Journal of Sustainable Development in Africa (Volume 13, No.4, 2011)
ISSN: 1520-5509
Clarion University of Pennsylvania, Clarion, Pennsylvania

REMITTANCES, HUMAN CAPITAL AND ECONOMIC PERFORMANCE IN NIGERIA

Udah, E. B.
Department of Economics, University of Calabar, Nigeria

ABSTRACT

This paper investigated 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, the paper employed the Ng and Perron (2001) modified unit root tests and Autoregressive Distributive lag (ARDL) bounds testing approach to co-integration developed by Peseran and Peseran (2001). The results showed that remittances affect economic performance in Nigeria through its interaction with human capital and technology diffusion. Government capital expenditure on economic and social services is equally important in accelerating the pace of economic growth and development. The findings of this study strongly suggest that for Nigeria to benefit from international transfers, policies should be fine-tuned to attract more remittances into the educational sector and technological transfers.

Key Words: Remittances, Human Capital, Co-integration and Economic Development

INTRODUCTION

The size of remittances inflow, the importance of human capital and technological diffusion in economic growth and development process of developing countries including Nigeria have triggered interesting debates among scholars and policy makers of international and development economics extraction. There are a number of reasons why the link between remittances, human capital, technological diffusion and economic growth and development would interest policy makers in Nigeria. In the past two decades, the Nigerian financial sector has undergone various types of reforms and is progressively gathering momentum in size and depth, not only to stabilize the financial sector but in readiness to absorbed tremendous amount of domestic and foreign financial capital. The country has equally adopted varied policy measures aimed at exploring new initiatives to attract foreign direct investment in apparent realization that inflow of international transfers could be huge alternative sources of funding investment projects in various sectors of the Nigerian economy.

In addition, as observed by Orozco (2003), on the average about 65 per cent of total official remittances inflows to Sub-Saharan Africa (SSA) come to Nigeria. He equally estimated that about 2 per cent of global inflow of remittances comes to Nigeria. Agu (2009) study corroborated the observed increased inflow of remittances to Nigeria. He submitted that there has been tremendous inflow of remittances to Nigeria since the commencement of civil rule in 1999. For instance, from a negative growth rate of 17.9 per cent in 1999, remittances grew to about 186.2 per cent in 2005.

In 2007 remittances growth rate of 69.67 per cent stood only second to oil in terms of receipts. In addition, at nearly $18 billion and $20 billion dollars in 2007 and 2008, remittances inflow outpaced all forms of foreign inflows, except oil. In comparison to Foreign direct Investment (FDI) as a percentage of GDP, available statistics indicated that in 2006 remittances inflow stood at 7.5 per cent of GDP compared to FDI which was 3.5 per cent of GDP and Portfolio flows at less than 1 per cent of GDP.

In the literature there are conflicting contributions of remittances to economic growth in developing countries. Edwards and Ureta (2003) for instance argued that in El Salvador remittances improved recipients' standard of living. This is because income from remittances provided certain basic necessities of life such as food, clothing, education and shelter. It has also been argued in the literature that remittances provide a substantial sources of foreign exchange earnings, which could be used to finance imports, and therefore useful in stabilizing balance of payments in some countries.

Opponents of the positive effects of remittances on economic growth and development argue that remittances have the potentials to fuel inflation in the recipient country. The channel they argue this happens is the tradable goods sector by appreciating the domestic currency, and that remittances rather than promoting hard work, encourages laziness, since households who receive remittances in most cases, elect not to work but to finance their consumption expenditure via foreign transfers (Chami et al 2003).

El-Sakka and McNabb (1999) in their study for Egypt discovered that imports financed through remittances have very high income elasticity, implying that remittances may have low multiplying effects. Their findings contrasted with the submission of Adelman and Taylor (1992), which employed the social accounting matrix to evaluate the direct and indirect changes in income stemming from remittances to Mexico. Their findings revealed that each dollar of remittances increased output by multiplier of 3 when successive rounds of indirect effect were taken into account.

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 Adebiyi (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 Adebiyi (2007) used partial equilibrium framework, Chukwuone et al (2007) employed living standard survey in their analysis.

Böhning (1975), Rempel and Lodbell (1978) argued against the positive effect of remittances on economic growth and development. In these studies, remittances are primarily used for consumption and housing expenditures. Chami et al. (2003) find a significant and negative growth effect of remittances. However, it has been argued in the literature that the estimate used in Chami et al (2003) is biased because of the instrumental variables used for remittances (Catrinescu, et al., 2006 and IMF, 2005). Rapoport and Docquier (2005) also argued that Chami et al. (2003) ignored the possibility that remittances could affect investment and human capital formation due to the existence of liquidity constraints, so that human capital, an important factor that affects growth, was absent in their analysis.

On the importance of the association between remittances and economic growth and development, Glytsos (2005) discovered that remittance spending differs across countries and that the negative effect of a decrease in remittances on growth is greater than the positive effect of an increase in remittances on economic growth and development in some countries, whereas in some countries the reverse is the case. Guiliano and Ruiz-Arranz (2006) found that remittances promote economic growth in countries with less developed financial systems since remittances finance investment and help to alleviate liquidity constraints. Catrinescu et al. (2006) submitted that remittances have a positive impact on growth, although weakly, and suggested that the existence of good institutions could provide the right environment to efficiently utilize remittances in productive activity.

The surveyed literature seems to suggest that there are certain complementary factors that may be required for remittances to have a positive impact on economic growth and development. The complementary factors as argued in this paper include human capital and technology diffusion. The Endogenous growth theory supports the argument that human capital and technological diffusion promote economic growth and development. This, the theory argues, happens through their effect on total factor productivity (TFP). Romer (1990) models the growth of total factor productivity as a function of human capital employed in the research sector, and found that the stock of human capital in an economy is a determinant of the rate of economic growth. Nelson and Phelps (1966) argued that including education (human capital) as an additional input in an aggregate production function to represent the relationship between education and aggregate output may be a gross misspecification; they argued that education promotes adoption and implementation of new technologies and model the growth of technology as being affected by an interaction of human capital in a catching up setting.

Benhabib and Spiegel (1994) followed Nelson and Phelps (1966) and Romer (1990) and model TFP growth as a function of human capital and its interaction in a catch-up setting. They suggested that the growth rates may differ among countries because of differences in human capital stock levels. Thus, human capital enhances economic growth by affecting the growth of TFP both directly and through its interactions. Xu (2000) submitted that technology transfers from U.S. multinationals contributes to productivity growth in developed countries but not in developing countries, and that a certain threshold of human capital is required in the host country in order to benefit from the technology transfer spillover.

Other studies that found positive and significant effects of the interaction between human capital and international transfers on economic growth and development are Eller, Haiss and Steiner (2006) and Li and Liu (2005). Balasubramanyam, Salisu and Sapsford (1999) and Makki and Somwaru (2004) found a positive interaction though insignificant. Thus, the foreign transfers' literature shows how the level of human capital stock affects the absorptive capacity of an economy and consequently, the positive effects of capital inflows such as FDI and remittances on economic growth and development.

The objective of this paper is to investigate whether or not remittances affect economic performance in Nigeria through its interaction with human capital and technological diffusion. The paper adopted the NG and Perron (2001) modified unit root tests and Autoregressive Distributive Lag (ARDL) Bounds testing approach to co-integration to test for time series characteristics and long run relationships of variables included in the model. It uses time series data for Nigeria and investigated the effect of the interaction between remittances and human capital; remittances and technological diffusion and

remittances on economic development. This approach, to the best of our knowledge has not been applied in remittance study in Nigeria.

Following the introduction, the rest of the paper is organized into four sections. Section two presents the theoretical underpinnings of the paper. In section three, the model and method of data analysis is presented. Presentation of results and discussions are done in section four and the paper concludes in section five with concluding remarks and recommendations.

CONCEPTUAL ISSUES

The conceptual framework that underpins the relationship between remittances, human capital, technological diffusion and economic growth and development can be explain within the Keynesians, the Mundell-Flemming model, Endogenous growth models, Neoclassical micro and macro theories. Keynesian model is the oldest attempt to model short run dynamic impact of international transfers on national output. The Keynesian model postulates that distortions or shocks to the economy on demand side have a disproportionate effect on national output. The model assumes sticky prices, fixed exchange rate, interest rate and the absence of supply constraints. In addition, the theory argues that the magnitude of these shocks on national output would depend on the size of the transfer shocks.

Glytsos (2005) developed a Keynesian type macroeconomic model to estimate the demand generated by remittances on consumption, investment and imports. The model contained three behavioural equations namely consumption, investment and imports and an income identity equation. The model presents remittances as part of disposable income. He found a positive and significant relationship between income, consumption and imports. He incorporated the demand effect generated by remittances on consumption through disposable income.

Dornbush and Fisher (1994) argued that individual's consumption demands are related to their available income and not just to output level. Culum (1998) submitted that the acceleration principle implies that under a growing aggregate demand new investment are required, which promotes foreign direct investment and the expansion of new investment opportunities. And as reported by Taylor et al (2005) remittances contributed about 16 per cent of per capita rural incomes in Mexico in 2002. It can be argued that remittances increased the real income of the recipients and therefore stimulate aggregate demand in the economy.

The Mundell-Flemming model provides a good alternative to analyse the short run dynamics of international transfers on national output. The central thesis of this framework is that the effect of international transfers or remittances on national output would depend on the mobility of capital and whether or not an economy is operating a fixed or floating exchange rate regime. If for instance, capital is perfectly mobile, and the economy operates a pure flexible exchange rate regime, the money market would determine the equilibrium level of national output and output is not affected by international transfers. The Mundell-Flemming framework further argues that under the assumptions of perfect capital mobility and floating exchange rate regime, a rise in aggregate amount of remittances may increase national expenditure.

Under a fixed exchange rate regime, the Mundell-Flemming model assumes that a favourable balance of payments position is arrived at by variations in money supply. It is only under a fixed exchange rate regime that a rise in aggregate remittances or international transfers may induce an increase in national income. This model therefore provides a simple framework to evaluate the complex interaction between the balance of payments and short run shocks.

The impact of remittances, human capital and technological diffusion on economic growth and development can also be formulated within the framework of Endogenous growth model. The Endogenous growth model seeks to explain the factors that determine the growth rate of national output that is left unexplained in the Solow and Neoclassical growth models. If remittances is spent on investment goods, Endogenous growth model provide the channel through which remittances could promote economic growth and development. The argument is that it accelerates the pace of economic growth through enhancing human capital or productivity and the one important channel that this could happen is through technological diffusion.

Massey (1993) summarizes the theoretical arguments of the neoclassical micro and macro theories of migration. The central thesis of the argument is that households are rational beings and attempt to maximize their utility function by taking into account the costs and benefits of net return, and geographic differences in the supply and demand for labour in home country and the country they intend to migrate to. This is a strong factor that drives the motivation for migration to foreign countries and consequently remittances. Other school of thought such as the New Economics of Migration School are of the opinion that migration is one strategy adopted by households to diversify their portfolio of income streams, reduce risk of poverty and enhance access to financial resources for the household.

Becker (1974) and Cox (1987) introduced the introduced the concept of altruism and the obligation migrants have on family members to pay back what was contributed for their travelling expenses. The focus of Becker's argument is that for the migrating household to optimize his utility function would depend on whether or not the well being of the rest of the household he left behind are satisfied. If there is disparity between the income levels of the migrant household and the rest of the family left behind, then the migrant household would be under pressure to remit income to his home country. Cox (1987) conceptualizes remittances as payments for services rendered before migration. This include financial and material support to the migrant to achieve his objective and other intangible services or assistance that the migrant had received over time from those he left behind.

THE MODEL

The model developed in this paper draws theoretical strength from Endogenous growth models. The model demonstrate the channel by which remittances affect economic growth and development and is based on previous works of Romer (1990), Nelson and Phelps (1966) and Benhabib and Spiegel (1994). We begin with a Cobb-Douglas production function as follows;

$Y = AK^{\alpha} Z^{Б} L^{1-\alpha-Б}$ ---------- (1)

Where

Y = national output

A = Total Factor productivity (TFP)

K = physical capital

Z = human capital

L = labour force

Using equation one as an argument, we can define k = K/L; z = Z/L; y = Y/L, which allows us to capture the intensive form of the p

oduction function, then equation one yields

$y = Ak^{\alpha} z^{Б}$ ---------- (2)

Taking log of both sides of equation two we have

logy = logA + αlogk + Блogz ---------- (3)

The argument of equation 3 is that per capita output is described by total factor productivity, physical and human capital. Several studies have argued that the growth rate of total factor productivity is a function of the quality of available human capital. For instance, Nelson and Phelps (1966) submitted that education, which is a proxy for human capital contributes to the adoption and implementation of new technologies. To close the gap between theoretical and actual level of knowledge they argued, would depend on the level of human capital. Romer (1990) in his study was also of the opinion that the growth rate of total factor productivity depends on the skilled content of human capital. Benhabib and Spiegel (1994) lend support to the findings of Nelson and Phelps (1966) and Romer (1990) by arguing that human capital has a direct effect on endogenous technological progress.

The literature on the effect of remittances on economic growth and development is ambiguous. Chami et al (2003) found a negative relationship between remittances and economic performance. Catrinescu et al (2006) study contradicts the findings of Chami et al (2003). He found that remittances have a positive effect on economic growth and development when the issue of endogeneity is taken into consideration and are tested in conjunction with institutional variables. Other studies such as Edwards and Ureta (2003), Hanson and Wooddruh (2003) and Lopez-Cordova (2006) found a positive relationship between remittances and economic growth.

Based on the above literature, we model factor productivity to depend on human capital and the interaction between human capital and remittances. This yields equation 4 as follows;

$logA = ð_0 + \alpha logz + (logz*logREM)$ ---------- (4)

Where

z = the ratio of human capital to labour and directly affect total factor productivity (A).

REM = remittance and indirectly affect total factor productivity.

Inserting equation 3 into 4 yields equation 5 as follows

$Logy = ð_0 + \alpha logz + (logz*logREM) + \beta logk$ ---------- (5)

Equation 5 states that per capita GDP is affected by the level of human capital, the interaction of human capital and remittances and physical capital. To measure total factor productivity we adopted the method of Akinlo (2006) by specifying

a Cobb-Douglas type equation where real GDP is regressed against labour and capital under the assumption of constant returns to scale. The estimated factor share is then used to construct a yearly estimate of total factor productivity.

We introduce technological diffusion (techd) variable into equation 5 by taking into account the dynamics of output under the conditional convergence theory, we link the long term growth implications of the endogenous growth model with convergence implications of the neoclassical growth model. The convergence theory argues that followers (developing countries) converge towards leaders (industrialized economies) by copying technology or importing technology. This is because import of technology or copying the existing technology is cheaper than innovation in the short run (Barro and Sala-i-Martin, 1995 and Mankiw et al, 1992). This allows us to write equation 6 as follows;

LogGdppc = δ_0 + αlogz + (logz*logREMt) + βlogkapt + Ƃloglbf + ∂logTechd + €logGexpt + Ut------- (6)

Equation 6 argues that per capita GDP has a positive relationship with human capital, the interaction of human capital with remittances, physical capital, labour force, technological diffusion and government capital expenditure (gexpt) on economic and social services.

Following Coe et al. (1997) who argued that there is significant technology transfer from developed to developing countries through import of machinery and equipment, research and development; we measure technology diffusion as aggregate imports of machinery and transport equipment. Coe et al (1997) measured technological diffusion as the weighted average of domestic research and development that developing countries contributed to overall capital stock, using machinery and equipment imports as weight. In Nigeria, it is difficult to obtain data on research and development associated with capital stock, therefore in this paper we used the value of total machinery and equipment imports as measure of technology diffusion (techd), and a priori we expect its coefficient to be positive.

The government capital expenditure on economic services (gexpt) is assumed to influence the level of human capital which is expected to cause improvements in total factor productivity. In addition, higher level of human capital speeds up the adoption of foreign technology that is expected to balance the knowledge gap between the developed and the developing countries (Nelson and Phelps, 1966; Lee 1995; Benhabib and Spiegel, 1994; Loening, 2002). This, in turn is expected to accelerate the pace of economic growth and development.

Table 3.0: Expected a priori signs of coefficients

Variables	Measurement	Expected a priori sign
Logz=log(srnt)	Secondary school enrolment + tertiary enrolment	+
(logz*logREM)	Interaction of human capital with remittances	+
(logtechd*logRem)	Interaction of technological diffusion and remittances	+
Log(Remt)	Log of Remittances inflow	+
Log(kapt)	Log of per capita investment	+
Log(gexpt)	Log of government capital expenditure on economic and social services	+ +
Log(techd)	Log of total annual imports of machinery and equipment	+
Log(lbf)	Labour force participation index	+

METHODOLOGY AND DATA

This paper investigated the relationship between economic development, remittances and human capital. Indeed, the paper attempted to investigate the human capital and technological diffusion channels by which remittances accelerate economic growth and development. Physical capital, government expenditure on economic and social services and labour employed in the course of economic development are included to investigate their relative impact on Nigeria's economic performance, using annual time series data from 1970 – 2008. The data are all sourced from Central Bank of Nigeria Statistical Bulletin 2005, 2007 and 2008, World Bank Africa Database CD-ROM (2005) and COMTRADE. In order to investigate the relationship that exists between the dependent variable and explanatory variables, this paper adopted the following procedures.

First, the time series characteristics of the variable are investigated. The purpose is to determine the order of integration. The paper conduct unit root test on the variables included in the regression by employing the Ng and Perron (2001) modified Unit Root tests. The objective here is to determine the underlying properties of the process that generate the result and discussion of the analysis, while conclusion is presented in the study time series variables employed. The choice of the Ng and Perron (2001) modified unit root test is based on the fact that the tests are more suitable for small samples than the traditional tests. In addition, as observed by Sinha (2007) the null hypothesis of a unit root is not over-rejected when Ng and Perron (2001), modified unit root tests are employed.

Second, the paper proceeds further to test the long-run (co-integration) relationship between the variables used in the model by employing the (ARDL) bounds testing approach to co-integration proposed by Pesaran et al (2001). In this paper, the Autoregressive Distributed Lag (ARDL) bound test used extensively by Pesaran and Pesaran (1997); Pesaran and Smith (1998) and Pesaran et al (2001) are employed. This technique has a number of advantages over Johansen co-integration techniques. Whereas the Johansen techniques require large data sample, a luxury that most developing economies do not

have, the ARDL model is the most useful method of determining the existence of co-integration in small samples (Ghatak and Siddiki 2001).

A second advantage of ARDL approach is that while other co-integration techniques require all of the variables to be of the same order, the ARDL approach can be applied whether the variables in the regression are purely of I(I) and/or purely I(0) or a mixture of both. This implies that the ARDL approach avoids the pre-testing problem associated with standard co-integration, which requires that the variables be already be classified into I(I) (Pesaran et al 2001).

A third advantage of the ARDL method is that if a researcher is not sure of the unit root properties of the data, then applying the ARDL procedure is the most appropriate model for empirical work. As observed by Bahmanio-Skooee (2001), the first step in any co-integration technique is to determine the order of integration of each variable in the model. This however, would depend on which unit root one uses, and different unit root test could lead to contradictory results. For example, applying the conventional unit root test such as Augmented Dickey Fuller and Phillip-Peron tests, one may incorrectly conclude that a unit root is present in a series that is actually stationary around a one-time structural break. This problem of testing for unit root is avoided with ARDL approach.

The ARDL approach requires two steps. In the first step, the existence of any long run relationship among the variables of interest is determined by using the F-test. The second stage requires the estimation of the long run relationship and to determine their values, thereafter the short run elasticity of the variables with the error correction representation of the ARDL model. The purpose of applying the ECM version of the ARDL is to determine the speed of adjustment to equilibrium. As argued by Pesaran and Pesaran (1997), the ARDL model is presented in equation 7.

$$\Delta Lgdppc_t = a_0 + \sum_{i=1}^{p} \alpha \Delta Gdppc_{t-1} + \sum_{i=0}^{p} \delta Lz_{t-1} + \sum_{i=1}^{p} \lambda LRemt \sum_{i=0}^{p} \beta \Delta lkapt_{t-1} + \sum_{i=0}^{p} d\Delta ltechd_{t-1} + \sum_{i=0}^{p} \vartheta lgexpt_{t-1} + \sum_{i=0}^{p} c\Delta lbft_{t-1} + \delta_1 LGDPpc_{t-1}$$

$$+ \delta_2 z_{t-1} + \delta_3 Remt_{t-1} + \delta_4 Lkapt_{t-1} + \delta_5 Ltechd_{t-1} + \delta_6 Lgexpt_{t-1} + \delta_7 Llbf_{t-1} + U_t \ldots\ldots\ldots (7)$$

Where

δ_1, i=1,2,3,4,5,6 and 7 are the long run multipliers

α, θ, λ,β,d,d', ∂ = are the short run dynamic coefficients of the ARDL model

Δ = is the first-difference operator

P = optimal lag length

The F-test is used to test the existence of long run relationship. When long run relationship exists, F- test indicates which variable should be normalized. The null hypothesis for no co-integration among variables in equation (7) is

H_0: $\Delta_1 = \Delta_2 = \Delta_3 = \Delta_4 = \Delta_5 = \Delta_6 = \Delta_7 = 0$ against

Against alternative

H_1: $\Delta_1 \neq \Delta_2 \neq \Delta_3 \neq \Delta_4 \neq 0\ \Delta_5 \neq \Delta_6 \neq \Delta_7 \neq 0$

The F-test has a non-standard distribution which depends on whether variables included in the model are 1(0) or 1(1); the number of variables and whether the model contains an intercept/or a trend. Given a relative small sample size in this study of 38 observations, the critical values are as reported by Pesaran et al (2001) which is based on small sample size.

If the F-test statistics exceeds their respective upper critical values, we can conclude that there is evidence of a long run relationship between the variables regardless of the order of integration of the variables. If the F-test statistics is below the upper critical value, we cannot reject the null hypothesis of no co-integration and if it lies between the bounds, a conclusive influence cannot be made without knowing the order of integration of the underlying variables.

If there is evidence of long run relationship (co-integration) of the variables, the following long run model is estimated

$$\text{Lgdppc}_t = \alpha_1 + \sum_{i=1}^{p} \text{QLgdppc}_{t-1} + \sum_{i=0}^{p} \beta_{1i}\text{Logz}_{t-1} + \sum_{i=1}^{p} \theta_{1i}\text{LogRemt}_{t-1} + \sum_{i=1}^{p} \lambda_{1i}\text{Logkapt}_{t-1} + \sum_{i=1}^{p} d_{1i}\text{logtechd}_{t-1} + \sum_{i=1}^{p} d_{1i}\text{loggexpt}_{t-1} + \sum_{i=1}^{p} \vartheta_{1i}\text{loglbf}_{t-1} + U_t$$

…… (8)

EMPIRICAL RESULT AND DISCUSSIONS

The results of the Ng and Perron (2001) modified unit root test is presented in table 4.0. Three of the variables under scrutiny namely GDP per capita (gdpcap), secondary school enrolment (srnt), government expenditure on economic and social services (gexpt) are I(1) process, which means that they are stationary at first difference. Capital (Kapt) and Labour force (lfbt), remittances (remt), technological diffusion (techd) are I(0) process, implying that they are stationary at levels.

The purpose of testing the stationarity properties of the variables in bounds approach to co-integration is because the (ARDL) bounds testing approach is applicable only in the presence of I(1) and I(0) variables or a mixture of both. This means that the assumption of bounds testing will collapse in the presence of I(2) variables (Pesaran et al 2001). The Ng and Perron (2001) modified unit root results presented in table 4.0, implies that the bounds testing approach is applicable in this study, as all the variables are a mixture of I(1) or I(0).

The next task of the paper having established the order of integration of variables included in the model is to estimate equation 6. The purpose is to establish the long run relationship among the variables. Following Pesaran et al (2001), since the time series are annual, the paper adopt 2 as the maximum order of the lags in the ARDL and estimated equation 6, if co-integration exists among the variables included in the model, we proceed to estimate equation 8 for the period 1970-2008.

The calculated F-statistics for the long run model and short run error correction model is presented in table 4.3. The critical values are reported in the same table and are based on critical values as reported in Pesaran et al (2001). The calculated F-statistics for the long run model is 6.75 and that of the short run model is 5.98. These values are higher than the upper and lower bound critical values at 5 per cent levels of significance. This implies that the null hypothesis of no co-integration cannot be accepted at 5 per cent and 10 per cent levels of significance and therefore, there is a long run relationship among the variables under scrutiny.

The long run result indicates that human capital proxy by secondary school enrolment, physical capital, labour force, government expenditure on economic and social services and technological diffusion are significant factors influencing GDP per capita. This is because the five variables do not only conform to a priori economic expectations; they are statistically significant at 5 and 10 per cent levels of significance. Their statistical significance strongly suggests that a 1 per cent increase in human capital, physical capital, labour force, government expenditure and technological diffusion leads to about 2.6, 2.1, 2.1, 0.7 and 0.9 per cent increase in real output respectively.

Following the estimation of the long run coefficients, the paper proceeds to estimate the error correction model. The paper adopts the general to specific approach to arrive at the parsimonious estimate by eliminating jointly insignificant variables. The error correction term shows the speed of adjustment to restore equilibrium in the dynamic model. In particular, the ECM coefficients show how quickly variables converge to equilibrium and the ECM coefficient is expected to have a negative sign. As observed by Gujarati, (2004) a highly significant error correction term is a strong confirmation of the existence of a stable long run relationship.

The result of the error correction model indicates that the error correction term (ecm1) is well specified and the diagnostic statistics are good. The ECM1 variable has the correct a priori sign and is statistically significant. The speed of adjustment of 0.41 shows a modest level of convergence. In particular, about 41 per cent of disequilibrium or deviation from long run growth rate of GDP in the previous period is corrected in the current year. The Durbin Watson (DW) statistics value of 1.8 shows the absence of first order serial autocorrelation in the model. The value of adjusted R^2 of 0.68 indicates a good fit. In particular, the model explains about 68 per cent of total variations of the dependent variable around its mean.

The paper conducted stability test of the long run and short run coefficients using the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMQ) and Jarque-Bera normality tests. As observed by Bahmani-Okooee (2001), the stability of the regression coefficients is evaluated by stability tests and stability tests can show whether or not the regression equation is stable over time. This stability test is appropriate in time series data, especially when one is uncertain when change might have taken place.

The null hypothesis is that the coefficient vector is the same in every period. CUSUM and CUSUMQ statistics are plotted against the critical bound of 5 per cent significance. As noted by Bahmani-Oskooee and Wing NG (2002), if the plot of these statistics remains within the critical bound of 5 per cent significance level, the null hypothesis, which states that all

coefficients in the error correction model are stable, cannot be rejected. The results of these tests strongly suggest that the model is fairly well specified and robust for policy analysis.

The result based on table 4.2 indicates that human capital has a positive effect on economic performance. This implies that economic performance is determined by the quality of human capital. A priori the remittance variable agrees with theoretical predictions, but it was not statistically significant at various lags. The paper argues that remittances promote economic development but this is interpreted with caution as the value of t-statistics does not allow us to placed confidence on this inference. The interaction of remittances with human capital enters with a positive sign and is significant. This strongly suggests that remittances have a positive impact on economic development but only within certain threshold of human capital development.

Technological diffusion and labour force coefficients have the correct a priori sign and is statistically significant. This means that to accelerate the pace of economic development, the country needs to ignite a simultaneous increase of technology diffusion and the skill level of the labour force. The interaction of technological diffusion and remittances is positive and significant, suggesting that remittances impact on economic development via transfer of foreign technology or importation of technology.

The government expenditure variable entered the short run model with the correct a priori sign and was statistically significant. Physical capital and labour force equally entered the short run error correction model with the right a priori signs and were significant. The implication of this is that a one per cent increase in government expenditure, physical capital and labour force will lead to 0.5, 1.8 and 2.6 per cent increase in per capita GDP.

CONCLUSION

This study attempted to investigate the impact of remittances on economic development through human capital and technological diffusion in Nigeria from 1970 to 2008. To do this the paper adopted the endogenous growth as a theoretical guide and estimated the parameters of the model using OLS estimation technique. To test the time series characteristics of the variables included in the model and long run relationship of variables, the paper adopted the Ng and Perron (2001) modified unit root test and Autoregressive Distributive Lag (ARDL) bounds testing approach to co-integration developed by Peseran and Peseran (2001).

The short run error correction results indicate that with the exception of remittance variable all other variables of interest had the correct a priori signs and were statistically significant. The findings of this study strongly suggest that for remittances to accelerate the pace of economic development, it requires complimentary factors. These include high level of human capital development, technological diffusion, physical capital and increase investment in education and infrastructure.

Education and training are the key drivers of economic development and as observed by Dahlman et al (2005) skilled human capital provides the platform by which economies could transit from Old Economy to New Economy. In the New Economy,

knowledge can be created and applied to achieve any desirable national objectives. Since remittances accelerate the pace of economic development through the complimentary role of human capital, policy makers in Nigeria should provide the right environment for the easy repatriation of foreign earnings.

The statistical significance and the correct a priori sign of the government expenditure variable have important policy implications. The Nigerian government need to fine-tune its domestic policies to stimulate the simultaneous increase in technological absorption via aggressive investment in human capital development and complimentary infrastructure that would further deepened the quality of the labour force. Increase incentives for both human capital formation and a reduction in the cost of technology adoption.

Appendices

Table 4.0: Ng and Perron (2001) Modified Unit Root Tests

Variables	MZa	MZt	MSB	MPT
Δlog(gdppc)	-18.6301	-3.02188	0.16220	1.42329
1%	-13.8000	-2.5800	0.17400	1.7800
5%	-8.1000	-1.9800	0.23300	3.1700
10%	-5.7000	-1.6200	0.27500	4.4500
Δlog(srnt)	-18.9187	-3.07555	0.16357	1.29522
1%	-13.8000	-2.5800	0.17400	1.7800
5%	-8.1000	-1.9800	0.23300	3.1700
10%	-5.7000	-1.6200	0.27500	4.4500
Log(techd)	-70.6213	-5.54101	0.07846	1.19042
1%	-13.8000	-2.58000	0.17400	1.7800
5%	-8.1000	-1.98000	0.23300	3.1700
10%	-5.7000	-1.62000	0.27500	4.4500
Δlog(gexpt)	-17.2310	-2.77663	0.16114	1.98897
1%	-13.8000	-2.5800	0.17400	1.78000
5%	-8.1000	-1.9800	0.23300	3.17000
10%	-5.7000	-1.6200	0.27500	4.45000
log(kap)	-16.1012	-2.83271	0.17593	1.53888
1%	-13.8000	-2.5800	0.17400	1.7800
5%	-8.1000	-1.9800	0.23300	3.1700
10%	-5.7000	-1.6200	0.27500	4.4500
log(lbf)	-7.49221	-1.86393	0.24878	3.52739
1%	-13.8000	-2.5800	0.17400	1.7800
5%	-8.1000	-1.9800	0.23300	3.1700
10%	-5.7000	-1.6200	0.27500	4.4500
log(Rem)	-25.2861	-3.22297	0.12748	5.46680
1%	-23.8000	-3.42000	0.14300	4.03000
5%	-17.3000	-2.91000	0.16800	5.48000
10%	-14.2000	-2.62000	0.18500	6.67000

Table 4.1 Over-Paramatized Estimation Result

Variable	coefficient	T-statistics	Probability
Log(srnt)	-0.013593	-0.322115	0.7583
Dlog(srnt(-1))	-0.260070	-5.131793	0.0022
Log(remt(-1))	-0.006701	-0.252464	0.8091
Log(rem(-2))	-0.036925	-1.463357	0.1937
Log(kapt)	0.176458	1.817588	0.1190
Log(kapt(-1))	-0.211896	-2.451462	0.0497
Log(lfbt)	0.471289	1.793709	0.1230
Log(lfbt(-1))	-0.388858	-1.103716	0.3120
Dlog(gexpt)	0.007818	0.280230	0.7887
Dlog(gexpt(-2))	0.075298	1.962990	0.0973
Log(techd)	-0.08890	-1.46208	0.1983
Log(techd(-1))	0.098288	1.672196	0.1455
Ecm1(-1)	0.040287	0.649999	0.5398

R^2 = 0.74; DW = 2.0

Table 4.2 Parsimonious Result

Variable	Coefficient	T-Statistics	Probability
C	0.125005	0.231103	0.8211
Dlog(srnt(-1))	0.234947	4.803946	0.0004
Dlog(remt)	0.006418	0.311234	0.7610
Log(remt(-1))	0.014979	0.589921	0.5663
Log(remt(-2))	-0.019496	-1.17688	0.2621
Log(kapt(-1))	0.184595	2.395493	0.0338
Log(lfbt)	0.266525	1.588834	0.1381
Log(gexpt(-2)	0.053883	2.087988	0.0588
Log(techd(-1))	0.106097	2.053376	0.0625
Log(srnt)*log(remt)	0.388499	6.05874	0.0023
Log(techd)*log(remt)	1.821714	16.48377	0.0000
Ecm1(-1)	-0.41355	-3.02014	0.0435

R^2 = 0.68; DW = 1.8; F-statistics = 5.98

Table 4.3: F-statistics for testing for the existence of Long Run relationship

Computed F-statistics (long run model)	6.75
Computed F-statistics error correction model	5.98
Bound Testing Critical Value	5% lower (2.365); upper (3.553

The critical values are taken from Pesaran et al (2001), unrestricted intercept and no trend with seven variables at 1 per cent is 3.027 to 4.296; at 10 per cent are 2.035 to 3.153.

Fig 3.1

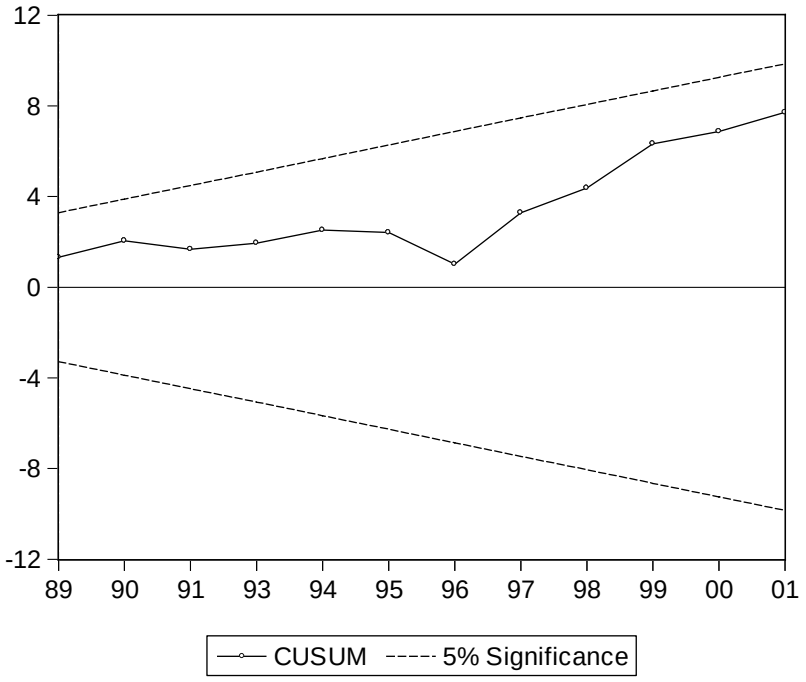
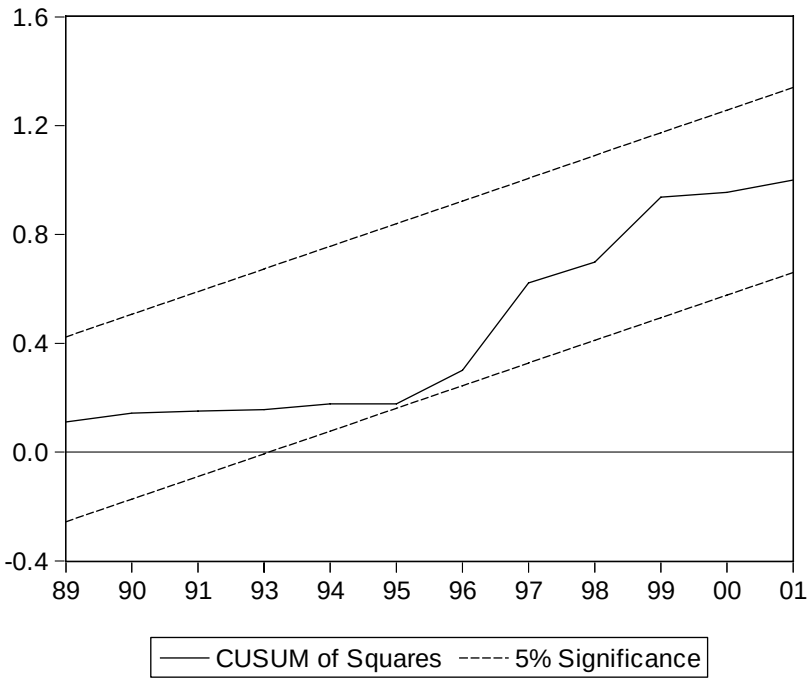


Fig. 3.2



REFERENCES

Adelman, I and J. E. Taylor (1992), 'Is Structural Adjustment with a Human Face Possible? The Case O Mexico', Journal of Development Studies, 26, 387-407

Agu, Chukwuma (2009) 'Remittances for Growth: A Two Fold Analysis of Feedback between Remittances, Financial Flows and the Real Economy in Nigeria', A paper presented at the African Econometric Conference in Nigeria.

Bahmani-Oskooee, M. (2001). Real and Nominal Effective Exchange Rates of Middle Eastern Countries and their Trade Performance, *Applied Economics*, 2, 103-111.

Bahmani-Oskooee, M. and Wing NG, R. C. (2002). Long-run Demand for Money in Hong Kong: An Application of the ARDL model, *International Journal of Business and Economics*, 1, 147-155.

Barro, R. & Sala-i-Martin, X. (1995) Economic Growth 1st Ed. USA: McGraw Hill Inc.

Balasubramanyam, U. N., Salisu, M., & Sapsford, D. (1999) "Foreign Direct Investment as an Engine of Growth", *Journal of International Trade and Economic Development* 8, 29 – 40

Benhabib, S. and Spiegel, M. (1994), "The Role of Human Capital in Economic Development Evidence from Aggregate Cross Country Data, *Journal of Monetary Economics,* 34, 143 – 173

Becker, G. S. (1974), 'A Theory of Social Interactions', *Journal of Political Economy*, 82/6, 1063-93

Bohning, W. (1975) "Some thoughts on Emigration from the Mediterranean Basin, *International Labour Review*, III, 251 – 277

Chami, R. F. Connel, J. Samar (2005) "Are Immigrant Remittance Flows a Source of Capital for development?' *IMF Staff Papers*, 52, 55 – 81

Chukwueze, N. E., E. Amaechina, Iyoko, S. E., Enebeli-Uzor and Okpukpara, B. (2007) "Analysis of Impact of Remittance on Poverty and Inequality in Nigeria" 6th PEP Research Network General Meeting.

Coe, D., E. Helpman and A. Hoffmaister (1999), 'North-South Research and Development Spillovers', *The Economic Journal*, 107, 134-149

Cox, D. (1987) "Motives for Private Transfers" *Journal of Political Economy*, 195/3, 508 – 46

Cox, E. and M, Ureta (2003) "International Migration, Remittances and Schooling: Evidence from El Salvador, *Journal of Development Economics*, 72, 429 – 461

Catrinescu, N., Leon-Ledesma, M., M. Piracha, B. Quillin (2006) "Remittances, Institutions and Economic Growth", IZA Discussion Paper No. 2139

Culem, C. G. (1988) "The Locational Determinants of Direct Investment among Industrialized Countries" *European Economic Review*, 32, 885 – 904

Dornbush, R. and Fischer, S. (1994) Macroeconomics, 6th ed. New York: McGraw Hill.

Eller, M., Haiss, P. and Steiner, K. (2006) "Foreign Direct Investment in the Financial Sector and Economic Growth in Central and Eastern Europe: The Crucial Role of the Efficiency Channel, Emerging Market Review, 7, 300 – 319

El-Sakka, M. and R. McNabb (1999), 'Macroeconomic Determinants of Emigrants Remittances' *World Development*, 27, 1493-1502

Ghatak, S. and Siddiki, J.(2001). The use of ARDL approach in estimating virtual exchange rates in India, *Journal of Applied Statistics*, 11, 573-583.

Glytsos, N. P. (2005) "The Contribution of Remittances to Growth, a Dynamic Approach and Empirical Analysis. *Journal of Economic Studies*, 32, 468 – 496

Guiliano, P. and Ruiz-Arranz (2006) "Remittances, Financial Development and Growth" IZA Discussion Paper Series 2160. Bonn, Germany

Hanson, G. and Woodruff, C. (2003) "Emigration and Education Attainment in Mexico". Unpublished Paper. University of California, San Diego

IMF (2005) "Two Current Issues facing Developing Countries: Workers Remittances and Economic Development" *World Economic Outlook*, 69 – 100

Li, X & Liu, X. (2005) "Foreign Direct Investment and Economic Growth: An Increasing Endogenous Relationship, *World Development,* 33, 393 – 407

Lopez-Cardova, E. and Omedo, A. (2006) "International Remittances and Development: Existing Evidence, Policies and Recommendations" Institute for the Integration of Latin America and Caribbean Integration, Trade and Hemisphere Issues Division. Occasional Series Paper.

Massey, D. S. (1993) "Theories of International Migration: A Review and Appraisal", in *Population and Development Review*, 19, 431 – 466

Makki, S. and Somwaru, A. (2004). "Impact of Foreign Direct Investment and Trade on Economic Growth: Evidence from Developing Countries". *American Journal of Agricultural Economics*, 86, 795 – 801

Mankiw, N., Romer, D. and Weil, D. (1992). "A Contribution to the Empirics of Economic Growth: *Quarterly Journal of Economics*, 107, 407 – 437

Nelson, R., and Phelps, E. (1966) "Investment in Humans, Technological Diffusion and Economic Growth". *The American Economic Review*, 56, 69 – 75

Ng, S. and Perron, P. (2001). Lag Length Selection and the Construction of Unit Root Tests with good and power, *Econometrica*, 69, 1519-1554.

Orozco, M. (2003) "Remittances, Real Sector and Development, in Paving the Way Forward for Rural Finance, An International Conference on Best Practices. Washington DC.

Pesaran, M. H., Shin, Y. and Smith, R. J. 2001. Bound Testing Approaches to the Analysis of level Relationships', *Journal of Applied Econometrics,* 16, 289-326

Pesaran, M. H. and Pesaran, B. 1997. Microfit 4.0 (Oxford University Press)

Pesaran, M. H. and Smith, R. J. 1998. Structural Analysis of Cointegration VARS, *Journal of Economic Surveys*, 12, 471-505.

Romer, P. (1990) "Endogenous Technological Change", *Journal of Political Economy*, 98, 71 – 102

Rapoport, H. and Docquier, F. (2005) "The Economics of Migrants' Remittances" IZA Discussion Paper 1531. Bonn. Germany

Remphel, H. and Cobdell, R. (1978) "The Role of Urban-to-rural Remittances in Rural development" *Journal of Development Studies*, 14, 324 – 341

Sinha, D. 2007. Does the Wagner's Law hold for Thailand? A time series study. MRRA paper number 2560. Hp//mpra.ub.uni_uenchen.de/5582/

Tomori, S. and M. A. Adebiyi (2007) "Migrants Remittances and the Economy: Theoretical and Impact Issues. In: Towards Africa's Renewal. Edited by Jeggar C. Senghor and Nana K. Poku, Ashgate Publisher, London, Chapter 12, 295 – 319

Taylor, J. E., Mora, J., Adams, R., & Lopez-Feldman, A. (2005) "Remittances, Inequality and Poverty: Evidence from Rural Mexico. Mimeo Davis: University of California.

Temple, J. (1999) "The New Growth Evidence", *Journal of Economic Literature*, 37, 112 - 156

Xu, B. (2000) "Multinational Enterprises, Technology Diffusion and Host Country Productivity Growth, 62, 477 – 493.