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## Article

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## An Empirical Investigation of Remittances and Financial Inclusion Nexus in Sub-Saharan Africa

**Lukman Oyeyinka Oyelami<sup>1</sup>**

**Abstract:** The scope of financial development has been expanding and moving gradually towards a more inclusive development thus attention is gradually shifting to financial inclusion. It is against this background that this study investigates the role of migrants' remittances on financial inclusion in selected SSA countries. Pooled Mean Group (PMG) form of panel ARDL was employed but cross-sectional dependent characteristics of the data required the use of cross-sectional methods that cater for such properties. Consequently, XTDCCE: Dynamic Common Correlated Effects in Stata by Ditzén (2016) and XTCCE Common Correlated Effects estimator by Neal (2015) were used as robustness checks. For the purpose of this empirical investigation, we collected data on Remittances, Account Ownership and Income Per Capita for twenty-seven SSA countries based on data availability. The conclusion is that remittances have no significant effect on financial inclusion in SSA. However, the variable demonstrates the potential to positively influence financial inclusion. Thus, there should be concrete policy efforts in the SSA to make remittances count for inclusive growth. The study contributes substantially by moving attention from a broad concept of financial development to Financial Inclusion and employed a more recent panel estimating techniques to investigate the nexus between remittances and Inclusion

**Keywords:** Inclusion; Remittances; ARDL; Africa

**JEL Classification:** E48; B41; F24

### 1. Introduction

Migration of skilled and unskilled labour from many developing countries to more developed countries has its pros and cons. It is very easy to posit that developing countries are likely to face the shortage of skilled and unskilled labour as a result of migration. However, the role remittances as a major source of capital inflows in these countries are often not taken into consideration. Thus, a robust discussion of migration should be analysed viz a viz with the issue of remittances. The issue of remittances has been widely considered in many global public debates, with scholars such as Gupta, Pattillo & Wagh (2007), Singh, Haacker, Lee & Goff (2010), Adams, Kwame & Klobodu (2016), and many others, emphasizing its importance to economic growth and development. Basically, remittances as a construct in this study, refer to transfers that are recorded in a country's Balance of Payments (BOPs). They comprise of private transfers, compensation of employees and migrants' transfers from one country to the other at the time of migration (Awad, 2009). However, informal channels such as postal money orders and private money

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changers have been identified and these channels constitute between 35% and 75% of official transfers in various countries (Freund & Spatafora, 2005).

Sub-Sahara African countries have not been categorised as one of the major recipients of remittances in the world. Among the top 25 remittances recipient countries, only Nigeria is in Sub Sahara African country. Although, other countries receive a larger share of remittances as a share of their GDP: Lesotho (27.3 per cent), Togo (10.1 per cent), Senegal (9.8 per cent), Cape Verde (9.0 per cent), and The Gambia (8.2 per cent). The issue of under-reporting of remittance in the region is also a big problem. According to World Bank report 2012, less than two-thirds of African countries (one-third of Sub-Saharan countries) report remittance data; and most often, flows through informal channels are not captured at all. However, the region has made substantial progress in term of remittances inflows over the years. Specifically, the region was estimated to witness 3.4, 3.7 and 3.7 in 2016, 2017 and 2018 respectively in remittance growth rate.

In recent times, attention has been given to different channels through which remittances interact with economic growth in developing countries. Some of the channels, as discussed in the literature include household consumption, investment, and national saving, exchange rate and financial development. Remittances and Financial Development have received huge empirical patronage in the region compared to other channels. Studies have examined the nexus between financial development and remittances by using different measures of financial development. The major conclusion from these studies is that remittance has a positive effect on financial development.

Also, studies in this area usually label remittance as an exogenous factor to domestic variables in developing countries. This assumption may not hold because other domestic variables may have a strong influence on remittances. Take for instance: a strong and viable financial sector in home countries can enable a cheap cost of transfer for the senders. An active financial sector can also make for easy access to funding for the recipient, and this is capable of facilitating increased remittances in such economy. This draws attention to the causal relationship between remittances and financial development. This in line with Demirgüç-Kunt, Córdova, Peria, & Woodruff (2011) which argued financial sector developments, using aggregate data, is subject to at least some form of endogeneity bias.

This study contributes to literature fundamentally by attempting to investigate the causal relationship between financial inclusion and remittances, especially in large SSA countries, and estimate their relationship. In doing this, the study is not unaware of the fact that some studies, such as Toxopeus & Lensink (2007) and Aga & Martinez Peria (2014) have attempted to investigate the connection between remittances and financial inclusion at a cross-sectional level in developing countries. This study, however, presents a fresh insight, especially in the way it concentrates on twenty-seven (27) selected sub-Saharan African countries. The import of this is that it gives room for rigorous but focused analysis on the confluence between remittances and financial inclusion, and by extension, assessing the extent of financial development in the sub-Saharan region of Africa. The definition of financial inclusion in the context of this study is guided by definition provided by Beck, Demirguc-Kunt & Levine (2009) which described financial inclusion is as the availability and equality of opportunities to access financial services. Beyond this introductory section of the paper, there are four other sections that make up the paper. Section two presents the literature review and section three addresses the issues of data

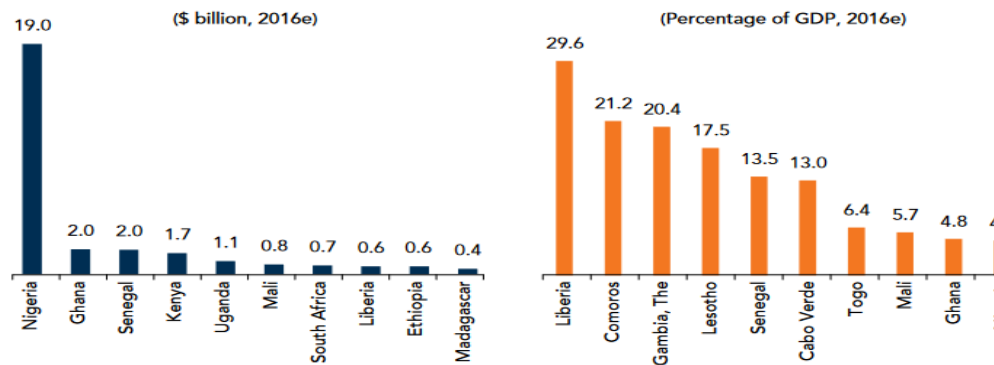
and methodology. Also, section four represents the empirical findings and section five focuses on research contribution and policy implications.

## **2. Literature Review**

### **2.1 Stylized Facts of Remittances and Financial Inclusion in Sub-Saharan Africa**

According to Ratha, Eigen-Zucchi & Plaza (2016), as shown in figure one, remittance flows to SSA Africa have declined. Specifically, it was estimated to decline by 6.1 per cent and reached \$33 billion in 2016. Several factors have been advanced for this nose-diving trend in remittance flows to the region. The most important of these factors is the poor economic performances in remittance-sending countries. Many European countries that have absorbed large migrants from the region have not been doing well economically. Another factor, as elucidated in the world bank 2016 report, is the decline in commodity prices, majorly the price of crude oil. This has a great impact on the countries receiving remittances from regional commodity exporters such as Saudi Arabia. Also, one of the factors is the exchange rate regime in remittance receiving countries in the region, especially Nigeria. The inconsistency in exchange rate policies, characterized by overregulated exchange regime in many of these countries, has caused the diversion of remittances to informal channels.

Moreover, the cost of remittances in SSA has been reported to be very high compared to other regions of the world. In SSA, average remittance costs increased, from 9.7 per cent in 2016 Q1 to 9.8 per cent in 2017 Q1 (Ratha, De, Plaza, Schuettler, Shaw, Wyss, & Yi, 2016). This makes the region the highest in the world. Unfortunately, intraregional remittances transfer corridor was reported to be most expensive in 2017, especially in countries such as Angola to Namibia (27 per cent), South Africa to Botswana (21 per cent), and Nigeria to Mali (20 per cent). This makes it extremely difficult to bring the cost of transaction below 3 per cent -5 per cent in the region, as envisaged in the Sustainable Development Goals (SDGs). However, with the increase in oil prices and much improved global economic activities in 2017 and 2018, remittances to SSA were projected to increase by 3.3 per cent. Specifically, Remittances to Nigeria, the largest regional remittance recipient, are expected to increase by 1.9 per cent. Similarly, Ghana, the second largest recipient in the region, is expected to receive 3.1 per cent more remittances. Remittance inflows to Senegal, the third largest recipient, are expected to grow by 2.6 per cent.



**Figure 1. Flow of Remittance in SSA countries**

*Source: International Monetary Fund; World Bank World Development Indicators; staff estimates*

The array of reports on financial development has shown that SSA and Africa at large have made a substantial improvement in the financial system. However, an international comparison of private credit to GDP indicates that there is a wide gap with other developing economies (World Bank, 2012). According to the same report, the ratio of private credit to GDP averaged 24% of GDP in SSA Africa in 2010, compared with 77% for all other developing economies, and 172% for high-income economies. Using the stock market as another indicator of financial development, less than 50 per cent of African countries have stock markets and only a few of these are liquid (Beck, & Demirguc-Kunt, 2009). When the market capitalization of these stock markets are compared with other markets in other regions of the world, market capitalization to GDP stands as 38% on the average, with the exception of South Africa, as compared to 44% in all other developing economies and 62% in high-income economies (World Bank, 2012).

Apart from the financial development indicators mentioned above, financial inclusion is gradually becoming another big issue in SSA. Many reports on financial inclusion have shown that the region is not performing well on all inclusion indicators, and this may be one of the reasons for non-inclusive growth in the region. Africa in general, according to Demirgüç-Kunt & Klapper (2012) reported that 23% of adults in Africa have an account at a formal financial institution. According to Massara, & Mialou (2014) in the IMF report, the report shows that only 34% of the population has bank accounts in SSA, compared to 94% in high-income OECD countries. Only 7.3% of the SSA population was reported to be using an account to receive their wages. Within SSA, there is a large variation in account ownership, ranging from 42% in Southern Africa to 7% in Central Africa. In the Democratic Republic of Congo and the Central African Republic, more than 95% of adults are “unbanked”. In 2017, Global Findex data shows that within SSA Africa the share of adults with a financial institution account has risen by a modest 4 percentage points since 2014, while the share with a mobile money account has grown roughly twice as fast — increasing by 9 percentage points.

## **2.2 Empirical Literature**

Generally, developing countries are the major beneficiaries of remittances, thus most works of literature featured here are based on them. Most importantly, the relationship between remittances and financial development has been extensively discussed in the literature amidst controversies. Most of the controversies arise from channels through which remittances influence financial development as well as the direction of causality between the two variables. Also, in the reviewed literature, financial development has been measured using different proxies, and this has influenced research outcomes which have made it difficult to achieve a consensus on the nature of the relationship between remittances and financial development.

Studies by Freund & Spatafors (2008) and Giuliano & Ruiz-Arranz (2009), for instance, observed that the remittances can complement investment if channelled into productive activities, with high returns when there is a functional financial system. Contrarily, the contribution of remittances may be insignificant, if it fails to ease the liquidity constraints in the financial system which makes it possible to release resources for productive engagements. However, most studies have argued that irrespective of the channel, remittances contribute to financial development and, by extension, economic growth.

Likewise, studies by Mundaca (2009), Demirgüç-Kunt & Peria (2011), Rao & Hassan (2011) and Aggarwal, Demirgüç-Kunt, & Peria, (2011) pointed out that there is a positive relationship between remittances and financial sector development. In particular, Demirgüç-Kunt & Peria (2011) argued that remittances enhance financial development, due to the positive association that exists between remittances and savings which by extension increases the bank credit. On the same plane, Mundaca (2009) averred that there is a need for complementarity between remittances and financial development to promote economic growth. This position is also corroborated by Nyamongo et al. (2012) in a similar study using data from Sub-Saharan Africa. However, a study by Karikari, Mensah, & Harvey, (2016) differs markedly in this regard. In taking a different stance, their study focused more on the direction of causality between remittances and financial development in fifty (50) selected African countries. They revealed that remittances promote certain aspects of financial development, while better financial system fosters receipts of remittances.

Apart from these panel studies, country-specific studies have also demonstrated elements of controversy. Oke, Uadiale & Okpala (2011) examined the relationship between remittance inflows and the financial sector development, using Nigeria as data. The data employed in the study cover 1977 to 2009. In this study, it was revealed that remittance inflows have a positive effect on financial development across all the variables used except the ratio of private credit to GDP. Similarly, Chowdhury (2011) investigated how financial sector development has benefitted from remittance inflows in Bangladesh. In this study, the co-integration analysis and vector error correction model were used to test the relationship between remittances and financial development. His conclusion is that Bangladesh's financial system has benefited from the increase in remittance inflows.

However, some scholars have expressed reservations about the impact of remittances on financial development. Bettin, Lucchetti & Zazzaro (2012) adopted a behavioural model of household's remittances to discuss the implication of financial development in the home country, with particular regard on decisions to remit and how much to remit. Using Longitudinal Survey of Immigrants to

Australia (LSIA) selected among legal immigrants who moved to Australia between 1993 and 1995, the study argued that a seriously inefficient financial sector in the home country may compromise immigrants' trust and induce them to consider it too risky to transfer large amounts. With this submission, reversed causality has been established between remittances and financial development. A similar study by Sibindi (2014) examined the direction of causality between financial development and remittances, concluding that the causal relationship runs from financial development to remittances without feedback, using data from Lesotho.

In recent times, studies are looking in the direction of causality between remittances and financial development. For example, Chowdhury (2016), using dynamic panel estimation established that remittances can be effective for promoting growth but financial variables. The study submitted that more developed financial systems may attract more remittances. In the same manner, Fromentin (2017) investigated the dynamic interaction between remittances and financial development in Latin America and the Caribbean countries, using Granger causality test and panel non-causality test. The conclusion of the study is that there is a positive, significant and bi-directional link between remittances and financial development. In the same argument, a country-specific study undertaken by Khurshid, Kedong Călin & Popovici (2017) shows the direction of causality remittances and financial development. After full-sample causality tests, the study found that a unidirectional causal relationship exists and it runs from financial development to remittances.

Recently, financial inclusion is becoming an important part of financial development, thus studies are emerging that seem to be interested in the relationship between financial inclusion and remittances, especially in developing countries. Toxopeus & Lensink (2007) used system equation estimates to examine if remittances have a developmental effect through financial inclusion in developing countries. They found that remittances contribute to development through financial inclusion. On their part, Anzoategui, Demirgüç-Kunt & Martínez Pería (2011) explored the nexus between international remittances and financial inclusion in El Salvador by using aggregate data on bank credit and deposit amounts over the period 1975-2007 for 109 developing countries. They reported evidence of linkage between remittances and financial inclusion.

Also, Aga and Martinez Peria (2014) employed survey data, including about 10,000 households in five countries—Burkina Faso, Kenya, Nigeria, Senegal, and Uganda – to determine the effect of remittances on financial inclusion in five selected SSA countries. They concluded that international remittances increase the probability that the household opens a bank account in all the five SSA countries. However, Mbrosius & Cuecuecha (2016) in country-specific study investigated the effect of remittances on the use of formal and informal financial services, using Mexican household data. They submitted that remittances greatly influence the ownership of savings account.

### **3. Data and Methodology**

Data employed for the purpose of this study are Adult with bank account per one thousand, credit to the private sector as a percentage of GDP, per capita Remittances and per capita GDP. The adult with bank account per one thousand is used as a proxy for financial inclusion, while credit to the private sector as a percentage of GDP serves as a proxy for financial development. Also, per capita remittances measure

international inflow of remittances. Per capita GDP is introduced as the control variable. Additionally, data used for this study were obtained from the International Monetary Fund (IMF) and the World Development Indicators (WDI) databases

In all, two models were estimated. In the first model, only twenty-seven (27) SSA countries were included in a balanced panel analysis. Only these countries were selected due to the non-availability of data in other countries found in the region. The countries in the first model are Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Comoros, Congo, Dem. Rep., Cote d'Ivoire, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Mali, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Swaziland, Tanzania, Togo and Uganda. Data employed were those from 2004 to 2016. This is relatively small, but we depended on large  $N$  and appropriate method of analysis to produce consistent results. The data however employed in the second model are from the periods from 1990 to 2016. In these periods, this study considered additional members. To prevent endogeneity bias in this study, the direction of causality between remittances and financial inclusion was thoroughly investigated using Dumitrescu & Hurlin (2012). The Dumitrescu Hurlin Panel Granger Causality was also used because of the presence of cross-sectional dependence in the data. Subsequently, the relationship among the variables was investigated using Panel ARDL and robustness was also performed, following Chudik & Pesaran (2015) panel estimation that accounts for heterogeneity and cross-sectional dependence in panel data. In addition, the PMG form of panel ARDL was specifically employed due to the short time nature of data used in this study.

### 3.1 Model Specification

In this paper, cross-section and time series data were used to study the possible relationship between account opening and independent variables of remittances and GDP per capita in the first model. In the second model, the credit to the private sector serves as dependent variables and remittances and GDP per capita were employed as independent variables. Functionally, the equations estimated can be expressed as follows.

$$ACC = F(REMT, GDP) \quad (1)$$

$$CREDIT = F(REMT, GDP) \quad (2)$$

Pooled Mean Group (PMG) can be formulated as follows:

$$y_{it} = \sum_{j=1}^n \lambda_{ij} y_{i,t-j} + \sum_{j=0}^q \delta_{ij} x_{i,t-j} + \mu_t + \varepsilon_{it} \quad (3)$$

In equation two, the number of cross section is denoted by  $i = 1, 2, \dots, N$  and  $t = 1, 2, \dots, T$ . Also,  $x_{i,t-j}$  is a vector of  $K \times 1$  regressors. While  $\lambda_i$  and  $\delta_i$  stand for the coefficients of vectors for scalars and exogenous variables and is a group-specific effect. Similarly, stands for the disturbance term and if the variables are  $I(1)$  and co-integrated, then the disturbance term is an  $I(0)$  process. This feature implies that error correction dynamics of the variables in the system swayed by the deviance from equilibrium, thus equation two can be re-parameterized to account for error correction thus:



$$\Delta y_t = \phi_i y_{i,t-1} + \theta_t^* X_{i,t-j} + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^* \Delta x_{i,t-i} + \mu_t + \varepsilon_t \quad (4)$$

The error correction parameter is indicated by  $\phi$  and it shows the speed of adjustment. In introducing dependent and independent variables in equation 3, our Pooled Mean Group (PMG) takes this form:

$$\Delta ACC_{ij} = \lambda_0 + \sum_{j=1}^{n1} a_{ij} \Delta ACC_{i,t-j} + \sum_{j=1}^{n1} b_{ij} \Delta REMT_{t-j} + \sum_{j=1}^{n2} c_{ji} \Delta GDP_{t-j} + \phi_1 ACC_{i,t-j} + \theta_1 RMT_{t=1} + \theta_2 GDP_{t=1} + \varepsilon_{t=1} \quad (5)$$

$$\Delta Credit_{ij} = \lambda_0 + \sum_{j=1}^{n1} a_{ij} \Delta Credit_{i,t-j} + \sum_{j=1}^{n1} a_{ij} \Delta REMT_{t-j} + \sum_{j=1}^{n2} b_{ji} \Delta GDP_{t-j} + \phi_1 Credit_{i,t-j} + \theta_1 RMT_{t=1} + \theta_2 GDP_{t=1} + \varepsilon_{t=1} \quad (6)$$

## Properties of Data

In an effort to base our estimation on sound econometric analysis, we subjected our data to preliminary econometric tests of cross-sectional dependence, panel unit root tests and co-integration tests. The results are presented in table one, two and three below.

## Cross – Sectional Dependence Results

In line with Pesaran (2004), we investigated cross-dependence of our data using Breusch-Pagan (1980) LM, Pesaran (2004) scaled LM, Baltagi, Feng, & Kao (2012) bias-corrected scaled LM & Pesaran (2004) tests CD and the results are reported in table one

**Table 1. Cross – Sectional Dependence Results**

	ACC	REM	GDP	Credit
Breusch-Pagan LM	2814.4(0.000)***	1056.4(0.000)***	2942.1(0.000)***	1654.1(0.000)***
Pesaran scaled LM	91.9(0.000)***	25.6(0.000)***	96.7(0.000)***	48.1(0.000)***
Bias-corrected scaled LM	90.7(0.000)***	24.3(0.000)***	95.5(0.000)***	46.9(0.000)***
Pesaran CD	52.0(0.000)***	2.30(0.021)***	53.1(0.000)***	26.4(0.000)***

Note:\*\*\*, \*\*, \* indicate significant at 1%;5% &10%

Source: Author's Computation

Based on the results from all the cross-sectional dependence tests, it is impossible to accept the null hypothesis that our data are cross-sectional independent. We particularly focused on the result from Pesaran CD because of the characteristic of panel data such that  $N > T$ . However, all results of CD tests were uniform, attesting to the fact that there is cross-sectional dependence on the data. Based on these outcomes, the second generation of unit root tests, particularly Pesaran cross-sectional augmented

panel unit root test (CIPS), will be required to test for stationarity. This is based on the fact the hypothesis of cross-sectional independence inherent in the first generation of unit root tests is too restrictive and unrealistic for macro series. This may lead to size distortions and low power (Hurlin & Migon, 2007). Pesaran (2007) CIPS unit root test results are presented below in table two.

**Table 2. Pesaran (2007) CIPS Test**

No trend					Trend			
Lags	Log(ACC)	Log(RE M)	Log(GDP)	Log(Credit)	Log(ACC)	Log(RE M)	Log(GDP)	Log(Credit)
0	-	-	-	-	-	0.4(0.65)	-	-
	3.7(0.00)* **	1.3(0.09) *	4.3(0.00)* **	1.8(0.02)* *	1.9(0.02)* **		3.7(0.00)* **	1.4(0.07)* *
1	-	-	-	-	0.4(0.69)* **	-	-	-
	2.5(0.00)* **	1.8(0.03) **	5.5(0.00)* **	3.3(0.00)* **		0.0(0.48)	6.1(0.00)* **	2.2(0.01)* *
2	-	-	-	-0.0(0.46)	18.3(1.00)	0.5(0.69)	-	-0.0(0.49)
	3.4(0.00)* **	1.4(0.06) *	3.5(0.00)* **				3.6(0.00)* **	

Note: \*\*\*, \*\*, \* indicate significant at 1%;5% &10%

*Source: Author's computation*

Pesaran CIPS test follows Dickey-Fuller regression augmented with the cross-section average of lagged levels of the individual series. The approach also assumes one or more common unobserved factors producing cross-country dependence. Persiaran CIPS results as presented in table 2 indicate the rejection of unit root hypothesis for all the variables, especially at lag 0 and 1. This shows that Account opening, remittances and GDP per capita and credit to the private sector are all stationary at level. Thus, the results from the first and second generation of unit root tests do not show major discrepancies.

Similarly, the presence of cross-sectional dependence and unit root in one of our variables necessitates the need to adopt a test of co-integration that takes care of the problems. In recent literature focusing on co-integration, Westerlund (2007) co-integration test has been credited with such capability. For the purpose of this study, Westerlund (2007) and LM Bootstrap panel co-integration test by Westerlund & Edgerton (2007) were adopted to investigate co-integration in our variables. The central purpose of the test is to check for the presence of co-integration, by determining whether or not the individual panel members are error-correcting. This implies that Westerlund (2007) and LM Bootstrap panel co-integration test by Westerlund & Edgerton (2007) can be used in both cases of cross-sectional dependency and independence. Also, these tests allow for heterogeneity among the units forming the panel. To enable comparison, the results of traditional co-integration tests, specifically Pedroni (1999, 2004), are reported alongside with Westerlund (2007) and LM Bootstrap panel co-integration test by Westerlund & Edgerton (2007). The two results are reported in table 3a and 3b for both models 1 and 2.

**Table 3a. (Model 1) Panel Co-Integration Tests results**

Within-Dimension				Between-Dimension			
		Model (log (inclusion) log(Remittances) log(per-capita)					
	v-stat	p-stat	pp-stat	Adf-stat	p-stat	pp-stat	Adf-stat
SSA Countries	-0.37	2.28	-1.40*	-2.23***	5.12	-7.46***	-3.89***

**(Model 2) Panel Co-Integration Tests results**

Within-Dimension				Between-Dimension			
		Model (log (inclusion) log(Remittances) log(per-capita)					
	v-stat	p-stat	pp-stat	Adf-stat	p-stat	pp-stat	Adf-stat
SSA Countries	-0.37	2.28	-1.40*	-2.23***	5.12	-7.46***	-3.89***

Note: the test statistics are normalized so that the asymptotic distribution is standard normal. \*, \*\*, \*\*\* indicate rejection of the null hypothesis of non-co-integration at the 10%, 5% and 1% significance levels.

*Source: Author's computation*

**Table 3b. Error-Correction Panel Co-Integration Test Results (Model 1)**

Tests	Value	Z-value	P-value	Robust P-value
Gt	-7.348	-29.980	0.000***	0.215
Ga	-0.965	6.760	1.000	0.750
Pt	-4.909	3.866	1.000	0.083*
Pa	-0.448	5.034	1.000	0.508

**Error-Correction Panel Co-Integration Test Results (Model 2)**

Tests	Value	Z-value	F-value	Robust P-value
Gt	-1.906	-2.399	0.008***	0.065**
Ga	-4.174	1.447	0.926	0.435
Pt	-6.213	-1.294	0.098*	0.393
Pa	-2.702	-0.199	0.421	0.532

Note: \*\*\*, \*\*, \* indicate significant at 1%; 5% & 10%

*Source: Author's computation*

The results of Pedroni (1999, 2004), as reported in Table 3a, reject the hypothesis of no co-integration, especially between dimension at a critical level of 5%, for the two models. Similarly, the results from Westerlund (2007) and LM Bootstrap panel co-integration test by Westerlund & Edgerton (2007) presented in Table 3b show that we can reject the hypothesis of no co-integration for the two models at 10%, despite accounting for cross-sectional dependence in the two models with. Thus, it is convenient to say that there is the long-run relationship among the variables. Given all the preliminary investigations, the models were found to be suitable for necessary estimations. Before estimating our model, we tested for causality direction between the two major variables in our models, in line with the point made at the background to this study. Based on the econometric properties of the data, we employed Dumitrescu & Hurlin (2012) Granger non-causality panel procedure. The test is particularly designed for heterogeneous panel data and it has proven to produce consistent and unbiased results in the face of a small sample and cross-sectional dependence. The results of causality tests are reported in table 4a and 4b for models 1 and 2 respectively.

In the Granger non-causality results, as presented in Table 4 upper parts, the results show that the hypothesis of Granger non-causality can be rejected between remittances and financial inclusion for SSA countries. This indicates that remittances Granger-cause inclusion for at least one panelvar (id). In terms of causality, this implies that the past of value of remittance can help predict financial inclusion proxy by account opening in SSA. Also, we explored the possibility of reversed causality between the two variables. The results, as reported in Table 4 lower parts, show that it can similarly reject the hypothesis of Granger non-causality from inclusion to remittances. This shows that there is a reversed causality from inclusion to remittances. In general, the results from the two tests indicate bi-directional causality between remittances and inclusion proxy by account opening, and this can pose a serious challenge for model estimation. On the other hand, the results from the second model basically indicate unidirectional causality from remittances to financial inclusion proxy by credit to the private sector.

**Table 4a. Dumitrescu & Hurlin(2012) Granger non-causality results: Model (1)**

Optimal number of lags(AIC) : 2(lags tested:1to2)		
w-bar	Z-bar	Z-bartilde
8.37	16.57***	3.51***
Optimal number of lags(AIC) : 2(lags tested:1to2)		
w-bar	Z-bar	Z-bartilde
9.09	18.43***	4.01***

Note: \*\*\*, \*\*, \* indicate significant at 1%;5% &10%

*Source: Author's computation*

**Table 4b. Dumitrescu & Hurlin (2012) Granger non-causality results: Model (2)**

Optimal number of lags(AIC) : 2(lags tested:1to2)		
w-bar	Z-bar	Z-bartilde
0.97	-0.10	
Optimal number of lags(AIC) : 2(lags tested:1to2)		
w-bar	Z-bar	Z-bartilde
3.1***	7.18***	5.82***

Note: \*\*\*, \*\*, \* indicate significant at 1%;5% &10%

*Source: Author's computation*

#### 4. Research Findings

As specified in model specification, Panel ARDL was used as a method of estimation. Specifically, we employed Pooled Mean Group (PMG) to estimate both long and short-run effect of remittances on financial inclusion proxy by account penetration and credit to the private sector in two different models. Estimation results from the two models are presented in table 4a and 4b. Most importantly, in an attempt to obtain reliable results from our estimations and due to the presence of cross-sectional dependence in our data, other estimation techniques were also employed. Precisely, we used *xtdcce* stata code, as developed by Jan Ditzén to implement Pesaran (2006) and Chudik & Pesaran (2015b). *xtdcce* provides for (Pooled) Mean Group estimations in a dynamic panel, with consideration for dependence between

countries. It also corrects small sample time series bias by using Recursive Mean Adjustment, as suggested by Chudik & Pesaran (2015b). The results are presented jointly with PMG results in table 4a and 4b.

The results from Table 5a indicate that remittance has a positive effect on financial inclusion, both in the short-run and long-run. However, the results as presented show that remittances do not have a statistically significant effect on financial inclusion as a proxy by account penetration. Considerably, remittances do have considerable effect in the long-run using PMG estimation method. But, this same position does not hold when other estimation techniques that take care of cross-sectional dependence are employed. Estimations from xtdcce by Ditzen, (2016) and xtcce dynamic CCE by Neal (2015) show that there is no significant effect of remittance on financial inclusion as a proxy by account penetration, both in the long-run and short-run. However, both methods indicate that remittances have positive on financial inclusion.

Similarly, the results in Table 3b show that remittances have a positive effect on financial inclusion. Using the PMG estimation method, the results show that there is a statistically significant effect of remittance on financial inclusion, only in the short-run. However, this does not apply in the long-run. Considerably, the results from other estimation techniques, such as xtdcce by Ditzen (2016) and xtcce dynamic CCE by Neal (2015) contradict PMG estimation results. The results show that remittances do not have a significant positive effect on financial inclusion. Since these methods account for cross-sectional dependence identified in our data, we are left with no option than to base our conclusion and policy prescriptions on the results from xtdcce by Ditzen (2016) and xtcce dynamic CCE by Neal (2015) estimation techniques.

**Table 5a. FI (Account Penetration)**

Long Run	Xtpmg	xtdcce2	Xtdcce2-cce
GDP	0.28(0.00)***	0.06(0.89)	0.07(0.89)
REM	29.1(0.00)***	33.8(0.74)	32.8(0.45)
SR			
<b>Ec</b>	-0.20(0.00)***	-0.27(0.02)***	-0.28(0.02)***
REM	48.7(0.40)	33.4(0.35)	33.6(0.35)
GDP	0.06(0.89)	0.05(0.40)	0.05(0.40)

**Table 5b. FI (Credit to Private Sector)**

	Xtpmg(1)	xtdcce2	Xtdcce2-cce
REM	0.32(0.11)	0.04(0.89)	0.07(0.89)
GDP	0.031(0.00)***	0.08(0.74)	32.8(0.45)
SR			
<b>Ec</b>	-0.12(0.00)***	-0.02(0.02)***	-0.07(0.02)***
REM	0.05(0.00)***	0.06(0.35)	0.06(0.35)
GDP	1.16(0.85)	2.11(0.40)	1.19(0.40)

## **5. Conclusion**

### **5.1 Research Contribution and Implications**

After thorough econometric analyses of our data, the study concludes that remittances have potential to explain changes in financial inclusion. To be sure, remittances have potentials to positively influence financial inclusion in SSA. However, this potential has not been fully harnessed, given the fact that empirical shreds of evidence show that remittances have no significant effect on financial inclusion in the SSA African region. This assertion aligns with another related study within and outside the region taken for consideration in this paper. A position such as this has been well explored by scholars, including Anzoategui & Demirguc-Kunt (2011), Martinez Peria (2011), Carmignani & Fayad (2013), and Coulibaly (2015). It is pertinent to also note that the views articulated by these scholars contradict the findings of similar studies, especially those of Toxopeus & Lensink (2008), Anzoategui, Demirguc-Kunt, & Martinez-Peria (2014), Karikari, Mensah & Harvey (2016), and Nyanhete (2017). Based on these findings, the study has been able to contribute to the literature by establishing the existence of positive interaction between financial inclusion and remittances but such interaction is not significant. However, the study has provided a shift of attention from financial development to financial inclusion which is a more pressing issue in the region.

The core set of policy intervention that can be employed in both countries of origin and host countries include:

- Reducing cost and risk of money transfer for migrants. This will go a long way in reducing transfer through unregulated channels.
- Financial education for migrants with a focus on providing information about existing financial products that meet their needs and also raise awareness on unregulated remittance transfer risks and solutions.
- Financial education should also be provided to recipients in host countries in order to build capability to make the best use of remittances.
- Authorities, especially remittances receiving countries in SSA should devise innovative system, such as EcCash Diaspora service that is offered by Econet Wireless in Zimbabwe, so as to attract more remittances from their migrants.

### **5.2. Research Limitation and Future Works**

There is paucity of secondary data on financial inclusion for many SSA African countries and the available data are not extended in term of periods. This can create a methodological challenge for researchers. More countries and periods would have been included in the study but for the paucity of data. Future study can include more countries and more variables especially those variables that focus more on the use of financial services rather than access to financial services as employed in this study.

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