IMPACT OF REMITTANCES AND REMITTANCE VOLATILITY ON REAL EFFECTIVE EXCHANGE RATE IN NIGERIA

by

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A Report Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Arts

in the Graduate Academic Unit of Economics

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This report is accepted by the Dean of Graduate Studies

THE UNIVERSITY OF NEW BRUNSWICK

December 2023

Abstract

Remittances constitute a major contributor to capital inflow in many low- and middle-income countries. Nigeria receives the highest proportion of the remittances in sub-Sahara Africa (40.2% in 2021). Despite the positive impact of remittances on the recipient households, its impact on the key macroeconomic variables like real effective exchange rate could leave undesirable outcomes for the country through the loss of trade competitiveness. Using the Dynamic Ordinary Least Squares (DOLS) methodology, the study finds that increase in remittances leads to a depreciation of the real exchange rate and shows no evidence of Dutch-disease in Nigeria. This means that increase in remittances into Nigeria does not negatively affect her trade competitiveness in the world market. Furthermore, remittance volatility resulted in appreciation of the real effective rate, although the result is not statistically significant.

Dedication

To my amazing wife and kids for their love and unwavering support for me.

Acknowledgements

I remain eternally grateful to my supervisor Professor Weiqiu Yu for her guidance in making this writing this report. I also extend my appreciation to the Examining Board for their constructive feedback and suggestions to make this work meet the required quality.

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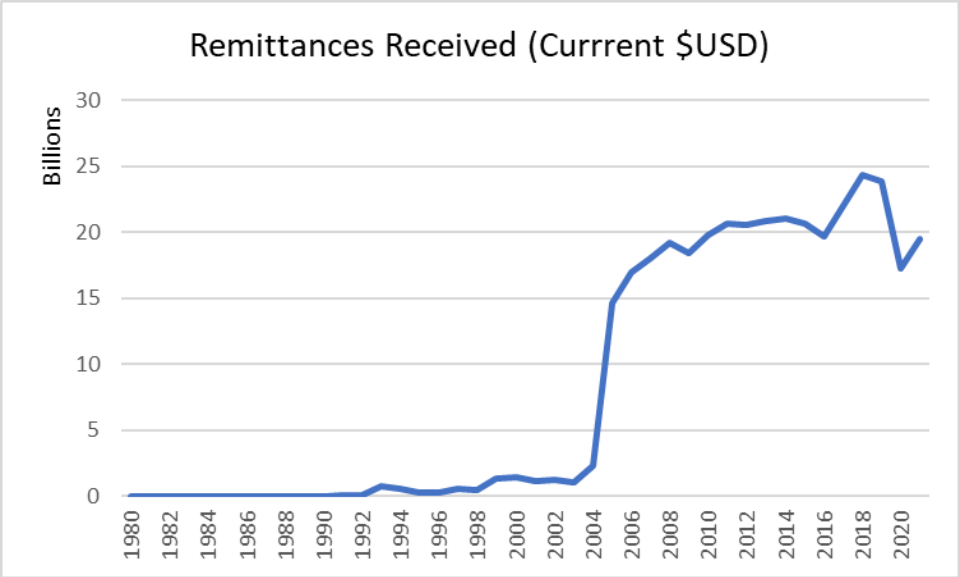
1.0 Introduction

Remittances refer to the proportion of emigrant workers' earnings sent to their home countries mainly for altruistic purpose (to support family members back in their home country) or for self-interest (for investment with the intent to earn a return) purpose. More than ever, migrant workers' remittances to their home countries have become a major source of capital inflow for many developing countries. During times of economic turmoil, remittances have remained a veritable tool for providing crucial lifeline support to families in recipient countries. Also, remittances play a key role in disaster recovery and reconstruction in many developing countries (Suleri and Savage, 2006). It was the most resilient form of capital inflow for many families in developing countries during the Covid-19 pandemic (World Bank, 2021)

In Nigeria, inflow of remittances into the economy has continued to rise and play a crucial role in the economy. Since the 1980s, the country has become one of the largest remittance receiving countries in the world. As shown in Figure 1, in 1980 the value of remittances into Nigeria stood at $21.94 US million. This rose to $1.3US billion in 1999 and $2.27US billion in 2004 and $14.64 US billion in 2005. It peaked at $24.31 US billion in 2018 before declining to $17.21 US billion in 2020 due to COVID-19. As of 2021, value of remittances into Nigeria stood at $19.48 US billion. The growth in remittances is not unconnected to the growth in the number of Nigerians who have migrated abroad. According to the International organization for Migration, Nigeria's total migrant stock stood at 456,600 in 1990, 969,700 in 2005 and 1.3million in 2020.

Figure 1: Remittances Received (Current $US)

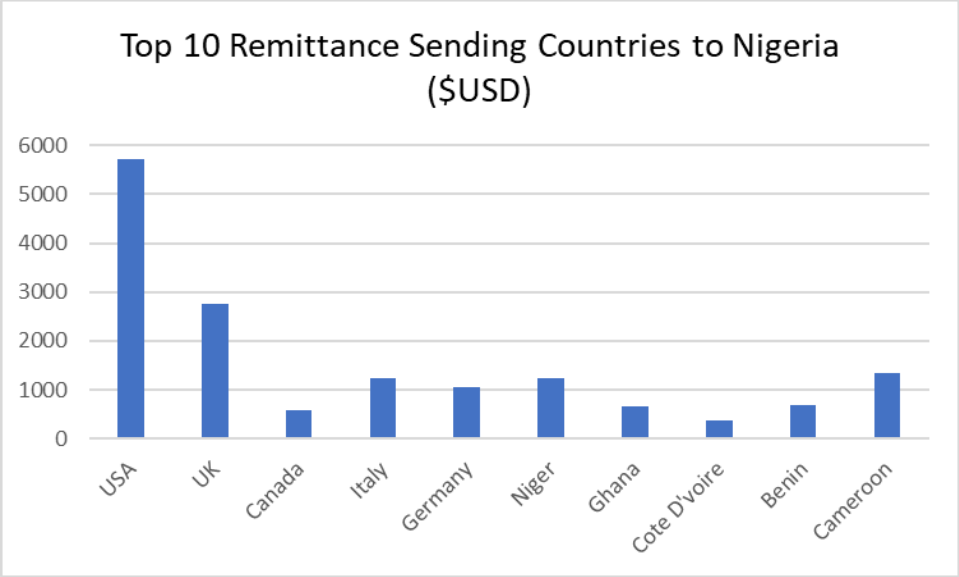


Source: (World Development Indicator, World Bank 2021)

Figure 2 shows the top ten countries from which remittances to Nigeria originate with the USA leading the pack. In 2021, the value of remittances sent by Nigerians living and working in the USA stood at $5.7billion, followed by the United Kingdom with $2.7billion. The West African countries of Cameroon, Niger, Ghana, Benin and Cote d'voire also serve as major remittance corridors to Nigeria with values of $1.35billion, $1.2billion, $662milion and $367million respectively. This is not surprising given that Nigerians living in these countries are mostly involved in business activities. In Europe, the UK, Germany, and Italy are the two leading destinations from which remittances are sent back to Nigeria. Remittances from Germany in 2021 stood at $1.04billion, while from Italy at $1.24billion. Remittances from Canada for 2021 was $585million. It is expected that with more stringent immigration laws in the USA and UK, more Nigerians will migrate

to Canada because of the immigrant-friendly policies, and this will result in increase in the number of Nigerian migrants to Canada and thus increase in remittances originating from Canada to Nigeria.

Figure 2: Top 10 Corridors of Remittances to Nigeria



Source: KNOMAD, Author's Computation

Due to the multi-dimensional role remittances play in developing economies such as smoothening consumption, improving educational and health outcomes of households, contributing to deepening the financial sector, determining trade competitiveness and economic growth, there has been a growing body of research on the impact it has at both the micro and macro levels. However, most of the empirical studies on the impact of remittances on real effective exchange rate have not taken into consideration the possible impact of remittance volatility in determining the behavior of real effective exchange rate. The real effective exchange rate is the measurement of the exchange rate takes into account the nominal exchange rate of the country and the relative prices of both the country and its trading partners. It is an indicator of a country's trade competitiveness in the world (Urama,2019). Since remittances represent a source of foreign currency inflow into a

country, there has been a growing body of research to understand its impact of the exchange rate of a country and its trade competitiveness. To this end, many studies have found that increased inflow in remittance inflow caused an appreciation of exchange rate of recipient countries, thereby negatively affecting their trade competitiveness of countries especially in low and middle-income countries (Bourdet and Falck (2006); Acosta 2008; Chowdhury and Rabbi (2012); Nguyen,2017). The negative impact of remittances on a country's trade competitiveness has been referred to in economic parlance as Dutch-disease. Dutch-disease is a phenomenon as defined by Sweder Van Wijnbergen (1984) as the consequences of the increase in the inflow of foreign currency into a country that triggers a rise in the price of non-tradable goods relative to that of tradable goods within the recipient country, leading to an appreciation of its exchange rate. Remittance volatility on the other hand represents the fluctuations in remittance inflow into a country. This could be in the form of a sharp decline or a sudden upsurge in the value of remittance at a particular time. This could also affect the exchange rate of a country and its trade competitiveness in the short run.

To fully understand the impact of remittances on real effective exchange rate, it is pertinent to also extend empirical studies to include the impact of remittance volatility especially for a country like Nigeria with a high remittance inflow. As pointed out by Amuedo-Dorantes and Pozo (2012), "in analyzing the impacts of remittances, a strategy that focuses only on remittances flows is narrow in scope and could completely miss out on a broader understanding of the subject matter." Furthermore, Annen, Batu, & Kosempel, (2016) emphasized that the relevance of remittances is not only about the quantum of flows but also in the volatility. It is the need to fill this gap in existing literature that this study

includes the impact of remittances and remittance volatility on real effective exchange rate in Nigeria. The research questions that this study seeks to answer are:

1) What is the impact of remittances and remittance volatility on real effective exchange rate in Nigeria.

2) Does increase in remittances cause Dutch disease in Nigeria?

To answer the research questions, this study investigates the relationship between remittances, and remittance volatility and real effective exchange rate using time-series data of the variables and applying the Dynamic Ordinary Least Squares econometric analysis to estimate the relationship. An appreciation of the Nigerian real effective exchange rate is synonymous with the presence of Dutch-disease.

The report is structured as follows: section two examines the existing literature, while section three presents the theoretical framework and methodology. In section four, the empirical results are analyzed. Section five summarizes the findings of the study and provides some policy recommendations.

2.0. Literature Review

The literature on the impact of remittances on the real exchange rate is quite robust, with each reaching relevant policy implications. Lopez et al. (2007) stated that there were three different means through which remittances impact the exchange rate. First, remittances may enhance the economy's external balance by increasing the nation's net foreign reserve holding. Second, remittances have the potential to impact on the economy's internal equilibrium, which is the state of effective use of domestic resources like labor and capital. Third, remittances impact the exchange rate through its effect on economic growth, although the effect may be uncertain in this instance.

A study by Amuedo and Pozo (2004) examined the impact of worker's remittances on the real exchange rate for 13 Latin America and Caribbean countries using fixed-effect model. To tackle the issue of endogeneity and deal with country specific effects in their model they used Instrumental variables (IV) in their estimation. They found empirical evidence that remittances appreciated the real exchange rate of the recipient country. Furthermore, they found that while ‘‘private’’ gifts in the form of workers' remittances do appreciate the real exchange rate (with an elasticity of about 0.22), ‘‘public’’ gifts in the form of foreign aid do not have a statistically significant impact on the real exchange rate. Mungule (2004) examined the determinants of Zambia's real effective exchange rate using quarterly time series data (between 1973 and 1997) and a vector error correction model (VECM). Using the purchasing power parity tests, impulse response and variance decomposition functions, the study found that the terms of trade, closeness of the economy and nominal devaluation were long-run determinants, while the excess supply of domestic

credit and the growth in nominal exchange rate/nominal devaluation were the short-run determinants of Zambia's real effective exchange rate. Bourdet and Falck (2006) applied the Ordinary Least Squares method to investigate the effect of remittances on Cape Verde's trade competitiveness for the period 1980-2000. They found that the increase in remittances flow made Cape Verde's trade overcompetitive. Further, they compared the effect of remittances on competitiveness to foreign aid. Their findings showed that the loss of competitiveness is higher with remittances than with foreign aid.

Similarly, Acousta et al. (2008) in their study adopted the Generalized Method of Moments (GMM) methodology to examine a dynamic panel of disaggregated sectorial data for 109 developing and transition countries for the period 1990-2003. The study showed evidence that rising levels of remittances exerted spending effects that led to real exchange rate appreciation and resource movement effects that was skewed in favor the non-tradable sector at the expense of tradable goods production. The underlying outcome of the study was that increase in remittances led to real exchange rate appreciation and created a Dutch-disease outcome for the countries examined. They also found evidence that Dutch disease effects was more pronounced under fixed exchange rate regimes. Barajas et al. (2010), argued that appreciation of currencies due to increased remittances were substantially weakened or even overturned depending on: degree of openness; factor mobility between domestic sectors; countercyclicality of remittances; the share of consumption in tradables; and the sensitivity of a country's risk premium to remittance flows. Chowdhury & Rabbi (2012) explored the use of the Johansen cointegration and Vector Error Correction models to examine the impact of remittances on real exchange rate and external trade competitiveness of Bangladesh. The study found that the flow of remittances appreciated

the real exchange rate and caused a decrease in the external trade competitiveness of Bangladesh

Nikas and Blouchoutzi (2014) found a mixed outcome in their study of Albania and Moldovia. Using a fixed effect model, they found that remittances caused Dutch disease in Albania through the appreciation of the Albanian currency but not in Moldova where remittances resulted in depreciation of the currency. Osigwe and Obi (2016) adopted the cointegration analysis approach in their study of timeseries data on remittances and real exchange rate in Nigeria from 1980-2012. They found evidence of a long run, positive relationship between remittances and real exchange rate while controlling for other independent variables such as openness of the economy, nominal exchange rate, terms of trade, growth of RGDP, ratio of government consumption to GDP and price level. They further found that all the other variables included in the model except ratio of government consumption to GDP and price level exhibited such long-run positive relationship with real exchange rate. The estimated short run estimation based on parsimonious error correction model revealed a negative but significant relationship between remittances and real exchange rate in the first and third periods lag.

Taguchi and Lama (2016) examined the impact of remittances on real exchange rate in both Nepal and Bangladesh. The study used the Vector autoregressive methodology and found that remittances led to appreciation of the Nepalese currency thus resulting in Dutch disease but not in Bangladesh. A similar result was found for Vietnam by Nguyen (2017) using OLS regression model for a time series data spanning 1990-2015. The results showed decline in Vietnam's trade competitiveness because of increased inflow of

remittances. The findings from the study indicate that a 1% increase of remittances led to a 3% appreciation in the real effective exchange rate which in turn undermines Vietnam's competitiveness.

Adejumo (2018) found evidence that increase in remittances resulted in appreciation of the Nigerian real exchange rate and negatively affected Nigeria's trade competitiveness. The study adopted the Error Correction Model (ECM), as well as the Johansen Cointegration Test for data spanning between 1980 to 2015. The study further found foreign direct investment and foreign portfolio investment exhibited the same relationship as remittances on real exchange rate, they caused an appreciation of the naira. However, they found that an increase in foreign aid resulted in the depreciation of the Nigerian Naira. A study by Nketiah et al. on remittances in Ghana (2019) shows that the real exchange rate was not much impacted by remittances. The analysis also found that, over time, a shift in the real exchange rate was typically correlated with changes in the underlying economic conditions.

Urama et al. (2019) found that increase in remittances contributed to the appreciation of the Naira, thus encouraging import of consumption goods in Nigeria. The study established that a long-run positive relationship existed between remittances and real exchange rate in Nigeria. Using the ARDL methodology, the result showed that a 1% increase in the inflows of remittances led to a 0.44% increase in the real effective exchange rate of Naira. This result is also consistent with the findings of Ilu (2019) who similarly adopted the ARDL model to examine both the short run and long run relationships between remittances exchange rate in Nigeria for the period 1981-2016.

In another study by Adejumo & Ikhide, (2019) using the Dynamic Ordinary Least Squares (DOLS) approach, and data covering 1981 to 2014, they found empirical evidence that remittance inflows have been associated with a depreciation in the real exchange rate in Nigeria. The result is at variance with Adejumo's (2018) earlier work using the Error Correction Model that found that remittances led to an appreciation of the Nigerian Naira.

A panel study of 41 developing countries by Polat and Rodríguez (2019) using a one-step system Generalized Method of Moments (GMM) dynamic panel data model to examine the impact of workers' remittances on real exchange rate levels found that remittances depreciated real exchange rate at level. However, they found that the lagged value of remittances caused an appreciation of the domestic currency for the country group studied. Diushalieva (2019) examined the impact of remittances on real exchange rates in Commonwealth Independent States (CIS). Using fixed effects and two-stage least squares methodology, the study found that high volume of remittances resulted in the appreciation of the currencies of the CIS and caused Dutch-disease in the countries examined.

Olanipekun (2020) studied the role remittances played in the real exchange rate determination and if there was evidence of Dutch-disease arising from remittances received by these countries. A panel of 26 countries within the Sub-Saharan region was investigated using the Pooled Mean Group estimation technique and data collected from 1981 to 2018. The 26 SSA countries comprised 15 non-CFA (Anglophone) and 11 CFA (Francophone) countries. It was found that remittances inflow led to the appreciation of the real exchange rate in the CFA zone while the result for non-CFA zone was not statistically significant. Also, evidence of Dutch-disease from remittances was found in the CFA zone in the long

run, while no substantial evidence of remittance-induced Dutch-Disease was found in the non-CFA zone.

Additionally, Munir and Riaz (2021) investigated the long-run relationship between remittances and real exchange rate and the magnitude of the impact remittances had on real exchange rate in Pakistan over the period of 1980 to 2014. The study employed the ARDL model. It was found that the inflow of remittances resulted in an appreciation of the real exchange rate. They also found a negative relationship between terms of trade and the real exchange rate but a positive relationship between inflation and the real exchange rate.

Although there are many studies on the impact of remittances on real exchange rate have, studies on remittance volatility have been sparse. Some studies of remittance volatilities have mainly focused on its impact on other economic variables outside the exchange rate. Some of the studies include Amuedo- Dorantes and Pozo (2012) which employed an instrumental variable approach to examine the impact of remittance income volatility and labor supply in Mexico. They found that increase in remittance volatility raise the employment likelihood of men and women, as well as the hours worked by employed women. They suggested that women may be better suited to adjust working hours higher than men in the face of remittance volatility. Also, a study by Jawaid and Raza (2014) which used cointegration technique and found that remittance volatility had a negative and significant effect on economic growth in Pakistan, Indian, Bangladesh and Sri Lanka, but an insignificant negative impact in Nepal. Opperman and Adjasi (2018) adopted a two-

step system panel GMM method and found that remittance volatility negatively impacts financial sector development in sub-Saharan countries.

Oguntomi and Igbenedion (2021) investigated the nexus between remittance volatility and life expectancy in Nigeria using the Fully Modified Ordinary Least Squares (FMOLS) and the ECM models. Estimates from the study showed that in the long-run remittance volatility have a statistically significant (negative) impact on life expectancy at birth in Nigeria

Awode, et al (2021) studied the effect of remittance and volatility in remittances on macroeconomic performance in Africa using the fixed effects model. Their result showed that remittance volatility exerts a negative but insignificant effect on the macroeconomic variables examined (RGDP, consumption, investment, export and exchange rate). Their result showed that a 1% rise in remittance volatility induced about 0.003%, 0.03%, 0.02%, 0.03% and 0.003% decline in RGDP, consumption, investment, export and exchange rate, respectively.

Although there is robust literature on the impact of remittances on real exchange rate, the results have not been unanimous. The possible reason for the mixed results could lie in the peculiar economic conditions prevalent in each of the countries studied. Furthermore, there has been no study that specifically examined the impact of remittance volatility on real effective exchange rate in Nigeria. This study is therefore an attempt to bridge the gap in the existing literature by including both remittances and remittance volatility in the model. The study adopts the use of real effective exchange rate as the dependent variable since according to the literature it defines trade competitiveness more

effectively (Sultonov, 2011; Hassan and Holmes, 2012; Kyzy, 2012; Ryota, 2013; Brahim et al., 2017, among others).

Summarily, from the literature review, it can be argued that remittances exert on country's real effective exchange rate through the spending and resource reallocation effects on the economy. Increase in remittances cause an increase in the disposable income which in turn increases aggregate demand in the economy and results in higher domestic price levels in the non-tradable sector and causes resource reallocation (labour supply) to the non-tradable sector thus making cost of production in the tradable sector to rise thereby making the country's export overcompetitive in relation to trading partners. It is the loss in the trade competitiveness resulting from the appreciation of a country's exchange rate and the ratio of tradable to non-tradable output that presents the indication that Dutch-disease is present in an economy (Acosta et al, 2008).

The Salter-Swan-Corden-Dournbusch (Swan,1955; Salter, 1959; Corden,1960; and Dornbusch,1974) model has been widely adopted in the remittance-Dutch disease studies (Acosta et al, 2008; Hatem Akeel, 2017; Taguchi & Lama 2016; Adejumo 2018). The model opines that an increase in capital inflow (remittances) increases the disposable income of recipient households. The higher income expands the aggregate demand in the non-tradable sector, thus leading to higher prices of non-tradable goods relative to the tradable sector (spending effect). The increased demand in the non-tradable sector also causes movement of resources away from the tradable sector to the non-tradable sector (resources reallocation effect). The overall effect of both spending and resource

reallocation effect culminates in appreciation of the domestic currency and negative trade competitiveness results in the presence of Dutch-disease. The justification for the wider application of this model against other frameworks for exchange rate determination used in the Dutch-disease modelling such as the Mundell-Fleming model stems from the fact that it distinguishes the domestic economy into tradable and non-tradable sectors which helps to segregate and understand the transmission mechanism for how capital inflows such as remittances causes hike in domestic price level through increase in aggregate demand, causes resource reallocation (labour supply) between the tradable and the non-tradable sector and appreciates the real exchange rate thus making exports overcompetitive in the international market. Furthermore, the model assumes price flexibility which is more realistic when compared to the assumption of fixed prices of the Mundell-Fleming model. The Salter-Swan-Corden-Dournbusch model therefore better helps us understand how domestic prices respond to upward movements in the aggregate demand resulting from increase in remittances.

3.0. Empirical Methodology

Having briefly evaluated two alternative theories for how Dutch disease is transmitted into an economy, this study adopts the Salter-Swan-Corden-Dornbusch model to the Nigerian case. This choice is justified based on the assumptions of the theory. First the theory assumes a small open economy. This in modern day parlance refers to a developing economy that participates in international trade. This fits with the current reality of Nigeria. Nigeria is a developing country and participates in international trade with her trading partners. Secondly, the theory assumes capital mobility which can be in the form of remittances, foreign investments into the country, receipts from exports such as oil revenue, among other sources of capital inflows. Nigeria receives a huge inflow of foreign currency from sale of her crude oil in the international market. It is also a growing destination for foreign portfolio investments as well as a large recipient of remittances due to the high number of Nigerian living and working abroad. The model further assumes that the economy produces tradable and non-tradable goods. In other words, the economy produces goods that are consumed locally (non-tradable) which prices are determined in the domestic market and goods which prices are determined exogenously in the international market.

This assumption also justifies the adoption of the model to the Nigerian study. The country produces tradable exportable goods, prices of which are determined by the international market. The assumption that huge inflow of remittances increases disposable income which in turn causes more consumption of non-tradable goods (spending effect) and shifts labor supply away from the tradable sector resulting in Dutch disease can be

justified in the Nigerian case because of labour mobility across sectors especially in low-skill sectors like agriculture. Summarily, the Salter-Swan-Corden-Dornbusch model can be applied to the Nigerian case thus: increases in remittance inflow to recipient households will cause their disposable income to increase. The increase in disposable income will trigger an increase in household consumption of non-tradable goods, which in turn will increase domestic prices of goods. Due to limited supply in the non-tradable sector of the Nigerian economy, the excess demand for non-tradable goods occasioned by the increase in disposable income will lead to price increase in the non-tradable sector. Given that relative prices of tradable goods and non-tradable goods determine the direction of real exchange rate, the excess demand for non-tradable goods resulting from the increase in remittances leads to a rise in the price of non-tradable goods relative to tradable goods, which suggests an appreciation of the Nigerian real effective exchange rate (spending effect). The resource reallocation effect usually happens through the labour market. The increased demand in the non-tradable sector also causes movement of labour away from the tradable sector to the non-tradable sector (resources reallocation effect). The overall effect of both spending and resource reallocation effect culminates in appreciation of the domestic currency and negative trade competitiveness results in the presence of Dutch-disease.

To specify the econometric model, a review of literature on the determinants of real exchange rate shows that it is determined by several variables such as terms of trade, remittances, government expenditure, inflation, interest rates, foreign direct investment, foreign aid, technological progress, exchange rate regimes, capital accumulation, among others (Chowdhury & Rabbi (2012); Nguyen (2017); Urama et al (2019); Olanipekun (2020). The focus of this study is to examine the impact of remittances and remittance

volatility on real effective exchange rate in Nigeria. Therefore, apart from remittances and remittance volatility, the model includes other control variables such as oil rent, foreign direct investments, Gross Domestic Product, deposit interest rate, and inflation The control variables were selected in line with the adopted theoretical framework. and other empirical studies (Adejumo 2018, Adejumo & Ikhide 2019; Urama 2019). The use of the real effective exchange rate REER index as our variable for exchange rate because it is a better indicator of a country's trade competitiveness (Sultonov, 2011; Hassan and Holmes, 2012; Kyzy, 2012; Ryota, 2013; and Brahim et al., 2017). The empirical model for the relationship between real effective exchange rate (REER) as a function of remittance and remittance volatility and other control variables is specified as:

$$\boldsymbol{LNREER = \beta_0 + \beta_1 LNREMIT + \beta_2 LNREMITVOL + \beta_3 OILRENT + \beta_4 LNFDI + \beta_5 LNGDP + \beta_6 INFL + \beta_7 DIR + U_t} \qquad (\mathbf{1})$$

where:

- β_0 = constant term
- $\beta_1 \ldots \beta_7$ = coefficients of the explanatory variables
- U_t = error term

LNREER = natural logarithm of real effective exchange rate ''Real effective exchange rate refers to the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs.'' (World Bank,2021)

LNRemit = natural logarithm of Remittances (measured in current $USD billions)

‘‘Personal remittances consist of personal transfers and compensation of employees. Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from non-resident households.’’ (World Bank,2021)

LNRemitvol = natural logarithm of remittance volatility, as measured by three-year rolling standard deviation of remittances.

Oil rent = Oil revenue as a % of GDP

‘‘Oil rents represents the difference between the value of crude oil production at regional prices and total costs of production.’’ (World Bank, 2021)

LNFDI = natural logarithm of Foreign Direct Investment (measured in current $USD billions)‘‘Foreign direct investment refers to direct investment equity inflows into an economy. It is the summation of all equity capital, reinvestment of earnings, and other investment capital inflows to an economy.’’ (World Bank, 2021).

INFLATION = ‘‘Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.’’(World Bank,2021)

DIR: Deposit interest rate

‘‘Deposit interest rate is the rate paid by commercial or similar banks for demand, time, or savings deposits.’’ (World Bank,2021)

LNGDP: Log of Gross Domestic Product (measured in current $USD billions)

‘‘GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products.’’ (World Bank,2021)

For ease of interpretation of the empirical result, all the variables except inflation, deposit interest rate and oil rent have been expressed in their logarithmic forms also due to their large nominal values. A positive slope coefficient in Equation 1 means appreciation of exchange rate while a negative coefficient means depreciation. From the theoretical framework described above, increase in remittances is expected to lead to appreciation of the real exchange rate. Thus, the slope coefficient $\beta 1$ is expected to be positive.

However, the review of literature shows that the results have been mixed, (Amuedo-Dorantes and Pozo (2004); Izquierdo and Montiel (2006); Nikas and Blouchoutzi (2014) Berrret, 2014, Adejumo & Ikhide (2018); Adejumo (2019); Urama et al (2019)). While most studies have found that remittances result in appreciation of the domestic currency, very few studies have found that increases in remittances result in depreciation of real effective exchange rate (Izquierdo and Montiel (2006); Berrret, 2014; Adejumo 2019). The mixed results could be due to the prevailing economic realities of the countries studied, quality of data, different methodology, and different time periods. Overall, more studies have found remittances cause appreciation of the exchange rate in countries studied. This makes it imperative for country specific studies to be conducted to understand the dynamics of the relationship between remittance and real effective exchange rate peculiar to each country. Based on economic models like the Salter-Swan-Corden-Dornbusch model, we

expect that coefficient of oil rent to be positive (appreciate the Nigerian currency). Nigeria is a major oil producing country, it is expected that increases in revenues from crude oil sales would appreciate the Nigerian currency. It is also expected that the coefficient of FDI to be positive Increase in FDI is expected to appreciate the Nigerian currency. The coefficient for inflation is expected to be negative, implying the increase in inflation will lead to depreciation of the Nigerian currency (Osigwe & Obi, 2016). This is because high inflation rate weakens the domestic economy by making imports cheaper and exports more expensive. Increase in deposit interest rate is expected to attract capital inflow into the Nigerian economy (ceteris paribus) and cause an appreciation of the Nigerian exchange rate, thus it is expected that the coefficient be positive, while increase in GDP is expected to appreciate Nigeria's real effective rate. This is because GDP growth reflects higher production rate and higher demand for the country's products which in turn appreciate the country's exchange rate.

The inclusion of remittances volatility in the model is justified because like other economic variables, remittances can be subject to fluctuations resulting from economic shocks from the source country like the 2008 financial crisis in the USA or global economic shock like COVID-19 pandemic or during economic boom. It is expected that the coefficient of remittance volatility will be negative when volatility is a sharp drop in volume of remittances but positive when volatility is a sudden upward jump in volume of remittances. However, this study does not focus on specific periods of volatility. Following the approach used by Broto, Diaz-Cassou, and Erce (2011) and Lee, Park, and Byun (2011); Jawaid and Raza (2014); Opperman and Adjasi (2019), I used the three-year rolling standard deviation to compute the volatility in remittances. From empirical literature, other

measures of volatility of a variable include moving averages, Hodrick–Prescott (1997) (HP) filter and generalized autoregressive conditional heteroscedasticity (GARCH). The choice of the method is based on simplicity of computation.

3.1. Data and Variables

This study uses a time series data spanning 1980-2021 taken from the World Bank's 2021 World Development Indicators (WDI) database. While the data is listed in the Appendix, Table 1 shows the summary statistics of the variables used in this study. REER is measured as an index of a country's nominal exchange rate adjusted for relative changes in consumer prices, remittances, oil rent, GDP, and FDI are measured in billions of $USD, while interest rate is measured rate paid by commercial or similar banks for demand, time, or savings deposits (usually as a percentage of deposits). Inflation is measured as an index of the average basket of goods in the current period against cost of the same basket of goods in at a base period.

Table 1: Descriptive Statistics

	REER	Remittances	Oil rent	FDI	Infl	Oil rent	DIR	GDP
Mean	4.81	20.48	11.82	21.1	18.74	11.7	11.16	25.61
Max	6.29	23.91	28.71	22.9	72.84	28.7	23.24	27.07
Min	3.91	14.7	1.6	19.06	5.39	1.57	4.2	24.04
Std. Dev.	0.60	3.21	6.42	1.126	16.51	6.12	4.04	0.97
Sample size	42	42	42	42	42	42	42	42

4.0. Empirical Findings

4.1. Stationarity Test

One challenge with using time series data for empirical analysis is the issue with non-stationarity. To avoid the problem of generating spurious results, I first performed the stationarity test on all variables using the Augmented Dickey Fuller (ADF; Dickey & Fuller, 1979, 1981) and the PP test (Phillips & Perron, 1988). The results are presented in Table 2. However, the stationarity results for oil rent, remittance volatility and inflation were inconclusive at levels using the ADF and PP test (the PP test results showed variables not stationary at levels but ADF shows variables stationary at levels), Therefore, I conducted KPSS stationarity test (Kwiatkowski, D.; Phillips, P. C. B.; Schmidt, P.; Shin, Y., 1992) (See Table 3) to confirm their stationarity either at levels or otherwise. The decision criterion for KPSS test is that a variable is stationary if the stationarity test result is less than the critical value. I used the 5% critical value. The KPSS test results confirmed the stationarity of the inflation and remittance volatility variables at levels, while the result for oil rent shows that it was non-stationary at levels, hence the need to take the first difference and test for the stationarity of oil rent using the ADF and PP tests.

Table2: ADF & Philip -Perron Stationarity Tests at Trend & Intercept

		ADF		PP		Stationarity Status
	t-statistic	Levels*	1st difference*	Levels*	1st difference*	
LNREER	-3.52	-2.7	-4.85	-2.22	-4.68	Stationary at 1st difference
LNREMIT	-3.52	-1.84	-6.48	-2.04	-6.48	Stationary at 1st difference
LNFDI	-3.52	-2.99	-10.01	-3.04	-10.01	Stationary at 1st difference
OIL RENT	-3.52	-2.04	-7.62	-3.83	-23.49	Stationary at 1st difference
LNREMIT VOL	-3.52	-3.64		-2.27		Stationary at level
INFL	-3.52	3.81		-3.07		Stationary at level
DIR	-3.52	-3.04	-4.02	-2.67	-8.03	Stationary at 1st difference
LNGDP	-3.52	-1.5	-7.21	-1.57	-6.93	Stationary at 1st difference

*Critical values at the 5% significant level

Table 3: KPSS Stationarity Test

	t-statistic	Levels*	1st difference*	Stationarity status
LNREER	0.14	0.12		Stationary at level
LNREMIT	0.14	0.12		Stationary at level
LNFDI	0.14	0.1	0.07	Stationary at 1st difference
OIL RENT	0.14	0.15	0.11	Stationary at 1st difference
LNREMIT VOL	0.14	0.11		Stationary at level
INFL	0.14	0.99		Stationary at level
DIR	0.14	0.16	0.05	Stationary at 1st difference
LNGDP	0.14	0.15	0.11	Stationary at 1st difference

*Critical values at the 5% significant level

4.2 Cointegration Test Results

Having determined from the result of the stationarity tests that the variables are a mix of I(0) and I(1), traditional cointegration tests such as the Johansen (1991), (1995) and Engle-Granger (1987) are not appropriate for the purpose of estimation. Thus, we adopt the ARDL bounds test for cointegration to determine if there exists a long run relationship between the explained variable and the explanatory variables in the model.

The ARDL bounds test by Pesaran and Shin (1998) and Pesaran et al. (2001) is a least square regression technique which allows the lags of both dependent and independent variables to be used as regressors (Greene, 2017). Unlike the traditional cointegration techniques that require all variables to be I(1), the ARDL model has several advantages in that it is applicable to mutually cointegrated variables with different orders of cointegration (Das and Chowdhury, 2019). In the ARDL model, the use of lagged values of independent and dependent variables provides an appealing separation between short and long run dynamics of the model (Das and Chowdhury, 2019). A long run relationship exists among the variables if the F-statistic value is greater than the upper bound while only a short run relationship exists if the F-statistic value is less than the lower bound. The lower bound represents the critical values I(0) regressors while the upper bounds represents the critical values I(1) regressors. The null hypothesis of the bounds test is that there is no cointegration among the variables in the model, while the alternative hypothesis is that a cointegration exists among the variables in the model. Another key assumption of the

ARDL/Bound testing methodology is that the error term must be serially independent (Pesaran et al., 2001). I conducted the Durbin-Watson and Breusch–Godfrey Serial Correlation (LM) tests for serial correlation. While the White's test for heteroscedasticity was used to examine if the variance of the residuals is constant over time. Finally, I tested for model stability using the cumulative sum of squares (CUSUM) test.

Table 4: ARDL Cointegration Test Results

The ARDL Bounds Test for Cointegration (F-value= (5.71))							
10%		5%		2.5%		1%	
I(0)	1(1)	I(0)	1(1)	I(0)	1(1)	I(0)	1(1)
1.92	2.89	2.17	3.21	2.43	3.51	2.73	3.90
The values represent the critical values of the bounds test.							

Table 4 contains the ARDL Bounds Cointegration Tests. Given the F-statistic value of 5.71 is higher than the critical values at both the I(0) and I(1) bounds at the 5% and even 2.5% level , I conclude that there is a long-run relationship between the dependent and explanatory variables in the model.

4.3 Dynamic Ordinary Least Squares (DOLS)

To examine the long run relationship of the variables in our model, I adopted the Dynamic Ordinary Least Squares (DOLS) methodology. The DOLS was proposed by Stock and Watson (1993) as a robust least square regression method to estimate the impact or effect of some independent variables on a dependent variable when the variables are non-stationary but cointegrated (Caballero, 1994).The advantage of using the DOLS is that it is

capable of addressing any potential small sample bias, simultaneity bias and endogeneity problem among the variables in a model through the inclusion of leads and lags values of first differences of the regressors (ordinary least square cointegration estimation produces consistent results (Vogelsang and Wagner, 2011). Endogeneity in a model can bias the results thus making inference difficult (Adejumo and Ikhide, 2018). To tackle this challenge, the DOLS improves upon the OLS by coping with dynamic sources of bias in a model (Al-Azzam and Hawdon, 1999).

The DOLS model specification of Equation (1) is presented below:

$$\begin{aligned} \boldsymbol{LNREER} = \boldsymbol{\beta_0} + \ & \boldsymbol{\beta_1 LNREMIT} + \boldsymbol{\beta_2 LNREMITVOL} + \boldsymbol{\beta_3 OILRENT} + \\ & \boldsymbol{\beta_4 LNFDI} + \boldsymbol{\beta_5 LNGDP} + \boldsymbol{\beta_6 INFL} + \boldsymbol{\beta_7 DIR} + \\ & \sum_{i=-a}^{i=a} \boldsymbol{\delta_i} \Delta \boldsymbol{LNREMIT_t} + \sum_{i=-b}^{i=b} \boldsymbol{\gamma_i} \Delta \boldsymbol{LNREMITVOL_t} + \\ & \sum_{i=-P}^{i=P} \boldsymbol{\eta_i} \Delta \boldsymbol{OILRENT_t} + \sum_{i=-q}^{i=q} \boldsymbol{\theta_i} \Delta \boldsymbol{LNFDI_t} + \sum_{i=-r}^{i=r} \boldsymbol{\lambda_i} \Delta \boldsymbol{LNGDP_t} + \\ & \sum_{i=-s}^{i=s} \boldsymbol{\tau_i} \Delta \boldsymbol{INFL_t} + \sum_{i=-v}^{i=v} \boldsymbol{\pi_i} \Delta \boldsymbol{DIR_t} + \boldsymbol{U_t} \qquad (\mathbf{2}) \end{aligned}$$

Where $\beta_1 \ldots \beta_7$ are the long-run coefficients of the explanatory variables; a, b, p, q, r, s, and v are leads of the first difference of the explanatory variables; -a,-b,-p,-q,-r,-s, and -v are lags of the first difference of the explanatory variables; Δ is the first difference operator. The DOLS equation above is the linear regression model used to estimate the long-run relationship among the variables in this model. To deal with potential data and model specification issues, I first ran stepwise regression, tested for structural breaks, and estimated the model with nominal exchange rate being the dependent variable.

Table 5: DOLS Estimation Results

	REMIT	FDI	OIL RENT	REMIT VOL	INFL	DIR	GDP
COEFFICIENT	-0.22	-0.6	0.08	0.39	-0.033	-0.11	0.89
STD ERR	0.08	0.26	0.04	0.53	0.02	0.04	0.24
P-VALUE	0.02*	0.04**	0.08***	0.4	0.07***	0.03**	0.005*

NOTE: *,,*** indicates statistical significance at the 1%, 5% and 10% respectively**

4.4. DOLS Estimation Result

Table 5 presents the long-run estimates of the final DOLS model. The result shows that the coefficient for remittances is negative (-0.22) and statistically significant at the 5% level. This signifies that a one percent increase in remittances leads to a 0.22% depreciation in the real effective exchange rate in Nigeria. This result is consistent with the findings of Adejumo and Ikhide (2019) but in contrast with other studies for Nigeria. Accordingly, I conclude that remittances does not appreciate the Nigerian real effective exchange rate and as such the conclusion that increase in remittances does not result in Dutch-disease in Nigeria. The result for remittance volatility shows a positive but insignificant relationship. This means that a one percent increase in remittance volatility leads to a 0.39% appreciation in the Nigerian real effective exchange rate. By its very nature, remittance volatility is temporary and as such its impact is insignificant and transient. As expected, the coefficient of inflation is negative (-0.033) and significant at 10% level, meaning inflation causes the Nigerian real effective exchange rate to depreciate. This finding echoes a similar result in the study by Urama et al (2019). Also, the result for oil rent is positive (0.084) and

statistically significant at 10%, signaling an appreciation of the real effective exchange rate which aligns with our expectation because Nigeria is an oil exporting country. The coefficient for GDP is positive and statistically significant at the 1% level. This shows that a one percent increase in GDP leads to a 0.89% appreciation of the real effective exchange rate of Nigeria. The coefficient for deposit interest rate shows that it has a negative (-0.11) impact on real effective exchange rate, meaning it depreciated the REER. Although this outcome is contrary to the expected outcome, one plausible explanation could be that foreign investors are keen on other economic fundamentals apart from high interest rates in making their investment decisions. The coefficient for FDI is also negative (-0.60) and statistically significant at 5%. This means that a one percent increase in FDI leads to a 0.6% depreciation in the Nigerian exchange rate.

I also estimated the DOLS model to account for the structural break in REER in 1987, to see if the structural break term has any significant impact on the outcome of the model. The results showed that the structural break term was significant. However, the inclusion of the structural break term altered the sign of the coefficients of variables (remittance volatility, Oil rent and GDP) which had a positive coefficient in our original model. This further made the overall outcome of the model contradictory to expectation from economic theory and other empirical studies. See appendix 3 for the result of the model with structural break.

4.5. Diagnostic Tests

Table 6 displays the results of both the Breusch–Godfrey Serial Correlation (LM) test for serial correlation and the Breausch-Pagan-Godfrey heteroskedasticity test with the null hypotheses being zero autocorrelation and homoskedasticity. The results show that the model does not suffer from serial correlation among the variables, and void of heteroskedasticity.

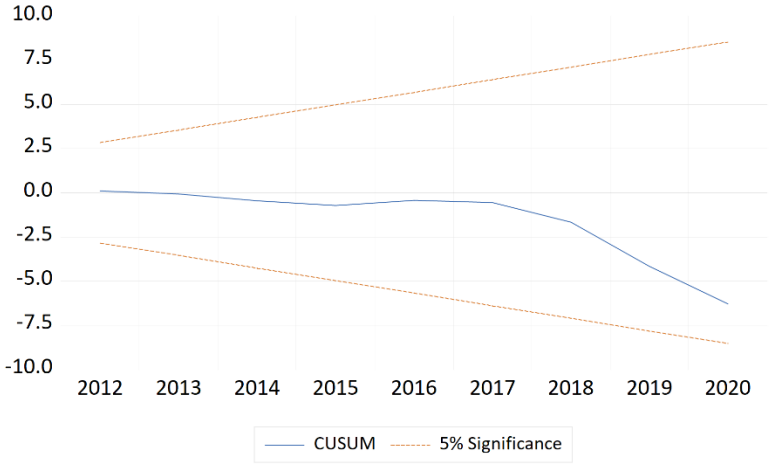
Table 6: Autocorrelation and Heteroskedasticity Test Results

Breusch Godfrey LM Autocorrelation test (p-value)	Breusch Godfrey Heteroskedasticity Test(p-value)
0.19	0.51

Stability Test

The cumulative sum (CUSUM) of recursive residuals was conducted to check the dynamic parameter stability of the model. Figure (5) shows that the CUSUM of the residuals lie within the 95% confidence bounds thus confirming that the model is stable.

Figure 3: CUSUM Test



5.0. Conclusion and Policy Recommendations

The purpose of this study is to examine the impact of remittances and remittance volatility on real effective exchange rate in Nigeria. Using the Dynamic Ordinary Least Squares (DOLS) methodology, the study finds that increase in remittances leads to a depreciation of the real exchange rate and shows no evidence of Dutch-disease. Furthermore, remittance volatility resulted in appreciation of the real effective exchange rate, but the result is not statistically significant. The model diagnostics conducted shows that the model does not exhibit evidence of autocorrelation and is also void of heteroskedasticity. Moreso, the CUSUM stability test shows that the model is stable.

It is therefore imperative that policy makers in Nigeria put in place measures that encourage efficient utilization of remittances especially towards the investment of remittances in small scale businesses that can drive job creation in the country. Also, the Nigerian government should continue to strengthen the existing diaspora-focused agency the Nigerians in Diaspora Commission (NIDCOM) to engage with the Nigerians living and working abroad especially with regards to encouraging them to channel part of their remittances to investments in the country. Since remittances serve the potential as a source of foreign reserve accumulation, Nigerian government can use remittances to finance key development projects that reduce the cost of doing business in the country and improve overall productivity of the country.

5.1. Limitation of Study and Areas of Possible Further Research.

A key limitation encountered is the non-availability of data for lower time frames like monthly or quarterly data for this study. Most empirical analysis of volatility in variable especially financial variables stock prices, commodity prices, exchange rates, are available in lower times frames. It is possible that the outcome of this study could be different if we used monthly or quarterly data for our analysis.

Another limitation of this study is that there could be a possible omitted variable bias as other key variables that affect real effective exchange rate such as Trade openness, government expenditure, Official Development Assistance (ODA), among other determinants of exchange rate were excluded from this study.

The result of the remittance variable is counter-intuitive to the postulations of economic theory which expect increase in remittance to lead to appreciation of the REER. This could be because of the methodology used which does not account for possible lag effects in the model. It is possible that the result could be different if a different methodology that accounts for possible lag effects is used to estimate the model. Therefore, the interpretation of the outcome of this study should be taken with caution.

Finally, the key variable (remittances) of the study was negligible until 2005, and then there was a sudden jump. Also, the REER also had a sudden drop in 1987, after which there was relative stability in its trend. These data problems along with potential problems of multicollinearity, varying scale of different variables, transformation of the variables, and specification issues etc. presented real challenges in my estimations. As such, the

results are unlikely to be robust to choices of variables and functional forms. Therefore, more investigation is needed to generate more reliable estimates.

Another possible area of further research in the study of remittances especially within the Nigerian context could be examining the decomposition of remittance usage for consumption and investment.

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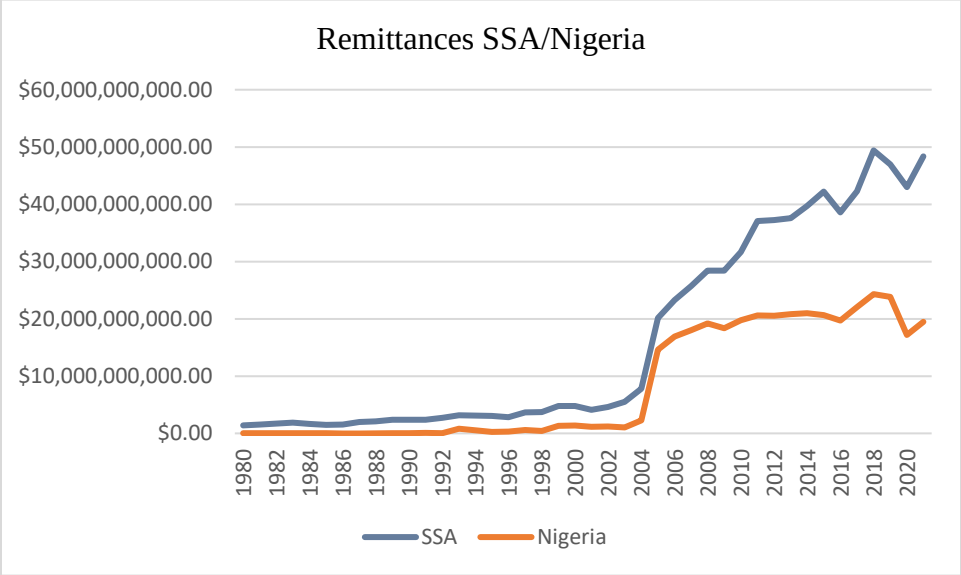
Appendix 1: Variables in their log forms except Inflation, DIR and Oil Rent.

Year	REER	REMIT	FDI	INFL	DIR	OIL RENT	GDP	REMIT VOL
1980	5.66	16.90		9.97	5.27	24.70	24.89	
1981	5.77	16.60	20.11	20.81	5.72	3.91	25.83	
1982	5.80	16.70	19.88	7.70	7.60	1.57	25.68	0.16
1983	5.96	16.44	19.71	23.21	7.41	4.62	25.30	0.13
1984	6.29	16.28	19.06	17.82	8.25	8.00	25.02	0.21
1985	6.18	16.13	20.00	7.44	9.12	9.37	25.02	0.16
1986	5.58	15.20	19.08	5.72	9.24	4.24	24.73	0.58
1987	4.43	14.82	20.23	11.29	13.09	8.76	24.69	0.67
1988	4.45	14.70	19.75	54.51	12.95	7.85	24.63	0.26
1989	4.33	16.14	21.36	50.47	14.68	19.91	24.51	0.80
1990	4.26	16.12	20.19	7.36	19.78	21.96	24.71	0.82
1991	4.10	18.00	20.38	13.01	14.92	14.39	24.62	1.08
1992	3.91	17.85	20.61	44.59	18.04	17.38	24.59	1.04
1993	4.00	20.49	21.02	57.17	23.24	28.71	24.05	1.48
1994	4.61	20.13	21.40	57.03	13.09	18.70	24.24	1.43
1995	5.08	19.34	19.63	72.84	13.53	16.30	24.51	0.59
1996	5.34	19.51	20.03	29.27	13.06	16.71	24.66	0.41
1997	5.46	20.19	19.97	8.53	7.17	14.54	24.72	0.45
1998	5.61	19.92	19.52	10.00	10.11	7.10	24.72	0.34
1999	4.24	20.99	20.73	6.62	12.81	10.11	24.81	0.55
2000	4.25	21.05	20.85	6.93	11.69	22.05	24.96	0.64
2001	4.36	20.88	20.90	18.87	15.26	15.24	25.03	0.09
2002	4.36	20.91	21.35	12.88	16.67	11.14	25.28	0.09
2003	4.30	20.78	21.42	14.03	14.22	12.12	25.37	0.07
2004	4.32	21.54	21.35	15.00	13.70	14.42	25.63	0.41
2005	4.46	23.41	22.33	17.86	10.53	17.70	25.89	1.35
2006	4.52	23.55	22.30	8.23	9.75	14.88	26.20	1.12
2007	4.51	23.61	22.52	5.39	10.29	13.83	26.35	0.11
2008	4.60	23.68	22.83	11.58	11.87	15.53	26.55	0.06
2009	4.53	23.63	22.87	12.54	12.96	8.67	26.41	0.03
2010	4.61	23.71	22.52	13.74	6.52	12.10	26.63	0.04
2011	4.61	23.75	22.90	10.83	5.69	15.51	26.75	0.06
2012	4.71	23.75	22.68	12.22	8.41	13.09	26.86	0.02
2013	4.77	23.76	22.44	8.50	7.95	9.88	26.98	0.01

2014	4.83	23.77	22.27	8.05	9.34	7.07	27.08	0.01
2015	4.79	23.75	21.84	9.01	9.15	2.78	26.92	0.01
2016	4.71	23.70	21.96	15.70	7.50	2.68	26.73	0.03
2017	4.62	23.82	21.60	16.50	9.55	5.47	26.65	0.06
2018	4.70	23.91	20.47	12.10	9.70	7.69	26.77	0.11
2019	4.82	23.89	21.56	11.40	8.90	6.51	26.89	0.05
2020	4.78	23.57	21.59	13.25	4.65	3.31	26.79	0.19
2021	4.76	23.69	21.92	16.95	4.21	6.25	26.81	0.16

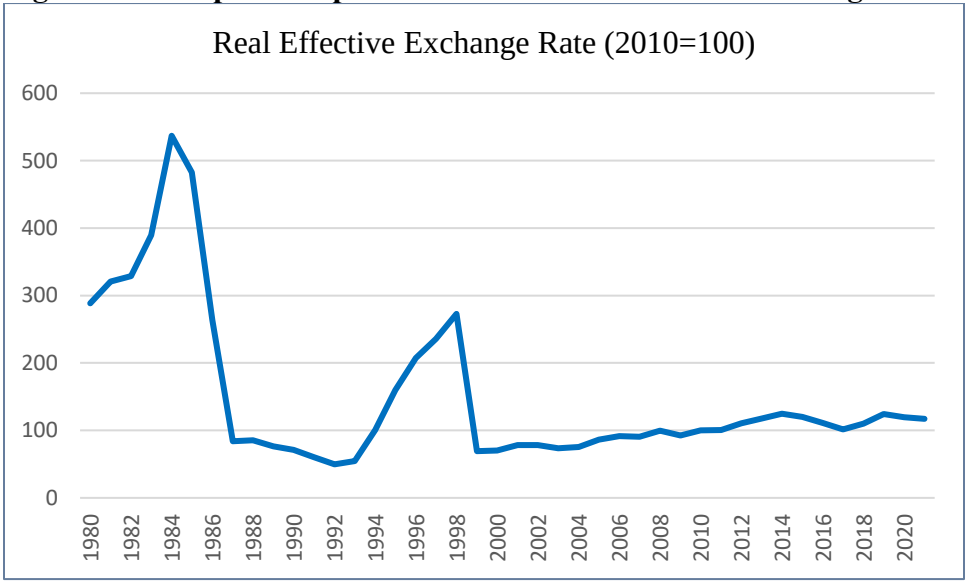
Appendix 2:

Figure A1: Remittances to SSA & Nigeria



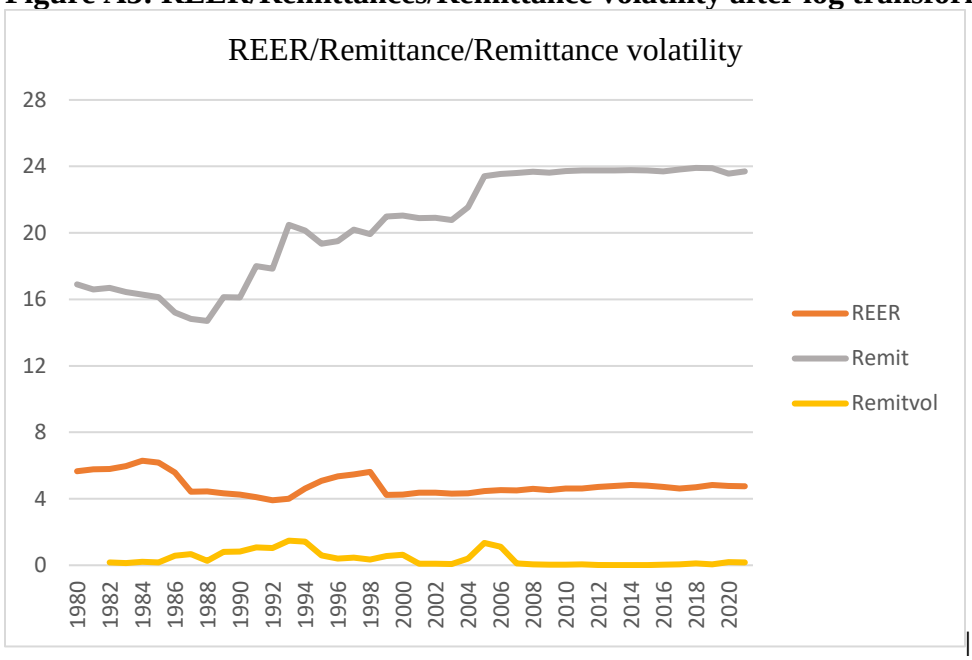
Source: World Development Indicators (World Bank, 2021)

Figure A2: Graphical representation of Real Effective Exchange Rate



Source: World Development Indicators (World Bank, 2021)

Figure A3: REER/Remittances/Remittance volatility after log transformation



Source: Author

Appendix 3: Result with Structural Break in REER

	REMIT	FDI	OIL RENT	REMIT VOL	INFL	DIR	GDP	SB(REER)
COEFFICIENT	-0.091	-0.03	-0.03	-0.37	-0.002	-0.15	-0.2	-0.93
STD-ERROR	0.02	0.04	0.01	0.1	0.005	0.008	0.06	0.12
P-VALUE	0.001*	0.58	0.004**	0.01	0.67	0.000*	0.003	0.0001*

To test if the structural break in REER in 1987, has any significant impact on the outcome of the model, I included a dummy variable in the model, SB(REER).

The result showed the structural break term was significant. However, the inclusion of the structural break term altered sign of the coefficients for remittance volatility, Oil rent, and GDP which were positive in the original model.

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