Innovations

The Impact of Remittance on Inflation in Bangladesh: An ARDL Analysis with Structural Breaks

Roksana Akhter

Assistant Professor, Department of Economics
Mawlana Bhashani Science and Technology University. Santosh, Tangail- 1902

Mobasshara Mim*

Student, Masters, Department of Economics
Mawlana Bhashani Science and Technology University, Santosh, Tangail- 1902
Corresponding author: **Mobasshara Mim**

Abstract

Theanalysis examines the short and long run properties of remittance on inflation in Bangladesh since 1981 to 2021, monitoringon structural breaks. Autoregressive Distributed Lag (ARDL) is employed to explore the connection between remittance and inflation. Results show that in the long run remittance has 74.3% expectant and substantialinfluence on inflation whereas consumption expenditure has 35.5% undesirable and considerableeffect on inflation.Conversely, in the short run consumption expenditure has 16.7% affirmative and suggestive impression on inflation in Bangladesh. The Error correction term (ECT) is 48% which indicates that in this speed the dependent variable returns to equilibrium. To encourage more remitting from the diaspora, the government of Bangladesh should work with banking institutions to lower the cost of remittance.The empirical results recommend a special interest rate for remittance beneficiaries so that the flow of money supply can be controlled in the economy.The research findings also suggest to invest in productive activity rather than spending for consumption purposes in order to lessen the impact of remittance inflows on inflation in Bangladesh.

Keywords*: Remittance, Inflation, Consumption Expenditure, ARDL, Structural Breaks.*

1.0 Introduction

1.1 Introduction

A remittance is a gift, payment, or debt between two individuals or businesses that involve the exchange of money. The term "remittance" has gained popularity in recent years to describe the financial support that migrant workers provide to their relatives back home as they earn a life elsewhere.Most households in developing countries and economies with low economic growth rely on these remittances as their principal

source of income. These homes are frequently found in extremely impoverished communities. Most of the perpetrators are foreign workers who are trying to send currency to their peoples. Money transfers occur typically online today.

Under this system, the transaction fee is the responsibility of the individual who initiated the transfer of funds. Transferring money internationally via digital means is gaining popularity due to the substantial time savings it offers. Persons living in tiny, developing nations with weak economic growth are highly reliant on remittance because family members who are employed abroad send them a large segment of their incomein the form of remittance.In less developed countries with slower economic growth, these factors contribute significantly to raising living standards.

Remittances from abroad are what fuel the economies of poor countries.Amongst the main foundations of overseas currency for anemerging nation alike Bangladesh is remittances (Azad, 2005; Chowdhury, 2011; Hasan et al., 2019). Its importance purpose is far more important than progress, assistance from various institutions and nations, because it is significantly more steadily than the stream of portfolio equity and private financing. Remittances make up about 12% of global trade, total GDP and make economic contributions growth in Bangladesh. Remittances referred by foreign nationals have completed aninvolvement significantly to economic development of Bangladesh. As stated by the authority of Bangladesh Bank (BB), in FY, remittances came to 16.42 billion between FY 2018-19 and FY 2019-20, 18.20 billion constituting the largest remittance collected up until now. Along withreadymade clothes, another largest economic contribution is produced by the expatriates, and they are essential to maintaining the nation's economy. Currently, Bangladesh Bank performs a record level of reserves, which were worth US$36 billion by the June 2020's end.

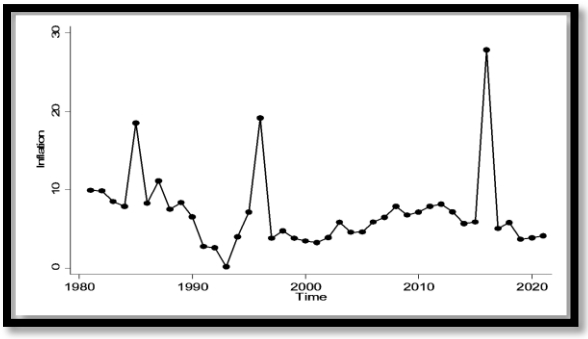
It is impossible to ignore the negative effects of remittances on the economy. Dutch disease, a diminished desire for recipients to labor, and a risk - shifting issue are only a few examples of the adverse effects of remittances on the receiving economy. Remittances can lead to a rise in the local currency by boosting the supply of foreign currency. This lowers the sector's ability to compete for traded goods, which causes the economy to stagnate (Javaid, 2009).Remittances enhance the money supply, which sequentially raises consumption of belongings and facilities. It increases requirements for products and services. Demand pull inflation is caused by the rise in demand, which pushes prices up (Iqbal &Abdus(2005) and Nishat &Nighat(1991)). In contrast, as a result of its undesirable effects, inflation has become one of the main macroeconomic objectives of stabilization programs. It raises corporate expenses, discouraging saving and investment. Additionally, it has a negative impact on consumption and agoniesfor low and fixed-income groups as their purchasing power become low. It is therefore more crucial than ever to investigate the nature of the link between these two variables becausethe policy objective of price stability is at odds with how remittances affect inflation. For nations like Bangladesh, where inflation has become a severe uneasiness and the importance of remittancesalso necessary, the situation becomes even more pertinent.

Moreover, Bangladesh has seen an increase in remittances. Additionally, inflation exhibits a fluctuating trend, with inflation rising.According to Fischer and Modigliani (1978), a negative and nonlinear link between inflation and economic growth has found.Whatever the case may be, remittances are correlated with household consumption, a higher standard of living, a rise in social value, and increasing aggregate demand, social security, among other things. Remittances are then either directly or indirectly linked to the escalating price level. Remittances may influence an economy's inflation rate in a number of different ways.The increase of demand on a domestic and economic level without a modification to the stock of properties and amenities will drive up the expenses of commodities in the same manner that no adjustment has taken place to the output level of a country. As remittance inflow increases, inflation develops. The portion of the economy's money supply is another way to explain how remittances have a beneficial impact on growth. The central

bank's reserve has increased due to the influx of remittances. The remittance has an effect on inflation because it is directly tied to Bangladesh's reserves. According to the money supply rule, it has a substantial impact on the economy's price level and ultimately leads to inflation.

1.2 Trend Analysis Plot

Trend analysis measures and explains patterns and trends in "noisy" data over time. Trend analysis is plotted for each variable used in the regression model.



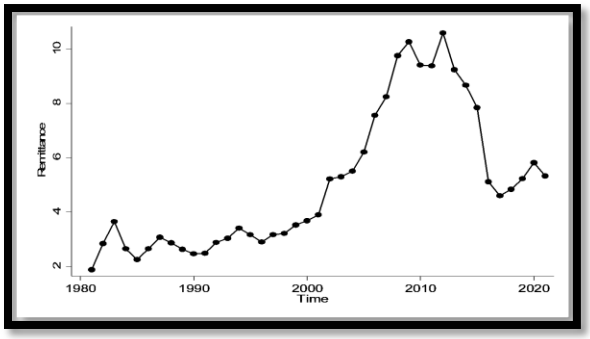
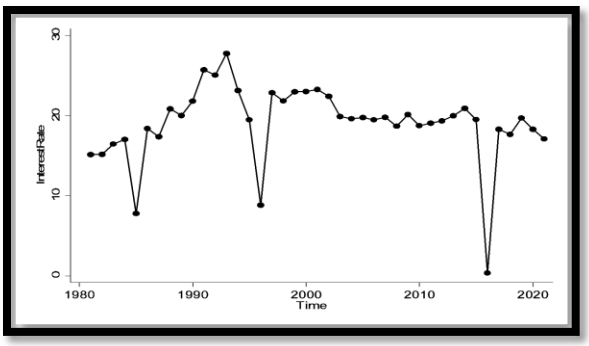


Figure 1: Trend in Inflation in Bangladesh Figure 2: Trend in Remittance in Bangladesh



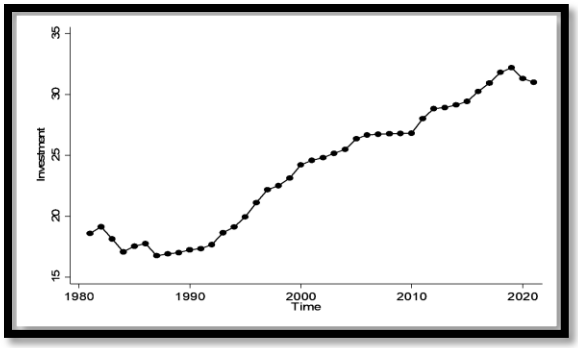


Figure 3: Trend in Interest Ratein Bangladesh Figure 4: Trend in Investment in Bangladesh

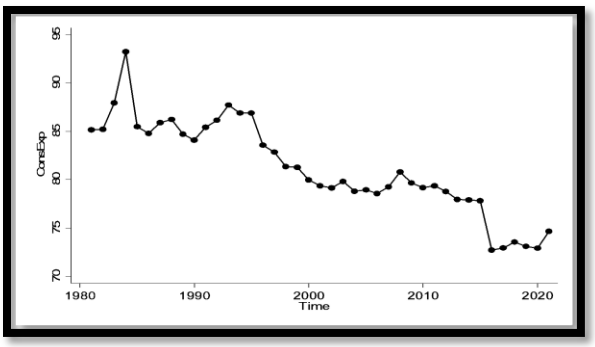


Figure 5: Trend in Consumption Expenditure in Bangladesh

The inflation and interest rate are in horizontal trend, remittance and investment are in uptrend and consumption expenditure is in downtrend.

2.0 Literature Review

2.1 Literature Review

Economic greatness for the development of Bangladesh is being aided by the remittances that millions of Bangladeshi immigrants send home to their families. Any identifiablestudy has not been carried out in Bangladesh to establish the impact of remittances on inflation, despite the fact that there is a great deal of research available to determine inflation throughout the world. Both globally and in Bangladesh, the relationship between inflation and GDP growth is heavily studied**.** If the necessity created by remittance is larger over the economy's ability to encounterthem, remittance may have inflationary effects on the economy. This as the theory is relatively new, only a few researches explicitly experimentally test the proposition.

Irfan (1983) examined the connection between remittances combined with consumption and hypothesized the impact on inflation. According to his research remittances raise consumption levels, which then spur monetary expansion and an increase in aggregate demand, which in turn causes demand pull inflation.

Zarate and Hoyos' (2004) research found that with an increase in household income via remittances, consumer spending (on housing, furnishings, and healthcare) or investment in productive activities (such education, agricultural production) rises. As a result, the demand for these goods rises more than that of other goods. These fluctuations in demand may lead to excessive variations in relative prices and total inflation when combined with the supply's price elasticity.

Balderas and Hiranya (2005) looked at the straight impact of remittances on the circulation of relative price variations and inflation in Mexico. Generalized impulse responses that were developed as of the estimate of a vector autoregressive model were used to obtain the results. The findings showed that since 1995, remittances have had a momentous and favorable influence on inflation and relative price fluctuation. According to the facts, the majority of remitted money is spent on consumption, which drives up the cost of consumer goods and services via the aggregate demand channel.

Ball et al.,(2008)'s study supported the idea that the economy's choices of regime of exchange rates affects how strongly remittances and inflation are related. They carried out a study to investigate how the exchange rate regime affected how remittances affected inflation. The investigation took into account annual and time series data for seven Latin American nations from 1980-81 to 2006-04. The findings used a panel vector autoregressive method which accounts for administration changes. According to the report, inflation might be result by remittances under a static exchange rate regime because of a stock of money due to the increase in money demand. However, the flow of remittances has deflationary implications under an exchange rate regime with flexibility.

Acosta et al.,(2007)'s study suggest that increased emigration has led to a strong and accelerated pace of rise in the drift of intercontinental remittances sent by incomer to their family members. Politicians and economists are concerned about the enormous amount of money sent home by migrants from their host nations. Most often, these remittances are sent from developed to emerging and less developed countries.

Iqbal and Qudus (2005) also looked at the labor participation rate under the effect of remittanceand discovered that it had a detrimental effect. They added that this might cause prices to increase as a result of supply constraints.

Roy and Rahman (2014), remittance can aid in the progress of overseascapitals and result in anexcess in the balance of payments. They contend that if the increase in foreign reserves is not fully sterilized by the central banks, the monetary source willflourish and the real exchange rate will appreciate. The price level will consequently increase.

Balderas and Nath (2008) claim that remittance's straight and subsidiary effect on aggregate demand may have an impact on inflation. According to Khan and Islam (2013), who used autoregressive approaches, a one percent growth in remittance inflows causes the inflation rate in Bangladesh to rise by 2.48 percent over the long term. No meaningful involvement amid these variables in short term, either.

Durand et al., (1996), in this paper the author investigates that around 75 percent of estimated remittances to Mexico are utilized for consumption, which has an impact on inflation. Arellano and Bond (1991) and Arellano and Bover (1995), employing panel dynamic estimator once again, discover that remittances boost inflation in underdeveloped nations, with the effect becoming more pronounced over time. Similar study shows an increase in remittances causes a rise in inflation rate, including by Narayan et al. (2011).

Katseli and Glytsos (1986), remittance has an oppositeaffiliation with Greece's inflation rate. Similar to this, Ball et al. (2013) tested the alliance among remittances, inflation, and exchange rate regimes for 21 rising nations using a theoretical model and panel vector autoregressive approaches. Remittances are expected to temporarily raise the domestic supply of money and inflation under a structure of fixed exchange rates, according to their theoretical model. On the other hand, under a floating exchange rate regime, remittances temporarily have no impact on the money supply, reduce inflation, and increase the real exchange rate.

Bangladesh received almost $22.1 billion in remittances in 2021, placing it as the seventh-highest recipient globally and the third-highest in south Asia, according to the World Bank. Remittances are one of the most significant economic factors now affecting Bangladesh since they influence economic growth, assist with balance of payments, boost national savings, raise foreign exchange reserves, and increase the velocity of money. Remittances can harm the receiving country's competitiveness in global markets by boosting the use of non-tradable commodities, driving up their prices, bolstering the real exchange rate, and lowering exports.Since the increasing remittance causes inflation, one consequence of inflation is a slowdown in the economy. Because rapidly changing prices make it hard to make sound economic decisions. This research differs by using time trending impact of remittance on inflation in Bangladesh for both the short-run and long-run and to measure the effectof consumption expenditure on inflation.

2.2 Objectives of the Study

The purposes of the study are:

i. To identify the short-run and long-run impact of remittance on inflation.

ii. To explore the effect of consumption expenditure on inflation.

3.0 Methodology

3.1 Data Source & Econometric Model

This study analyzes the effect of remittances on Inflation in Bangladesh. Time series data were used for analysis from 1981 to 2021 obtained from World Development Indicator (WDI) as well as International Monetary Fund (IMF). According to recent literature, the personal remittances received (% of GDP), real interest rate (%), final consumption expenditure (% of GDP), and total investment (% of GDP) are used as independent variables and the Inflation, (GDP deflator %) is used as a dependent variable.

First, we have applied Augmented Dickey Fuller test for the unit root test to see whether the chosen variables are stationary or not. Then, we've used VAR Lag Selection criterion to select the best lag for the ARDL bound test and Error Correction Model. In the third step, we've used the ARDL bound test approach to ascertain whether the long-term link between the variables is presented. For diagnostic test, Durbin Watson d test is used to look at the model's autocorrelation, heteroskedasticity problem is identified using the White test and we have CUSUM and CUSUM of squares tests to evaluate the model's stability.

The basic econometric model is the following:

$$Inflation_t = \beta_0 + \beta_1 Remit_t + \beta_2 Interest_t + \beta_3 Invest_t + \beta_4 Consexp_t + \mu_t$$

Where t represents a period indicator and μ_t represents the error term, Inflation denotes the inflation, Remit is remittance, Interest is interest rate, Invest is investment and Consexp is consumption expenditure. β_0 is constant while $\beta_1 Remit_t + \beta_2 Interest_t + \beta_3 Invest_t + \beta_4 Consexp_t$ are remittance, interest rate, investment and consumption expenditure respectively.

3.2 ARDL Model Estimation

This inquiry employed the autoregressive distributed lag (ARDL) estimation technique to study the impact of remittance on inflation in Bangladesh. The ability to evaluate both short-run and long-run parameters at once is an advantage of the ARDL model. The bound test cointegration equation is presented thus:

$$\Delta Inflation_t = \theta + \sum_{i=1}^{p}(\theta 1 i \Delta Inflation_{t-1}) + \sum_{i=1}^{q}(\theta 2 i \Delta Remit_{t-1}) + \sum_{i=1}^{q}(\theta 3 i \Delta Interest_{t-1}) + \sum_{i=1}^{q}(\theta 4 i \Delta Invest_{t-1}) + \sum_{i=1}^{q}(\theta 5 i \Delta Consexp_{t-1}) + \theta_{6i} Inflation_{t-1} + \theta_{7i} Remit_{t-1} + \theta_{8i} Interest_{t-1} + \theta_{9i} Invest_{t-1} + \theta_{10i} Consexp_{t-1}$$

The error correction dynamics are represented by the first part of the mentioned equations θ1 through θ5, while the long-term relationships between the dependent and independent variables of the model are illustrated by the second part of equations θ6 through θ10.

The short-run and long-run ARDL equation is as follows:

$$\Delta Inflation_t = \theta + \sum_{i=1}^{p}(\theta 1 i \Delta Inflation_{t-1}) + \sum_{i=1}^{q}(\theta 2 i \Delta Remit_{t-1}) + \sum_{i=1}^{q}(\theta 3 i \Delta Interest_{t-1}) + \sum_{i=1}^{q}(\theta 4 i \Delta Invest_{t-1}) + \sum_{i=1}^{q}(\theta 5 i \Delta Consexp_{t-1}) + \eta_1 ECT_{t-1} + \mu_t$$

The above error correction term (ECT) analyses the rate of dynamic corrections of the short-run deviations of the variables from the long-term as well as how long it will take for the system to reach its long-term equilibrium path.

4.0 Results and Discussions

4.1 Pre-estimation Tests

4.1.1 Unit Root Test

Table 1: Unit root test for individual series

Variable	At level		At 1st Difference	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
Inflation	-3.717**	-3.685***	-6.417***	-6.326***
Remit	-1.372*	-1.467	-3.857***	-3.825***
Interest	-3.298***	-3.315	-5.942***	-5.889***
Invest	-0.067	-3.874**	-4.237***	-4.019***
Cons exp	-0.859	-4.028**	-6.030***	-5.903***

Note:***** and * denotes 1%,5% and 10% level of significance respectively.

Source: Author's estimation

The stationary time series test is shown in Table 1. In this table each sequence of integration series is investigated using the Augmented Dickey-Fuller (ADF) test. The integration results suggest a jumbled order. The application of the Autoregressive Distributed Lag (ARDL) estimate technique is acceptable because, whereas inflation, interest rate, investment and consumption expenditure are integrated of order 0, remittance is integrated at order 1.

4.1.2 Test of Cointegration

Table 2: ARDL bound-test of cointegration

K	F-statistics	Level of Significance	Lower bound	Upper bound
4	10.265	10% 5% 2.5% 1%	2.450 2.860 3.250 3.740	3.520 4.010 4.490 5.060

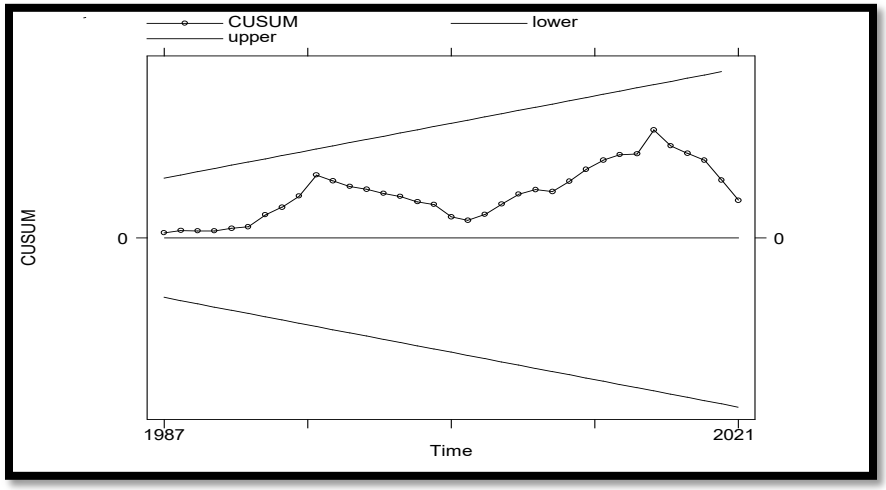
Source: Author's estimation

The affiliationwithin the variables in the long run equilibrium is examined using the ARDL bound test. The null hypothesis in this test is that there is no long-term association. The ARDL bound test uses F-statistics to test the hypothesis. As the F-statistics value exceeds the upper critical value, the null hypothesis can be rejected.

4.1.3 Structural Break Test

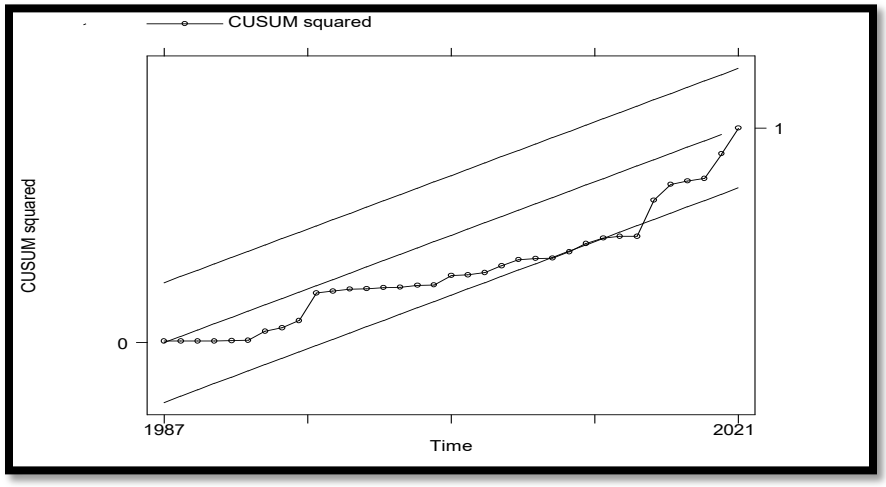
The regression model's stability and model misspecification are tested using the cumulative sum (CUSUM).

Figure 6: CUSUM Test



Source: Author's estimation

Figure 7: CUSUM Square Test



Source: Author's estimation

Figure 6 indicates the graph of CUSUM and figure 7 indicates the graph of CUSUM Square. To examine the stability of factors of the long run and short run ARDL CUSUM and CUSUM Square test are applied. In figure 1, the CUSUM test is stable but in figure 2 there is seen structural break in 2014 and 2015.

4.2 Estimation

Since we have found two structural breaks in the model, to remove the structural breaks we have used two dummy variables of remittance and interest rate because we have seen multiple major breaks in these variables.

4.2.1 Short-run and Long-run model

Table 3: Short-run and Long-run Estimates

Dependent Variable: Inflation

	Variable	Coefficient	Standard Error	T statistics	P value
ADJ	Inflation	-0.479	0.106	-4.500	0.000
LR	Remit	0.743	0.193	3.860	0.001
	Interest	-1.323	0.145	-9.110	0.000
	Invest	-0.935	0.231	-4.050	0.001
	Cons exp	-0.355	0.184	-1.930	0.067
	z	-0.189	3.455	-0.050	0.957
	z_remit	0.917	0.478	1.920	0.068
	z_interest	-0.322	0.113	-2.850	0.059
SR	Interest	0.078	0.022	3.970	0.002
	Invest	0.722	0.235	3.080	0.005
	Cons exp	0.167	0.097	1.730	0.097
	Cons	37.735	10.100	3.740	0.001

R Squared =0.9960

Adjusted R-squared=0.9936

Source: Author's estimation

Short-run estimate

Table 3exhibits the short-run and long-run results of the models. As of the estimation, interest rate, investment and consumption expenditure exert a helpful and considerable control on inflation in Bangladesh. From the analysis, a 1% increase in interest rate will induce about 7.8% rise in inflation. Similarly, 1% increase in investment increases inflation by 72.2%. Likewise, 1% rise in consumption expenditure increases the inflation by 16.7%.

The error correction term is considerable and adverse, as anticipated in a system with long-run cointegration, according to the results. Based to the analysis, a short-term shock to the system will cause the series to recover to around 48% of the equilibrium value from the prior year.

Long-run estimate

The resultagain shows that in the long-run, remittance has anoptimistic and noteworthy impact on inflation. Whereas interest rate, investment and consumption expenditure represent negative relationship with

inflation which is as expected. From the analysis, 1% increase in remittance will increase the inflation by 74.3%. On the flip side, 1% rise in interest rate will reduce inflation by about 1.323. Similarly, 1% increase in investment will bring about a fall of 93.5% in inflation. Likewise, 1% increase in consumption expenditure will decrease about 35.5% of inflation.

Overall, about 99.36% of variations in inflation is clarified by changes in the independent variables; this represents a good fit.

4.3 Post Estimation Diagnostic Tests

4.3.1 Diagnostic Tests

Table 4: Post estimation Results

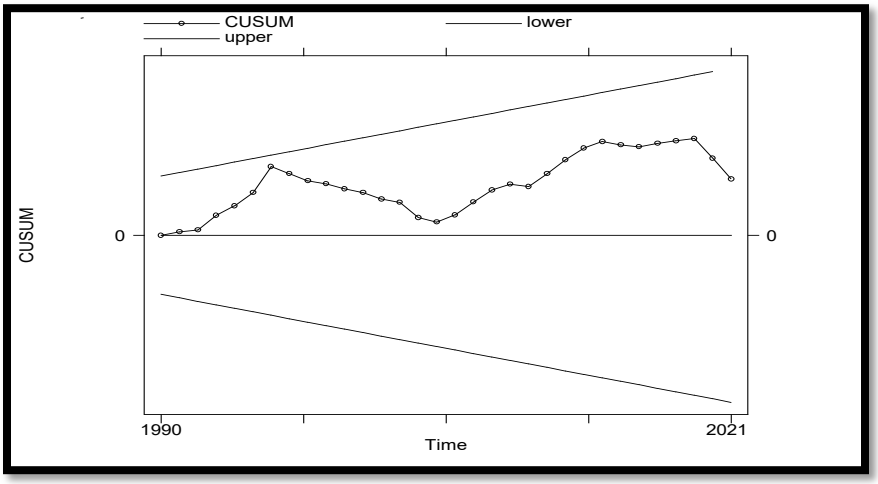
Diagnostics	Statistics	Interpretation
Durbin Watson d statistics	d-stat=2.257661	No serial autocorrelation
Heteroskedasticity Test	Chi^2=38.00(0.4236)	Homoskedasticity
Skewness	Chi^2=10.30(0.7396)	Normally distributed
Kurtosis	Chi^2=0.28(0.5980)	Normally distributed

Source: Author's estimation

4.3.2 Structural Break Test

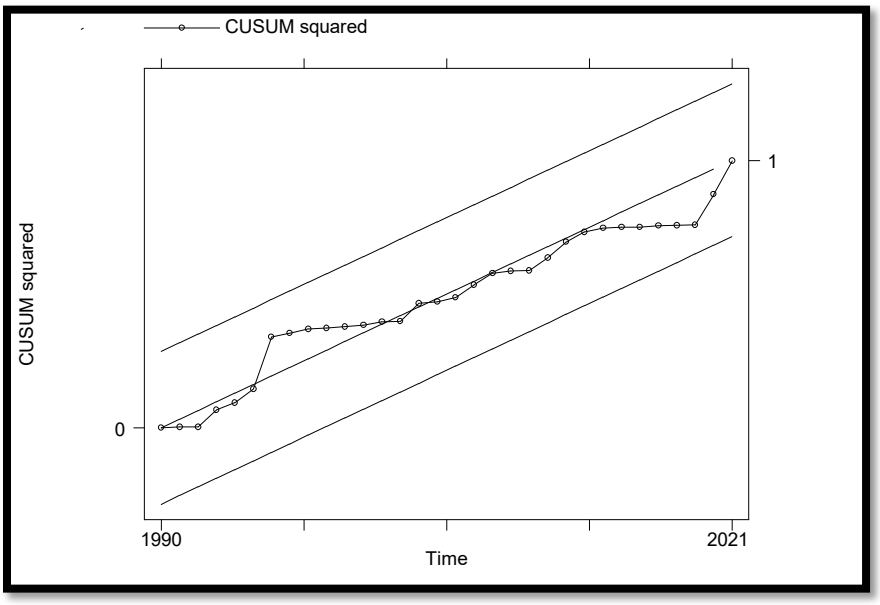
The cumulative sum and the 5% critical line are plotted simultaneously.

Figure 8: CUSUM Test



Source: Author's estimation

Figure 9: CUSUM Square test



Source: Author's estimation

Figure 8 and 9 represent that the CUSUM and CUSUM Square are situated between the two critical lines. Therefore, the estimated model is structurally stable.

5.0 Conclusion and Recommendations

The result analysis shows that the ADF unit root test, where some variables have I(0) stability and others have I(1) stability, has established the mixed order of integration. In that situation, an ARDL model has been applied. In the model, we discovered two break spots during the structural break test. We have conducted an ARDL model with these two dummy variables in order to overcome this break. In the end, we are able to fix the structural gap. The results of the ARDL approach's after-bounds testing indicate that the F-statistics 9.539 is more than the upper bound at the 10%, 5%, 2.5%, and 1% significance levels. The result of bound testing displays the variables' long-term relationships. When the assessment process proceeds towards equilibrium at a rate of 48% in the demanding economy, the speed of adjustment term, or ECT, is 0.479, which is denial and substantial at the 1% level.

Bangladeshi government must work with banking institutions to reduce the cost of sending money outside.In order to reward recipients of remittances made oversanctioned channels, this study suggests a specific interest rate. This will boost household consumption, increase remittance flow through official routes, and boost their purchasing power.A significant problem in Bangladesh's overall socio-economic scenario is the labor export sector. The potential of this industry has not yet been maximized. It should be noted that if the administration accelerates diplomatic forces to increase workers exports, the benefits of labor allots and remittances will stream in the same manner as our economy's advantageous segments.

To avoid inflation, the remittance should be used for profitable investments rather than personal consumption. If the government and legal authority support small and medium enterprise policies, the

amount of unproductive foreign remittance investment would be minimized. In addition, the main focus should be on investing remittances in ways that are secure and profitable in order to control inflation.

References

1. *Azad, A. K. (2005). Migrant workers' remittances: A source of finance for micro-enterprise development in Bangladesh. Remittances: Development Impact and Future Prospects, 119-132.*
2. *Chowdhury, M. B. (2011). Remittances flow and financial development in Bangladesh. Economic Modelling, 28(6), 2600-2608.*
3. *Hasan, S. B., Akhter, R., & Saha, S. (2019). Impact of remittance on economic growth in Bangladesh. American Journal of Trade and Policy, 6(1), 41-48.*
4. *Javaid, S. H., &Riazuddin, R. (2009). Dutch disease investigated: empirical evidence from selected South-East Asian economies. State Bank of Pakistan.*
5. *Iqbal, Z., & Sattar, A. (2010). The contribution of workers' remittances to economic growth in Pakistan. Working Papers & Research Reports, RR-No.*
6. *Nishat, M., &Bilgrami, N. (1991). The Impact of migrant worker's remittances on Pakistan economy. Pakistan Economic and Social Review, 21-41.*
7. *Fischer, S., & Modigliani, F. (1978). Towards an understanding of the real effects and costs of inflation (No. w0303). National Bureau of Economic Research.*
8. *Irfan, M., & Farooq, G. M. (1983). An Investigation of Household Reproductive Behaviour in Pakistan (No. 1983: 4). Pakistan Institute of Development Economics.*
9. *Zarate-Hoyos, G. A. (2004). Consumption and remittances in migrant households: toward a productive use of remittances. Contemporary Economic Policy, 22(4), 555-565.*
10. *Balderas, J. U., & Nath, K. (2005, November). Remittances, relative price variability and inflation in Mexico. In 75th annual meeting of the Southern Economist Association, Washington, DC.*
11. *Ball, C. P., & Reyes, J. (2008). Inflation targeting or fear of floating in disguise? A broader perspective. Journal of Macroeconomics, 30(1), 308-326.*
12. *Acosta, P., Fajnzylber, P., & Lopez, J. H. (2007). The impact of remittances on poverty and human capital: evidence from Latin American household surveys (Vol. 4247). World Bank Publications.*
13. *Roy, R., & Rahman, M. (2014). An empirical analysis of remittance–inflation relationship in Bangladesh: post-floating exchange rate scenario.*
14. *Ulyses Balderas, J., & Nath, H. K. (2008). Inflation and relative price variability in Mexico: the role of remittances. Applied Economics Letters, 15(3), 181-185.*
15. *Khan, Z. S., & Islam, S. (2013). The effects of remittances on inflation: evidence from Bangladesh. Journal of Economics and Business Research, 19(2), 198-208.*
16. *Durand, J., Kandel, W., Parrado, E. A., & Massey, D. S. (1996). International migration and development in Mexican communities. Demography, 33, 249-264.*
17. *Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. The review of economic studies, 58(2), 277-297.*
18. *Arellano, M., &Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. Journal of econometrics, 68(1), 29-51.*
19. *Glytsos, N., &Katseli, L. T. (1986). Theoretical and empirical determinants of international labour mobility: A Greek-German perspective (No. 148). CEPR Discussion Papers.*

20. *Narayan, P. K., Narayan, S., & Mishra, S. (2011). Do remittances induce inflation? Fresh evidence from developing countries. Southern Economic Journal, 77(4), 914-933.*
21. *Ball, C. P., Lopez, C., & Reyes, J. (2013). Remittances, inflation and exchange rate regimes in small open economies 1. The World Economy, 36(4), 487-507.*