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Nigo, Ayine and Gibogwe, Vincent

University of Westminster, University of Westminster

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Impact of financial resources on agricultural growth in Sub-Saharan Africa

Ayine Nigo

Institutional Affiliation 2: School of Organisations, Economy and Society,
Westminster Business School, University of Westminster, 309 Regent St.,
London W1B 2HW, United Kingdom

A.nigo@westminster.ac.uk

Vincent Gibogwe

Institutional Affiliation1: School of Organisations, Economy and Society,
Westminster Business School, University of Westminster, 309 Regent St.,
London W1B 2HW, United Kingdom

gibogwv@westminster.ac.uk

Abstract

This study contributes to the literature on financial efficiency and growth. We show that banking development exerts a statistically significant and positive impact on local economic growth. We use the ARDL method to find the impact of institutional financial quality on agriculture sector growth in 14 Sub-Saharan African countries from 1990 to 2020. Our results show that land, rural population, and per capita agricultural income growth have long-run and significant (at 1% level) causal effects on the magnitude of agricultural value added as a percentage of GDP.

Keywords: foreign direct investment, economic growth, absorptive capacity, human capital, market liberalization.

JEL Classification: O19; O47; O55; F63. F36; G21; O15

Introduction

Agriculture, on average, contributes 25.1% of GDP to the countries covered in this study (World Bank, 2022) is the primary source of food to human beings and fodder to animals, provides raw materials to agro-based industries; contributes to foreign exchange earnings (FAO, 2002; Adeleye *et al.*, 2020; Chandio *et al.*, 2020; Sunkad, 2022) and is the provider of employment to a sizeable proportion of the rural population; ranging between 19.9% in Botswana and 76.4% in Malawi (World Bank, 2021). However, it faces shortfalls, like food supply shortages (Bjornlund *et al.*, 2020; Wudil *et al.*, 2022), that lead to rising food imports, some of which cause a rise in food prices as high imports costs (FAO, 2019). There have been government efforts (Adeleye *et al.*, 2020), including developing the financial sector to enable farmers to access inputs, tools, and equipment (Adjognon *et al.*, 2017). This study looks at the finance–agricultural growth nexus for 14 Sub-Saharan countries from 1990 to 2020; the literature is reviewed in Section 2. The methodology is detailed in Section 3; results are discussed in Section 4; and Section 5 concludes with policy recommendations.

2. Review of Related Literature

A few empirical studies covered here on the financial agricultural-growth nexus have overwhelmingly supported the supply-leading hypothesis (Qazi and Wizarat, 2011; Chandio *et al.*, 2016; Khandker and Koolwal, 2016; Khan *et al.*, 2017; Chandio *et al.*, 2018; Omoriege *et al.* 2018; Chandio *et al.* 2020; Agbodji and Johson, 2021; Ngong *et al.*, 2022) where the impact of formal credit on agricultural output is positive. For instance, Qazi and Wizarat, 2011 use the autoregressive distributed lag approach in 1997 to 2001 data in Pakistan and find that financial liberalization affects agricultural growth positively both in the short and the long run; but real interest rate positively affects agricultural growth in the short run and negatively in the long run. Khan *et al.* 2017 explore the agricultural credit potential (marginal, small, medium, and large farmers) performance and relationship with agricultural growth in India from 1980 to 2011. Using the Vector Error Correction Model (VECM), they find a unidirectional causality running from Agricultural credit to Agricultural Gross Domestic Product; agriculture gross domestic product is highly responsive to increased agricultural credits. Agbodji and Johson (2021) analyze the impact of agricultural credit on maize, sorghum and paddy rice productivity in Togo. Their results are varied depending on the type of crop and the end use of the crop. The impact is positive and significant on maize and sorghum but not

significant impact on paddy rice productivity. However, when looking at the cash element of the crop, the portion sold in the market, the impact of agricultural credit is negative concerning maize, positive to sorghum, and not significant for paddy rice.

Two studies (Yazdi and khalalizadeh 2011; Shabaz *et al.* 2013) supported the feedback hypothesis where there is a bidirectional causality between agricultural economic growth and financial Development. Yazdi and khalalizadeh 2016 examine the causal relationship between the dynamic financial Development, economic growth and instability in Iran using annual time series covering the period 1970-2011 using the error correction model (ECM) and find a bidirectional causality between agricultural economic growth and financial Development. They recommend improving the efficiency of the financial sector and having credible pro-investment macroeconomic policies that boost agricultural growth. Shabaz *et al.* 2013 investigate the relationship between financial Development and agricultural growth from 1971-2011. Using the vector error correction method (VECM), they find that financial Development positively affects agricultural growth, implying that it plays a significant role in stemming agricultural production and hence agricultural growth. Both capital and labour in the agriculture sector also add to agricultural growth. The Granger causality analysis revealed bidirectional causality between agricultural growth and financial Development, suggesting a feedback hypothesis.

These differing findings can be explained by some factors, including using different methods in the analysis, using different periods, the choice of predictors and measures of banking development or banking stability and the development level of the banking system and institutional characteristics of countries under consideration (Aluko and Ibrahim 2020; Marwa and Zhanje, 2015; Topcu, 2016 both cited in Bayar *et al.* 2021).

3. Methodology

We apply the variables used by Chandio *et al.* (2020) and Ngong *et al.* (2022) in their studies, viz the agriculture value added (% of GDP) is used as a proxy for growth in agriculture, net bank credit to the private sector in US\$, agricultural land in hectares, rural population; and growth rate of real per capita agricultural GDP as a control variable: all these are obtained from the World Bank World Economic Indicators.

We use the ARDL method to find the impact of institutional financial quality on agriculture sector growth in 14 Sub-Saharan African countries from 1990 to

2020. Nkoro & Uko (2016) have shown that the ARDL technique frees variables from residual correlation as all variables are assumed to be endogenous. Their model distinguished dependent and explanatory variables in any long-run relationship and identified the co-integrating vectors with multiple co-integrating vectors. They derived the Error Correction Model (ECM) by integrating short-run adjustments with long-run equilibrium without losing extended-run information. Additionally, by excluding nonstationary variables from the analysis through unit root tests, the technique paves away problems associated with violations of assumptions of constant mean and variances that would, among other things, lead to misleading estimates (Nkoro and Uko, 2016). ARDL also is appropriate in dealing with variables that are stationary: at the level $I(0)$ and at the difference $I(1)$; and by use of the Pesaran-Shin bounds co-integration technique (Pesaran and Shin, 1999, and Pesaran *et al.*, 2001 as cited in Nkoro and Uko, 2016) the technique distinguishes between long run and short models.

The long-run specification is expressed in the following form:

$$agva_t = \beta_0 + \beta_1 credit + \beta_2 land + \beta_3 rpop + \beta_4 pcgdp + \varepsilon_{it} \quad (1)$$

Where $agva_t$ is the agriculture value added (% of GDP); $credit$ is bank credit to the private sector in US\$; the $land$ is agricultural in hectares; $rpop$ is rural population; and $pcgdp$ is the growth rate of real per capita agricultural GDP. β_1 through β_4 are parameters to be estimated, β_0 is the intercept and ε error term.

As for ARDL, its generalized form is:

$$Y_t = \gamma_0 + \sum_{i=1}^p \delta Y_{t-1} + \sum_{j=0}^q \beta_j' X_{t-1} + \varepsilon_{it} \quad (2)$$

Where Y_t is a dependent variable, $(X_t)'$ is a $k \times 1$ vector that is allowed to be purely $I(0)$ or $I(1)$ or co-integrated, δ is the coefficient of the lagged dependent variable called scalar, β_j are $k \times 1$ vector; p, q are optimal lag orders; ε_t is the stochastic error term.

4. Analysis and results

4.1. Summary Statistics

Domestic credit to the private sector (% of GDP), as a measure of financial efficiency and Development, shows the ability of banks to transform their mobilized deposits into productive credits and is expected to enhance growth

in agriculture. This would allow countries at the lower end of growth in agriculture to have easier access to credit to fund investments more efficiently, thus increasing growth (Adeleye *et al.*, 2020). The control variables include land, rural population and growth rate of real per capita agricultural GDP. From Table 1, the highest agriculture value added (% of GDP) (59.8%) was recorded in Congo Democratic Republic in 2001, followed by Uganda (56.6%) in 1990; Botswana had the lowest level of (1.8) in 2005, followed by South Africa (2.0%) in 2020. Overall, the share of agricultural value added to GDP is relatively high compared to other developing countries (World Bank, 2022). Most countries did poorly in real per capita agricultural GDP growth, with the highest being only 1.52% in Malawi in 1993; the lowest was South Africa (0.38%) in 1990. We also use the ratio of standard deviation to the mean, called coefficient of variation (CV), to check the size of the standard deviation and, therefore, the relative level of variability. As a rule of thumb, a $CV > 1$ shows a higher variability, and a $CV < 1$ indicates a lower variability. From CV, then variability is relatively low in three of the five variables; credit was excessively variant.

Table 1. Descriptive statistics

Variable	Obs	Mean	Std. dev	Min	Max	Cv
Agva	434	25.44	14.63	1.82	59.75	0.57
Credit*	432	27.50	110.00	0.00	920.00	4.00
Landha*	434	35.20	36.90	1.49	137.00	1.05
Agropop*	434	13.90	11.00	0.62	44.60	0.79
Agrgdppc	419	1.01	0.08	0.38	1.52	0.08

Source: Authors' computation, 2022

Notes: * credit is in US\$bn, land in a million ha and agrpop in millions

4.2. Correlation analysis

Part of Table 2 presents the correlation between variables. Two observations are made here. First, there is no multicollinearity among the variables, as all coefficients indicate a moderate correlation with one another below the benchmark of 0.8. (Dada and Abanikanda, 2022) Moreover, the regressors do not have a perfect or exact linear representation of one another. Second, the potential relationships between growth in agriculture and other variables are

mixed, half are positive, and half are harmful; however, the potential relationships between bank credit and most other variables are favourable.

Table 2. Correlation matrix

1	2	3	4	5	6	7	8
	Agva	credit	landha	ruralpop	agrddppc	Unit root	Lag length
Agva	1					D	1
credit	-0.3031	1				D	1
Land	-0.2934	0.3445	1			D	1
Ruralpop	0.4182	0.1238	0.1881	1		D	1
Agrddppc	0.0321	0.0179	0.035	-0.0137	1	L	0

Source: Authors' computation, 2022

4.3. Unit root test

In the causality between two or more variables, the series must be stationary; that is, the series must have no seasonality, a constant mean, and a constant autocorrelation structure; and should tend to return to the long-term trend following a shock. We cannot use time series that are nonstationary; that is, those that have a non-constant mean, a non-constant variance and a non-constant autocorrelation over time (Yuan *et al.* 2007, cited in Akinwale and Grobler, 2019; Asteriou & Hall, 2011, cited in Mongale *et al.* 2018). If we fit regressions that use nonstationary series, our results will be spurious, and their outcomes cannot be used for forecasting or prediction (Granger and Newbold, 1974); cited in (Akinwale and Grobler, 2019). Therefore, it is vital to check whether the series is stationary (Mongale *et al.*, 2018). Several tests, including the Levin-Lin-Chu, Harris Tzavalis, Fisher type and Im-Pesaran-Shin, are used for testing stationarity, also called unit root tests. If the series is nonstationary, differencing is made to make them stationary. The order of differencing at which the series becomes stationary is said to be integrated of order d , i.e. $I(d)$; for the first order, it is said to be integrated of order 1 ($I(1)$); for the second order, it is said to be integrated with the order 2 ($I(2)$). (Fang and Wolski, 2016; cited in (Ilesanmi and Tewari, 2017). The results of the stationarity test we made using Im-Pesaran-Shin are presented in Table 2,

under Unit root - Column 7) above, where four of the variables are stationary at difference; only one is stationary at level.

4.4. Optimal lags

After obtaining a functional form and knowing the variables we are using, we proceed to the next step of obtaining optimal lags for the variables we are using. Given that the economic processes are dynamic where a dependent variable takes time to respond to the effect of regressors (Scott Hacker and Hatemi, 2008; cited in Chikalipa and Okafor 2019), there is a need to capture all past information that could entail the estimation framework; failure to do this would result to misspecification. Using lags becomes essential, and choosing the optimal lag length is vital. Choosing the optimal number of lags avoids losing degrees of freedom, multicollinearity, serial correlation, and misspecification errors. There are already econometric packages like Stata that we are using that are useful in estimating optimal lags, using techniques like the final prediction error (FPE), Akaike's information criterion (AIC), Schwarz's Bayesian information criterion (SBIC), and the Hannan and Quinn information criterion (HQIC), to name a few. Given the complication of estimating optimal lags on panel data, we manually estimated each optimal lag length for the variable for all 14 countries and then came up with the most common lag among the countries. The results are presented in Table 2 - Column 8 above, where 1 was the most common optimal lag length for all variables, saving real per capita agricultural GDP growth rate with the optimal lag length of 0.

4.5. Co-integration test

After completing the static test, we do a co-integration test to establish whether a long-run relationship exists between or among variables (Ilesanmi and Tewari, 2017). Co-integration indicates that time series move together eventually and that the error term resulting from the linear combination of time series quantifies the deviation of the time series from their typical long-run relationship, which can be used to predict their future values (Granger, 1986); cited in (Akinwale and Grobler, 2019). Based on Pedroni's test, the results in Table 3 here show that of the seven statistics, four are, in absolute terms, more significant than 2. These results are corroborated by those obtained from the Kao residual co-integration test, where the t-statistic coefficient is significant at a 1% level. Therefore, the null hypothesis of no co-integration is rejected for all panel and group statistics, implying that our panel exhibits co-integration among the variables. In other words, the findings validate the long-term impact

of the exogenous variables on the endogenous variable in Sub-Saharan Arica.

Table 3: Pedroni's co-integration tests

No. of Panel units: 14 Regressors: 4

No. of obs.: 433 Avg obs. per unit: 31

Data has been time-demeaned.

Test	Panel	Group
V	0.3524	.
Rho	-0.9398	0.2701
T	-4.214	-4.502
Adf	-4.476	-2.953

Source: Authors' computation, 2022

4.6. Results

Our next task is to select which of the two (Pooled Mean Group -PMG and Dynamic Fixed Effects - DFE) models are suitable for our data. [For some reason, our data could not be accepted in running the MG model.] So we used the Hausman test (whose results of $\text{Chi}^2 = 117.23$; $\text{Prob} > \text{chi}^2 = 0.0000$) led us to choose DFE as our most efficient estimator.

Our estimated model is displayed in Table 4 below, showing that land, rural population, and per capita agricultural income growth have long-run and significant (at 1% level) causal effects on the magnitude of agricultural value added as a percentage of GDP. In contrast, the causal effect of private credit is not significant. As for the short run, only land and rural population have a significant (at 1% level) causal impact on the magnitude of agricultural value added as a percentage of GDP, whereas the causal effect of private and growth of per capita agricultural income is insignificant. As for the error correction (EC) term, all variables have a significant joint causality in the long term. The adjustment speed of -0.33 has the correct sign and shows co-integration among the variables in the panel of data from 14 countries in Sub-Saharan Africa; ad is significant at a 1% level. Any deviations from the long-run equilibrium are corrected at 33.0% (adjustment speed) per year. We want

to note that Table 4 provides a general picture of the 14 countries. The top panel applies to every country, even at an individual level. The bottom panel is a summary of all countries. However, it will differ from country to country; estimates can be made available upon request.

Table 4: Regression results

		Coefficient	St.err.
__ec	creditus D1.	-0.0000000000292	(8.16E-12)
	land	-0.0000128***	(4.27E-07)
	ruralpop	-0.0000122***	(1.98E-07)
	agrddppc	22.99354**	(9.437475)
SR	__ec	-0.3301852***	(0.0332125)
	credit D1.	0.0000000000306	(2.70E-11)
	land D1.	-0.00000208***	(3.51E-08)
	ruralpop D1	0.00000324***	(9.87E-08)
	agrddppc D1	2.748658	(1.866391)
	_cons	21.37331***	(96.141392)

Source: Authors' computation, 2022

Note: ***, **, implies significant at 1% and 5% level; figures in parentheses are standard errors

5. Conclusion.

We use the ARDL method to find the impact of institutional financial quality on agriculture sector growth in 14 Sub-Saharan African countries from 1990 to 2020. Nkoro & Uko (2016) have shown that the ARDL technique frees variables from residual correlation as all variables are assumed to be endogenous. Their model distinguished dependent and explanatory variables in any long-run relationship and identified the co-integrating vectors with multiple co-integrating vectors. Our results show that land, rural population, and per capita agricultural income growth have long-run and significant (at 1% level) causal effects on the magnitude of agricultural value added as a percentage of GDP. In contrast, the causal effect of private credit is not significant. As for the short run, only land and rural population have a significant (at 1% level) causal impact on the magnitude of agricultural value added as a

percentage of GDP, whereas the causal effect of private and growth of per capita agricultural income is insignificant. As for the error correction (EC) term, all variables have a significant joint causality in the long term.

We contend that domestic credit to the private sector (% of GDP), as a measure of financial efficiency and development, shows the ability of banks to transform their mobilized deposits into productive credits and, therefore, enhances growth in agriculture. The process would allow countries at the lower end of growth in agriculture to have easier access to credit to fund investments more efficiently, thus increasing growth.

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