

## ***REMITTANCES AND ECONOMIC GROWTH IN NIGER: AN ERROR CORRECTION MECHANISM APPROACH***

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### **Abstract**

*Migration has for a long time been a significant source of revenue for a huge number of persons in the Republic of Niger. In order to improve their families living condition, a great number of young people in Niger follow the migration path. In 2019, a total of 293 million U.S. dollars has been sent by migrants to their family members in Niger (World Bank, 2019), that is 3% of Niger GDP. The study used various time series econometric techniques including unit root test, Engle-Granger cointegration test, vector equilibrium correction method and some diagnostic tests on the residuals to inspect the connection between remittances and economic growth in Niger. The empirical results showed that there is the existence of a long run relationship between remittances and economic growth in Niger. The error correction term's coefficient shows that about 51.62% of the discrepancy between long run and short run is corrected with a yearly data suggesting an acceptable rate of adjustment to equilibrium. Also, in the short run ceteris paribus a 10% increase in the remittances would lead to 2.03% increase in Niger Gross Domestic Product.*

**Keywords:** Remittance, Engle-Granger cointegration, error correction model, Economic growth, Niger

**JEL Classification :** C32 ; F24 ; F43 ; O15

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## **1. Introduction**

Migration has become an important question of concern around the world. In 2019, for the world as a whole, an estimated number of 272 million people were international migrants; this is 3.5 per cent of the global population (United Nations, 2019). These international migrants played a huge part in international remittance. In 2019, it is estimated that about 573 billion U.S. dollars was sent by migrants to their home countries (World Bank, 2019). In order to fight poverty, many young people from Niger have chosen to migrate.

The main aim of the article is to examine the effects that remittances have on Niger economic growth. This article is motivated to provide an empirical evidence of the impact of remittances sent to Niger on its economic growth. For this purpose, the study used various time series econometric tests such as the Augmented Dickey and Fuller (ADF) test developed by Dickey and Fuller, stationary test developed by Kwiatkowski-Philips-Schmidt-Shin (KPSS), Engle-Granger cointegration test, Vector equilibrium correction method and some diagnostic tests on the residuals including Serial correlation test, Heteroskedasticity test.

The remainder of the article is structured in the following way: Section 2 provides the literature review, while Section 3 discusses the research data, the research hypotheses and the methodology. Section 4 displays the outcome of the performed econometric tests and presents discussions. Section 5 concludes the article.

## **2. Literature review**

The connection among remittances and economic growth has been the main objective of many empirical works in the literature. Because of different social, economic, ethnical and cultural differences, remittances have different effects on economic growth. Many authors have examined the connection between remittances and economic growth. The results obtained and the methods used varied from one article to another. There are also differences in the countries studied and the periods used.

Friday (2019) used Autoregressive distributed lag (ARDL) model to scrutinize the short- and long-term connection between remittances, the development of finance sector and economic growth of Nigeria from 1981 to 2017. The empirical result showed that that there is a long-term connection between the research variables. The results also revealed that remittances have a significant negative effect on economic growth in both short and long term and the development of finance sector has a significant negative effect on economic growth. The results, furthermore confirmed the existence of complementarity between remittances and financial sector development in influencing economic growth.

Manuel & Mariellen (2019) in their article examined the the effet that investment and the money sent by migrants have on youth in rural area. Their research results showed that the

money sent by migrants positively contribute to the bearable economic development of youth in rural area of their countries of origin.

Agnieszka, Anna & Weronika (2018) in their article used age-specific growth rates model to study the direct and indirect impact of international migration on the population of Poland. Their study revealed that the direct impacts of migration appear to be instantaneous and smaller than that of fertility or mortality.

Katarzyna, Kamal, Sizar & Nematollah (2018) in their article studied migration and its impacts on developing countries. They used case studies from Tanzania, Zimbabwe, Philippines, South Africa, Iraq and Iran to explore migration patterns within these six countries.

Hamadou (2018) in his article investigated how migration flow is managed in Niger. He found that managing migration flows poses a problem in Niger and it is one of the major challenges that the country has faced in recent years because of its diverse implications.

Annie & Nicole (2018) explored the link between international migration, the money they send and the investment in human capital in the country of Kenya. 2009 Household data from Kenya is used in their research article. Their empirical results revealed a positive and significant link between the amount of money received by a household and the amount of expenditures assigned to education. Their results support various specifications, including instrumental variable approach.

Adigun & Ologunwa (2017) used time series analysis on secondary data covering the period from 1980 to 2015 to examine the trend and pattern of remittances and its impact on economic growth of Nigeria. The empirical results reveal that remittances are mostly used in consumption and investment in small business. The results also revealed that remittances have a positive effect on the economic growth of Nigeria.

Faisal, et al. (2017) used General Method of Mean to investigate the effect of macroeconomic, partisan and monetary aspects on remittances to Pakistan using data covering the period from 1972 to 2012. The empirical result showed that inflation has substantial and transposed relation with remittances demonstrating fewer investment by diaspora because of unstable macroeconomic conditions. The results also indicate a negative relation between financial liberalization index and remittances as it increases peoples' access to loans. The results also showed that democracy prompts migrants to send to their homes.

Meyer & Shera (2017) used a panel data set of six receiving remittances countries including Albania, Bulgaria, Macedonia, Moldova, Romania and Bosnia Herzegovina to investigate the impacts of remittances on economic growth. The empirical results demonstrated that remittances positively affect growth growth.

Adarkwa (2015) based on developmentalist, structuralist and pluralist views on remittances used time series analysis to study the impact of remittances on economic growth of four African countries: Cameroon, Cape Verde, Nigeria and Senegal. The empirical results

revealed that remittances have a positive influence on GDP of Nigeria and Senegal whereas remittances have negative effect on GDP of Cameroon and Cape Verde.

Di Marco, Marzovilla & Luciano (2015) used correlation test and covariance model to scrutinize the effect of remittances on the business cycle of the Philippines from 1977 to 2013. The empirical results revealed that remittances play a fundamental role in Philippine's economy.

Nahla (2015) used Autoregressive distributive lag approach and Granger Causality test to explore the link between international remittances on economic growth in Kenya. The data used in the study cover the period from 1993 to 2014. The empirical results revealed that international remittances are significant elements influencing the economic growth in Kenya.

Tchantchane, Rodrigues & Fortes (2013) used Auto Regressive Distributed Lag model to investigate the long and short run role of remittance, education expenditure and foreign direct investment on economic growth rates in the Philippines. The empirical results demonstrated that there is no sign of a long-run link between foreign direct investment and the rate of economic growth in the Philippines. The results also indicated direct and indirect effects of remittance on expenditure in the Philippines including expenditure on education and consumption expenditure.

Yisa et al. (2013) used cointegration and causality tests to explore and evaluate the influences of the money sent by migrants on economic growth in Nigeria. The study used remittance inflows, and other known determinants of economic growth, such as Gross Capital Formation, Foreign Direct Investment, openness and foreign exchange rate. The empirical results showed that there is long run equilibrium link between the research variables. The results also revealed one unidirectional causality starting from Gross Domestic Product to Remittance Inflows, from Capital Formation to Remittances and from Remittance Inflows to Openness.

Ferdous, Siwar, Basri & Rabiul, (2011) in their article provided a brief discussion of the international migration. They used secondary data to show up and explain the impacts on international migration and remittances on economic growth in Bangladesh.

Bichaka & Christian (2010) used neoclassical framework on a panel data for 36 African countries during the period from 1980 to 2004 to study the aggregate effects of remittances on economic growth. The empirical results showed that remittances have positive effects on economic growth by providing another means to support investment and helping to tackle liquidity problems.

McKenzie, Goodwin and Carreira (2009) examined the usage of Forecast Error Variance Decompositions to direct the econometrician's model specification. The authors use wholesale chicken markets to conduct their study. The empirical results demonstrated that Forecast Error Variance Decomposition method has the capability to deliver better model selections to Granger causality tests.

Hillel & Frédéric (2004) revisited the current theoretical and empirical literature on the money sent by migrants. Their research results proved that models based on diverse purposes have in common numerous same predictions. Their results outlined the difficulty to realize real discriminative tests in the absence of appropriately comprehensive data on migrants, on receiving households and on the moment the money is sent.

Felix, Amitava & Obi (2000) used a vector autoregressive analysis to analyze to find out the effects of the Nigerian energy sector on the Nigerian economy. Their findings showed that the Nigerian energy sector had an influence on its economy. The results also revealed that the country was not able to control the price of its chief export and import components.

The specification and identification of simultaneous equations model have been questioned by many researchers. As an alternative to the classical way, Lütkepohl (2000) proposed Impulse response functions as tools for interpreting VAR models.

Phillips (1998) introduced a method on how to apply impulse response and forecast error variance on nonstationary data. The empirical results proved that the finding are relevant in finite samples in VARs with some unit root and cointegration. The results also showed that impulse responses and forecast error decomposition are unpredictable at long horizons in unrestricted VARs with some unit roots.

Dickey and Fuller (1979) investigated the distribution of the variables for Autoregressive Time series with a Unit Root on a sequence of normally distributed independent variables with zero mean and common variance. The empirical results demonstrated that the power of the statistics studied are higher than the one of the Box-Pierce Q statistic in a Monte Carlo study.

The dissimilarity of this article from other articles on remittances and economic growth in developing countries is the insufficiency or even the inexistence of sufficient research article on Niger. The article consequently also intends to fill in this prevailing gap.

### **3. Data and Methodology**

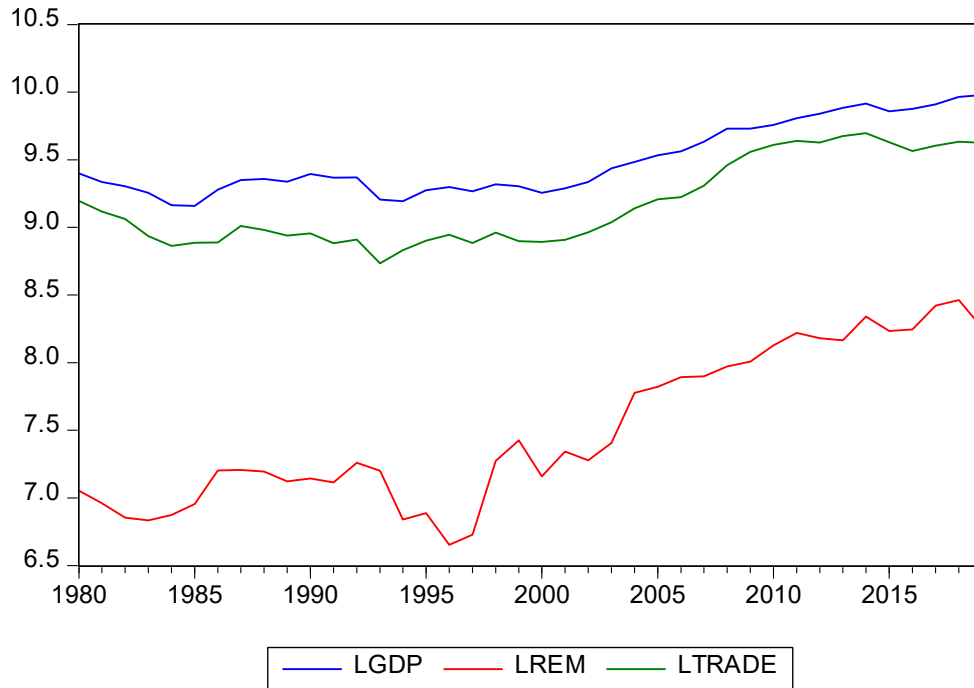
#### **3.1. Data**

For the analysis of the relationship between remittances and economic growth in Niger, the study used annual data of Niger provided from the International monetary fund. The data used are from 1980 to 2019. The data are entirely transformed in logarithms and are designed with the letter L at the start of the variable. The study used Gross Domestic Product (GDP) as substitution of economic growth. GDP is used as dependent variable. Remittance and trade are used as independent variables. In this study remittance is the variable of interest. Table 1 shows the descriptive statistics of the variables.

**Table no.1: Series descriptive statistic**

Variables (US \$)	Obs.	Mean	Median	Maximum	Minimum	Std. Dev.
Lgdp	40	9.493018	9.368560	9.977724	9.158538	0.261527
Lrem	40	7.499713	7.275868	8.461992	6.653026	0.559415
Ltrade	40	9.169878	9.024845	9.695703	8.734048	0.314652

Source: The author's calculation



**Figure no.1: Series graph**

### 3.2. Research hypotheses

The following hypotheses have been formulated and tested:

Hypothesis 1: There is a long-run relationship between remittances and economic growth in Niger.

Hypothesis 2: Remittances have a significant impact on economic growth in Niger.

Hypothesis 3: economic growth has no significant impact on remittances in Niger.

### 3.3 Methodology

To test the significance of the remittance influence on economic growth in Niger, the article used a overall model specified in the following equation:

$$LY_t = \beta_0 + \beta_1 Lrem_t + \sum_{i=2}^n \beta_i X_{it} + \mu_t \quad (1)$$

Where  $L$  denotes natural logarithm,  $Y$  stands for Gross domestic product,  $rem$  remittance,  $X$  are matching series for growth (in our study, only trade is represented by the term) and  $u$  embodies the error term. The equation for this study becomes then:

$$Lgdp_t = \beta_0 + \beta_1 Lrem_t + \beta_2 Ltrade_t + \mu_t \quad (2)$$

To complete the econometric procedure, the study will first perform unit root test to check the series stationarities in order to exclude spurious regression. In second step, the series will be tested for cointegration to determine the long run relationship. Following the Engle-Granger method, residual series produced from following equation is tested for existence of cointegration in the model:

$$\hat{u}_t = Lgdp_t - (\beta_0 + \beta_1 Lrem_t + \beta_2 Ltrade_t) \quad (3)$$

In third step, further residual tests including serial correlation and heteroskedasticity tests were performed for the accuracy of prediction of the model.

#### 4. Results and discussions

##### 4.1. The augmented Dickey-Fuller (ADF) test

The Augmented Dickey-Fuller test is performed on the research variables at their level and their first differences. The ADF test null hypothesis is specified as follow: “Series has a unit root”. If the series are stationary at the level, the series are said to be integrated of order zero  $I(0)$ . Variables are said integrated of order one,  $I(1)$  if they do not have unit root at their first differences. The outcome of Augmented Dickey-Fuller unit root tests is provided in Table no.2 and 3.

**Table no.2: Augmented Dickey-Fuller (ADF) test at Series level**

Variables	Number of lag	5 % critical value	ADF test statistics	P-value
Lgdp	1	-2.941145	0.014307	0.9541
Lrem	1	-2.941145	-0.715304	0.8303
Ltrade	1	-2.941145	-0.238419	0.9246

Source: The author’s calculation

**Table no.2** shows the ADF test results at the series level. The null hypothesis of unit root in the series cannot be discarded for all the research variables because their ADF test statistics are larger than the 5 % critical value and their respective probability values are higher than 0.05. Hence, all the research variables are non-stationary at their level.

**Table no.3: Augmented Dickey-Fuller (ADF) Test at Series' first differences**

Variables	Number of lag	5 % critical value	ADF test statistics	P-value
Lgdp	1	-2.943427	-4.193044*	0.0022
Lrem	1	-2.943427	-5.258981*	0.0001
Ltrade	1	-2.943427	-3.162543*	0.0305

Source: The author's calculation

**Table no.3** shows the results of the ADF unit root test on series' first differences. The 5 % critical value is -2.943427. The ADF test statistics for all the variables (Lgdp, Lrem and Ltrade) are lower than the 5 % critical value and the p-values are inferior to 0.05, which shows that the null hypothesis is rejected. Hence, all the series are stationary as they do not have unit root.

The results of the Augmented Dickey-Fuller test indicate that the hypothesis of unit root cannot be rejected if we consider a 5% significance level for all the research variables at series level. However, the results indicate that the unit root hypothesis is rejected at 5% significance level for all the research variables at series' first differences. Consequently all the variables in the study are integrated of order one I(1).

Next, a second test is conducted on the variables under study to verify the accuracy of the performed ADF test. The Kwiatkowski-Philips-Schmidt-Shin (KPSS) stationary test is then applied. The results of the KPSS stationary tests are provided in Table no3 and 4.

**Table no.4: KPSS test result at Series level**

Variables	KPSS statistic	1 % critical value	5 % critical value	10 % critical value
Lgdp	0.639825*	0.73900	0.46300	0.34700
Lrem	0.681509*	0.73900	0.46300	0.34700
Ltrade	0.572300*	0.73900	0.46300	0.34700

Source: The author's calculation

**Table no.4** shows the KPSS test results at the series level. The null hypothesis of stationarity is discarded for all the research variables because their KPSS test statistics are larger than the 5 % critical value of 0.46300. Therefore, all the research variables are non-stationary at their level. Next, a test on the series' first differences will be conducted to investigate the series integration order.

**Table no.5: KPSS test result at Series' first differences**

Variables	KPSS statistic	1 % critical value	5 % critical value	10 % critical value
Lgdp	0.452125**	0.73900	0.46300	0.34700
Lrem	0.124434**	0.73900	0.46300	0.34700
Ltrade	0.366137**	0.73900	0.46300	0.34700

Source: The author's calculation



**Table no.5** shows the KPSS test at the series' first differences. The null hypothesis of stationarity cannot be discarded for all the research variables because their KPSS test statistics are inferior than the 5 % critical value. Hence, all the research variables are stationary at their first differences.

The results of the Augmented Dickey-Fuller (ADF) test are proved by the KPSS stationary tests. Henceforth all the series (Lgdp, Lrem and Ltrade) are non-stationary at their level but become stationary in their first differences. The 3 variables used in the article are found to be integrated of order one I(1).

#### ***4.2. Engle-Granger cointegration test result***

Using the Engle-Granger method, residual series obtained from equation (3) is tested for cointegration in the model. The Augmented Dickey-Fuller test is applied for investigating the presence of unit root in the residual series. The results of the are given bellow in Table no 4.

**Table no.6: Engle-Granger cointegration test result**

<b>Variable</b>	<b>5 % critical value</b>	<b>ADF test statistic</b>	<b>p-value</b>
Model residual	-1.949856	-2.805796**	0.0063

*Source:* The author's calculation

According to the ADF unit root test results on the residual presented in **Table no.6**, the null hypothesis of the presence of unit root is rejected at 5% significance level which indicates the presence of cointegration in the model. Therefore, giving the Engle-Granger test result the variables are found cointegrated. There is a long-term equilibrium connection among economic growth, remittance and trade.

#### ***4.3 Error correction model estimation result***

Having established that the variables in the study are cointegrated. The residuals from the equilibrium regression are used in the equation below to analyze the long-run and the short-run effects of the variables and to determine the adjustment coefficient. The error correction equation used in the study is given as follow:

$$\Delta Lgdp_t = \beta_0 - \beta_1 ect_{t-1} + \beta_2 \Delta Lgdp_{t-1} + \beta_3 \Delta Lrem_{t-1} + \beta_4 \Delta Ltrade_{t-1} + \varepsilon_t \quad (4)$$

Where  $\Delta Lgdp_t$  stands for the first difference of Lgdp ,  $\varepsilon_t$  the error term and  $\Delta Lgdp_{t-1}$ ,  $\Delta Lrem_{t-1}$ ,  $\Delta Ltrade_{t-1}$  are respectively the lag of the first difference of Lgdp, Lrem and Ltrade. The error correction model estimation result is given in Table no.5.

**Table no.7: Error correction model estimation result**

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013132	0.008592	1.528371	0.1360
Lag of ect	-0.516226	0.216008	-2.389849	0.0227
Lag of first difference of Lgdp	0.445428	0.272281	1.635913	0.1114
Lag of first difference of Lrem	-0.105204	0.060548	-1.737528	0.0916
Lag of first difference of Ltrade	-0.008187	0.197806	-0.041390	0.9672

Source: The author's calculation

Table no.7 provides the error correction model estimation result. The error correction mechanism indicates the discrepancy between the long-run and the short-run. The error correction estimation result shows that, in the short run the coefficient of remittance (Lrem) which is the variable of interest is statistically significant at 10% or lower level. Based on the calculation of the elasticity of Lgdp to the change in Lrem, a 10% increase in remittances ceteris paribus will result in a 2.03% change in the Gross domestic product. In the long-term, the coefficient of the error correction term (-0.516226) suggests that 51.62% of the discrepancy between long-term and short-term is corrected with a yearly data suggesting an acceptable rate of adjustment to equilibrium.

#### 4.4. Results of the tests on residuals

In order to check the accuracy of the model, some diagnostic including serial correlation test and heteroskedasticity test tests are performed to investigate the reliability of the estimates.

##### 4.3.1. Serial correlation test

Breusch-Godfrey serial correlation LM test is used for testing serial correlation in the residuals. The test result is given bellow in Table no.8. The test null hypothesis is stated as follow ‘‘ No serial correlation’’ in the series.

**Table no.8: Breusch-Godfrey serial correlation LM test result**

Breusch-Godfrey serial correlation LM test			
F-statistic	0.640583	Prob. F(2,32)	0.5336
Obs*R-squared	1.462820	Prob. Chi-Square(2)	0.4812

Source: The author's calculation

According to the test results on the residual presented in Table no.8, the null hypothesis of no serial correlation cannot be is rejected at 5% significance level which indicates that the residuals are not serial correlated.

#### 4.3.2. Heteroskedasticity test

Breusch-Pagan-Godfrey Heteroskedasticity test is used for testing heteroskedasticity in the residuals. The test result is given bellow in Table no.9. The test null hypothesis is stated as follow “ No heteroskedasticity” in the series

**Table no.9: Breusch-Pagan-Godfrey Heteroskedasticity test result**

<b>Heteroskedasticity test: Breusch-Pagan-Godfrey</b>			
<b>F-statistic</b>	1.112071	Prob. F(3,34)	0.3577
<b>Obs*R-squared</b>	3.395526	Prob. Chi-Square(3)	0.3346
<b>Scaled explained SS</b>	3.855841	Prob. Chi-Square(3)	0.2775

*Source:* The author’s calculation

According to the test results on the residual, the null hypothesis of no heteroskedasticity cannot be rejected at 5% significance level which indicates that there is no heteroskedascity in the residuals series.

## 5. Conclusion

This article examines the link between remittances activity and economic growth for Niger. For this analysis, the article employed different econometric tests such as unit root test, Engle-Granger cointegration test, equilibrium error correction mechanism and some diagnostic tests on the residuals. The attained empirical results suggest that in the short run ceteris paribus a 10% increase in the remittances would lead to 2.03% increase in Niger GDP. The results also showed the existence of a long run relationship between remittances and economic growth in Niger. The coefficient of the error correction term shows that about 51.62% of the discrepancy between long run and short run is corrected with a yearly data suggesting an acceptable rate of adjustment to equilibrium.

The present research is important because of two main reasons: first, there are no previous studies exploring the link between remittances sent to Niger and its economic growth; next, the study delivers valuable empirical evidence for policy makers in Niger on the influence of remittances on economic growth in Niger. The study endorses that policy makers in Niger encourage studies of this kind by providing financial support to Nigerien researchers.

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