THE EFFECTS OF AGRICULTURAL FINANCE AND FINANCIAL DEVELOPMENT ON THE ECONOMIC GROWTH OF THE SSA COUNTRIES[1]

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ABSTRACT

This study examined the effects of agricultural finance and financial development on the economic growth of the SSA from 2000 to 2021. The study employed the panel ARDL regression models and the panel VAR-based Granger causality test as tools for data analysis. The study revealed that capital accumulation impacts agricultural performance negatively in the long run; the effect on economic growth is negative in the short run but positive in the long run. Also, there is no evidence for the short-run impact of labour on both agricultural performance and economic growth; however, the long-run effect is positive and significant. There is a piece of strong evidence supporting financial development as an agricultural performance and economic growth drivers both in the short and long run. Per capita income which reflects the individual purchasing power impacted agricultural performance only in the long run whereas its impact on economic growth which is only significant in the long run is negative. Further, it is revealed in the study that the role played by agricultural performance in driving economic growth cannot be overemphasised both in the short run and long run. Therefore, this study recommends strengthening institutional capacity for financial sector monitoring through legislation and countercyclical buffers, promoting R&D and policies to enhance industrial and agricultural performance, and advancing financial institutions to optimise agriculture-linked industrialisation. Also, governments should encourage affordable agricultural credit, supported by awareness campaigns, and prioritise apprenticeship programs, reskilling and technology-driven R&D to boost labour productivity and sustain economic growth in Sub-Saharan Africa.

1. INTRODUCTION

Across the globe agriculture remains one of the important activities in the real sector with huge contributions to economic growth. Apart from this, the sector is the engineroom of many economies for solving chronic economic development problems such as unemployment, low and narrow-based output, and poverty among others (Ho, Pham & Nguyen, 2021). One of the major challenges confronting the sector over the years, especially in the SSA where the real sector is largely underdeveloped, is inadequate funding. The responsibility of funding the real sector of any economy falls mainly on the financial sector; hence in most developed countries the level of financial development is such that provides easy access to funds at an affordable cost to the agricultural sector so that the sector can contribute as expected to the economy growth (AfDB, 2020). However, in the SSA the situation appears to be different. Although most of the SSA countries have banks, capital markets and other financial intermediaries with high rankings among their contemporary in the World, the agricultural sector of most of the SSA countries is grossly underdeveloped due to inadequate funding and this is limiting the contributions of the sector to the economic growth of many SSA countries.

Normally, a virile and strong financial sector where banks both at the sub-regional and country level in the SSA are achieving outstanding ratings. From international agencies such as the FITCH rating it is expected to bring about a high level of financial development that will have a significant impact on the agricultural sector. For instance, within the last five years, Africa Development Bank AfDB which is the most dominant Sub Regional financial institution in SSA has continued to maintain AAA ratings for five years consecutively (IMF, 2021). At the country level, the five big banks in South Africa and the five-tier money lenders in Nigeria have continued to maintain impressive rankings among their contemporaries across the globe (World Bank, 2020). In addition, the SSA capital markets which include the JSE (Johannesburg Stock Exchange), NSE (Nigeria Stock Exchange) and the KSE (Kenya Stock Exchange) have all been recording impressive performances among their contemporaries, especially within the last decade despite the COVID-19 pandemic (IMF, 2020). These outstanding track records in the financial sector of most of the SSA countries are expected to procreate a kind of financial development that will have significant positive contributions to the growth of the real sector by providing a broad-based finance structure that makes funding available and affordable to the agricultural sector which is an important sub-sector of the real sector.

According to Aluko and Ajayi (2018), promoting the synergy between agricultural finance and financial development is very important to the economic growth of any country. Realising this fact prompted many SSA countries to embark on different programs as well as the establishment of agencies that will aid this synergy in a bid to make accessible and affordable funds available for the agricultural sector. One of these programs is the mobile banking strategy which is one of the efforts to improve financial inclusion. In the last ten years many SSA countries have intensified efforts to have a broad-base financial development that will have a spread effect on the rural communities where many subsistence farmers that dominate the agricultural sector in the SSA reside. Countries like Nigeria, South Africa, Rwanda, Kenya and Uganda among others have made tremendous achievements in this regard (Asratie, 2021). The financial inclusion strategy followed a series of efforts such as microcredit schemes leading to the increase in the numbers of microfinance banks and other specialised microfinance agencies that are saddled with the main responsibilities of making loans and other credit facilities with less stringent conditions available to the agricultural and other sectors of many SSA countries. Many schemes like these are prominent in countries such as South Africa, Nigeria, Zambia, Rwanda, Tanzania, Uganda and Kenya among others (Mbulawa, 2015). Apart from this, some countries in the SSA have established specialised development banks for the real sector. Examples are the Bank of Agriculture (BOA) and Bank of Industry (BOI) in Nigeria, the Development Bank of Southern Africa (DBSA) in South Africa, the Development Bank of Rwanda (PLC) in Rwanda, the Land and Agricultural Development Bank (LANDBANK) in South Africa, East African Development Bank in Uganda among others. All these banks have a specialised mandate to make more funding to the real sector, especially the Agricultural sector more than other sectors of the economy. All these efforts have been taken by these countries to promote the synergy between financial development and agricultural finance to aid the contributions of the agricultural sector's economic growth in the SSA.

Despite all these efforts, the performance of the agricultural sector is still far below expectations in the SSA sub-region. For instance, in Nigeria, the contribution of the sector to the GDP fell from 29.25% in 2019 to 24.65% in 2020 and it fell further to 22.35% in 2021 (World Bank, 2021). The same trend has been recorded recently in South Africa where the sector only contributed 2.4% to the GDP compared to sectors like industry and services which contributed 25.2% and 65. 45% in 2020 (World Bank, 2021). In Kenya, although there was a rise in the share of the agricultural sector in the GDP between 2019 and 2020, recently the contribution has been falling. For instance, the growth rate of the sector fell

from 7.3% in 2020 to 6.3% in the 2021 second quarter. In Rwanda, the story is the same as the contribution of the sector to GDP fell from 26.35% in 2017 to 23.54% in 2019 (World Bank, 2021). The data shown here is an indication that all the efforts discussed above have yielded little or no effect. But the question is: could agricultural finance with the level of financial development be held responsible for the fall in contributions of the agricultural sector to economic growth despite the impressive rankings of many financial institutions in the SSA? This question among others remains one of the tasks in this study. In addition, the financial development synergy with the agricultural sector should manifest via agricultural finance. Some issues on this have been discussed under the background of the study. These issues—such as financial inclusion and the specialised nature of the agricultural sector—are critical challenges that must be addressed for financial development to have a meaningful impact on agricultural finance. These issues have continued to resonate in the finance literature to date without any consensus on the extent of the influence of financial development on agricultural finance (Onyishi, Arene & Ifiorah, 2015).

Furthermore, the effectiveness of financial development in addressing agricultural finance challenges depends on several widely recognised factors (Zakaria, Jun & Khan, 2019). It is believed that the identification of these factors affecting SSA can go a long way in providing policy options that will improve the allocation of funds to the agricultural sector in a more accessible and affordable manner (Onyishi, Arene & Ifiorah, 2015). Consequently, apart from investigating the impacts of both agricultural finance and financial development on economic growth in the SSA, the study will also assess the level of the influence of financial development on agricultural finance as well as identify these factors that determine the level of financial development in the SSA.

2. EMPIRICAL LITERATURE

The empirical literature on the relationship between financial development and agricultural finance is relatively scarce. What is common in the literature is the impact of financial development on agricultural output. However, some authors also used agricultural output to proxy agricultural finance since it is believed that the level of finance put into a sector dictates the performance of the sector (Chandio, Yuansheng & Magsi, 2016). The reason behind this is the fact that there has been no data on the finance of agriculture for many countries. Few studies using expenditure or funding proxies for agricultural finance focus on sub-Saharan Africa, as most are based on industrialised countries. However, studies using agricultural output as a proxy for agricultural finance are reviewed below.

One of the few studies on factors affecting agricultural finance is that of Veselinović and Drobnjaković (2014). The study investigated both macro and micro determinants of agricultural finance in Serbia. The role played by the financial sector was put into perspective in the study and both qualitative and quantitative approaches were applied in the methodology. The result of the study suggests that the financial sector in Serbia offered a very poor loan facility to the agricultural sector in the country and this inhibits the growth of the agricultural sector. It was discovered that access to finance remains a great challenge to the sector in the country and the financial sector has not played the required role in resolving these challenges. Dhrifi (2014) investigated the impact of financial development on agricultural productivity. A panel of 44 African countries from 1990 to 2012 was analysed using the generalised method of moments. The results indicate that financial development alone does not positively impact agricultural productivity without the presence of strong institutional quality. The study also found that a particular threshold exists before institutional quality can have a significant impact on agricultural productivity. Chisasa and Makina (2015) used South Africa as a case study and examined the effect of bank credit on the output of the agricultural sector. The study spanned from 1970 to 2011, whereas Johansen cointegration analysis was applied and the Granger causality test was carried out. The study discovered that both bank credit and capital formation have a significant impact on agricultural output in the country. Furthermore, the study found that there exists a bidirectional causality between capital formation and agricultural output during the period under review.

Ismail and Kabuga (2016) examined the effect of agricultural output on the economic growth of Nigeria. The ARDL cointegration approach was used and the study found a significant long-run relationship between agricultural output and Nigeria's economic growth. The study concluded that agricultural output is an important determinant of the economic growth of Nigeria, hence the need to take the sector seriously. Chandio, Yuansheng and Magsi (2016) determined the impact of government expenditure on the agricultural sector and its implication on the economic growth in Pakistan. The study applied Johansen cointegration and error correction model. The result established a significant causal relationship between government finance and agricultural output. Furthermore, it was discovered that both agricultural output and government expenditure have a significant impact on the economic growth of the country. Notwithstanding, the study identified paucity of funds as the main challenge facing the agricultural sector in Pakistan. Onoja (2017) used agricultural sector productivity and investigated the impact of financial development on it in a group of 75 developing countries. Panel data analysis was employed, along with several multivariate analyses incorporating

both fixed and random effects models. The results from the panel data indicated that economic size, institutional quality, agricultural environment factors, infrastructure and human capital all have significant impacts on the agricultural productivity in the countries investigated.

Using a West African country, Karimou (2018) investigated the impact of agricultural output on the economic growth of the Benin Republic. Other variables that were used in the study are industrial output and capital formation. The study applied the vector error correction model and found a significant co-movement between agricultural output, capital formation, industrial output and the GDP of the Benin Republic. The study also found that capital formation is very germane to the growth of the agricultural sector in the Benin Republic. Ibrahim and Alagidede (2018) applied GMM to 29 SSA countries and found that financial development has a stronger impact on economic growth under balanced sectoral growth. However, the transmission of finance to growth was primarily through investment, particularly in the real sector of the SSA economy.

Olayungbo and Quadri (2019) examined the effect of financial development on economic growth in Sub-Saharan Africa, this time incorporating the role of remittances into their analysis. Twenty SSA countries were selected for the study, and after the application of ARDL estimating techniques, the pooled mean group result shows that there exists a significant long-run relationship between remittances, financial development and economic growth in the SSA. Particularly it was established that financial development has a significant impact on economic growth in the SSA in both long and short-run periods. Ibidunni et al (2019) examined the impact of labour productivity on the SSA economy. The study focused on 43 SSA countries and applied panel data regression analysis. It revealed that labour productivity and the contribution to the growth of the SSA economy is very low during the period under review, naimly 2010-2017. The study concluded that SSA countries will need to invest more in agriculture to engage more labour which will contribute meaningfully to the growth of the sector. Still, regarding financial development and agricultural productivity, Zakaria Jun and Khan (2019) used South Asian countries as a case study. In the panel analysis variables such as human and physical capital, income and trade openness were used to proxy financial development. Panel cointegration results indicate that these variables have a long-run relationship with agricultural productivity and that financial development improves agricultural productivity. Financial development was also found to have an inverted U Shape whereas trade openness is negatively related to agricultural productivity in the sub-region.

In a similar study, Florence and Nathan (2020) assessed the impact of the commercial banks' credit to the agricultural sector as a financial development proxy on agricultural sector performance in Uganda. The ARDL bound test was applied and the study found that there is a significant long-run relationship between the commercial bank credit and agricultural output in the economy. The study further found out that agricultural credit by the commercial banks failed to have a short-run impact; however, in the long run, the impact became significant. The study concluded that credit to the agricultural sector should be prioritised by the Ugandan government if the sector is to have sustainable improved performance. Furthermore, Raifu and Aminu (2020) determined the impact of financial development on agricultural performance, and the role of institutions was also put into perspective in the study. The study computed the financial development index from some sets of indicators and used some institution variables as independent variables in the study. Data from 1990 to 2016 were used and with the application of the ARDL, it was established by the study that there is a positive and significant relationship in the long run between financial development and agricultural performance in Nigeria. Mohammed, Damba and Amikuzuno (2020) examined the impact of agricultural output on the economic growth of Ghana. The study used capital formation and inflation rate as other variables in the model apart from the agricultural output. The application of the Johansen cointegration analysis showed that there exists a long-run relationship between agricultural output and the Ghanaian economic growth but the effect of the agricultural output on the economic growth of the country is not significant. Ho, Pham and Nguyen (2021) investigated the impact of financial development on the economic growth of the ASEAN countries. Linear panel data of both fixed and random effects were used for about 120 countries and the result suggests that the role of trade openness in promoting the economic growth of these countries was more than that of financial development. The study established that financial development will influence the economic growth of these countries significantly if trade openness plays its expected role. Also, Zhao and Gong (2021) investigated the impact of financial development on the economic growth of some cities in China. The GMM was applied and the result showed that financial development failed to affect the economic growth of the selected Chinese cities during the period under investigation. The study concluded that China can only achieve effective financial development that is growth-promoting if the entire financial sector of the country is reformed.

The empirical literature clearly shows a greater focus on financial development and economic growth than on agricultural finance and economic growth. Few studies explicitly link agricultural finance to financial development and

economic growth, and to the best of the author's knowledge, none exist for SSA. This highlights the originality of the present study. Additionally, most studies treat agricultural finance as a subset of financial development, as previously noted in the literature gaps. This study addresses this by using agricultural output as a proxy for agricultural finance—reflecting its tangible outcomes—and incorporates it alongside a financial development index as the independent variable, with economic growth as the dependent variable.

3. MATERIALS AND METHODS

The model adopted to investigate the impact of financial development on agricultural finance follows the empirical studies of Zakaria, Jun and Khan (2019), and Onyishi, Arene and Ifiorah (2015), where the output in the agricultural sector was used to proxy the extent of finance deployed to the sector at a particular period. The generic model can be expressed functionally as:

$$A = f\left(K, L, FD\right) \quad \text{.....(1)}$$

Where in equation (1), A is the agricultural output, K is the capital, L is the labour, and FD is the financial development. However, Zakaria, Jun and Khan (2019) emphasised per capita income as a key determinant of agricultural finance, noting that in developing countries, where agriculture is largely subsistence-based, household income significantly influences the level of financing in the sector. It is important to note that the computation of financial development (FD) already incorporates several variables, including trade openness and key macroeconomic indicators like inflation and exchange rates. Therefore, the new model can be functionally specified as follows:

$$A = f\left(K, L, FD, PCI\right) \quad \text{.....(2)}$$

To estimate equation (2) parametrically, it is expressed in a dynamic regression model (ignoring the constant term) as equation (3) below:

$$\Delta \log A_{it} = \sum_{j=1}^{p-1} \alpha_{ij} \Delta \log A_{i,t-j} + \sum_{j=1}^{q-1} \delta_{ij}^{'} \Delta \log X_{i,t-j} + \theta_i (\log Y_{i,t-1} - \beta_{ij}^{'} \log X_{i,t}) + \varepsilon_{it} \quad \text{.....(3)}$$

Where in equation (3), X is the vector of the explanatory variables (capital, labour, financial development and per capita income). Also, the adjustment parameter is expected to be significantly negative and have an absolute value of less than one.

The parameter is the long-run impact estimate of the explanatory variables on the dependent variable (agricultural output). The parameter captures the short-run impact of the regressors on the regressand while the parameter captures the short-run dynamic of the dependent variable. The parameters p and q are the lag parameters which can be optimally selected using statistical criteria or independently fixed.

Adapting the endogenous growth model employed by Onyishi, Arene and Ifiorah (2015), a model that described the relationship between financial development, agricultural finance and economic growth of the SSA is specified in this study. In contrast to Onyishi, Arene and Ifiorah (2015), this study replaces financial intermediation with a financial development index and substitutes intermediate inputs with agricultural finance (proxied by agricultural value added). The model, therefore, is expressed functionally as:

$$Y = f\left(K, L, FD, AF, PCI\right) \quad \text{.....(4)}$$

Where Y is the economic growth, K is the capital, L is the labour force, FD is the financial development, AF is the agricultural finance, and PCI is the per capita income

$$\Delta \log Y_{it} = \sum_{j=1}^{p-1} \gamma_{ij} \Delta \log Y_{i,t-j} + \sum_{j=1}^{q-1} \vartheta_{ij}^{'} \Delta \log X_{i,t-j} + \varphi_i (\log Y_{i,t-1} - \lambda_{ij}^{'} \log Z_{i,t}) + \varepsilon_{it} \quad \text{.....(5)}$$

Where in equation (5), Z is the vector of the explanatory variables (capital, labour, financial development, agricultural finance and per capita income). Also, the parameter is the speed of adjustment which is expected to be significantly negative and less than one. The parameter is the long-run impact estimate of the explanatory variables on the dependent variable (agricultural output). The parameter captures the short-run impact of the regressors on the regressand while the parameter captures the short-run dynamic of the dependent variable. The parameters p and q are the lag parameters which can be optimally selected using statistical criteria or independently fixed.

The Panel VAR (PVAR) based Granger causality is adopted to examine the causal relationship between agricultural finance, financial development and economic growth in the SSA in this study. The PVAR(p) equations are presented below:

$$\Delta \log A_{it} = \sum_{i=1}^{p} B_{11,i} \Delta \log A_{i,t-i} + \sum_{i=1}^{p} B_{12,i} \Delta \log FD_{i,t-i} + \sum_{i=1}^{p} B_{13,i} \Delta \log Y_{i,t-i} + D_{11} + \nu_{1t} \quad \text{..(6)}$$

$$\Delta \log FD_{it} = \sum_{i=1}^{p} B_{21,i} \Delta \log A_{i,t-i} + \sum_{i=1}^{p} B_{22,i} \Delta \log FD_{i,t-i} + \sum_{i=1}^{p} B_{23,i} \Delta \log Y_{i,t-i} + D_{21} + v_{2t} \quad (7)$$

$$\Delta \log Y_{it} = \sum_{i=1}^{p} B_{31,i} \Delta \log A_{i,t-i} + \sum_{i=1}^{p} B_{32,i} \Delta \log FD_{i,t-i} + \sum_{i=1}^{p} B_{33,i} \Delta \log Y_{i,t-i} + D_{31} + v_{3t} \quad (8)$$

The hypothesis of non-granger causality is tested for each of the variables. A variable does not Granger-cause another if the joint coefficients of its lagged values in the equation of interest are statistically zero. Otherwise, the variable Granger causes the dependent variable. The test typically follows a chi-square distribution, although a Fisher (F) version also exists. A significant result indicates that the lagged values of the tested variable provide explanatory power for predicting the dependent variable in the equation.

Table 1: Measurement and source of data

Variable	Measurement	Sources of data
A	Agricultural value added.	World Bank Development Indicators
FD	Domestic to the private sector	World Bank Development Indicators
K	Gross fixed capital formation (Constant)	World Bank Development Indicators
L	Total labour force	World Bank Development Indicators
PCI	GNI per capita	World Bank Development Indicators
Y	Gross Domestic Product (Constant)	World Bank Development Indicators

Source: World Bank Indicators

Table 1 depicts the variables employed in this study and their respective sources. This study employed data on 27 sub-Saharan African countries from 2000 to 2021.

4. RESULTS AND DISCUSSION

Table 2 shows the descriptive statistics for agricultural finance (A), real gross domestic product (Y), gross fixed capital formation (K), labour force (LF), financial development index (FD) and per capita income (PCI) in the SSA from 2000 to 2021. It can be observed that the mean for all the variables is positive. The coefficient of variation (C.V.) is used to measure the relative dispersion in data and is calculated as the standard deviation divided by the mean. A variable with a larger coefficient of variation shows it has much more variation than the other.

Table 2: Descriptive statistics

Variable	Mean	Std. Dev.	C.V.	Max.	Min.	J-B	Obs
A	1671.526	1779.483	1.065	9470.672	265.089	636.418***	594
Y	3.97E+10	9.06E+10	2.282	5.20E+11	6.90E+08	4847.946***	594
K	25.751	13.466	0.523	74.117	2.857	263.068***	594
LF	18.288	22.728	1.243	142.422	0.002	5792.498***	594
FD	7.75E+09	1.54E+10	1.987	8.02E+10	36402660	2675.954***	594
PCI	15.947	13.483	0.846	70.382	0.002	793.308***	594

***p<1%; **p< 5%; *<10%

Source: Author's analysis

It can be deduced from the table that the gross fixed capital formation has the lowest degree of variation while the real gross domestic product has the highest level of variation among the variables. The high degree of variation in the gross domestic product reflects the frequent degree of the business cycle in the SSA economies. The lower degree of variation in the gross fixed capital formation implies that the capital formation in the SSA countries has not been faring well over the decades, despite the seemingly high rate of output formation in the economies. The limited fluctuation in gross fixed capital formation indicates a persistent challenge: capital investment in SSA countries has remained relatively stagnant over the past decades, even with periods of high output growth. This suggests a potential disconnect between output and investment. The probability value of the Jarque-Bera (J-B) normality test is statistically significant for all the variables and this implies that they are not normally distributed. However, since we are using a fairly large sample size, the issue of normality in data will not pose a problem due to the law of large sample size; the parameter estimates based on the data will converge to their true value asymptotically.

Table 3 depicts the panel unit root test results for the variables. The tests are categorised into two groups: those assuming a common unit root process across all panels (Levin-Lin-Chu and Breitung tests) and those allowing for individual unit root processes across panels (Im-Pesaran-Shin, ADF Fisher Chi-square, and PP Fisher Chi-square tests). The result shows that there is no consensus on the stationarity of the variables under the homogeneity assumption; however, capital, labour and per capita income are shown to be stationary under the heterogeneity assumption. The results suggest that the variables may have a mixed order of integration, with strong evidence that agricultural finance and real GDP are integrated of order one, $I(1)$. The employment of the panel ARDL model suffices in carrying out such analysis by accommodating integrated and stationary regressors and this aids in achieving the objectives of this study.

Table 3: Unit root test results summary

Variable	Common unit root		Individual unit root		
	LLC	BRG	IPS	ADF	PP
A	2.075	1.060	3.786	33.174	31.280
Δ(A)	-12.788***	-5.288***	-15.706***	286.594***	453.680***
Y	-3.431***	3.921	0.269	76.134**	71.738*
Δ(Y)	-15.847***	-9.794***	-16.384***	303.811***	611.649***
K	-2.284**	-1.072	-2.140**	72.751**	71.958*
Δ(K)	-13.963***	-7.508***	-12.831***	251.017***	422.176***
Lab	0.842	-6.760***	-1.815**	82.569***	143.494***
Δ(Lab)	-39.722***	-4.936***	-23.558***	576.231***	833.299***
PCI	1.130	0.468	-2.803***	85.124***	133.582***
Δ(PCI)	-38.571***	-4.702***	-22.556***	558.018***	1082.540***
FD	0.147	4.881	2.063	48.882	202.547***
Δ(FD)	-15.421***	-4.848***	-13.849***	249.333***	398.029***

Note: variables with Δ implies first difference; ***p<1%; **p< 5%; *< 10%
Source: Author's analysis

Table 4: Panel cointegration test results summary

Test Type	Dependent variable			
	Agric Finance (A)		Economic growth (Y)	
	ADF	PP	ADF	PP
Kao	-3.42***		-5.58***	
Pedroni (Common AR)	-9.84***	-9.76***	-2.25**	-11.3***
Pedroni (Individual AR)	-5.58***	-4.14***	-3.61***	-13.7

Note: ADF and PP are the augmented Dickey-Fuller and the Phillips-Perron test statistics.
***p<1%; **p< 5%; *< 10%
Source: Author's analysis

The panel cointegration test results for the agricultural finance and economic growth models are presented in Table 4. The null hypothesis tests the absence of a cointegration relationship among the variables (given the dependent variable). A statistically significant result, or a very low p-value, indicates the rejection of the null hypothesis and the acceptance of the alternative hypothesis, which posits the existence of a cointegration relationship among the variables (between each independent variable and the dependent variable). The Kao cointegration test result shows that the test statistics are significant at a 1% level and thus implies accepting the hypothesis of cointegration. Also, in the Pedroni test result, there is evidence of cointegration by the PP and the ADF tests in the first panel, as wel as in the second panel.

Table 5 shows the regression model estimate of the impact of financial development on agricultural finance. The coefficient of capital is found to be significant in the PMG model and only in the long run and is negative. All things being equal, a percentage increase in capital is shown to reduce agricultural finance by about 0.21% in the long run. Moreover, the coefficient of labor is found to be significant and positive in the PMG model, but only in the long run, unlike the case of capital.

The result shows that a percent rise in the labour force will increase agricultural finance by about 0.19% on average in the long run. There is a shred of strong evidence for the positive impact of financial development on agricultural finance by the three models. The result shows that a percent rise in the financial development level will bring about a 0.087% to 0.13% increase in agricultural finance in the short run and a 0.23% to 0.32% increase in the long run on average. Lastly, the coefficient of per capita income is found to be significant and positive in the PMG model, but only in the long run. All things being equal, the result shows that if the per capita income increases by one percent, agricultural finance will increase by about 0.22% in the long run. The error correction term is significant in the three models and it can be deduced that if an unexpected shock hits the economy, the agricultural finance will adjust back to its initial steady state correcting at most about 14% of the shock effect or at least about 47% of it.

It can be inferred from the result in Table 5 that capital insignificantly impacted agricultural finance in the short run but negatively in the long run. This is contrary to theory as capital is expected to drive output, as well as to the studies of Karimou (2018) and Zakaria, Jun and Khan (2019). The insignificance of capital in contributing to agricultural finance in the short run is likely due to the continued reliance on crude implements in agricultural practices across many SSA countries. Most farming operations remain subsistence-based, primarily supporting hand-to-mouth consumption, which limits the scale and productivity needed to attract or utilise capital effectively. Moreover, the high cost of modern farming equipment—combined with unfavourable exchange rates—makes mechanisation largely inaccessible. Other potential explanations include poor rural infrastructure, which hampers distribution and market access, limited access to affordable credit facilities for smallholder farmers, weak institutional support, and inadequate extension services. Also, there are not enough savings to encourage capital accumulation in the SSA and the available ones are not properly channelled to the right source. All these factors contribute to the insignificant impact of capital on agricultural financem the accumulation of which over a long period leads to the noticeable negative effect in the long run. Although labour impact on agricultural finance is expected to be positive,

the effect is found to be significant only in the long run. Similar to the case of capital, much of the labour force engaged in agriculture across SSA remains largely unskilled. Unlike advanced economies such as France, where scientific methods are integrated into agricultural practices to boost productivity, farming in SSA is still predominantly manual. A significant proportion of farmers are not literate and are often resistant to adopting modern farming techniques. Agricultural extension workers frequently face challenges in promoting labour-saving innovations, many of which are perceived as foreign or even inappropriate by older farmers. Consequently, the adoption of modern practices is slow and limited mostly to the small group of educated farmers. This low adoption rate contributes to the insignificant impact of labour on agricultural output and, by extension, on agricultural finance in the short run. However, in the long run, the cumulative effect of the few skilled and innovative labourers becomes more pronounced, significantly enhancing agricultural finance.

Table 5: Panel ARDL regression estimates for agricultural finance

Variable	DFE	MG	PMG
log(K)	0.019	0.126	-0.209***
	(0.121)	(0.412)	(0.026)
log(L)	-0.179	-6.935	0.185***
	(0.312)	(19.368)	(0.038)
log(FD)	0.251***	0.317*	0.225***
	(0.043)	(0.173)	(0.017)
log(PCI)	0.118	6.955	0.217***
	(0.305)	(19.302)	(0.034)
Δlog(K)	0.040	-0.052	-0.032
	(0.037)	(0.035)	(0.026)
Δlog(L)	-0.025	5.527	6.640
	(0.111)	(10.873)	(5.469)
Δlog(FD)	0.132***	0.048	0.087***
	(0.021)	(0.038)	(0.029)
Δlog(PCI)	0.019	-5.517	-6.640
	(0.111)	(10.845)	(5.457)
ECM(-1)	-0.229***	-0.470***	-0.139***
	(0.027)	(0.057)	(0.047)
Constant	0.393**	1.265*	0.303***
	(0.187)	(0.736)	(0.109)
Hausman test	131.850***	84.928***	

Note: variables with Δ implies their short-run. Also, DFE, MG, and PMG are the dynamic fixed-effect, mean group, and pooled mean group panel ARDL estimators.

***p<0.001; **p< 0.01; *<0.05

Source: Author's analysis

In confirmation to theory, the study shows evidence for the significant positive impact of financial development on agricultural finance both in the short run and long run. This supports the claims of Onoja (2017), Florence & Nathan (2020) and Raifu and Aminu (2020) but is contrary to the studies of Veselinović and Drobnjaković (2014) and Dhrifi (2014). The significant impact of financial development reflects the recent forms of transaction aided by global technological advancement. For instance, it is becoming easier nowadays to order agricultural products or items from China using different forms of electronic payments such as Bitcoin or any other kind of cryptocurrency. Moreover, interbank transfer is becoming prominent in transactions among SSA countries these days. On per capita income, the study only proves evidence of its positive impact on agricultural finance in the long run. The insignificant short-run impact of per capita income on agricultural finance reflects the lower level of purchasing power of an average person in the SSA countries. However, the accumulative effect is observable over time. In the modern monetised economy, unlike in a barter system, effective demand—that is, demand that translates into actual purchases—is largely determined by purchasing power. However, this ability is found to be very limited, especially among the masses in developing countries such as SSA countries. As a result, it is anticipated that the effects of individual demand-driven decision-making will be felt in every area of economic activity.

Table 6 shows the regression model estimate of the impact of financial development and agricultural finance on economic growth in the SSA countries. There is a piece of strong evidence from the result presented that capital negatively impacts economic growth in the short run but positively in the long run. The result shows that if capital increases by a percent, real GDP will reduce by 0.06%−0.08% on the impact in the short run but will eventually grow by about 0.21% in the long run.

The coefficient of labour is found to be relatively significant only in the long run and is positive. All things being equal, a percentage increase in labour is shown to bring about a 0.77%−26.1% increase in real GDP growth on average in the long run. The significant impact of financial development on real GDP growth is found more evidently in the long run than in the short run. It can be deduced from the result that a percent rise in the financial development level will bring about a 0.04% increase in the real GDP growth in the short run and about a 0.13% to 0.49% increase in the long run on average. On the impact of agricultural finance on real GDP growth, the short-run and the long-run results consistently show that agricultural finance positively impacts real GDP growth. It can be deduced that if agricultural finance increases by one percent, real GDP

will rise on the impact by 0.06%−0.44% in the short run and will eventually grow by about 0.38%−1.06% on average in the long run. Lastly, the coefficient of per capita income is found to be significant in both the MG and PMG models, but only in the long run, and it is negative. All things being equal, the result shows that if the per capita income increases by one percent, real GDP growth will decline by about 0.74%−25.8% in the long run. The error correction term is statistically significant across all three models, indicating the speed at which real GDP adjusts to restore equilibrium following a shock. Specifically, the speed of adjustment is 12% in the DFE model, 46% in the MG model and 16% in the PMG model.

Table 6: Panel ARDL regression estimates for economic growth

Variable	DFE	MG	PMG
log(K)	0.211*	0.802	0.206***
	(0.109)	(2.573)	(0.003)
log(L)	-0.049	26.060*	0.769***
	(0.284)	(13.516)	(0.223)
log(FD)	0.486***	-2.460	0.133***
	(0.059)	(3.828)	(0.020)
log(A)	0.376**	6.622	1.063***
	(0.158)	(11.477)	(0.054)
log(PCI)	-0.069	-25.782*	-0.741***
	(0.276)	(13.175)	(0.219)
Δlog(K)	-0.075***	-0.076**	-0.057***
	(0.018)	(0.034)	(0.018)
Δlog(L)	-0.018	-3.982	0.414
	(0.053)	(3.539)	(1.670)
Δlog(FD)	-0.011	0.020	0.038***
	(0.011)	(0.023)	(0.014)
Δlog(A)	0.060***	0.143	0.435***
	(0.021)	(0.088)	(0.080)
Δlog(PCI)	0.037	3.920	-0.435
	(0.053)	(3.541)	(1.678)
ECM(-1)	-0.121***	-0.462***	-0.160***
	(0.015)	(0.069)	(0.025)
Constant	1.849***	6.259***	1.959***
	(0.227)	(1.032)	(0.109)
Hausman test	110.803***	6.406	

Note: variables with Δ implies their short-run; ***p<1%; **p< 5%; *< 10%

Source: Author's analysis

By implication, the results in Table 6 reveal that capital has a negative impact on economic growth in the short run but a positive effect in the long run. This is inconsistent with the standard theory of production and economic growth, particularly Inada's conditions, which suggests that positive additions to capital should yield marginal increases in output. One plausible explanation for the observed short-run negativity is the underutilisation or misallocation of capital resources in SSA countries. In the short term, firms may face difficulties adopting or integrating new technologies due to structural and institutional lags. However, in the long run, as firms adjust and optimise capital usage, their contribution becomes positive, aligning with theoretical expectations.

Similarly, labour shows a statistically significant positive effect on economic growth only in the long run. This result aligns with Ibidunni *et al*. (2019), who found labour to be insignificant in the short run. In the SSA region, much of the labour force engaged in economic activities is unskilled, which likely diminishes productivity gains in the short term. However, over time, labour-augmenting factors such as vocational training, knowledge spillovers and sensitisation programs may enhance labour productivity. Nonetheless, while several higher institutions exist, access remains limited for many, and such assumptions should be treated cautiously without further empirical verification.

Regarding financial development, the study finds a robust and significant positive effect on economic growth in both the short and long run. This supports the findings of Ibrahim and Alagidede (2018), Olayungbo and Quadri (2019), and Ho, Pham and Nguyen (2021), affirming the growth-enhancing role of financial systems. With the recent expansion of digital banking and mobile money across SSA, financial services have become more accessible, enabling more efficient resource allocation and intermediation. However, this finding contrasts with Zhao and Gong (2021), who found financial development to be insignificant, underscoring the need to consider country-specific financial structures and institutional quality.

Agricultural finance is also found to positively influence economic growth in both the short and long term, in line with theoretical expectations and supported by studies such as Ismail and Kabuga (2016) and Chandio, Yuansheng and Magsi (2016). This suggests that improved funding for agriculture can stimulate broader economic activity, given agriculture's central role in many SSA economies. However, contrary findings by Okunlola, Osuma & Omankhanlen (2019) and Mohammed, Damba and Amikuzuno (2020) suggest that the effectiveness of agricultural finance may depend on how funds are allocated and absorbed within the sector. Potential limitations such as inefficient credit delivery systems and poor infrastructure may undermine the full impact of agricultural finance.

Interestingly, per capita income is found to exert a negative effect on economic growth in the long run, which deviates from theoretical expectations. This result may reflect income inequality or consumption patterns that do not favour productive investment. In economies where rising per capita income is concentrated among a few, the broader economy may not experience inclusive growth. Policymakers could address this issue by implementing redistributive policies, increasing investment in human capital, and improving access to credit for economically marginalized groups, thereby ensuring that income gains translate into sustainable economic growth.

Table 7: PVAR(1) granger causality test result summary

Null Hypothesis:	**Chi-square**
FD does not Granger Cause A	7.698***
A does not Granger Cause FD	4.453**
Y does not Granger Cause A	10.697***
A does not Granger Cause Y	22.378***
Y does not Granger Cause FD	16.963***
FD does not Granger Cause Y	10.590***

***p<1%; **p< 5%; *< 10%

Source: Author's analysis

It has to be understood that Granger causality simply implies precedence. In a statistical sense, it means that a variable could help in predicting the future of other variables if its occurrence precedes the variable, and therefore Granger caused it. Table 7 depicts the panel VAR model-based Granger causality test result. The values in the table represent the chi-square value for the test and the asterisks denote the level of their respective significance. From the results, there is evidence of bidirectional causality running from each of the variables (financial development, agricultural finance and real GDP growth) to the other thus implying that they could all help predict one another. Therefore, the development in the financial sector is a panacea for economic growth in SSA countries. This for instance can be seen in the case of China which has turned the development of the cryptocurrency market into economic growth. Also, when the economy is growing, there will be a need to expand the financial sector which in turn brings about economic growth. A rise in financial development will aid in financing the agricultural sector in return.

5. CONCLUSIONS

This study investigated the impact of agricultural finance and financial development on economic growth in Sub-Saharan Africa. The results indicate that capital negatively affects agricultural performance in the long run and exerts a negative short-run, but positive long-run, impact on economic growth. Labour has no short-run effect but contributes positively in the long run. Financial development significantly drives both agricultural performance and economic growth in the short and long run. Per capita income positively affects agriculture only in the long run but reduces economic growth over time. Agricultural performance also significantly supports growth in both periods. Policy efforts should focus on strengthening financial regulation, expanding R&D, and supporting agricultural and industrial alignment. Affordable agricultural credit and awareness campaigns should be promoted. Enhancing labour productivity through training and technology is also crucial. This study contributes uniquely by linking agricultural finance to financial development and growth in SSA, a rarely explored area. However, limitations include data constraints and potential country-level heterogeneity. Future research should consider more granular data and country-specific analyses.

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Conflict of interests

The authors declare there is no conflict of interest.

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ЕФЕКТИ ПОЉОПРИВРЕДНОГ ФИНАНСИРАЊА И ФИНАНСИЈСКОГ РАЗВОЈА НА ЕКОНОМСКИ РАСТ ЗЕМАЉА ПОДСАХАРСКЕ АФРИКЕ

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САЖЕТАК

Ово истраживање је испитивало утицај пољопривредних финансија и финансијског развоја на економски раст подсахарске Африке (SSA) у

периоду од 2000. до 2021. године. У студији су коришћени панел ARDL регресиони модели и панел VAR тест Грејнџерове узрочности као алати за анализу података. Истраживање је показало да акумулација капитала дугорочно негативно утиче на пољопривредне перформансе; ефекат на економски раст је негативан краткорочно, али позитиван дугорочно. Такође, нема доказа о краткорочном утицају рада ни на пољопривредне перформансе, нити на економски раст. Међутим, дугорочни ефекат је позитиван и значајан. Постоје снажни докази који подржавају финансијски развој као покретач пољопривредних перформанси и економског раста, и краткорочно и дугорочно. Доходак по становнику, који одражава индивидуалну куповну моћ, утиче на пољопривредне перформансе само дугорочно, док је његов утицај на економски раст, који је значајан само дугорочно, негативан. Даље, студија открива да се улога пољопривредних перформанси у подстицању економског раста не може пренагласити — и у кратком и у дугом року. Стога, ова студија препоручује јачање институционалних капацитета за надзор финансијског сектора кроз законодавство и контрацикличне резерве, унапређење истраживања и развоја (R&D) и политика за побољшање индустријских и пољопривредних перформанси, као и развој финансијских институција ради оптимизације индустријализације повезане са пољопривредом. Такође, владе треба да подстичу приступачне пољопривредне кредите, уз подршку кампања за подизање свести, те да дају приоритет програмима приправништва, преквалификације и технолошки вођеном истраживању и развоју како би се повећала продуктивност рада и одржао економски раст у подсахарској Африци.

Кључне ријечи: *пољопривреда, финансије, раст, ARDL - ауторегресивни модел са распоређеним закашњењима, PMG – комбинована групна средина.*