

# Workers' Remittance and Their Effect on the Level of Investment in Nigeria: An Empirical Analysis

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## Abstract

Despite the increasing importance of remittances in total international capital flows, the relationship between remittances and stock of capital formation has not been adequately studied. This paper studies one of the links between remittances and fixed capital formation, in particular how local financial sector development influences a country's capacity to take advantage of remittances. Using time series data for the period 1977-2010, the study employed the ADF and Philip-Perron modified unit root tests and based its analysis on a Dynamic Ordinary Least Squares- two-stage Instrumental Variable [2SIV] approach to control for the endogeneity problem that arises from utilization of lag independent variables. We find that remittances boost stock of physical investment in Nigeria countries with positive relationship with developed financial systems by providing complementarities to finance investment in a developed financial system. Substantial government allocation on social services is equally important in accelerating capital formation. The findings of this study strongly suggest that for Nigeria to benefit from international transfers, Nigeria financial sector should be fine-tuned to complement remittances potential capital formation.

**Keywords:** workers' remittances, investment, dynamic, ordinary least squares, Nigeria

## 1. Background

Developing countries have experienced a tremendous surge in the inflow of remittances in the past decades. The phenomenon became a major source of foreign exchange earnings, exceeding private capital flows, export earnings and foreign aid. In 2007, officially recorded worldwide migrants' remittances were \$385 billion, \$278 billion of which was to developing countries. The worldwide figure rose to \$440 billion in 2010, of which that of developing countries reached \$325 billion. Registering a quick recovery to the level in 2008, remittances fell only 5.4 percent in 2009 compared to a 36 percent decline in foreign direct investment (FDI) between 2008 and 2009 and a 73 percent decline in private debt and portfolio equity flows from their peak in 2007 in the face of the economic crisis (World Bank, 2011).

Nigeria remains the single largest recipient of the phenomenon in Sub-Sahara Africa while receiving between 30 percent and 60 percent of the region over the last decade (Chukwuone *et al*, 2008). Remittance flows to the country amount to US\$9 billion in 2009 with a growth rate of 4.8 percent between 2009 and 2010 (World Bank, 2010). The overwhelming majority of remittance in Nigeria is person to person flows mainly from the United States, the United Kingdom, Italy and other Western Europe countries. Chukwuone *et al* (2008) believe that inflows from abroad have been key stabilising factors to the Nigeria naira against other international currencies in the past three years.

Given the tremendous increase in remittance inflows into the developing world including Nigeria, economic impact on the receiving country emerged an important topic of study. If remittances are a source of a country's capital resource, along with foreign investment, domestic savings and foreign aid, economic theory predicts a positive long run effect on the economic growth prospects of the recipient country. However, if remittances are primarily used by households to alleviate short-term cash constraints through consumption activities, the anticipated outcome would be poverty reduction for the recipient economies through improved living standards. These economies could have access to better health care and education improving their overall well-being,

advancing a country's capital formation with the expectation of a positive impact on long-term economic growth. This study seeks to examine whether or not the Nigerian Diaspora and their remittances do leverage physical investment improvement in Nigeria. A closer reading of the literature suggests that the research on the related issue dominate journal articles from the perspective of growth but say little on their physical investment channel. Not surprisingly, the verdict of such literature is ambiguous, shaky and fails to underpin the impact of the resources in Nigeria settings. Moreso, in an attempts to unpack the unknown quantum, namely the probe into remittance –investment growth nexus, the study realises that the current fragmentary evidence of the impact of Diaspora and remittances on growth enhancements precludes a conclusive verdict in literature and that the subject requires more empirical evidence particularly in Nigeria where the subject matter is to our knowledge very scarce.

Following the introduction, the rest of the paper is organized into four sections. Section two presents the remittance trends and stylized facts. In section three, the literature is reviewed. Section four consists of the methodology - theoretical underpinnings and model specification and method of data analysis is presented. Presentation of results and discussions are done in section five and the paper concludes in section five with concluding remarks and recommendations.

Overall, examination of the stylized facts based on the aggregate quantity of workers' remittances reveals remittances' relative global macroeconomic importance. Flows of workers' remittances have been growing consistently over time and now represent the largest balance of payments inflow to Nigeria. Their relative stability versus that of other inflows to Nigeria may provide additional macroeconomic benefits in terms of cyclicity of output and consumption, issues that this study will not examine.

## 2. Trends of Remittances and Stylised Facts

Remittance flows proved to be resilient during the global financial crisis and became even more important as a source of external financing in many developing countries. Officially recorded remittances sent to developing countries reached \$325 billion, registering a quick recovery to the level in 2008. India was the largest developing country recipient of workers' remittances in 2010 with US\$53.1 billion, followed by China, Mexico, Philippines, Bangladesh, Nigeria, Pakistan, Lebanon, Vietnam and Egypt (Figure 1).

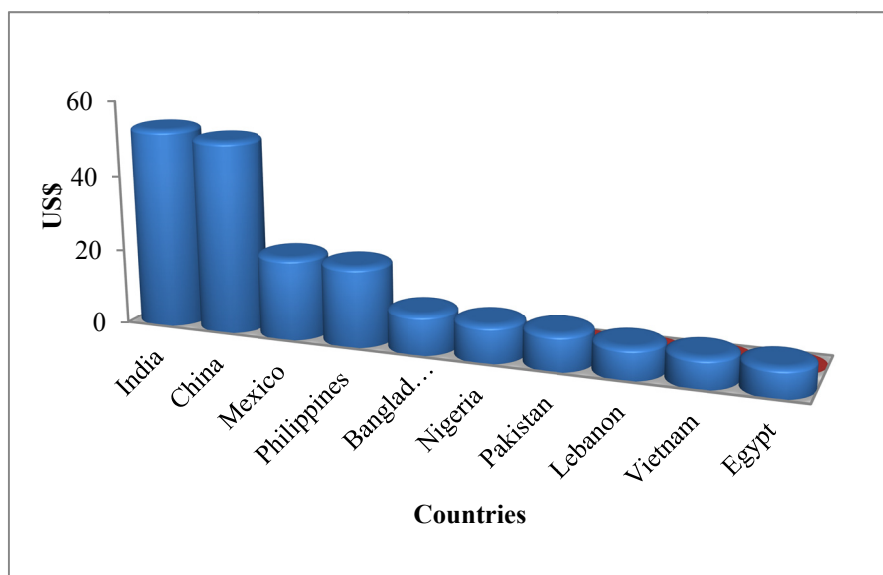


Figure 1. Largest recipient of remittances in developing countries in 2009

Source: World Bank Statistics (2010) and authors' calculation.

In sub-Saharan Africa, Western Africa receives high level of the remittances as percentage of GDP to the entire block, with Gambia, Togo, Senegal and Cape Verde in descending order, dominating the pack. Although Nigeria remain unarguably the highest recipients in absolute term (figure 2).

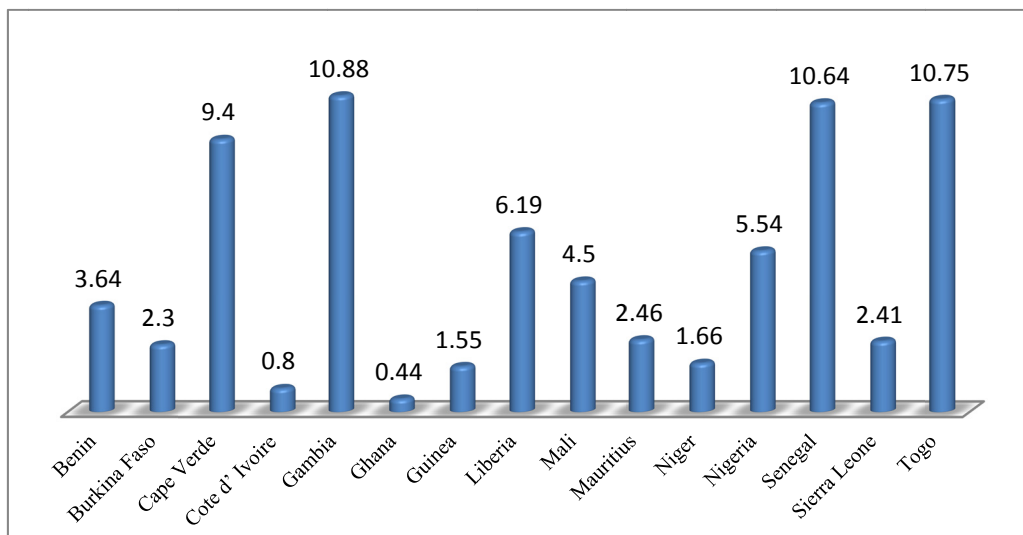


Figure 2. Remittance as %GDP in West African countries, 2010

Source: World Bank Statistics (2010) and authors' calculation.

In terms of their importance in the balance of payments and their contributions to economic performance, workers' remittances recently exceed both official aid and FDI capital flows to Nigeria and have generally displayed much less variability than other balance of payments (figure 3). The next section reviews the literature.

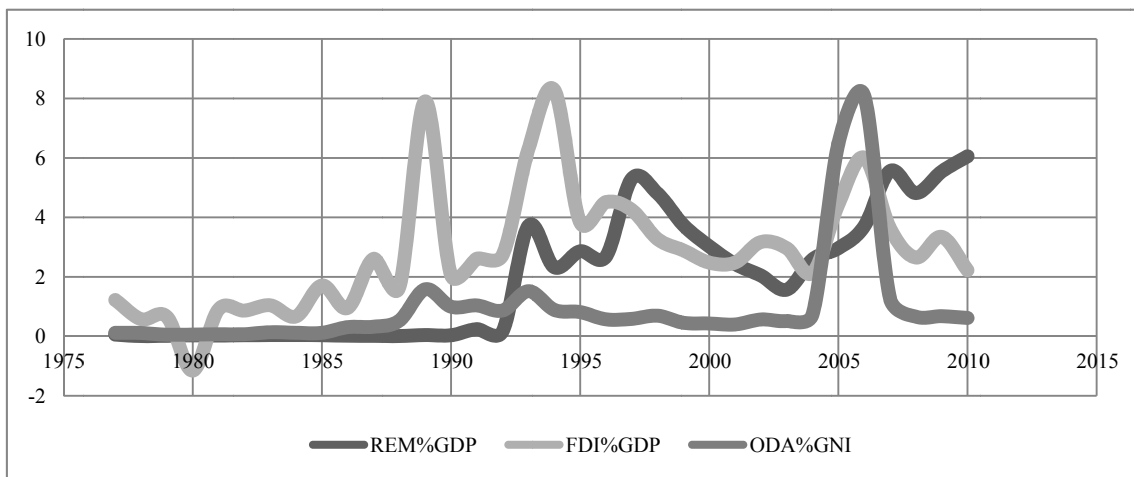


Figure 3. Ratio of remittances, official flows and FDI to GDP in Nigeria, 1977-2010

Source: World Bank Statistics (2010) and authors' calculation.

### 3. Empirical Literature Review

According to the World Bank (2006) remittances are more effective in both raising investment and enhancing growth in countries with higher levels of human capital, strong institutions, and good policy environments. Remittances are a stable form of external finance and often increase during times of economic hardship (Biller, 2007). In contrast, remittances can also deteriorate the balance of trade by stimulating an increase in imports (Biller, 2007). Remittances also have the tendency to create demand for leisure and reservation wages that as a consequence can reduce the participation of persons in the productive labour force, thus reducing the labour supply (Fajnzylber & Lopez, 2007 and Griffin et al, 2008). Lucas (2005) found that remittances impact positively on investment in India, Morocco and Pakistan. The results from a study conducted by Leon-Ledesma and Piracha (2004) for 11 transition economies of Eastern Europe for the period 1990-1999 affirm the view that remittances have a positive impact on productivity and employment, both directly and indirectly, through investment.

Similarly, Ratha (2003) provides empirical evidence that remittance is a component of foreign savings which complement the total pool of resources available to investment in Mexico, Egypt and sub-Sahara Africa. Extending the work of Ratha, Amavilah (2008) and Kagochi *et al* (2010) examine the relationship between remittances and economic growth in a cross-country panel data analysis of six Sub-Saharan Africa (SSA) countries within the conventional neoclassical growth framework. The results of the study suggests that while remittances have a positive impact on economic growth of SSA countries with high GDP per capita they do not cause direct impact on economic growth of low GDP SSA countries. The study also finds that capital formation, life expectancy and education have a positive impact on economic growth in SSA. Ahoritor and Adenutsi (2009) and Adenutsi (2011) also found significant positive impact of remittances on economic growth.

A different perspective on the long-run impact of remittances comes from Glytsos (2001) and Chami *et al* (2003) that extend the work of Kozel and Adelman (2000). Adopting two-stage least squares (TSLS), Glytsos point to different inter-country priorities of remittance spending and to asymmetric impact of remittance changes. The analysis also reveal a uniform country performance of instability and uncertainty, with great temporal and inter-country fluctuations of remittance effects and conclude that the good done to growth by rising remittances is not as great as the bad done by falling remittances.

In a broader dimension Rao and Hassan (2009) investigates the indirect and direct effects of remittances on the growth rates for 40 developing countries. Their study analyses the strength of these effects using the standard incomplete panel data methods of OLS of both FE and RE combined with the Generalized Method of Moment (GMM). While they evidenced a positive and significant growth effects on remittances they however reported that the direct growth effects of remittances is insignificant. The Ordinary least square (OLS) and Fixed Effects (FE) Instrumental Variables Regressions model of Bajara *et al* (2009) similarly suggest that decades of private income transfers—remittances—have retarded long run economic growth in remittance-receiving economies. According to them, this negative effect might be due to the fact that the phenomenon are generally not intended to serve as investments but rather as social insurance to help family members finance the purchase of life's necessities. This reason to me is however not in tandem with the standard economic growth theory which presupposes economic growth as a first order condition to poverty reduction as confirmed by the empirical study of Anyawu and Erhjikarpor (n.d) in their study of the examination of the impact of international remittances on poverty reduction in African countries. The authors use panel data of 33 African countries over the period 1990-2005 and found that international remittances – defined as the share of remittances in country GDP – reduce the level, depth, and severity of poverty in Africa.

Other opponents argued that remittances may increase inequality, because it is the rich who can migrate and send back money, making recipients even richer Stahl (1982). At the macroeconomic level, large inflows of foreign exchange can have serious consequences resulting from the advance effects on tradable commodities and on relative competitiveness due to an appreciation of real exchange rates in the receiving country. One is the possibility that countries can face a situation similar to the “Dutch Disease” in which the inflow of remittances causes a real appreciation, or postpones depreciation, of the exchange rate. This has the effect of restricting export performance and hence possibly limiting output and employment especially in small economies where remittance inflows are large in comparison to the country's GDP (Jadotte, 2009; and Catrinescua, Leon-Ledesma, Pirachac, and Quillind, 2009).

The macro econometrics investigation of Zuniga (2011) is recent restatement and empirical test of this proposition. Zuniga while controlling for remittances at level of developing countries and adopting panel vector autoregressive (panel VAR). He posed mixed result by suggesting that remittances have a positive, albeit small, impact on economic growth in Eastern European economies, the Americas and Asia; but does not appear to have a statistically significant impact on African economic growth. Other opponents argue that at macroeconomic level, large inflows of foreign exchange can have serious consequences resulting from the advance effects on tradable commodities and on relative competitiveness due to an appreciation of real exchange rates in the receiving country. One is the possibility that countries can face a situation similar to the “Dutch Disease” in which the inflow of remittances causes a real appreciation, or postpones depreciation, of the exchange rate. This has the effect of restricting export performance and hence possibly limiting output and employment especially in small economies where remittance inflows are large in comparison to the country's GDP (Jadotte, 2009; Ratha, 2004; and Catrinescua, Leon-Ledesma, Pirachac, and Quillind, 2009).

The multiplier stories capture at least the short-run impact of remittances on the receiving economy suggesting that the phenomenon may in fact be detrimental to long-run growth. One piece of evidence that is quite suggestive comes from Kozel and Adelman (2000). They performed a labour a labour force participation and labour supply study of Pakistan using data from the 1986 PIDE survey. They found a significant negative impact

of remittances on the labour force participation of males. Stahl and Habib (1989) based their study on Keynesian multiplier using input- output tables for Bangladesh to construct a simple remittance multiplier for the year 1976 to 1988. The average value for the multiplier is found to be 1.24, and this implies basically a consumption effect. Nishat and Bilgrami (1991) use the same Keynesian structure to estimate the remittance multiplier but for Pakistan. They found a multiplier of 2.43, which even more primarily operate through the consumption effect. The model is a simple- consumption, investment, import demand and taxes are each single-equation functions of disposable income or GNP- so this estimate should be used with caution. Adelman and Taylor (1990) construct a social accounting matrix for Mexico and found that for every Dollar received from migrants working abroad, its GNP increased by US\$2.69 to US\$3.17 depending on whether remittances were received by urban or rural households. According to them, rural households tend to consume more domestically produced goods, hence generate larger multiplier effects than urban households. Based on a data set of 74 low and middle income developing countries Durand *et al* (1996) further explore the implication for Adelman and Taylor's analysis.

This exchange makes concrete an underlining question raised by the number on remittances, and by those who argue that that they are used as capital flows to finance investment and growth. Given that remittances are quite large relative to the sizes of many sub Sahara African economies, if their role are principally a capital flow to finance economic growth, why has their being this great controversial evidence on remittance economic growth linkages. Of course this evidence may as well exist, but might not be apparent because of the lack of a unified model to capture the growth effect of remittances. Obviously, a discussion of the phenomenon at the cross - country level, credible and appropriate in checking the logical conclusions of country studies, even as it creates, at the same time, the necessary opportunity to appreciate the role of remittances on the development process requires much more deeply empirical investigation. We therefore review next the remittances- financial deepening literature.

Agu (2009) specified a four-sector medium scale macro model to investigate the relationship between remittances flows and the macro economy in Nigeria. He found a weak link between remittances and the real sector and components of aggregate demand. The possible reasons for this weak link between remittances and the real sector of the Nigerian economy, he argued, could be the existence of leakages of remittances proceeds through imports. Tomori and Adebisi (2007) and Chukwuone *et al* (2007) in their study of the effect of remittances on poverty levels argued that remittance is an important channel to alleviate poverty in developing countries. Whereas Tomori and Adebisi (2007) used partial equilibrium framework, Chukwuone *et al* (2007) employed living standard survey in their analysis. Also, Kure and Nwosu (2008) examine the impacts of remittances on growth in Nigeria where growth, investment, human and private capital are estimated, using data for the period 1990-2007. One important finding from their paper is that remittances have a positive impact on economic growth in Nigeria through investment in private and human capital, with a pass-through effect on private consumption. Very recently, Uda (2011) conducted an investigation into the channels by which remittances impact on economic performance in Nigeria using the Ordinal Least Squares estimation technique. To test the time series characteristics and long run relationships of the variables included in the model, he employed the Ng and Perron modified unit root tests and Autoregressive Distributive lag (ARDL) bounds testing approach to co-integration developed by Pesaran and Pesaran. Uda reported that remittances affect economic performance in Nigeria through its interaction with human capital and technology diffusion. He suggests that for Nigeria to benefit from international transfers, policies should be fine-tuned to attract more remittances into the educational sector and technological transfers.

Regardless of what might be the motivation, role of remittances on private investment are mixed. Obviously, a discussion of the phenomenon at the country level, credible and appropriate in checking the logical conclusions of specific country studies, even as it creates the necessary opportunity to appreciate the role of remittances on the development process requires much more deeply empirical investigation in Nigeria.

## 4. Methodology

### 4.1 Theoretical Framework

Harrod-Domar Growth Model is a simple one which postulates that changes in national income  $\Delta Y$  depends linearly on changes in capital stock  $\Delta K$  and that investment or changes in capital stock is financed out of domestic savings  $S$  in the closed economy version of the model i.e  $\Delta K = S$ . The model says that domestic savings  $S$  itself depend on national income  $Y$ , i.e.  $S = sY$ , where  $s$  is the saving ratio of income:

$$\Delta Y = b\Delta K \quad (1)$$

$$\Delta K = S = sY \quad (2)$$

Substituting (2) into (1), we have

$$\Delta Y/Y = sb \quad (3)$$

Harrod-Domar explained that equilibrium economic growth is determined by the product of savings ratio  $s$  and annual investment returns. This means that economic growth will proceed at the rate at which society can mobilise domestic savings resources coupled with the productivity of investment. Realising that the major constraint on the part of developing economies is the shortage of capital, the Harrod-Domar model prescribed the open extension where investment can be financed both by the domestic and the foreign capital flow (emphasis on remittance). Then the model may be written as:

$$\Delta Y = b\Delta K \quad (4)$$

$$\Delta K = S + F \quad (5)$$

Substituting (4) into (5) and dividing through  $Y$ , we have

$$\Delta Y/Y = b/(S/Y) + (F/Y)/Y \quad (6)$$

$$\Delta Y/Y = b/s + f \quad (7)$$

This implies that if  $f > 0$ , economic growth can be increased beyond what domestic savings resources will allow. In other words remittance inflow can supplement domestic investment funds to enhance the capacity of the economy to grow.

#### 4.2 The Model

The relationship between physical capital investment and remittances will be formally tested using Stock and Watson (1993) Dynamic Ordinary Least Squares (DOLS). The model specification will follow the work of Griffith et al (2008) with little modification as follows:

$$\Delta \ln \text{prvin} = \beta^i X_i + \Delta \sum_{j=-k}^k \lambda_j^i \Delta X_{t-j}^i + \varepsilon_t \quad (8)$$

where  $\ln \text{prvin}$  is fixed capital investment,  $X = [\ln \text{rgdp}, \ln \text{remit}, \ln \text{fdi}, \ln \text{credit}]$  with

$\ln \text{prvin}_{t-1}$  denotes the initial level of capital investment,  $\ln \text{rgdp}$  is real gross domestic product,  $\ln \text{remit}$  is remittances,  $\ln \text{fdi}$  being foreign direct investment,  $\ln \text{credit}$  is real private sector credit. All these variables are in logs and will be deflated by the retail price index.  $\beta$  is a vector of  $\beta$ -coefficients, so that  $\beta \ln \text{rgdp}$ , for example, is the coefficient with respect to  $\ln \text{rgdp}$ .  $\varepsilon_t$  is the error term. However, to the extent that income growth is one of the main determinants of remittances as well as being affected by remittances, there is an endogeneity problem, which has the tendency to have made this result biased and inconsistent and not reliable for policy formulation. Also the inclusion of the leads and lags of the first differences of the I(1) regressors intend to take care of serial correlation and endogeneity issues, making the DOLS procedure an unbiased and asymptotically efficient estimator of the long-run relation, even in the presence of endogenous regressors (Stock and Watson, 1993).

Instrumental variables are therefore used to deal with endogeneity problem in estimating the relationship between capital formation and growth in remittances. Adopting the model used by Chami and others (2003), in the first-stage regression, the growth rate of remittances is estimated as a function of other variables (instruments) that are correlated with remittances growth but uncorrelated with the stochastic error term in the second-stage regression. The following equation is therefore estimated in the first-stage regression:

$$\Delta \ln \text{REM}_t = \alpha_0 + \alpha_1 \Delta \ln \text{CF}_t + \alpha_2 Y_t + \alpha_3 \Delta \ln \text{CPI}_t + \alpha_4 \Delta \ln \text{RIR}_t + \omega_t \quad (9)$$

Where  $\ln \text{WR}$  is the log of workers' remittances and instrumental variables are, per capita GDP in Nigeria ( $Y_N$ ), Inflation as measured by the consumer price index (CPI), real interest rate in Nigeria. CF is fixed capital formation in Nigeria. The fixed capital formation is essentially used as a proxy for physical capital formation. The growth of per capita real income is then estimated as a function of the fitted growth rate of remittances ( $\Delta \hat{W}$ ) from the first stage regression.

The second stage equation is therefore estimated as follows:

$$\Delta \ln \text{CF}_t = \alpha_0 + \alpha_1 \Delta \ln \text{CF}_{t-1} + a_2 \Delta Y_t + \alpha_3 \Delta \hat{W}_t + \alpha_4 \ln \text{FDI}_t + a_5 \Delta \ln \text{FD}_t + a_6 \text{FD} * \text{REM}_t + \varepsilon_t \quad (10)$$

We are interested in testing whether the marginal impact of remittances on capital formation  $\alpha_3$  is statistically

significant. While remittances have the potential to affect capital formation, we examine one specific link between remittance and capital formation, specifically through financial markets. The hypothesis we would like to test is whether the level of financial depth in Nigeria affects the impact of remittance on capital formation. To this end we interact the remittances variable with an indicator of financial depth and test for the significance of the interacted coefficient.

All the data will which covered from 1977 to 2010 and are sourced from the Central Bank of Nigeria Statistical Bulletin Annual Statistical Digest of the International Financial Statistics (IFS) of the International Monetary Fund (IMF) and the World Development indication of the World Bank. The Augmented Dickey Fuller Test and Philip Peron unit root tests will be carried out on each variable to test for stationary.

#### 4.3 Estimation Technique

Before estimating the models, the variables used in the model are subjected to stationary tests, using Augmented Dickey-Fuller (ADF) and Philip Perron test following equation 1.

Our ADF test consists of estimating the following equation:

$$\Delta Y_t = \alpha + \beta_t + \delta Y_{t-1} + \Psi \sum_{i=1}^m \Delta Y_{t-i} + \varepsilon_t \quad (11)$$

Where  $\alpha$  represent the drift,  $t$  represents deterministic trend,  $\beta, \delta, \psi$  are parameters to be estimated,  $m$  (lag length) is a lag large enough to ensure that  $\varepsilon_t$  is a white noise process; and  $\Delta$  is the difference operator. In the ADF approach, we test whether  $\delta = 0$

The Philips-Perron test is based on the following statistic:

$$\tilde{t}_\alpha = t_\alpha \left( \frac{\gamma_0}{f_0} \right)^{1/2} - \frac{T(f_0 - \gamma_0)(se(\hat{\alpha}))}{2 f_0^{1/2} s}$$

Where:  $\hat{\alpha}$  estimate;  $\tilde{t}_\alpha$  is the t-ratio of  $\alpha$ ;  $se(\hat{\alpha})$  is the coefficient standard error;  $T$  is the sample size or number of observations and  $s$  is the standard error of the test regression. In addition,  $\gamma_0$  is a consistent estimate of the error variance in the standard Dickey-Fuller equation (calculated as  $(T-k)s^2/T$ , where  $k$  is the number of regressors). The remaining term,  $f_0$ , is an estimator of the residual spectrum at frequency zero.

If the variables are integrated of order one 1(I) or of different order of integration, we test for the possibility of significance of the variable relationship using 2 stage instrumental least square procedure.

#### 4.4 Data Analysis and Results

All variables are tested at levels and first difference using ADF unit root test. The justification for the use of ADF unit root is based on large sample ( $n > 30$ ).

The ADF-unit root test results reported in (appendix table 1) revealed that all the variables under consideration are stationary at first difference. This implies that the null hypothesis of non-stationary for all the variables is rejected. Next, the Philip-Perron (PP) test is conducted to complement the ADF. The results also show the rejection of the non hypothesis and presented in table 2 of the appendices.

This Lagrange multiplier ((autocorrelation) (LM)) test indicates that there is no serial correlation in the residual since the Obs\*R-square is significant at 5 percent. The second stage regression results as presented in table 3 is cast on the principle of moving from “general to specific” estimations such that only results for the models’ most significant economic and statistical properties are reported and discussed in the final analysis. Estimated equations show good statistical and theoretical properties with respect to the data used. While the effect of remittances capital is conspicuous, the  $R^2$  and adjusted  $R^2$  are in the range of 0.94 and 0.92 clearly indicating that the functions explain nothing less than 92 percent of the linear behaviour of the dependent variables in the lower case and 94 percent in the upper case during the 1977 to 2010 periods.  $R^2$  is the fraction of the variance of the dependent variable explained by the model. The F value of 62.67 is highly significant, easily passing the significant test at the 1 and 5 percent levels.

The estimated coefficient of the lagged investment variable is large and positive. This implies that the value of additional capital good exceeds its cost and leads to strong inducement to invest (Keynes, Marginal Efficiency of Capital (MEC)). Regarding the remittances variable, it is remarkable that this is positive and significant. Specifically, the result indicates that a percentage increase in remittances will bring about nothing less than 22 percent increase in capital formation in Nigeria. Also in accordance with the results previously found, the

interaction between remittances and financial depth is positive and significant. This result implies that the growth effects of remittances are enhanced in deeper financial systems, supporting complementarities of remittances and other financial flows. In other words, it provides evidence of complementarities between remittances and financial instruments boosting fixed capital formation in Nigeria.

Interestingly, the results from our model indicate that the GDP per capita has a positive relationship with capital formation but lost its statistical significance. Validating the theoretical disincentive nature of the Nigerian budgetary allocation which adds a substantial number to the current expenditure in the face of an extremely small capital stock coupled with the current rate of low capital formation. This result according to Nurkse (1956) implies 'a circular constellation of forces tending to act and react upon one another in such a way as to keep a poor country in a state of poverty'. Expectedly, the results from our model indicate that FDI has a positive and statistically significant effect on the total fixed capital in Nigeria. Accordingly, we find that a 1 percent increase in FDI flow to Nigerian economy would result in about 44 percent increase in the physical capital formation in Nigeria. There appears to be a robust relationship between fixed capital formation and FDI in Nigeria between the periods of 1977 to 2009.

Finally, CUSUM square for stability of short-run dynamics and long-run parameters of investment function, it is core that cusum of squares stay within the 5 percent critical bound (represented by two straight lines whose equations are detailed in Brown, Durbin, and Evans, 1975, Section). The CUSUM of squares plots does not move outside the 5 percent critical lines. This result is suggestive of coefficient stability, therefore, we can safely conclude that the estimated parameters for the short-run dynamics and long-run of remittances function exist over the entire sample periods since residual result shows the future tendency of further stability. Also, the normality test lends credence to the parsimony of our model parameters. Considering the values of Jarque-Bera, Kurtosis and the skewness, it suggests that the model is normally distributed which implies that the result of the model is robust for policy analysis.

## 5. Conclusion

What is the investment impact of remittances? How does financial development influence the growth effects of remittance? To shed light on these important questions, this paper uses DOLS to provide empirical evidence on the impact of remittances on investment and also its interaction with financial development in Nigeria over the period 1977 to 2010. The results indicate that remittances have significant positive effect on investment. The complementarities between the interactive variable implies that remittances can bring about more growth if financial sector is more developed and other incentives are provided for remittance recipient economies. By becoming a complement for credit markets, remittances if well managed can help improve the allocation of finance to capital formation and boost economic growth.

These findings do not, however, give insight into all the channels through which remittance may affect growth. In particular we did not explore other possible impact of remittance on growth. Also apart from FDI, financial development, economic growth, we also left other possible determinants of capital formation like institutional aspect that may explain this effect. It is possible for example those other factors other than the ones specified may explain why remittances can have positive impact on fixed capital formation. Nonetheless, we interpreted the nil impact of economic growth on fixed capital formation as suggestive evidence of poor government expenditure on capital goods.

Overall, our empirical analysis provides the first macroeconomic evidence of how remittances and financial development may interact in promoting capital formation the evidence that remittances complement liquidity constraints and help undertake profitable investment in Nigeria is encouraging but while many policy-makers stress the need to stimulate remittances by reducing transfer cost, the biggest challenge is to understand how remittances can complement financial development in Nigeria.

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## Appendix

Table 1. Unit root test using ADF statistic

Stationarity test for variables					
Variables		ADF test stat	Critical values		Order of integration
			1%	5%	
LCF	Level	0.496698	-3.670170	-2.963972	I(1)
	1 <sup>st</sup> diff	-3.582835	3.670170	-2.963972	
FD	Level	-0.960991	-3.646342	2.954021	I(1)
	1 <sup>st</sup> diff	-6.225771	-3.653730	-2.957110	
LFDI	Level	-0.442837	-3.646342	-2.954021	I(1)
	1 <sup>st</sup> diff	-4.862137	-3.653730	-2.957110	
LREMFIT	Level	-1.274574	-3.699871	-2.976263	I(1)
	1 <sup>st</sup> diff	-17.24638	-3.699871	2.976263	
LRGDP	Level	-1.198639	-3.646342	-2.954021	I(1)
	1 <sup>st</sup> diff	-4.312394	-3.653730	-2.957110	
LREM*FD	Level	-0.583711	-3.646342	-2.954021	I(1)
	1 <sup>st</sup> diff	-5.438177	-3.653730	-2.957110	

Source: Computed by the author. Note: tests include intercept only.

Table 2. PP-unit root test statistics

Stationarity test for variables					
Variables		ADF test stat	Critical values		Order of integration
			1%	5%	
LCF	Level	0.326274	-3.653730	-2.957110	I(1)
	1 <sup>st</sup> diff	-4.434140	-3.661661	-2.960411	
FD	Level	-0.796691	-3.646342	-2.954021	I(1)
	1 <sup>st</sup> diff	-6.229040	-3.653730	-2.957110	
LFDI	Level	-1.239808	-3.661661	-2.960411	I(1)
	1 <sup>st</sup> diff	-13.31058	-3.679322	-2.967767	
LREM*FD	Level	-0.583711	-3.646342	-2.954021	I(1)
	1 <sup>st</sup> diff	-5.430980	-3.653730	-2.957110	
LRGDP	Level	-1.572699	-3.646342	-2.954021	I(1)
	1 <sup>st</sup> diff	-4.430814	-3.653730	-2.957110	

Source: Computed by the author.

Table 3. Serial correlation LM test

Unlike the Durbin-Watson statistics for AR(1) errors, LM test may be used to test for higher order ARMA errors and is applicable whether or not there are lagged dependent variables.

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	3.571556	Probability	0.045369
Obs*R-squared	7.598243	Probability	0.022390

Source: Computed by the author.

Table 4. Estimates for capital formation

Dependent Variable: LCF				
Method: Least Squares				
Date: 04/27/07 Time: 23:21				
Sample(adjusted): 1979 2010				
Included observations: 31				
Excluded observations: 1 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-41.64414	15.49596	-2.687419	0.0129
DLCF	1.112992	0.552780	2.013446	0.0554
FD	-0.139919	0.078403	-1.784608	0.0870
LFDI	0.449957	0.219624	2.048764	0.0516
LREMFDF	3.193947	1.371055	2.329554	0.0286
LREMFIT	0.222392	0.100830	2.205622	0.0372
LRGDP	2.176586	1.415337	1.537858	0.1372
R-squared	0.940004	Mean dependent var		11.77387
Adjusted R-squared	0.925005	S.D. dependent var		1.882073
S.E. of regression	0.515410	Akaike info criterion		1.707970
Sum squared resid	6.375531	Schwarz criterion		2.031774
Log likelihood	-19.47354	F-statistic		62.67111
Durbin-Watson stat	1.211197	Prob(F-statistic)		0.000000

Source: Computed by the author.