MIGRATION, HUMAN CAPITAL FORMATION AND ECONOMIC GROWTH IN NIGERIA

Omolola S. Olarinde

ABSTRACT

This paper benefits from country specific data on migration to examine its effect on Nigeria’s human capital formation and economic growth. It specified an equation predicated on the New Economics of Labour Migration (NELM) considering migration probabilities as an incentive to build additional skills. The model established the effect of migration, cost of acquiring additional skills and other control variables (population and access to education) on human capital formation. An exogenous growth model captured the effects of migration, human capital formation, public spending on education, remittances and access to education on economic growth. The Ordinary Least Squares (OLS) technique was applied to a distributed lag specification covering the period 1980 to 2011. Long run relationship among the variables was established employing the Johansen cointegration technique. Data for the estimates were collected from the World Bank (World Development Indicators) and Immigration Statistics Yearbooks. Six member countries of the Organisation for Economic Cooperation and Development (OECD) namely, Canada, United Kingdom, United States, Denmark, Italy and Sweden, to which Nigerians have migrated, were considered on account of data availability.

Migration stock impacted positively on HCF. All the variables were significant at the 1.0% level except lagged variables, which were significant at the 10.0% level. There was a positive relationship between HCF and cost of acquiring additional skills, implying that additional expenses on skill formation yielded positive returns. Human capital increased in the opposite direction as population, implying strained resources from population pressures. Access to education had no significant impact on HCF. Further, the exogenous model revealed that economic growth responded positively to migration suggesting a net gain in output resulting from migration. HCF was also associated with economic growth although not statistically significant.

Keywords: Nigerian migrants, Human capital formation, Migration stock, Employment potentials.

JEL Classification: F22, H52, I26

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1. STYLIZED FACTS

In the 1980s the United Kingdom (UK) witnessed a rise in the number of nurses migrating from sub-Saharan Africa from 915 in 1988/89 to 3789 (Adepoju and van der Wiel, 2010). Notably, the number of female caretakers recruited by private agencies to work in cares homes abroad for the elderly is undocumented (ibid). The new millennium can be considered a period of lost demand for nurses from Nigeria. Table 1 shows the number of nurses leaving Nigeria between 2004 and 2012 by countries of destination as documented by the Nursing and Midwifery Council (NMC, 2012) a parastatal of the Ministry of Health in Nigeria, solely responsible for regulating all cadres of nurses and midwives. According to the NMC records, the highest importers of labour in the health sector from Nigeria are the United States (US), UK and Canada. The US, which dominates the list, also has the highest reduction (92%) in number of nurses from Nigeria. All regular recipients of labour from Nigeria listed in the table recorded a significant decline in the number of nurses from Nigeria in 2012 against 2004. This is in the face of nurse shortages in OECD countries (see OECD, 2008; Simons, Villeneuve and Hurst, 2005).

One explanation may be competing markets for labour supply. Particularly, the Philippines, has encouraged migration to mitigate internal labour market constraints (Lorenzo, Galvez-Tan, Icamina, and Javier, 2007). Also, the global financial crisis reduced the demand for labour as a result of economic difficulties at the destination countries (IOM, 2011). The trend may also suggest imbalances between skills demanded for at the country of destination and the preparedness of Nigerian workers to meet those requirements. This alludes to the demand for labour in the OECD, which has been in the health care sector and information technology (OECD, 2012) whereas the number of Nigerian university graduates declined between 1990 and 2000 for all specializations except for engineering technology. Graduates in health care professions have declined steadily between 1990 and 2005 and did not rise back to the 1990 values. The specialisation with highest number of graduates remains administrative and other social sciences (NBS, 2010). Observably, the direction of association could be reversed where low demand for Nigerian workers causes them to build fewer skills relevant to the OECD.
Table 1. Nurses Leaving Nigeria by Countries of Destination 2004 – 2012

<table>
<thead>
<tr>
<th>Year</th>
<th>United Kingdom</th>
<th>United States</th>
<th>Canada</th>
<th>New Zealand</th>
<th>Ghana</th>
<th>South Africa</th>
<th>Bahamas</th>
<th>United Arab Emirates</th>
<th>Malta</th>
<th>Central America</th>
<th>Spain</th>
<th>Denmark</th>
<th>Bahrain</th>
<th>Sydney</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>1564</td>
<td>1024</td>
<td>2153</td>
<td>53</td>
<td>40</td>
<td>81</td>
<td>57</td>
<td>27</td>
<td>19</td>
<td>127</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5159</td>
</tr>
<tr>
<td>2005</td>
<td>1047</td>
<td>1432</td>
<td>2800</td>
<td>50</td>
<td>31</td>
<td>71</td>
<td>44</td>
<td>38</td>
<td>24</td>
<td>136</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5684</td>
</tr>
<tr>
<td>2006</td>
<td>968</td>
<td>2517</td>
<td>1881</td>
<td>42</td>
<td>50</td>
<td>92</td>
<td>51</td>
<td>33</td>
<td>14</td>
<td>102</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5757</td>
</tr>
<tr>
<td>2007</td>
<td>94</td>
<td>1211</td>
<td>1518</td>
<td>47</td>
<td>55</td>
<td>102</td>
<td>48</td>
<td>42</td>
<td>26</td>
<td>154</td>
<td>27</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3324</td>
</tr>
<tr>
<td>2008</td>
<td>96</td>
<td>1146</td>
<td>1194</td>
<td>18</td>
<td>25</td>
<td>26</td>
<td>45</td>
<td>12</td>
<td>12</td>
<td>70</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2653</td>
</tr>
<tr>
<td>2009</td>
<td>24</td>
<td>692</td>
<td>843</td>
<td>5</td>
<td>32</td>
<td>73</td>
<td>27</td>
<td>9</td>
<td>1</td>
<td>90</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1796</td>
</tr>
<tr>
<td>2010</td>
<td>51</td>
<td>646</td>
<td>661</td>
<td>26</td>
<td>9</td>
<td>62</td>
<td>39</td>
<td>33</td>
<td>2</td>
<td>72</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1610</td>
</tr>
<tr>
<td>2011</td>
<td>28</td>
<td>581</td>
<td>378</td>
<td>3</td>
<td>48</td>
<td>38</td>
<td>12</td>
<td>21</td>
<td>2</td>
<td>29</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>1147</td>
</tr>
<tr>
<td>2012</td>
<td>15</td>
<td>203</td>
<td>167</td>
<td>0</td>
<td>6</td>
<td>26</td>
<td>13</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>12</td>
<td>457</td>
</tr>
</tbody>
</table>

Emigration likelihood is five to ten times higher for workers with over 12 years of education (Beine et al., 2006). Indeed in Nigeria, tertiary educated workers make up over 50 per cent of emigrants (OECD, 2011). Rational Nigerian workers who want to build tradable skills would strive for post-secondary school qualifications. This informed a focus on post secondary school education in describing human capital formation in Nigeria in this paper. Secondary school certificate holders have the highest rates of unemployment in Nigeria and at the same time, wages for this same group are far lower than those with tertiary education; indicating this portion of the labour force is trapped with low demand for their skills at origin and destination countries. Notably, in spite of the selection criteria in destination countries, between 1990 and 2000, secondary school certificate holders had a substantial increase (209%) compared to tertiary educated workers (138%) arguably channeling some of the labour force problems abroad. In comparison, the growth for the graduates far exceeded lower skilled workers. Primary school certificate holders have the lowest migration growth rates (32%) perhaps as a consequence of restrictions on admittance placed by developed economies. Another possible explanation for their low migration rates may be the incomes required to fund the movement as low income groups are also associated with low educational attainment.

The subsequent section summarises the relevant theories of migration, human capital accumulation and economic growth, followed by a discussion of previous related studies. Section four presents the theoretical framework and methodology while section five discusses the trends of the variables, diagnostic tests and results of the time series analysis. The paper concludes in section six, including policy recommendations.

2. MIGRATION, HUMAN CAPITAL FORMATION AND ECONOMIC GROWTH

Theory and empirical studies have established the global net benefits of labour mobility, but their findings are inconclusive about the impact migration has on the country of origin, particularly given lack of country specific migration and demographic data. Notably, scholars generally agree that a ‘well controlled, restrictive migration policy is better than none at all’ (Stark, 2005) prompting increased research on effect of migration on the output of the country of origin.

The theories describing the effects of migration on human capital have broadly reflected the prevailing development concerns of each period. Migration was considered positive, characteristically voluntary, motivated by economic gains and supply-demand driven in Ravenstein (1885; 1889), Stouffer (1940) and Lee (1966) push-pull type models. In this period, migration was simply a consequence of modernization rather than a development failure. The model predicted that urban population would rise largely as a result of migration. De Haas (2010) reflects that international migration patterns indicate an association with population growth rates rather than affirm increases in migration from global south to north.

The most investigated of migration theories for economic analysis have been those linked with dependency, which were supported by evidence showing widening gaps in the standards of living between the rich and poor nations over time. They negated the neoclassical assumption
that economic and social forces, tend towards equilibrium. For instance, Myrdal’s (1957) hypothesis of geographic dualism replaces steady state equilibrium with circular and cumulative causation. In the case of two economies with the same initial level of development, if an exogenous shock causes disequilibrium in one economy making it worse off, the economic and social forces strengthen the disequilibrium. In this case, there is no convergence of wages, but rather cumulative movements away from equilibrium (Thirlwall, 2011: 264). While brain drain arguments are valid, arguably the occurrence has not been so massive as to be regarded as a source of cumulative disequilibrium. Indeed several categories of qualified Nigerian workers, in the health care, sports and other fields have been more productive abroad making it difficult to evaluate the net effect of their emigration. Further, returns from such efficiency can be exported to the country of origin (Dos Santos and Postel-Vinay, 2003).

The representative neoclassical model is the cost-benefit framework attributed to Harris-Todaro (1970) and extended by Borjas (1989) to international migration. It focuses on the individual decision to migrate rather than structural or economy wide determinants. It indicates that migrants weighed expected present value of migration rather than have full information about the conditions at the country of destination (Todaro and Smith, 2009: 347). The assumptions of the model are more realistic nonetheless but the evidence from around the world does not support the predictions that the poorest members would be the most ready to migrate, given the costs associated with migration (Hagen-Zanker, 2010).

More recently, collective decision-making models associated with Mincer (1978) and Stark, (1991) follow a Becker (1974) type framework to replace individual with household participation in the migration choice. Of these, the New Economics of Labour Migration (NELM) attributed to Stark (1991) has stimulated research on the subject. The NELM may be regarded as an extension of the human capital investment approach attributed to Hicks (1932), Schultz (1961), Sjaastad (1961) and advanced by Harris-Todaro (1970). This attempt at linking migration with human capital investment is useful in explaining that migrants are selective because of household estimated costs and that developing countries make household investment decisions in the absence of accessible financial markets for the poor (de Haas, 2011, 2008). Household effects are particularly significant for developing economies in which the characteristics of community contributions are important since it is more difficult to secure income through private insurance markets or government programs (de Haas, 2010: 20).

The economic frameworks explaining how migration impacts on the economy of the sending country include trade and neoclassical (labour market and economic growth) models. This paper adopts the neoclassical framework because it is applicable in determining the impact of human capital on output. Trade models are more suited to explaining migration as interdependent on imports and exports. Labour market models are harmonized with the neoclassical growth framework.

Until the 1980s growth theory, following Grubel and Scott (1966) emphasised high skill loss of human capital leaving developing economies with poorer output. Two transmission mechanisms explain the discrepancy between drain and gain outcomes. First, a focus on the proportion of
skilled to unskilled migration, which showed that if there are a few skilled workers and a large fraction of them emigrate, the impact is more devastating than when some of the pool of human capital leaves the country. Second, growth models did not account for externalities such as measure of feedback effects including investment incentives, remittances and return migration (Beine, Docquier, and Rapoport, 2006: 6). In more recent literature, other channels such as remittances, networks and human capital formation reveal different outcomes for the impact of migration on the source economy, particularly net positive impacts. Some of these are discussed in the following section.

Migration is often discussed from one perspective for simplicity, whereas it has global implications and sometimes trade offs between benefits to the sending and destination economy. Notably, labour and technical knowledge are a universal good, while mobility of workers must also become a real contribution to the local community in which they find themselves they should not be a drain on their country of origin. It must help bring about a robust, productive and economic system essential for sustainable development. In an integral way, for labour mobility to translate to economic development, global output levels must rise and net benefits must be higher in the face of migration than otherwise, benefits must accrue to the migrants, their economy, as well as the destination country. To be considered beneficial, integrated markets must promote institutions that sustain economic development. This paper examines the actual outcome is for the source country and stayers in the face of migration. It assumes that migrants themselves benefit from moving otherwise it will be irrational for them to do so. Circumstances in which this is not the case are beyond the scope of work.

3. REVIEW OF METHODOLOGY AND EMPIRICAL STUDIES

Three broader methodological approaches have been applied to migration and human capital investment analysis. One is the cost-benefit framework (Harris and Todaro, 1969; Borjas, 1989), which could be tested using a systematic cataloguing that compares the costs and benefits of education to the household (see Zaqqa, 1996). Another is an investment framework where expected earnings are discounted to estimate investment decisions, following Grossman-Shapiro (1982) type models. In practical terms, one way to discount present value of future earnings is by appealing to socio-economic panel data (Bodman, 1998). Both methods are meaningful for household level analysis. Finally, the NELM (Stark, 1991) uses macroeconomic variables to explain the relationship between migration and human capital formation through linear regressions. This type of aggregate analysis forms the focus of this paper in estimating the effect of migration on human capital formation and output.

Several studies support that higher probabilities of migration come with increases in the level of human capital accumulation in general (Docquier and Rapoport, 2012; Ghodussi and Siyahhan, 2010; Farchy, 2009; Di Maria and Lazarova, 2009; Docquier and Rapoport, 2006; Poutvaara, 2000, Vidal, 1998). Others such as Stark and Wang (2002) and Beine et al (2007) affirm that

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skilled migration fosters human capital formation even in low income countries. Batista et al (forthcoming) using a tailored household survey find evidence in Cape Verde, possibly a country with the highest emigration in Africa, to support significant correlations between probability of migration and investment in specific educational advancement. Conversely, a shock decreasing probabilities of migration also resulted in lower educational attainments. A striking corroboration that some skilled workers train just to go abroad comes from a survey indicating that 40 per cent of skilled doctors working in the United Kingdom were influenced to train in medicine by the possibility of migration (Kangasniemi et al 2004 cited in Farchy, 2009). Many developing nations are however, exempted from these general conclusions because even when incentives to build human capital are accounted for, skilled emigration rates are beyond any net skill creation threshold (Docquier and Rapoport, 2006).

In the NELM framework, the necessary condition for migration to result in human capital formation is that the levels of human capital increase in the same direction as migration. The dependent variable, human capital formation may be captured using literacy rates (Groizard and Llull, 2004) or enrolment in tertiary education (Di Maria and Lazarova, 2009). Enrolment was considered the correct approach to incentives rather than graduate outturn because they better explained workers’ response to the motivation to acquire skills (ibid). Completion rates may be associated with ability, which is not necessarily what the incentive effect measures. Respectively, the impact of migration on enrolment rates would account for incentive effects; that is for human capital accumulation spurred by the probability of migrating. The other key determinant of human capital formation is public spending on education as a proxy for the cost of acquiring it (ibid).

It is expected that migration will be correlated with human capital formation since the same factors such as income level, may account for an individual being more likely to migrate or accumulate human capital. In addition, the level of education may also provide a higher probability to migrate (Batista et al, forthcoming; Di Maria and Lazarova, 2009; Cieslik and Tarsalewksa, 2005, Beine et al, 2006). This relationship could be verified through tests of homoscedasticity and serial correlation or by paying attention to Durbin Watson values of regression.

When examining migration of skills between countries, studies use either a simpler model where skill compositions between two economies are homogeneous (Stark and Fan, 2007; Stark and Wang, 2002) or the heterogeneous framework (Ghoddusi and Siyanhann, 2010; Di Maria and Lazarova, 2009; Stark, 2005). The decision is mostly based upon demographic variables available. It is useful to point out that occupational specific data accounts for the fact that skills are only partly transferable across borders (Czaika and Vothknetch, 2012). The effect of heterogenous skills may cancel out since newly acquired skills could be a catalyst to technological development. This is supported with evidence on the growth of the industrial technology sector in India (Stark and Fan, 2007b).

Since there is plurality in the findings regarding the impact of migration on output what influences these differences in results? We turn first to Beine, Defoort and Docquier (2007),
Beine et al (2006) and Schaeffer (2005) who detail what could affect the outcomes of migration on development. They affirm that countries with initially low levels of human capital and low immigration rates benefit more from the incentive effect. Moreover, human capital accumulation decisions may be made early in life so that individuals decide whether they would accumulate skills useful in domestic country or abroad. The country of origin may then experience short-term losses if the skills formed are different from those required there (Schaeffer, 2005). Further, while the incentive effect of migration on human capital formation is positive, financial constraints are likely to limit people’s capacity to respond in poor countries.

Others contend that investment in skill decisions vary with levels of education, mix between emigrants and immigrants and the type of skill formation (Stark, 2007; Beine et al, 2006; Groizard and Llull, 2004). For example, countries with little educational progress, those in Eastern Europe and SSA experienced a brain drain. Particularly, in a study of 127 countries, Beine et al (2006) show migration induces human capital formation while using counterfactual simulation to estimate country effects. An earlier study (Beine et al, 2003) had shown that these results were true regardless of the wealth of the country of origin. Further, migration impacts may be enrolment-specific, as tertiary level emigration have positive effects on secondary level enrolment rates (Di Maria and Lazarova, 2009). In Doucquier and Marfouk (2006), the differences between skilled and total emigration rates are particularly strong in Africa, while Marchiori, Shen and Docquier (2009) show that drains or gains depend on short and longer term impact on the resident workforce as skilled emigration would strain domestic output if it did not induce human capital formation. That is, the magnitude of migration could tilt the results towards a brain drain.

Beine, Defoort, and Docquier (2007) affirm that the classification by authors according to income levels affect findings. The World Bank classifications as to what constitutes high, middle or low-income countries when contrasted with other definition such as gross national income below a determined level would produce distinct results (also see Beine, Docquier, and Rapoport, 2006). In this instance, the country specific analysis for Nigeria in this paper partly addresses this problem peculiar to a panel of countries.

Most studies of migration and output effects for developing economies in SSA use panel data (Beine, Docquier and Rapoport, 2008; Beine et al, 2001; Groizard and Llull, 2004) and arrive at varied results depending on some earlier outlined factors. Beine, Docquier and Rapoport (2006) after adjusting for endogeniety using instrumental variables, find incentive effects although overall losses for Africa. They account for where the skill was formed by using the age of the migrant and found this reduced the magnitude of brain drain. This mechanism shows a positive relationship between migration and development in SSA. However, Groizard and Llull (2004) using two stage least squares find that at higher probabilities of migration, human capital formation is depleted. Other perspectives maintain that there are rather optimal possibilities of migration to which the individual responds (Ghoddusi and Siyahhan, 2010). For instance, Beine, Docquier, and Rapoport (2006: 633-634) and Vidal (1998) refer to a critical threshold, which grows in the same direction as the probability of migration and wage differentials. This again
raises the paradox that although migration provides a stronger incentive in poorer nations financial constraints do not allow them to acquire higher education.

There is some level of openness required to achieve human capital formation growth associated with migration. In fact, comparing proportions of individuals with higher education to the general population, Stark and Fan (2007) conclude that people will invest in skill formation once the probability of emigration in the first period exceeded five per cent. Other reports hold that the source country can experience a brain gain where there are moderate probabilities of migration. They refer to optimal rates that are neither too high nor too low to encourage the worker to invest in global human capital (Ghodussi and Siyahhan, 2010; Stark, 2005). More than that migration is conducive to and can be a substitute for subsidies for encouraging socially optimum levels of human capital formation (Stark and Wang, 2001).

The impact of openness to migration on economic growth when positive, could be economically significant (Farchy, 2009; Bodman, 1998) or of marginal magnitude (Barro and Sala-i Martin, 1995). How much output grows with migration depends on the net skill levels retained in the country of origin. It is also influenced by the exchange between potential emigrants and immigrants, so an open economy may find some of its lost skills replaced through immigration (Stark, 2007; Belletini and Ceroni, 2007). In addition, the likelihood of return to the country of origin raises the gains from migration because the returnees are endowed with improved human capital (Farchy, 2009). Further, high student mobility eventually distorts labour migration outcomes of the country of origin because of the decision to postpone optimal accumulation of human capital and then, eventually, acquire global skills in the destination country. The latter could be mitigated in the cases where skills are heterogeneous, by government subsidy on skills needed in the source country rather than global skills (Ghodussi and Siyahhan, 2010). The lack of immediate growth in output could be characterised by high delays in the responses to probabilities of migration attributed to risk adverse agents who weigh the cost of investing in human capital accumulation. For example, when the general enrolment ratio was lagged three years, the results support the creation of skill argumentation (Farchy, 2009).

Loses from migration are also concentrated on least developed economies, since their best workers are also most likely to migrate. Finally, low-income economies would not invest in human capital accumulation given the barriers to migrate to developed countries (Vidal, 2008). Yet, another group of scholars find that the larger the gap between incomes in the destination country and the country of origin the higher the incentive to migrate and therefore, more likely there would be a net gain on the latter economy (Lucas, 2008; Cieslik and Tarsalewska, 2005; Stark and Wang, 2002). One explanation is the instance of middle-income households being the same ones to receive remittances from abroad, which begins to equalize as poorer income households gain from migration networks (Taylor, 2006).

In summary, the conventional thought remains that the major winners are undoubtedly the migrants themselves; and although there are significant global benefits, the gains to the country of origin remain rather ambiguous.
4. THEORETICAL FRAMEWORK AND METHODOLOGY

There can be a positive relationship between probability of migration and net earnings per worker (Cieslik and Tarsalewska, 2005 p. 6). According to Stark (2005), wages or standards of living drive migration decisions, so that a worker accumulates human capital in order to maximise wages. The worker has a cost function of forming human capital (h) given as:

\[ c(h) = k(h) \]  
(1)

In the formation of human capital he/she considers private returns (p) and/or social returns (s) in an associated production function:

\[ f(h) = p \ln(h+1) + s \ln(\bar{h}+1) \]  
(1.1)

for all h>0; p>k and s>0

The net earnings per worker function associated with human capital is:

\[ w(h) = pln(h + 1) + sln(\bar{h} + 1) - kh \]  
(2)

for all positive values of h. The worker maximises human capital subject to the first order condition given as:

\[ dw(h)/d(h) = p/(h + 1) - k \]  
(3)

and the sufficient condition is expressed as:

\[ d^2 w(h) \over dh^2 = - \frac{p}{(h + 1)^2} > 0 \]

So that the worker’s optimal decision considering private returns to human capital is stated as:

\[ h^* = \frac{p}{k} - 1 \]  
(4)

\[ w(h^*) = (p + s)ln\frac{p}{s} - s + k \]  
(5)

If we also consider the externalities associated with human capital, we modify equation (2)

\[ w(h) = pln(h+1)+sln(\bar{h}+1)-kh \]

So that equation 2 above can be re-written as:

\[ dw(h)/d(h) = p + s/(h + 1) - k, \]  
and it becomes

\[ h^{**} = \frac{p+s}{k} - 1 \]  
(6)

In this case, equation 5 becomes

\[ w(h^{**}) = (p+s)ln\frac{p+s}{k} - (p+s) + k \]

A comparison of the optimal human capital (h*) without externalities to the optimal human capital with externalities (h**) and the wages associated with both shows that since s>0 and h**>h*, then

\[ w(h^{**})-w(h^*) = (p+s)ln\frac{p+s}{p} - s \]  
(7.1)

The reasoning is that since for every x>1, x lnx> x-1, then

\[ x = \frac{p+ins}{p} > 1 \text{ and } w(h^{**}) - w(h^*) > 0 \]  
(7.2)

The wages associated with social benefits from human capital formation are higher than those that result only from calculations of private returns. Imagine also that a worker has two economies to choose from, source (a) and destination (b) so that the level of returns at the destination to a worker whose human capital in the source economy is (h) is expressed as:

\[ B \ln (a + 1) + C \]  
(7.3)
Where: \( B \geq p + s \) and \( C \geq 0 \) and \( B \) and \( C \) are constant and exogenous to the model.

The theoretical model describes a simple two-country economy, with production exhibiting constant returns to scale. Labour is the only input in the production process therefore gross earnings per worker equal output per worker. The economy produces a single commodity whose price is normalised to 1. The workforce is homogeneous so that there are \( N_j \) identical workers in the set \( j = (S, D) \); where \( S \) describes the size of the labour force in the country of origin and \( D \) is the same variable for the destination country. Since private returns are higher in the destination country relative to the country of origin, the direction of the migration will be from \( B^a \) to \( B^b \). The optimal level of human capital for the open economy is thus expressed as:

\[
V^{a*} = p \frac{(B^b - B^a) + B^a}{k} - 1 \tag{7.4}
\]

Where: \( p \) is the probability of migration, for every \( 0 < p < 1 \)

Capital for investments is generated through domestic savings as well as from abroad.

\[
\tilde{W}(h) = q [B \ln(h + 1) + C + (1 - q)p \ln(h + 1) + s \ln(h + 1) - kh] \tag{7.5}
\]

Since:

\[
\frac{dw(h)}{dh} = \frac{qB}{h+1} + \frac{(1+q)p}{h+1} - k = \frac{q(B-p)+p}{h+1} - k \tag{7.6}
\]

\[
\frac{d^2w(h)}{dh^2} = - \frac{q(B-p)+p}{h+1} < 0 \tag{7.7}
\]

A worker’s optimal level of human capital when comparing source and destination countries is:

\[
w(\tilde{h}^*) = (p + s) \frac{\lna(B-p)}{k} - [p(B - p) + p] + k \tag{8}
\]

Equation 8 indicates that there can be a positive relationship between probability of migration and net earnings per worker (Cieslik and Tarsalewksa, 2005 p. 6). Wages or standards of living drive migration decisions, so that a worker accumulates human capital in order to maximise wages. The worker finds that it is more advantageous to accumulate human capital when there are two economies he/she considers and one (b) has higher returns on human capital than the other (a).

The key advantage for Nigeria of the framework proposed by Cieslik and Trasalewska (2005) resting on Stark (2005) NELM theory is that it employs variables from basic demographic data, appropriate where statistics are generally deficient. The approach investigates the correlations between migration and gross investment in human capital and then explores the relationships between migration, human capital formation and GDP growth per capita relying on the Solow-Swan (1956) model, chosen because of the assumption of constant returns to scale and its implication on wage convergence. If we assume wages converge over time, this excludes the scenario of perpetual migration, which is rather associated with cumulative causation or other disequilibrium models.
The functional form for the relationship between migration and human capital formation tests the impact on human capital formation \( h \) of public spending on education \( p \), migration \( m \), access to education \( e \) and a measure of growth in workforce, represented by population changes \( n \) while the error term \( \varepsilon \) is stochastically normally distributed.

\[
h_t = \alpha_0 + \alpha_1 m_t + \alpha_2 p_t + \alpha_3 e_t + \alpha_4 n_t + \varepsilon_t \tag{9}\]

The natural logarithm values are specified, so that equation (9) becomes:

\[
\ln h_t = \alpha_0 + \alpha_1 \ln m_t + \alpha_2 \ln p_t + \alpha_3 \ln e_t + \alpha_4 \ln n_t + \varepsilon_t \tag{10}\]

The initial regression was indicative of autocorrelation problems, suggested by the Durbin-Watson values, therefore the equation was modified introducing distributive lags for access to education and public spending. Equation 10 was estimated as:

\[
\ln h_t = \alpha_0 + \alpha_1 \ln m_t + \alpha_2 \ln p_t + \alpha_3 \ln p_t(-2) + \alpha_4 \ln e_t + \alpha_5 \ln e_t(-1) + \alpha_6 \ln n_t + \varepsilon_t \tag{11}\]

Where the values in parenthesis indicate the number of lags included. The dependent variable, \( h \), represents human capital formation and is the enrolment level at higher education in the country. Enrolment rates are more easily available as there are gaps in data on completion rates for tertiary institutions in Nigeria. In addition, enrolment reacts to work prospects much faster than the stock of university graduates (Di Maria and Lazarova, 2009). Enrolment however has a disadvantage that it does not depict actual outcomes.

Two main variables affect levels of human capital in this framework, migration and public spending on education or cost of acquiring education. \textit{A priori}, it is expected that migrant stock will increase with human capital formation, since we have postulated that it grows when the probability of migrations rises. The other key factor that affects human capital formation is public spending on education since government spending on this component also subsidises the costs of education making it more accessible. Public spending on education may reduce private investment in skill formation and the more the government investment the less the cost of acquiring education. Human capital is expected to increase as public spending on education rises because improved skills are the direct returns on such spending. An alternative to public spending as a measure of investment in education has been savings rate as it is generally considered that higher savings rates imply more investment. Nonetheless, because of the significant informal sector in Nigeria and high income inequalities that would affect the average values, savings will not be representative of investment in education decisions.

Human capital accumulation is also affected by access to education \( e \), another control variable which this paper has adopted using the number of teachers to proxy access to education since it describes the supply-side of education. Statistics also show that 75 per cent of school age pupils have access to schools in Nigeria (NBS, 2009).

Premised on the growth model, a rise in education improves a worker’s productivity. The traditional macroeconomic proposition on the relationship between migration and economic
growth is extended allowing individual workers to respond to probabilities of migration, by building more skills, following Di Maria and Lazarova (2009). Distributed lag of the variables were included to adjust for problems of serial correlation. The specification is below, where In represents natural logarithm form:

\[ y_t = \alpha_0 + \alpha_1 m_{t-1} + \alpha_2 h_{t} + \alpha_3 h_{t-1} + \alpha_4 e_t + \alpha_5 y_{t-1} + \varepsilon_t \] 

(12)

And the natural log form is stated as:

\[ y_t = \alpha_0 + \alpha_1 \ln m_t + \alpha_2 \ln h_t + \alpha_3 \ln h_{t-1} + \alpha_4 \ln v_t(-1) + \alpha_5 \ln y_{t-1} + \varepsilon_t \] 

(13)

The equation implies that the growth rate of output per worker (\( Y \)) measured in purchasing power parity (PPP) is affected by the four coefficients to be estimated. Migration (\( m \)) that is the change in emigration stock, which can be interpreted as the probability of migration (Vidal, 1998); the level of human capital (\( h \)), the skill level in the country which affects economic development through the standard growth framework; access to education (\( e \)) represents the advantages of having more teachers; remittances (\( r \)) are a source of addition income and foreign exchange could contribute to the GDP, particularly in SSA where remittances are at values close to official development aid and are considered the largest financial flow after Foreign Direct Investment.

5. FINDINGS

We examine the moments and distributions of all the variables in Table 2. In absolute terms, the units of measurement for migration and cost of education variables are in tens of thousands, human capital and income are in hundred thousands while remittances and population are in hundred millions. Also, the differences between the maximum and minimum values are huge for human capital, migration, public spending and remittances. In fact remittances and savings present outliers with very low minimum values when compared to the mean. Therefore at the regression stage, deviations from the normal distribution were at the transformed to the natural logarithm of the values in order to reduce spacing of the data points and normalise the series without affecting the order.

The absolute values of human capital (\( h \)), remittances (\( r \)), access to education (\( e \)), public spending (\( p \)), savings (\( s \)) and migration (\( m \)) are skewed to the right, that is, most values are concentrated on the right of the mean, with extreme values to the left. A positive sign is indicative of skewness to the right. Standard of living (\( y \)), human capital and access to education, are closer to the kurtosis value of three expected for a normal distribution. Remittances and savings are clearly skewed, with kurtosis higher than three. A value greater than three indicates that it is sharper than the normal distribution, with values concentrated around the mean and thicker peaks. Migration has a kurtosis value of 1.4 that is flatter than the normal distribution with a wider peak.
Table 2: Descriptive Statistics

<table>
<thead>
<tr>
<th>Unit</th>
<th>Nr of students Enrolled, Units</th>
<th>Stock of migrants, Units</th>
<th>Public Spending on Education, NGN, millions</th>
<th>Remittances, USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>H</td>
<td>M</td>
<td>P</td>
<td>R</td>
</tr>
<tr>
<td>Mean</td>
<td>640641.20</td>
<td>22051.58</td>
<td>56968.59</td>
<td>104000000.00</td>
</tr>
<tr>
<td>Median</td>
<td>527493.00</td>
<td>17285.00</td>
<td>13529.25</td>
<td>35915840.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>1274772.00</td>
<td>43647.00</td>
<td>234842.00</td>
<td>523000000.00</td>
</tr>
<tr>
<td>Minimum</td>
<td>43898.00</td>
<td>5017.00</td>
<td>448.60</td>
<td>593365.00</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>324946.50</td>
<td>13732.17</td>
<td>78444.86</td>
<td>158000000.00</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.39</td>
<td>0.30</td>
<td>1.25</td>
<td>1.62</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>2.04</td>
<td>1.42</td>
<td>3.08</td>
<td>4.11</td>
</tr>
<tr>
<td>Observations</td>
<td>32</td>
<td>32</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit</th>
<th>GDP per capita NGN, millions</th>
<th>Nr of teachers, Units</th>
<th>Population, Units</th>
<th>Savings, NGN Billions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>Y</td>
<td>E</td>
<td>N</td>
<td>S</td>
</tr>
<tr>
<td>Mean</td>
<td>410771.80</td>
<td>567183.40</td>
<td>114000000</td>
<td>1012.06</td>
</tr>
<tr>
<td>Median</td>
<td>359932.20</td>
<td>568545.00</td>
<td>111000000</td>
<td>122.73</td>
</tr>
<tr>
<td>Maximum</td>
<td>833593.00</td>
<td>847859.00</td>
<td>163000000</td>
<td>6531.91</td>
</tr>
<tr>
<td>Minimum</td>
<td>180757.40</td>
<td>336056.00</td>
<td>75543388</td>
<td>5.70</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>171800.20</td>
<td>122913.60</td>
<td>25956249</td>
<td>1879.81</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.93</td>
<td>0.34</td>
<td>0.26</td>
<td>2.04</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>2.92</td>
<td>2.49</td>
<td>1.90</td>
<td>5.74</td>
</tr>
<tr>
<td>Observations</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
</tr>
</tbody>
</table>
These movements can be observed in Figure 1. Migration stock moves in the same direction with human capital, as predicted by the NELM framework. Migration patterns may have varied with both internal and external policy. Notably, in Nigeria migration rose since 1980, coinciding with the decade of growth related to the discovery of crude oil in Nigeria. Migration fell by about six per cent between 1990 and 1991 and by about 37 per cent in the following year and did not rise until 1995, when highly skilled workers emigrated in mass from the country during the numerous conflicts between the academia and the military rule. This relationship between migration and output during the decades of growth suggests periods of higher income are associated with increased migration in Nigeria, related to views that the poor do not have the means to migrate. It also corresponds with Nigeria’s membership within the Commonwealth of Nations, a period of more lenient regulations on mobility between Nigeria and the UK. Migration to the United Kingdom, the country that suspended commonwealth privileges to Nigeria in 1995, rose that very year and significant increases were seen again in 1996. Migration declined in the years 2007 and 2008 relative to 2006. These shifts imply that migration responded more to market conditions following the 2007 global financial crises than to internal policy at the country of destination, following more strict entry regulations in 1995.

Human capital was notably at its lowest between 1980 to 1995 (see Fig. 1) also coinciding with frequent strikes caused by disagreements between institutions of higher learning and the federal government. Particularly in the 1980’s Nigeria lost over 10 000 academia from tertiary educational institutions alone as well a total of 30,000 from the private and public sectors (Ara Corporation, 2012). Human capital was at its highest between 1997 and 2005 declined after 2007, although the values rose after 2009. The human capital preliminary results appear to be related more with imbalances in tertiary education associated with frequent strikes in institutions of higher education. Notably, there was high student mobility in the 1980s while Nigeria retained membership in the Commonwealth of Nations (Adepoju and van der Wiel, 2010).

The remittances by migrants to Nigeria were above 500 million US dollars in the early 1980s but declined afterwards, while the lowest figure reported was for the year 2001. The values have been quite volatile over the 32-years of analysis. It declined persistently through the 1980s, a period of economic prosperity in Nigeria when stayers were expected to have marginal need for remittances, but increased in 1988 relative to 1987. Notably, in 2003, remittances picked up but dropped again by 2007, following the global financial crisis, which is assumed to have affected Nigerian workers abroad. Remittances decline until 2010 when it rose but not near the values of the early 1980s. Nigeria currently receives significant absolute dollar values in remittances. Savings in Nigeria have risen steadily and had a common trend with remittances during 2006 to 2011.

Access to education has varied significantly, rising between 1980 and 1984, which may have followed the 1977 educational reforms in the country. Afterwards, the values declined between 1985 and 1987. By 1992 the previous educational reforms were again reviewed. Access to education grew steadily after 2001 but plummeted from 2008 to 2009. A significant increase in the variable can be seen between the years 2003 and 2005. It declined afterwards, and did not grow again until 2010.
GDP per capita has risen steadily through the period of analysis (1980-2011) mostly associated with exports of crude oil. Output has been quite stable over the period increasing marginally on the average. Public spending on education has fluctuated but increased steadily since 1995 with higher growth rates since 2006.

The relationship between the variables was examined using a pairwise correlation matrix. The results indicated that migration is strongly correlated with GDP, access to education, total public spending on education, recurrent public spending on education and human capital formation. The highest correlation is between migration and GDP growth showing that at higher standards of living there is more migration. This could be related to the income status of the country since middle-income countries have been able to take advantage of global labour markets given that they can afford to migrate. Migration also has the highest correlation values (0.77) with human capital. In addition, remittances are negatively correlated with all of the variables apart from net migration rates. Possible problems arising from correlation were addressed by using distributive lags of the explanatory variables. Further White’s heteroscedasticity tests showed statistically insignificant Chi-squared, indicating that the null hypothesis of no significant difference from the mean could not be rejected. Therefore the results did not suffer from heteroscedasticity.

Next, the variables were tested for stationarity using the Augmented Dickey Fuller (ADF) test including constant and trend, for unit root. Human capital was trend stationary in the mean at I(0) order of integration. All the other variables (migration, remittances, public spending, savings, standard of living) are integrated of order one, I(1), with the exception of access to education, which is in the second order I(2). This trend shows the behaviour of the variables relative to the mean, observably most of the variables had extreme values skewed to the right.
**FIG. 1.** TRENDS IN VARIABLES, NATURAL LOG VALUES

Legend:
H Human Capital
Y Gross Domestic Product
LM Migration (Stock)
E Access to Education
R Remittances
P Public Spending on Education, Total
S Savings

*LN denotes natural logarithm values*
5.2.4 Regression Results

At the next stage, Ordinary Least Squares (OLS) regression analysis was run and the results on the impact of migration on human capital formation presented in the equation (14) below with t-statistics shown in parenthesis. The detailed results are presented in Table 3. Human capital grows in the same direction as migration meeting the necessary condition for an incentive effect of migration on additional skill formation. This fits with regression results placing countries within sub-Saharan Africa amongst those who benefit from incentive effects (Batista et al, *forthcoming*; Farchy, 2009). Observably, the magnitude of migration from Nigeria relative to its population size is marginal, although absolute number of skilled migrants is high (OECD, 2011).\(^2\) The results should be interpreted with caution since Nigeria clearly experiences loss of highly skilled personnel. The outcome implies that on the net, more skills are built in the face of migration than in its absence in Nigeria.

The NELM theory posits that human capital formation would be positively related with migration since people would build more skills if they could receive higher returns for them on a global market. Human capital also has a direct relationship with public spending on education, access to education and savings. In this sense, the results for Nigeria confirm an incentive effect that migration has on human capital formation. The results indicate that migration impacted positively (0.55) on human capital formation in the current time, significant at ten per cent levels of confidence (0.09). The implication is that if migration, that is the probability to migrate, was high then it encouraged more people to accumulate human capital. One per cent increases in migration accounted for a 0.55 per cent increase in human capital showing that human capital responds strongly to changes in migration.

A high probability of migration, derived from the magnitude of the coefficient, is required for a unit change in human capital formation. Using a sample of 127 countries including those in the SSA region, the value of migration was found to be between 0.042 and 0.050 (Beine *et al*, 2006). Notably, the magnitude of impact for this paper shows a much higher value at 0.55. This could have resulted from data discrepancies between both studies since Beine *et al* (2006) relied on panel data series while this paper is country specific. Also, it was impossible to measure migration by skill level directly in our paper giving missing data on graduates by field of study.

Rodriguez-Pose and Vilata-Buti, (2004) point out that, contradictory results have been obtained from models using stock or flow variables in the measure of human capital. This paper has used stock variables in the measure of migration and appealed to enrolment rates, which are flow variables in the measure of human capital following Di Maria and Lazarova (2009). The enrolment as a proxy for human capital formation is the right point of analysis in measuring responses to incentives. While it is suitable to measure agent responses to incentive effects on enrolment rates, this did not provide information about what a country is doing with its educated

---

\(^2\)This can easily be computed by dividing number of emigrants by total population in various countries reported in the Migrant database document and comparing various country values.
stock. This paper also lacked indicators of adjustment between education supply and labour demand.

Again, migration explains an important proportion of human capital formation. A diagnostic test similar to hierarchical regression estimation technique\(^3\) was conducted. The adjusted R squared values declined by two percentage points when the migration variable was excluded from the time series analysis. This suggests the importance of the migration variable in the equation by about the same two per cent. Similarly, public spending affects the results by about four per cent, population and access to education by three per cent and remittances by one per cent. Savings appears not to influence the R squared values at all. While two per cent is a marginal contribution, the result associating migration with human capital formation are important given the sparse empirical evidence on skills in the presence of liberalized movement of people in Nigeria.

Public spending on education measures investment in human capital formation, which is expected to increase human capital formation, as more government investments would translate to increased turnout of students. Our results conform Di Maria and Lazarova (2009) whose findings show that human capital and public spending are positively related. Public spending on education had a statistically significant impact on human capital formation, positive and relevant in magnitude. There are more poor people in Nigeria, while the rich can afford private investment in higher education, the bulk of lower income earners rely on subsidised public education to cushion their costs of acquiring skills. Lagged values of access to education and public spending show that human capital grows with additional government expenditure on education two periods earlier. Similarly, the impact of additional teachers on human capital formation shows it takes one period for the explained variable to respond. Respectively, the growth in human capital formation was induced by increases in the number of teachers a year earlier. Public spending on education (0.24) also had a significant and positive relationship with human capital formation. This means one unit change in public spending on education would lead to a 0.24 unit change in human capital formation.

Population changes showed Malthusian type strains on resources, specifically, human capital. Increase in the Nigerian population has put pressure on public spending on education, which grew less proportionally. Indeed public spending on education has not increased at the same rate as population growth over the years, so that the same resources are spread over a growing number of people.

\[
H = 111.19 + 0.55m - 6.55 n + 0.24 p + 1.04 e (-1) + 0.25 p (-2) + 0.08s - 0.04r \\
\text{\quad (14) (1.73) (1.89) (2.22) (1.96) (2.01) (0.26) (1.19)}
\]

Adjusted R-squared 0.77 F-stat 15.44 Durbin-Watson stat 1.9

Number of observations 30

Table 3. OLS Regression Results on Migration and Human Capital Formation

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Observations</td>
<td>30 (After adjustments)</td>
</tr>
<tr>
<td>Variable</td>
<td>Coefficient</td>
</tr>
<tr>
<td>C</td>
<td>111.20 (1.91)</td>
</tr>
<tr>
<td>M</td>
<td>0.55*** (1.73)</td>
</tr>
<tr>
<td>P</td>
<td>0.24** (2.22)</td>
</tr>
<tr>
<td>N</td>
<td>-6.55*** (-1.89)</td>
</tr>
<tr>
<td>E(-1)</td>
<td>1.04*** (1.96)</td>
</tr>
<tr>
<td>P(-2)</td>
<td>0.25** (2.01)</td>
</tr>
<tr>
<td>S</td>
<td>0.08 (0.27)</td>
</tr>
<tr>
<td>R</td>
<td>-0.04 (-1.19)</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.77</td>
</tr>
<tr>
<td>F-statistics</td>
<td>15.45</td>
</tr>
<tr>
<td>D-W-Statistics</td>
<td>1.90</td>
</tr>
</tbody>
</table>

Source: Authors Computation based on Appendix A2 and A3
Note: *, ** and *** indicate statistical significance below 1%, 5% and 10% levels, respectively. t-values are in parentheses
Access to education (e) is included in the equation as a control variable. Access to education represents the ease with which one can procure skills. Since data on the total number of teachers in private and public primary and secondary schools has been used to represent access to education, higher values express better access to education and therefore, more human capital accumulation. Indeed the quality of education at primary and secondary school level explain the potential to enroll for higher education as poor performance would mean the student would not meet entry requirements into institutions of higher learning. Access to education (e) had a positive and significant impact on human capital formation.

Savings is the total private savings; it includes savings in commercial banks, saving certificates and stamps, time deposits and other deposits. It enters the equation as a proxy to account for private investments in human capital. It is expected to increase in the same direction as human capital formation. However, in Nigeria the informal sector is large and the poor often subscribe to various private and community thrift and savings plans, these are not captured in the official documents. This might explain why the impact of private investments on human capital was not statistically significant, although as expected it had a positive sign.

In the estimation of a growth model, some changes were made to the textbook specification of output per worker [GDP per capita]. First population (n) had been used in the dependent variable to normalize GDP. Subsequently an attempt to account for population growth increased the Durbin-Watson statistics slightly. More importantly, adding population rendered the migration variable statistically insignificant. Since it is plausible that migration captures some of the changes in workforce, it became necessary to exclude population from the OLS equation and focus on migration, our variable of interest.

Second, public spending affected the level of significance of human capital and therefore was excluded from the growth model. Similarly, investment was initially added to capture the impact of savings on output per worker. This has usually been the case in Nigerian studies where the informal sector is large and actual saving rates are difficult to estimate. The investment variable was statistically significant but also interacted with the remittances variable, which remained positive but statistically and economically insignificant in the presence of investment. Investment was retained in the estimation.

In a subsequent effort to check the robustness of the estimates against the estimation technique, the Generalised Method of Moments (GMM) and Two Stage Least Squares (TSLS) were used to estimate the same specification. The distributed lags were excluded from the GMM and TSLS estimations and the statistically insignificant variable, access to education, was also removed. The results show that the direction of the relationship, as well as the statistical and economic significance was consistent. The GMM and TSLS methods had almost identical results. Observable from Table 4, the migration variable impact was appreciably higher in magnitude in both the GMM and TSLS compared to OLS. Similarly the effect of remittances on output per worker became marginally higher in magnitude with the GMM and TSLS. Finally, human
capital became statistically insignificant although the magnitude of impact had risen marginally using the more recent methods. The direction of impact remained consistent throughout.

The growth model confirms the findings that list Nigeria among countries that experienced an incentive effect but does not prove a brain gain (Beine et al, 2006). That is output per worker increased in the same direction as migration, remittances and human capital formation. However, human capital in the previous period, captured by using distributed lags was associated with a decline in growth in the OLS results. Further the human capital coefficient was not statistically significant while using the GMM and TSLS techniques. The new economics of labour migration theory predicts that migration would affect human capital formation and in addition, that the impact of skill formation and migration on economic development would be positive. Notably, the empirical evidence on the impact of migration on economic development is split among positive, significant but marginal impacts (Di Maria and Lazarova, 2009; Bodman, 1998), positive but insignificant impact on economic development (Lucas, 2008) and marginal but not significant role on betta (β) growth convergence (Barro and Sala-i-Martin, 1995).

Further, the result may be sensitive to the initial economic condition of the country of origin; particularly migration has a positive and significant impact on economic development in an already thriving economy and that proximity to the technological frontier matters (Di Maria and Lazarova, 2009). The case of Nigeria remain ambiguous, while growth rate would situate it as a thriving economy, standards of living using human development and poverty indicators continue to position Nigeria among poor performers.

The impact of human capital on economic growth depends on the quantity, quality and type as well as on many factors relating labour supply to demand (Rodriguez-Pose and Vilata-Bufi, 2004), inevitably none of these factors could be accounted for in this paper given missing data on migration by level of skill. In addition, the effect of migration and human capital formation may require a threshold probability of the former that motivates workers to invest in the latter. Particularly, if workers perceive that the skills they build would not be valued in the destination country or securing admittance to the destination country is difficult, then the motivation to build such skills will diminish. The results show a positive, statistically significant but of marginal magnitude influence that human capital (0.05) in the current period had on growth.

There was also a positive relationship between remittances (0.06) and economic growth although marginal in magnitude and significant at one per cent using the TSLS and GMM. Remittances entered the equation as a private source of income in the absence of other indicators to capture the same. Indeed its contribution as a source of private income is marginal.

The regression results on the impact of migration and human capital formation on economic growth are presented in Table 4, with t-statistics shown in parenthesis. The natural logarithmic values of the variables have been estimated. Having used lagged values of some of the explanatory variables and the explained variable, the Durbin-h test for higher order serial
correlation value was calculated applying the formula $h = 1 - \frac{1}{2}d \sqrt{\frac{T}{1-T+Var\beta_1}}$ and the result was -5.08. The null hypothesis indicating the condition for no serial correlation is that $h$ values lie between $-1.96 < h < 1.96$, that is, we reject the null hypothesis for Durbin-h values less than -1.96. Therefore, the result shows no serial correlation of the error terms.

$$Y = 1.17 + 0.13 m + 0.05 h - 0.12 h(-1) + 0.04 \text{inv} + 0.87 y(-1)$$

(14)

$$(3.87) (1.87) (-6.53) (1.95) (17.59)$$

Adjusted $R^2= 0.99$ Number of Observations = 31 $F= 458.05$ Durbin-h = -5.08

Beine et al (2006) also point out that in SSA the ratio of skilled workers to the average skill level is particularly large and therefore, net increases in human capital formation are below the levels required to account for economic development. This paper shows a significant but negative implication of human capital a period earlier on growth, which has a coefficient of -0.12. This is counterintuitive and partly results from the variable used to capture human capital, that is, enrolment rates rather than completion rates. This is first because enrolment rates are considered more appropriate in capturing the incentive effect (Di Maria and Lazarova, 2009) more recent data on completion dates are not available, and the last graduate outturn statistics from the NBS dated back to 2007.

Finally, more populated countries tend to be more open to migration following gravitation theories (Beine et al, 2006). In our analysis, population has a positive and significant relationship with economic growth. Notably, the same variable might have a negative impact where it represents Malthusian type pressures and conflicts (Di Maria and Lazarova, 2009). In the latter instance, higher population exerts pressure on available resources leading to conflicts regarding their allocation. The variable was however removed from the final analysis given the autocorrelation problems it posed, particularly since economic growth was previously adjusted for changes in population. Further migration was highly correlated with public spending on education. Therefore the public spending variable was also removed from the final OLS equation.

As a final stage of analysis, the Johansen co-integration test was run to test if there was long run relationship between the variables. It is used typically when variables are integrated of order I(1), although it is not obligatory to pre test the order. It is therefore possible to apply the Johansen test though the variables have different orders of integration. This test is chosen because it allows for more than one co-integrating result, required to determine if there is any long-term relationship between the parameters. The outcome indicates correlations between the variables. The results show Eigen values are significantly different from zero and two co-integrating equations at five per cent level of significance and one co-integrating equation at one per cent level of significance. This affirms that there is a long-term relationship between the variables.
Table 4. Migration, Human Capital Formation and Output

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Observations</td>
<td>31</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruments (for GMM and TSLS)</td>
<td>Population, Public Spending on Education, and Investment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable/Method</th>
<th>OLS</th>
<th>Variable/Method</th>
<th>GMM</th>
<th>TSLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.1791 (2.5015)</td>
<td>C</td>
<td>5.6246 (4.5578)</td>
<td>5.6246 (3.2064)</td>
</tr>
<tr>
<td>M</td>
<td>0.1293* (3.8704)</td>
<td>M</td>
<td>0.6002* (8.2779)</td>
<td>0.6002* (6.8086)</td>
</tr>
<tr>
<td>H</td>
<td>0.0462*** (1.8774)</td>
<td>H</td>
<td>0.0206 (0.1989)</td>
<td>0.0206 (0.1295)</td>
</tr>
<tr>
<td>H(-1)</td>
<td>-0.1161* (-6.6364)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>INV</td>
<td>0.0418*** (1.9484)</td>
<td>R</td>
<td>0.0621** (2.8648)</td>
<td>0.0621** (2.6798)</td>
</tr>
<tr>
<td>Y(-1)</td>
<td>0.8767* (17.5973)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.9908</td>
<td>0.8046</td>
<td>0.8046</td>
<td></td>
</tr>
<tr>
<td>F-statistics</td>
<td>651.9140</td>
<td>-</td>
<td>49.0809</td>
<td></td>
</tr>
<tr>
<td>D-W-Statistics</td>
<td>1.80</td>
<td>0.4787</td>
<td>0.4787</td>
<td></td>
</tr>
<tr>
<td>Durbin-h</td>
<td>-5.08</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Authors Computation based on Appendix A2 and A3*

Note: *, ** and *** indicate statistical significance below 1%, 5% and 10% levels, respectively. t-values are in parentheses.
6. CONCLUSION

The paper determined that human capital formation in response to the probability of leaving the country compensates skills lost from migration. It benefitted from a dataset on annual immigration to six member countries of the Organization for Economic Cooperation and Development (OECD). The emigration of labour has for long been viewed as detrimental to economic growth in the country of origin and possible gains have been considered insufficient to plug the drain. The contemporary thoughts are more pluralistic and show new channels through which labour mobility principles engender economic growth such as the incentive effect on human capital formation. Migration outcomes have been mixed rather than strictly positive or negative. This paper concluded on an incentive effect that raised human capital induced by the probability of working abroad and that a net positive effect resulted from migration in Nigeria.

The pairwise correlation matrix shows that migration is strongly correlated with growth (0.90) and human capital formation (0.77) while human capital formation is correlated with growth (0.54) in Nigeria. The ordinary least squares (OLS) was utilised to estimate the relationship between migration and human capital formation in Nigeria. This methodology when subject to autoregressive distributive lags was found robust. The estimates suggest that the effects of migration are positive (0.50) and significant at ten per cent levels of confidence. In the second relationship, an OLS regression was run and found that migration had a positive effect on economic growth (0.11). In addition, this growth was through the human capital formation channel, which had a positive (0.06) and significant impact on economic growth. There was also a positive but not significant relationship between remittances and output in the growth analysis. Access to education had a positive but marginal and not significant relationship on economic growth. Finally Generalised Method of Moments and Two Stage Least Squares estimations were applied and the results were consistent in direction of impact between migration and human capital formation. Further the results affirmed that migration and human capital formation positively affected output per worker in Nigeria.

The results are indicative of the incentive effect of migration and positive impact on economic growth premised on the NELM theory that migration leads to human capital formation and the latter results in improved output at the country of origin. Nigeria should remain liberal in its migration policy since the possibility of migrating induces human capital formation. In addition, Nigeria should invest in those skills it wishes to retain in order to improve productivity in the country.
REFERENCES


London School of Economics.2012, January. [econ.lse.ac.uk/staff/ec533/Acemogu%Author%20chapter%201.pdf](http://econ.lse.ac.uk/staff/ec533/Acemogu%Author%20chapter%201.pdf).


Taylor, E. J. 2006. International migration and economic development. United Nations Secretariat, Population Division, Department of Economic and Social Affairs. Turin:


## Appendix 1: Definition and sources of variables used in the estimations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Explanation</th>
<th>Expected Sign</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>H: Human Capital Formation</td>
<td>Student enrolment in the universities, colleges of education, monotechnics and polytechnics</td>
<td>Enrollment variables better explain demand for education decisions</td>
<td>Explained variable</td>
<td>Federal Ministry of Education and Nigerian Bureau of Statistics (NBS, 2010)</td>
</tr>
<tr>
<td>Y: Gross Domestic Product per capita</td>
<td>Gross domestic product adjusted for changes in population (N, millions)</td>
<td>Living conditions in an economy explain investments in education or human capital formation</td>
<td>+</td>
<td>NBS, Annual Abstract of Statistics, 2010</td>
</tr>
<tr>
<td>P: Public Spending on Education</td>
<td>Recurrent government expenditure on education (N, millions)</td>
<td>Government spends on education supplementing private spending and making education more accessible</td>
<td>+</td>
<td>CBN, Statistical Bulletin 2011</td>
</tr>
<tr>
<td>R: Remittances</td>
<td>Workers Remittances and Compensation of Employees Paid (US$)</td>
<td>In human capital model, control variable for return migration. In economic growth model, the contribution of remittances on output is measured.</td>
<td>- +</td>
<td>World Development Indicators, 2010</td>
</tr>
<tr>
<td>M: Migration</td>
<td>Nigerian emigrants to six OECD countries for purpose of work</td>
<td>Same as above. The countries are Canada, Denmark, Italy, Sweeden, United Kingdom, United States.</td>
<td>+</td>
<td>Immigration statistics yearbooks of the US, UK and Canada</td>
</tr>
<tr>
<td>E: Access to education</td>
<td>Total number of teachers in private and public primary and secondary schools</td>
<td>The more teachers the more accessible education becomes and the less costly</td>
<td>+</td>
<td>World development indicators, 2010 and UNESCO</td>
</tr>
<tr>
<td>N: Population</td>
<td>Population</td>
<td>Higher populations mean more labour however in Malthusian type models population negatively affects growth</td>
<td>+ or -</td>
<td>WDI, 2010</td>
</tr>
<tr>
<td>S: Cumulative Savings</td>
<td>Sum of savings and time deposits with commercial banks, national provident fund, federal savings bank, federal mortgage bank, time deposits with merchant banks, premiums, bonds, saving certificates and saving stamps, life insurance funds and other deposits</td>
<td>Savings are a proxy for private investment and represent household contributions related to human capital formation</td>
<td>+</td>
<td>Statistical Bulletin of the Central Bank of Nigeria, 2013</td>
</tr>
</tbody>
</table>