# EXAMINING INFLATION, EXCHANGE RATE AND REMITTANCE INFLOW NEXUS IN NIGERIA

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## ABSTRACT

*This study empirically investigates the inflation, exchange rate and remittance inflow nexus in Nigeria. Using data from 1980 to 2022, it employs the vector error correction model (VECM) to estimate the relationship among the variables of interest and granger causality to test their direction of causality. The VECM result shows that there is a statistically significant negative relationship between exchange rate and remittance inflow in Nigeria. This implies that a depreciation of naira will reduce remittance inflow into the country and vice versa. The result also shows a negative, though not statistically significant, relationship between inflation and remittance. Hence, it cannot be concluded that inflation impacts remittance inflow in Nigeria. Also, the result reveals that financial sector and economic growth somehow impacts remittance inflow into Nigeria. The Granger causality test result reveals a bi-directional causality between exchange rate and remittance inflow but none between inflation and remittances. From these, the study recommends that policymakers should design policies that enhances exchange rate appreciation as well as stimulates financial sector development and economic growth so as to increase remittance inflow into the country.*

## 1.0 INTRODUCTION

Foreign remittances are one of the drivers of economic development in developing countries. Nigeria, as a developing country, has benefited a large inflow of remittances and foreign direct investments (Mbutor, 2010). Remittance inflow into Nigeria in 2022 totalled US$20.1 billion, accounting for about 4% of the economy's GDP (de Best, 2023). Remittances enormously impact the macroeconomic condition of most economies, especially the developing economies. It promotes macroeconomic stability by mitigating the impact of current account reversal in the event of diminishing inflow and helps to boost investors' confidence during international crises that could result in a fall in the national reserves (Jha et al., 2010; Mbutor, 2010). Aside from their impact on macroeconomic stability, remittances also stimulate aggregate demand for goods and services in the recipient country (Elahi and Rahman, 2021).

Existing empirical literature posits that high remittance inflow into a country reduces poverty, increases growth rate and improves social indicators in some countries (Lopez et al., 2007; Acosta et al., 2009). However, these impacts are largely influenced by the magnitude of the remittance inflow relative to the size of the receiving country. While there is the possibility of remittance inflow improving the economic growth and development of developing economies like Nigeria, the magnitude of the inflow can be so large that it negatively impacts the macroeconomic stability of the receiving country and results in Dutch Disease (Adejumo and Ikhide, 2019; Lopez et al., 2007).

The magnitude and stability of remittance inflow into a country can be influenced by different macroeconomic variables, including exchange rate and inflation. Exchange rate volatility is a common trend in developing countries, especially those operating flexible or managed floating exchange rate regime. Recently, there is a persistent trend of exchange rate appreciation in developing countries compared to the developed (Adejumo and Ikhide, 2019). The impact of exchange rate on remittance inflow is mainly determined by the purpose of the remittance, and the nature of the exchange rate system in the recipient country (Olubiyi and Kehinde, 2015). If

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the purpose of the remittance is investment, and changes in exchange rate are anticipated, then exchange rate depreciation will negatively impact remittance inflow by reducing inflow. However, if variations in exchange rate are unanticipated, then exchange rate depreciation will improve inflow of remittance into the country (Golberg, 2008). Also, the effect of exchange rate on remittance is highly influenced by the nature of the remittance. According to Olubiyi and Kehinde (2015), if remittance inflow is altruistic in nature, and based on selfless deeds, a depreciation of the exchange rate causes a reduction in remittance inflow while an appreciation leads to an increase in remittance inflow. Hence, the impact of exchange rate on remittance inflow in a country is inconclusive.

The relationship between remittance inflow and exchange rate is not unilateral. Although exchange rate is a key determinant of remittance inflow into a country, remittance inflow also influences exchange rate movement in the recipient country. Hypothetically, increase in remittance inflow will increase the supply of dollar in the foreign exchange market, leading to the appreciation of the recipient country's currency. However, this hypothesis seems invalid in the case of the Nigerian economy. Despite being the largest receiver of remittances in West Africa, the country's exchange rate has faced a depreciating trend in recent times (The World Bank, 2023, Olubiyi and Kehinde, 2015).

Remittance inflow also influences price level in the recipient country both directly and indirectly. It stimulates aggregate demand by enhancing the purchasing power of households and firms, increasing household consumption and investment level in the economy (Elahi and Rahman, 2021; Ball et al., 2013). Also, it influences inflation in the economy through exchange rate channel (Adejumo and Ikhide, 2019) and precipitates an appreciation of exchange rate thus generating spending effect. An appreciation of the exchange rate causes foreign goods to be cheaper relative to domestic goods, increasing the demand for imported goods. It is therefore expected that an increase in demand for these foreign goods will increase their prices.

The exchange rate regime prevalent in an economy can also influence the effect of remittance on the economy's inflation rate. According to Ball et al., (2013) hypothesis, under a fixed exchange rate regime, increased remittances precipitates higher inflation, while under a flexible exchange rate regime, an increase in remittance inflow reduces the economy's inflation rate. Also, remittance inflow affects inflation through money supply by raising the recipient country's central bank reserve which if not properly controlled, could increase the inflation level. (Rahman and Dilanchiev, 2021).

While empirical studies have mainly investigated the impact of remittance on inflation in the recipient country, there is also the possibility of inflation impacting remittance inflow. As in the case with exchange rate, the impact of inflation on remittance inflow will be largely influenced by the purpose of the remittance. If the purpose of remittance is investment, then an increase in inflation could precipitate a decrease in investment as returns on investment may be eroded by inflation. This will ultimately reduce the inflow of remittance into the country. Thus, whether for consumption or investment purposes, inflation reduces the inflow of remittance into a country as it reduces the purchasing power of money.

The interconnectedness of inflation, exchange rates, remittances and their macroeconomic importance has made them a significant subject of empirical investigation by academics and policymakers. In Nigeria, there has been an increasing trend in remittance inflow since 1993 (although with a few inconsistencies), with an enormous total of US$ 20.1 billion in 2022 which is the highest in West Africa (The World Bank, 2023). Nigeria is among the top ten (10) remittance-receiving countries globally and top four (4) in Africa. Aside proceeds from crude oil, remittance inflow to Nigeria is the second-largest source of foreign receipt, surpassing foreign direct investment and portfolio investment flow (The World Bank, 2018; Olubiyi and Kehinde, 2015). In

spite of these, there has not been a commensurate level of economic growth and development in the economy. Also, there has been a consistent rise in price level since 2018 with over a 100% increase in inflation rate from about 11.4% in 2018 to 26% in August 2023 (CBN Statistics, 2023) while exchange rate has not fared better within the same period.

Against this backdrop, this study examines the inflation, exchange rate and remittance inflow nexus in Nigeria. Specifically, the study investigates the impact of both exchange rate and inflation on remittance inflow, and the corresponding effect of remittance on exchange rate and inflation in Nigeria. Although, researchers have investigated the impact of remittance inflow on inflation and also on exchange rate (Ozigwe and Obi, 2016; Adejumo and Ikhide, 2019; Yussuff, 2018), from the literature reviewed so far, none has empirically examined the combine impact of these variables on remittance inflow in Nigeria. This allows the study to investigate the interconnectedness between remittance inflow, exchange rate and inflation in Nigeria, and the existing channels of relationship. Also, it contributes to the existing body of literature by investigating the causal relationship among these variables in Nigeria.

Following Section one above, Section two provides the stylised facts and empirical review while Section three presents the theoretical framework and methodology. Section four offers the empirical result with conclusion and recommendations of the study in Section five.

## 2.0    LITERATURE REVIEW
### 2.1    Stylized Facts on Inflation, Exchange Rate and Remittance Inflow to Nigeria

For more than three decades, there has been a consistent increase in the emigration of Nigerians to other countries of the world. As a result of this, Nigeria has been experiencing an increase in remittance inflow over the years. In the 1980s, remittance inflow to Nigeria was less than US$100 million but increased significantly to about US$250 million in the early 1990s. However, remittance inflow in 2000 rose to US$1.4 billion while in 2010 it stood at US$19.7 billion. In 2018, the figure reached an all-time high of US$24.3 billion after which it declined significantly due to COVID-19 global epidemic. In 2022, remittance inflow to Nigeria stood at US$20.1 billion (WDI, 2023). The low remittance inflow in the 1980s and early 1990s can be attributed to low rate of emigration and the underdevelopment of Nigeria's financial sector at the time. The period 2000 was characterized by financial development, liberalization, and integrations, as well as improved means of recording financial transactions and a higher rate of emigration. Hence, a marked increase in remittance inflow was witnessed in the period and beyond (Olubiyi and Kehinde, 2015). Figure 2.1 shows the trend analysis of remittance inflow to Nigeria between 1980and 2022.

Figure 2.1: Trend analysis of remittance inflow to Nigeria (1980 – 2022)

Remittances (in million dollars)
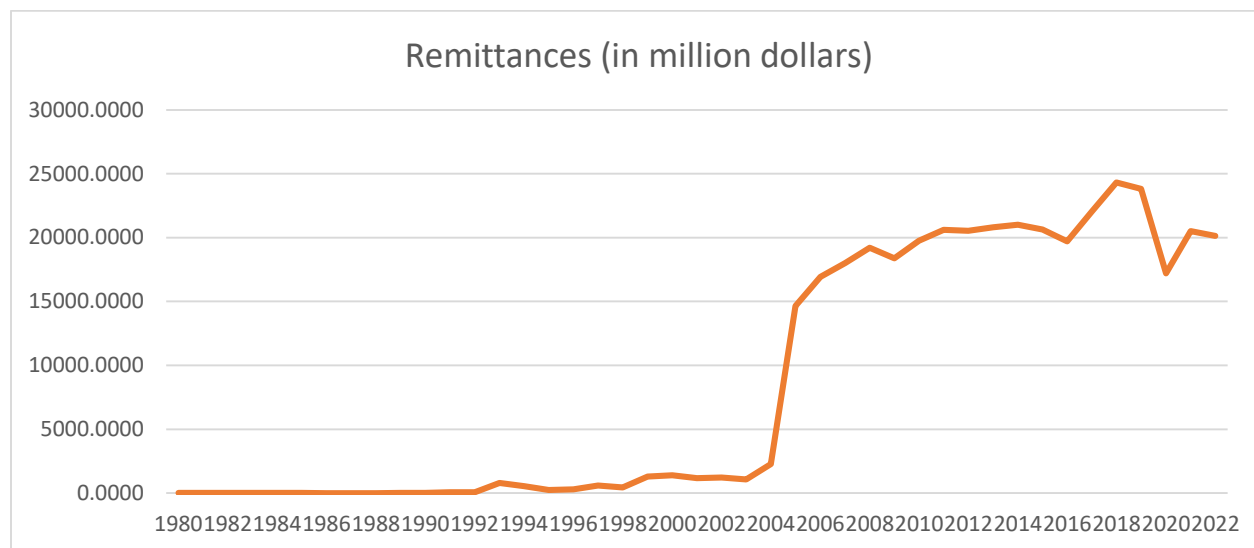
Source: Author's computation using data from World Development Indicator

The real effective exchange rate (REER) in Nigeria is characterized by an averagely stable trend as shown in Figure 2.2. In 1984, the REER was as high as 537, after which it steadily depreciated until 1994 when it started appreciating again. REER continued to appreciate gradually to 273 in 1998 after which it again depreciated steadily until 2011. Since 2012 till 2022, the average REER remains at 117 (WDI, 2023). The fall in REER in the late 1980s can be associated with the devaluation policy by the Central Bank of Nigeria (CBN) as a correction to the 1970s balance of payment crisis which was argued to have been caused by exchange rate misalignment (Olubiyi and Kehinde, 2015). However, the depreciation in 1999 and beyond could be associated with large import expenditures and increasing inflation in Nigeria.

Price stability has remained a fundamental challenge of the Nigerian economy. The 1980s to 1990s was a period of high inflationary pressure and inconsistencies in Nigeria. As shown in Figure 2.2, inflation rate doubled from 10% in 1980 to 21% in 1981, after which it went down to 8% in 1982 and then jumped to 23% in 1983. This was a result of crashing oil prices and mounting external debt that led to hyperinflation which reached its peak in 1995 at an all-time high rate of 75%. Also, this chronic inflation was largely affected by the implementation of the structural adjustment program as counselled by the International Monetary Fund (IMF). In the early 2000, several policy measures were developed by the government to stabilize inflation and reduce price volatility in Nigeria. However, the global financial crisis of 2008 also had an inflationary effect on the economy, creating a period of high inflation and increased price volatility (Ekpeyong, 2023). Another episode of high inflation in Nigeria was the recession period of 2016 and 2017. The post-recession era was characterized by the government making efforts to stabilize prices and reduce inflation. However, the global economic environment in addition to fluctuating oil prices hindered the achievement of price stability and low inflation in the country. As at 2022, Nigeria's inflation rate stood at 19% (WDI, 2023 and CBN, 2023).

Figure 2.2: Inflation and Real Effective Exchange Rate trend in Nigeria (1980 – 2022)

Inflation and Real Effective Exchange Rate in Nigeria
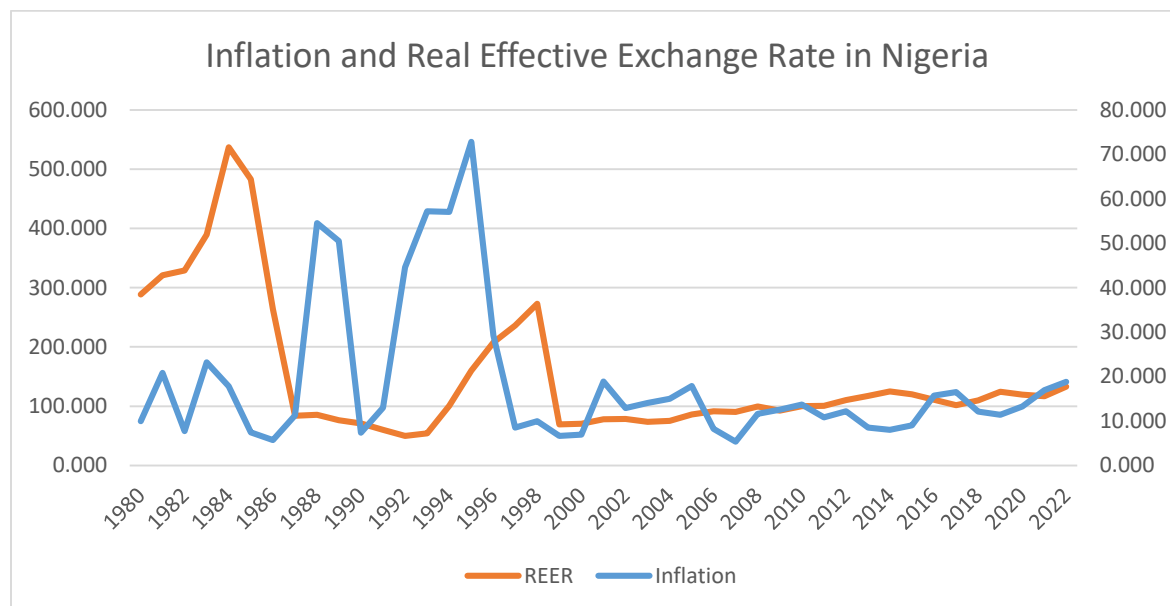
Source: Author's computation using data from World Development Indicator and CBN


## 2.2     EMPIRICAL REVIEW

Remittances have been found to significantly influence the economies of many recipient countries (Chami et al, 2008) which has resulted in several empirical studies investigating its impact on both macroeconomic and microeconomic variables in different countries.

Urama et al (2017) used the ARDL and bound testing methodology to investigate how the huge remittance inflow between 1978 and 2017 has enhanced Dutch disease in Nigeria. The result of the study shows that remittance inflow significantly affects real exchange rate of Nigeria. Specifically, a 1% increase in remittances leads to a 0.44 percent increase in real exchange rate. The appreciation of the currency increases imports and discourages export, leading to Dutch disease. Osigwe and Obi (2016) examined how remittance inflow influence exchange rate movements. Using cointegration analysis and the parsimonious error correction model, the result shows that there exists a negative long run relationship between exchange rate and remittances which also significantly affect real exchange rate in the country.

Investigating the reverse relationship, Olubiyi and Kehinde (2015) examined the impact of exchange rate on remittance inflow in Nigeria. Adopting the generalised methods of moment to analyse the cumulative remittance inflow to Nigeria between 1980 and 2013, the study found that real exchange rate has a negative impact on remittance inflow. Ultimately, the study concluded that altruism is the major driver of remittance inflow in Nigeria. Obi et al (2015) examined the causal relationship between remittances, exchange rate and money supply in Nigeria. Employing the Johansen cointegration and granger causality tests, the result shows that a cointegrating relationship exists among the variables, and also, that there exist a unidirectional causality from exchange rate and money supply to remittances in Nigeria.

Mbutor (2010) analyzed the role of monetary policy in enhancing remittance inflow to Nigeria. Adopting the Vector Autoregressive (VAR) model with two stage deductions, the study found that monetary policy indirectly impacts remittance inflow through intervening variables like exchange

rate, interest rate and inflation. The study also found that economic performance enhances the influx of remittance into the country and that exchange rate depreciation impedes remittance inflow into Nigeria. Also, Ayunku and Dickson (2021) examined how remittances, inflation and exchange rate impacts economic performance in Nigeria. Result from the granger causality test and the multivariate regression analysis revealed that remittances and exchange rate have a bidirectional causality with economic growth, and that all the variables significantly impact economic growth with only inflation having a negative impact.

Related studies in Ghana by Adenutsi and Ahortor (2008) explored the monetary factors that influences the inflow of remittances into the country and how remittances influence other monetary variables in the economy. Using VAR model to analyse quarterly data between 1983 and 2005, the result showed that money supply, exchange rate and interest rate have a positive impact on remittance inflow in the country while inflation has negative impact. Mumuni and Quaidoo (2015) investigated how the inflow of remittance affects price level in Ghana. The bounds test result shows that remittance inflow has no impact on inflation in the short-run. However, in the long-run, remittance inflow significantly impacts inflation in the economy. Another study in Ghana by Mawutor et al (2023) empirically investigated the impact of FDI, remittances and import on economic growth. The Autoregressive Distributed Lag result validates the significant impact of remittance on the economic growth of Ghana. Tuuli (2015) adopted the error correction model to investigate the impact of remittance on Ghana's real exchange rate. The study result showed that increase in the level of remittance inflow led to an appreciation of the Ghanaian exchange rate. However, Nketiah et al., (2019) adopted the OLS estimation method to empirically investigate the impact of remittances on Ghana's real exchange rate and economic performance. The study result revealed that remittance have no significant impact on Ghana's real exchange rate.

Globally, empirical studies have considered the relationship between remittance and other economic variables. Adenutsi (2014) investigated the variables and factors influencing the inflow of remittance in 36 sub-Saharan African (SSA) countries between 1980 and 2009. The study's result showed that, when certain variables are controlled for; the level of financial development, real exchange rate and level of investment in a country influences remittance inflow in SSA countries. El Saka and McNaab (1999) considered the varying effect of official and unofficial remittances on real exchange rate under the fixed and floating exchange rate regimes in Egypt. Using the ordinary least square estimation technique, the result showed that under the managed floating regime, exchange rate has a high significant impact on official remittances but when the exchange rate is fixed, it has a low significant effect on the inflow of official remittance into the country. In contrast, unofficial remittances are highly and significantly influenced by exchange rate under the fixed exchange rate regime. Barajas et al., (2010) examined how workers' remittances influence the equilibrium real exchange rate in recipient economies. The result showed that, contrary to findings of deepening Dutch disease or exchange rate appreciation, increase in remittance can actually lead to a depreciation of the equilibrium exchange rate and overturn the Dutch disease effect in the country. This depends on factors such as; the degree of trade openness in the economy, the rate of factor mobility among the sectors of the economy, sensitivity of the risk premium and percentage of consumption in tradable.

From the reviewed literature, especially those on Nigeria, most studies examined the effect of remittances on either exchange rate or inflation. However, the reverse relationship of the impact of inflation and exchange rate on remittance inflow in Nigeria has not gained much empirical attention. In the light of this, this study examines the inflation, exchange rate and remittances

nexus in Nigeria. Since remittance inflow is from various countries, this study adopts the real effective exchange rate as it captures the exchange rate across the basket of goods traded.

## 3.0 THEORETICAL FRAMEWORK AND METHODOLOGY

### 3.1 Theoretical Framework

The theoretical framework adopted for this study is the Lucas and Stark (1985) motivations of remittance. Lucas and Stark (1985) developed three models for remittances viz: Pure Altruism, Pure Self-Interest and Tempered Altruism or Enlightened Self-Interest.

In the pure altruism model, the migrant sending the remittance home derives utility from the utility of the household members at home while the household utility is dependent on its per capita income. In the model, the migrant's utility is derived to be a function of his wage, his consumption, the weight of altruism attached to individual household members, household consumption per capita and the size of the household. The household consumption per capita is a function of household per capita income and household size. The model then derived the level of remittance r that maximizes the migrant's utility function and the household's consumption function. The equation is given as:

$$r = r(w, y, n)$$

Where r is the remittance, w is the wages of the migrant, y is household per capita income and n is the size of the household. The model posited that $\frac{\delta r}{\delta w} > 0, \frac{\delta r}{\delta y} < 0 \ and \ \frac{\delta r}{\delta n}$ is unrestricted depending on the economies and diseconomies of scale.

In the pure self-interest model, the migrants' motive for sending remittance home is purely selfish. The study highlighted three motivations in this model which are:

1. The aspiration to inherit.
2. Motivation to invest in assets back at home and ensure the assets are properly managed.
3. The intention of returning home.

The third model – tempered altruism or enlightened self-interest – is a fusion of the first two. Here, remittance is seen as an intertemporal, mutually contractual agreement between a migrant and his household at home. This agreement is influenced by two factors: investment and risk. This stems from the cost of education of the migrant, which is largely borne by the household. Studies like Rempell and Lobdell (1978) and Johnson and Whitelaw (1974) have found a positive relationship between the migrant's level of education and the amount of remittance sent home. This is the investment factor. The risk factor is captured in the motivation for remittance being for the purpose of risk diversification. In a developing economy characterised by inefficient capital market and insurance, migration is seen as a risk diversification strategy. For risk diversification, the household may choose to sponsor some of its members for urban migration, in which both parties bear the cost and benefit from the returns.

### 3.2 Methodology

This study adopts the Vector Error Correction Model (VECM) Model to investigate the relationship between inflation, exchange rate and remittance inflow in Nigeria. The VECM is a restricted version of the VAR model which captures the linear interdependencies among multiple time series variables by adopting the error correction feature.  It is an n-equation, n-variable linear model in which each variable is in turn explained by its own lagged values, plus current and past values of

the remaining n-1 variables. This simple framework provides a systematic way to capture rich dynamics in multiple time series. The VAR matrix for this study is specified as:

$$\begin{pmatrix} REM_t \\ REER_t \\ INFLATION_t \\ LNRGDP_t \\ DIR_t \end{pmatrix} = A_o + A_1 \begin{pmatrix} REM_{t-1} \\ REER_{t-1} \\ INFLATION_{t-1} \\ LNRGDP_{t-1} \\ DIR_{t-1} \end{pmatrix} + \cdots + A_n \begin{pmatrix} REM_{t-n} \\ REER_{t-n} \\ INFLATION_{t-n} \\ LNRGDP_{t-n} \\ DIR_{t-n} \end{pmatrix} + \varepsilon_t^i$$

Where

$$A_0 = \begin{pmatrix} \propto_0 \\ \beta_0 \\ \gamma_0 \\ \theta_0 \\ \rho_0 \end{pmatrix}, A_1 = \begin{pmatrix} \alpha_1 & \alpha_2 & \dots & \propto_n \\ \beta_1 & \beta_2 & \dots & \beta_n \\ \gamma_1 & \gamma_2 & \dots & \gamma_n \\ \theta_1 & \theta_2 & \dots & \theta_n \\ \rho_1 & \rho_2 & \dots & \rho_n \end{pmatrix}, A_2 = \begin{pmatrix} \delta_1 & \delta_2 & \dots & \delta_n \\ \vartheta_1 & \vartheta_2 & \dots & \vartheta_n \\ \sigma_1 & \sigma_2 & \dots & \sigma_n \\ \mu_1 & \mu_2 & \dots & \mu_n \\ \pi_1 & \pi_2 & \dots & \pi_n \end{pmatrix}, A_3 = \begin{pmatrix} \tau_1 & \tau_2 & \dots & \tau_n \\ \varphi_1 & \varphi_2 & \dots & \varphi_n \\ \omega_1 & \omega_2 & \dots & \omega_n \\ \phi_1 & \phi_2 & \dots & \phi_n \\ У_1 & У_2 & \dots & У_n \end{pmatrix}$$

However, if the unit root test result reveals that the variables are stationary at first difference, then cointegration test will be conducted. If the variables are cointegrated, then the study will estimate a VECM with the following matrix specification:

$$\Delta y_t = \Pi y_{t-1} + \Gamma_1 \Delta y_{t-1} + \Gamma_2 \Delta y_{t-2} + \Gamma_3 \Delta y_{t-3} + \cdots + \Gamma_p \Delta y_{t-p} + \varepsilon_t$$

Where $\Pi = \alpha\beta'$ ; $y_t$ = (REM, INFLATION, REER, LNRGDP, DIR), $\Delta$ being the differencing notation;, and $\varepsilon_t$ is the white noise stochastic disturbance term. Matrices $\alpha$, $\beta$ and $\Gamma_i$ are the speed of adjustment parameters, cointegrating matrix and short-run parameters respectively.

Granger causality test is also conducted to determine the existence or otherwise of any directional causality between inflation, exchange rate and remittances in Nigeria. The following variables were adopted for the study analysis: remittance inflow {measured as a % of GDP (REM)}, consumer price index (INFLATION), real effective exchange rate (REER) while the study adopted both the logarithmic value of real gross domestic product (LNRGDP) and deposit interest rate (DIR) as control variables. Monthly time series data from 1980 to 2022 was sourced from the World Development Indicator (WDI) and the Central Bank of Nigeria (CBN) statistical bulletin. Annual time series were transformed to monthly data using the Denton Benchmarking Method.

## 4.0 EMPIRICAL ANALYSIS

### 4.1 Unit Root test

Based on Pesaran (2007), both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were performed to examine the stationarity of the variables. Table 1 shows that all the variables are stationary at first difference under both tests. Based on this, the study adopted the VAR Model for inferential analysis.

Table 1: Unit root test result

| Variables | Phillips-Perron | | | Augmented Dickey-Fuller | | |
|---|---|---|---|---|---|---|
| | Levels | 1st Difference | I(D) | Levels | 1st Difference | I(D) |
| REM | 0.5684 | 0.0000*** | I(1) | 0.4657 | 0.0000*** | I(1) |
| INFLATION | 0.0531 | 0.0000*** | I(1) | 0.1096 | 0.0406** | I(1) |
| REER | 0.2360 | 0.0011*** | I(1) | 0.2831 | 0.0009*** | I(1) |
| LNRGDP | 0.9158 | 0.0001*** | I(1) | 0.9371 | 0.0001*** | I(1) |
| DIR | 0.1319 | 0.0000*** | I(1) | 0.4755 | 0.0088*** | I(1) |

*, **, and *** represents 10%, 5% and 1% levels of significance respectively

## 4.2    Lag length Selection

To estimate the VAR, the appropriate lag length for the model was examined using the Schwarz Information Criteria (SIC). The selected Lag length was 2 as revealed in Table 2.

Table 2: Lag Length Selection Result

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| 0 | -20124.90 | NA | 7.73e+29 | 83.00988 | 83.05302 | 83.02683 |
| 1 | -12908.04 | 14255.16 | 1.02e+17 | 53.35273 | 53.61154 | 53.45442 |
| 2 | -10618.47 | 4475.275* | 8.97e+12* | 44.01431* | 44.48880* | 44.20074* |
| 3 | -10617.69 | 1.516512 | 9.91e+12 | 44.11417 | 44.80434 | 44.38534 |
| 4 | -10616.81 | 1.684888 | 1.10e+13 | 44.21363 | 45.11948 | 44.56955 |
| 5 | -10615.78 | 1.949842 | 1.21e+13 | 44.31248 | 45.43400 | 44.75313 |
| 6 | -10614.53 | 2.336261 | 1.33e+13 | 44.41043 | 45.74763 | 44.93582 |
| 7 | -10612.98 | 2.874909 | 1.47e+13 | 44.50712 | 46.06000 | 45.11725 |
| 8 | -10611.01 | 3.605323 | 1.62e+13 | 44.60209 | 46.37065 | 45.29697 |

 * indicates lag order selected by the criterion

## 4.3    Cointegration Test

After selecting the lag length, the Johansen cointegration test was conducted to test for long run relationship among the variables of interest. The cointegration tests result under Trace and Maximum Eigenvalue are as shown in Tables 3 and 4 respectively. Both Trace and Maximum Eigenvalue tests shows that there are 3 cointegrating equations in the model at 5% confidence level. This result confirms the long run relationship among the variables of interest.

| Table 3: Unrestricted Cointegration Rank Test (Trace) | | | | |
|---|---|---|---|---|
| Hypothesized | | Trace | 0.05 | |
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob.** |
| None * | 0.080725 | 105.9211 | 69.81889 | 0.0000 |
| At most 1 * | 0.055635 | 64.67787 | 47.85613 | 0.0006 |
| At most 2 * | 0.045975 | 36.62908 | 29.79707 | 0.0070 |
| At most 3 | 0.026437 | 13.56695 | 15.49471 | 0.0956 |
| At most 4 | 0.000895 | 0.438595 | 3.841466 | 0.5078 |

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level

 * denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

| Table 4: Unrestricted Cointegration Rank Test (Maximum Eigenvalue) | | | | |
|---|---|---|---|---|
| Hypothesized | | Max-Eigen | 0.05 | |
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob.** |
| None * | 0.080725 | 41.24320 | 33.87687 | 0.0055 |

**4.4**

| | | | | | |
|---|---|---|---|---|---|
| At most 1 * | 0.055635 | 28.04879 | 27.58434 | 0.0436 |
| At most 2 * | 0.045975 | 23.06213 | 21.13162 | 0.0264 |
| At most 3 | 0.026437 | 13.12836 | 14.26460 | 0.0750 |
| At most 4 | 0.000895 | 0.438595 | 3.841466 | 0.5078 |

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

**Vector Error Correction Model**

Since the variables are cointegrated, the study estimated a VECM with the result shown in Table 5. The result showed that an increase in inflation causes a decrease in remittance inflow. However, this result is not statistically significant. Exchange Rate (REER) has a negative relationship with remittance which is statistically significant at 1% confidence interval. This suggests that an increase in exchange rate (a depreciation of the exchange rate), leads to a decrease in remittance inflow. The coefficient for REER is -0.67 and this implies that a 1% increase in REER will cause a 0.67% decrease in remittance inflow. This means that when the exchange rate depreciates, the value of foreign currency relative to local currency is now higher. Hence, migrants can send lesser amount of foreign currency home to obtain the same value of domestic currency as before. Also, the depreciation of the exchange rate could signal an adverse economic condition to migrants, thereby reducing their motivation for sending remittance home for savings or investment. RGDP has a positive relationship with remittance inflow and this is statistically significant at 5% interval. With a RGDP coefficient of 1.34, it implies that when RGDP increases by 1%, remittance inflow increases by 1.34%. Although this is quite contrary to the a-priori expectation of a negative relationship. This can be supported by Lucas and Stark (1985) self-interest theory. If the motivation for sending remittance home is based on pure self-interest, especially if it is based on the intention of purchasing an asset, then an increase in economic growth will foster higher remittance inflow into the domestic economy. The deposit interest rate (DIR) also has a positive relationship with remittance which is statistically significant at 1% confidence interval. The coefficient of DIR is 0.09 implying that a 1% increase in interest rate will increase remittance inflow by 0.9%.

The autocorrelation LM test and White Heteroskedasticity test shows that there is no serial correlation among the variables, and the variables are homoscedastic.

Table 5: VECM estimate result

| Regressors | CointEq1 | |
|---|---|---|
| | Coefficient | t-statistics |
| Inflation | -1.34 | 0.962 |
| REER | -0.67\*\*\* | -4.569 |
| LNRGDPU | 1.34\*\* | -2.28 |
| DIR | 0.09\*\*\* | 3.52 |
| Autocorrelation LM test | 0.326 | |
| White Heteroskedasticity test | 0.797 | |

\*\*Indicates statistical significance at the 5% level
\*\*\*Indicates statistical significance at the 1% level

The cointegrating equation for the model is as follows:

$$REM = -1.335INFLATION_t - 0.713REER_t + 1.656GDPU_t + 0.017DIR_t - 18.644 + \varepsilon_t$$

### 4.5 Granger Causality

Finally, granger causality test was conducted to establish the direction of causality among the variables of interest. The result from the granger causality test result shows that remittances (REM) granger causes REER and DIR but not inflation and GDP. REER granger causes remittance (REM) and DIR. Inflation does not granger cause any of the variables. Based on this result, the study posits that there is a bidirectional causality between exchange rate and remittance in Nigeria. However, there is neither unidirectional nor bidirectional causality between inflation and remittance in Nigeria.

Table 6: Granger Causality test result

Dependent variable: D(REM)

| Excluded | Chi-sq | df | Prob. |
|---|---|---|---|
| D(REER)) | 6.2234 | 1 | 0.0421 |
| D(INFLATION) | 0.0179 | 1 | 0.8268 |
| D(LNGDP) | 6.3224 | 1 | 0.0391 |
| D(DIR) | 3.1203 | 1 | 0.3445 |
| All | 4.8370 | 4 | 0.1855 |

Dependent variable: D(REER)

| Excluded | Chi-sq | df | Prob. |
|---|---|---|---|
| D(REM) | 5.9591 | 1 | 0.0501 |
| D(INFLATION) | 0.274029 | 1 | 0.6006 |
| D(LNGDP) | 0.563794 | 1 | 0.4527 |
| D(DIR) | 9.2575 | 1 | 0.0027 |
| All | 14.0887 | 4 | 0.0128 |

Dependent variable: D(INFLATION)

| Excluded | Chi-sq | df | Prob. |
|---|---|---|---|
| D(REM) | 0.6614 | 1 | 0.4161 |

| D(REER) | 1.5162 | 1 | 0.2182 |
|---------|--------|---|--------|
| D(LNGDP) | 1.7069 | 1 | 0.1914 |
| D(DIR) | 1.3622 | 1 | 0.2431 |
| All s | 6.207715 | 4 | 0.1842 |

## 5. CONCLUSION

This paper examines the inflation, exchange rate and remittance nexus in Nigeria. The study employs a VECM model to estimate the relationship among the variables of interest and granger causality test to establish the direction of causality among the variables. The VECM result shows that there is a negative relationship between the real effective exchange rate (REER) and remittance inflow in Nigeria. This implies that an increase in the exchange rate, that is a depreciation of Naira, will reduce remittance inflow into the country. Conversely, a decrease in the exchange rate, which is an appreciation of naira to foreign currencies, increases remittance inflow into the country. This relationship is found to be statistically significant. The relationship between inflation and remittance is negative, however, this is not statistically significant. Hence, it cannot be concluded that inflation impacts remittance inflow in Nigeria. The result also shows that the financial sector has a mild effect on remittance inflow into the country. This effect, although mild, is positive and statistically significant. The result also shows that economic growth significantly affects remittance inflow into the country.

The Granger causality test result established a bi-directional causality between exchange rate and remittance inflow into the country. This supports the empirical evidence that remittance inflow affects exchange rate movement in the recipient country (Ayunku and Dickson, 2021; Osigwe and Obi, 2016). However, the result shows no causality between exchange rate and inflation. This result contrast some empirical evidences which suggests that remittance inflow precipitates spending in the recipient country hence inflation (Adejumo and Ikhide, 2019).

Also, findings of the study further lend credence to the self-interest motive proposed by Lucas and Stark (1985) based on the negative coefficient of REER, which is also statistically significant. Since the returns on investment are in the home country's currency, exchange rate appreciation would be preferred to depreciation. Hence, the negative relationship. However, this does not rule out the pure altruism motive of Nigerian migrants sending money home. According to Olubiyi and Kehinde (2015), pure altruism remains the major motive of remittance inflow into Nigeria.

Based on this result, this study recommends that policymakers should design policies that enhance exchange rate appreciation so as to increase remittance inflow into the country. As suggested by empirical evidence, increased remittance inflow would enhance economic growth and alleviate poverty in the country. Policies should also be directed towards developing the financial sector in order to have a stronger influence on remittance inflow into the country.

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