DYNAMIC MODELLING OF THE INFLUENCE OF DIASPORA CASH REMITTANCE ON MACROECONOMIC STABILITY IN NIGERIA

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Abstract:

Remittance flows into low-income and fragile states represent a lifeline that supports households as well as provides much-needed tax revenue (IMF - Sayeh & Ralp Chami; 2021). **Purpose**: on the basis of this record, the study sought to examine the dynamic modelling of the influence of diaspora cash remittance as measured by Personal Remittances Received (PRR); Exchange Rate (EXCHR); and Outward Remittances Flows (ORF) on macroeconomic stability in Nigeria as measured by Unemployment Rate (UNEMPR) and Gross Domestic Product per capita growth (GDPpcgr) using quarterly time-series data sourced from World Bank and World Development Indicators for the periods 2010Q1-2020Q4. **Technique/Approach**: the study was disintegrated to apply Engle-Granger two-step method of error correction model (ECM) together with Granger Causality test to analyse the causal effect of Personal Remittances Received; Exchange Rate; Outward Remittances Flows on Unemployment Rate, as well as, utilize vector autoregressive (VAR) technique to investigate the dynamic influence of Personal Remittances Received; Exchange Rate and Outward Remittances Flows on gross domestic product per capita growth. **Findings**: the result of Granger Causality test upheld the hypothesis of PRR does not involve Granger causality of UNEMPR and the hypothesis that UNEMPR does not involve Granger causality of PRR. However, unidirectional causality runs from EXCHR to UNEMPR; as well as, from ORF to UNEMPR. The result of the error correction model (ECM) demonstrated that personal remittances received and exchange rate have insignificant and significant short-term and long-term effects on increasing the rate of unemployment. Whereas, outward remittances flow significantly minimized the rate of unemployment. More so, the results of the vector autoregressive (VAR) technique portrayed that the past realization of GDPpcgr was associated with a significant increase of 0.84 percent in GDPpcgr. Whilst, the past realization of Personal Remittances Received and outward remittances flows were related to an insignificant increase in GDPpcgr respectively; also, the past realization of exchange rate retarded the GDPpcgr. Furthermore, variance decomposition forecast of 4-

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period horizon reported that 100 percent of deviation in GDPpcgr is explicated by GDPpcgr in the short-term, indicating that personal remittances received, exchange rate, and outward remittances flows had no strong exogenous influence on predicting GDPpcgr in the future. Whereas, in the long-term forecasted error in GDPpcgr produced about 97.57 percent; while, Personal Remittances Received, exchange rate and outward remittances flow had a weak influence on predicting GDPpcgr in the future. **Concluding Remark**: the study concluded that it is an imperative for policy makers to design more policy measures that will encourage, facilitate a smooth and efficient inflow of cash remittance from abroad into the country so as to stabilize the economy.

JEL: E01; E20; E24

Keywords: diaspora remittance, macroeconomic stability, gross domestic product per capita growth, unemployment, ECM, VAR technique, Engle-Granger two-step method

1. Introduction

1.1 Background to the Study
Diaspora, in general term, is referred to a community of people from the same homeland who have scattered or migrated to other lands. The reason is that this community of people might have been forced from or chosen to leave their homeland to settle in other lands. Diaspora may be created by voluntary emigration or by coercion. Voluntary diaspora is a community of people who have left their homelands in search of economic opportunity, in contrast, forced diaspora often arises from traumatic events such as wars, imperialistic conquest, or from enslavement, or from natural disasters like famine or extended drought. On the other hand, remittance is a twenty-first century phenomenon that dates back to the industrial revolution. Many experts believe that it was during the industrial revolution that farmers and workers started moving to bigger cities in search of employment. They would often send money to their families back home, so they could meet their day-to-day needs. Just as it did back then, remittance continues to help families around the world to meet routine expenses. Remittance is money by which a person working in a foreign country send to a loved one, family etc. in his/her home country. According to the International Monetary Fund, remittances are household income from foreign economies arising mainly from the temporary or permanent movement of people to those economies. Remittances include cash and non-cash items that flow through formal channels such as electronic wire, or informal channels, such as money or goods carried across borders. A typical remittance transaction takes place in three steps: The migrant sender pays the remittance to the sending agent using cash, check, money order, credit card, debit card, or a debit instruction sent by e-mail, phone, or through the Internet. Though the crux of this study is to focus on the cash aspect of diaspora remittances with discussing the Nigerian context of it. Diaspora remittance plays an important role in contributing to economic growth, livelihoods, community development

projects, and innovation and entrepreneurship. The importance of remittances is in the role they play in economies. They help poorer recipients meet basic needs, fund cash and non-cash investments, finance education, foster new businesses, service debt and essentially, drive economic growth. Empirical studies show that the primary benefit of remittances to recipients' household is the improvement in their general welfare. According to analysts, 70% of remittances are used for consumption purposes, while 30% of remittances funds go to investment-related uses.

In 2014, 17.5 million Nigerians lived in foreign countries, with the UK and the US having more than 2 million Nigerians each. In a report released by Agusto Consulting in 2021, Nigeria has over $21 billion annually in inflows from diaspora remittances, making it the second-largest recipient of remittances on the continent, only after Egypt. The remittances from the Nigerian diaspora have become a major mainstay of the Nigerian economy. At the macro level, diaspora remittances represent the second-largest source of foreign exchange inflow into the country, second only to crude oil earnings. It is established that for decades, remittances from Nigerians living abroad have significantly added to domestic income, social welfare and economic development. The remittances remain major sources of stable external financing for Nigeria and developing countries. Thus, it is worth noting that, it is a very important drive of economic growth, remedy for unemployment and also it generates wealth. As World Bank in its recent report on Migration and Development as it that global flow of remittances has raised critical issues of concern to the well-functioning of the Nigerian economy. From the report, the decline in the flow of remittances to Nigeria, particularly in 2020 was copiously on display. The decline of remittance flow to Nigeria in 2020 was recorded as a whopping 27.7 per cent, from $23.24 billion the previous year to $16.8 billion. This was worse than the 1.6 per cent decline recorded for the low- and medium-income countries as well as the 12.5 per cent decline of the Sub Saharan African (SSA) countries. This implies that aside from the negative COVID-19 pandemic effects on the global flow remittances, Nigeria's case manifests other causative factors. In light of the above, given the increasing importance of Diaspora remittances, the Central Bank of Nigeria (CBN) recently unveiled a new policy that grants unfettered access to foreign exchange (FX) from Diaspora and other money transfer remittances. The new CBN policy allows beneficiaries of Diaspora remittances through International Money Transfer Operators (IMTOs) to henceforth receive such inflows in the original foreign currency through the designated bank of their choice. The regulation was part of efforts to liberalise, simplify and improve the receipt and administration of Diaspora remittances into Nigeria. Thus far, diaspora remittance is still on the decline, it has not performed appropriately based on the provided figures above. Given the fact, remittances from Nigerians living abroad have significantly added to domestic income, social welfare, economic growth and development and to the reduction in unemployment – its decline greatly portends danger for the economy. Many studies have been executed on the subjects, using several methods and techniques to deal with the problems arising from the subject matter. However, using this designed approach in this study would make a more significant difference from the methods used

in previous studies, and the outcomes found by recent studies. Hence, it has become necessary and indeed imperative to examine the dynamic modelling of the influence of diaspora cash remittance and its potential effect on the macroeconomic stability in Nigeria.

2. Literature Review

There are many theoretical literatures regarding diaspora remittances and macroeconomic stability. These theories were developed to address issues surrounding the stability of the economy by proffering solutions to bridge the gap that would exist between remittances from non-citizens living abroad and how the money sent to their home countries increase the gross domestic product and alleviate unemployment. This section takes a critical review of some of the theories.

2.1 Review of Theoretical Literature
2.1.1 The Neoclassical Approach
The neoclassical approach can be traced back to Smith (1776) and Ravenstein (1889). Borjas (1987c) postulated that an 'immigrant market' exists between countries. Potential host countries select suitable migrants through immigration policies for the human physical capital gain. In the same way, a migrant will choose to maximize his/her own utility subject to a budget constraint by seeking the country that will maximize his/her well-being. Other constraints might include immigration regulations imposed by potential country and emigration regulations by source country. The central argument is to maximize wages. This theory predicts a linear relationship between wage differentials and migration with the assumption that there is full employment. (Bauer and Zimmerman 1999; Massey et al. 1993; Borjas 2008) Wage differentials between regions cause the labour to shift from a low wage region to a high wage region. The larger the differential, the greater the flow will be. Hicks (1932, p.76) stated that "*differences in net economic advantages chiefly in wages are the main causes of migration*". However, subsequent studies found that it is the real expected earning gap that was the major factor in decision making and not the absolute real wage differential (Todaro, 1969, 1976; Todaro and Maruszko, 1987).

2.1.2 Unemployment Approach
Marx (1867) addressed the issue of unemployment at great length in the first volume of *Capital*, especially in Chapter 25, "The General Law of Capitalist Accumulation." Marx argued that workers assume less power than capitalists in the bargaining process over wages in a free-market capitalist economy. Pollen (2008) stated that the argument is supported by the mere fact that if workers fail to find employment, they have no other way of surviving. The reasonably stronger bargaining position assists capitalists in gaining higher revenues. High unemployment and underemployment result in workers' bargaining power drastically declining. Active workers could effortlessly be substituted

by involuntary unemployed persons. Marx (1867) concluded that purposeful to the operations of a capitalist economy was high involuntary unemployment. When a capitalist economy grows swiftly, it leads to involuntary unemployment. The result thereof is that employees would abuse their increased bargaining power to influence wage increments. Friedman, like Marx, associates the occurrence of high unemployment in capitalist economies with the capability of employees to raise bargaining power. Friedman (1968) concludes that free-market capitalism will guarantee that companies are offering employees employment with suitable remuneration packages. Workers have the courtesy to choose between employment and leisure. Leisure would, therefore, be defined as voluntary unemployment. Where workers refuse to accept free market-determined wages, it would result in the natural rate of involuntary unemployment becoming positive.

2.1.3 Human Capital Growth Approach

The first important stage of the growth theories which are based on human capital relied on the growth-accounting, the prominent figure of which was the Russian Simun Kuznets (1981). In his theory, he examined the long-term growth processes in a complex way, he determined as a combined effect of many factors, on which – in his opinion –the population demographical characteristics, and the economic distribution of it, the structural changes in population, or the technical progress, the capital, the change of labour or the change of the social environment has an impact. Kuznets was awarded the Noble memorial prize in economics, because he took a significant part in determining a clear concept of the GDP, and until today the Gross Income per capita is the important element of economic rankings between countries. In addition to this, Kuznets detailed indirectly related costs – such as educational costs – which have an influence on the size of national income. In his view, the condition of the long-term GDP growth resulted from in addition the physical capital stock growth, the technological advance and human knowledge development and expansion. With the further elaboration of the theory of Kuznets, it can be defined that the present return of unit of physical capital is higher than the productivity of a previous period because the economy's general knowledge pool is increased, which we called the knowledge production (Sikora, 2004; Kuznets, 1981). After the Conference of Capital Investment in Human Being which was held in the United States in 1961, the importance of human capital in economic growth was widely accepted.

2.2 Review of Empirical Literature

Diverse literatures emerge with different findings in empirical research; some studies found a negative relationship between remittances and the growth of the economy, some found positive relationship while other studies found mixed relationship. This section is devoted to reviewing some of these literatures and their findings. For instance;

A. Positive Findings of Empirical Literature

Adeseye, A. (2021) examined the Effect of Migrants Remittance on Economy Growth in Nigeria. Remittance inflow was used as the dependent variable and gross domestic products, inflation, imports and exports were independent variables. The study employs annual data obtained from world development and international financial statistics which covers the period of 29 years (1990-2018). Quantitative data collected were evaluated through descriptive statistics; and the hypotheses formulated were tested with the use of multiple linear regressions which includes ANOVA, Correlation, and Coefficient. The findings of the study discovered that a significant relationship exists between remittance and gross domestic product, exports and imports in Nigeria while inflation has no significant relationship with remittance.

Ahmad (2015) examined the impact of workers' remittances on the economic growth of Jordan using the Ordinary Least Square approach. The finding suggests that workers remittances have a positive impact on the economy of Jordan within the period under consideration.

Margaret & Ajibola (2018) investigated the contributions of foreign remittances on economic growth in Nigeria from 1980 to 2016, using the Vector error correction modelling (VECM) technique to analyse the long run and short-run impact of disaggregated remittances that is Migrants 'Remittances and Workers' Remittances to find out whether they will perform differently in relation to economic growth in Nigeria. The results showed a unidirectional causality from GDP per capita to migrant's remittances while no causality was found between workers' remittances and gross domestic product per capita.

Godfrey & Godstime (2020) focused on Remittance Inflow and Unemployment in Nigeria. Remittance is treated as being endogenously determined by the number of migrants, the nominal exchange rate (with the Naira as local currency), the inflation rate and the migrant's income. Data from 1981 to 2019 is calibrated for structural breakpoints and stationarity under conditions of regimes changes. While the data was found to have been affected by regime changes and stationary in levels, an Instrumental Variable Regression model was estimated and it was found that remittance positively and significantly influence unemployment.

Iheke, O. R. (2012) in his study analysed the effect of remittances on the Nigerian economy. The study employed secondary data covering the period 1980-2008. Results of data analysis revealed that remittance inflow has been on the increase over the past two decades. Also, remittances, per capita income, investment and time were the positive and significant factors influencing output while the consumer price index significantly influenced output negatively.

Ebenezer A. O. (2009) examined the direction and magnitude of remittances effect on financial development in Nigeria. Using DMB deposit, credit, loan and liquidity to proxy for financial development, and adopting a structural dynamic model, we found that workers ' remittances show a sign of positive effect on demand deposit, positive and significant effect on liquidity and positive and significant effect on DMB credit and loan.

Rufai, et al. (2019) assessed the extent of labour mobility, its determinants and how it influences remittance inflows and household poverty using the logit regression model Propensity Score Matching and Linear Regression with Endogenous Treatment Effect Approach. Results reveal that while more males travelled for employment purposes, more females travelled due to marriage arrangements. More of the migrants that were working after migration had worked before migration and had the highest average amount of remittance sent to households. The study shows that labour mobility increases the amount of remittance sent to households. However, the increase was higher among male migrants than female migrants. More than half of the migrants had poor households; meanwhile, labour mobility was found to reduce the extent of poverty.

Meyer & Shera (2017), using panel data set of six countries for the period 1999-2013, examined the impact of remittances on economic growth in those countries. The result revealed that remittances have a positive impact on economic growth in those countries.

Also, Olusuyi, & Ebun (2017) investigated the dynamic impact of remittance on economic growth within the Nigerian context using the generalized method of moment (GMM) estimation technique. The result confirmed the positive impact of remittances on economic growth. Especially, a unit increase in remittance caused the GDP to rise by about 0.7817 units.

B. Negative Findings of Empirical Literature

Conversely, studies such as Aggarawal and Spatafora (2005), Barajas, Chami, Fullenkamp, Gapen and Montiel (2009) failed to establish a positive relationship between remittances and economic growth. Specialifically, Gini (2013) examined the role of remittances on the economic growth of Central and Eastern European (CEE) countries for the period of 1996-2001. The result confirmed the negative effect of remittances on economic growth in four South Asian emerging economies for the period 1997-2016, utilizing balanced panel data. The result revealed that remittance impacted negatively on three of those four countries, namely, Bangladesh, Pakistan and Sri Lanka.

Also, Anetor (2019) studied the nexus between remittances and economic growth in Nigeria; and the result of the study confirmed the negative impact of remittances on economic growth in Nigeria, both in the short-run and long-run.

Asmau Abdullahi (2020) examined the linkages between international migrant remittances and entrepreneurship development in Nigeria. First using data from the World Bank African Development Indicators, the study employs a Vector Autoregressive (VAR) approach to trace the linkages and complementarities of entrepreneurship development to changes in remittance inflow. The study however finds a weak link between remittances and entrepreneurship development in Nigeria.

Okeke, I. C. (2021) focused on the impact of international remittances on unemployment in Nigeria. An unemployment rate model was formulated and the unit root test was first applied to the data set. The time series were stationary and the two-stage least squares (2SLS) method was used to identify the impact of remittances on the

unemployment rate in Nigeria. The findings reveal that international remittances affect unemployment negatively and there exists a unidirectional causality between international migrant remittances and unemployment without feedback. In the same vein, a study by Rao and Hassan (2011) on the impact of remittances on economic growth for forty countries over the period of 1960-2007 reported that remittances had no significant impact on the economies of those countries in the study.

C. Mixed Findings of Empirical Literature

Caroline, & Nikola (2005) developed the first empirical methodology to estimate Remittances: Transaction Costs, Determinants, and informal flows. They use insights from the literature on shadow economies and empirically estimate informal remittances for more than 100 countries using historical data on the balance of payments (BOP), migration, transaction costs, and country characteristics. Their results imply that informal remittances amount to about 35-75 percent of official remittances to developing countries. There is significant regional variation: informal remittances to Sub-Saharan Africa and Eastern Europe and Central Asia are relatively high, while those to East Asia and the Pacific are relatively low.

Nyamongo, et al. (2012) investigated the role of remittances and financial development on economic growth in a panel of 36 countries in Africa over the period 1980–2009. It uses a panel econometrics framework and the main findings of the study are as follows: (1) Remittances appear to be an important source of growth for these countries in Africa during the period under study. (2) Volatility of remittances appears to have a negative effect on the growth of countries in Africa. (3) Remittances appear to be working as a complement to financial development. (4) However, the importance of financial development in boosting economic growth appears weak, at least among the countries under study.

In their study, Oshota, & Badejo (2015) investigated the relationship between remittances and economic growth in Nigeria, using an error correction modelling approach for the period 1981 to 2011. And the result of the finding revealed that remittances positively impact the economic growth of Nigeria. We have found that a 1 percent increase in remittances would lead to a 0.19 percent increase in the RGDP in the long run. However, remittances show a significant negative relationship with output in the short run.

Sutradhar, S. R. (2020) investigated the impact of workers' remittances on the economic growth of four South Asian emerging countries by employing balanced panel data from 1977 to 2016. Pooled OLS, fixed effects, random effects and dummy variable interaction models are used to estimate the impact of remittances. The empirical regression analysis confirms a negative effect of remittances on economic growth in Bangladesh, Pakistan and Sri Lanka. Conversely, remittances have a positive impact on economic growth in India. This study also indicates a joint significant and negative relationship between remittances and economic growth in four countries.

Okharedia & Osagie (2019) examined the influence of foreign remittances on the economic performance of Nigeria using time series data for the period 1986-2018. The time-series data was sourced from the World Bank. Error Correction Model (ECM) technique was adopted to determine the impact of foreign remittances on economic performance in Nigeria and how the exchange rate mediates the relationship. From the empirical examination, the paper posited that a reduction in the exchange rate is required for foreign remittances to effectively influence the performance of the economy of Nigeria. The study, further, concluded that while the foreign remittances improve the performance of the economy of Nigeria, the exchange rate is harming it.

3. Methodology and Data Estimation techniques

To examine the dynamic modelling of the influence of Diaspora cash remittance on macroeconomic stability in Nigeria. The study adopts Engle-Granger two-step method with modification to determine the long-run relationship between Diaspora cash remittance as measured by personal remittances received (PRR), exchange rate (EXCHR), outward remittances flow (ORF) as explanatory variables and Macroeconomic stability as measured by unemployment rate (UNEMPR) as explained variable in model-I. The study also adopts Vector autoregressive (VAR) technique to model the joint dynamics and causal relations among Diaspora cash remittance as measured by personal remittances received (PRR), exchange rate (EXCHR), outward remittances flow (ORF) as predictor variables and macroeconomic stability as measured by gross domestic product per capita growth (GDPpcgr) as a criterion variable in model-II.

3.1 Study Variables and Data Sources

In order to examine the dynamic modelling of the influence of Diaspora cash remittance and macroeconomic stability in Nigeria, the study analyses time-series quarterly data drawn from variables such as Unemployment Rate (UNEMPR) and Gross Domestic Product per capita growth (GDPpcgr) which are dependent variables used as proxies for macroeconomic stability and are both in percentage for the periods of 2010Q1-2020Q4; and study explanatory variables such as Personal Remittances Received (PRR) which is also a percentage of GDP; Exchange Rate (EXCHR) which is in unit, and Outward Remittances Flows (ORF) which is in millions of U.S Dollars and are all obtained from World Bank and World Development Indicators (WDI) for the periods of 2010Q1-2020Q4 respectively that are used to capture Diaspora cash remittance. In line with the above, the functional form of dynamic modelling of the influence of diaspora cash remittance on macroeconomic stability in Nigeria is specified as follows;

Model-I

UNEMPR = f (PRR, EXCHR, ORF)…………………………………….. (1)

Where;
UNEMPR = explained variable;
PRR, EXCHR, ORF are explanatory variables.

Model-II

GDPpcgr = f (PRR, EXCHR, ORF)………………………………….. (2)

Where:
GDPpcgr = criterion variable;
PRR, EXCHR, ORF are predictor variables.

3.2 Engle-Granger Two-step Method

Engle and Granger evolved a critical technique of estimating relationship between variables under study in 1987. According to them, the steps to determining whether two variables that possess the same order of integration move in the same direction are the following;

- Pre-test each variable to determine its order of integration, and
- Estimate the error correction model.

If the integrated variables are found to be integrated to the same order, then it must be tested whether these variables are co-integrated (Johansen, 1988).

3.2.1 Unit Root Test (Pre-test)

Here, the study conducts a pre-test on each variable to determine its order of integration, this is done using Augmented Dickey-fuller unit root test to make inference of the number of unit roots in each of the variables' examination. The model makes the choice of deterministic lag length of the Akaike Information criterion for all the variables under study. The pre-test starts with the unemployment rate (UNEMPR) with trend and constant; then with personal remittances received (PRR) with constant; with the exchange rate (EXCHR) with trend and constant; with outward remittances flow (ORF) with trend and constant. The outcome of Augmented Dickey-Fuller unit root tests results is provided in Table 1 below, and the equation is specified as follows;

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \sum_{j=1}^{P} \delta j \, \Delta y_t\text{-}j + \varepsilon_{it} \quad \text{... (3)}$$

Where;
α is a constant term;
β_t is the coefficient on a time trend series;
γ is the coefficient of y_{t-1};
P is the lag order of the autoregressive process;
$\Delta y_t = y_t - y_{t-1}$ are first difference of y_t;
y_{t-1} are lagged values of order one of y_t;

Δy_{t}-j are changes in lagged values;
ε_{it} is the white noise.

Table 1: Augmented Dickey-Fuller Test Results

Series	ADF Level	5% Critical Level	Order of Integration	P-Value
UNEMPR	-2.200241	-3.518090	I(0)	0.4774
D(UNEMPR)	-6.716573	-3.520787	I(1)	0.0000
PRR	-1.368231	-2.931404	I(0)	0.5889
D(LPRR)	-6.398151	-2.933158	I(1)	0.0000
LEXCHR	-2.179640	-3.518090	I(0)	0.4884
D(LEXCHR)	-7.087396	-3.520787	I(1)	0.0000
LORF	-1.622028	-3.518090	I(0)	0.7676
D(LORF)	-6.3011305	-3.520787	I(1)	0.0000

Source: Author's Computation with E-view 10 Software.

The results above show that the series possess stationarity property after the first difference, meaning that the null hypothesis of unit roots is rejected. Hence, it is necessary to estimate the long-run equilibrium relationship using static ordinary least square (SOLS) as one of the steps advocated by Engle and Granger, 1987. Table 2 below displays static ordinary least square results and its equation regression line is expressed as follows;

$$UNEMPR_t = \beta_0 + \beta_1 PRR + \beta_2 EXCHR + \beta_3 ORF + \varepsilon t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where;
β_0 is the intercept of UNEMPR;
β_1, β_2, β_3 are the respective slopes of PRR, EXCHR, ORF;
ε_{it} is the error term.

B. Engle-Granger Co-integration Test Results

Table 2: SOLS Results: Dependent variable: UNEMPR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-30.03560	0.805296	-37.29760	0.0000
LPRR	0.652638	0.325919	2.002458	0.0520
LEXCHR	6.664411	0.159970	41.66047	0.0000
LORF	-0.178350	0.046452	-3.839457	0.0004

Note: R-squared=0.981772; F-statistic=718.1273; Prob(F-statistic)=0.000000; D-W Stat=0.736415
Source: Author's computation with E-view 10 software.

From the results of static ordinary least square (SOLS) above, it is evident that the regression result is spurious. As Newbold and Granger (1974) in one of their studies stated that spurious regression signs are the ones with high R^2 (that is; 0.981772) and low Durbin-Watson statistic (that is; 0.736415), (Rule of thumb: $R^2 > dw$). Hence, this necessitates the application of the residual-based test.

3.2.2 Engle-Granger Residual-Based Tests

It is worthy to note that the results of static ordinary least square indicate the evidence of spurious regression. The Engle-Granger residual-based test for co-integration is simply unit root tests applied to the residuals obtained from Static Ordinary Least Square (SOLS) estimation. If the variables understudy co-integrate, an OLS regression yields a 'super-consistent' estimate, (Stock, 1987). This means there is a strong linear relationship between the variables under study. In order to determine if the study variables co-integrate, a test of unit root is conducted again on residual sequence obtained from ordinary least square in equation 4 utilizing the Augmented Dickey-Fuller test. Table 3 below displays the result. The residual sequence denoted by ε_t is a series of estimated values of the deviation from the long-run relationship and it is expressed as follows;

$$\varepsilon_t = y_t - y_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

They stand as earlier defined.

Table 3: Engle-Granger Residuals-based test result

Augmented Dickey-Fuller test on Residual

	t-statistic	Prob*
Augmented Dickey-Fuller test statistic	-3.979049	0.0002
Test critical values 1% level	-2.622585	
5% level	-1.949097	
10% level	-1.611824	

Source: Author's computation with E-view 10 software.

The result in table 3 above shows that the residuals contain no unit root, hence in absolute terms the result of the Augmented Dickey-Fuller test is higher than the value of t-statistic at 5% critical level. This implies that the residual is stationary at the level I(0) meaning that it is integrated of order zero, as it is statistically significant. This simply means the result has passed the co-integration test, thus there is long-run relationship between the explained variable (UNEMPR) and explanatory variables (PRR, EXCHR, ORF). In conclusion, it is noted that the residuals generated from static ordinary least square are stationary at level, hence the variables co-move to long-run equilibrium. That makes it necessary to estimate the error correction model (ECM) which is done in the next section.

3.2.3 Error Correction Model (ECM)

An error correction model is applied to estimate a dynamic movement of variables under study. It relates to the fact that the last period's deviation from long-run equilibrium, the error, influences its short-run dynamics. Thus, the error correction model is applied here to directly estimate the speed explained variable, which is unemployment rate (UNEMPR) returns to equilibrium after innovation in explanatory variables such as personal remittances received (PRR), exchange rate (EXCHR), outward remittances flow (ORF). The error correction model equation can be illustrated as follows;

$\Delta UNEMPR_t = \sigma + \sum_{i=1}^{k-1} \beta 1 \Delta UNEMPR_{t-1} + \sum_{j=1}^{k-1} \beta 2 \Delta PRR_{t-1} + \sum_{m=1}^{k-1} \beta 3 \Delta EXCHR_{t-1} + + \sum_{q=1}^{k-1} \phi \Delta ORF_{t-1} + \lambda ECM_{t-1} + \mu_t$ ……………………………… (6)

Where;

σ = constant;

k-1 = the lag length;

λ = speed of adjustment parameter;

β, ϕ = short-run dynamic coefficients of the model's adjustment log-run equilibrium;

ECM = lagged value of the residuals obtained from the co-integrating regression of the dependent variable on the regressors, which contains long-run information derived from the long-run co-integrating relationships;

μt = Residual (stochastic error term; often called impulses, innovations or shocks).

The ECM results are displayed in Table 4 below.

Table 4: Error Correction Model (ECM) Estimated Results

Variable	Coefficient	Standard	t-Statistic	Prob.
C	8.08E-05	0.037668	0.002145	0.9983
D(LPRR)	0.602705	0.531145	1.134728	0.2636
D(EXCHR)	6.593534	0.614538	10.72926	0.0000
D(ORF)	-0.348334	0.067990	-5.123290	0.0000
ET(-1)	-0.298448	0.121900	-2.448308	0.0191

The estimated result of the error correction term (ECT) in Table 4 above displays that the a priori expectation is met, as well as satisfied the stability condition of the study. This suggests that the estimation results have the needed signs for each of the equations. The error correction term (ECT) value is --0.298448 with its associated P-value being 0.0191. This result implies that the speed of adjustment towards long-run equilibrium from short-run disequilibrium is 29.84% quarterly. Suggesting that it takes the unemployment rate 29.84% quarterly to return to long-run equilibrium from short-run disequilibrium after an innovation to explanatory variables in the model. More so, the absolute value of the coefficient of Personal Remittances Received D(LPRR) indicates a positive sign of 0.602705 with its statistically insignificant corresponding p-value being 0.2636. This implies that as personal remittances received increase by 1%, it causes the unemployment rate to insignificantly increase by 0.60% on average. Furthermore, the absolute value of the coefficient of exchange rate D(LEXCHR) reports a positive sign of 6.593534 with its statistically significant corresponding p-value of 0.0000. It is suggested that 1% increase in the value of the exchange rate will accelerate the unemployment rate by 6.59% on average.

The result negates the finding by Okharedia & Osagie (2019) who examined the influence of foreign remittances on the economic performance of Nigeria using time series data for the period 1986-2018 and found that while the foreign remittances improve the performance of the economy of Nigeria, the exchange rate is harming it. Similarly, the absolute value of the coefficient of Outward Remittances Flows D(LORF) possesses a

negative sign of -0.348334 with its corresponding p-value of 0.0000. This suggests that 1% increase in outwards remittance flow produces about 0.34% decrease in the unemployment rate on the average in Nigeria within the periods under study. This result agrees with the finding by Okeke, I.C., (2021) which focused on the impact of international remittances on unemployment in Nigeria and found that international remittances affect unemployment negatively.

3.2.4 Granger Causality Test

Table 5: Granger Causality Test Results

Null Hypothesis	Obs	F-Statistic	Prob.
LPRR does not Granger cause UNEMPR	42	0.34029	0.7138
UNEMPR does not Granger cause LPRR		0.07684	0.9262
LEXCHR does not Granger cause UNEMPR	42	5.58027	0.0379
UNEMPR does not Granger cause LEXCHR		0.22393	0.8004
LORF does not Granger cause LPRR	42	4.45433	0.0185
UNEMPR does not Granger cause LORF		0.26151	0.7713
LEXCHR does not Granger cause LPRR	42	0.09351	0.9109
LPRR does not Granger cause LEXCHR		0.92967	0.4037
LORF does not Granger cause LPRR	42	2.66777	0.0827
LPRR does not Granger cause LORF		1.56792	0.2220
LORF does not Granger cause LEXCHR	42	2.43945	0.1011
LEXCHR does not Granger cause LORF		0.41172	0.6655

Source: Author's Compilation with E-view 10 Software.

In Table 5, when two lags are applied, the hypothesis that LPRR does not involve Granger causality of UNEMPR cannot be rejected at the 5% level of significance, and the hypothesis that UNEMPR does not involve Granger causality of LPRR cannot be rejected at the 5% level of significance. Again, the hypothesis that LEXCHR does not involve Granger causality of UNEMPR can be rejected at the 5% level of significance, and the hypothesis that UNEMPR does not involve Granger causality of LEXCHR cannot be rejected at the 5% level of significance. Thus, unidirectional causality runs from LEXCHR to UNEMPR at the 5% level of significance. More so, the result further displays that the hypothesis of LORF does not involve Granger causality of UNEMPR can be rejected at the 5% level of significance, and the hypothesis that UNEMPR does not involve Granger causality of LORF cannot be rejected at the 5% level of significance. Thus, unidirectional causality runs from LORF to UNEMPR at the 5% level of significance. This result agrees with the finding by Okeke, I. C., (2021) which focused on impact of international remittances on unemployment in Nigeria and found that there exists a unidirectional causality between international migrant remittances and unemployment without feedback.

4. Optimal Lags selection for Model-II

Though, in this study, the VAR model has three independent variables – personal remittances received (PRR), an exchange rate (EXCHR) and outward remittances flows (ORF). The decision of the choice of the model is based on the result of least value with Asterisk which is reported by Akaike Information Criteria. The results of the optimal lag period of the model are chosen to be 1 and it is presented in Table 6 below.

Table 6: Optimal Lag Selection Results

Lag	AIC	SC	HQ
0	8.257662	8.424840	8.318539
1	1.122793*	1.98681*	1.427177*
2	1.736505	3.241105	2.284397
3	2.159101	4.332412	2.950502

Source: Author's Compilation with E-view 10.

The above optimal lag selection result indicating using 1 lag as suggested by Akaike Info Criteria, hence 1 Lag will be used for all the analysis.

4.1 Unit Root Test for Model II

This section performs the unit root test of Augmented Dickey-Fuller test on the study variables (i.e. GDPpcgr, PRR, EXCHR, ORF) in this model at their level and their first differences. It means that if the series is stationary at the level, the series is said to be integrated of order zero I(0). Variables are said to be 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 7.

Table 7: Augmented Dickey-Fuller Test Results with optimal 1 lag

Series	ADF Level	5% Critical Level	Order of Integration	P-Value
GDPpcgr	-0.231201	-2.931404	I(0)	0.9264
D(GDPpcgr)	-6.575312	-2.933158	I(1)	0.0000
LPRR	-1.368231	-2.931404	I(0)	0.5889
D(LPRR)	-6.398151	-2.933158	I(1)	0.0000
LEXCHR	-0.077548	-2.931404	I(0)	0.9454
D(LEXCHR)	-7.102345	-2.933158	I(1)	0.0000
LORF	-1.737239	-2.931404	I(0)	0.4058
D(LORF)	-6.329997	-2.933158	I(1)	0.0000

Source: Author's Compilation with E-view 10.

The result of Augmented Dickey-Fuller unit root test above reports that when each of the variables is tested at level I(0) they are not stationary, but when they are each tested at first Differencing I(1) they become stationary at 5% critical level. Hence, that makes it necessary to apply the co-integration test for their long-run relationship.

4.2 Co-integration Test for Model II

In this section, the Johansen Co-integration test is employed to test for the presence of a long-run relationship between study variables. It can be recalled that the result of the unit root test reports that the series possess the same order of integration that requires the application of the co-integration test. Table 8a and 8b display the results respectively.

Table 8a: Co-integration Test Results for model II with Optimal Lag 1

Unrestricted Co-integration Rank Test (trace)			
Hypothesized Trace 0.05			
No. of CE(s) Eigenvalue Statistic critical value Prob. **			
None	0.299800	26.77258	47.85613	0.8627
At most 1	0.168912	11.80424	29.79707	0.9384
At most 2	0.086812	4.033406	15.49471	0.9008
At most 3	0.005207	0.219250	3.841466	0.6396

Trace test indicates no co-integrating eqn(s) at the 0.05% level.

Table 8b: Co-integration Test Results for model II with Optimal Lag 1

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)			
Hypothesized Max-Eigen 0.05			
No. of CE(s) Eigenvalue Statistic critical value Prob. **			
None	0.299800	14.96835	27.58434	0.7507
At most 1	0.168912	7.770829	21.13162	0.9172
At most 2	0.086812	3.814156	14.26460	0.8784
At most 3	0.005207	0.219250	3.841466	0.6396

Note: Max-eigenvalue test indicates no co-integrating eqn(s) at the 0.05% level
Source: Author's Compilation with E-view 10 software

The estimated results in Table 8a and Table 8b above represent the Johansen Co-integration test. Johansen co-integration test is conducted to verify whether there is a long-run relationship among the variables under study. But with the evidence from the Trace test and Max-eigenvalue indicate there is no co-integrating equation. In both estimated results of Trace statistic and Max-Eigen statistic; it is revealed that long-run relationship does not exist among the variables under study at 5% critical level of significance. That is, there is no existent long-run relationship amongst GDPpcgr, PRR, EXCHR, and ORF in the model. In confirming the presence of no co-integrating relationship among the study variables, the next step is to apply the VAR approach to model the joint dynamics and causal relations among the predictor variables (i.e, PRR, EXCHR, ORF) and their lagged period influence on the criterion variable (GDPpcgr).

4.3 Vector Autoregressive (VAR) Estimate

The VAR estimate is used here to explain and forecast the dynamic behaviour of multivariate time-series data. Its structure is that each variable is a linear function of past lags of the other variables, the results are reported in Table 9 below. Hence the linear equation can be specified as follows;

$GDPpcgr_t = \sigma + \sum_{i=1}^{k} \beta_1 GDPpcgr_{t-1} + \sum_{j=1}^{k} \phi j LPRR_{t-j} + \sum_{m=1}^{k} \varphi m\ LEXCHR_{t-m} + \varphi n\ LORF_{t-n} + \mu_{1t}$
…………………………. (7,1)

$LPRR_t = \sigma + \sum_{i=1}^{k} \beta_1 GDPpcgr_{t-i} + \sum_{j=1}^{k} \phi j\ LPRR_{t-j} + \sum_{m=1}^{k} \varphi m\ LEXCHR_{t-m} + \sum_{n=1}^{k} \varphi n\ LORF_{t-n} +$
μ_{2t} …………………………. (7,2)

$LEXCHR_t = \sigma + \sum_{i=1}^{k} \beta_1 GDPpcgr_{t-1} + \sum_{j=1}^{k} \phi j\ LPRR_{t-j} + \sum_{j=1}^{k} \phi m\ LEXCHR_{t-j} + \sum_{n=1}^{k} \varphi n\ LORF_{t-n} +$
$+ \mu_{3t}$ ………………………… (7,3)

$LORF_t = \sigma + \sum_{i=1}^{k} \beta_1 GDPpcgr_{t-1} + \sum_{j=1}^{k} \phi j\ LPRR_t + \sum_{m=1}^{k} \varphi m\ EXCHR_{t-m} + \sum_{n=1}^{k} \varphi n\ LGORF_{t-n} +$
μ_{4t} ………………………...…… (7,4)

Where:
σ = Intercept;
k = the lag length;
β, ϕ, φ = short-run dynamic coefficients of the model;
t = 1…., q. = each period of time;
$y_{i,t,}$ = observation at time $\dot{t}$ of the $\grave{\iota}$ th variable.
μ_t = Residual (white noise) in the equation.

Table 9: Vector Autoregressive (VAR) Technique Results

Variables	Coefficient	Std. Error	t-Statistic	Prob.
D(GDPpcgr(-1))	0.840558	0.179156	4.691761	0.0000
D(LPRR(-1))	0.168550	0.386697	0.435870	0.6654
D(LEXCHR(-1))	-1.160711	0.998066	-1.162959	0.2521
D(LORF(-1))	0.179675	0.172524	1.041454	0.3042
C	4.617110	3.680536	1.254467	0.2173

Source: Author's Computation with E-view 10 Software.

From the results of VAR(1) estimate presented above; it is demonstrated that the absolute value of the coefficient of the past quarter of Gross Domestic Product per capita growth (GDPpcgr) is associated with a significant increase of 84.05 % in GDPpcgr on average. The result further depicts that the past quarter of Personal Remittances Received (PRR) shows an increase in the GDPpcgr by 16.85% on average. Furthermore, the past quarter of the estimated result of the exchange rate (EXCHR) shows that GDPpcgr is decreased by 1.16% on average. Finally, the result further displays that the past quarter of outward remittances flows (ORF) multiplies the GDPpcgr by 17.96% ceteris paribus.

4.4 Variance Decomposition Forecast
This section checks if there is any significant impact from shocks, variance decomposition analysis is applied to each study variable for short-term and long-term periods. A four-period horizon is considered. Table 10a, 10b; 10c and 10d respectively give the variance decomposition for gross domestic product per capita growth (GDPpcgr); personal

remittance received (PRR); exchange rate (EXCHR) and outward remittances flows (ORF).

Table 10a: Variance Decomposition of GDPpcgr

Period	S.E	GDPpcgr	LPRR	LEXCHR	LORF
1	0.939596	100.0000	0.000000	0.000000	0.000000
2	1.274123	99.52038	0.006385	0.008431	0.464802
3	1.503165	98.64815	0.036733	0.035194	1.279926
4	1.677493	97.57374	0.106968	0.090562	2.228730

Table 10b: Variance Decomposition of LPRR

Period	S.E	GDPpcgr	LPRR	LEXCHR	LORF
1	0.331760	51.01441	48.98559	0.000000	0.000000
2	0.452303	51.04292	47.50906	0.157325	1.290699
3	0.536616	50.97923	44.93639	0.481031	3.603347
4	0.602010	50.92991	41.80322	0.915219	6.351651

Table 10c: Variance Decomposition of LEXCHR

Period	S.E	GDPpcgr	LPRR	LEXCHR	LORF
1	0.060117	15.01174	37.71944	47.26882	0.000000
2	0.083754	13.59872	32.83328	53.35639	0.211605
3	0.101353	12.25289	28.14734	59.04339	0.5556388
4	0.115934	11.00643	23.89582	64.17842	0.919337

Table 10d: Variance Decomposition of LORF

Period	S.E	GDPpcgr	LPRR	LEXCHR	LORF
1	0.525167	0.006226	0.469149	14.77867	84.74595
2	0.684264	0.065796	2.388845	16.13281	81.41255
3	0.779556	0.210062	5.321824	17.05873	77.40938
4	0.844523	0.398072	8.916369	17.55943	73.12613

Source: Author's Computation with E-view 10 Software

Table 10a reports that in the first quarter of GDPpcgr, 100 % of forecast error variance in gross domestic product per capita growth is explained by the variable itself indicating that personal remittances received (PRR), an exchange rate (EXCHR), outward remittances flow (ORF) in the model have no strong exogenous impact; they do not have any influence on gross domestic product per capita growth (GDPpcgr) in the short-term. While, in the long-term, that is a period of quarter 4; forecast error variance in gross domestic product per capita growth produces about 97.57% (that is own shock); whereas, PRR, EXCHR and ORF have weak influence on GDPpcgr. Hence, Gross domestic product per capita growth shows strong influence from the short-run period into the future.

Table 10b displays that in the first quarter of personal remittance received (PRR); 48.98% of forecast error variance in personal remittance received (PRR) is explicated by the variable itself. Suggesting that a combined influence of exchange rate (EXCHR) and outward remittances flows (ORF) is zero. This exhibits that the two variables have a very weak influence on predicting personal remittances received in the short-term, except

gross domestic product per capita growth which has a strong influence on predicting the personal remittances received. In the long-term, 41.80 % of forecast error variance in personal remittances received is defined by personal remittances received itself. This indicates that personal remittances received shows a strong influence from the short-run period into the future. The influence of exchange rate and outward remittances flows on personal remittances received is very insignificant, however, gross domestic product per capita growth exhibits a very strong influence on predicting personal remittances received in the long-term of four quarters.

More so, Table 10c reports that in the first quarter of EXCHR; 47.26% of forecast error variance in the exchange rate is predicted by the variable itself. However, gross domestic product per capita growth, personal remittances received and outward remittances flows display weak influence on predicting exchange rate in the short-term period respectively. Similarly, 64.17% forecast error variance in the exchange rate is predicted by the exchange rate itself in the long-term. Whereas, the results further report that gross domestic product per capita growth, personal remittances received and outward remittances flows have a weak influence on predicting exchange rate in the future.

Furthermore, Table 10d indicates that in the first quarter of ORF; 84.74% of forecast error variance in outward remittances flows is predicted by the variable itself. Whilst, gross domestic product per capita growth, personal remittances received and exchange rate have weak influence in explaining outward remittances flows in the short-term. The result further reveals that in the long-term 73.12% of forecast error variance in outward remittances flows is predicted by outward remittances flows themselves. Whereas, gross domestic product per capita growth, personal remittances received and exchange rate have a similar weak influence on predicting outward remittances flows in the future.

4.5 Impulse Response Functions

This section describes the evolution of the predictor variables - personal remittances received (PRR), the exchange rate (EXCHR) and outward remittances flows (ORF) in reaction to a shock in the criterion variable - gross domestic product per capita growth (GDPpcgr). The charts below provide the results of their responses in 4 quarters horizon.

The estimated result presented in Figure 1 below shows that a one standard deviation shock to Personal Remittances Received (PRR) causes a significant increase in macroeconomic stability as measured by GDPpcgr for 1, 2, 3, and 4 quarters respectively after which the effect peaks in all through the whole quarters as the Personal Remittances Received (PRR) remains positively stable above the zero line. Conversely, the result of the response of exchange rate (EXCHR) report shows that a one standard deviation shock to exchange rate (EXCHR) causes a maximum long-lasting and decreasing impact on macroeconomic stability as measured by GDPpcgr for quarters I,2,3, and 4 respectively after which the effect remains negatively below the zero line for a long period. More so, the estimated result of the response of outward remittances flows (ORF) displays that a one standard deviation shock to outwards remittances flow (ORF) produces a minimal

effect on GDPpcgr as the line lies flat on the zero line in-between quarter 1 and quarter 2 afterwards it starts rising in quarter 2 and remains high above the zero line for quarters 3 and 4 respectively.

Figure 1: Impulse Response Functions of LPRR, LEXCHR and LORF to GDPpcgr

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

Response of PRR to GDPPCGR

Response of LOG(EXCHR) to GDPPCGR

Response of LOG(ORF) to GDPPCGR
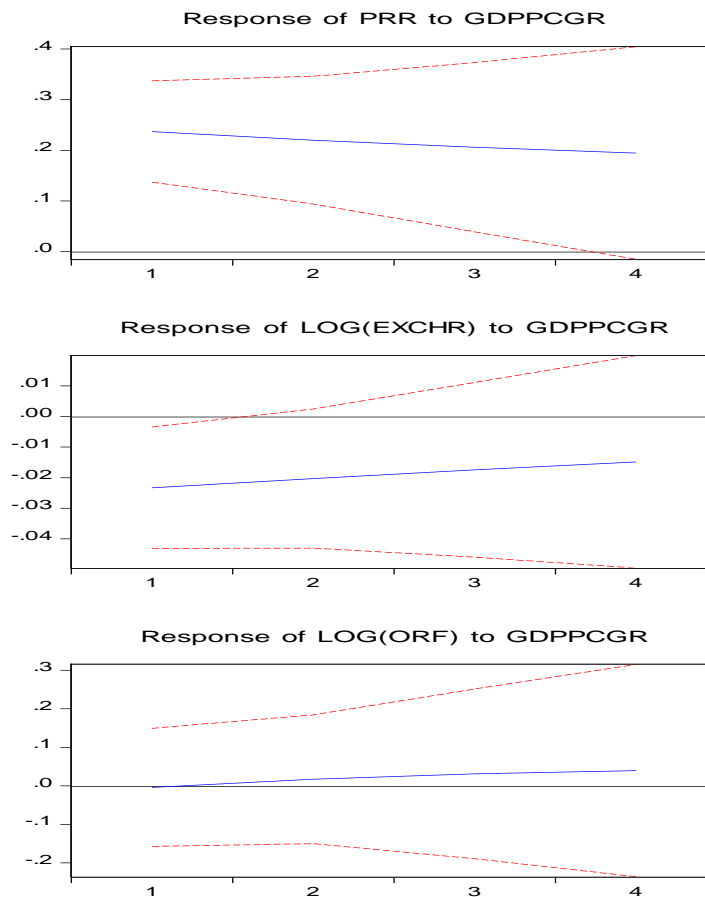
5. Concluding Remark

Remittance flows into low-income and fragile states represent a lifeline that supports households as well as provides much-needed tax revenue. As of 2018, remittance flows to these countries reached $350 billion, surpassing foreign direct investment, portfolio investment, and foreign aid as the single most important source of income from abroad (IMF - IMF - Sayeh & Ralp Chami; 2021). Drawing from this experience, the study is sought to examine the dynamic modelling of the influence of diaspora cash remittance on macroeconomic stability in Nigeria from 2010Q1 to 2020Q4. Obtaining data from Word Bank and World Development Indicators (WDI) for analysing this dynamic influence variables understudy have on each other. In the course of the investigation, it was revealed from the findings of the error correction model (ECM) of Engle-Granger two-step techniques that the last quarter's deviation from a long-run equilibrium influences its short-run dynamics. That is the speed at which the unemployment rate returns to equilibrium after innovation in personal remittances received, exchange rate

and outward remittances flow was about 29.84%. More so, the result further revealed that personal remittances received and exchange rate insignificantly and significantly accelerated the unemployment rate. Whereas, outwards remittance flow decreased the unemployment rate. The positive influence personal remittances received and the exchange rate had on the unemployment rate could be as a result that when this remittance sent home from abroad was not used for the purpose it was sent for. The household that received this remittance didn't make use of it properly – it is possible the household could use it to invest in Ponzi schemes and other activities that have no economic value. The rise in the exchange rate from the result could be that when changes in the currency exchange rate occur affect unemployment, as a result of currency appreciation, which makes imports cheaper, and exports become less competitive, hence the domestic demand falls. Thus, infant industries reduce costs and cut jobs, causing unemployment to rise. Furthermore, LPRR does not involve Granger causality of UNEMPR and UNEMPR does not involve Granger causality of LPRR. Thus, unidirectional causality runs from LEXCHR to UNEMPR and unidirectional causality runs from LORF to UNEMPR at the 5% level of significance. The results of the vector regressive (VAR) estimate demonstrated that the past quarter of Gross Domestic Product per capita growth (GDPpcgr) had a self-significant increase of 0.84% in the future. The result further depicted that the past quarter of Personal Remittances Received (PRR) increased the GDPpcgr. Furthermore, the past quarter of exchange rate (EXCHR) decreased GDPpcgr. While the past quarter of outward remittances flows (ORF) multiplied the GDPpcgr ceteris paribus. The results of variance decomposition forecast revealed that the 100 % of forecast error variance in gross domestic product per capita growth is explained by the variable itself indicating that personal remittances received (PRR), an exchange rate (EXCHR), outward remittances flows (ORF) in the model had no strong exogenous impact on gross domestic product per capita growth (GDPpcgr) in the short-term. While, in the long-term forecast error variance in gross domestic product per capita growth produced about 97.57%, whereas, PRR, EXCHR and ORF had a weak influence on GDPpcgr. Hence, Gross domestic product per capita growth showed a strong influence from the short-run period into the future. On the basis of these findings, the study concluded that it is imperative that policy makers should design more policy measures that will encourage, boost and facilitate an efficient inflow of remittances to the country.

Conflict of Interest Statement
The author solely decided to carry out this study to examine how remittance from Nigerians abroad improves and stabilizes the economy. Hence, it is stated equivocally that I didn't receive any funding from anybody, group; organization or government(s). On the basis of this position, there was no influence on the study design, techniques, and sources of data collection and analysis.

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