



## Do FDI and foreign remittance inflows affect the unemployment rate? A new insight

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### ABSTRACT

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#### Keywords

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This study aims to investigate the impact of FDI and foreign remittances on unemployment from 1991 to 2020 from Bangladesh's perspective. With the use of EViews 10 version, this study used the ARDL technique to capture the long-run and short-run estimations. The study utilized the unemployment rate as a dependent variable and foreign direct investment (FDI) and foreign remittances as independent factors. The remaining factors include exchange rate, GDP growth, exports, and inflation rate; these are controllable variables. The results of the research show that FDI and foreign remittance have a positive and statistically significant association with unemployment rate in Bangladesh, both in the long run and in the short term. Thus, according to the findings, FDI and foreign remittances are creating more unemployment in Bangladesh. Unlike the general economic theory, which states that the bidirectional relationship of FDI with the unemployment rate, as well as foreign remittances with the unemployment rate, is inverse, these research outcomes basically suggest that FDI and foreign remittance inflows are displacing domestic labor with, perhaps, a low-cost, highly skilled overseas workforce, and also indicate that there might be an increasing trend in the brown-field investment sector. For policy implications, this investigation lends support to the theory that Bangladesh should focus more and more on skilled development policies for domestic workers and create a sound environment for foreign investors in order to reduce the country's unemployment rate.

**Contribution/Originality:** In contrast to previous Bangladeshi studies, this study offers new insights into Bangladesh's unemployment situation while examining the simultaneous effects of foreign direct investment (FDI) and remittances by utilizing the most sophisticated econometric models, such as the autoregressive distributed lag (ARDL) model.

## 1. INTRODUCTION

Both FDI and foreign remittances are decisive economic growth drivers in third-world nations like Bangladesh. Third-world nations are modernizing in most areas, particularly in the production sector, as a result of capital inflows through FDI and foreign remittances to a third-world nation from a first-world nation.

FDI is vital to enhancing the economy because the exports and domestic investments are augmented by it, creating employment opportunities and enabling human capital to be skilled through the transfer of know-how and technology (Hossain, 2008). According to the research by Ghosh and Sarker (2015), FDI can influence Bangladesh's long-term economic growth favourably.

From emerging nations like Bangladesh to developed nations, the need for qualified personnel is rising daily. Economic growth is enhanced for foreign remittances because of the strengthening of the balance of payment, Gross National Income GNI, national savings, and foreign exchange reserves (Hasan, 2019). Siddique, Selvanathan, and Selvanathan (2012) suggested that an increase in remittances from abroad may help Bangladesh's economy thrive.

There are lots of problems in third-world nations like Bangladesh. Unemployment is one of the major problems. There are lots of talented and skilled workers in Bangladesh. But there need to be more opportunities to set them up as employed. FDI and foreign remittances help create employment opportunities through money inflows from developed countries to developing countries like Bangladesh. Sharmin and Khandaker (2015) found that the unemployment rate and FDI are negatively correlated.

Examining how FDI and foreign remittances affect Bangladesh's unemployment rate is the aim of this study. To the best of the author's knowledge, no concentrated effort has been made to look at how FDI and foreign remittance affect unemployment from Bangladesh's perspective, in spite of the fact that numerous studies have been conducted to investigate the relationship between remittance and GDP, FDI and GDP, and GDP and unemployment. Thus, the authors identified a potential research gap in examining the link between foreign remittances and Bangladesh's unemployment rate while taking into account the nation's foreign direct investment (FDI). Moreover, the study's exploration of this topic led to a ground-breaking claim. Primary sources should be prioritized to gather reliable and accurate information. But due to lack of time, a secondary source is used.

Six components make up the study's remaining portion:

- i. Literature review in Section 2.
- ii. Materials and Methods in Section 3.
- iii. Empirical Results in Section 4.
- iv. Discussion in Section 5.
- v. Conclusion in Section 6.
- vi. Policy Implications and Future Research in Section 7.

## 2. LITERATURE REVIEW

In most nations in the twenty-first century, FDI and overseas remittances are prevalent components. Most scholars attempt to investigate this by looking at how economic development is related to both FDI and foreign remittances. There is a favorable effect of FDI on economic growth, as studied by Batten and Vo (2009); Zhang (2001); Sokang (2019); Bouchoucha and Ali (2019) and Sahu (2021). On the other hand, according to Fayissa and Nsiah (2010); Imran, Zhong, Moon, Zhong, and Moon (2021); Adjei, Bo, Nketiah, Adu-Gyamfi, and Obuobi (2020), and Meyer and Shera (2017) foreign remittance and economic development have a favorable link (2017). In addition to exports, Alalawneh (2023) looked into how remittances and foreign direct investment affected unemployment rates in Jordan. According to the findings, export, foreign direct investment, and remittances all helped to lower unemployment over in the long run.

The majority of research found a negative link between FDI and unemployment, such as Carp (2012); Karimov, Paradi-Dolgos, and Koroseczné Pavlin (2020); Alkofahi (2020) and Zeb, Qiang, and Rauf (2014). However, other scholars, including Bayar (2014); Mucuk and Demirsel (2013); Bayar and Sasmaz (2017); Almula-Dhannoon, Abdul-Malik Dhannoon, Muneer Al-Salman, and Fadhil Hammadi (2020) and Çiftçioğlu, Fethi, and Begovic (2011) have found a correlation between the variables that is significant and positive in their research, which states that FDI can lead to unemployment.

The summary of the relevant literature about FDI and foreign remittances' effects on the unemployment rate is given in the following Table 1:

Table 1. Literature review.

Authors	Data type, focused country, period of study	Variables	Method	Findings
Djambaska and Lozanoska (2015)	Time series data; Republic of Macedonia; (Annual, 1999-2013)	Unemployment, foreign direct investment, corruption, population size and inflation.	Multiple linear regression analysis	The statistically significant negative association of inflation on unemployment, the positive association between corruption and unemployment, and the statistically significant impact of FDI on unemployment.
Anthony-Orji, Ogbuabor, and Nwosu (2018)	Time series data; Nigeria; (Annual, 1977-2013)	FDI, real exchange rate, remittances, foreign portfolio investment, unemployment rate, and trade openness.	ARDL-UECM, ARDL-bounds test	The negative effects of FDI, foreign private investment, and trade openness on the unemployment rate, whereas the real exchange rate, and remittances have a positive effect.
Mazher, Mukhtar, and Sohail (2020)	Time series data; Pakistan; (Annual, 1972-2014)	Unemployment, FDI, foreign remittances, inflation, GDP growth rate, oil prices, exports.	Autoregressive distributed lag (ARDL) model	FDI and remittances have long-term negative effects on unemployment but are statistically insignificant in short run.
Jushi, Hysa, Cela, Panait, and Voica (2021)	Panel data; eight Balkan countries; (Annual, 2000–2017).	Labor force, trade openness, population growth, GDP growth, remittances, and FDI.	Vector autoregressive VAR models	The insignificant association of population growth, remittances and labor force participation, and conversely, significant relationship of prior levels of GDP, trade, and FDI with GDP growth (financial growth).
Das and Sethi (2020)	Time series data (Yearly, 1980-2016). Country: India and Sri Lanka	FDI, foreign aid, foreign remittances, financial development, GDP.	Vector error correction model (VECM) and Granger causality test.	FDI and remittances are significantly related to the GDP in India, and there is a significant association between foreign aid and remittances and the GDP in Sri Lanka.
Comes, Bunduchi, Vasile, and Stefan (2018)	Panel data; Bulgaria, Romania, Hungary, Croatia, Czech Republic, Slovakia and Slovenia. (Annual, 2010–2016).	FDI, remittances, and GDP.	Hierarchical cluster analysis (HCA) dendrogram analysis	FDI and remittances have a positive association with GDP; however, foreign direct investment is larger than remittances.
Evans and Kelikume (2018)	Time series data; Nigeria; (Annual, 1980-2016)	FDI, foreign aid, international tourism, GDP, capital formation, remittances, trade, and exchange rate.	The Cobb-Douglas production function and ARDL bounds test.	The short-term positive and significant association of FDI, trade, aid, remittances, and tourism with welfare under terrorism and militancy, as well as the significant association of aid and remittances, and the long-term insignificant association of FDI, trade, and tourism.
Balcerzak and Zurek (2011)	Time series data; Poland, (Quarterly, from 1995 to 2009)	Unemployment and FDI	VAR.	FDI has a negative impact on unemployment, suggesting that FDI resulted in reducing the unemployment rate.
Johnny, Timipere, Krokeme, and Markjackson (2018)	Time series data; Nigeria; (Yearly, from 1980 to 2015)	Capital formation, FDI, and unemployment.	Ordinary least square (OLS), unit root tests, and co-integration test.	The significantly positive association between capital formation and unemployment and the non-significantly negative relationship between FDI and unemployment.
Jaouadi (2014)	Time series data;	Unemployment and	Cointegration	FDI has a negative impact on

Authors	Data type, focused country, period of study	Variables	Method	Findings
	KSA; (Annual, 1990-2012)	FDI	approach	unemployment, suggesting that FDI resulted in reducing the unemployment rate.
Fabuš (2015)	Panel data; Bratislava, Zilina, Presov and Kosice; (Annual, 1998-2013)	Unemployment and foreign direct investment (FDI)	Correlation and regression analysis	Overall, there is an indirect relationship between unemployment and FDI, although there is a moderate relationship between them in Bratislava, and a significant one in Trencin and Presov.
Dritsakis and Stamatiou (2017)	Panel data; 13 new EU members; (Annual, 1995-2013)	Foreign direct investments, unemployment, GDP and exports.	Panel data analysis: Unit root test, cointegration tests, fully-modified ordinary least square (FMOLS), Dynamic ordinary least square (DOLS) estimates, and causality analysis.	Economic growth has a long-term unidirectional association with unemployment, exports have a unidirectional association also with FDI but in the short term, and exports have a bidirectional association in the long term with economic growth.
Nikolaev and Stancheva (2013)	Time series data; Bulgaria; (Annual, 1997-2012)	Foreign direct investments, unemployment.	correlational and regression analysis	The reverse link between foreign direct investment and unemployment
Habib and Sarwar (2013)	Time series data; Pakistan; (Annual, 1970-2011).	GDP per capital, FDI, employment level, exchange rate.	Johansonco-integration approach.	The variables have associations in long run.
León-Ledesma and Piracha (2004)	Panel data, Central and East European economies, (Annual, 1990-1999)	Remittances and employment	Econometric model	The positive impact of remittances on employment and productivity.
Okeke (2021)	Time series data, Nigeria, (Annual, 1977-2018)	International remittances and unemployment	Unit root, two-stage least squares (2SLS), cointegration, and error correction model (ECM)	The negative impact of foreign remittance on unemployment and one-way causality from foreign remittance to unemployment.
Ihedimma and Opara (2022)	Time series data, Nigeria, (Annual, 1981-2019)	Remittances and unemployment	Instrumental variable regression model	The positive association between remittances and unemployment.
Jackman (2014)	Cross-sectional time-series data; eighteen Latin American and Caribbean countries; (Yearly, from 1991 to 2010)	Unemployment, remittances, fiscal policy, economic growth, monetary impulses, world growth, trade openness, domestic credit	Panel threshold model (Hansen, 2000)	When there is a low ratio of remittances to GDP, remittances have a positive and substantial influence on unemployment; nevertheless, when there is a large ratio, remittances have a negative impact.
Reza, Fan, Reza, and Wang (2018)	Time series data; Bangladesh; (Annual, 1990-2015).	GDP, export, import, foreign direct investment, inflation and exchange rate.	VECM and co-integration test.	GDP has a positive link with FDI in the long and short run.
Hussain and	Time series data:	FDI, trade and	VECM	The variables have significant

Authors	Data type, focused country, period of study	Variables	Method	Findings
Haque (2016)	Bangladesh; (Annual, from 1973 to 2014)	GDP		associations in long run.
Siddique et al. (2012)	Time series data; India, Bangladesh and Sri Lanka (Annual, 19976-2006).	Remittances and GDP.	VECM and granger causality test.	There is a significant relationship between remittances and GDP in Bangladesh, no relationship between these variables in India, and bidirectional relationship between these variables in Sri Lanka.
Datta and Sarkar (2014)	Time series data; Bangladesh; (Annual, 1975-2011).	Remittances and GDP.	ARDL	The long-term association without casual relation between remittances and GDP.
Zobair (2021)	Time series data; Bangladesh; (Annual, 1976-2017).	Foreign aid, FDI, foreign remittance and GDP.	ARDL	The relationship between GDP and FDI is positive, but the link between GDP and foreign aid and remittances is negative.

Examination of earlier studies suggests that one can hardly find any work considering the joint effect of both FDI and foreign remittances on Bangladesh’s unemployment rate. Thus, extensive research is required to uncover the association of FDI, and foreign remittances with unemployment in emerging economies like Bangladesh.

### 3. MATERIALS AND METHODS

#### 3.1. Data Description

The unemployment rate was employed as a dependent variable in the study, whereas FDI and foreign remittances from abroad were used as independent factors. The remaining variables are inflation rate, export, GDP growth, and exchange rate, which are used as controlled variables. The data on variables in this study is from 1991 to 2020. The few variables are converted into percentages, not in percentages, to remove the heteroskedasticity problem. The data definition, source, and description are given in the Table 2:

Table 2. Data description.

Variables	Definition	Description	Source
UNEM	The skilled people are unwillingly out of work due to lack of job opportunities is called unemployment.	unemployment (% of total labor force)	WDI (World development indicator from world bank).
FDI	Foreign direct investment (FDI) is an investment made in another nation for the purpose of growing an existing firm, starting a new one, or for any other purpose involving ownership.	foreign direct investment (Net inflows, % of GDP)	
REM	Remittance is the transfer of money from a foreign country to a domestic country by citizen.	Percentage of personal remittances, received (Current US\$)	
INF	Inflation is the rate of decrease of value of money.	Inflation, GDP deflator (Annual %)	
EXPT	Selling products and services internationally is known as Export.	Percentage of exports (Goods and services-current US\$)	
GDPGR	The average yearly rate of change in a country's GDP is known as its GDP growth rate.	GDP growth (Annual %)	

Variables	Definition	Description	Source
EXCH	The exchange rate is the cost of converting one currency into another.	Percentage of official exchange rate (Local currency units, LCU per US\$, period average)	

### 3.2. Methods

The unit root test was employed in the study to check the data's stationarity. Following that, lag is chosen using lag selection criteria. This study prioritizes Akaike's information criterion (AIC) for lag selection since it offers reliable data. By utilizing ARDL Bounds Test, the relationship between the variables in the long-term is determined.

#### 3.2.1. Specification of Model

The following econometric model is used.

$$UNEM = \alpha_0 + \gamma_1 FDI_t + \gamma_2 REM_t + \gamma_3 INF_t + \gamma_4 EXPT_t + \gamma_5 GDPGR_t + \gamma_6 EXCH_t + \epsilon_t(1)$$

Equation 1 shows how FDI, remittances, and other macroeconomic factors relate to the unemployment rate. Where: UNEM= Unemployment; FDI= Foreign direct investment; REM= Remittance; INF= Inflation rate; EXPT= Export; GDPGR= GDP growth rate; EXCH= Exchange rate;

The study used the ARDL bound test technique, which was suggested by Pesaran, Shin, and Smith (2001) to achieve its primary goal. The ARDL Bound test model is given by converting the model (1):

$$\begin{aligned} \Delta UNEM = & \alpha_1 + \Omega_1 UNEM_{t-1} + \Omega_2 FDI_{t-1} + \Omega_3 REM_{t-1} + \Omega_4 INF_{t-1} + \Omega_5 EXPT_{t-1} + \Omega_6 GDPGR_{t-1} + \\ & \Omega_7 EXCH_{t-1} + \sum_{j=1}^p \epsilon_1 \Delta UNEM_{t-j} + \sum_{j=0}^q \epsilon_2 \Delta FDI_{t-j} + \sum_{j=0}^q \epsilon_3 \Delta REM_{t-j} + \sum_{j=0}^q \epsilon_4 \Delta INF_{t-j} + \\ & \sum_{j=0}^q \epsilon_5 \Delta EXPT_{t-j} + \sum_{j=0}^q \epsilon_6 \Delta GDPGR_{t-j} + \sum_{j=0}^q \epsilon_7 \Delta EXCH_{t-j} + \Phi_{1t} \end{aligned} \quad (2)$$

$\Omega_1$  to  $\Omega_7$  = Coefficients of long run.

$\epsilon_1$  to  $\epsilon_7$  = Coefficients of short run.

$\Delta$  = First difference.

P = Dependent variable's lag order.

Q = Lag order of independent and controlled variables.

$\Phi$  = Error term.

#### 3.2.2. Estimation Method

After obtaining co-integration, the study employed the following ARDL model to get the long run parameters.

$$\begin{aligned} \Delta UNEM = & \zeta_0 + \sum_{j=1}^p \epsilon_1 \Delta UNEM_{t-j} + \sum_{j=0}^q \epsilon_2 \Delta FDI_{t-j} + \sum_{j=0}^q \epsilon_3 \Delta REM_{t-j} + \sum_{j=0}^q \epsilon_4 \Delta INF_{t-j} + \\ & \sum_{j=0}^q \epsilon_5 \Delta EXPT_{t-j} + \sum_{j=0}^q \epsilon_6 \Delta GDPGR_{t-j} + \sum_{j=0}^q \epsilon_7 \Delta EXCH_{t-j} + \epsilon_{1t}(3) \end{aligned}$$

ECM is employed to get the short run parameters and long run estimation.

$$\begin{aligned} \Delta UNEM = & \zeta_0 + \sum_{j=1}^p \epsilon_1 \Delta UNEM_{t-j} + \sum_{j=0}^q \epsilon_2 \Delta FDI_{t-j} + \sum_{j=0}^q \epsilon_3 \Delta REM_{t-j} + \sum_{j=0}^q \epsilon_4 \Delta INF_{t-j} + \\ & \sum_{j=0}^q \epsilon_5 \Delta EXPT_{t-j} + \sum_{j=0}^q \epsilon_6 \Delta GDPGR_{t-j} + \sum_{j=0}^q \epsilon_7 \Delta EXCH_{t-j} + \ell ECM_{t-j} + \epsilon_{1t}(4) \end{aligned}$$

## 4. EMPIRICAL RESULTS

### 4.1. Unit Root Test

To avoid spurious results, the study utilized the unit root test. Tables 3 and 4 demonstrate that unemployment, FDI, and GDP growth rate are stationary variables at 1st difference. On the other hand, remittance, export, and exchange rate are stationary at this level. The remaining variable is inflation, which is stationary at 1st difference according to ADF and stationary at level according to Phillips–Perron PP.

Table 3. Unit root test (ADF) results.

Variables	ADF stationarity test			Integration order
	Intercept	Trend and intercept	None	
UNEM	-5.151 -3.711* -2.98**	-5.079 -4.356* -3.595**	-5.407 -2.650* -1.953**	I(1)
FDI	-6.149 -3.689* -2.972**	-6.288 -4.323* -3.580**	-6.248 -2.650* -1.953**	I(1)
REM	-3.980 -3.679* -2.968**	-3.978 -4.309* -3.574**	-1.989 -2.647* -1.952**	I(0)
INF	-8.488 -3.689* -2.972**	-8.375 -4.323* -3.580**	-8.649 -2.650* -1.953**	I(1)
EXPT	-5.197 -3.679* -2.968**	-5.484 -4.309* -3.574**	-3.085 -2.647* -1.952**	I(0)
GDPGR	-4.683 -3.689* -2.972**	-4.631 -4.323* -3.580**	-4.896 -2.650* -1.953**	I(1)
EXCH	-3.979 -3.679* -2.968**	-3.778 -4.356* -3.595**	-2.811 -2.647* -1.952**	I(0)

Note: \* and \*\* indicates 1% and 5% level of significant respectively.

Table 4. Unit root test (PP) results.

Variables	PP stationarity test			Integration order
	Intercept	Trend and intercept	None	
UNEM	-8.524 -3.689* -2.971**	-7.898 -4.323* -3.580**	-5.424 -2.650* -1.953**	I(1)
FDI	-6.161 -3.689* -2.971**	-6.794 -4.323* -3.580**	-6.261 -2.650* -1.953**	I(1)
REM	-4.063 -3.679* -2.967**	-4.045 -4.309* -3.574**	-1.827 -2.647* -1.952**	I(0)
INF	-4.928 -3.679* -2.967**	-5.578 -4.309* -3.574**	-2.341 -2.647* -1.952**	I(0)
EXPT	-5.266 -3.679* -2.967**	-5.490 -4.309* -3.574**	-3.165 -2.647* -1.952**	I(0)
GDPGR	-4.085 -3.689* -2.971**	-4.045 -4.323* -3.580**	-4.410 -2.650* -1.953**	I(1)
EXCH	-3.836 -3.679* -2.967**	-5.825 -4.309* -3.574**	-2.728 -2.647* -1.952**	I(0)

Note: \* and \*\* indicates 1% and 5% level of significant respectively.

Table 5. Results of lag selection criteria.

Lag period	LogL	LR	FPE	AIC	SC	HQ
0	-20.634	NA	0.426	1.973	2.306	2.075
1	-13.256	10.539*	0.271	1.518	1.898*	1.634
2	-11.688	2.127	0.262*	1.477*	1.905	1.608*

Note: Likelihood ratio (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz criterion (SC) and Hannanqu inn (HQ).  
\* indicates 5% level of significant respectively.

4.2. Lag Selection Criteria

The study used lag selection criteria to avoid serial correlation of error correction terms. There are five measures to select optimal lag in this table. From Table 5, maximum criteria and our prioritized criteria, Akaike's information criterion (AIC), suggest that the optimal lag is 2. So, lag 2 is used in this study.

Table 6. Results of ARDL bounding test.

<b>F-statistic</b>	<b>4.27</b>	
<b>k</b>	<b>6</b>	
<b>Significance</b>	<b>Critical values (Pesaran et al., 2001)</b>	
	<b>Bound I (0)</b>	<b>Bounds I (1)</b>
10%	2.12	3.23
5%	2.45	3.61
1%	3.15	4.43

4.3. ARDL Bounding Test

The cointegration of the variables is investigated in this study using the ARDL bound test. We can say that the variables are cointegrated over the long term since the F-statistic is higher than the upper bound critical values in Table 6 for the 5% and 10% levels of significance. This means that the null hypothesis is not true.

4.4. Long Run Relationship for ARDL Approach

Selected Model: ARDL (2,1,2,1,2,1,1)

In Table 7, all the variables are statistically significant except the exchange rate variable because of its greater p-value than 5%. Unemployment positively correlates with the variables without exports because of a negative sign in its coefficient. The coefficient of constant (C) is 1.282, which means that without the influence of the independent variable, unemployment increased by 1.282, which is statistically significant.

By calculating the coefficients of variables in long run, the study concluded the following Table 8:

Table 7. Results of long run relationship for ARDL approach.

Variable	Coefficient	Std. error	t-statistic	Prob.
FDI	0.842	0.186	4.518	0.001
REM	0.040	0.009	4.218	0.001
INF	0.049	0.021	2.322	0.040
EXPT	-0.079	0.011	-7.176	0.000
GDPGR	0.346	0.106	3.252	0.007
EXCH	0.047	0.031	1.531	0.154
C	1.282	0.533	2.402	0.035

Table 8. Changing of UNEM in long-run.

Variables	Variables increased by unit	UNEM increased or decreased by mentioned unit in below
FDI	1	0.842
REM	1	0.040
INF	1	0.049
EXPT	1	-0.079
GDPGR	1	0.346
EXCH	1	0.047

4.5. Short Run Relationship for ARDL Approach

Selected Model: ARDL(2, 1, 1, 1, 2, 2, 1)

Table 9 shows that the UNEM is changed according to the independent variables in short run, and the adjustment speed of UNEM is provided by the ECM (-1) in long run.

The coefficient of ECM (-1) is -1.057006, which carried an expected negative sign, and because of its lower p-value than 5%, it is statistically significant. This negative sign proves an association between the variables in long run. The UNEM will be in equilibrium with disequilibrium at a speed of 106% (rounding of 1.05006\*100).

The R-squared is 0.811703, less than the Durbin-Watson statistic of 2.452808. So, the model is statistically significant. And the adjusted R-squared is 0.717555, exposing that the UNEM is influenced by explanatory variables by 72% (rounding of 0.717555\*100).

In short run, the variables except UNEM (-1), GDPGR, AND EXCH are significant according to p-values that are below 5%. UNEM (-1), EXPT, GDPGR, and GDPGR (-1) have a negative impact, and FDI, REM, INF, EXPT (-1), and EXCH have a positive impact on UNEM in short-run.

By using the coefficients of variables in short run, the study concluded the following Table 10:

Table 9. Results of short run relationship for ARDL approach.

Variable	Coefficient	Std. error	t-statistic	Prob.
D(UNEM(-1))	-0.199	0.127	-1.567	0.145
D(FDI)	0.604	0.177	3.414	0.006
D(REM)	0.015	0.005	3.060	0.010
D(INF)	0.027	0.007	3.766	0.003
D(EXPT)	-0.013	0.006	-2.339	0.039
D(EXPT(-1))	0.035	0.009	3.966	0.002
D(GDPGR)	-0.125	0.058	-2.127	0.056
D(GDPGR(-1))	-0.242	0.099	-2.433	0.033
D(EXCH)	0.012	0.018	0.716	0.488
ECM(-1)*	-1.057	0.141	-7.478	0.000
R-squared	0.811			
Adjusted R-squared	0.717			
Durbin-Watson stat	2.452			

Note: \*indicates error correction term (ECM).

Table 10. Changing of UNEM in short-run.

Variables	Variables increased by unit	UNEM increased or decreased by mentioned unit in below
UNEM(-1)	1	-0.199
FDI	1	0.604
REM	1	0.015
INF	1	0.027
EXPT	1	-0.013
EXPT(-1)	1	0.035
GDPGR	1	-0.125
GDPGR(-1)	1	-0.242
EXCH	1	0.013

#### 4.6. Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test is adopted to test the serial correlation problem. This test shows in Table 11 that there is no serial correlation among the variables. Because the p-value of F-statistic 0.2416 is greater than 0.05.

Table 11. Results of serial correlation test.

Particulars	Value	Particulars	Value
F-statistic	1.669	Prob. F(2,9)	0.241
Obs*R-squared	7.578	Prob. chi-square (2)	0.022

4.7. Heteroskedasticity Test

Breusch Pagan-Godfrey test is adopted to examine the Heteroskedasticity problem. In Table 12, since the p-value of the F-statistic is greater than 0.05, it is concluded that there is no Heteroskedasticity problem.

Table 12. Results of heteroskedasticity test.

Particulars	Value	Particulars	Value
F-statistic	1.536	Prob. F(16,11)	0.237
Obs*R-squared	19.342	Prob. chi-square(16)	0.251
Scaled explained SS	2.198	Prob. chi-square(16)	1.000

Note: \*Indicates the LM (Lagrange multiplier) test statistic known as "Obs\*R-squared" is used to test the null hypothesis that no heteroskedasticity exists.

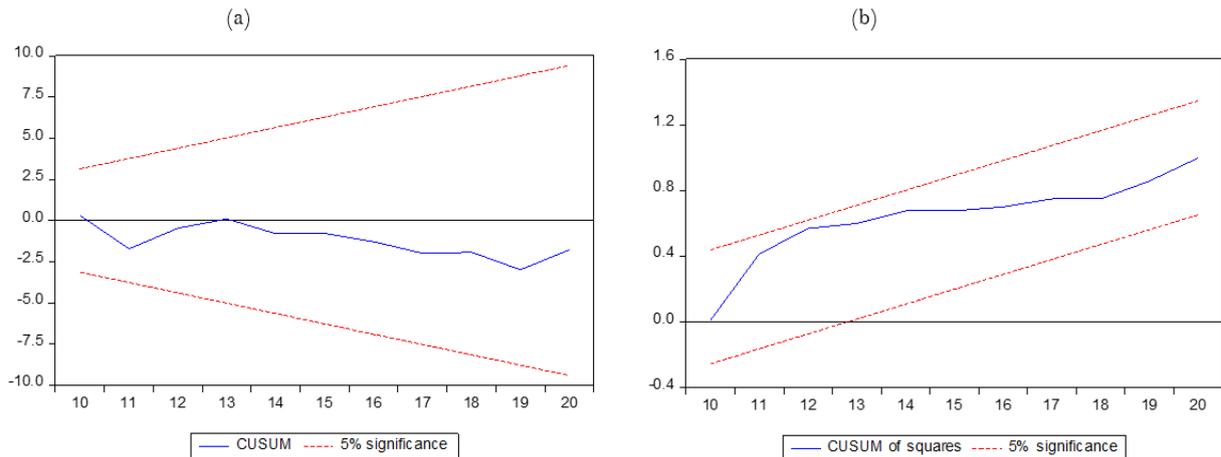


Figure 1. Plots of CUSUM and CUSUMSQ. Subfigure, (a) displays the plot of CUSUM; (b) displays the plot of CUSUMSQ.

4.8. Stability Test

The study used the CUSUM and CUSUM of Squares tests for stability testing. Figure 1 expresses that the blue lines are estimated lines of CUSUM and CUSUM of Squares, and the two red lines in each subfigure indicate 5% significance. The estimated line in both subfigures is within the red lines. So, it is concluded that the variables of the model are stable.

5. DISCUSSION

From the analysis of Section 3, one can say that a relationship among the variables in the long run exists. FDI, foreign remittances, inflation, and GDP growth rate have positive and significant long-term effects on unemployment. In the long run, conversely, exports have negative and significant effects on unemployment, whereas the exchange rate affects it positively and insignificantly. This means that if the FDI, foreign remittances, inflation, exchange rate, and GDP growth increase, unemployment also increases in the long run because of the positive association, such as unemployment increasing by 0.842414 units for increasing FDI by 1 unit. Conversely, if exports increase, unemployment decreases in the long run because of the negative relationship between them, such as unemployment decreasing by 0.079711 units for increasing exports by 1 unit.

In the short run, FDI, foreign remittances, inflation, exports with lag 1, and the exchange rate have positive relationship with unemployment. Among them, the only exchange rate is statistically insignificant. Unemployment with lag 1, exports, GDP growth, and GDP growth with lag 1 have a negative impact on unemployment, but only unemployment with lag 1 and GDP growth among them are statistically insignificant. Interpretation of this is that unemployment increases due to the increase in FDI, foreign remittances, inflation, export with lag 1, and exchange rate. For example, unemployment increases by 0.015673 by reason of the increase in foreign remittance by 1 unit. Conversely, unemployment decreases as a consequence of increasing unemployment with lag 1, exports, GDP

growth, and GDP growth with lag 1. For example, unemployment decreases by 0.125198 units because of increase in GDP growth of 1 unit. FDI has greater impact on unemployment than foreign remittances in both the short run and long run. Because of the coefficient of FDI is greater than that of foreign remittance.

According to most studies and general theory, FDI and foreign remittances affect unemployment negatively. But the study found that there is a positive relationship between FDI and foreign remittances and unemployment. Mamoon and Rahman (2016) also found a positive relationship between FDI and unemployment in Bangladesh in their study. Probably in Bangladesh context, FDI and foreign remittance inflows are displacing domestic labor with lower cost and highly skilled overseas workforce, and these are also invested in the brown-field investment sector (mergers and acquisitions) instead of the green-field investment sector. Due to these problems, FDI and foreign remittances positively affect unemployment.

## 6. CONCLUSION

This study found a long-run relationship among the variables. Foreign direct investment, remittances, inflation, and GDP growth rate have positive and significant effects on unemployment in long run. On the other hand, the exports have negative and significant effects, and the exchange rate has positive and insignificant effects on unemployment in the long run. In short run, foreign direct investment, remittances, inflation, exports with lag 1, and exchange rates have a positive relationship with unemployment. Among them, the only exchange rate is statistically insignificant. Unemployment with lag 1, exports, GDP growth, and GDP growth with lag 1 have a negative impact on unemployment, but only unemployment with lag 1 and GDP growth are statistically insignificant. Foreign direct investment has a greater impact on unemployment than remittance in both the short and long run. Because the coefficient of foreign direct investment is greater than remittances.

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## 7. POLICY IMPLICATIONS AND FUTURE RESEARCH

The government of Bangladesh has to adopt additional measures to support local workers' skill development, foster foreign investment in greenfield projects, and manage capital inflows to the country via FDI and remittances from outside. Thus, these increase the number of job opportunities.

Only 30 years' worth of secondary data was used in the study. Additional research would use original data spanning more than 30 years to fill the gap. In addition, panel data, rather than the time series data used in this study, will be used in future research to compare Bangladesh's unemployment rate with those of other nations.

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**Data Availability Statement:** The corresponding author can provide the supporting data of this study upon a reasonable request.

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