The Brain Gain (skilled emigrants) and Economic Development in Sub-Saharan African (SSA) Countries

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Abstract

The development impact of international migration continues to attract development policy and scholarly attention. This paper examines the development impact of skilled migration for 38 Sub-Saharan African (SSA) countries between 1980 and 2019. Skilled emigration ratios are measured as the ratio of the total, low-skilled, medium-skilled and high-skilled emigrants from a particular SSA country to a destination OECD country. The Ordinary Least Squares (OLS) method is used as a baseline model supplemented by fixed effects (FE) and Generalized Method of Moments (GMM) as robustness checks. The OLS results indicate statistically significant effect of total and low-skilled emigration on GDP per capita in the SSA countries than a medium and highly skilled emigration. At country level, the skilled emigration-growth effect holds and is mediated by the human capital development. Although the FE results show no significant level effects of skilled migration on GDP per capita, the growth effect is positively mediated by the quality of institutions in the countries of origin. The GMM results reveal statistically significant effect of skilled migration on GDP per capita in SSA countries. Additionally, the effect of highly-skilled migration on GDP per capita is statistically significantly conditioned by institutional quality. The findings of this study suggest that suitable policy and institutional frameworks are imperative to attract and condition the growth and development impact of skilled emigration in the SSA region.

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1. Introduction

There is growing consensus among scholars, policy makers and development actors that there are vast skills and knowledge residing in Diaspora. In recent years, Diaspora expatriates who maintain ties with their countries of origin have received increasing policy attention in the migration and development discourse. This is driven by the growing recognition of the importance of Diaspora in the development of their home countries. Diaspora resources such as skills, knowledge, experience, financial inflows (remittances), and trade links, contribute to the socio-economic development of both sending and destination countries. However, little, is known from developing countries such as Sub-Saharan Africa (SSA) about the development impact of skilled migrants. Related studies that dominate the scholarship cover the development impact of skilled immigrants in destination countries, mostly developed economies in the OECD countries (Ehrlich and Kim, 2015; Michel Beine et.al, 2003). Nevertheless, SSA countries continue to be affected by human capital deficiency and the overall human capital development, and the issue is aggravated by the brain drain of African talents out of the continent. Recent studies find that there are 30.6 million African Diaspora. The UN Economic Commission for Africa (UNECA) and the (IOM) estimate that at least 20,000 skilled people leave the continent annually (IOM UN Report, 2020). Indeed, the UNESCO report of the year 2000 indicates that, there were over 300,000 highly qualified Africans scattered all over the world, 30,000 of whom had PhDs. In addition, African migrants are increasingly qualified in the destination countries.

Blaise and Anyanwu (2019) find that Africa is largely characterized by emigration of its skilled talents to developed OECD countries. The highly skilled emigration rate from the continent— especially West and East Africa — is among the highest in the world (see OECD, 2015). The authors observe that brain drain from Africa increases the stock of highly skilled African Diaspora. According to the Migration data brief (2016) there were 12.5 million African immigrants in OECD countries in 2016. The same brief indicates that over 60% of African migrants have an upper secondary level of educational attainment and half of this number (30%) has completed higher education. With prevailing push factors and globalization, the rate of skilled emigration from Africa is likely to increase with time. This continues to exacerbate human capital deficiency in the region. Indeed, a report by the World Health Organization (WHO) indicates that, more than four million additional health professionals are urgently needed in 57 countries, 36 of which are in sub-Saharan Africa (WHO, 2006). This gap affects the human capital, total factor productivity and economic development in the region.

Despite the increasing rate of emigration of skilled Africans (low, medium and highly skilled emigrants) to developed economies, there is a growing policy demand from the continent to attract African talents to bridge the gap and contribute to economic growth. However, the field continues to exhibit scanty of empirical work to determine the development impact of skilled emigrants in the sending SSA countries. Most studies have focused on the development impact of remittances with less attention to the development impact of skilled emigrants in their countries of origin. The latter seems to be overshadowed by the extensive work on skilled immigrants from developed economies.

The sparse empirical studies on the development impact of skilled emigrants in developing countries remain inconclusive. As a result, the scholarship presents two empirical strands. The first strand holds a pessimistic view about the development impact of brain drain. The proponents argue that emigration of skilled migrants has a detrimental effect on the stock of human capital and total factor productivity in sending countries, hence affecting economic growth. Indeed, (Bhagwati and Hamada, 1974; Miyagiwa, 1991; Haque and Kim, 1995 cited in Blaise and Anyanwu, 2019) argue that emigration of an individual with a higher than average level of education and income results in a decrease in the average level of income and education. Thus, GDP per capita is reduced and the average human capital that is needed for future growth is also reduced. In addition, it results in a tax loss for sending countries and a loss of externalities related to the education of the individual.

Other scholars based on a long-run perspective to argue that the growth effects of brain drain have perhaps been overstated by previous research. Accordingly, (Michael Beine et al, 2003) find that brain drain appears to have negative growth effects in countries where the migration rate of the highly educated is higher than 20% and/or where the proportion of highly educated in the total population is above five percent.

The second empirical strand challenges the first and claims a positive development impact of brain drain in origin countries. The promoters of this paradigm argue that in the long-run, brain drain induces incentives in sending countries to invest in education- which ultimately affects positively human capital formation. With more emigration from sending countries, families opt to invest in the education of their children in anticipation of future emigration. This is coupled with the positive effect of close ties between emigrant and his/her family in the origin. More so, emigrants maintain links through remittance transfers, temporary or permanent return, political and business links. Such networks strengthen institutional mechanisms and influence development in sending countries (see Rapoport, 2010; Meyer, 2001; Kerr, 2008; Spilimbergo, 2009; Docquier et al, 2010; Agrawal et al, 2011 cited in Blaise and Anyanwu, 2019).

This paper contributes to this body of knowledge by examining the development impact of skilled African emigrants in the SSA countries. In order to shed light on the effect of brain gain on growth and development in the region, this study adopts a nested analytical framework to examine the institutional factors in conditioning the development impact of skilled emigrants in SSA region.

The Sub-Saharan Africa (SSA) region is an interesting case to contextualize the development impact of skilled emigrants in developing countries. The region has experienced an exodus of brains (and continues to do so) for the last four decades, most of which have migrated to OECD countries (OECD & AFD Brief, 2019). Though not extensively documented, these professionals maintain ties with their countries of origin. This could be demonstrated by exponential inflows of remittances to SSA countries over the last three decades. Anecdotally, evidence suggest that most skilled African migrants already had or have interest to implement projects back in their countries of origin. This study seeks to bridge the existing gap by empirically shading light on how skilled African emigrants impact development of their continent, and how institutional factors influence the impact.

Considering the existing contested claims in the literature, this study opts for an optimistic view by hypothesizing that skilled emigrants positively affect economic growth and human capital development in SSA countries. To address the research objective, the analytical framework of this study is embedded in two dominant theoretical frameworks of migration and development: the endogenous growth theory and the new economics of labor migration theory.

The rest of this paper is organized as follows: Section 2 reviews the relevant literature; Section 3 presents the stylized facts about skilled emigration from developing countries and SSA countries in particular; Section 4 describes the data and empirical strategy; section 5 presents results and discussion; and section 6 present the conclusions.

2. Literature review: The Nexus of Skilled Emigration and economic development

The literature on skilled emigrants and development in the origin countries has remained mixed. This debate is shaped by the two concepts; brain drain and brain gain. Brain drain as simply implies the exodus of skilled emigrants from developing countries to developed countries, and brain gain simply implies how migrants contribute back to their countries of origin. For all along brain drain has influenced empirical and policy narratives about the development impact of skilled emigrants. The argument has been built on the early pessimistic claims that emigration of skilled emigrants has detrimental effects on the sending economies. However, recent literature is increasingly challenging the latter by claiming the development impact of skilled emigrants both in sending and origin countries. The empirical discussion of this study is embedded in the theoretical framework of New Economics of Migration (NELM) and endogenous growth theories.

2.1 The New Economics of Labor Migration (NELM)

The NELM theory bases its predominance on the determinants of migration and how the outcomes of migration influence economic development. Theoretically, the theory explains factors influencing emigration (push factors) and factors stimulating migrants to contribute back to their countries of origin (pull factors).

In terms of push factors, the theory arguably claims that migration is a collective and investment strategy decided collectively by the household to deal with economic hardship in the sending country such as income risks and unemployment, to mention but a few. The NELM emphasizes that migration is a labor market phenomenon influenced by the labor market behaviors both in sending and receiving countries. In support of the latter, Stark (1985) claims that migration is a distinct labor market and other non-labor market phenomena has contributed to our understanding of the process of economic development. More so, Alexandre Abreu (Alexandre, 2010 cited in Kadozi, 2019) has asserted that wage differences are due to geographic differences in labor demand and supply, although other factors might play an important role as well, for example, labor productivity, or the degree of organization of workers- as well as labor market conditions.

The relative deprivation is another determinant of emigration. This is based on the hypothesis that migrants carry out interpersonal income comparisons with their peers and wish to

improve relative positions of their social status. This influences the decision to migrante. This theoretical view applies mostly to the case of brain drain when skilled emigrants are failed by market failures in their home countries (see Stark, 1984; Stark and Taylor 1989 and 1991 cited in Kadozi, 2019). In the same vein, Todaro and Harris (1969; 1970) argue that migration decisions are carried out by individuals and shaped by known or expected income differences between migrant origins and destinations.

In terms of pull factors, the theory theorizes factors motivating migrants to contribute back in their countries of origin. These include altruistic, self-interest, loan and co-insurance theoretical motives respectively. The most important motive is the altruistic motive is whereby a migrant feels committed to the social welfare of his/her family. The idea behind is the commitment by the migrant to the household in his/her country of origin. And this commitment is born out of love for the family, and liability of a migrant (see Elbadawi et al. 1992).

The self-interest, co-insurance and loan agreement motives are driven by personal interests and collective agreement between migrant and the household that supported his or her migration. The self-interest seems to be interesting in the case of this study. In this case, migrants are driven by personal interests to contribute back, let say by transferring remittances. Though skills transfer is not frequently emphasized in this case, the same motive could be praying out. The majority of professional migrants return to work or set-up business ventures in their countries of origin in SSA countries. This implies that it is the same "calculated strategy" that is playing out as postulated by Clemens et al (2014). Then, it is understood as an outcome of migration- brain gain. It is worth noting that altruistic and self-interest motives influence brain gain, whereby migrants are motivated to contribute back due to the love of their households/countries, or their socio-economic interests.

More so, skilled emigration increases human capital formation through incentive effects. Accordingly, the recent theoretical claims challenge the early pessimistic paradigms about the brain drain. This paradigm shift is based on the claim that emigration of skilled migrants creates incentives (incentive effect) for human capital formation in the sending countries. The proponents of this school of thoughts claim that families invest in the education of their children in the perspective of future emigration. When highly skilled individual does not emigrant the stock of human capital formation increases in sending country.

In brief, NELM explains determinants of migration as a collective and investment strategy chosen by the household to send its migrant, and remittances and other benefits of migration are returns to the collective decision. However, the theory remains unable to determine the role of institutional environment in origin countries to sustain human capital formation and attract skilled talents from emigrants.

2.2 Endogenous Growth Model

The endogenous growth approach relates the outcomes of migration to the development back in countries of origin and theoretically explains the source of widening gap between developed and developing countries to be attributed to the brain drain- the human capital loss from developing countries.

The endogenous growth theory identifies three main determinants of long-term economic and sustainable growth, namely physical capital, human capital and technological innovations. The approach places emphasis on investment in human capital accumulation and technological innovations driven by research and development. Accordingly Ehrlich, I., & Kim, J (2015) claim that, the accumulation of human capital is subject to three types of externalities, or knowledge spillover effects: across generations, within countries, and across countries. The intergenerational spillover effects involve the transmission of knowledge from parents to children. The within-country spillover effects result from social interaction across skill groups. While the cross-country spillover effects take place through international knowledge transfers which applies to the transfer of skills, technologies and R&D from Diaspora.

Besides population growth, unemployment, ineffective/weak health and education policies, brain gain emerges as an outstanding negative factor affecting human capital accumulation in developing countries. By diminishing human capital save. Thus, brain drain widens the already existing human capital deficiency in developing countries. Hence, in Ehrlich and Kim (2015) migration is treated as an exogenous variable in the endogenous growth model affecting total factor productivity through human capital.

However, on the other side, the same theoretical approach claims that the outcome of migration- specifically remittances transferred back by migrants affects growth and development by improving human capital development in the recipient countries. The theory argues that remittances affect growth through their effects on total factor productivity and human capital development in the recipient countries. The theoretical approach demonstrates that the national output growth is determined by endogenous inputs of total factor productivity (technological progress), physical capital and human capital under the assumption of constant return. In addition, the effect of remittances in growth and development is detected through these factors of the endogenous growth model (Udah, E. B, 2011cited in Kadozi, 2019).

The endogenous growth model asserts that remittances affect growth and development by complimenting to the total factor productivity and human capital development. In this regard, the effect of remittances on growth is not direct, instead it is factored in through its influence on human capital through interaction between human capital and remittances.

2.3 Stylized facts: Skilled emigration and economic growth in SSA countries

The rate of emigration (including skilled) in SSA has increased significantly over the last three decades influenced by social and economic factors as well as political conflicts in the region. It is estimated that 30.6 million Africans are in Diaspora. Indeed, the number of African migrants aged 15 years old and over residing in OECD countries increased from 7.2 million in 2000/01 to 12.5 million in 2015/16. However, available evidence indicates that emigration of skilled migrants is higher in among low-income African countries than in middle-income countries. Dillip Ratha et al (2011) claim that migration rate among the tertiary educated in low-income African countries is twice that of middle-income countries.

As depicted in figure 1, averagely, the total emigration rate of skilled emigrants in Africa has been increasing exponentially over the last three decades. The slight drop in the total emigration during the late eighties and the first years after 2000 might have been influenced by restrictive immigration policies in the recipient countries OECD countries. Overall, despite restrictive immigration policies, migration is an unstoppable reality of modern time. Surprisingly, recent evidence seems to indicate that the emigration rate increases with economic development as it is depicted in case of Africa (see Figure 2).
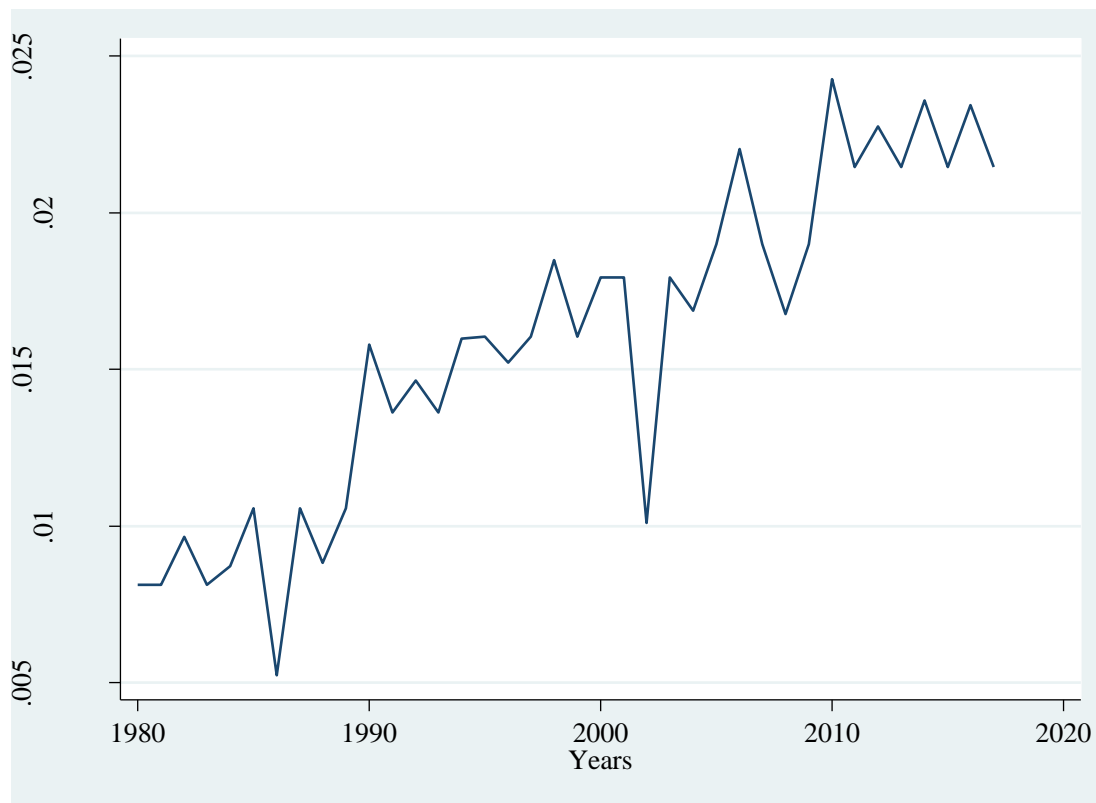

Figure 1: Trend of total emigration rates: SSA average, 1980-2015 Evidently, results from Figure 2 indicate that the emigration rate has exponentially increased with real GDP per capita in SSA countries. Implying that, skilled emigration rate has positive association with economic growth in the region. These findings challenges the traditional "*emigration life cycle*" paradigm which claims that emigration first increases with low economic development, and then falls with development. Indeed, the recent cross-country study by Michael Clemens (2020) challenges the latter school of thoughts by strongly arguing that average emigration rates are higher in countries with sustained increases in GDP per capita than in either chronically poor countries or established rich countries. Possibly, in the context of SSA countries, the two phenomena have manifested themselves in the region, mostly in the recent years.
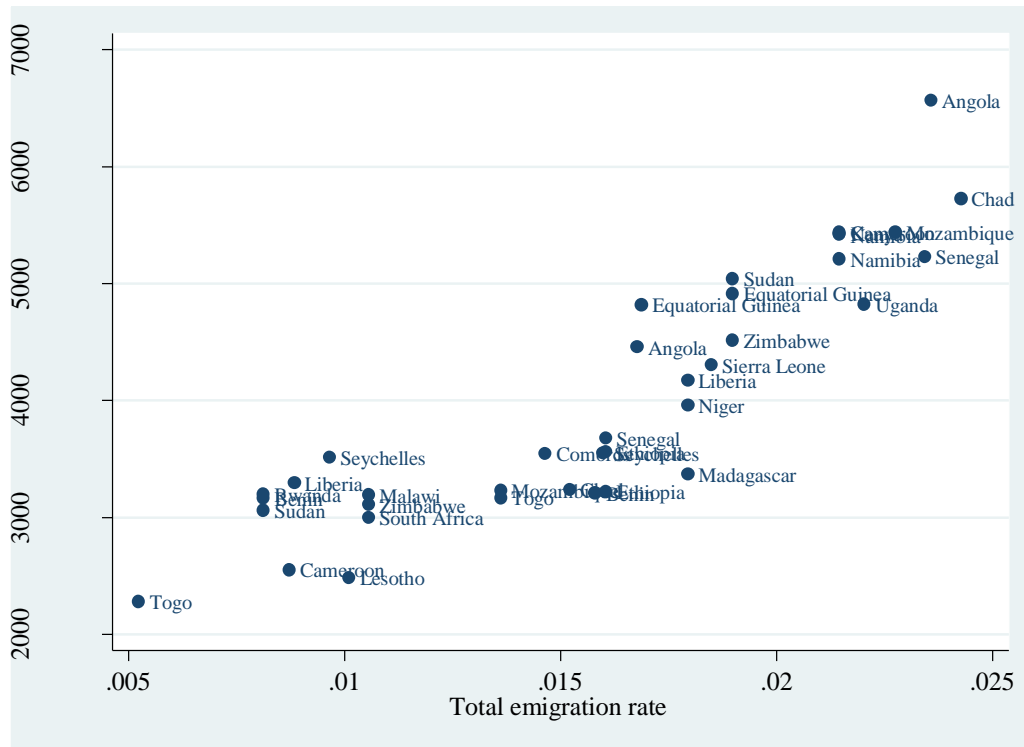
Figure 2: Real GDP per capita and Total Emigration Rate: Average 1980-2017

1. Data

This study examines the impact of skilled emigrants on GDP growth and human capital development in SSA countries from 1980 to 2019 and how institutional factors mediate the development impact of SSA skilled emigrants. The data employed in this study was taken from the World Bank's World Development Indicators, OECD International Migration Database and the IAB brain-drain database developed by the Institute for Employment Research in Germany. After restricting the data to only SSA countries and dropping countries with too many missing values, 1,200 country-year observations are used for analysis in this study.

The study has one dependent variable; the GDP per capita (constant US dollar). The main explanatory variables of interests are: emigrant's skills levels (low, medium and highly skilled) and the variable of total skills of emigrants (tot). Other explanatory (control) variables are the Personal remittances, received (% of GDP), Foreign direct investment, net inflows (% of GDP), Financial development index, Regulatory Quality, Political Stability and Absence of Violence, Broad money (% of GDP), Domestic credit to private sector (% of GDP), gross capital formation (% of GDP), Openness (sum of imports & exports % GDP). All variables are in natural logs form to remove sharpness in the time series data.

4. Empirical strategy

In order to estimate the development impact of skilled emigration from African countries, we utilize a combination of Ordinary Least Squares (OLS), country fixed effects (FE) models and the Generalized Method of Moments (GMM). The OLS method provides baseline

estimates of the development effect of skilled emigrants while the FE method addresses the confounding effect of time-invariant country-specific characteristics. Finally, the GMM approach addresses potential endogeneity between skilled emigration, remittances and growth.

4.1 The Base Model – Ordinary Least Squares (OLS)

The outcome variable is real Gross Domestic Product per capita, which is expressed in equation (1) as a linear function of skilled emigration, value of remittances and other covariates. A simple log-linear Cobb-Douglass production function is specified.

$$LogGDPPC_{it} = \alpha + \beta_1 Skills_{it} + \beta_2 LogRemit_{it} + \sum_{k=1}^{K} \delta^k X_{it}^k + \varepsilon_{it} \quad (1)$$

Where $LogGDPPC_{it}$ is the log-transformed real GDP per capita for country i in time period (year) t. Variable "$Skills$" represents four variables that capture the rate of overall skilled emigration (irrespective of the level of skills), low-skilled emigration, medium-skilled emigration and high-skilled emigration from Sub-Saharan African countries. $LogRemit$ is the log of remittances received and X is a vector of other control variables besides skills which could influence the country's level of GDP per capita. The variables are chosen based on previous literature and theory on migration and development and availability of data. The main parameter of interest in equation (1) is β, representing the effect of skilled migration on GPD per capita. The parameter vector δ^k represents the coefficients of each independent variable k in the covariate vector X. Finally, ε represents the error term assumed to be independently and identically distributed (i.i.d.).

4.2 Panel Data Techniques – Country Fixed Effects

To supplement the OLS estimation, we utilize the panel nature of the dataset to estimate country fixed effects models. The advantage of FE estimation is that time-invariant country-specific characteristics that could affect GDP per capita are controlled for and smoothed out of the estimated effect of skilled emigration and remittances. In addition, FE models allow for the estimation of the dynamic effects of skilled emigration and remittances. This follows a slight modification of equation (1) by adding time-invariant country-specific characteristics represented as c_i in equation (2).

$$LogGDPPC_{it} = \alpha + c_i + \beta_1 Skills_{it} + \beta_2 LogRemit_{it} + \sum_{k=1}^{K} \delta^k X_{it}^k + \varepsilon_{it} \quad (2)$$

4.3 Heterogeneous effects of Skilled Emigration in SSA

Empirical evidence reveals that the effect of skilled emigration on growth and GDP per capita varies from country to country. This is often mediated by a number of country-specific institutional quality variables like the quality of regulations, government effectiveness, rule of law, political stability, among others (Nifo & Vecchione, 2014). In order to explore potential heterogeneous effects, we add interaction terms between regulatory quality and skilled emigration rates. This approach allows us to examine the extent to which the effect of skilled emigrants affect economic growth mediated by the quality of institutions (regulations) in the

SSA countries. The interaction effects of skilled emigration variables with regulatory quality are estimated in equation (3)

$$LogGDPPC_{it} = \alpha + c_i + \beta_1 Skills_{it} + \beta_2 LogRemit_{it} + \gamma_1(Skills * Inst)_{it}$$
$$+ \sum_{k=1}^{K} \delta^k X_{it}^k + \varepsilon_{it} \quad (3)$$

Where $(Skills * RegQuality)$ is the interaction term of regulatory quality and skilled emigration rates. The parameter γ_1 therefore captures the heterogeneous effects of skills, by the quality of a country's institutions (proxy by regulatory framework).

4.4 Addressing Endogeneity Issue – the GMM Approach

In this section, we address the problem of endogeneity by employing a generalized method of moment (GMM) estimators as put forward by Arellano and Bond (1991; see Catrinescu et al., 2006 and Aggarwal et al. 2006). The GMM technique is adopted as a remedy for the lack of a good external instrumental variable in the field of migration and development estimations.

To specify the GMM model, equation (4) is modified as follows:

$$LogGDPPC_{it} = c_i + LogGDPPC_{it-1} + \beta_1 Skills_{it} + \beta_2 LogRemit_{it}$$
$$+ \sum_{k=1}^{K} \delta^k X_{it}^k + \varepsilon_{it} \quad (4)$$

Where, $LogGDPPC_{it-1}$ is the Log of GDP per capita lagged one year. All other variables remain as earlier elaborated in (2) and ε_{it} is the time-varying error term.

To eliminate unobserved heterogeneity (c_i), Arellano and Bond (1991; see Ferdaous, 2016) suggest first-differencing equation (5) to eliminate the unobserved country-specific effect, since the disturbance does not vary with time. This eliminates omitted variable bias and overcomes endogeneity by using lagged values of the dependent variables as instruments as represented in equation (5) (Catrinescu et al. (2006) and Aggarwal, Demirguc-Kunt, and Martinez Peria (2006)) cited in Kadozi, 2019).

$$\Delta LogGDPPC_{it}$$
$$= \Delta LogGDPPC_{it-1} + \beta_1 \Delta Skills_{it} + \beta_2 \Delta LogRemit_{it} + \lambda \Delta Z_{it}$$
$$+ \sum_{k=1}^{K} \delta^k \Delta X_{it}^k + \Delta \varepsilon_{it} \quad (5)$$

Where $\Delta LogGDPPC_{it}$ is the first-differenced natural log of GDP per capita in country i during time t; $\Delta LogGDPPC_{it-1}$ is the lagged first difference of the dependent variable; ΔX_{it} is a vector of first-differenced predetermined and endogenous variables and ΔZ_{it} is a vector of first-differenced exogenous variables that are used as instruments. We therefore estimate the coefficients of the variables to examine the joint effects of skilled migrants on economic growth in SSA countries while accounting for endogeneity issues using the GMM and 2SLS estimation techniques.

5. Empirical Results and Discussion

This section presents the results of the empirical estimation models explained in the previous section. We present first the baseline results of pooled OLS estimating the effects of skilled migration on real GDP per capita in 28 selected SSA countries. Then, we present empirical results examining the effects of skilled migration on real GDP per capita conditioned by the institutional variables in the same countries. In the same empirical estimations, we cater for country specific effects (rather than average effect) using the same variables of interests. We present the results of country dummies (of interest) to gauge how skilled migrants affect economic growth of dummy country in relation to the rest of other selected SSA countries. Finally, we present the results of the dynamic panel estimates based on the GMM estimator.

5.1 Impact of Skilled Emigrants on real GDP per capita

Despite the push factors as discussed above, migrants contribute back to their countries of origin. This contribution could be in the form of remittances, skills and technology transfers among others. Table 1 presents the baseline OLS estimates of the effect of skilled emigrants (low, medium, highly skilled, and the total emigration rate) on real GDP per capita in SSA countries.

Table 1: Skilled Migration and GDP Per Capita: Pooled OLS Results

VARIABLES	(1)	(2)	(3)	(4)
Total Emigration Rate (TER)	2.654***			
	(0.875)			
Low-skilled Emigration Rate		7.031***		
		(1.114)		
Medium-skilled Emigration Rate			-3.393***	
			(0.520)	
High-skilled Emigration Rate				-0.402***
				(0.114)
Remittances (% of GDP)	-0.00667***	-0.00639***	-0.00741***	-0.00712***
	(0.000828)	(0.000798)	(0.000860)	(0.000888)
Regulatory quality	0.0139	-0.00839	0.0675	0.0218
	(0.0561)	(0.0542)	(0.0546)	(0.0534)
Human Capital Index	0.942***	0.964***	0.804***	0.923***
	(0.0598)	(0.0596)	(0.0610)	(0.0584)
Private Sector Investment	0.614***	0.579***	0.625***	0.577***
	(0.210)	(0.204)	(0.211)	(0.222)
Financial Development Index	1.917***	1.621***	2.296***	2.280***
	(0.262)	(0.279)	(0.253)	(0.261)
Openness Index	0.161	0.207	0.362**	0.175
	(0.138)	(0.136)	(0.145)	(0.136)
Log(FDI Net Inflow)	0.132***	0.128***	0.134***	0.135***
	(0.0147)	(0.0146)	(0.0138)	(0.0140)

Log(Population)	-0.110***	-0.0818**	-0.118***	-0.142***
	(0.0339)	(0.0349)	(0.0299)	(0.0302)
Constant	4.151***	4.134***	4.333***	4.262***
	(0.259)	(0.256)	(0.261)	(0.260)
Year effects controlled	Yes	Yes	Yes	Yes
Observations	781	781	781	781
R-squared	0.663	0.672	0.676	0.666

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

As depicted in Table 1, total and low skilled emigration rates statistically and significantly affect real GDP per capita in the SSA region. On the other hand, medium and high-skilled emigration rates have statistically and significantly a negative effect on GDP per capita in the region. The possible reason for these mixed findings in the region could perhaps be attributed to the heterogeneity of African countries in terms of institutional and development factors. The institutional variables mediate the growth effect of skilled migration in the region. There is general consensus in the literature that the quality of institutions plays out differently in the region, implying that the effect of skilled emigration on economic growth could be country-specific. More so, African countries are at varying levels of development, which in turn influences differently the rates of skilled emigration as well as the "absorption capacity" for new ideas that skilled migrants can contribute. This argument is reinforced by similar studies asserting that cross-country analysis lacks the power to detect remittance-growth effects (see Baldé, 2009; Clemens & McKenzie, 2014; Rodrik, 2016; Clemens and McKenzie, 2014:1 cited in Kadozi, 2019). Indeed, Dilip Ratha et al (2011) assert that one of the mistakes often made in discussions of skilled migration is to treat Africa as a single homogenous entity. Aggregate migration rates mask wide disparities among country groups and individual countries. More so, African countries differ in terms the quantity and quality of emigrants and this variation turns out to differentially influence their development impact back home.

Similar findings overwhelmingly confirm the positive and statistically significant effect of human capital, FDI and private sector investment on GDP per capita in the SSA countries. Evidently, a one unit increase of human capital index increases GDP capita in the SSA region by 0.942%, and statistically significant effect is observed across the four models in table 1. Similarly, a one dollar increase in FDI net inflows increases GDP per capita by 0.132%. The effect of investment is also positive and significant: a one dollar increase in the private sector investment leads to an increase in GDP per capita by 0.614%. Averagely, the respective positive and significant effect of human capital, FDI and private investment across the SSA countries seem to be attributed to the recent investments put in the latter development indicators in the region.

However, averagely, remittance inflows and population respectively adversely affect the GDP per capita in the SSA region. Accordingly, a one percentage point increase in the share of remittances to GDP adversely affects GDP per capita by 0.67%. With regards to population, a one percent increase in a country's population size is associated with 0.11%

decrease in real GDP per capita. These results are corroborated by existing empirical findings related to the impact of remittance inflows and population growth on the economic growth and development in Africa. Indeed, cross-country studies from various studies confirm insignificant effects of remittances on economic growth in the SSA region. This relationship is mostly attributed to the heterogeneity of African countries in terms of level of development and varying level of policy and institutional frameworks in the region. These factors condition the degree to which remittances impact development in the region. However, when the analysis is customized at country level, the effect of remittance inflows on growth and development becomes strong and statistically significant for some specific countries. This signals the most important factor which has been continuously underestimated in the empirical studies of migration and development, the aspect of context. For population growth, the results are obvious considering the ongoing boom of demographic rate in SSA countries which is translated into negative effect on GDP per capita in the region.

Estimates presented in Table 2 indicate that, on average, the quality of institutions – represented by quality of regulations – mediates the growth effect of skilled emigration in the SSA countries.

Table 2: Skilled Migration, Institutions and GDP Per Capita: Fixed Effects Results

VARIABLES	(1) (Model 1)	(2) (Model 2)	(3) (Model 3)	(4) (Model 4)
Total Emigration Rate	-9.940*			
	(5.481)			
Low-skilled Emigration Rate		9.205		
		(11.01)		
Medium-skilled Emigration Rate			0.0532	
			(3.098)	
High-skilled Emigration Rate				-0.00934
				(0.220)
Remittances (% of GDP)	-0.00194*	-0.00309***	-0.00241**	-0.00210**
	(0.000995)	(0.000895)	(0.000942)	(0.000982)
Regulatory quality	0.0328	0.0593	0.0649	-0.0596
	(0.0487)	(0.0472)	(0.0832)	(0.0950)
Total Emigration Rate X Regulatory Quality	4.178**			
	(1.947)			
Low-skilled Emigration Rate X Regulatory Quality		4.853		
		(4.169)		
Medium-skilled Emigration Rate X Regulatory Quality			1.935	
			(3.095)	

High-skilled Emigration Rate X Regulatory Quality				0.705**
				(0.275)
Human Capital Index	0.122	0.212	0.157	0.153
	(0.367)	(0.373)	(0.358)	(0.358)
Private Sector Investment	0.112	0.138	0.120	0.0600
	(0.286)	(0.252)	(0.278)	(0.273)
Financial Development Index	1.121	0.920	1.146*	1.064*
	(0.707)	(0.645)	(0.618)	(0.606)
Openness Index	-0.0162	-0.106	-0.0800	-0.102
	(0.180)	(0.168)	(0.163)	(0.167)
Log(FDI Net Inflow)	0.0452***	0.0462***	0.0475***	0.0448***
	(0.00939)	(0.00917)	(0.00936)	(0.00961)
Log(Population)	-0.109	0.252	-0.0980	-0.00950
	(0.441)	(0.375)	(0.431)	(0.419)
Constant	6.956***	6.066***	6.839***	6.721***
	(0.873)	(0.876)	(0.940)	(0.863)
Year effects controlled	Yes	Yes	Yes	Yes
Observations	781	781	781	781
R-squared	0.534	0.513	0.497	0.517
Number of countries	28	28	28	28

Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

As evidenced in the Table 2, Model 1 presents results of empirical estimates related to the effects of total emigration rate and its interaction with regulatory quality (as measure of institutional quality) on the real GDP per capita in SSA countries. The subsequent models present similar level and interaction effects for low-skilled, medium-skilled and high-skilled emigration rates, respectively. Interestingly, the interaction of total emigration rate and regulatory quality has a positive and statistically significant coefficient, confirming that regulatory quality positively mediates the growth effect of total emigration rate. Similarly, the interaction term of high-skilled emigration rate and regulatory quality is positive and statistically significant, further providing strong evidence in support of the role of the quality of institutional framework in mediating the growth effects of skilled emigrants in the SSA region. In other words, on average, the growth effect of skilled emigration increases with the quality of institutional frameworks in the region.

The growth effects of low-skilled and medium-skilled emigration rates are not statistically significant, as indicated in columns 2 and 3. It has been extensively documented that institutional deficiency such as political instabilities, regulatory inefficiencies, market failures and non-responsive policies like employment and migration policies influence emigration of skilled Africans from the region. The same institutional and policy failures limit the potential to tap, attract and retain skilled African talents in the region. Conversely, in African countries where institutional and policy frameworks (for instance for education) are effectively working, findings from existing studies suggest a significant effect of skilled emigrants on

economic development. It is presumed that skilled emigration affects growth through its positive effect on the total factor productivity and human capital development within specific African countries. This is in line with Kadozi's (2019) claim that remittance-education growth effect increases with prevailing pro-human capital development institutional frameworks and policies in SSA countries.

5.2 Skilled Emigration, Human Capital Development and Growth

In this section, we examine whether skilled emigrants impact economic growth through human capital development in the SSA region. The section presents empirical results related to the interaction term of skilled emigration rate and human capital development index on the GDP per capita. Table 3 presents the estimation results for interactions between skilled emigration and human capital development index. Empirically, the results in column 1 and 2 reveal a positive and statistically significant interaction between total emigration rate and human capital development index. A similar observation is made in the case of low-skilled emigration in Column 2. The overall implication is that, emigration compliments the human capital development in positively impacting economic growth in the SSA countries. However, the mediating effects of human capital are insignificant in the case of medium-skilled and high-skilled emigration rates in columns 3 and 4. These results are contradict the findings by Blaise and Anyanwu (2019), which suggest that the higher the education levels of emigrants, the greater the impact of the Diaspora in Africa. We presume that the finding is partly attributable to the institutional heterogeneity of SSA countries as presented in earlier sections. Additionally, the effect seems to be overshadowed by the prevailing weak human capital development indices on average in the SSA countries. More so, African countries have varying levels of Diaspora human capital development policies which condition the development impact of brain gain. Similarly, the later effect is coupled by the prevailing diaspora policy engagements and how the same policies are playing out within African countries.

Table 3: Skilled Emigration, Human Capital & GDP Per Capita: Fixed Effects Results

VARIABLES	(1)	(2)	(3)	(4)
	Model 1	Model 2	Model 3	Model 4
Total Emigration Rate	-33.75***			
	(8.637)			
Low-skilled Emigration Rate		-45.55*		
		(23.10)		
Medium-skilled Emigration Rate			6.616	
			(17.53)	
High-skilled Emigration Rate				-1.675
				(1.389)
Remittances (% of GDP)	-0.00269***	-0.00350***	-0.00249**	-0.00265***

	(0.000935)	(0.000940)	(0.00105)	(0.000956)
Human Capital Index (HCI)	0.0209	0.147	0.186	0.101
	(0.405)	(0.397)	(0.367)	(0.396)
HCI×Total Emigration Rate	11.28**			
	(4.188)			
HCI × Low-skilled Emigration Rate		19.24**		
		(7.303)		
HCI × Medium-skilled Emigration Rate			-4.702	
			(10.63)	
HCI × High-skilled Emigration Rate				0.861
				(0.825)
Regulatory quality	0.101**	0.0980**	0.115**	0.100**
	(0.0373)	(0.0365)	(0.0419)	(0.0401)
Private Sector Investment	0.125	0.117	0.153	0.119
	(0.277)	(0.248)	(0.260)	(0.257)
Financial Development Index	1.069*	0.988*	0.875	0.845
	(0.609)	(0.574)	(0.626)	(0.579)
Openness Index	-0.0815	-0.106	-0.0537	-0.116
	(0.174)	(0.180)	(0.164)	(0.164)
Log(FDI Net Inflow)	0.0410***	0.0415***	0.0490***	0.0430***
	(0.00750)	(0.00776)	(0.00966)	(0.0100)
Log(Population)	0.265	0.562	-0.0618	0.0346
	(0.371)	(0.414)	(0.482)	(0.334)
Constant	6.540***	5.769***	6.724***	6.893***
	(0.731)	(0.841)	(1.093)	(0.780)
Year effects controlled	Yes	Yes	Yes	Yes
Observations	781	781	781	781
R-squared	0.560	0.546	0.498	0.509
Number of countries	28	28	28	28

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

5.3 Skilled Emigration and Economic Growth: Country effects

This section contextualizes the analysis to a country level effect, as recommended by several empirical studies (Clemens & McKenzie, 2014; Rodrik, 2016). In this regard, we examine the effect of skilled emigration on real GDP per capita in one of the SSA countries in relation to the rest of the SSA countries under study. Accordingly, the analysis was conducted on countries like Mauritius, Mauritania and Rwanda. Table 4 reports the results of Rwanda (results of the two other countries can be provided upon request). In Rwanda, the skilled emigration-driven growth impacts are evident.

Table 4: Skilled Emigration and GDP Per Capita in Rwanda: Radom Effect Results

	(1)	(2)	(3)	(4)

VARIABLES	Model 1	Model 2	Model 3	Model 4
Total Emigration Rate	2.392			
	(3.610)			
Low-skilled Emigration Rate		6.749		
		(4.861)		
Medium-skilled Emigration Rate			-3.483**	
			(1.555)	
High-skilled Emigration Rate				-0.446
				(0.474)
Remittances (% of GDP)	-0.00675***	-0.00646***	-0.00746***	-0.00715***
	(0.00217)	(0.00220)	(0.00199)	(0.00200)
Regulatory quality	0.00668	-0.0141	0.0641	0.0234
	(0.240)	(0.227)	(0.221)	(0.221)
Human Capital Index	0.935***	0.957***	0.791***	0.911***
	(0.218)	(0.217)	(0.205)	(0.213)
Private Sector Investment	0.558	0.531	0.553	0.501
	(0.663)	(0.618)	(0.716)	(0.784)
Financial Development Index	1.984**	1.679	2.327**	2.292**
	(0.961)	(1.102)	(0.951)	(0.978)
Openness Index	0.110	0.161	0.300	0.107
	(0.378)	(0.370)	(0.282)	(0.333)
Log(FDI Net Inflow)	0.134***	0.130***	0.136***	0.139***
	(0.0340)	(0.0340)	(0.0332)	(0.0335)
Log(Population)	-0.124	-0.0935	-0.132	-0.157
	(0.121)	(0.128)	(0.0961)	(0.104)
Rwanda X Total Emigration Rate	143.7**			
	(62.74)			
Rwanda X Low-skilled Emigration Rate		477.0**		
		(188.8)		
Rwanda X High-skilled Emigration Rate			37.10***	
			(13.26)	
Rwanda X High-skilled Emigration Rate				2.620***
				(0.970)
Constant	4.209***	4.179***	4.408***	4.339***
	(0.530)	(0.520)	(0.504)	(0.521)
Year effects controlled	Yes	Yes	Yes	Yes
Observations	781	781	781	781
Number of country2	28	28	28	28

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

In Rwanda, the impact of skilled emigration on the economic growth holds. Evidently, results from Table 4 reveal significant positive impact of skilled emigrants (total, low, medium and high-skilled emigrant rate) on GDP per capita. The coefficients of the four categories of skilled emigration and the Rwanda dummy are positive and statistically significant, providing strong evidence that the effect of skilled emigration in Africa countries is country specific. These results are reinforced by the assertion of Frédéric Docquier (2014) that whether a country gains or loses from migration depends on country-specific factors such as the level and composition of migration, the country's level of development, and such characteristics as population size, language, and geographic location. The skilled emigration-driven growth effect seems to have been influenced by the recent development the country has registered. This is coupled with strong policy engagement of Rwandan Diaspora and effective institutional arrangements that have created opportunities and confidence in Diaspora, and lead to an effective transfer of skills and remittances back home.

5.4 Generalized Method of Moments (GMM) results

Table 5 presents the GMM estimation results for the effect of skilled emigration rates on real GDP per capita. The first lag of the dependent variable is instrumented with the second lag of the same. Emigration variables are considered as endogenous and instrumented using their first lags. Unlike the previous estimates, the GMM results reveal a positive and significant effect of skilled migration on real GDP per capita. The results are specifically more significant for high-skilled migration, indicating that real GDP per capita is more sensitive to high-skilled relative to low and medium skilled migration. The significant interaction between high-skilled emigration and regulatory quality confirms that the latter mediates the effect of the former on real GDP per capita, consistent with the results presented in earlier sections. In other words, the effect of high-skilled emigration is more pronounced in countries with better regulations – as a proxy for quality of institutions. Across all four model specifications, the Arellano and Bond P-values are bigger than any reasonable level of significance, leading to no rejection of the null hypothesis of no second-order autocorrelation.

Table 5: Effect of Skilled Emigration on GDP Per Capita: GMM Results

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4
Lag Log(GDP per capita)	0.985***	0.984***	0.984***	0.985***
	(0.00370)	(0.00367)	(0.00346)	(0.00368)
Total Emigration Rate	1.590*			
	(0.876)			
Low-skilled Emigration Rate		-0.422		
		(1.471)		
Medium-skilled Emigration Rate			1.382***	
			(0.527)	
High-skilled Emigration Rate				0.257**
				(0.118)
Total Emigration Rate X Regulatory Quality	0.0306			
	(0.1309)			
Low-skilled Emigration Rate X Regulatory Quality		-0.0388		
		(0.2042)		
Medium-skilled Emigration Rate X Regulatory Quality			0.2048	
			(0.1606)	
High-skilled Emigration Rate X Regulatory Quality				0.218**
				(0.0103)
Private Sector Investment	0.0453	0.0463	0.0488	0.0493
	(0.0326)	(0.0321)	(0.0335)	(0.0313)
Financial Development Index	0.0613	0.0664	0.0960	0.0736
	(0.121)	(0.130)	(0.122)	(0.123)
Openness Index	-0.00305	0.000621	-0.00419	0.000307
	(0.0527)	(0.0528)	(0.0520)	(0.0502)
Log(FDI Net Inflow)	0.00644	0.00650	0.00655	0.00612
	(0.00732)	(0.00732)	(0.00731)	(0.00714)
Log(Population)	0.687**	0.689**	0.724**	0.755**
	(0.334)	(0.337)	(0.341)	(0.353)
Constant	0.0548*	0.0589**	0.0561**	0.0473*
	(0.0294)	(0.0291)	(0.0269)	(0.0273)
Year effects controlled	Yes	Yes	Yes	Yes
Observations	457	457	457	457
Number of country2	28	28	28	28
AR(2) P-value	0.443	0.468	0.471	0.520
Diff. Hansen P-value	1.000	1.000	1.000	1.000

Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Lag Log(GDP per capita) is instrumented with the second lag of GDP per capita. The four emigration variables

are each instrumented with its first lag.

6. Conclusion and policy implications

International migration continues to attract growing policy and scholarly attention, often with divergent views about the development impact of skilled migrants (brain gain) in their countries of origin. This paper examines the development impact of skilled migrants in 38 Sub-Saharan African (SSA) countries for the period from 1980 to 2019, with customized analysis at the country level. Specifically, the study measures the effect of skilled emigration rate (ratio of the number of highly skilled emigrants from a particular SSA country to a destination OECD country to the total labor force of the country of origin) and remittances on real GDP per capita in the migrants' countries of origin. The study further explores whether the development impact of skilled migrants is mediated by the institutional factors in the source country. The analytical framework of the study is embedded in the three dominant theoretical and empirical approaches about migration and its outcomes; the new economics of labor migration (NELM), endogenous growth approach and incentive effect. The study uses Ordinary Least Squares (OLS) as the baseline model, complemented by Fixed Effects models to account for country-specific time-invariant characteristics (country heterogeneity). The endogeneity of emigration variables is dealt with using the Generalized Method of Moments (GMM). The study findings confirm that three theoretical approaches are complementary in explaining the development impact of brain gain. The OLS results indicate a statistically significant effect of total and low-skilled emigration on GDP per capita in the SSA countries and no statistically significant effect of medium and highly skilled emigration on GDP per capita while, FE results indicate no significant level effects of skilled migration. At country level, the effect of skilled emigration in Rwanda holds, and it is statistically significant. Disaggregated analysis shows a positive and statistically significant impact of highly-skilled migrants in the region. The GMM results further reveal that the effect of skilled migration and remittances is mediated by institutional factors – particularly regulatory quality – in the countries of origin. The findings suggest that the quality of institutional framework and skills level are significantly imperative for enhancing development impact of skilled emigrants in the region. The findings of this study suggest that policy and institutional frameworks are imperative to attract and condition the growth and growth impact of skilled emigration in the SSA region. Secondly, the effect of skilled emigrants in the SSA countries differ and it is country specific attributed to the fact that heterogeneity of countries in the region in terms of level of development, Institutional policy environment, Diaspora engagement policies, and the capacity to attract and make use of Diaspora resources. Third, considering the problems of data on skilled emigration in Africa, it is imperative for policy makers and other stakeholders to improve and harmonize data collection and reporting of skilled emigration flows. This will enable scholars to better study the development impact of both brain drain and brain gain in the SSA countries.

References

Balago, G. S. (2014). Financial sector development and economic growth in Nigeria: An empirical investigation. *International Journal of Finance and Accounting*, *3*(4), 253-265.

Blaise Gnimassoun and John C. Anyanwu (2019), The Diaspora and Economic Development in Africa,

Benmamoun, M., & Lehnert, K. (2013). Financing growth: comparing the effects of FDI, ODA, and international remittances. *Journal of Economic Development*, *38*(2), 43.

Beine, M. A., Docquier, F., & Rapoport, H. (2003). Brain drain and LDCs' growth: winners and losers.

Brücker H., Capuano, S. and Marfouk, A. (2013). Education, gender and international migration: insights from a panel-dataset 1980-2010, mimeo. Available: https://www.iab.de/en/daten/iab-brain-drain-data.aspx accessed on: 24th April 2020.

Chee, Y. L., & Nair, M. (2010). The impact of FDI and financial sector development on economic growth: Empirical evidence from Asia and Oceania. *International Journal of Economics and Finance*, *2*(2), 107-119.

Dilip Ratha, Sanket Mohapatra, Ca˘glar Özden, Sonia Plaza, William Shaw, Abebe Shimeles (2011), Leveraging Migration for Africa; *Remittances, Skills, and Investments,* The International Bank for Reconstruction and Development / The World Bank

Ehrlich, I., & Kim, J. (2015). Immigration, human capital formation, and endogenous economic growth. *Journal of Human Capital*, *9*(4), 518-563.

International Organization Migration and United Nation (2020), World Migration Report, International Organization for Migration

Gnimassoun, B., & Anyanwu, J. C. (2019). The Diaspora and economic development in Africa. *Review of World Economics*, *155*(4), 785-817.

Gyimah-Brempong, K., & Wilson, M. (2004). Health human capital and economic growth in Sub-Saharan African and OECD countries. *The Quarterly Review of Economics and Finance*, *44*(2), 296-320.

Frédéric Docquier (2014), The brain drain from developing countries. IZA World of Labor 2014: 31, doi: 10.15185/izawol.31

Hayes, A. F. (2013). Mediation, moderation, and conditional process analysis. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach edn. New York: Guilford Publications*, 1-20.

Kherfi, S., & Soliman, M. (2005). FDI and economic growth in CEE and MENA countries: A tale of two regions. *International Business & Economics Research Journal (IBER)*, *4*(12).

Kottaridi, C., & Stengos, T. (2010). Foreign direct investment, human capital and non-linearities in economic growth. *Journal of Macroeconomics*, *32*(3), 858-871.

Kraay, A. (2018). *Methodology for a World Bank human capital index*. The World Bank.

Lee, R., & Mason, A. (2010). Fertility, human capital, and economic growth over the demographic transition. *European Journal of Population/Revue européenne de Démographie*, *26*(2), 159-182.

Michael Beine, Frédéric Docquier, Hillel Rapoport (2003), Brain Drain and LDCs' Growth: Winners and Loser, Discussion Paper No. 819, IZA

Michael A. Clemens (2020), The Emigration Life Cycle: How Development Shapes Emigration from Poor Countries

Ndlovu, G. (2013). Financial sector development and economic growth: Evidence from Zimbabwe. *International Journal of Economics and Financial Issues*, *3*(2), 435-446.

Nifo Sarrapochiello, A., & Vecchione, G. (2014). Do Institutions Play a Role in Skilled Migration? The Case of Italy.

Odeniran, S. O., & Udeaja, E. A. (2010). Financial sector development and economic growth: Empirical evidence from Nigeria. *Economic and Financial Review*, *48*(3), 91-124.

OECD & AFD Migration Data Brief, 2019, available on; www.oecd.org/migration

Savvides, A., & Stengos, T. (2008). *Human capital and economic growth*. Stanford University Press.

Svirydzenka, K. (2016). *Introducing a new broad-based index of financial development*. International Monetary Fund.