Analysis of Savings-Investment Gap in Sub-Saharan Africa: Does the nexus between Foreign Remittances and Domestic Financial Sector matter?

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Abstract

In recent times, increasing attention is being paid to examine the developmental impact of remittances inflow, particularly due to the emergence of remittances as the fastest growing source of capital flows for developing countries. To this end, we contribute to the literature by analyzing the interactive effects of remittances and financial development on savings-investment gap for a panel of 18 Sub-Saharan African (SSA) countries over the period of 1990 to 2017. Our Panel ARDL model estimation showed that higher remittances have significant reducing effect on savings-investment gap in the long run, and this becomes magnified while accounting for individual and interactive effects of remittances and financial development. We also uncovered the widening effects of rising real GDP growth and bank deposits over a long-term horizon, whereas higher private sector credit widens the savings-investment gap only in the short-run. Meanwhile, liquid liabilities have no significant effect on savings-investment gap both in the short run and long run. We further offered evidence on the complementarity and substitutability effects of remittances and financial development over the short-term and long-term horizons, respectively. We also demonstrated the superior forecast accuracy of the predictive savings-investment gap model - that accounts for both individual and interactive effects - over other specifications, and this is robust to the choice of financial development indicators, samples and forecast horizons. Our results underscore the urgent need for a reduction of transfer costs, so as to encourage both migrant workers and their beneficiaries to make use of the official channels for sending and receiving remittances in the region.

Keywords: Savings-Investment Gap, Remittances, Financial Development and Panel ARDL.

1. Introduction

The relative importance of remittances, as a source of foreign capital flows, is gradually becoming more quintessential in recent times given the upsurge in remittances sent by migrant workers in developed economies to their home countries, mostly developing economies (Le, 2011). Remittances have outpaced foreign direct investment (FDI), both as a share of GDP and in absolute terms, to become the largest source of foreign capital inflows to low and middle income economies and it is three times larger than official development assistance (World Bank, 2019). Remittances inflow to low and middle income countries rose markedly from about \$285 million in 1970 to \$531 billion in 2018 with the share of Sub-Saharan African countries averaging 8.2% over a similar period. Remittances inflow to Sub-Saharan Africa rose sharply from \$23 million (0.04% of GDP) in 1970 to \$48 billion (2.82% of GDP) in 2018 (World Bank, 2019). However, it is not the absolute size of remittances flow that matters for policy issues, but its share in total GDP of the recipient country (Akindipe, 2020).

The foregoing suggests that despite the increasing inflow of remittances, its share in total GDP is still at low ebb. This could be attributed to the migrant stocks, wage structure and economic conditions of the foreign countries where they reside, exchange rate movement, and transaction costs of sending and receiving remittances, among others (Lartey, 2013; Dash, 2020; KNOMAD, 2020). Further, Tung (2018) alluded to the fact that the actual volume of remittances is underreported because remittances inflow through the informal channel are usually not captured in the official statistics. This suggests that concerted efforts need to be made by the government and other stakeholders in Sub-Saharan African countries to boost the inflow of remittances to the region, especially through the formal channels. Given the decreasing inflow of other sources of foreign capital including foreign direct investment (FDI), foreign portfolio investment (FPI) and official development assistance (ODA), it is imperative to improve the growth enhancing effects of remittances, particularly through the investment channel.

There are basically two motives why migrants transfer a fraction of their incomes to their home countries, and they are **altruistic and portfolio motives** (see, for instance, Bouhga-Hagbe, 2004 and Barajas, *et al.*, 2009). The altruistic motive relates to assisting the migrant's families in the home country, especially during economic downturns (counter-cyclical behaviour), which suggests that the migrant derives satisfaction from his/her family's utility. On the other hand, the portfolio motive is investment-driven, particularly for portfolio diversification rationale (pro-cyclical behavior). Intuitively, remittances engender both income transfer and capital flows. Nevertheless, these two motives have economic implications, including boosting consumption (a demand-side phenomenon) and stimulating production (a supply-side phenomenon), which helps to improve the receiving country's domestic investment and economic growth (OECD, 2006).

The proponents of foreign remittances argued for its relative stability and increment during economic downturns in the recipient country compared to foreign direct investment and foreign portfolio investment (Aggarwal, Demirgüç-Kunt and Peria, 2011). Other benefits of remittances to the recipient household or country include: improvement in recipient's standard

of living, expansion of consumption and investment, relaxation of financial constraints, stability of institutions, promotion of industrialization through the financial development channel, and encouragement of investment in healthcare and education, among others (Bjuggren, Dzansi and Shukur, 2010; Efobi, Asongu, Okafor, Tchamyou and Tanankem, 2016; Qiang, Khurshid, Calin and Khan, 2019; Akindipe, 2020). On the other hand, the devastating impacts of higher remittances inflow in the recipient country include its ability to reduce the incentive to work and save, stoke inflationary pressures and drag economic growth through the real exchange rate appreciation channel (Acosta, *et al.*, 2008; Sobiech, 2019).

There are numerous country-specific studies on the linkage between remittances and other macroeconomic variables, such as, financial sector development and economic growth¹. We also acknowledge panel-data studies on developing countries². However, studies with specific focus on Sub-Saharan African countries did not consider the channel through which the remittances-financial development nexus affects investment³. Nonetheless, the study by Okodua (2013) was limited to the impact of remittances on private investment in 31 Sub-Saharan African countries using the GMM technique, while Lartey (2013) only examined the effects of remittances on investment and growth. To this end, we contribute to the extant literature by investigating whether the nexus between foreign remittances and financial sector development matters in plugging the domestic savings-investment gap in Sub-Saharan Africa. In specific terms, we proffer answers to the following research questions: (1) What is the pairwise correlation: between remittances inflow and financial development; between remittances inflow and savings-investment gap, as well as, between financial development and savings-investment gap in Sub-Saharan Africa? (2) What is the role of the nexus between foreign remittances and financial development in narrowing domestic savings-investment gap in Sub-Saharan Africa? This will be done through examining the interactive effects of the three most prominent financial development indicators (ratio of broad money supply to GDP, ratio of private sector credit to GDP and ratio of liquid liabilities to GDP) with remittances on the domestic savings-investment gap in the region.

Following the introduction, the rest of the paper is structured as follows. Section two gives a snapshot of stylized facts. Section three presents a brief review of the relevant theoretical and empirical literatures. Section four comprises the methodological approach and data utilized in

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¹See, for instance, Adenutsi (2011), Hassan and Shakur (2017), Peprah, Ofori and Asomani (2019), Kousar, Rais, Mansoor, Zaman, Shah and Ejaz (2019), Misati, Kamau and Nassir (2019), Olaniyan (2019), Garba, Adekunle and Adeniyi (2020).

²See, for instance, Bjuggren, Dzansi and Shukur (2010), Fayissa and Nsiah (2010), Abida and Sghaier (2014), Chowdhury (2016), Efobi, Asongu, Okafor, Tchamyou and Tanankem (2016), El Hamma (2016), Karikari, Mensah and Harvey (2016), Matuzeviciute and Butkus (2016), Ali, Law and Yusop (2018), El Hamma (2018), Tung (2018), Bangake and Eggoh (2019), Brown, Carmignani and Fayad (2019), Eggoh, Bangake and Semedo (2019), Qiang, Khurshid, Calin and Khan (2019), Sobiech (2019) and Dash (2020).

³See, for instance, Nyamongo, Misati, Kipyegon and Ndirangu (2012), Couharde and Generoso (2014), Adetou and Fiodendji (2019), Bandura, Zivanomoyo and Tsaurai (2019), Chitambara (2019), Olayungbo and Quadri (2019), Tah (2019).

this study. Section five entails empirical analysis and discussion of results. Section six concludes the study.

2. Stylized Facts on Remittances, Migrant Stock & Savings-Investment Gap in SSA

2.1 Sub-Saharan Africa remains the least recipient of foreign remittances

Remittances inflows to low and middle income countries increased markedly by about 73% from \$307 billion in 2009 to \$531 billion in 2018 with the share of Sub-Saharan Africa averaging 6.6% and 6.9% of global remittances in both periods, respectively. East Asia and Pacific remains the region with the highest remittances inflow among low and middle income countries, while it is worrisome that Sub-Saharan Africa maintains its position as the lowest recipient region of remittances over time (see **Table 1**). Nonetheless, there has been a significant increase in remittances inflow to Sub-Saharan Africa. This could be attributed to good economic conditions in high-income countries which host many migrants from Sub-Saharan Africa.

Insert Table 1 here

2.2 Nigeria ranks first on remittances receipt over the past 2 decades

Table 2 presents the absolute values of remittances inflow to Sub-Saharan Africa. Senegal had the highest remittance inflows in 1990 but fell to second and third positions in 2010 and 2017, respectively. Botswana was seventh largest recipient of remittances in 1990 but later relegated to being the least recipient from 2010 to 2017. Benin, Guinea and Namibia also ranked low in terms of remittances inflow over a similar period. Meanwhile, Nigeria emerged the largest recipient of remittances in the region since year 1995, even though the country took fourteenth position out of 18 SSA countries under study in 1990. It is worthy of note that Ghana, which ranked sixteenth on the remittance scale in 1990, climbed up the remittances inflow ladder to attain the tenth and second positions in 2010 and 2017, respectively. Rwanda and Togo achieved similar feat by moving up the chart of top recipients of remittances in Sub-Saharan Africa. Noteworthy is the feat of Togo which rose from ninth position in 1990 to eighth in 2010 and maintained same position in 2017. Nonetheless, South Africa was in fourth position in 1990, third in 2010 but fell to sixth position in 2017. Similarly, Madagascar and Niger moved up and down the remittances chart during the period under review. In general, remittances inflow to Sub-Saharan Africa is remarkable and rising gradually over the years.

Insert Table 2 here

2.3 West Africa maintains lead in remittances inflow (percent of GDP) in the last 3 decades

The World Bank, as well as, the Sustainable Development Goals (SDG) indicator 17.3.2 gives more credence to remittances as % of GDP than its absolute value, even though an increase in remittances (in absolute value) would translate into higher ratios between remittances and GDP as long as the former grows at a faster pace relative to the latter. In terms of remittances as % of GDP, **Table 3** shows that Togo topped the chart in 2005 and 2010 but was ousted by Ghana and Senegal from 2015 upwards. It is worthy of note that only Senegal experienced an upward trend throughout the period. Though, Benin ranked first in 1990, its position fell to twelfth

position in 2017. More so, despite being the highest remittances recipient (in absolute value) in 2010 and 2017, Nigeria ranked third and fifth respectively on the remittance (% of GDP) scale. Expectedly, Botswana which had the least remittances in absolute value in 2010 and 2017 also had the least remittances as % of GDP during these periods. Nonetheless, Côte d'Ivoire maintained eleventh position in 1990 and 2010, but its rank fell to fourteenth in 2017.

Insert Table 3 here

2.4 In spite of recording a substantial increase in migrant stock, Sub-Saharan Africa has the World's highest remittances transfer cost

Apparently, most countries in Sub-Saharan Africa had a significant increase in the number of emigrants over the years, thereby suggesting that higher number of emigrants is a probable determinant of the increasing remittance flows to the region (see **Table 4**). However, the Remittance Prices Worldwide database posits that the average cost of remitting \$200 to low and middle income countries stood at 6.8%, with Sub-Saharan Africa having the highest average cost of about 9% (KNOMAD, 2020). This triples the SDG target 10.c of 3% and also exceeds the global average of 7%. Unfortunately, intraregional remittance costs remain at approximately 20% in the region despite the fact that intraregional migrants in SSA constitute more than two-third of all global migrants from the region. The relatively high remittances transfer cost is a disincentive to migrants who would prefer to send money home through informal channels in a bid to reduce transaction costs. In addition, the high costs of transferring money along various remittance corridors has lowered the gains from migration, especially for poor recipients in the migrant's home country. Recruitment costs charged migrant workers are very high despite the SDG goal 10.7.1 - which aims at reducing recruitment costs. Most migrants continue to face various recruitment misconducts including excessive charges. These malpractices pose a serious challenge on the volume of remittances sent to migrant's home country, as well as, the volume of investment and standard of living of recipients (KNOMAD, 2020). It is therefore imperative that government and other stakeholders make concerted efforts to address the high intraregional transaction costs.

Insert Table 4 here

2.5 Two-third of Sub-Saharan African countries under study have substantial savings-investment gap

Savings-Investment gap expresses the difference between aggregate investment and aggregate savings in an economy (see **Table 5**). A positive savings-investment gap shows that aggregate savings fall short of aggregate investment. On the other hand, a negative savings-investment gap indicates that economy-wide investment is below the economy-wide savings. Accordingly, most of the countries (including Benin, Burkina Faso, Ghana, Guinea, Guinea-Bissau, Kenya, Madagascar, Mali, Namibia, Niger, Rwanda and Senegal) have positive savings-investment gap over the period of 1990 to 2017, whereas Cote d'Ivoire is the only country with negative savings-investment gap over the same period. On the one hand, Botswana, Nigeria and South Africa have predominantly negative savings-investment gap, while countries with predominantly positive savings-investment gap are Cameroon and Togo (see Table 5).

Apparently, Botswana, which has the lowest remittance inflows (% of GDP) in the region, also had a substantial savings-investment gap, such that, savings outweighed investment throughout the period under review except in 2010 and 2015. Given that 66% of the SSA countries under study have huge savings-investment gap, we hypothesize that countries could maximize this investment opportunity through two channels – domestic financial sector and remittances inflow, whose relation to each other could either be complements or substitutes. This is the major thrust of the current empirical exercise, which is addressed in later sections of this paper.

Insert Table 5 here

3. Literature Review

3.1 Theoretical Review

There are two major views in the theoretical literature on the relationship between remittances and financial development especially as it relates to their role in promoting economic growth - substitutability hypothesis and complementary hypothesis. Further, the foremost theory in the literature linking foreign flows (remittances, in our case) with domestic investment is the two-gap model of financial aids. We also take note of the baseline accelerator theory of investment. Accordingly, these four theoretical postulations are reviewed in this study.

3.1.1 Substitutability Hypothesis

The substitutability hypothesis states that remittances serve as an alternative available to economic agents who are unable to access funds from financial institutions or where the financial sector is underdeveloped or inefficient. The substitutability hypothesis holds mostly in countries with weak and underdeveloped financial sector as it occurs when remittances pass through the informal sector instead of the formal financial institutions. Numerous studies give support to the substitutability hypothesis (see Hassan and Shakur, 2017; Bandura, Zivanomoyo and Tsaurai, 2019; Brown, Carmignani and Fayad, 2019; Olayungbo and Quadri, 2019; Tah, 2019; Garba, Adekunle and Adeniyi, 2020 (particularly, where interest rate spread is employed as the qualitative measure of financial development)).

3.1.2 Complementarity Hypothesis

The complementarity hypothesis posits that remittances and financial development are complements because they promote each other. The proponents of the complementary hypothesis alluded that a well-developed financial sector afford migrants the opportunity to easily and conveniently send money to their home country, a situation which makes money available for the financial institution to make funds available for investment purposes thereby instigating competitions among financial institutions and improving their performance. A competitive financial sector could engender a reduction in transfer cost thereby creating more incentives for migrants to keep sending money to their home country, and as such keep making more money available for investment, a situation which will simultaneously increase remittances and make the financial sector more developed and competitive, as well as, increase the national income of the receiving country. Intuitively, remittances and financial development can effectively serve as complements only when the financial sector is well-developed. The complementarity hypothesis has been widely supported in several empirical

studies (see Nyamongo, Misati, Kipyegon and Ndirangu, 2012; Abida and Sghaier, 2014; Karikari, Mensah and Harvey, 2016; El Hamma, 2016; El Hamma, 2018; Qiang, Khurshid, Calin and Khan, 2019; and Misati, Kamau and Nassir, 2019, Garba, *et al.*, 2020 (particularly, where liquid liabilities, private sector credit and total bank deposits are employed as the quantitative measures of financial development).

3.1.3 Two-Gap Model

Identifying the need for foreign capital inflows to fill the savings and foreign exchange gaps, Chenery and Strout (1966) developed the two-gap model of foreign aids. Whereas, the difference between domestic investment and domestic savings describes the saving gap, the foreign exchange gap is the discrepancy between the foreign exchange received and disbursed through exports and imports respectively. The postulations of the two-gap model were substantiated by the Harrod-Domar growth model through its advocacy for attracting foreign capital (such as, remittances, foreign portfolio investment, foreign direct investment and foreign aids, among others) to bridge the savings-investment gap especially in economies with low domestic savings in relation to domestic investments (Todaro and Smith, 2012). The theory posits that foreign capital (including remittances) can be used to equilibrate domestic savings and investment.

3.1.4 Accelerator Theory of Investment

The acceleration theory posits that an increase in consumption or income will increase investment by a multiple amount. It suggests a direct relationship between income (total output) and investment spending. The rationale behind this is that an increase in income will raise consumption (demand) which will require the production of more commodities thereby prompting additional investment expenditure especially when the available capital stocks are fully used. The investment induced by income or consumption dynamics is called induced investment. A certain level of capital stock is required to produce a given level of output and this can be written as:

$$K_t = vY_t \quad (1)$$

Where K is capital stock; Y is output or income; v is capital-output ratio (K/Y) and t is time period.

Equation or Eq. (1) shows that capital stock (net induced investment) is an increasing function of aggregate output or income with the assumption that the capital-output ratio (v) is constant. This assumption indicates that output and capital stock grows at the same rate such that when income or output is Y_t , the required capital stock will be $K_t = vY_t$ and when income or output is Y_{t-1} , capital stock becomes:

$$K_{t-1} = vY_{t-1} \quad (2)$$

Eq. (2) implies that the previous level of capital stock is an increasing function of the previous level of output or income. Put differently, an increase in output or income in the previous period will instigate an increase in investment spending in the same period. The increase in capital stock in the previous and current period can be obtained by deducting Eq. (2) from Eq. (1) to give:

$$K_t - K_{t-1} = v(Y_t - Y_{t-1}) \quad (3)$$

$K_t - K_{t-1}$ signifies the increase in capital stock (or new investment) in the current year thus, eq. 3 becomes:

$$I_t = v(Y_t - Y_{t-1}) \quad (4)$$

Eq. (4) shows that the increase/decrease in current income or output (Y_t) over the previous period's income output (Y_{t-1}) will increase/decrease investment v times beyond the increase/decrease in income. Thus, the capital-output ratio, v , is the accelerator as it denotes the degree of acceleration such that when $v = 5$, investment spending will increase five times as much as the increase in income or output.

3.2 Empirical Review

There is a plethora of time-series and panel studies in the extant literature examining the remittance-financial development nexus as well as its relationship with different macroeconomic indicators, albeit with diverse findings. The variance in the findings could be attributed to the choice of estimation technique, scope, data types and sources, among other factors. On the country-specific studies, Adenutsi (2011) employed the dynamic error correction model to evaluate the remittance-financial development nexus in Ghana using quarterly time-series data for the period between 1987Q3-2007Q4. He found that financial development granger-causes remittances inflow, although with devastating effects on economic growth. Similarly, the findings of Peprah, Ofori and Asomani (2019) revealed that financial development and remittances are positively related to economic growth in Ghana although their joint effect is higher.

Using the instrumental variable two-stage least square (IV-2SLS) and generalized methods of moment (IV-GMM) estimation techniques, Hassan and Shakur (2017) found an inverse relationship between remittances and GDP growth in the short-run but a direct relationship in the long-run. They further averred that the financial sector plays no role in improving the impact of remittances on economic growth in Bangladesh. On the other hand, Misati, Kamau and Nassir (2019) adopted the autoregressive distributed lag (ARDL) framework to estimate the link between remittances and financial development in Kenya. The result showed that remittance is positively related to financial development. They alluded that the use of modern technology in transferring remittance reduces costs of building physical structures, cost of salaries to employees and cost of transport to financial institutions. On the other hand, Kousar, Rais, Mansoor, Zaman, Shah and Ejaz (2019) discovered that remittance raises poverty level and income inequality while financial development has a positive impact on poverty reduction and income inequality in Pakistan. Further, Olaniyan (2019) and Garba, *et al.*, (2020) tested the validity of the complementarity and substitutability hypotheses in Nigeria using generalized methods of moment and two-stage least square (2SLS) methods, respectively. These studies revealed that remittances had negative effect on economic growth but enhance economic growth when interacted with financial development indicators, particularly liquid liabilities, private sector credit and total bank deposits.

In a panel study comprising 14 countries from Southern African Development Community, Bandura, Zivanomoyo and Tsaurai (2019) showed that remittance has a positive impact on

economic growth but a negative impact on financial development. Nyamongo, Misati, Kipyegon and Ndirangu (2012) argued that remittances have growth effects in 36 African countries, but its volatility adversely affects growth. They further stated that remittances complement financial development, though the importance of the financial sector in spurring growth appears weak. However, the empirical findings of Chowdhury (2016) revealed that remittances inflow neither complement nor substitute financial development. Nevertheless, El Hamma (2016), Chitambara (2019) and Adetou and Fiodendji (2019) showed that the growth effect of remittances is enhanced in the presence of strong institutions and well-developed financial sector.

In their study on 36 African countries spanning the period between 1980 and 2004, Fayissa and Nsiah (2010) showed that remittances have positive influence on economic growth as it helps to circumvent liquidity constraint problems and provides other means of financing investment. Eggoh, Bangake and Semedo (2019) and Olayungbo and Quadri (2019) corroborated this finding in their panel study of 49 developing countries over the period of 2001-2013 and 20 Sub-Saharan African countries spanning 2000 to 2015, respectively. Sobiech (2019) argued that the efficiency, depth and size of the financial sector determine the strength of the interaction between remittance and financial development. Karikari, Mensah and Harvey (2016) argued that remittances promote some aspects of financial development and better financial system foster remittance receipts through formal channels, while Bangake and Eggoh (2019) identified threshold effect of financial development in the remittances-growth relationship.

On the link between remittances and investment, Lartey (2013) employed the GMM technique to estimate panel data of 36 Sub-Saharan African countries from 1990-2008. The findings indicated that remittances and growth are positively related and the interaction between remittances and financial depth has positive effect on growth. Further, the author argued that remittances directly affect growth through the investment channel but indirectly through the consumption smoothing effect. Similarly, Okodua (2013) collected panel data for 31 Sub-Saharan African countries from 2000-2011 and used the GMM method to estimate the link between remittances and private investment. The results showed that remittances are positively related to private investment and it serves as both capital and financial flows. Conversely, the finding of Tung (2018) showed that whereas remittances are inversely related to domestic investment, GDP per capita has a positive impact on domestic investment in 19 Asian-Pacific countries. Dash (2020) adopted the panel cointegration and causality approach to investigate the remittances-domestic investment nexus in 6 South Asian Countries from 1991-2017. The result showed that remittances increase domestic investment in the short-run and long run implying that it serves both consumption and investment purposes. Further result revealed that unidirectional causality runs from remittances to domestic investment. Moreover, Bjuggren, Dzansi and Shukur (2010), in their panel study of 79 developing countries, found that remittances, well-developed credit market and high quality institutional framework stimulate investment. However, the marginal significance of remittances, as a financier of investment, diminishes with a more developed financial market and improved institutional framework.

To this end, we contribute to the literature in the following distinct ways. Firstly, we examine the role of remittances-financial development nexus in bridging the savings-investment in Sub-Saharan African countries both in the short-run and long-run, a study which to the best of our knowledge is particularly rare for Sub-Saharan African countries. Secondly, our paper employs the Panel Autoregressive Distributed Lag (ARDL) framework which is superior to other panel estimation methods in the following ways: it accommodates variables with mixed order of integration, that is, variables that are integrated of order zero and order one; it has the ability to estimate short-run and long-run models simultaneously; it is capable of estimating models with varying degree of lags of both the dependent and independent variables, and it complies with both small and large sample sizes, most especially if the time dimension is relatively long, thereby requiring that the issue of non-stationarity is addressed.

Lastly, unlike previous studies, we evaluate the forecast accuracy of our baseline model (premised on the Accelerator Theory of Investment) and alternative specifications in order to determine whether augmenting the baseline model with individual and interactive effects of remittances and financial development matters in modelling savings-investment gap in Sub-Saharan Africa. We complement our findings by undertaking a sensitivity analysis to investigate same (forecast evaluation of the baseline model and alternative specifications) for sub-regional groupings in SSA including Economic Community of Central African States (ECCAS), Southern African Development Community (SADC) and Economic Community of West African States (ECOWAS). In order to allow for out-of-sample forecast evaluation using the Root Mean Square Error (RMSE) and the test statistic of Campbell and Thompson (2008), we utilized 75% of the sample size, while considering two forecast horizons of 2 and 4 years⁴.

4. Methodology and Data

4.1 Pre-estimation Tests

4.1.1 Panel Unit Root Tests

The panel unit root tests can be classified on the basis of whether there are restrictions on the autoregressive process across cross sections or series.

Consider the following AR(1) process for panel data:

$$y_{it} = \rho_i y_{i,t-1} + X_{it} \delta_i + \epsilon_{it} \quad (5)$$

Where $i = 1, 2, \dots, N$ cross-section units or series that are observed over periods $t = 1, 2, \dots, T_i$; the X_{it} represent the exogenous variables in the model, including any fixed effects or individual trends; ρ_i are the autoregressive coefficients, and the errors ϵ_{it} are assumed to be mutually independent idiosyncratic disturbance.

The restriction that if $|\rho_i| < 1$, then y_{it} is said to be weakly or trend stationary. On the other hand, if $|\rho_i| = 1$, then y_{it} contains a unit root or is nonstationary.

There are two assumptions about the autoregressive coefficient ρ_i :

- That the persistence parameter is common across cross-sections so that $\rho_i = \rho$ for all i . Panel unit root tests including, Levin, Lu, Chu (LLC), Breitung and Hadri tests employ this assumption;

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⁴There is no theoretical basis for partitioning of the entire data into 25%, 50% or 75%, according to Westerlund and Narayan (2012). The only intrinsic value of such attempt is to generate robustness for analysis.

- b. That the autoregressive coefficient ρ_i can be allowed to vary freely across cross sections. Other panel unit root tests, such as, Im, Pesaran, and Shin (IPS), and Fisher-ADF and Fisher-PP tests follow this assumption.

For the purpose of this study, three of the panel unit root tests were employed and they include LLC, Breitung and Fisher-ADF unit root tests.

4.1.2 Panel Cointegration Tests

We employ two panel cointegration tests with the null hypothesis of no cointegration, and they are Kao test (1999) and Pedroni's test (2004).

(1) Pedroni's Test (2004)

This test, also referred to as Engle-Granger based cointegration test, is concerned with the examination of the residuals of a spurious regression performed using $I(1)$ variables. If the variables are cointegrated, then the residuals should be integrated of order zero, that is, $I(0)$. However, if the variables are not cointegrated, then the residuals are said to be integrated of order one, that is, $I(1)$. Pedroni (2004) proposed several tests for cointegration that allow for heterogeneous intercepts and trend coefficients across cross sections.

Consider the following regression

$$y_{it} = \alpha_i + \delta_i t + \beta_{1i}x_{1i,t} + \beta_{2i}x_{2i,t} + \dots + \beta_{Mi}x_{Mi,t} + e_{i,t} \quad (6)$$

For $t = 1, \dots, T$; $i = 1, \dots, N$; $m = 1, \dots, M$; where y and x are assumed to be integrated of order one, that is, $I(1)$. The parameters α_i and δ_i are individual and trend effects which may be set to zero if desired, so that eq. (6) becomes

$$y_{it} = \beta_{1i}x_{1i,t} + \beta_{2i}x_{2i,t} + \dots + \beta_{Mi}x_{Mi,t} + e_{i,t} \quad (7)$$

Under the null hypothesis of no cointegration, the residuals will be $I(1)$. The general approach is to obtain the residuals from eq. (6), and then to test whether residuals are $I(1)$ by running the auxiliary regression as follows:

$$e_{it} = \rho_i e_{i,t-1} + u_{it} \quad (8)$$

or

$$e_{it} = \rho_i e_{i,t-1} + \sum_{j=1}^{p_i} \psi_{ij} \Delta e_{i,t-j} + v_{it} \quad (9)$$

for each cross section. Pedroni described various methods of constructing statistics for testing the null hypothesis of no cointegration, where $\rho_i = 1$. There are two alternative hypotheses: the homogeneous alternative, where $\rho_i = \rho < 1$ for all i (which Pedroni termed as the within-dimension test or panel statistic test), and the heterogeneous alternative, where $\rho_i < 1$ for all i (also referred to as the between-dimension or group statistics test).

(2) Kao Test (1999)

The Kao test is another Engle-Granger based cointegration test that follows the same basic approach as the Pedroni's test, except that the former captures cross-section specific intercepts and homogeneous coefficients on the first-stage regressors as found in eq. (6), for instance. In a similar vein, Kao (1999) describes a bivariate regression as follows:

$$y_{it} = \alpha_i + \beta x_{it} + e_{it}, \quad i = 1, \dots, N; \quad t = 1, \dots, T \quad (10)$$

$$y_{it} = y_{i,t-1} + u_{it} \quad (11)$$

$$x_{it} = x_{i,t-1} + \epsilon_{it} \quad (12)$$

Where α_i are the fixed effects varying across the cross-sectional observations; β is the slope parameter common across i ; e_{it} , u_{it} , and ϵ_{it} are error terms. Note that since both y_{it} and x_{it} are

random walks or follow a first-order autoregressive process, under the null hypothesis of no cointegration, the residual series e_{it} should be nonstationary.

Kao (1999) then runs either the pooled auxiliary regression,

$$e_{it} = \rho e_{i,t-1} + v_{it} \quad (13)$$

Or the augmented version of the pooled specification, that is, eq. (13)

$$e_{it} = \rho e_{i,t-1} + \sum_{j=1}^p \psi_j \Delta e_{i,t-j} + v_{it} \quad (14)$$

Where the lagged difference terms are captured in eq. (14) to resolve the issue of autocorrelation, and the number of lags, p , is chosen such that the residuals v_{it} are serially uncorrelated with past errors. The null and alternative hypotheses are as follows:

$H_0: \rho = 1$ (There is no cointegration)

$H_1: \rho < 1$ (There is cointegration)

4.2 Estimation Technique & Forecast Evaluation

4.2.1 Pooled Mean Group Estimator (PMG)

Pesaran and Smith (1995) showed that, unlike in static models, pooled dynamic heterogeneous models generate estimates that are inconsistent even in large samples (the problem cannot be solved by extending the sample through increasing the number of cross sections, N). The authors observed that while it is implausible that the dynamic specification is common to all countries, it is at least conceivable that the long-run parameters of the model may be common. Pesaran and Smith (1995), therefore, proposed estimation by either averaging the individual country estimates, or, by pooling the long-run parameters, if the data allow, and estimating the model as a system. In a later work, Pesaran, Shin and Smith (1999) termed the second approach the pooled mean group (PMG) estimator, which combines the efficiency of pooled estimation while avoiding the inconsistency problem flowing from pooling heterogeneous dynamic relationships (Asteriou and Hall, 2007). In panel settings with individual effects, standard regression estimation of autoregressive distributed lag (ARDL) models is problematic due to bias caused by correlation between the mean-differenced regressors and the error term. This bias only vanishes for large number of observations T , and cannot be corrected by increasing the number of cross sections N . To address this problem, a number of small T -large N , dynamic panel GMM estimators have been developed (for instance, Arellano and Bond's Difference GMM). However, in large T data sets, this assumption underlying dynamic GMM (which is $N > T$) is often inappropriate and the estimator breaks down. In such cases, a popular alternative is the pooled mean group (PMG) estimator developed by Pesaran, *et al.* (1999). These authors also refer to PMG as the maximum likelihood (ML) estimators since the long-run parameters are nonlinear functions of the short-run parameters in the panel ARDL model.

The PMG is an intermediate estimator which allows intercepts, short-run coefficients and error variances to differ freely across groups, but constrains the long-run coefficients to be the same. This is unlike the two extreme estimators, mean group (MG) and dynamic fixed-effects (DFE) estimators, where the former assumes heterogeneity in all coefficients (intercept, short-run and long-run coefficients) and error variances across the cross sections, while the latter assumes that only the intercept coefficient differs across cross sections, but other coefficients (short run and long-run) and error variance are homogeneous across groups/cross sections. The selection

of the appropriate estimator, particularly between MG and PMG estimators, is based on Hansen test for estimator selection. Under the null hypothesis, PMG is the efficient estimator, whereas MG is the efficient estimator under the alternative hypothesis. In addition, the advantage of adopting the pooled mean group (PMG) estimator in the present study is that it allows for the level of financial development and remittances to have similar effects across countries in the long run, while permitting heterogeneous short-run adjustments across groups to changes in the levels of financial development and remittances. This, in fact, follows a conventional wisdom that countries with similar socio-economic characteristics or economic conditions - as is the case with many commodity-dependent SSA countries⁵ - are expected to converge to a common steady state level (that is, absolute convergence), that is characterized by a uniform growth rate across macroeconomic indicators, such as, output, investment, remittances and financial development.

4.2.2 Model Specification

In this study, we adopt the accelerator model of investment (that is, eq. 4) as our baseline specification. We then augment the baseline model with both the individual and interactive effects of remittances and financial development on savings-investment gap, which in turn constitutes the overparameterized or general specification such that restricting the partial slope coefficients on the explanatory variables (remittances and financial development) to zero ultimately yields a reduced-form model, also known as, the accelerator model of investment. Following Pesaran and Smith (1995), eq. (4) is augmented with the individual and interactive effects of remittances and financial development on savings-investment gap and is expressed in terms of a panel autoregressive distributed lag model of order (p, q₁, ..., q₄) as follows:

$$\Delta is\_gap_{it} = \phi_1 is\_gap_{i,t-1} + \phi_2 growth_{i,t-1} + \phi_3 remit_{i,t-1} + \phi_4 fd_{i,t-1} + \phi_5 rem\_fd_{i,t-1} + \sum_{j=1}^{p-1} \alpha_j \Delta is\_gap_{i,t-j} + \sum_{j=0}^{q_1-1} \lambda_j \Delta growth_{i,t-j} + \sum_{j=0}^{q_2-1} \delta_j \Delta remit_{i,t-j} + \sum_{j=0}^{q_3-1} \gamma_j \Delta fd_{i,t-j} + \sum_{j=0}^{q_4-1} \theta_j \Delta rem\_fd_{i,t-j} + \epsilon_{it} \quad (15)$$

Where p is the lag length associated with the dependent variable for i = 1, ..., N and j = 1, ..., p; q_k is the lag length associated with the k-regressors (X's) for i = 1, ..., N; j = 1, ..., q_k, where k = 1, ..., 4.

The error correction version of eq. (15) is derived as follows:

$$\Delta is\_gap_{it} = \phi_1 [is\_gap_{i,t-1} - \left(-\frac{\phi_2}{\phi_1} growth_{i,t-1} - \frac{\phi_3}{\phi_1} remit_{i,t-1} - \frac{\phi_4}{\phi_1} fd_{i,t-1} - \frac{\phi_5}{\phi_1} rem\_fd_{i,t-1} \right)] + \sum_{j=1}^{p-1} \alpha_j \Delta is\_gap_{i,t-j} + \sum_{j=0}^{q_1-1} \lambda_j \Delta growth_{i,t-j} + \sum_{j=0}^{q_2-1} \delta_j \Delta remit_{i,t-j} + \sum_{j=0}^{q_3-1} \gamma_j \Delta fd_{i,t-j} + \sum_{j=0}^{q_4-1} \theta_j \Delta rem\_fd_{i,t-j} + \epsilon_{it} \quad (16)$$

By letting,

$$ECT_{it} = is\_gap_{i,t-1} - \beta_1 growth_{i,t-1} - \beta_2 remit_{i,t-1} - \beta_3 fd_{i,t-1} - \beta_4 rem\_fd_{i,t-1} \quad (17)$$

Where $\beta_1 = -\frac{\phi_2}{\phi_1}$, $\beta_2 = -\frac{\phi_3}{\phi_1}$, $\beta_3 = -\frac{\phi_4}{\phi_1}$, $\beta_4 = -\frac{\phi_5}{\phi_1}$

Eq. (16) becomes:

⁵About 51% of SSA countries are by nature oil producers and resource-intensive countries (see, IMF, 2020: pp. 16). Also refer to **Appendix A** for the classification of the 18 SSA countries, by sub-region and economic structure, under study.

$$\Delta is\_gap_{it} = \phi_1 ECT_{it} + \sum_{j=1}^{p-1} \alpha_j \Delta is\_gap_{i,t-j} + \sum_{j=0}^{q_1-1} \lambda_j \Delta growth_{i,t-j} + \sum_{j=0}^{q_2-1} \delta_j \Delta remit_{i,t-j} + \sum_{j=0}^{q_3-1} \gamma_j \Delta fd_{i,t-j} + \sum_{j=0}^{q_4-1} \theta_j \Delta rem\_fd_{i,t-j} + \epsilon_{it} \quad (18)$$

$$fd_{it} = \{llt_{it}, credit_{it}, deposit_{it}\} \quad (19)$$

Eq. 18 is the general specification, such that, restricting $\delta_j = \gamma_j = \theta_j = 0$ yields the baseline accelerator model similar to eq. 4, that is,

$$\Delta is\_gap_{it} = \phi_1 ECT_{it} + \sum_{j=1}^{p-1} \alpha_j \Delta is\_gap_{i,t-j} + \sum_{j=0}^{q_1-1} \lambda_j \Delta growth_{i,t-j} + \epsilon_{it} \quad (20)$$

Similarly, restricting $\theta_j = 0$ yields the baseline investment model that is augmented by the individual effects of remittances inflow and financial development, that is,

$$\Delta is\_gap_{it} = \phi_1 ECT_{it} + \sum_{j=1}^{p-1} \alpha_j \Delta is\_gap_{i,t-j} + \sum_{j=0}^{q_1-1} \lambda_j \Delta growth_{i,t-j} + \sum_{j=0}^{q_2-1} \delta_j \Delta remit_{i,t-j} + \sum_{j=0}^{q_3-1} \gamma_j \Delta fd_{i,t-j} + \epsilon_{it} \quad (21)$$

where subscripts i and t stand for country and time period, respectively; Δ is the first difference operator; is_gap is the savings-investment gap (difference between total investments and savings), % of GDP; $growth$ is real GDP growth rate (%); fd stands for financial development indicators - which in this case, are liquid liabilities, % of GDP (llt); domestic credit to private sector, % of GDP ($credit$) and bank deposits, % of GDP ($deposit$); $remit$ is remittances inflow, % of GDP; rem_fd is the interaction term involving two explanatory variables, namely, remittances inflow and a set of financial development indicators including, liquid liabilities, private sector credit and bank deposits (% of GDP); ECT stands for the error correction term, where ϕ_1 is the speed of adjustment parameter, which is expected to be negative, less than one in absolute terms, and statistically significant at conventional levels (1%, 5% or 10%). It signifies the absolute convergence of each country to the same equilibrium long-run savings-investment gap following shocks to growth, remittances inflow and financial development indicators. From eq. 17, $\beta_1, \dots, \beta_4$ are long-run parameters, while from eq. 18, $\alpha_j, \lambda_j, \delta_j, \gamma_j, \theta_j$ are short-run parameters, and ϵ is the error term which is assumed to be normally distributed and serially uncorrelated.

A priori Expectations

With reference to eq. 17 and eq. 18, respectively, the expected signs of the regression coefficients are as follows:

$$\beta_1 > 0; \beta_2 > \text{or} < 0; \beta_3 > 0 \text{ or} < 0; \alpha_j > \text{or} < 0; \lambda_j > 0; \delta_j > \text{or} < 0; \gamma_j > 0 \text{ or} < 0$$

The parameters of great interest in this study are $\beta_4, \theta_j > \text{or} < 0$ (if both coefficients are negative, then remittances inflow and financial development are alternative options or substitutes in financing investment opportunities), whereas the positivity of both coefficients implies that remittances and financial development are self-reinforcing and are complements in financing investment opportunities.

4.2.3 Forecast Evaluation

Given that the superiority of any predictive model lies in its out-of-sample forecasts (Campbell, 2008), we evaluate and compare the in-sample and out-of-sample forecast performance of our hypothetical predictive models (that is, the baseline investment model augmented with the individual and interactive effects of remittances and financial development) with the baseline accelerator model of investment and the baseline model that is augmented with the individual

effects of remittances and financial development only, which are more restrictive⁶. We achieve this using forecast evaluation tools including the root mean square error (RMSE) and the Campbell and Thompson test statistic (C-T test, subsequently). The in-sample forecast is conducted using 75% of the full sample data. The out-of-sample forecast, on the other hand, is based on two forecast horizons, namely, 2 and 4 years. We also support our arguments with predictability graphs for only the unrestricted predictive model in order to compare the fitted values of savings-investment gap with its actual value. The Campbell and Thompson test statistic is computed as: $1 - (\widehat{RMSE}_1 / \widehat{RMSE}_0)$, where $\widehat{RMSE}_1$ and $\widehat{RMSE}_0$ are, respectively, the root mean square errors obtained from the unrestricted model and the restricted models, respectively. A positive value of the statistic implies that the unrestricted model outperforms the restricted model; otherwise, it does not.

4.3 Data Description and Sources

The scope of this study is limited to 18 Sub-Saharan African countries for the period between 1990 and 2017. The sampled countries include: Benin, Botswana, Burkina Faso, Cameroon, Côte d'Ivoire, Ghana, Guinea, Guinea-Bissau, Kenya, Madagascar, Mali, Namibia, Niger, Nigeria, Rwanda, Senegal, South Africa and Togo. The choice of these countries is predicated on the evidence of their massive influx of remittances during the period under review, their proven savings-investment gap, as well as, data availability on the variables of interest (remittances, financial development indicators [ratio of liquid liabilities to GDP, ratio of credit to private sector to GDP and ratio of bank deposits to GDP], the ratios of domestic investment and savings to GDP and real GDP growth). While we obtained the data on the financial development indicators from Beck, *et al.*, (2019), other variables have their data sourced from the World Bank's World Development Indicator (2019). Aside from data paucity, the sample period, 1990-2017, was selected because of the exceptional surge in emigration together with massive remittance inflows into most Sub-Saharan African countries during this period.

5. Empirical Analysis and Discussion of Results

5.1 Preliminary Analysis

5.1.1 Descriptive Statistics & Correlation

The statistical features for all variables employed in this study are summarized in **Table 6**. Considering the fact that the sampled countries have a mix of positive and negative savings-investment gap, the average savings-investment gap for the SSA region is positive at 7.6% of GDP. This is an affirmation of the existence of huge investment opportunities in Sub-Saharan Africa. Remittances inflow averaged 2.3% of GDP for the region over a period of 1990 to 2017. Comparatively, we can infer, on the average, that remittances fall short of the amount that is required to bridge the savings-investment gap in SSA; hence the need to deepen the domestic financial sector and/or to attract the inflow of remittances through the formal channels, mainly banks. For the indicators of financial development, the average value of liquid liabilities is

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⁶We can otherwise state that the baseline accelerator model of investment and the baseline model augmented with individual effects only are both nested in the general model of investment (which captures both the individual and interactive effects. While the first two specifications constitute the restricted models, the general specification is otherwise called the unrestricted model.

higher at 24.8% of GDP, compared to the mean values of other indicators: credit to private sector (20.9% of GDP) and bank deposits (19.6% of GDP).

By implication, we can sufficiently state that Africa's financial sector is highly liquid, but this has not adequately translated into higher volume of domestic credit to the private sector. This is reflected by the fact that credit to private sector does not match the deposits at banks in the majority of SSA countries, indicating a ratio of less than 100%⁷. Real GDP growth rate in SSA averaged 3.9%⁸ over the period of 1990 to 2017. In terms of standard deviation, we observed that the three indicators of financial development are highly volatile, while the least volatile series is remittances inflow (% of GDP) followed by real GDP growth. This clearly demonstrates the relative stability of remittances inflow (% of GDP) over the sample period. Meanwhile, the increasing volatility in the SSA's financial sector development puts the region at high risk of the contagious effects of global crises, such as, the 2008-09 global financial crisis which caused instability in the banking segment of the financial sector of African countries with high presence of foreign banks⁹.

Insert Table 6 here

On the other hand, pairwise correlation coefficients were computed between variables employed in this study (see **Table 7**). All variables except remittances have negative correlation with savings-investment gap. This suggests that the region's financial sector has a key role to play in narrowing the savings-investment gap. A possible explanation for the positive correlation between savings-investment gap and remittances is in two-folds: (1) that remittances are not channeled through banks due to the high transaction cost¹⁰; an event that has prompted huge remittance flows via unofficial/informal channels¹¹; (2) that the

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⁷The countries in this category include: Ghana, Guinea, Botswana, Guinea Bissau, Benin, Madagascar, Kenya, Cameroon, Rwanda, Nigeria, Togo, Niger, Burkina Faso and Mali. All other countries have higher ratios (Senegal – 103.5%, Cote d'Ivoire – 105.3%, Namibia – 109.6%, and South Africa – 231.6%).

⁸The sampled SSA countries are a combination of fast-growing economies (such as, Benin, Burkina Faso, Cote d'Ivoire, Ghana, Guinea, Kenya, Mali, Niger, Rwanda, Senegal and Togo), whose real growth rates are at least 5% per annum from 2017 to 2019 and low/weak growth countries (including Botswana, Cameroon, Guinea Bissau, Madagascar, Namibia, Nigeria and South Africa), whose real GDP growth rates are strictly below 5% per annum over a similar period. Ironically, the middle income countries (Botswana, Cameroon, Namibia, Nigeria and South Africa) generally dragged the overall growth in the SSA region overtime, whereas the majority of fast-growing economies in the region belong to the low income group (see, IMF, 2020).

⁹A bank is said to be foreign-owned if at least 50% of its shares are held directly by foreign citizens. While countries including Botswana, Burkina Faso, Cameroon, Cote d'Ivoire, Ghana, Madagascar, Mali and Rwanda have high shares of foreign-owned banks (above 50%), countries like Kenya, Namibia, Nigeria, Senegal, South Africa and Togo have limited shares of banking assets held by foreigners (see, Massa and Willem te Velde, 2008).

¹⁰The cost of transferring remittances (US\$200) is highest in SSA at 9%, relative to other low and developing regions (KNOMAD, 2020).

¹¹Unofficial channels involve sending remittances through carriers, such as, family members, friends or through unlicensed money transfer operators using traditional networks, such as, “hawala”. This is a traditional system of transferring money used in Arab countries and South Asia, whereby the money is paid to an agent who then instructs an associate in the relevant country or area to pay the final recipient.

beneficiaries are not incentivized to save some part of remittances received, implying that remittances are spent mainly on consumption at the expense of funding investments¹². These reasons partly explain the weak positive correlation between remittances and economic growth in the SSA region. All financial sector indicators employed in this study (liquid liabilities, private sector credit and bank deposits) have negative correlation with growth. This is expected as the financial sector in the region is not sufficiently developed so as to translate savings into profitable investments that would have a high multiplier effect on economic growth. As expected, there is a positive and strong correlation among the financial development indicators, particularly: between liquid liabilities and bank deposits, on the one hand, and between bank deposits and private sector credit on the other hand.

Insert Table 7 here

5.1.2 Panel Unit Root Test Results

Considering the fact that we are dealing with long panels which suggest the need to address issues around non-stationarity, we present the results of panel unit root test using three approaches in **Table 8**. We observe that irrespective of approaches, three variables including savings-investment gap, remittances inflow and real GDP growth are stationary at levels, implying that these variables are integrated of order zero, that is, $I(0)$. However, there is some disparity in the results of the unit root test approaches for the remaining variables which are the three indicators of financial development (liquid liabilities, private sector credit and bank deposits); hence they are largely non-stationary, but become stationary at first difference. This implies that they are integrated of order one, that is, $I(1)$.

Insert Table 8 here

5.1.3 Panel Cointegration Test Results

For the sake of robustness, we equally employed two cointegration test approaches (see **Table 9**). We observe that all specifications, except Model VI, showed that irrespective of test approaches, we can sufficiently conclude the existence of a long-run relationship between savings-investment gap and its proposed determinants including real GDP growth and the three measures of financial development (liquid liabilities, private sector credit and bank deposits). In order to address the issue of spurious correlation among the financial development indicators (as shown in **Table 7**), we captured the indicators in separate savings-investment gap models.

Insert Table 9 here

5.2 Regression Results and Discussion

With the existence of a long-run relationship between savings-investment gap and its supposed determinants, we estimate two variants of the savings-investment gap model: the first looks at the individual effects of remittances and financial development (see **Table 10**), while the

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¹²Garba, *et al.* (2020) suggest the need to encourage migrant workers and their beneficiaries to make use of banks so that remittances could be made available to finance genuine investment projects.

second combines the individual and interactive effects of both variables on savings-investment gap in Sub-Saharan Africa (see **Table 11**).

Our results showed that irrespective of the proxy variable for financial development (particularly private sector credit and bank deposits), remittances inflow has negative impact on savings-investment gap both in the short-run and long-run. The impact becomes effective only over the long-term horizon considering the statistical insignificance of the short-run impact coefficients at the 10% level across specifications. Controlling for private sector credit and bank deposits, 1 percentage point increase in each of these indicators reduces the savings-investment gap by 0.8 and 0.6 percentage points, respectively, in Models II and III (see **Table 11**). This result affirms the possible role of remittances as an alternative option to augment limited domestic savings in financing a given level of investment in the SSA region¹³. Accounting for the individual and interactive effects of remittances and the financial sector magnifies the impact of remittances in narrowing the savings-investment gap in the region; as every 1 percentage point increase in remittances translates to a range of 0.9 and 1.5 percentage points decline in savings-investment gap on the average keeping other variables constant (see **Table 11**). Generally, irrespective of specifications, high rates of economic growth have a knock-on effect in stimulating additional investments over a long-term horizon (see **Tables 10 and 11**), thereby building up the savings-investment gap¹⁴. This finding clearly validates the postulation of the accelerator theory which states that a positive relationship exists between domestic investment and output/income growth.

Our result is mixed regarding the impact of financial development on savings-investment gap. Irrespective of specifications (Models II and V), private sector credit exerts positive short-term influence on widening the savings-investment gap as banks increasingly channel a large portion of their deposit liabilities to fund profitable investment opportunities; hence, for every 1 percentage point increase in private sector credit, the saving-investment gap widens by an average of 0.9 percentage point (see **Table 10**) and by 1.5 percentage points (see **Table 11**), keeping other variables unchanged. Irrespective of specifications (Models I and IV), liquid liabilities have no significant impact on savings-investment gap both in the short-run and long-run, whereas, bank deposits significantly widen savings-investment gap only in the long run (see Models III and VI). This result could be linked to the money creation effect of the initial deposit liabilities when banks operate a fractional reserve banking system, which stipulates that banks keep an excess reserve to meet demand deposits and to fund investment opportunities by extending loans to prospective investors. These loans, if kept in the bank, constitute a new deposit that is further partitioned into demand deposits and loanable funds after taking care of legal reserve requirement and this process continues over and over again. In essence, for every 1 percentage point increase in bank deposits, savings-investment gap widens by an average of 0.2 percentage point (see **Table 10**) and 0.4 percentage point (see **Table 11**), keeping other variables constant.

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¹³Our results reflected the findings of Bjuggren, *et al.* (2010); Okodua (2013), and Dash (2020).

¹⁴This parallels the findings of Tung (2018) that a positive relationship exists between per capita income and investment.

With respect to the explanatory variable of interest which is the interaction between remittances and financial development (see **Table 11**), we observed mixed results across the three indicators of financial development. Our result showed that the interactive effect of remittances and bank deposits is significant only in the short run (see Model VI in **Table 11**). By implication, a combination of improved financial development in terms of higher bank deposits and huge inflow of remittances reinforce each other in narrowing the savings-investment gap. This would be the case if the migrant workers make remittances transfer through the banking channel, also would the beneficiaries save some part of the remittances received in the bank. However, our results revealed that the interactive effects of remittances and other financial development indicators (liquid liabilities and private sector credit) are significant over a long-term horizon only (see Models IV and V in **Table 11**). By implication, higher remittances inflow coupled with improved financial sector development in terms of higher liquid liabilities and private sector credit represent independent and alternative ways of bridging the savings-investment gap. This would play out if beneficiary households, already faced with high cost of borrowing from banks, depend hugely on remittances inflow to finance investment opportunities, thereby bypassing the huge debt servicing burden, were they to successfully secure a bank loan. In this way, the beneficiary household considers the domestic financial sector and remittances inflow as substitutes. Meanwhile, the fact that most beneficiary households spend a large chunk of the remittances received on consumption rather than on investment, the savings-investment gap becomes widened¹⁵. This further support our earlier finding that on the average, remittances inflow falls short of the amount that is required to narrow the gap between domestic investment and savings (see **Table 6**).

In terms of the choice of estimator between PMG and MG, the result of Hansen's test showed that we cannot reject the null hypothesis that PMG is the efficient and most suitable estimator since the probability value associated with the Chi-square test statistic is greater than 10% level of significance or 0.1 (see **Tables 10 and 11**). We validate this outcome in favour of all three indicators of financial development (liquid liabilities, private sector credit and bank deposits). Moreover, the result of the redundancy test performed on the interactive terms in Models IV to VI revealed that the panel ARDL that captures the individual and interactive effects between remittances and financial development indicators, particularly liquid liabilities and private sector credit are preferred to equivalent models that incorporate the individual effects only. This is premised on the fact that we cannot accept the null hypothesis that the interactive terms are redundant given that the probability value associated with the Wald test statistic is in excess of 10% level of significance or 0.1 (see **Table 11**). In addition, the adjustment parameter or the coefficient on the error correction term (ECT) fulfils the convergence condition of being

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¹⁵Our results also paralleled the previous findings of Ramirez and Sharma (2008); Giuliano and Ruiz-Arranz (2009); Mundaca (2009); Dzansi and Shukur (2010); Bettin and Zazzaro (2011); Nyamongo, Misati, Kipyegon and Ndirangu, (2012); Lartey (2013); Chia (2014), and El Hama (2016) while negating the findings of Chowdhury (2016). We also affirmed the findings of Garba, *et al.* (2020) that there are both complementarity and substitutability effects of remittances and financial sector development on economic growth via the investment channel. Similarly, Adeniyi, *et al.*, (2017) revealed that the complementarity or substitutability effect of remittances and financial development on output volatility depends on the indicators of financial development used.

negative, less than 1 in absolute value and statistically significant at the 1% level across specifications. The coefficient which is 0.4 across the six specifications (see **Tables 10 and 11**) implies that previous errors arising from shocks to the explanatory variables (growth, financial development indicators and remittances) are corrected in the current period at an adjustment rate of 40%. By implication, there is a moderate convergence of savings-investment gap towards its equilibrium or long-run value for Sub-Saharan Africa.

Insert Tables 10 & 11 here

5.3 Modelling Savings-Investment Gap in SSA: Does the Nexus between Remittances and Financial Development matter?

We further evaluate the forecast accuracy of our unrestricted predictive model or general specification (which in this case, is the baseline investment model augmented with the individual and interactive effects of remittances and financial development) in relation to the restricted predictive models which include the baseline accelerator model of investment and the baseline model that is augmented with the individual effects of remittances and financial development only. Based on the RMSE and the C-T test statistic, we observe the in-sample forecast superiority of our unrestricted predictive model over the benchmark restrictive models using 75% of the full sample size. Similarly, we are able to validate the improvement in the out-of-sample forecast accuracy of our general specification over the two restricted predictive models. This is premised on lower RMSE and positive C-T test statistic of our unrestricted model over the two restricted models (see **Tables 12 and 13**), and our result is robust to the choice of financial development indicators (liquid liabilities, private sector credit and bank deposits) and out-of-sample forecast horizons (2 and 4 years). We further demonstrate graphically the relative superiority of predicting savings-investment gap using the baseline investment model augmented with the individual and interactive effects of remittances and financial development. The predictability graphs make a comparison between the actual and predicted values of savings-investment gap based on the forecasts from the general specification for the SSA region (see **Appendix B1**).

Insert Tables 12 & 13 here

5.4 Sensitivity Analysis: Does the nexus between remittances and financial development matter in modelling Savings-Investment Gap across SSA sub-regions?

Additionally, we conduct sub-regional sensitivity analyses to evaluate the forecast accuracy of our unrestricted predictive model or general specification (which in this case, is the baseline investment model augmented with the individual and interactive effects of remittances and financial development) in relation to the restricted predictive models which include the baseline accelerator model of investment and the baseline model that is augmented with the individual effects of remittances and financial development only. Based on the RMSE and the C-T test statistic for the three SSA sub-regions under study, we observe the superiority of the in-sample and out-of-sample forecasts based on the unrestricted predictive model over the benchmark restrictive models using 75% of the full sample size forecast horizons of 2 and 4 years, respectively. This is premised on lower RMSE and positive C-T test statistic of our unrestricted model over the two restricted models (see **Tables 14-19**), and our result is robust to the choice of financial

development indicators (liquid liabilities, private sector credit and bank deposits), out-of-forecast horizons (2 and 4 years) and SSA sub-regions under study. We further demonstrate graphically the relative superiority of predicting savings-investment gap using the baseline investment model augmented with the individual and interactive effects of remittances and financial development. The predictability graphs make a comparison between the actual and predicted values of savings-investment gap based on the forecasts from the general specification for the three sub-regions under study – ECCAS, SADC and ECOWAS (see **Appendices B2-B4**).

Insert Tables 14, 15, 16, 17, 18 & 19 here

6. Concluding Remarks

We contribute to the literature by investigating the nexus among savings-investment gap, remittances and financial sector development (with proxies including liquid liabilities, private sector credit and bank deposits), unlike the majority of the previous studies that considered a pair-wise relationship between the variables. We collect yearly data on 18 Sub-Saharan African countries over the period from 1990 to 2017. Unlike previous studies, with the aid of forecast tools (RMSE and C-T test statistic), we evaluate the forecast accuracy of our proposed model – Accelerator model of investment augmented by the individual and interactive effects of remittances and financial development - in relation to the restricted models (with and without individual effects of remittances and financial sector development) using 75% of the full sample and two forecast horizons (2 and 4 years) for in-sample and out-of-sample forecasts, respectively for the SSA region as a whole and its three sub-regions under study - Economic Community of Central African States (ECCAS), Southern African Development Community (SADC) and Economic Community of West African States (ECOWAS).

Utilizing the Panel ARDL model estimated using Pooled Mean Group (PMG) estimator, we observed that remittances inflow has negative impact on savings-investment gap both in the short-run and long-run, irrespective of the financial development indicators used. Accounting for the individual and interactive effects of remittances and the financial development magnifies the impact of remittances in narrowing the savings-investment gap in the region, most especially in the long run. Generally, irrespective of specifications, high rates of economic growth have a knock-on effect in stimulating additional investments over a long-term horizon. Irrespective of specifications, private sector credit exerts significant short-term influence on widening the savings-investment gap as banks increasingly channel a large portion of their deposit liabilities to fund profitable investment opportunities. Irrespective of specifications, liquid liabilities have no significant impact on savings-investment gap both in the short run and long run, whereas, bank deposits significantly widen savings-investment gap only in the long run. Moreover, our result showed that the interactive effect of remittances and bank deposits is significant and negative only in the short run, thereby justifying the complementarity hypothesis. On the other hand, our results revealed that the interactive effects of remittances and financial development indicators - liquid liabilities and private sector credit - are significant and positive over a long-term horizon only, thereby affirming the postulates of the substitutability hypothesis.

In addition, we showed that the unrestricted model – which considers the individual and interactive effects of remittances and financial development - is preferred to the restricted version that accounts for only the individual effects through the Wald test for variable redundancy. Further, we observed the superiority of the in-sample and out-of-sample forecasts based on the unrestricted predictive model over the benchmark restrictive models (which ignores both effects or consider the individual effects only) premised on lower RMSE and positive C-T test statistic associated with the former over the latter, and our results are robust to the choice of financial development indicators, out-of-sample forecast horizons (2 and 4 years) and samples (SSA and the three sub-regions under study). We also demonstrated this graphically in the **Appendix**. Our findings showed that significant investment opportunities abound in Sub-Saharan Africa that could be financed either by the domestic financial sector or the inflow of remittances or a combination of both. Meanwhile, the win-win strategy for SSA countries is to improve the confidence of migrant workers and the beneficiary households in the domestic financial sector so that both parties are encouraged to make use of the formal channel, which is expected to enhance the capacity of banks to create more credit facilities¹⁶. Achieving this would require a reduction of the remittance transfer costs in the region and encouraging the beneficiaries to spend more on investment rather than on consumption.

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¹⁶We acknowledge the recent directive by the Central Bank of Nigeria to the International Money Transfer Operators (IMTOs) to make remittances available to the beneficiaries in dollar cash or through their domiciliary accounts. This is in a bid to improve the inflow of foreign exchange; a situation that was warranted by the country's weak external reserves position largely due to lower oil export receipts and limited foreign investment inflows, magnified by the outbreak and increasing spread of the coronavirus pandemic and its new strain.

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