Migrant Remittance Inflow and Industrialization in Africa: What Role Does Financial Development Play?

B. W. Adeoye, Chinenye Ifeoma Nwokolo, and Nnenna Ifunanyachukwu Igboanugo

Abstract The eruption of Global Financial Crises at the rear end of 2008 with its aftermath effect has shifted the focal point of financial-cum-capital reliance of most developing countries away from sources of finance induced externally. This, however, kick-started research interest toward considering other ways of sourcing financial resources for development apart from the widely known sources like foreign portfolio investment (FPI), foreign direct investment (FDI) and official development assistance from overseas. This notwithstanding, migrants' remittances imperatively remain a better source of finance as it is found to be more resilient, in times of macroeconomic shocks and other natural disturbances compared to other sources of capital flows. This uniqueness has made it a point of focus to African Development practitioners as a more reliable source for financing development in Africa. Thus, for any developing country to have a sustainable development it must transit from agricultural produce to industrialization as it is seen as the bedrock of development. This ignited our motivation for this study to assess how migrant remittances can directly and/or indirectly influence industrialization using a panel data of 46 African countries from 1980 to 2017. The direct effect is evaluated through financial development channels. The study used both interactive and non interactive empirical evidence methods for a more robust estimation; this includes (a) Fixed Effects techniques (FE) to rule out heterogeneity; (b) General Method of Moments (GMM) to rule out persistence in industrialization and (c) Instrumental Quantile Regressions (QR) to explain for the previous levels of industrialization. The non interactive stipulations will give account for the direct impact of migrant remittances on industrialization while the interactive stipulations will account for the indirect effect. The findings clearly show that personal remittance inflows can only drive industrialization through financial development at the early stage.

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1 Introduction

The eruption of Global Financial Crises at the rear end of 2008 with its aftermath effect has shifted the focal point of financial-cum-capital reliance of some developing countries away from sources of finance induced externally. This, however, kick-started research interest toward considering other ways of sourcing financial resources for development apart from the widely known sources like foreign portfolio investment (FPI), foreign direct investment (FDI) and official development assistance from overseas (Efobi, Asongu, Okafor, Tchamyou, & Tanankem, 2016; Ajide & Alimi, 2018; Olayungbo & Quadri, 2019). This notwithstanding, migrants' remittances imperatively remain a better source of finance, due to the fact that it is found to be more resilient compared to other capital inflows in times of macroeconomic shocks and other natural disturbances (Ratha, Mohapatra, & Xu, 2008). This uniqueness has made it a point of focus to African Development practitioners as a more reliable source for financing development in Africa. In addition, African Development Bank and United Nations Economic Commission for Africa have advised Africans to refocus their attention by leveraging on migrant's remittance.

It was observed in Fig. 1 that remittance has been less pro-cyclical compared to other foreign inflows to Africa. Hence, the motivation for this study is the importance Africans have attached to remittance due to its consistent and continuous flow despite the economic conditions faced by the home country. Consequently, this study examines the likelihood of remittance driving industrialization in Africa and the complementary effort of financial institutions in achieving this industrialization.

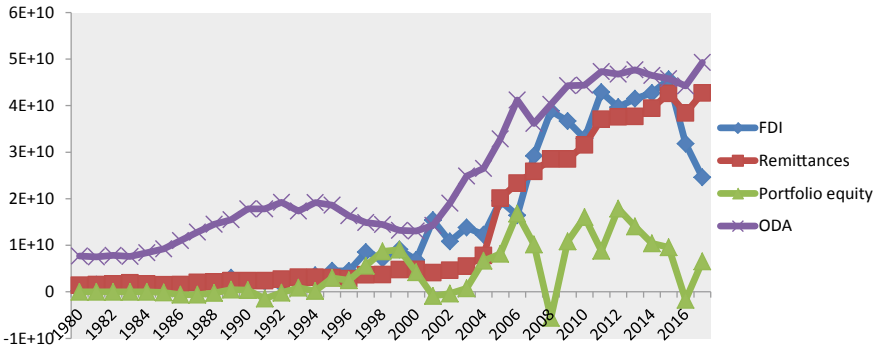

Fig. 1 Foreign inflow to Africa. *Source* Authors' Computation from World Development Indicators (2018)

Moreover, agricultural produce dominates Africa's economy and has also been the major share of foreign exchange earnings especially in Sub-Saharan African countries. (UNCTAD, 2014; Loto, 2016). The adverse effect of this situation includes harming the institutional structure and rent-seeking behavior due to over-dependence on primary produce, exposing the economy to external shocks caused by commodity price change and the country stands at risk because it can be easily broken into by opposing parties that want to take over control of the resources (Collier & Hoeffler, 2001). In addition, this scenario has resulted in the importation of virtually other consumables, eroding the performance of the manufacturing/industrial sectors. More so, it has increased the poverty level because this sector cannot address the rising unemployment rate as the real sector (manufacturing sector). At this point, these tendencies necessitate structural transformation in African countries by moving from primary-based products to industrialization (Chenery & Strout, 1966) considering the negative effect of over-dependence on the primary commodity.

Based on this scenario, it is crystal clear that industrialization is pivotal in Africa. It is widely believed that industrialization will build a more resilient economy that will help to create jobs, improve the standard of living of the people and reduce poverty (Adeoye, 2004; Dauda & Odior, 2016; Loto, 2016).

In the light of the foregoing, several developmental initiative programs have focused on industrialization as the way forward in Africa to combat the rising poverty level and make growth inclusive. For instance, The African Development Bank High5s target considered industrialization as its third goal that will help quicken economic transformation to improve the living conditions of Africans. Also, the African Union Agenda 2063 was designed toward growth and industrialization. In addition, Industrialization is the Ninth Sustainable Development Goals targeted at reducing poverty and increasing living standard of people in Africa through job creation. However, one of the main constraints of industrialization in Africa is capital which has made most countries in the continent resource-dependent. Nevertheless, if remittance is well harnessed due to the huge volume of inflow to Africa[1] and it's less cyclical and volatile nature compared to other capital inflows (see Fig. 1), it can possibly drive industrialization in Africa.

To this end, the impact of migrant remittance on industrialization is assessed with a panel data of 46 African countries spanning from 1980 through 2017. Our important research questions are as follows: to what degree will migrant remittance drive Africa's industrialization? Can this outcome be influenced by the efficiency of financial institutions in various African countries? A survey of the literature on the combined impacts of remittance and financial development on industrialization, from a developmental view of Africa as a whole, reveal there are relatively scanty studies on the issue of the concept. This avails the study opportunity to fill this most recent gap in the literature. Consequently, the importance of this paper is due to the rising trend of migrant's remittance inflows into Africa and the rising policies interest on how to optimally maximize this enormous financial resource. Therefore, to help

[1]From $14 billion in 2001 rose to $40 billion in 2010 and further sprout to $52 billion in 2015 (World Bank, 2017).

resolve the menace of industrialization peculiar to Africa, it is necessary to have a critical view on this issue of context, which would be of help in specifying directions for new policies for development in Africa.

The next section of our paper presents the stylized fact on migrant's remittance inflow, industrialization in Africa and the role of financial development; the third section critically reviews the literature on how remittance inflows can drive industrialization; the forth section comprises the methodology and overview of the data used, while the fifth section contains empirical results and discussion. The final section concludes and makes relevant policy prescriptions and developmental strategies.

2 Stylized Facts on Migrant's Remittance Inflow and Industrialization in Africa

To further broaden our understanding of the variables of interest to this paper (migrant remittance Inflow, industrialization in Africa and the role financial development plays), we explore a trend analysis of the variables for 37 years (1980–2017). Figure 1 presents the comparison trend of the industrial sector performance in Africa and other regions across the world. It was observed that the annual growth rate of the industrial sector in SSA was negative between the period 1982–83 and sprouted to about 4% in 1984; it has incessantly declined after this period until in the year 2000 when it got to a peak of 5%. After that it consistently declined up till 2017. Overall, the industrial annual growth rate was not more than 5% for the entire period of 1980–2017. Excluding countries in Europe and Central Asia/Latin America and the Caribbean, countries from other regions like South Asia and East Asia and the Pacific witnessed a higher growth rate than Sub-Saharan African countries (Fig. 2).

In addition, we further looked at the contribution of the GDP growth rate by sector, in other to compare the industrial sector performance with other sectors in SSA

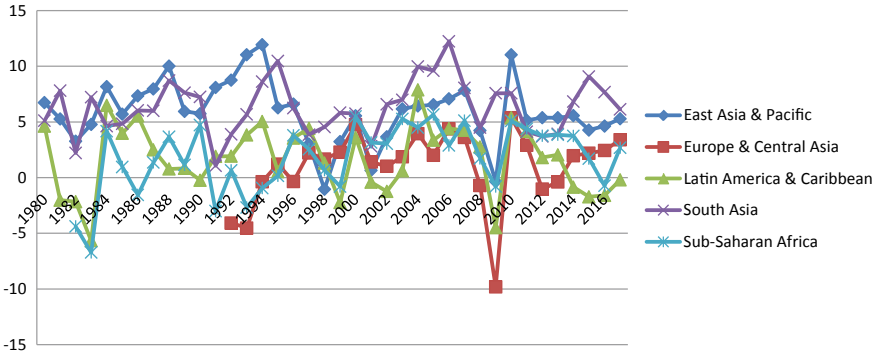

Fig. 2 Industry, value added (annual% growth). *Source* Author's computation from World Development Index (WDI), (2018)

countries. Figure 3 presents an overview of the sectorial performance in SSA. Evidently, based on growth rate, the manufacturing sector performance is far below other sectors. Manufacturing value-added share of GDP (MVA) has been on the decline from 17% in 1981 to less than 10% in 2017, which is lower than those of the agricultural and service sectors. It is apparent from the trend analysis above that Africa has leapfrogged from the agricultural sector to the service sector skipping industrialization. However, several factors have been attributed to the poor performance of the manufacturing/industrial sector in the region most especially the capital among others. Hence, this constraint has made the sector to continue to underperform. Capital is an important input factor that can spur growth in the sector (Solow, 1956; Gui-Diby & Renard, 2015). In recent times, remittance is seen as an essential capital flow that can influence the performance of the industrial sector in Africa either direct or indirect. Based on this, we examined the trend analysis of diaspora remittance in the SSA region compared with other regions (Fig. 4).

Apart from South Asian countries, remittance inflow in SSA countries is consistently higher with volumes that are many folds more than those of East Asia and the Pacific, Europe and Central Asia as well as Latin America and the Caribbean countries. However, aside from South Asia, none of these regions have ever reached this threshold attended by the SSA region as displayed during the entire period of study.

Figure 5 illustrates the relationship between remittance and industrialization in African countries. The scatter plot presented includes a sample of some selected countries in the region, where industrialization is captured as MVA as a share of GDP as used by Efobi et al. (2016) and Gui-Diby and Renard (2015). While remittance is captured using personal remittance as a share of GDP, form the figure, it is observed that a weak negative relationship exists between remittance and industrialization in the selected African countries. Hence, as remittance is increasing, manufacturing value-added percentage of GDP is decreasing. Even using regression analysis (see Table 1), a slightly negative relationship of about 0.03806 exists between

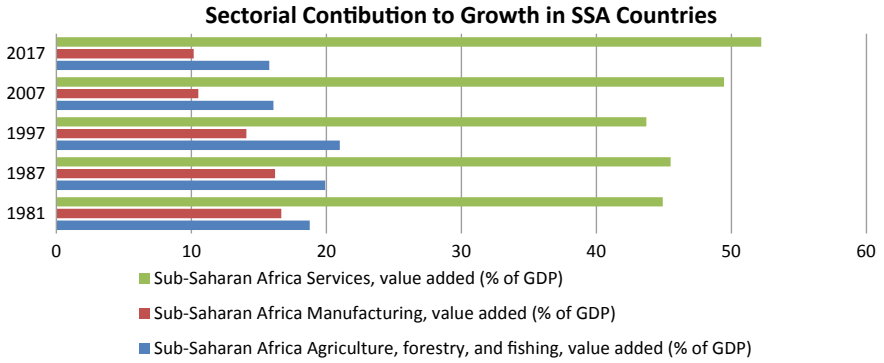

Fig. 3 Sectorial contribution to GDP in Sub-Saharan Africa (percentage). *Source* Author's computation from World Development Index (WDI), (2018)

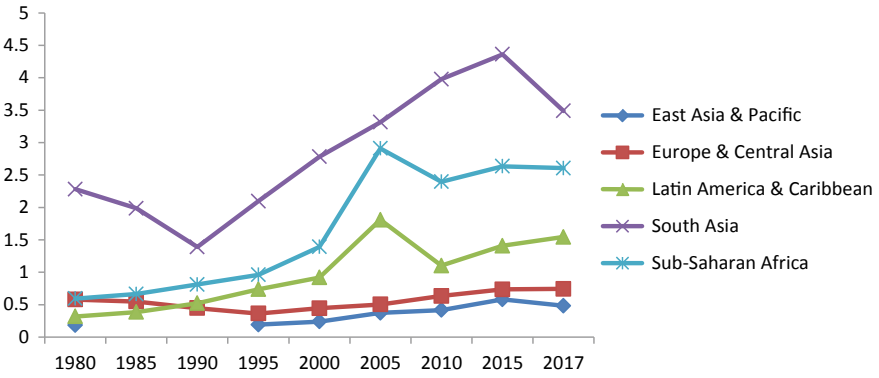

Fig. 4 Remittance inflow as a share of GDP. *Source* Author's computation from World Development Index (WDI), 2018

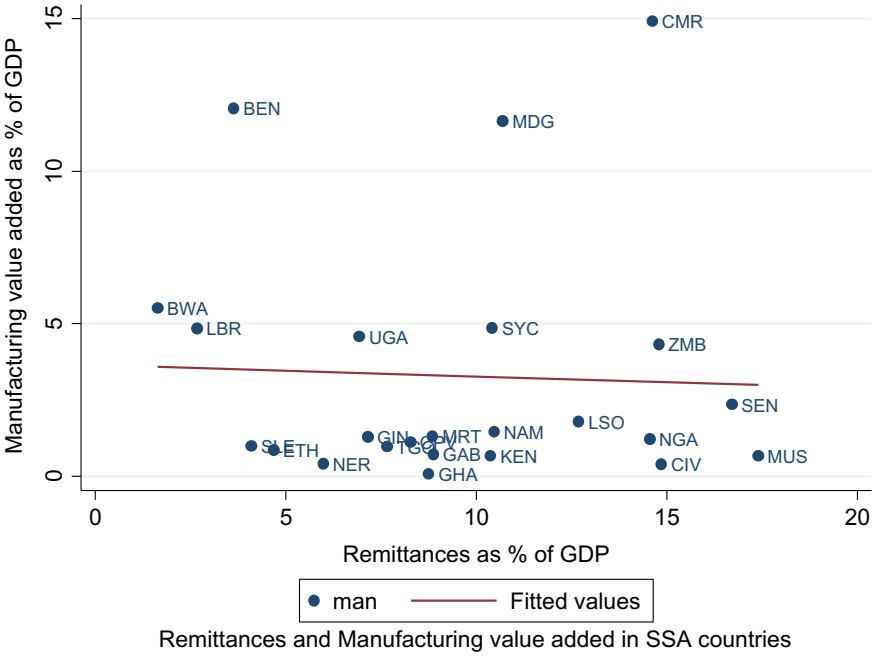

Fig. 5 Scatter plot (industrialization and Remittance in Africa from 1980 through 2017). *Source* Author's Computation (2019)

Table 1 Regression analysis for the scatter plot

Man				
	Coefficients	Standard error	*t* stat	*P*-value
Intercept	3.646429	2.017815	1.807118	0.08444
Rem	−0.03806	0.019360	−1.9660	0.04946

Source Author's Computation

the variables at a 5% significance level. Thus the argument that remittance can drive industrialization in African countries is subject to some factors (macroeconomic factors, inefficiency of financial institutions or the business environment). Although the relationship is preliminary, the study intends to use more sophisticated econometric analytical techniques that will help control for endogeneity and simultaneity issues.

3 Literature Review

This section of the paper undertakes a brief review of the literature and theory underpinning the determinants of migrant's remittance. The theory underpinning migrant remittance based on the literature is majorly channeled through two main factors which include pure altruistic motive and self-interest purpose. The altruistic motive posits that the migrant remit money to family members back home based on their welfare. Therefore, the migrant is satisfied when the well-being and consumption of the family left behind are better off. In a nutshell, remittance is viewed as a mechanism that absorbs shock in a circumstance where the migrant relations are worst hit by the deterioration in economic conditions such as financial crises. In such cases as this, remittance is considered as being countercyclical in nature since they are seen as compensatory transfer to smoothen the consumption of their family member in times of economic disturbances. For self-interest purposes, the motivation for migrant to remit funds to the home country is reduced due to the poor economic conditions in the domestic country. However, remittance is not always countercyclical. This is well spelled out by Lucas and Stark (1985:904); they posit that migrant remit money for investment or acquisition of assets in their home country and for them to be respected when they return to their home country (Stark, 1991, 1995).

On the empirical front, this paper is basically focuses on some salient empirical review that seemed central to the particular study at hand. Hence, the review of literature is in three strands, firstly studies on remittance and financial sector development and secondly, studies on remittance and industrialization.

Remittance and Financial Sector Development

Empirically, the nexus between remittance and financial sector development is well articulated in the literature. Several studies have examined how remittance promotes financial institution efficiency and in spite of different roles remittance plays in the

efficiency process, the raising academic interest on the issue of context is evidence that remittance stimulates efficiency in the financial institution.

Aggarwal, Demirguc-Kunt, and Peria (2011) assessed the link between remittance and financial development using panel data of 109 developing countries from 1975 to 2007. It was observed that remittance is positively significant to financial development. In the same vein, Cooray (2012) examined the effect of remittances on financial sector development in 94 non-OECD countries. It was established that remittances have a positive effect on the efficiency of financial development. In addition, the effect of remittances on financial institutions is felt more in countries where government ownership of banks is lessened. Similarly, Fromentin (2015) analyzed the effect of remittances on financial development in both Latin America and the Caribbean countries and posits that remittances impact financial sector development positively. Ojapinwa and Bashiru (2014) using a panel data of 32 SSA countries, assessed the impact of migrant remittance on financial development spanning from 1996 through 2010. They established that remittance impacts financial development positively across the countries examined. Kaberuka and Namubiru (2014) also recorded a positive impact in Uganda. On the contrary, a similar study was conducted by Karikari, Mensah, and Harey (2016) in 50 developing countries across Africa between 1990 and 2011. It was revealed that remittance does not promote financial sector development. Githaiga and Kabiru (2014) employed a panel of 31 countries spanning from 1980 through 2012 to investigate how remittances determine financial sector development efficiency and discovered that remittances are negatively related to financial sector development.

Remittance and Industrialization Nexus

Dzansi (2013) used a sample of 40 countries between 1991 and 2004. The study showed that remittance promotes the relative growth of traded manufacturing sectors in the home country. On the contrary, Acosta, Lartey, and Mandelman (2009) in their study revealed that the volume of migrant remittance is subject to the rise in real exchange rate and thereafter leads to lack of international competitiveness. This invariably results in a decrease in the output of both manufactured/tradable goods. Hence, remittances can also affect the performance of the manufacturing sector through the increase in demand for non-tradable goods. Amuedo-Dorantes (2014) analyzed the effect of remittance on manufacturing sector performance and found that non-tradable goods are more in demand than tradable ones which affected the production of the sector. In the same vein, Lartey, Mandelman, and Acosta (2008) also confirm this using a panel data of 109 developing countries spanning from 1990 through 2003. The findings showed that remittances have an impact on the prices of non-tradable goods compared to tradable ones. Hossain and Hasanuzzaman (2015) estimated the relevance of migrant remit in Bangladesh economy and showed that remittance impacts investment positively in the long run. It revealed that remittance can boost domestic entrepreneurship and enterprise.

It has been deduced from the literature that remittance can affect industrialization through direct or indirect channels. For instance, Hossain and Hasanuzzaman (2015) established a positive relationship between migrant's remittance and investment in

Bangladesh. Also, another direct effect of remittance is that it can drive industrialization through diaspora skill transfer from abroad to the home country (Brinkerhoff, 2006). Indirect channels through which remittance can influence industrialization include (i) the exchange rate which impacts the manufacturing sector performance negatively, by affecting the value of tradable manufacturing goods. (ii) Another indirect effect of remittance on industrialization is its positive impact on the financial institution by enhancing their level of efficiency (Aggarwal et al., 2011; Ojapinwa & Bashorun, 2014; Karikari et al., 2016). Thus efficiency in this context shows how the financial sector is able to pool savings and allocate is as capital for productive investment that can lead to industrialization in the long run (Ewetan & Ike, 2014; Olayungbo & Quadri, 2019). According to Amuedo-Dorantes, 2014, remittance inflows basically increase the consumption level of households; hence this will in turn affect the manufacturing sector through the rise in the demand for non-tradable goods. Regardless of the channel, what is important is maximizing the positive impact of migrant's remittance and bring about expected industrial growth. Hence, in achieving this, some factors need to be considered. For example, the government has to be involved in policies that are geared toward maximizing the gains from migrant's remit. Firms too need to be involved in this maximization process by promoting migrant's input through vertical integration of domestic businesses/enterprises. Also, individuals can also be involved in this through capacity and skill development. However, in all this government intervention is pivotal among others in maximizing the gains of migrant's remittance. Therefore, it is the duty of the government to create policy and economic incentives that are targeted at encouraging economic transactions. Improving the performance of financial institutions should be the major target of the policy. Hence, the contribution of the financial institution in the link between migrant remittance and industrialization is absolutely supportive. This simply implies that in spite of the quantity and quality of remittance inflows, the financial institution's contributory role in promoting productive investment and business development cannot be overlooked. Studies like Aggarwal et al. (2011), Kaberuka and Namubiru (2014), Ojapinwa and Bashorun (2014), Karikari et al. (2016), have established that positive relationship exists between migrant remittance and financial development basically in countries where there are improved financial institutions. Indisputably, a huge number of studies have examined as well as probed into how remittance inflow enhances financial institution efficiency in developing countries. However, studies on the tripartite relationship of the highlighted issue of context (migrant's remittance-financial development-industrialization) in Africa are scarce or at best emerging. This gave us the privilege to fill the existing gap in the literature.

4 Methodology

4.1 Theoretical Framework and Methodology

The theory that best explains the link between capital flows and industrial growth is the endogenous growth theory (AK model). This theory has been widely adopted by studies (Pagano, 1993; Bailiu, 2000; Saibu, 2014) that have explored the relationship between capital inflows and growth. The endogenous growth theory describes the expected outcomes of changes in financial development and capital inflows on steady-state growth based on the effect they have on capital accumulation. In this regard, the framework is drawn from the work of Pagano (1993), that used it to assess financial development-growth nexus. However, this framework is further extended to include capital inflow (remittances).

In the AK model closed economy version, the total production function is given as

$$Y_t = \mathrm{AK}_t \tag{1}$$

Output in Eq. 1, shows a linear function of the total capital stock. Hence, this production function can also be viewed in a reduced form as to where the economy competes with foreign economies as posited by Romer (1989) or the model where it is assumed to be either physical or human capital. Following the assumption that the stock of capital depreciates at δ per period, the gross investment becomes

$$I_t = K_{t+1} - (1 - \delta)K_t \tag{2}$$

In Eq. 2, only financial intermediaries can transfer savings to investment. In order to achieve this, they keep absorbing resources, ensuring that a dollar saved by individual yields less the dollar saved for investment. In this regard, the proportion of savings left after the financial intermediaries have taken their fraction for service rendered must be equal to gross investment which is required for capital market equilibrium. Thus capital market equilibrium ensures that

$$\varphi S_t = I_t \tag{3}$$

Using Eq. (1) through (3), the output growth rate (g) is written as

$$g = A\left(\frac{1}{Y}\right) - \delta = A\varphi s - \delta \tag{4}$$

where s represents gross savings. The equation shows the steady-state growth rate in the closed economy with financial intermediaries.

The model is further extended to include capital flows (remittances). Assume foreign residents want to invest in their home country or some fractions of the remittances

sent to family members are saved or used for investment purposes. Consequently, a large pool of savings will be available for investment. Thus, when there is a capital inflow (remittance), capital market equilibrium becomes

$$\varphi^*(S_t + \mathrm{Re}m_t) = I_t^* \tag{5}$$

The steady-state growth rate now becomes

$$g^* - A^*\frac{1^*}{Y} - \delta = A^*\varphi^*\frac{(S + \mathrm{Re}m)}{Y} - \delta = A^*\varphi^*S^* - \delta \tag{6}$$

Equation (6) shows the *AK* model steady-state growth rate with the financial intermediary and remittance inflow. Comparing Eqs. (4) and (6) in this endogenous growth model will highlight channels through which capital inflow (remittance) can influence growth. Remittance inflow can drive industrial growth if it leads to an increase in productive investment. However, some fraction of remittances should be used to finance productive investment not only for consumption.

Given that industrial growth is consequently captured by aggregate growth in the economy. Thus, to show the industrial growth rate Eq. (6) is re-written as

$$\mathrm{Ind} = f(A^*(\varphi^*S^* + \mathrm{Re}m) \tag{7}$$

4.2 Model Specification

Drawing from Bailliu (2000) and Saibu (2014) models on financial development, our model is specified as

$$\mathrm{Ind}_{i,t} = f(\mathrm{FinD}_{i,t}, \mathrm{Re}m_{i,t}) \tag{8}$$

$$\mathrm{Ind}_{i,t} = \lambda_0 + \lambda_1 \sum_{i=1}^{n=2} \mathrm{FinD}_{i,t} + \lambda_2 \sum_{i=1}^{n=1} \mathrm{Re}m_{i,t} + \mu_{i,t} \tag{9}$$

$$\begin{aligned}\mathrm{Ind}_{i.t} = {} & \alpha_0 + \alpha_1\mathrm{BM} + \alpha_2\mathrm{DCPS} + \alpha_3\mathrm{Re}m_{i,t} + \alpha_4\mathrm{Elec}_{i,t} + \alpha_5\mathrm{AT}_{i,t} \\ & + \alpha_6\mathrm{DI}_{i,t} + \alpha_7\mathrm{PoP} + \alpha_8\mathrm{TO}_{i,t} + \alpha_9\mathrm{FDI}_{i.t} + \mu_{1.t}\end{aligned} \tag{10}$$

Ind is industrialization measured by industry share percent of GDP and manufacturing share percent of GDP. BM denotes broad money as a percent of GDP, DCPS denotes domestic credit to the private sector, Re*m* is remittance, while other variables are control variables for industrialization like Elec which denotes electricity measured by electricity production capacity, AT represents assess to telephone, DI

is domestic investment measured by gross fixed capital formation, Pop denotes population growth, TO represents trade openness and FDI is foreign direct investment to explain economic globalization.

4.3 Data Source and Scope of the Study

This study used secondary data in a panel form comprising 46 Sub-Saharan African countries (SSA) based on the United Nations classification in 2018. The observation period spans from 1980 through 2017. Data was sourced from the World Development Indicator (WDI) of the World Bank (2018). The study adopted Generalized Method of Moment (GMM), Fixed Effect and Quantile regression technique for its analysis. The dependent variable in this study is industrialization which is proxy as MVA percentage of GDP and IVA percentage of GDP.[2] Our independent variables include personal remittance received (% of GDP) and financial development which is measured by variables that capture their access and efficiency level like credit to private sectors and broad money. This shows how efficient the financial institutions are in issuing credit to economic operators because aside from consumption, some fraction of migrant remittance is likely going to be deposited in the financial institution for either future consumption or investment. While our major focus in this study is migrant's remittance, financial development is the link through which migrant's remittance can induce industrialization in Africa. For industrialization, six control variables were employed namely Domestic investment proxy as Gross fixed capital formation percent of GDP, Electricity, Population growth, Domestic investment, Trade openness, Foreign Direct Investment (FDI) and Diaspora Bonds, Access to telephones. Diaspora Bonds are not included in the estimation due to lack of data for SSA countries, since it is anticipated that the a priori expectations of each variable will exert a positive impact on industrialization.

4.4 Empirical Modeling and Estimation Strategies

In estimating the Fixed Effect estimations, we employed the following estimation techniques: (a) Instrumental Variable Fixed Effects techniques (FE) to rule out heterogeneity; (b) General Method of Moments (GMM) to rule out the issue of persistence in industrialization and (c) Quantile Regressions (QR) to explain the previous levels of industrialization. Hence, behavior of the data is necessitated for multiple estimation strategies (Ajide & Alimi, 2018; Asongu & Nwachukwu, 2016; Efobi et al., 2016).

At this point, the instrumentation of the independent variables with the first lag is necessary due to the issue of simultaneity/endogeneity. Hence, the process for

[2]Bundled using Principal Component Analysis (PCA) technique.

instrumenting remittance is as follows:

$$\mathrm{PR}_{it} = \partial + \infty_j(\mathrm{PR}_{i,1-t}) + \mu_{ijt} \tag{11}$$

where PR stands for remittance at period t for country i, ∂ denotes constant, $\mathrm{PR}_{i,t-1}$ denotes remittance at country i at time $t-1$ and μ_{ijt} is stochastic error term. Thus, the fitted values from the instrumentation are the independent variables used in the Fixed Effect and QR specification. Fixed Effect is necessary because the study focuses on a specific N set of countries (set of 46 SSA countries) (Baltagi, 2008).

Hence, the panel Fixed Effect model is expressed as follows:

$$\mathrm{Ind}_{it} = \phi_0 + \phi_1\mathrm{PR}_{it} + \phi_2\mathrm{FinD} + \phi_3\mathrm{PRFinD}_{it} + \sum_{h=1}^{6} x_h X_{hji} + \eta_1 + \mu_{i.t} \tag{12}$$

where Ind_{it} denotes industrialization, PR represents remittance, FinD denotes financial development, PRFinD_{it} denote interaction between remittance and financial development, X represents a set of other covariance (Domestic investment, Trade, Access to telephone, Electricity, Population growth, FDI, Diaspora Bonds), ϕ is constant, η_1 is the country specific effect, subscript i denotes cross-section countries dimension, subscript t represents time series dimensions and μ_{it} denote the error term.

4.5 General Method of Moment (GMM)

For the study to account for endogeneity bite and also to establish the link between the variables, the system GMM technique was adopted. The motivation for adopting this technique includes (i) that the estimation techniques are appropriate in handling the issue of persistence in industrialization (dependent variable). The correlation coefficient of industrialization with its first lag supersedes rule of thumb threshold value. (ii) It appropriates in studies where $N > T$: the sample size N which is the number of countries observed must be far greater than T (number of years). For this study, our sample size which is 46 is greater than the time period 37. (iii) The estimation technique is fit to rule out endogeneity issues. (iv) The GMM technique is consistent with cross-country variations. Following the fourth, it has been suggested by Bond et al. (2001) that among Arellano and Bover (1995) and Blundell and Bover (1998) system, the GMM estimation technique is better compared to the one suggested by Arellano and Bond (1991). The first two reasons for adopting GMM techniques are seen as the basic requirements (Tchamyou, 2018), while the remaining reasons are associated with the merits of adopting the estimation technique (Tchamyou, 2018). Hence, in the specification, the two-step approach is adopted as against the one step to help control heteroskedasticity generated in the residual.

Equations 13 and 14 are specified at levels and first difference to summaries the estimation technique procedures of the system GMM.

$$\begin{aligned}\mathrm{Ind}_{it} =& \phi_0 + \phi_1 \mathrm{Ind}_{it=1} + \phi_2 \mathrm{PR}_{it} + \phi_3 \mathrm{FinD} + \phi_4 \mathrm{PRFinD}_{it} \\ &+ \sum_{h=1}^{6} \infty_h X_{hji-1} + \eta_1 + \xi_1 + \mu_{i.t} \end{aligned} \tag{13}$$

$$\begin{aligned}\mathrm{Ind}_{it} - \mathrm{Ind}_{i,t-\tau} =& \phi_0 + \phi_1 (\mathrm{Ind}_{it=\tau} - \mathrm{Ind}_{i,t-2\tau}) \\ &+ \phi_2 (\mathrm{PR}_{i,t} - \mathrm{PR}_{i,t-\tau}) + \phi_3 (\mathrm{FinD}_{i,t} - \mathrm{FinD}_{i,t-\tau}) \\ &+ \phi_4 \left(\mathrm{PRFinD}_{i,1} - \mathrm{PRFinD}_{i,t-1}\right) \\ &+ \sum_{h=1}^{6} \infty_h \left(X_{hji-1} - X_{hji-2\tau}\right) + \xi_1 - \xi_{1-t} + \mu_{i.t-\tau} \end{aligned} \tag{14}$$

where ∞_h represent tau which is the coefficient of auto-regression, ξ_1 is the time-specific constant. All other variables remain as explained earlier.

4.6 Instrumental Quantile Regressions

This modeling technique is basically on the mean values of industrialization. Quantile regression (QR) helps us to address the conditional mean of industrialization, hence, enabling us to assess the nexus all through the conditional distribution of industrialization (Billger & Boel, 2009; Okada & Samreth, 2012; Efobi et al., 2016). The OLS assumption of the normal distribution error term is invalid in the QR estimation model. More so, this technique enables us to check the parameter estimation of conditional distribution of industrialization at various points, therefore making the estimation technique robust in the presence of outliers.

We solve the following optimization problem to obtain the θth quintile estimation of the outcome (or industrialization). This is expressed in Eq. (15) without subscripts, hence Eq. (15) for the sake of simplicity is presented as

$$\min_{\beta \in R^k} \left[\sum_{i \in \{i: yi \geq xi\beta\}} \theta |yi - xi\beta| + \sum_{i \in \{i: yi \geq xi\beta\}} (1-\theta) |yi - xi\beta| \right] \tag{15}$$

where $\theta \in (0, 1)$. Thus, it is contrary to the Ordinary Least Square technique that is basically used for minimizing the sum of square residual; using the QR, it minimized the weighted sum of absolute deviations. Hence, y_i, given x_i which is the industrialization conditional quintile becomes,

$$Qy(\theta / xi) = xi\beta\theta \tag{16}$$

For every θth specific quintile, the unique slope parameters are modeled. Thus, in OLS slope it is analogous to $E(y/x) = xi\beta$ where the parameters are examined basically at the mean of industrialization conditional distribution. From Eq. (16) above, the explained variable yi is industrialization, where xi is a constant term which includes migrant's remittance, financial development, interaction between migrant's remittance and financial development, electricity, assess to telephone, domestic investment, population growth, trade openness and FDI.

5 Empirical Findings and Discussion

This section examines the empirical analysis of the data retrieved as well as its interpretation. Prior to proceeding with the regression result, we make an attempt to discuss the descriptive statistics of the variables employed in order to help in understanding the nature of its variable and its pattern of growth. As part of the analysis, industrialization as a variable is an index obtained by conducting a principal component analysis (PCA) using the variables manufacturing value added and the industry value added. The Eigenvalue of the first component was used in making the industrialization index as the value was the only one greater than 1, having a value of 1.24717. Thus, the index was gotten from its rotation.

Table 2 revealed that the broad money supply as a percentage of GDP was on the average of 27.94% throughout the period under review for the whole Sub-Saharan African countries. One of the countries had a peak of 151.55% broad money outgrowing the current output in the economy while one of the countries within the years had a very low level of financial development measured by the broad money supply of 0.02%. The normality of the broad money supply as a measure of financial development is not following a normal distribution as the Jarque–Bera test shows a significant statistic. Industrialization also hovers around −2.18 and 4.48, meaning that the extent of fluctuations in industrialization is relatively low. The level of infrastructure measured by fixed telephone subscription and electricity power consumption on the average was relatively low as the result reveals that on average, 468.49 Kwh per capita of electricity was consumed in the region throughout the period and 2.09 people per 100 on average have access to fixed telephone subscription.

The domestic credit made available to the private sector on average was 17.80%, lower than the monetary base of the region as a percentage of output, but there were higher lending to the private sector, higher than the level of the broad money supply. The percentage of GDP received as personal remittances on average stood at 4.45%, while its peak was 235.92% and there was a period in which nothing was received as personal remittances. The trade flow in the region was considerably high as it averaged to 70% and had its peak at 311.35%.

The next descriptive statistics conducted is the correlation matrix of the variables; this will help to examine the level of relationship that exists among the explanatory variables.

Table 2 Descriptive statistics of the variables employed

Code	Definition	Mean	Max	Min	Std. Dev.	Jarque-Bera test	Obs
BM	Broad Money	27.94	151.55	0.02	20.63	6214.05	1721
DCP	Domestic Credit to Private sec	17.80	160.12	0.005	19.98	28418.75	1721
EPC	Electricity Power Consumption	468.49	4777.06	17.57	742.06	16090.03	1745
FDI	Foreign Direct Investment	3.46	161.82	−28.62	8.28	993093.40	1748
FTS	Fixed Telephone Subscription	2.09	32.65	0.000	4.55	30827.41	1748
GFCF	Domestic Investment	20.55	89.39	−2.42	9.52	2335.53	1743
IND	Index of Industrialization	0.00	4.48	−2.18	1.12	472.69	1733
PG	Population Growth	2.61	7.92	−6.18	1.04	6998.31	1748
PR	Personal Remittances	4.45	235.92	0.00	17.47	888524.10	1732
T	Trade	70.00	311.35	6.32	36.16	1417.29	1728

Source Authors Construct using Data extracted from World Development Indicator (2018)

The core aim of conducting a correlation matrix is to examine the degree of relationship among the explanatory variables. From Table 3, it can be seen that on average, the highest degree of relationship among the explanatory variables is 0.63 (between domestic credit to private sector and broad money) as they are both measures of financial development and it is expected. It can therefore be concluded that there is no high degree of multicollinearity associated with the regression results and thus, the analysis can be conducted. The next attempt is to assess the stationarity of the variables employed.

Table 4 (see Appendix) reveals the panel unit root test at both level and first difference by assuming that the unit root process is common across cross sections and the other unit root process follows the individual uniqueness. The variables employed were investigated to examine at what order of stationarity they are. It is important that the variables exhibit constant mean and variance over time for regression analysis to be done. To do this, the Levin *t*-test assuming a common unit root process and the Im, Pesaran and Shin test that assume individual unit root test were employed. From Table 4, the result however revealed that broad money supply, domestic credit to private sector, electricity power consumption, fixed telephone subscription, population growth rate and trade are not stationary at level and were further tested at first difference. The result reported the variables to be stationary at

Table 3 Correlation matrix

	BM	DCP	EPC	FDI	FTS	GFCF	IND	PG	PR	T
BM	1.00									
DCP	0.63	1.00								
EPC	0.28	0.61	1.00							
FDI	0.02	−0.04	−0.02	1.00						
FTS	0.61	0.52	0.43	0.08	1.00					
GFCF	0.12	0.05	−0.01	0.23	0.17	1.00				
IND	0.05	0.17	0.13	0.03	0.12	0.22	1.00			
PG	−0.33	−0.26	−0.22	0.02	−0.40	0.01	−0.05	1.00		
PR	0.09	−0.02	−0.07	0.04	−0.02	0.13	−0.04	−0.11	1.00	
T	0.27	0.12	0.03	0.30	0.36	0.31	0.35	-0.16	0.26	1.00

BM, Broad Money; *DCP* Domestic Credit to Private sectors; *EPC* Electricity Power Consumption; *FDI* Foreign Direct Investment; *FTS* Fixed Telephone Subscription; *GFCF* Domestic Investment; *IND* Index of Industrialization; *PG* Population Growth; *PR* Personal Remittances; *T* Trade openness

Table 4 Effect of personal remittances on the level of industrialization in Africa

Variables	GMM	RE	Q.10	Q.25	Q.50	Q.75	Q.90
L.IND	0.890*** (0.004)						
PR	−0.0003*** (0.000)	−0.010*** (0.001)	−0.0005 (0.001)	−0.005*** (0.001)	−0.008*** (0.001)	−0.012*** (0.001)	−0.020*** (0.001)
BM	−0.001** (0.001)	−0.002 (0.002)	−0.005* (0.003)	−0.006*** (0.002)	−0.004*** (0.001)	−0.008*** (0.001)	−0.008** (0.004)
DCP	−0.002*** (0.000)	−0.014*** (0.002)	0.014*** (0.002)	0.012*** (0.003)	0.006** (0.002)	0.010*** (0.003)	0.013** (0.006)
EPC	0.00003*** (0.000)	0.0001 (0.000)	−0.0008** (0.000)	0.00006 (0.000)	0.00002*** (0.000)	0.00002** (0.000)	0.00003*** (0.000)
FDI	0.001* (0.000)	−0.006*** (0.002)	−0.009 (0.006)	−0.018*** (0.003)	−0.023*** (0.008)	−0.012 (0.012)	−0.012*** (0.004)
FTS	0.002 (0.002)	0.010 (0.008)	0.004 (0.012)	−0.033*** (0.013)	−0.024*** (0.007)	−0.015* (0.009)	−0.068*** (0.010)
GFCF	0.002*** (0.001)	0.010*** (0.002)	-0.003 (0.005)	0.009*** (0.003)	0.013*** (0.003)	0.027*** (0.006)	0.044*** (0.005)
PG	−0.034*** (0.005)	−0.065*** (0.018)	−0.103*** (0.030)	−0.037 (0.053)	−0.031 (0.037)	0.021 (0.029)	0.020 (0.034)
T	0.0001 (0.000)	0.001* (0.001)	0.003 (0.003)	0.011*** (0.001)	0.015*** (0.001)	0.015*** (0.002)	0.025*** (0.002)
Constant	0.076**	0.181	−1.058***	−1.399***	−1.260***	−1.161***	−1.286***
Observations	(0.032) 1,671	(0.141) 1,716	(0.140) 1,716	(0.155) 1,716	(0.165) 1,716	(0.114) 1,716	(0.158) 1,716
Number of countries	46	46					

(continued)

Table 4 (continued)

Variables	GMM	RE	Q.10	Q.25	Q.50	Q.75	Q.90
AR (1) Prob.	0.000						
AR (2) Prob.	0.170						
Sargan Chi (Prob)	32.51(0.298)						
Hansen Chi (Prob)	11.45(0.324)						
Fisher	51903.1***						
Wald Prob.		0.000					

Standard errors in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$, Figures in parenthesis without *'s are standard errors.; Index of Industrialization *BM* Broad Money; *DCP* Domestic Credit to Private sectors; *EPC* Electricity Power Consumption; *FDI* Foreign Direct Investment; *FTS* Fixed Telephone Subscription; *GFCF* Domestic Investment; IND; *PG* Population Growth; *PR* Personal Remittances; *T* Trade openness

first difference both when it assumes the individual unit root process and when it assumes the common unit root process. Other variables aside from the ones listed above are stationary at level, meaning that long-run relationship is feasible for them.

The next section presents the econometrics results of our models earlier stated in section three. To do this, we present three different tables, one examining the effect of personal remittances inflows as well as financial development measures on industrialization. The next table examines the modulating effect which financial development measured by broad money plays in enhancing the procyclicality of personal remittances inflow in industrialization. Also, the last table examines the modulating effect which financial development measured by domestic credit to the private sector which plays in enhancing the procyclicality of personal remittances inflow in industrialization.

Table 5 presents the non interactive effect of remittances on industrialization in Africa. We first present the system Generalized Methods of Moments estimation result. It can be revealed from the analysis that following the system GMM, personal remittances have a negative effect on the level of industrialization and this is statistically significant at 1%. The implication of this result is that remittance inflow into the region is not channeled toward industrialization. Allowing for random effects result did not show the contrary as the impact of remittance inflows on industrialization remains significant and negative. Examining the quintile regression result in order to investigate if higher remittance inflows have different impacts on the extent of industrialization within the region, the result further shows that for panel C, D, E and F, personal remittances still have negative impact on industrialization irrespective of the level of industrialization. The result reveals that for economies with higher level of industrialization, personal remittance inflows have a larger negative impact than the countries with lower level of industrialization.

It is also important to examine the impact of financial development measured by broad money supply on Africa's industrialization strength. From the result, it can be seen that broad money supply available has an indirect impact on industrialization, irrespective of the technique used, whether the GMM employed for correction of endogeneity or the random effect. The quantile regression also shows that broad money supply as a percentage of GDP within the region does not stimulate industrialization. However, for domestic credit to the private sector, the result shows that using GMM and Random effect Panel OLS, the result remained negative, but for the quantile regression, it shows different conclusions that can be drawn; this justifies the relevance of adopted empirical strategy. From panel C to F, the effect which domestic credit to private sector has on industrialization was positive, especially for countries where the level of industrialization is low. The conclusion here is that domestic credit alone as a measure of financial development enhances the level of industrialization irrespective of the current level of industrialization while personal remittances and broad money supply do not yield positive interaction.

We further examine the post-diagnostic properties of the system-GMM model estimated. We begin by examining if there is the presence of serial correlation of first-order AR (1) process as well as the second-order AR (2) process. The Arellano–Bond test for autocorrelation has a null hypothesis of no autocorrelation and is applied

Table 5 Effect of personal remittances interacting with broad money on the level of industrialization in Africa

Variables	GMM	RE	Q.10	Q.25	Q.50	Q.75	Q.90
IND_{t-1}	0.890*** (0.003)						
PR	−0.0004*** (0.000)	−0.010*** (0.001)	−0.001 (0.001)	−0.005*** (0.001)	−0.008*** (0.001)	−0.012*** (0.001)	−0.020*** (0.002)
BM	−0.001** (0.001)	−0.002 (0.002)	−0.004 (0.003)	−0.007*** (0.002)	−0.004*** (0.001)	−0.008*** (0.002)	−0.008** (0.004)
DCP	−0.002*** (0.000)	−0.014*** (0.002)	0.014*** (0.002)	0.011*** (0.003)	0.006*** (0.002)	0.011*** (0.002)	0.013** (0.005)
PR*BM	−0.00039* (0.000)	−0.00001 (0.000)	0.00007*** (0.000)	0.00003* (0.000)	−0.00001** (0.000)	−0.00006*** (0.000)	−0.0001*** (0.000)
EPC	0.00004*** (0.000)	0.00001 (0.000)	-0.00007 (0.000)	0.00007 (0.000)	0.00002*** (0.000)	0.00002** (0.000)	0.00003*** (0.000)
FDI	0.001** (0.000)	−0.006*** (0.002)	−0.009*** (0.003)	−0.017*** (0.003)	−0.024*** (0.005)	−0.011 (0.012)	−0.012** (0.005)
FTS	0.001 (0.001)	0.010 (0.008)	0.001 (0.008)	−0.032*** (0.011)	−0.024*** (0.007)	−0.014 (0.009)	−0.068*** (0.015)
GFCF	0.002*** (0.001)	0.010*** (0.002)	−0.002 (0.004)	0.009** (0.004)	0.013*** (0.003)	0.027*** (0.006)	0.043*** (0.005)
PG	−0.034*** (0.005)	−0.065*** (0.018)	−0.104*** (0.024)	−0.038 (0.037)	−0.020 (0.032)	0.027 (0.026)	0.021 (0.051)
T	0.0002 (0.000)	0.001* (0.001)	0.003 (0.002)	0.011*** (0.002)	0.015*** (0.001)	0.015*** (0.001)	0.025*** (0.003)
Constant	0.075** (0.029)	0.184 (0.142)	−1.098*** (0.091)	−1.400*** (0.133)	−1.277*** (0.095)	−1.180*** (0.145)	−1.276*** (0.208)

(continued)

Table 5 (continued)

Variables	GMM	RE	Q.10	Q.25	Q.50	Q.75	Q.90
Observations	1,671	1,716	1,716	1,716	1,716	1,716	1,716
Number of countries	46	46					
AR (1) Prob.	0.000						
AR (2) Prob.	0.168						
Sargan Chi (Prob)	33.26(0.41)						
Hansen Chi (Prob)	31.18(0.457)						
Fisher	84699.1***						
Wald Prob.		0.000					

Standard errors in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$, Figures in parenthesis without *'s are standard errors; Index of Industrialization *BM* Broad Money; *DCP* Domestic Credit to Private sectors; *PR*BM* interaction between personal remittance and Broad Money; *EPC* Electricity Power Consumption; *FDI* Foreign Direct Investment; *FTS* Fixed Telephone Subscription; *GFCF* Domestic Investment; IND, *PG* Population Growth; *PR* Personal Remittances; *T* Trade openness

to the differenced residuals. The test for AR (1) process in first differences usually rejects the null hypothesis but this is expected since the first difference variable will be correlated with the error term. However, in order to detect autocorrelation in levels it is important to test for AR (2) in first differences. The result shows that there is no serial correlation of AR (2) associated with the result as the model estimated shows that the null hypothesis of no serial correlation is not rejected. The Sargan test has a null hypothesis that the instruments as a group are exogenous. Therefore, the higher the *p*-value of the Sargan statistic, the better. The result also reveals that we fail to reject the null hypothesis that the instruments used are exogenous, meaning that the set of instruments are exogenous. In robust estimation, as well, Stata reports the Hansen J statistic instead of the Sargan with the same null hypothesis. The result also reveals that they are not rejected. The fisher statistics tests the null hypothesis that there is no considerable harmony associated with the regression result. The *f*-statistics was also rejected.

Table 6 examines the modulating effect which financial development in the form of broad money supply has on causing personal remittance flows to have a significant impact on industrialization. As earlier examined in Table 5, it was seen that personal remittances does not have a positive impact on industrialization irrespective of the level of industrialization in Africa. This finding is in line with the scatter plot and the regression analysis done earlier as a preliminary. However, we take a step further to examine if financial development in the form of increasing broad money supply stimulates personal remittance inflows to have a significant impact on industrialization. Using the system-GMM, we can discover that the interaction between personal remittance inflows and broad money still did not stimulate industrialization. The same result is applicable for the random effect as the result revealed that the level of financial development cannot cause a stimulus and positive emission of positive influence on industrialization. However, to justify the use of techniques such as the quantile regression; the result revealed that at lower level of industrialization (Q.10) and (Q.25), personal remittances was able to cause a positive stimulus on industrialization simply because the level of financial development as measured by broad money was able to accommodate it. At higher level of industrialization (Q.50; Q.75 and Q.90), personal remittances could not cause increases in industrialization irrespective of the level of financial development associated with the region.

Table 7 also presents the result that shows the modulating effect which financial development in the form of domestic credit to private sector has on causing personal remittance flows to have significant impact on industrialization. As earlier also examined in Table 5, it was seen that personal remittances do not have positive impact on industrialization irrespective of the level of industrialization in Africa. However, we take a step further to examine if financial development in the form of domestic credit to private sector stimulate personal remittance inflows to have significant impact on industrialization. Using the system-GMM, we can discover that the interaction between personal remittance inflows and domestic credit to private sector still did not stimulate industrialization. The same result is applicable for the random effect as the result revealed that the level of financial development cannot cause a stimulus and positive emission of positive influence on industrialization. However, to

Table 6 Effect of personal remittances interacting with domestic credit to private sector on the level of industrialization in Africa

Variables	GMM	RE	Q.10	Q.25	Q.50	Q.75	Q.90
IND_{t-1}	0.890*** (0.003)						
PR	−0.0003*** (0.000)	−0.010*** (0.001)	−0.001 (0.002)	−0.005*** (0.001)	−0.008*** (0.001)	−0.012*** (0.001)	−0.019*** (0.002)
BM	−0.001 (0.001)	−0.002 (0.002)	−0.004* (0.003)	−0.006** (0.003)	−0.004*** (0.001)	−0.009*** (0.002)	−0.008*** (0.003)
DCP	−0.002*** (0.000)	−0.014*** (0.002)	0.014*** (0.002)	0.012*** (0.004)	0.006*** (0.002)	0.012*** (0.003)	0.013*** (0.005)
PR*DCP	−0.00003*** (0.000)	−0.00013 (0.000)	0.00017*** (0.000)	−0.00029 (0.000)	−0.000066 (0.000)	−0.0002*** (0.000)	−0.0004*** (0.000)
EPC	0.00004*** (0.000)	0.00001 (0.000)	−0.00008 (0.000)	0.00006 (0.000)	0.00002*** (0.000)	0.00002** (0.000)	0.00003*** (0.000)
FDI	0.001*** (0.000)	−0.006*** (0.002)	−0.009*** (0.003)	−0.018*** (0.003)	−0.024*** (0.004)	−0.016 (0.013)	−0.012 (0.007)
FTS	0.0008 (0.001)	0.009 (0.008)	0.002 (0.011)	−0.034** (0.016)	−0.024*** (0.008)	−0.016** (0.007)	−0.069*** (0.007)
GFCF	0.002*** (0.000)	0.010*** (0.002)	−0.002 (0.005)	0.009*** (0.003)	0.013*** (0.003)	0.027*** (0.006)	0.044*** (0.006)
PG	−0.033*** (0.005)	−0.064*** (0.018)	−0.099*** (0.023)	−0.043 (0.042)	−0.019 (0.041)	0.025 (0.029)	0.021 (0.044)
T	0.0001 (0.000)	0.001* (0.001)	0.003 (0.003)	0.011*** (0.001)	0.015*** (0.002)	0.015*** (0.002)	0.025*** (0.002)
Constant	0.074** (0.031)	0.190 (0.142)	−1.116*** (0.099)	−1.379*** (0.120)	−1.278*** (0.136)	−1.171*** (0.118)	−1.278*** (0.161)

(continued)

Table 6 (continued)

Variables	GMM	RE	Q.10	Q.25	Q.50	Q.75	Q.90
Observations	1,671	1,716	1,716	1,716	1,716	1,716	1,716
Number of countries	46	46					
Wald Chi-Sq		188.24					
AR (1) Prob.	0.000						
AR (2) Prob.	0.168						
Sargan Chi (Prob)	35.52 (0.306)						
Hansen Chi (Prob)	11.6 (0.395)						
Fisher	95229.2***						
Wald Prob.		0.000					

Standard errors in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$, Figures in parenthesis without *'s are standard errors; Index of Industrialization; *BM* Broad Money; *DCP* Domestic Credit to Private sectors; *PR*DCP* interaction between personal remittance and Domestic Credit to Private sectors; *EPC* Electricity Power Consumption; *FDI* Foreign Direct Investment; *FTS* Fixed Telephone Subscription; *GFCF* Domestic Investment; *PG* Population Growth; *PR* Personal Remittances; *T* Trade openness

Table 7 Panel unit root test

	Test at level		Test at first difference		
	Common unit root process	Individual unit root process	Common unit root process	Individual unit root process	Conclusion
Variable	Levin, Lin and Chu *t**	Im, Pesaran and Shin W-stat	Levin, Lin and Chu *t**	Im, Pesaran and Shin *W*-stat	
BM	0.67009 (0.7486)	1.30362 (0.9038)	−12.7096** (0.0000)	−18.1743** (0.0000)	Stationary at I(1)
DCP	−0.05190 (0.4793)	1.96005 (0.9750)	−14.2362** (0.0000)	−17.6900** (0.0000)	Stationary at I(1)
EPC	6.13661 (1.0000)	8.29821 (1.0000)	−6.63133** (0.0000)	−12.9507** (0.0000)	Stationary at I(1)
FDI	−4.55393*** (0.0000)	−5.87425*** (0.0000)	–	–	Stationary at I(0)
FTS	−1.57353 (0.0578)	1.18305 (0.8816)	−6.77503** (0.0000)	−16.2959** (0.0000)	Stationary at I(1)
GFCF	−3.46042*** (0.0003)	−3.64561*** (0.0001)	–	–	Stationary at I(0)
PG	−17.2605*** (0.0000)	−24.7222*** (0.0000)	–	–	Stationary at I(0)
PR	−1.85503* (0.0318)	−0.17151 (0.4319)	−18.8493** (0.0000)	−22.7310** (0.0000)	Stationary at I(1)
T	−1.39950 (0.0808)	−1.72004* (0.0427)	−18.3327** (0.0000)	−21.5155** (0.0000)	Stationary at I(1)
IND	−2.93176*** (0.0017)	−2.09658* (0.0180)	–	–	Stationary at I(0)

* Implies statistically significant at 5% and ** Implies Statistically significant at 1%; *BM* Broad Money; *DCP* Domestic Credit to Private sectors; *PR*DCP* interaction between personal remittance and Domestic Credit to Private sectors; *EPC* Electricity Power Consumption; *FDI* Foreign Direct Investment; *FTS* Fixed Telephone Subscription; *GFCF* Domestic Investment; *PG* Population Growth; *PR* Personal Remittances; *T* Trade openness Index of Industrialization

justify the use of techniques such as the quantile regression; the result revealed that at lower level of industrialization (Q.10), personal remittances was able to cause a positive stimulus on industrialization simply because the level of financial development as measured by domestic credit to private sector was able to accommodate it. At medium and higher level of industrialization (Q.25, Q.50; Q.75 and Q.90), personal remittances could not cause increases in industrialization irrespective of the level of financial development associated with the region.

6 Conclusion and Policy Recommendation

This study examines the effect which personal remittance inflow has on Africa's industrialization trajectory given the level of financial development persistent in the region as measured by domestic credit to private sector and broad money supply. It can be concluded from the study that personal remittance inflow alone cannot cause a positive impact on the level of industrialization; likewise do broad money supply and domestic credit to private sector, irrespective of the technique employed as well as the level of industrialization persistent in Africa. However, the interaction of personal remittance inflow and broad money supply reveals that personal remittance inflow given the level of broad money is able to increase the industrialization in those countries already at the bottom of industrialization than the countries with a higher level of industrialization. The result for domestic credit to private sectors reveals among others that personal remittance inflow interacting with domestic credit to private sector increases industrialization also among countries already experiencing the very low industrialization pace. The implication of this study is that personal remittance cannot increase industrialization at a higher pace; that is, personal remittance inflows can only finance low level of industrialization and not massive investments for mega industrialization growth. Based on our empirical findings, the policy implication is that; there is need for improved financial institution in Africa such that the pool savings from remittance can be directed to massive investment that will lead to industrialization. The focus for further research is to assess other means through which remittance can drive industrialization in Africa since remittance is a reliable source of capital inflow for developing countries.

Appendices

Appendix 1
See Table 4.
Appendix 2
See Table 8.

Table 8 Variable definitions and measurement unit

Code	Variables	Variable details	Measurement unit	Sources of data
IND	Industrialization	Manufacturing value added/industrial value added	% of GDP Index by PCA	World Bank (WDI)
PR	Personal remittance	Personal remittance received	% of GDP	World Bank (WDI)
BM	Bank efficiency	Broad money	% of GDP	World Bank (WDI)
DCP	Domestic credit	Domestic credit to private sectors	% of GDP	World Bank (WDI)
EPC	Electricity	Electricity Power Consumption	Kwh per capital	World Bank (WDI)
FDI	FDI	Foreign direct investment	% of GDP	World Bank (WDI)
FTS	Assess to telephone	Fixed telephone subscription	Per 100 people	World Bank (WDI)
GFCF	Domestic investment	Gross fixed capital formation	% of GDP	World Bank (WDI)
PG	Population	Population growth	Annual growth	World Bank (WDI)
T	Trade openness	Trade	% of GDP	World Bank (WDI)

WDI World Bank Development Indicators

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