DOES EXCHANGE RATE AFFECT REMITTANCES IN NIGERIA?

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ABSTRACT. The size and rate of remittances to Nigeria are remarkable. However, theories do not unanimously pin down the effects of exchange rate on remittances. Employing a simple choice-theoretical model, it was discovered that real exchange rate impacted negatively on remittances. This implies that an expected depreciation of the real exchange rate which signals adverse economic conditions back home dwarfs remittance inflows. Thus, although altruism mostly dictates remittances to Nigeria, self-interest or returns-seeking motive is also important.

1. INTRODUCTION

The size and importance of workers' remittances are gaining continuous interest among researchers. Global remittances have increased systematically from less than a billion dollars in the 1980s to US$101.3 billion in 2005 while in 2006, it rose to US$317.9 billion. Four years later, the inflow surged to US$440.1 billion (World Bank, 2011) and by the end of 2013, it was 541.9 billion dollars (World Bank, 2013). This suggests that global remittances experienced an average annual growth of 8.5% between 2006 and 2013.

Although factors driving remittances such as GDP, migration stock, and cost of remitting have received considerable treatment in the literature, the same thing cannot be said of exchange rate. The direction of effect of exchange rate on remittances depends on the purpose of remitting on the one hand and the nature of exchange rate behaviour on the other hand. If remittances are for investment purposes and exchange rate changes are anticipated, depreciation will generate additional cost of investment, thereby attenuating the inflow. In this case, remittances are affected negatively. But if it is unanticipated, remittances will be affected positively (Golberg, 2008). If remittances are altruistic in nature, depreciation is expected to reduce remittances while appreciation is expected to increase it, all things being equal. Thus, the effect of exchange rate on remittances is inconclusive and need to be re-examined.

This study empirically investigates the direction of effects of exchange rate movement on remittances in Nigeria. The country is highest labour exporter in sub-Saharan Africa and remittance inflows are second most important source of foreign exchange after oil revenue. In 2010, Nigeria was the tenth top remittance receiver in the world, sixth in the developing world and first in sub-Saharan Africa (SSA). The World remittances ranking placed Nigeria on the fifth position in 2012 and 2013 (World Bank, 2013). The stock of remittances in the country rose from US$22 million in 1980 to US$1.3 billion in 2000 and rose further to US$3.3 billion in 2005 while by 2013, it stood at $21 billion, an amount that accounted for more than 6 percent of GDP in 2013. (CBN, 2013).

Meanwhile, available statistics show that when exchange rate rose from 0.89 per US dollar in 1985 to 4.01 in 1987, remittances rose from US\$10 million to US\$66 million. When it depreciated slightly from 129 in 2003 to 132 in 2004, remittances rose slightly from US\$9.2 billion to US\$9.9 billion. But when naira appreciated from its value in 2004 to 131.3 in 2005, remittances dropped to US\$3.3 billion. Also, when real exchange rate appreciated form 136.72 in 2000 to 102.7 in 2010, remittances rose dramatically from US\$1.3 billion to US\$10 billion in the same period. This suggests that there could be a relationship between remittances and exchange rate.

There are many studies on remittances in Nigeria. Some examine the effect of the flows on the economic growth and development (Kure & Nwosu, 2008; Osili, 2007; Nwajiuba, 2005; Babatunde & Martineti, 2010; Ogwumike & Olubiyi, 2009; and Adepoju, 2007). Papers such of Adepoju (2007), Adepoju and Weil (2010), Orozo (2007) focus on the characteristics of remittance to the country and their use. Despite the theoretical effect of exchange rate on remittances coupled with what the data say, empirical estimate of the effect is lacking in Nigeria. Countries that have been able to investigate this matter have realized substantial net benefits from remittances inflows by implementing necessary regulatory, market and technological reforms at the required levels (Ratha, 2006; Ketley, 2006 and Kemegue et al 2011). The absence of how exchange rate influences remittances weakens the efforts of the policymakers in optimizing the use of remittances. This study fills this gap by investigating how effective is exchange rate in determining the behaviour of remittances.

After the introductory section, stylized facts about remittances and exchange rate in Nigeria are presented in section two while section three reviews the literature. Section four presents the theoretical framework and methodology while sections five and six present results and concludes respectively.
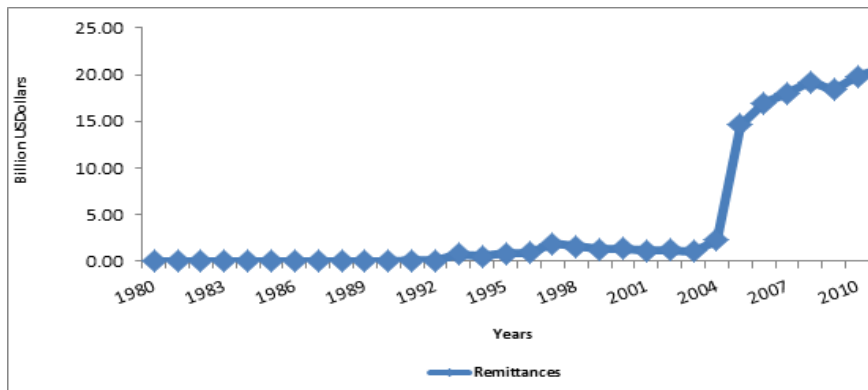

Figure 2.1: Trend of Workers' Remittances (1980-2013). *Source: computed using World Bank Migration and Remittances (2013) dataset published by the World Bank, Washington D.C.*

2. STYLIZED FACTS ABOUT REMITTANCES AND EXCHANGE RATE

Nigeria has been experiencing increased remittance inflows since more than three decades. In the 1980s, remittances were less than one billion dollars but rose steadily to US\$1.4 billion in 2000 (Figure 2.1). Six years later, the inflow increased to US\$16.9 billion and by 2010, the country recorded a sum of US\$19.8 billion. In 2012, remittances rose to US\$20 billion and also rose by one billion dollars in 2013. The reason for the small size of remittances in 1980 could be traced to the small number of Nigerian emigrants, and difficult means of remitting due to scarce financial transfer institution. These reasons also accounted for why remittances were grossly underreported because a large proportion was hand-carried. The marked increase experienced

in 2000 and beyond could be attributed to the proliferation of transfer institutions, increase in the size of emigrants and improved way of recording remittances.

The behavior of real exchange rate index is presented in Figure 2.2 and it is the case that after a relatively stable trend, there was real depreciation from 1986 to 1992 after which a gradual appreciation occurred from 1993 to 1998. Another real depreciation occurred from 1999 to 2001but quickly followed by real appreciation in 2002 through 2010. The exchange rate depreciation experienced in1986and beyond was a fallout of devaluation policy of the authorities following the argument that a major cause of balance of payments crisis experienced in the 1970s and early 1980s was due to exchange rate misalignment.
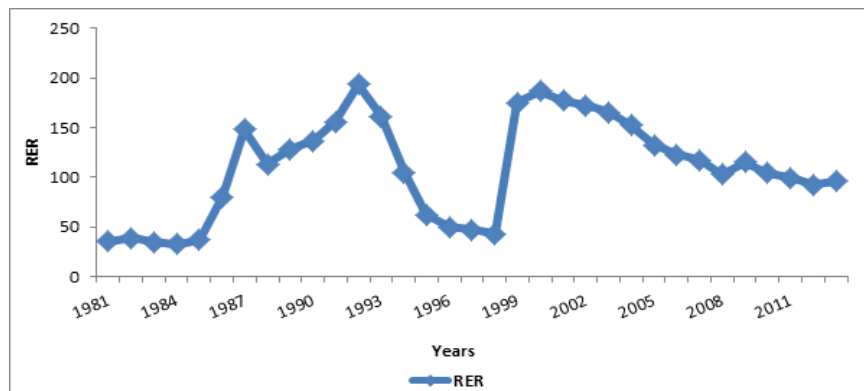

Figure 2.2: Trend of Real Exchange Rate in Nigeria (1980-2013). *Source: computed using the World Development Indicators (2014).*

The real appreciation that occurred in later period could be informed by relatively low inflation rate and large foreign inflow such as remittances, oil revenue, and foreign direct investment. The real depreciation that occurred in 1999 through 2000 could be traced to large import expenditure and rising price level. It is noteworthy that as from 2010 through 2013, exchange rate has been appreciating in real term due perhaps to falling relative price and relatively stable (but high) inflation rate. Generally, during the period of economic boom and high inflation, exchange rate depreciated while during the period of economic downturn, real exchange rate appreciated.
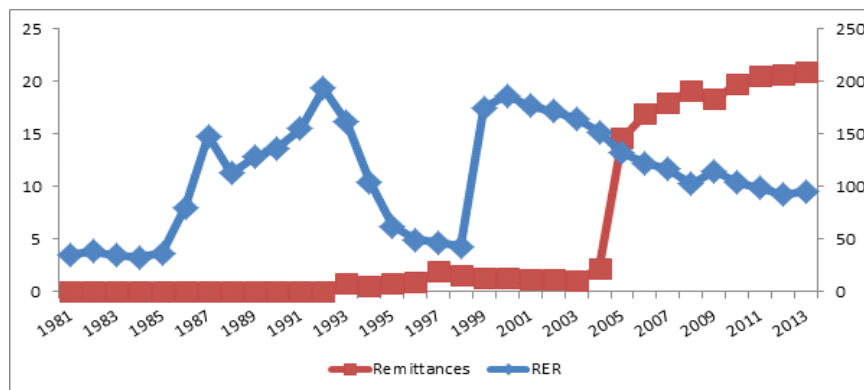

Figure 2.3: The behavior of workers' remittances and real exchange rate in Nigeria. *Source: computed. using World Bank Migration and Remittances (2013) dataset published by the World Bank, Washington D.C and World Development Indicaors (WDI, 2013).*

Figure 2.3 relates remittances to real exchange rate. A close inspection of that graph reveals that during the devaluation regime (1986 to 1992), remittances were on the increase. However, when devaluation gave way to managed floating in 1992, real exchange rate appreciated while remittances continued to increase. The relationship between the two variables is clearly appreciated between 1998 and 2013. First, between 1998 and 2003, when exchange rate was depreciating, remittances were falling. Between 2003 and 2006 when exchange rate appreciated from 186.8 to 132.6, remittances rose from 1.06 billion dollars to 6 billion dollars.Between 2006 and 2013 when real exchange rate continued to appreciate from 132.6 to 102.7, remittances rose to 21 billion US dollars. Thus, this trend suggests that the period of depreciation coexisted with the period of declining remittances while the period of appreciation was associated with the period of increased remittances.

3. Literature Review

The theoretical bases for analyzing the effect of exchange rate behavior on remittances can be traced to the seminal work of Mundell (1963) and Fleming (1962) that establish the Mundel-Fleming condition. The conditions imply that governments face a trade-off between credibility and flexibility (Frenkel 1999; Bearce 2007). Credibility suggests that exchange rate is fixed and can only change when announcement is made in advance. As a result, exchange rate volatility was eliminated or reduced and this encourages international capital inflow such as remittances (Calvo & Reinhart 2002).

In contrast, flexibility is associated with floating exchange rates, which mandates the monetary authorities to adjust interest rates based on economic circumstances. Under flexible rates, the authorities can flirt with monetary variables to stabilize employment and output. Moreover, the exchange rate can adjust to counteract current account imbalances. This flexibility comes at the cost of lower monetary policy credibility, because in the absence of a transparent target for the exchange rate, the public is unsure of policy makers' commitments to maintaining stable prices. The implication of this is that flexibility may not attract more remittances.

Another theoretical link between exchange rate and remittances stems from the motive of remittances - portfolio or self-interest motive. Foreign investors and creditors prefer fixed exchange rate and so, to the extent that remittances are for investment purposes, fixed exchange rate facilitates remittances (Blomberg et al 2005; Frieden 2002; Frieden et al 2001). But under the condition of self-interest motive, floating exchange rate is preferred against fixed exchange rate.

Meanwhile, in a country where exchange rate parallel market exists and if the purpose of remitting is altruistic or self-interest, then devaluation creates arbitrage opportunities for remitters to remit through unofficial channel and reduce remittances through the official channel. Thus, if official exchange rate negatively affects remittances, it could be that parallel market is very active (El Sakka & McNabb, 1999). But if tacit action was observed against parallel market practice, cost of conversion tends to rise and if it rises above the expected premium, remitters will be forced to do conversion through the official exchange rate. It follows that under pegged exchange rate, if the cost of arbitrage opportunities is high in the parallel market, exchange rate may not have any effect on remittances. But if the cost of arbitraging is not so high that it overweighs expected premium, official remittances will decrease while unofficial remittances will increase.

The empirical tests of any of these theories are still scarce and the available ones provide diverse results. For instance, While Swamy (1981) and Straubbaar (1986) argue that there is no significant effect of exchange rate on remittances, Elbadawi and Rocha (1992) and Freund and Spatafora (2005) found negative and significant effect. Yet, Hasan (2008), Faini (1994) and Rajan & Subramanian (2005) provided a positive effect.

Swamy (1981) presented a simple model of remittances that include active parallel market premium in the home country and the difference between the preferential exchange rate for remittances and the official exchange rate in the home country. He found that remittances were not significantly affected by any of the above factors. The same result is suggested by the study of Straubbaar (1986) in the case of Turkey and Germany. But Elbadawi and Rocha (1992) argued that the non-significance of exchange rate on remittances in the Swamy (1981) result was due to the presence of muliticolinearity and small data size thereby, suppressing the threshold difference that exchange rate have to reach before being effective in the remittance model. The black market premium effect attracted the attention of Wahba (1989) when he argued that migrants are investors facing arbitrage conditions, whereby they equate the expected marginal benefits and costs for using black market as a medium of exchange. According to his model which was developed within the framework of portfolio management, remitters face perfect arbitrage conditions with a binary outcome where the migrant either remits all of his savings or remits nothing. The model shows that migrants will channel remittances through the official means if the black market premium is smaller than the cost of using the black market. Using the model for Egypt, it was found that official remittances are sensitive to black market premium. Miranda (1988) and Rocha (1989) came up with the same result for the Marghreb countries.

The works of Elbadawi and Rocha (1992) show that if exchange rate differential (exchange rate misalignment) rises by 10 percent, remittances per capita will fall by about 3 percent. Thus, the extent of exchange rate misalignment determines the presence of arbitrage opportunities which in turn, determine the rate of remitting. By implication, for a given investment project, a large misalignment will require small remittance inflow, since the money will command high premium in the parallel market. In the same vein, Freund and Spatafora (2005) argue that exchange rate misalignment impacted negatively on official remittances. Thus under fixed/ managed-pegged exchange rate regime, official remitting reduces. El Sakka & McNabb (1999) investigate macroeconomic effects on remittances in Egypt. Employing Ordinary Least Square estimation approach, he found that official remittances are highly responsive to exchange rate under managed floating regime, but less responsive under fixed exchange rate regime. Also, in a fixed exchange rate regime, unofficial remittances are highly responsive to changes in exchange rate. Overall, there was negative and significant effect of exchange rate on official remittances. They interpreted the result as meaning that migrants will divert remittances towards the parallel market when the back market premium increases because active parallel market facilitate macroeconomic inconsistency, thereby making official remitting riskier.

However, Hasan (2008) finds, in Bangladesh, that exchange rate impacted positively on remittances. Specifically, if exchange rate increases by 10 percent, remittances to Bangladesh will rise by around 2.5 percent. Faini (1994) assesses the responsiveness of remittances to exchange rate and other macroeconomic variables in five Mediterranean countries. The result indicated that real exchange rate is indeed a significant determinant of remittances. He also discovered that remittances are altruistically motivated.

Rajan and Subramanian (2005) claim that countries that have sound macroeconomic policies to keep the real exchange rate competitive are able to continually attract remittances. Kemegue et al (2011) adopted Generalized Method of Moments (GMM) among others to examine the determinants of remittances in 35 sub-Saharan African (SSA) countries between 1980 and 2008. Their result shows that when cross-sectional dependence of the error term and individual effects are controlled for, the quality of financial service delivery, the investment opportunities in the home country and exchange rate considerations are significant to remittance inflows to SSA.

In summary, the possible effects of exchange rate on remittances is far from simple, and cannot be predicted without specific assumptions about the behavior of remitters, receiver, and economic behaviour. Further the scanty evidence in Africa, both at the aggregate level and on country-specific bases did not allow a robust comparison. Of particular interest, albeit surprise is the absence of empirical investigation in the case of Nigeria despite its position on the remittance ranking and the fact that the country has embarked on series of exchange

rate regimes ranging from fixed exchange rate through crawling pegged to managed-floating. This lack of empirical investigation does not allow for a precise effect of exchange rate on remittances. This paper seeks to fill this empirical gap with the expectation that the outcome of the investigation will be helpful to establish an appropriate exchange rate and/or remittance policy.

4. Methodology

4.1. **Model Specification.** Following the review of literature, a remittance model specified by Faini (1994) is employed. The reason is that the model is not only flexible but also possesses some features of altruism and self-interest theories. Assuming that the migrant's utility is composed of his and his family's consumptions which is represented by a Constant Elasticity of Substitution (CES) function specified as follows:

$$U(C_h, C_f) = [(1-\beta)C_f^{-\delta} + \beta C_h^{-\delta}]^{-1/\delta} \tag{4.1}$$

and a set of constraints is composed of his income in the host country, the income of his family back home, exchange rate and the amount to remit. Equations 4.2 and 4.3 show these specifications.

$$C_h = Y_h + \lambda R = Y_h + R_h \tag{4.2}$$

$$C_f = Y_f - R \tag{4.3}$$

Where C, R and Y indicate consumption, remittances and income respectively, the subscripts f and h refer to the migrants and their families respectively. The migrant family's marginal propensity to consume is β and λ denotes the real exchange rate. It assumed that remittances are expressed in terms of what it can purchase in the home country. Thus, the optimization problem facing the remitter is to establish the level of remittance that will maximize his utility function in equation 1 subject to a set of constraints given in equations 2 and 3. One way of doing this is to first substitute equations 4.2 and 4.3 in equation 4.1, this yields equation 4.4 below

$$U(Y_h, R_h) = [(1-\beta)(Y_f - R)^{-\delta} + \beta(Y_h + \lambda R)^{-\delta}]^{-1/\delta} \tag{4.4}$$

Taking the derivative with respect to R, it is possible to solve for optimal level of remittances given in equation 4.5:

$$\overline{R} = \frac{Y_f - \alpha Y_h}{1 + \alpha\lambda} \tag{4.5}$$

$$\alpha = \left(\frac{\lambda\beta}{1-\beta}\right)^{-1/1+\delta} = \left(\frac{\lambda\beta}{1-\beta}\right)^{-\sigma} \tag{4.6}$$

That is α measures the responsiveness of remittances to changes in family income and σ is the elasticity of substitution $(1/1+\delta)$. There are at least two important features in equations 4.5 and 4.6 that need to be discussed. First, equation 4.5 says that although remittances depend on the level of real exchange rate, the direction is ambiguous. Consider a case in which $\sigma \to 0$, that is, substitution effect is weak. If λ increases (depreciation), remittances will fall and this suggests that income effects are stronger than substitution effects. In a special case where $\sigma = 0$, equation 4.5 becomes

$$R = \frac{Y_f - Y_h}{1 + \lambda} \tag{4.7}$$

This implies that remittances are dominated by income effect following real exchange rate depreciation. But if the substitution effect is very strong, in which case, $\sigma \to 1$, real depreciation of exchange rate will lead to increase in remittances.

The second feature is that the impact of real exchange rate on remittances and the amount remitted depend on the size of β. Suppose that income effects are strong, that is, $\sigma \to 0$, an increase in β would make remittances more sensitive to variations in real exchange rate. Specifically, if β is large, then family's consumption, as a share of total income, will be large and so are remittances. But real exchange variations have a stronger income effect which in turn leads to decline in remittances. Correspondingly, if substitution effect dominates, a larger value of β would imply a smaller impact of real exchange rate variations on remittances but it will be positive. Thus, exchange rate will impact negatively on remittances if income effect is stronger than substitution effect and the marginal propensity to consume is small. But if marginal propensity to consume is large, remittance effect of exchange rate will be positive and large if income effect prevails or small if substitution effect prevails. Given equation 4.7 therefore, remittances equation can be specified as follows:

$$R_t = f(Y, Y^*, E, X) \tag{4.8}$$

Where R_t is the amount of remittances inflow from advanced countries to Nigeria, Y and $Y*$ represent Nigerian income and foreign income respectively, E is the exchange rate while X stands for other catchall variables affecting remittances.

4.2. **Definition of Variables and Measurement Issues.** For the purpose of econometric analysis, we rely on a log-linearization of (7) with the assumption that the remittances elasticity with respect to migrant's income and family's income may not sum to one. The log-linearization also allows us to work with data from different sources and with difference measurement. In this way all the variables are transformed to their respective growth, rather than their respective level. We apply the resulting equation to the real value of aggregate remittances to Nigeria from 1980 to 2013. We include in the set of catchall explanatory variables, the domestic and the foreign nominal interest rates to capture the portfolio allocation motive. Other variables considered are domestic inflation rate and money supply. Inflation rate is included so as to investigate how remittances respond to changes in domestic inflation. Increase in inflation rate reduces real income of the migrant's family and to the extent that remittances are altruistic in nature, this call for more remittances. Suppose remittances are for exchange/portfolio purpose, and the rate of inflation is greater than interest rate differentials, remittances might fall. The inclusion of money supply is to examine the effectiveness of financial development on the decision to remit. Positive effect implies complementarity while negative effect implies substitutability.

Home and foreign income are represented by the per capita income of the respective country. According to Faini (1994) and Kemegue et al (2011), increase in foreign per capita income implies increase in migrant's income and hence increase in remittances. Correspondingly, increase in home per capita income implies increase in migrant's family income and hence reduction in remittances if it is based on altruistic motive or no relationship if it is based on exchange motive. Real exchange rate is nominal exchange rate adjusted for relative price level. Foreign price level is represented by the US general price level. The US general price level is used as proxy for foreign price level because first, it is commonly used in the literature and second, more than 60% of Nigeria remittances are from the US (Olubiyi, 2009). Interest rate in this case is deposit, rather than lending rate while inflation is the percentage change in the consumer price index. Finally, money supply is represented by broad money (M2). Following the definition of the variables, the estimable equation is given by equation 4.9

$$\ln R_t = \beta_0 + \beta_1 \ln Y_t^h + \beta_2 \ln Y_t^f + \beta_3 \ln EXH_t + \\ + \beta_4 (r_t^h - r_t^f) + \beta_5 INF_t + \beta_6 M2_t + \varepsilon_t \tag{4.9}$$

Where Rt is the amount of remittances inflow at time t, Y is GDP per capita, EXH is the real exchange rate index, r is deposit rate. Letters t, h and f stand for time; home (Nigeria) and foreign (US) respectively while ε is the stochastic disturbance.

Except for remittances, data for all the variables were sourced from the World Development Indicators (2014) published by the World Bank, Washington D.C. Data on remittances were extracted from the IMF Balance of Payments Yearbook (2012) published by the International Monetary Fund.

4.3. **Methodological issues and estimation technique.** Equation 4.9 assumes the absence of serial correlation, that is, $cov(\varepsilon_i, \varepsilon_j) = 0$; $i \neq j$. However, in the event where some variables were not readily observed, the existence of serial correlation is not impossible. Another problem in the equation is that the error distribution appears to depend on the regressors' distribution, that is, there is the possibility of heteroskedasticity. Although this problem can be dealt with using appropriate Instrumental Variable (IV), the IV estimates of the standard errors are inconsistent, preventing valid inference. These problems can be partially addressed through the use of heteroskedasticity consistent or "robust" standard errors and statistics. However, the usual approach today is to use the Generalized Method of Moments (GMM), introduced by Hansen (1982). The GMM estimator produces consistent results even in the presence of serial correlation (and heteroskedasticity if the sample is sufficiently large).

However, for GMM to be the appropriate estimation technique, it must satisfy the condition of relevant and valid IV (Baum & Schaffer, 2003). The IV will be relevant if it correlates with the endogenous regressors and at the same time orthogonal to the errors. The validity condition implies that the number of the IV must be greater than or equal to the number of the explanatory variables. The J-statistic, developed by Hansen (1982) gives the value of GMM objective function evaluated using an efficient GMM estimator. If the set of IV is equal to the number of regressors, then the value of J will be zero. Otherwise, J will be greater than zero. The J-statistic behaves like $\chi 2$ random variable with degree of freedom equals the number of overidentifying restrictions. The GMM specification of equation 8 after log-linearizing all the variables is provided in equation 4.10:

$$
\begin{aligned}
\Delta \ln R_t = {} & \beta_0 + \beta_1 \Delta \ln R_{t-1} + \beta_3 \Delta \ln Y_t^h + \beta_2 \Delta \ln Y_t^f + \\
& + \beta_4 \Delta \ln EXH_t + \beta_5 \Delta(r_t^h - r_t^f) + \beta_6 \Delta INF_t + \beta_7 \Delta M2_t + \Delta \varepsilon_t \quad (4.10)
\end{aligned}
$$

5. PRESENTATION OF RESULTS

The descriptive statistics of the variables is presented in Table 5.1. Between 1980 and 2013, average inflation rate was 21% while average interest rate differential was -5.84. This implies that on average, the deposit rate of the US was higher than that of Nigeria. The mean of log of money supply was 26.4 while the average growth of per capita income of Nigeria and the US were 10.9 and 10.44 respectively. The mean log of remittances was 17.04 while the mean value of real exchange rate was 4.53.

Table 5.1: Descriptive Statistics of the Variables					
Variable	Obs	Mean	Std. Dev.	Min	Max
INF_t	33	21.01	18.68	5.38	72.84
$(r_t^h - r_t^f)$	33	-5.84	13.87	-36.12	22.49
$\ln R_t$	33	17.04	2.00	13.29	20.08
$\ln M2_t$	33	26.37	2.19	23.35	30.04
$\ln EXH_t$	33	4.53	0.62	3.49	5.26
$\ln Y_t^h$	33	10.93	0.15	10.68	11.30
$\ln Y_t^f$	33	10.44	0.18	10.13	10.68

The minimum rate of inflation was 5.4 and it was experienced in 2007. The minimum interest rate differential was -36.12 and it occurred in 1992. It must be recalled that 1992 marked another round of political tension and large scale insecurity in the country. During this period, the country experienced economic downturn and the banking sector was not financially sound. Minimum log of money supply was 23.35 and it occurred in 1981, the period when

the banking sector has not been regulated and when the economy was suffering from various economic crisis. The log of per capita income in Nigeria recorded its lowest in 1984 with a value of 10.68 while that of the US recorded its lowest in 1984 with 10.13. The maximum per capita income in Nigeria occurred in 2010 while that of the US occurred in 2007. Remittances had its lowest growth in 2001 with 13.29 while real exchange rate experienced lowest value of 3.49 and it occurred in 1984.The maximum inflation rate occurred in 1995 with 72.84% while the maximum interest rate differential occurred in 2009. In the same vein, the maximum log of money supply was 30.04.

The correlation matrix of the variables is presented in Table 5.2. Some pairwise relationships were significant while some were not significant. Those pair variables having significant relationship include inflation-interest rate differentials, remittances-interest rate differentials, money supply-interest rate differentials, Nigeria per capita GDP-interest rate differentials, US per capita-interest rate differentials, money supply-remittances, Nigeria per capita income-remittances, US per capita income-remittances, Nigeria per capita income-money supply, US per capital income-money supply and US per capital income-Nigeria per capital income. Our variables of interest, real exchange rate-remittances were significant so also is real exchange rate-money supply.

Inflation and deposit rate differential were negatively related and the relation was strong. This implies that any time Nigeria inflation rises, the difference between the country's deposit rate and that of the US will fall. Money supply and interest rate differential are positively but weakly related. The same relationship was found for interest rate differential and Nigeria per capita income on one hand and the US per capita income on the other hand. Remittances showed a negative but weak relationship with interest rate differential while with real exchange rate, the relationship was strong and negative. The relationship between inflation and money supply was positive but very weak suggesting that increase in money supply is a sign of increased inflation in Nigeria, but since the relationship is weak and insignificant, such relationship may not count. The relationship between inflation and Nigeria per capita income was negative and relatively strong. Thus, any time inflation increases, people's purchasing power is expected to fall or vice versa. The same scenario exists in the case of the relationship between inflation rate and the US's per capita income. Remittances and inflation are positively but weakly related. That is, high inflation rate implies low remittance inflows. Perhaps the reason for this is that increased inflation which in turn leads to decreased purchasing power will require emigrants to send more money so as to counter the effect of inflation on consumption.

Table 5.2: Pairwise Correlation Coefficients showing the relationship between remittances and real exchange rate							
	$(r_t^h - r_t^f)$	INF_t	$\ln R_t$	$\ln M2_t$	$\ln EXH_t$	Y_t^h	Y_t^f
$(r_t^h - r_t^f)$	1						
INF_t	-0.5913*	1					
$\ln R_t$	-0.0218*	0.2488	1				
$\ln M2_t$	0.3952*	-0.1734	-0.4110*	1			
$\ln EXH_t$	-0.0513	0.0829	-0.5180*	0.5079*	1		
Y_t^h	0.4028*	-0.2241	-0.437*	0.8365*	0.3102	1	
Y_t^f	0.3665*	-0.1744	0.4982*	0.9677*	0.6097*	0.7323*	1
Note: * denotes significance at 5% level							

Remittances and money supply are negatively and relatively strongly related. Thus, when money supply increases, remittances will fall, or it may be that anytime remittances fall, increase in money supply is implied. Remittances relate negatively and strongly with Nigeria per capita income. This suggests that remittances tend to be countercyclical, raising income during economic downturn or during high inflation and dampening it during booming period. The US's per capita income has a positive relationship with remittances and the relationship

was relatively strong. This suggests that when the US economy is doing fine, remittances will increase.

The relationship between real exchange rate and remittances is negative and strong. In this case, depreciation implies decline in remittances. Meanwhile, it may also be the case that if remittances increase, real exchange rate falls. Hence the result shows that exchange rate depreciation (appreciation) discourages (facilitates) remittances.

The estimation of the (baseline) OLS version of equation 9 alongside some basic diagnostic tests are presented first and later the GMM results. The result of the determinants of remittances in the absence of real exchange rate is presented in Table 5.3. This Table answers the question: in the absence of real exchange rate, how will remittances respond to their determinants?

The statistical properties of the model are presented at the bottom of the Table. The result shows that all the variables used in the model were jointly significant, given the p-value of the F-statistics. The regressors were able to explain 78% of total variation in remittance inflow to Nigeria. The root mean squared error (MSE), B-G serial correlation and B-P-G heteroskedasticity show evidence of serial correlation and heteroskedasticity problems. Nevertheless, four out of six variables considered to determine remittances were significant. These are the interest rate differentials, Nigeria per capita income, the US per capita income and lagged remittances. Recall that interest rate differential is used to capture the financial decision of the remitter, that is, changes in interest rate also dictate changes in the financial wealth and hence, changes in remittances. The coefficient of the interest rate differential was small, negative and statistically significant. The interpretation of this is that although asset financing is important for remitting, it appears not to notably affect remitting behavior of migrants. This could suggest that altruistic rather than financial motive tend to dominate remitting behavior in Nigeria. Inflation does not play any role in remittances behavior in Nigeria, even though it shows positive effect. This suggests that remitters tend not to incorporate inflation into their remitting decision. There is no effective role played by the financial sector in remittances decision. This is established by the insignificance of the coefficient of broad money (M2) in the model.

The effect of Nigeria's per capita income on remittances was negative and significant. It must be noted that per capital income in the remittances model was used to capture altruistic motive of remitting. If per capita income falls, remittances will rise if altruistic purpose prevails. The baseline result shows that per capita income is an important determining factor of remittances and this further validates the assumption of altruistic motive.

Table 5.3: Long run estimation result of the				
determinants of workers' remittances in Nigeria				
$\ln R_t$	Coef.	Std. Err.	t	P>|t|
$(r_t^h - r_t^f)$	-0.02	0.00	-4.82	0.00
INF_t	0.001	0.01	-0.29	0.77
$\ln M2_t$	-0.49	0.57	-0.86	0.40
Y_t^h	-1.71	0.59	-2.89	0.05
Y_t^f	0.26	0.13	1.97	0.10
_cons	-1.61	1.51	-1.06	0.48
$Prob > F = 0.00$				
$R - squared = 0.98$				
$Adj R - squared = 0.72$				
$Obs = 33$				
$Root MSE = 1.03$				
$B - G Serial Corr LM Test : Prob.F(1, 22) = 0.049$				
$B - P - G Hetero Test : F(7, 23) = 00.02$				

When real exchange rate was introduced in the remittances model, there was no change in the signs but there were changes in the magnitude of effect (Table 5.4). To start with, the variables are jointly significant, given the p-value of the F-statistics. The inclusion of real exchange rate has increased the proportion of variation that was explained by our regressors in total variation. In this case, our regressors can explain around 80% of total variations in remittance inflow.

Table 5.4: OLS Result Showing the				
Effect of RER on Workers' Remittances				
$\ln R_t$	Coef.	Std. Err.	t	P>|t|
$(r_t^h - r_t^f)$	-0.09	0.03	-3.52	0.00
INF_t	0.001	0.01	-0.33	0.74
$\ln M2_t$	-0.82	0.62	-1.33	0.20
Y_t^h	-2.30	1.01	-2.28	0.05
Y_t^f	0.31	0.09	3.38	0.00
$\ln R_{-1}$	0.63	0.17	3.82	0.00
$\ln REXR$	-0.69	0.17	-4.16	0.00
Cons	-93.98	74.72	-1.26	0.22
$Prob > F = 0.00$				
$R - squared = 0.79$				
$Obs = 32$				
$Adj R - squared = 0.73$				
$Root MSE = 1.02$				

Four explanatory variables positively affected remittances while three negatively affected it. Also, out of the seven regressors, five have a significant effect on remittance inflows. The first four variables mentioned in the first analysis maintained their significance while real exchange rate joined. Meanwhile, the magnitudes of effect have changed. In particular, 10% increase in interest rate differential will now lead to 0.9% increase in remittances. This magnitude of effect has increased slightly compared to the baseline result, and this implies that exchange rate appears to play effective role in the decision guiding factor movement. Inflation still shows negative but insignificant effect on remittances. In the same vein, the financial sector of the economy appears not to play any important role in remittance decision. However, the result shows that financial sector tends to substitute remittances. That is when the financial development improves, remittances decline but when there is no improvement, remittances increase. The magnitude of effect of the country's per capita income also increases and this clearly shows the countercyclicality capacity of remittances in Nigeria. In particular, if the country's per capita income increases by 10%, remittances will fall by 23.0%. Observably, the model still confirms the altruistic motive of remitting in Nigeria. If the per capita income in the US increases by 10%, remittances are expected to increase by 3.1%. This increase could be traced to altruistic and investment portfolio decisions of the remitter. If the economic condition of the country is good or if the remitter intend to come back home, increase in his income could lead to increase in remittances for the purpose of investing in the home country.

Lagged value of remittances play important role in the remitting behavior of migrants as the estimated coefficient was positive and significant. This implies that remittances behavior is dynamic and pointing to the fact that the extent of remitting depends on the utilization of previous remittances. Such dynamics will be more telling when remitters are carrying out some investment projects in the home country or when the inflows are used as instructed.

Real exchange rate showed a negative and significant effect on remittances with a coefficient of -0.69. This suggests that a 1% increase in real exchange rate (one percent real depreciation) led to 0.69% decline in remittances. Therefore, during depreciation, fewer dollars are sent back home since depreciation has increased the quantity of domestic currency (naira in this case) per unit of foreign currency (dollar). Conversely, 1% decrease in real exchange rate (one percent real appreciation) led to 0.69% increase in remittances. The result therefore indicates that

an expected depreciation of the real exchange rate signals to adverse economic conditions in the home country leading to a fall in remittance inflows while an expected appreciation of the real exchange rate which signals strong economic fundamentals would result in an increase in remittance inflows.

It must be recalled that the estimated coefficients in the OLS results are inconsistent and inefficient owing to the presence of endogeneity and heteroscedasticity noted in the Table 5.4. Thus, an alternative estimation technique that is generally used to address these problems is GMM (see equation 10). The GMM specification was estimated and the result is presented in Table 5.5. Compared to the baseline (OLS) results, the GMM actually improved the efficiency and consistency of the coefficients. This is indicative from all the diagnostic tests, including overidentification tests shown at the bottom of the table. Furthermore, the value of Wald statistic shows that the independent variables are jointly significant (Arellano and Bond, 1990). In the GMM result, our variables were able to explain approximately 90% of total variation in remittances, implying that the model better fits the data than the earlier ones.

While there was no change in the direction of effect, there were notable differences in the magnitude of the estimates. It is also of note that the lagged dependent variable was positive and significant, suggesting that most of the omitted variables would have been reduced to the barest minimum. It is of interest to find out that inflation, and money supply appear not to play significant role in the remitting behavior of the emigrants. The per capita income of both source (Nigeria) and destination (abroad) consistently prove to be very important decision variables for the remitters. The countercyclicality of remittances is also established in this result since increase in Nigeria's per capita income tends to reduce the rate at which emigrants remit. Therefore, remittances will increase during the period of low income due to economic downturn but increase during recovery period. This clearly establishes the altruistic motive of remittances in Nigeria. Furthermore, remittance decision appears to be contingent on the economic behavior of the destination country. Since the estimated value was 0.3, it follows that if remittances were perceived in terms of goods, then it is a normal good, responding positively to changes in income. Interest rate differential still maintains a significant inverse relationship with remittances and its magnitude of effect was notably smaller. This suggests that remitters tend to reduce the rate at which they remit if foreign interest rate is relatively favourable.

Both nominal (EXR) and real exchange rates (PEXH) were significantly and inversely related to remittances with nominal exchange rate having higher effect. This result shows that without controlling for relative price level, remittances respond faster to changes in exchange rate in a reverse order. In this case, depreciation will necessitate large reduction in remittance inflow while appreciation will lead to large increase in remittances.

But when consideration is given to the real value of exchange rate, the rate of change in remittances with respect to changes in real exchange rate is slower. This suggests that relative price level also play important role in the responsiveness of remittances to exchange rate. Since the response is slower than the case of nominal, it means that even if there is exchange rate depreciation while the general price level is high, the rate of remitting will decline slightly because the remitter has to incorporate the real value of the amount sent in terms of its purchasing power which is anchored on not only the mere value of exchange rate but also on the general price level. Therefore both relative price and nominal exchange rate matter for remittance decision.

Our model predicts that if the elasticity of real exchange rate is negative, then substitution effect is weak and income effect is strong. Meanwhile our model proposes that substitution effect is weak if exchange rate depreciation leads to increased consumption of domestic goods by the recipients, but dominates if the emigrants demand for more home goods following currency depreciation, because it has now become cheaper, thereby substituting home goods for foreign goods. Since the result shows a negative estimate of elasticity of real exchange rate, it is the case that the substitution effect is weak and the income effect dominates. The interpretation of this is that real depreciation of exchange rate allows recipients in Nigeria to substitute

remittances for income in purchasing domestic goods. This suggests that a substantial portion of remittances was used to settle the recipients' spending obligations. It could also mean that the amount remitted was spent to carry out remitters' projects at home which could not be established at the country of residence. Whichever way, it is the case that the substitution effect of remittances arising from changes in real exchange rate is weak in the case of Nigeria.

Table 5.5: GMM result of the relationship			
between remittances and real exchange rate			
$\ln \Delta R_t$	Coeff	z	P>|z|
$\ln \Delta EXH_t$	-0.812	-2.700	0.007
$\ln \Delta R_{-1}$	0.236	1.920	0.087
$\Delta(r_t^h - r_t^f)$	-0.032	-2.250	0.021
ΔINF_t	0.007	0.560	0.579
ΔY_t^h	-1.214	-3.100	0.002
ΔY_t^f	0.336	2.980	0.003
$\Delta \ln M2_t$	2.048	1.430	0.152
$\ln \Delta REXR_t$	-0.252	-2.300	0.021
_cons	0.110	3.480	0.001
$Wald chi2(8) = 145.100$			
$Adj - R - squared = 0.899$			
$obs = 30$			
$Hansen\prime s J test = 2.388$			
$Hansen\prime s J(prvalue) = 0.665$			

6. CONCLUSION AND POLICY IMPLICATION

This paper investigates the effects of exchange rate on remittances in Nigeria. We employ a simple choice-theoretical model using alternative estimation techniques. Our findings reveal that real exchange rate impacts negatively on remittances. This suggests that depreciation of the real exchange rate which signals adverse economic conditions back home tends to reduce remittance inflows. Conversely, appreciation of the real exchange rate which signals to strong economic fundamentals increases remittance inflows. The empirical result confirms the graphical exposition and correlation results discussed earlier. Meanwhile the results also confirm that economic conditions of Nigeria and altruism strongly drive remittances in Nigeria. This is in line with the findings of Singh et al. (2009). Furthermore, the negative and statistically significant coefficient of interest rate differential shows that emigrants reduce remittances when domestic (home) deposit rate is not encouraging. This improves on earlier findings by Katseli and Glystos (1986) that a negative interest rate differential between home and foreign interest rates had no relationship with remittance inflows. This is more consistent with self-interest remittance inflows than altruism.

The self-interest motive is further strengthened by the negative and statistically significant coefficient of the real exchange rate. This is understandable due to the assumption that returns on investment are in home country currency units hence a real exchange rate appreciation would be preferred to depreciation by returns seeking emigrants. This aligns with Higgins et al. (2004) who finds that exchange rate uncertainty as a measure of risk is significant to remittance inflows. These results confirm that although altruism motive mostly dictates remittances inflows to Nigeria, self-interest or returns seeking motives are also important drivers. Our result shows that financial sector plays a mild role in remittance inflow, an indication that remitters are not yet convinced that the financial institutions are well developed. However, since remittances are strongly driven by altruism, a large proportion of the amount sent home are not banked and this could be responsible for the mild effect.

Following these conclusions, it is recommended that the authorities should implement policies that will enhance real exchange rate appreciation if Nigeria wishes to harness remittance inflows

for investment purpose. Doing may discourage conspicuous spending, generate employment and also increase output. Furthermore, the appreciation will favour importation of capital and intermediate goods necessary to grow the industrial sector. However, real appreciation may also lead to increase in importation of final goods and to the extent that final good imports outlay outweighs capital goods outlay, the appreciation may inflict more injury on the balance of payments, thereby, causing macroeconomic imbalances. To prevent this situation, policy of exchange rate appreciation should be implemented alongside policy that will discourage imports of final goods.

Apart from appropriate exchange rate policy and internal policy that will discourage importation of final goods, domestic deposit rate that will encourage banked remittances is recommended. If the deposit rate cannot be generalized (in which case, all depositors will benefit), special rate can be arranged with remitters. For this to be effective, the financial system must be well developed. This would further mitigate its negative impact on macroeconomic variables such as money supply, and inflation. Many Latin America, South Asia, Eastern Europe and Mediterranean regions have financed various community based development projects through official remittances.

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