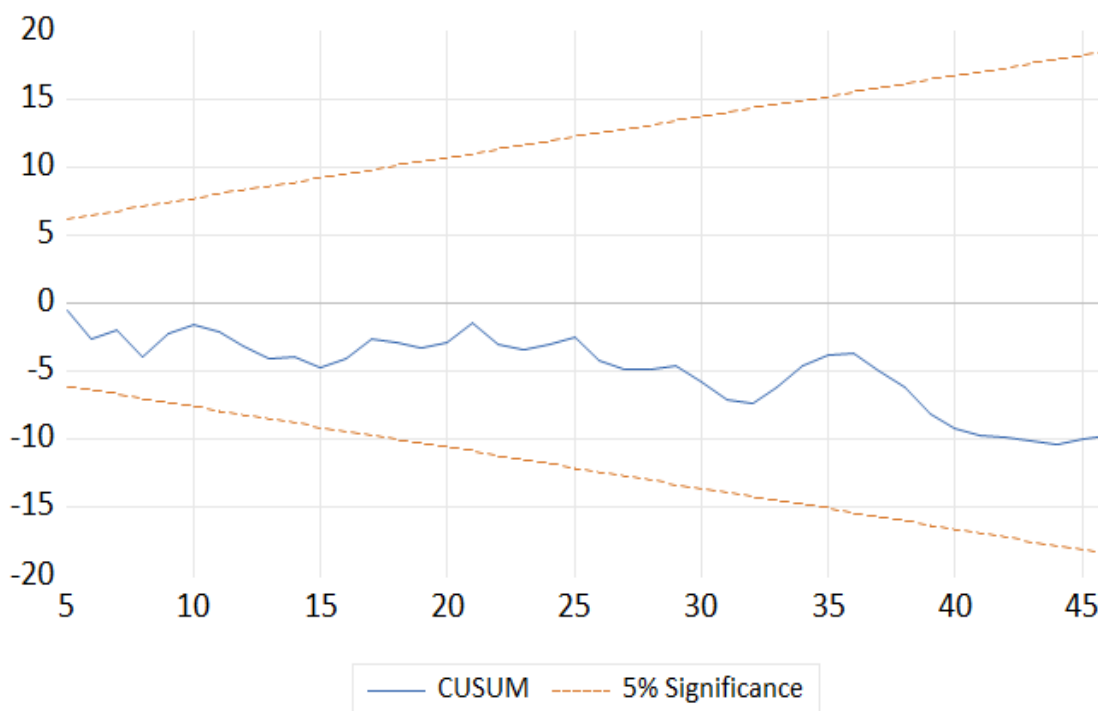
#### 4.9 Chow test for Structural Breaks

<b>F-statistic</b>	12.54327	<b>Probability</b>	0.0003
<b>Log likelihood ratio</b>	29.68450	<b>Prob. Chi-Square</b>	0.0000
<b>Wald value</b>	40.75490	<b>Prob. Chi-Square</b>	0.0000

Source: Author

The F-statistic is 12.54327, which is greater than 2, and the p-value is 0.0003, which is less than 5% of the significant amount. The findings suggest that the variables have a statistically significant link. As a result, the null hypothesis could be rejected. It means that there are no breaks in the span of 2005 observation.

#### 4.10 Stability Diagnostic Model (Cusum Test)



**Source: Author**

The aforementioned graphs demonstrate that the CUSUM test is situated under critical limits, so our model is structurally sound.

## 5. Conclusion Recommendation and Policy Amplification

The Co-integration between external remittances, physical capital, inflation rate, and economic development in Pakistan for the era 1974-2019 was analytically scrutinized in this study. The review implemented the Bounds test technique developed by Pesaran et al. (2001) in combination with ECM methodology for monitoring long-term and short-term interactions. The findings revealed a strong and important long-run link between external remittances and economic development, although the relationship is negative in the short-run. The effect of physical capital for economic development is optimistic and important in both the long-term and the short-term. The inflation rate has an adverse influence on economic development in the long term and the short term.

The findings of this study suggest that global labor migration has noticeable detrimental effects on underprivileged groups in developing countries like Pakistan. In the long term, the inflow of remittances will contribute to sustainable growth and advancement of the welfare and change for low-income households as the impact of remittances rises and develops over time. The government should also formulate a policy to boost the volume of remittances by reducing the transaction costs of remittance movements. Our research has likely geopolitical ramifications, as a result of which, amid the tragedy, remittances will continue to support macroeconomic growth.

### 5.1 Limitation of the Study

Pakistan's study constraints with time-series data review for the period 1974-2019 require annual figures spanning a limited time and variables for each region. To promote economic development, external remittances have the same ramifications as exchange rates, capital inflows, portfolio, and foreign direct investment.

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