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Ekpeyong, Paul and Adewoyin, David

University of Ibadan

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FINANCIAL DEVELOPMENT, TAXATION AND ECONOMIC GROWTH IN SUB SAHARAN AFRICA

PAUL EKPEYONG[a]   DAVID ADEWOYIN[b]

[a]Graduate, University of Ibadan (gekpeyong036@stu.ui.edu.ng)
[b]University of Ibadan (Davidadewoyin@aol.com)

This study investigates the correlation between tax policies, financial development, and economic growth in Sub-Saharan Africa. The research sample comprises 12 countries from West Africa, Southern Africa, and East Africa, spanning the years 2000 to 2019. The selected countries include Nigeria, Senegal, Mali, Benin, Burkina Faso, Cameroon, Cape Verde, Ghana, South Africa, Namibia, Lesotho, Kenya, and Tanzania. To analyze the data, the study utilizes the pooled mean group (PMG) or mean group auto-regressive distributed lag (MG-ARDL) estimation method. The findings indicate that private sector credit to GDP and foreign direct investment significantly drive economic growth, while the variables of liquidity, inflation, population, and taxes do not exert a significant impact on economic growth. Moreover, the effectiveness of these policies varies across countries, suggesting that some nations benefit more from tax policies, while others benefit more from financial development. It should be noted that the variations in economic structures and institutional frameworks among the countries in the panel data may influence the relationship between the variables. Based on the study's results, policymakers should prioritize a set of policies to promote economic growth in Sub-Saharan Africa. These policies include measures to enhance financial development, improve taxation policies, foster public investment, address macroeconomic imbalances, strengthen institutional quality, and promote regional integration. The effective implementation and ongoing monitoring of these policies are crucial for achieving the desired impact and sustainable development in the region.

1. INTRODUCTION

The relationship between finance and economic growth in Sub-Saharan Africa has been a topic of considerable debate with no clear consensus. While some studies, such as those by Atindehou et al. (2005), Ghirmay (2004), and Agbetsiafe (2004), have examined this connection, there remains limited research specifically focused on the relationship between taxes and economic growth in the region. Recent studies by Odhiambo (2007) and Anthony et al. (2010) have explored this relationship in Africa, while studies by Andre (2007), the OECD (2009), and Chudik et al. (2015) have also contributed to the discussion.

Understanding the link between finance and growth is crucial for determining the appropriate strategies for economic development. The literature on economic development consistently highlights the strong correlation between finance and economic growth. However, empirical studies on the causal relationship between finance and economic growth have yielded ambiguous and inconsistent findings. Recognizing the significant contribution of the financial sector to economic growth, Schumpeter (1911) emphasized how a well-developed financial system facilitates growth by reallocating resources to more productive areas and fostering technological advancements.

In Sub-Saharan Africa, taxes are often viewed as hindering growth. Tax laws frequently fail to consider the unique characteristics of taxpayers and the limited administrative resources of countries in the region. Consequently, governments in the area have initiated reforms aimed at reducing the burden of tax systems

on economic progress. These reforms aim to create a tax environment that supports labor, entrepreneurship, investment, and savings. The objective is to redefine tax systems to minimize the adverse effects on growth while maintaining fiscal revenues, rather than simply reducing the overall tax burden. However, the success of these reforms in expanding the domestic revenue base has been mixed, despite reductions in tax and tariff rates.

The impact of tax policies on economic growth continues to be a subject of empirical discussion, particularly in emerging nations. Taxes serve as a tool for fiscal policy, influencing various aspects of economic progress. Tosun and Abizadeh (2005) identified five potential ways in which taxes can affect economic growth. Firstly, taxes such as corporate and personal income taxes and capital gains taxes can reduce investment rates. Secondly, taxes may discourage labor force expansion by favoring leisure over work. Thirdly, tax policies can hinder productivity growth by discouraging investment in research and development (R&D). Fourthly, taxes may cause resources to shift to less productive industries, following a Harbinger paradigm. Finally, excessive tax burdens can impede the efficient utilization of human resources, even when they have high social output.

The interplay between financial development, taxation, and economic growth holds significance, particularly in the context of Sub-Saharan Africa. While several studies have examined this relationship, many countries in the region still face challenges that impede their ability to achieve sustained economic growth. Weak institutional and regulatory frameworks, governance issues, low financial literacy levels, and a large informal sector are among the obstacles to financial development in Sub-Saharan Africa. Moreover, the effectiveness of taxation policies in promoting economic growth is a growing concern. Taxes play a crucial role in generating government revenue for financing public goods and services. However, inconsistent and opaque taxation policies can distort incentives, discourage entrepreneurship and investment, and erode trust in the tax system.

The existing research on the relationship between financial development, taxation, and economic growth in Sub-Saharan Africa has produced inconclusive or mixed results. Some studies find a positive relationship between financial development and economic growth in the region, while others observe negative or insignificant connections. Further research is needed to gain a comprehensive understanding of this relationship and to identify effective policy interventions that can promote sustainable economic growth in Sub-Saharan Africa.

2. BRIEF LITERATURE REVIEW

In recent years, there has been a substantial body of research examining the connection between financial development, taxation, and economic growth in Sub-Saharan Africa. Several studies have utilized different econometric approaches and datasets to explore this relationship. For example, Olorunfemi et al. (2020) employed the autoregressive distributed lag (ARDL) approach and found a positive and significant impact of financial development on economic growth in the region. Akinwale et al. (2020) used panel data analysis and discovered a positive and significant effect of financial development on economic growth, while taxation had a negative but insignificant impact.

Other studies have also contributed to this research area. Ogunbiyi et al. (2021) utilized the system generalized method of moments (GMM) and found a negative and significant impact of taxation on economic growth in Sub-Saharan Africa. Fashina et al. (2020) employed the dynamic panel threshold model and found that corruption had a negative effect on the relationship between tax revenue and economic growth in the region. Abiola et al. (2020) used panel data analysis and found a positive and significant impact of access to credit on economic growth in Sub-Saharan Africa. Kola-Olusanya et al. (2020) also

employed panel data analysis and found that reducing corporate taxes had a positive and significant effect on economic growth.

These studies relied on data from various sources, including the World Bank's World Development Indicators, the International Monetary Fund's International Financial Statistics, national statistics agencies, and central banks within the region. The sample sizes in these studies ranged from 21 to 49 Sub-Saharan African countries. To address econometric challenges, researchers employed robust methodologies such as panel data analysis, dynamic panel models, threshold models, and GMM estimation techniques, which allowed for controlling unobserved heterogeneity and examining long-run relationships.

Although the methodological approaches used were generally appropriate, some studies did not fully account for additional factors like political instability, institutional quality, and trade openness, which could also influence economic growth in the region. Future research should consider these factors to enhance the comprehensive understanding of the relationship between financial development, taxation, and economic growth in Sub-Saharan Africa. Additionally, investigating the causal relationships between these variables is crucial, as the findings from the reviewed studies may be susceptible to endogeneity bias.

Panel 1: Financial development and economic growth overview of 10 different literature

Author	Country/Region	Methodology	Main finding
Fry (2020)	14 Asian developing countries	parametric and nonparametric estimation techniques	Positive impact
Ikhide (2021)	Selected African countries	Panel regression	Positive impact
Seck (2021)	30 African countries	Multivariate panel regression technique	Positive impact
Luintel and Khan (1999	90 countries	Multivariate Vector Auto Regressive model	double-causality link between the variables of each country
Beck et al. (2020)	74 developed and developingcountries	transversal analysis, Generalized Method of Moments (GMMs)	Positive impact
Beck and Levine (2022)	40 countries	Generalized Method of Moments (GMMs)	Positive impact
Huran and Chun (2020)	89 countries (INDs, EMEs, ODCs	Bayesian dynamic factor model	-Positive impact (INDs,EMEs) -No Impact (ODCs)
Kar and Pentecost (2020)	Turkey	Granger causality, Co-integration, Vector Error Correction Model(VECM)	Unidirectional causality(Economic growth to financial development)

Güryay et al. (2021)	Northern Cyprus	Ordinary Least Squares techniques	Positive impact
Adusei (2021)	ModifiedOrdinary Least Squares) Error correction GMM	Cointergration FMOLS(Fully- FMOLS(Fully-ModifiedOrdinary Least Squares) Error correction GMM	-negative impact: Financial development undermines economic growth (Financial development is an anti-growthfactor)

Source: Authors

3 TREND ANALYSIS OF FINANCIAL DEVELOPMENT IN SUB-SAHARAN AFRICA

Figure 2: Domestic credit to the private sector (% of GDP) from 1985-2017
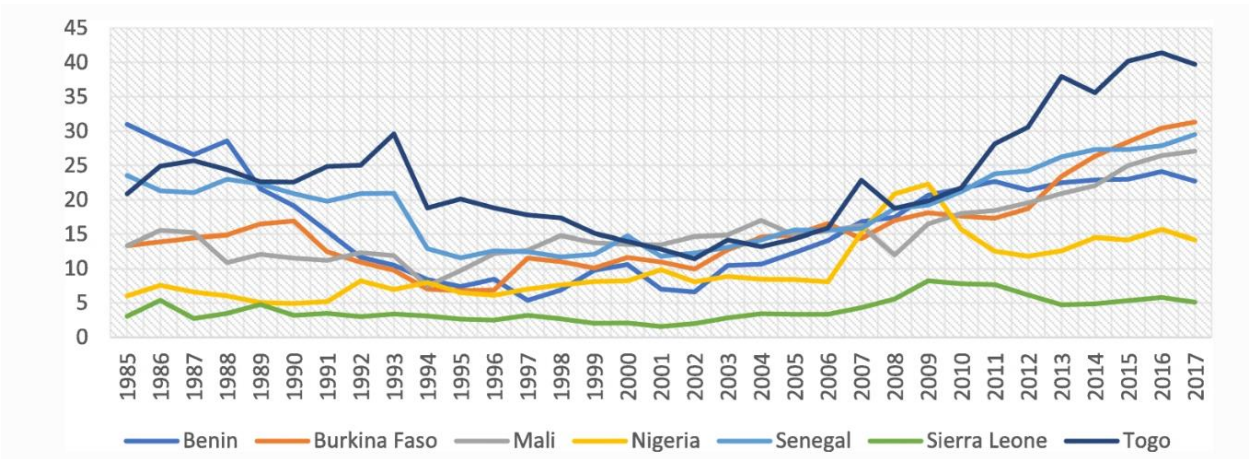
Source: Author Compilation, WDI

The growth of domestic credit to the private sector was below 5% of the gross domestic product in Sudan, between 1995 to 2003 but it has been on an upward trend to around 10% to 15% till 2006 and has been below 15% till 2011. Cameroun level of financial development has been between 5% and 10% from 1995 till 2008 but had a little upward movement of around 12% till 2011. Botswana has registered a good and relative development in domestic credit to the private sector from 1995 till 2011, the growth has been consistently increasing from 1995 from a level of 11% to 24% of GDP in 2011. Burundi has experienced a great level of turbulence in the financial sector which is seen in the unstable movement from 1995 till 2011. Even though the Central African Republic has been on the increase the percentage has been below 10% but it experiences its highest development of 10% in 2011.

The Congo Republic has a drastic fall in the percentage of domestic credit private sector in 1999 from 15% to 10% and remain constant till 2008 but an upward flow to 13% till 2011. Also, Chad's development in the financial sector was unstable between 1999 and 2002 as the percentage is around 15% and 10%, between 2003 and 2007 it has a stable level of development of 10%. Gabon recorded a high percentage of domestic credit to the private sector of GDP from 1995 till 2011, it only show a slight downfall in 1999.

The financial development growth of Gambia and Kenya has been at a constant rate even though there is poor growth of the indices in Gambia Kenya has a considerable percentage of 40% growth but countries like Lesotho, Madagascar, and Malawi have a high percentage of domestic credit to the private sector.

4. MODEL AND METHODOLOGY

This study focused on a sample of 12 Sub-Saharan African countries from West Africa, South Africa, and East Africa, covering the period from 2000 to 2019. The selection of countries was based on their high levels of financial inclusion and remittances during the chosen period. The West African countries included Nigeria, Senegal, Mali, Benin, Burkina Faso, Cameroon, Cape Verde, and Ghana. South Africa, Namibia, and Lesotho represented Southern Africa, while Kenya and Tanzania represented East Africa. The decision to select these countries was influenced by factors such as their financial development indicators and the significant inflow of remittances.

The study period from 2000 to 2015 was chosen due to a remarkable increase in the number of emigrants and remittances received during that time. For example, it was reported that between 2000 and 2015, there was an annual average of 4.65 million migrants compared to 2.0 million migrants from 1990 to 2000 (International Migration Report, 2015). Lesotho stood out with the highest average annual remittances as a percentage of GDP between 2000 and 2013, reaching 41.3% (World Development Indicators, 2015).

In addition to remittances, the study included other variables commonly found in growth literature, such as direct and indirect taxes, inflation rate, population growth, broad money supply, and foreign direct investment (FDI) as a percentage of GDP. These variables were chosen based on their availability in the data for the selected countries. Variables like remittances and money supply were scaled by GDP to account for relative economic differences among the countries.

The theoretical and empirical perspectives on remittances and their impact on economic growth have been mixed. Some studies, including Chami et al. (2003), Karagoz (2009), and Kumar (2012), found negative effects of remittances on growth, suggesting that constant inflows of remittances discourage domestic work efforts. However, other studies such as Faini (2005), Azam and Khan (2011), Kumar and Vu (2014), and Karikari et al. (2016) found positive effects of remittances on growth through productive investments. Financial development is expected to have a positive impact on growth, as it positively affects the overall economy. Trade openness can have either positive or negative effects on economic growth, depending on the countries' ability to contribute and benefit from the global market. Direct and indirect taxes are expected to have a positive impact on growth if the revenue is invested in increasing productive capacity. On the other hand, population growth and inflation rate are expected to negatively affect economic growth. FDI can promote domestic growth through technology transfer but can also create competition and crowd out domestic investors.

The study employed the pooled mean group (PMG) or mean group-autoregressive distributive lag (MG-ARDL) method for estimation. The PMG estimator, proposed by Pesaran et al. (1999), involves pooling and averaging the coefficients over the cross-sectional units, while the MG approach estimates each unit separately and averages the coefficients. The ARDL model was chosen due to its suitability for the dataset, as it can accommodate variables with different stationarity properties (I(0) and I(1), but not I(2) as in this study) and is applicable to studies with small sample sizes. With 13 cross-sections and a 19-year time series, the study's dataset was relatively small for panel studies but could be adequately addressed using the ARDL model. Importantly, the ARDL model captures both the short-run and long-run dynamics of the variables of interest. Therefore, both the PMG and the MG estimations are carried out in this study. Eq. (11) can be written in panel ARDL form of Pesaran and Smith (1999) as:

$$\Delta Y_{it} = \beta_0 + \Phi Y_{t-1} + \sum_{t=1}^{P} \alpha_b \Delta Y + \sum_{t=1}^{P} \lambda_b \Delta MS + \sum_{t=1}^{P} \kappa_b \Delta PRIVATE + \sum_{t=1}^{P} \eta_b LIQ\_LIA + \sum_{t=1}^{P} \Omega_b TAX$$

$$+ \sum_{t=1}^{P} \epsilon_b FDI + \sum_{t=1}^{P} f_b INF + \sum_{t=1}^{P} \Im_b POP + \mu_1 MS + \mu_2 PRIVATE + \mu_3 LIQ\_LIA + \mu_4 TAX + \mu_5 FDI + \mu_6 INF + \mu_7 POP + \xi_t$$

Where β_0 is the coefficient of the past lagged value of the dependent variable, α_b λ_b κ_b η_b Ω_b ϵ_b and f_b are the short run coefficients while μ_1 to μ_7 indicate the long run coefficients On the other hand, the MG estimator can be written following Pesaran and Shin (1995) as:

$$MG = N^{-1} \sum_{i=1}^{N} \overline{\beta_i}$$

eqn (1.4)

Where MG and βi in Eq.(1.4) imply mean group and the coefficient estimates

5. EMPIRICAL RESULT AND DISCUSSION

This section focuses on the empirical analysis of the study. It provides answer to the objective posed by the study. In this regard, the chapter will consider the relationship between financial development, taxation and economic growth in sub-Sahara Africa.

It is imperative to check the descriptive statistics before analyzing the data series in order to observe the variability and distribution of the variables as shown in Table 1. After which Table 2 also shows the correlation matrix of the variables.

Table 1: Descriptive statistics

	GDPGR	MS	PRIVATE	LIQ_LIA	FDI	INF	POP	TAX
Mean	4.28	35.40	7.55	3.87	2.880	5.259	2.257	14.44
Std.dev	3.34	21.47	8.12	4.04	2.540	6.108	0.874	7.013
Minimum	-14.78	11.3	-25.52	-12.5	-1.42	-9.62	-0.4	0.14
Maximum	15.38	125.3	65.05	35.21	12.67	41.51	3.48	49.63
Variance	11.19	461.15	34.30	23.22	6.42	37.32	0.76	49.18
Skewness	-0.75	1.52	1.34	1.35	1.31	2.49	-0.92	1.02
Kurtosis	9.08	4.86	5.34	3.22	4.63	13.40	2.84	7.16
Obs.	252	252	252	252	252	252	252	252
Prob	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

GDPGR, MS, PRIVATE, LIQ_LIA FDI, INF, POP and Dit represent economic growth, broad money supply, Private sector credit, Total liquid liabilities, foreign direct investment, inflation, population growth and tax to GDP percentage respectively

The given descriptive statistics table provides information about various economic variables in a dataset, including GDP growth rate, money supply, private sector credit, total liquid liabilities, FDI, inflation, population, and tax. Each variable is described using measures such as mean, standard deviation, minimum, maximum, variance, skewness, kurtosis, number of observations, and probability.

The GDP growth rate measures the change in the value of goods and services produced by a country over a specific period. In this dataset, the mean GDP growth rate is 4.28, with a standard deviation of 3.34. The minimum and maximum values are -14.78 and 15.38, respectively. The negative skewness (-0.75) indicates a slight leftward skew, suggesting that there may be more observations with lower GDP growth rates. The positive kurtosis (9.08) implies heavy tails and a more peaked distribution than a normal distribution. Money supply refers to the total amount of money circulating in an economy. The mean money supply is 35.40, with a standard deviation of 21.47. The minimum and maximum values are 11.3 and 125.3, respectively. The positive skewness (1.52) suggests a rightward skew, indicating more observations with higher money supply values. The positive kurtosis (4.86) implies heavy tails and a more peaked distribution.

Private sector credit represents the credit extended to the private sector by banks and financial institutions. The mean private sector credit is 7.55, with a standard deviation of 8.12. The minimum and maximum values are -25.52 and 65.05, respectively. The positive skewness (1.34) suggests a rightward skew, indicating more observations with higher private sector credit values. The positive kurtosis (5.34) implies heavy tails and a more peaked distribution. Total liquid liabilities represent short-term debt and obligations owed by companies or governments. The mean total liquid liabilities are 3.87, with a standard deviation of 4.04. The minimum and maximum values are -12.5 and 35.21, respectively. The positive skewness (1.35) suggests a rightward skew, indicating more observations with higher total liquid liabilities. The positive kurtosis (3.22) implies heavy tails and a more peaked distribution.

FDI (foreign direct investment) represents the total investment made by foreign entities in an economy. The mean FDI is 2.880, with a standard deviation of 2.540. The minimum and maximum values are -1.42 and 12.67, respectively. The positive skewness (1.31) suggests a rightward skew, indicating more observations with higher FDI values. The positive kurtosis (4.63) implies heavy tails.Inflation measures the rate at which the overall price level in an economy is increasing. The mean inflation rate is 5.259, with a standard deviation of 6.108. The minimum and maximum values are -9.62 and 41.51, respectively. The positive skewness (2.49) indicates a heavily right-skewed distribution, suggesting a significant number of observations with higher inflation rates. The positive kurtosis (13.40) implies heavy tails and a highly peaked distribution. Population represents the total number of people living in a specific area or country. The mean population is 2.257, with a standard deviation of 0.874. The minimum and maximum values are -0.4 and 3.48, respectively. The negative skewness (-0.92) suggests a leftward skew, indicating more observations with lower population values. The positive kurtosis (2.84) implies a more peaked distribution.

Lastly, tax represents the amount of taxes collected by a government from individuals and businesses. The mean tax is 14.44, with a standard deviation of 7.013. The minimum and maximum values are 0.14 and 49.63, respectively. The positive skewness (1.02) suggests a rightward skew, indicating more observations with higher tax values. The positive kurtosis (7.16) implies heavy tails and a more peaked distribution. These descriptive statistics provide an initial overview of the distribution of economic variables in the dataset. It is important to consider the context and factors that influence these variables. For instance, high inflation rates may indicate an overheated economy, while high taxes may affect economic growth and investment. Population can be influenced by migration patterns, birth rates, and mortality rates.

However, it's crucial to note that these statistics alone do not provide a complete understanding of the dataset. They should be interpreted alongside other contextual information and analytical tools.

Table 2: Correlation matrix of the selected variables

	GDPGR	MS	PRIVATE	LIQUID	FDI	INF	POP	TAX
GDPGR	1.0000							

MS	-0.2838	1.0000						
PRIVATE	0.1911	-0.0638	1.0000					
LIQUID	0.0218	0.1636	-0.0959	1.0000				
FDI	0.1959	0.3877	0.0459	0.1012	1.0000			
INF	0.0515	-0.1584	0.0166	-0.0419	0.0836	1.0000		
POP	0.2702	-0.6288	0.0148	0.0299	-0.2931	-0.0429	1.0000	
TAX	0.2725	-0.2635	-0.0157	-0.1576	-0.0615	0.0339	0.2279	1.0000

Author's derivation from STATA result

The correlation matrix reveals the pairwise correlations between various economic variables, including GDP growth rate, money supply, private sector credit, total liquid liabilities, FDI, inflation rate, population, and tax. Positive correlations indicate a positive relationship, while negative correlations suggest an inverse relationship. However, it's important to remember that correlation does not imply causation. The GDP growth rate shows weak positive correlations with population and tax, implying that higher population and taxes may be associated with higher GDP growth. However, these correlations are not very strong. Interestingly, GDP growth rate has a negative correlation with money supply, suggesting that an increase in money supply may lead to a decrease in GDP growth.

The money supply exhibits a negative correlation with private sector credit and inflation rate. This implies that as private sector credit increases, the money supply may decrease, and as the money supply increases, the inflation rate may decrease. Private sector credit shows a negative correlation with total liquid liabilities, indicating that as private sector credit increases, the total liquid liabilities may decrease due to collateral requirements for loans. FDI has a weak positive correlation with GDP growth rate, suggesting that as FDI increases, GDP growth rate may also increase. However, other factors may also influence economic growth. The inflation rate has a weak negative correlation with population, indicating that as the population increases, the inflation rate may decrease. On the other hand, there is a weak positive correlation between the inflation rate and tax, suggesting that higher taxes may lead to increased inflation.

Overall, the correlation matrix highlights complex relationships between the variables. It serves as a starting point for understanding the potential impacts of these variables on economic growth. However, further analysis is necessary to determine the nature and causality of these relationships.

Table 3: Panel unit Root Results with individual intercept

Variable	Level	LLC	P-v	IPS	P-v	ADF	P-v	PP	P-v	Status
GDPGR	0	-7.09	0.00***	-2.15	0.02**	57.28	0.04**	67.37	0.00***	1(0)
MS	0	-5.96	0.00***	-0.82	0.2	52.07	0.1	74.7	0.00***	
	1	-10.7	0.00***	-8.18	0.00***	135.1	0.00***	147.1	0.00***	1(1)
PRIVATE	0	-4.54	0.00***	-3.25	0.03**	72.45	0.02	46.54	0.00	1(0)
LIQ_LIA	0	-12.3	0.00	-12.43	0.62	65.34	0.23	52.65	0.16	
	1	-16.2	0.00***	-14.23	0.00***	24.2	0.00***	82.23	0.00***	1(1)
INF	0	-2.89	0.00***	0.08	0.53	50.36	0.12	47.47	0.19	
	1	−13.5	0.00***	−11.84	0.00***	191.8	0.00***	241.9	0.00***	1(1)
FDI	0	−3.48	0.00***	−1.56	0.06*	55.39	0.05*	52.61	0.09	1(0)
POP	0	27.45	1.00	2.72	0.1	98.39	0.00***	69.68	0.00**	
	1	96.77	0.00***	−3.92	0.00***	107.5	0.00***	87.02)	0.00***	I(1)
TAX	0	−3.78	0.00***	−3.46	0.00***	78.56)	0.00***	104.99	0.00***	I(0)

***, **, and * indicate significance at 0.01%, 0.05%, and 0.10%.; P-v indicates probability value. All the variables are expressed in log form except inflation and population growth that are already in rates.

Before proceeding with the inferential estimation of the variables, it was necessary to examine their time series properties. This step aimed to ensure the appropriate application of the panel autoregressive distributed lag (ARDL) model, which is suitable for variables that are purely integrated of order zero (I(0)) or purely integrated of order one (I(1)), but not for variables integrated of order two (I(2)) (Pesaran, Shin, and Smith, 2001). To assess the stationarity properties of the variables, panel unit root tests were conducted, including the Levin, Lin, and Chu (LLC, 2002), Im, Pesaran, and Shin (IPS, 2003), Augmented Dickey Fuller (ADF, 1979), and Phillips-Perron (PP, 1988) tests. The results, as shown in Table 3, indicate that variables such as GDP, foreign direct investment, taxation, and private sector credit are stationary at levels, indicating they are I(0) variables according to the LLC, IPS, ADF, and PP panel unit root tests.However, variables such as money supply and total liquid liabilities as a share of GDP exhibit mixed results. While they are stationary at levels based on the LLC and PP tests, the IPS and ADF tests suggest non-stationarity at the level form. Consequently, these variables are differenced once to achieve first-difference stationarity. Similar differentiating is applied to the inflation variable. Regarding population growth, it is stationary at levels according to the ADF and PP tests but requires differencing once to achieve first-difference stationarity. After the first difference, it becomes stationary based on three out of the four panel tests. Therefore, variables such as inflation, financial development, and population growth follow an integrated of order one (I(1)) process, while GDP, foreign direct investment, and taxation are integrated of order zero (I(0)).

These unit root test results indicate that the variables exhibit mixed stationarity properties, with a combination of I(0) and I(1) processes, making them suitable for the pooled mean group/autoregressive distributed lag (PMG/ARDL) model.

Table 4: Pedroni Co-integration Test

Test	Statistics	Prob
Modified Phillip perron	3.1748	0.0007
Phillips perron	-7.2735	0.0000***
Panel ADF stat	-5.8468	0.0000***

*and*** signifies 10% and 1% significance level

The Pedroni test for panel co-integration is a statistical test used to determine if a set of variables are co-integrated. Cointegration is the long-term relationship between two or more variables, and it indicates that they move together in the long run. The Pedroni test is commonly used when there are panel data, which is data that contains multiple observations for each unit or entity in the sample. The null hypothesis of the Pedroni test is that there is no co-integration between the variables, and the alternative hypothesis is that all the panels are co-integrated. In this case, the test was conducted for a panel of 12, and the number of periods was 20. The test used a kernel of Bartlett, and a lag of 2.00 (Newey-West) was applied. The AR parameter was panel-specific, and the augmented lags were 1. The results of the Pedroni test show that the statistics for the modified Phillips-Perron t, the Phillips-Perron t, and the augmented Dickey-Fuller t are 3.1748, -7.2735, and -5.8468, respectively. The p-values for these statistics are 0.0007, 0.0000, and 0.0000, respectively.

These results suggest that there is evidence of co-integration between the variables. The null hypothesis of no co-integration can be rejected in favor of the alternative hypothesis that all the panels are co-integrated. This means that there is a long-term relationship between the variables that persists over time.

In conclusion, the Pedroni test for panel co-integration provides evidence that the set of variables in this study are co-integrated. This suggests that the variables move together in the long run and that they are influenced by similar underlying factors. The results of this test provide support for further analysis of the relationship between these variables and can be used to inform future modeling and forecasting efforts.

Table 5: Kao Co-integration test

Test	Statistics	Prob
Modified Dickey fuller T	-7.6431	0.000*
Dickey fuller T	-7.1795	0.0000***
Augmented Dickey F stat	-3.3979	0.0001***
Unadjusted modified dickey fuller	-14.3448	0.0000***
Unadjusted dickey fuller	-8.7400	0.0000***

*and*** signifies 10% and 1% significance level

The Kao test for co-integration is a panel unit root test used to assess whether there exists a long-term relationship among the variables in a panel dataset. Its purpose is to determine if the variables are co-integrated, meaning they move together in the long run. The null hypothesis of the test assumes no co-integration, indicating no long-term relationship among the variables, while the alternative hypothesis suggests that all panels in the dataset are co-integrated, indicating a long-term relationship among the variables. The Kao test conducts various unit root tests, including the Modified Dickey-Fuller, Dickey-Fuller, Augmented Dickey-Fuller, Unadjusted Modified Dickey-Fuller, and Unadjusted Dickey-Fuller tests. Each test produces a statistic and a corresponding p-value. In this case, the Kao test statistics are all statistically significant, with p-values of 0.0000. This strong evidence leads to the rejection of the null hypothesis and acceptance of the alternative hypothesis, indicating that all panels in the dataset are co-integrated. Therefore, the variables exhibit a long-term relationship, suggesting that changes in one variable are likely to impact the other variables in the panel dataset over time.

It's important to note that the co-integration test does not provide information on the direction or causality of the relationship between the variables. Further analysis would be necessary to explore the specific nature of the relationship and the underlying factors that drive the co-integration.

Table 5: Cross sectional dependence test (Average correlation coefficients & Pesaran (2004) CD test)

Variable	CD-test	p-value	Corr	Abs(corr)
MS	19.19	0.000	0.515	0.650
PRIVATE	3.96	0.000	0.106	0.230
LIQ_LIA	0.93	0.351	0.025	0.337

FDI	1.89	0.059	0.051	0.234
INF	9.16	0.000	0.246	0.306
TAX	3.33	0.001	0.090	0.305

The Pesaran CD test was conducted to assess cross-sectional dependence among the variables in the panel data analysis. The test results indicate that several variables exhibit significant cross-sectional dependence. The variable "MS" shows strong evidence of cross-sectional dependence, with a high CD test statistic and a very low p-value. It also has a moderate positive correlation with the other variables, suggesting some degree of interdependency. There may be multi-collinearity concerns with this variable.

Similarly, the variable "private" also exhibits significant cross-sectional dependence, as indicated by its CD test statistic and p-value. However, its average correlation coefficient is relatively low compared to other variables, indicating a weaker relationship with the other variables. Multi-collinearity issues are less of a concern for this variable. On the other hand, the variable "liquid" does not show evidence of cross-sectional dependence, as its CD test statistic and p-value do not reach significance. It has a very low average correlation coefficient and no multi-collinearity concerns.

The variable "FDI" shows some evidence of cross-sectional dependence, but to a lesser extent compared to "MS" and "PRIVATE." Its average correlation coefficient is relatively low, suggesting a weaker relationship with the other variables. However, there may still be some multi-collinearity issues with this variable. The variable "INF" exhibits strong evidence of cross-sectional dependence, with a high CD test statistic and a very low p-value. It has a moderate positive correlation with the other variables, and there may be multi-collinearity concerns as well. Lastly, the variable "tax" also demonstrates significant cross-sectional dependence, as indicated by its CD test statistic and p-value. Its average correlation coefficient is relatively low, suggesting a weaker relationship with the other variables. Multi-collinearity concerns are less prominent for this variable.

In summary, the CD test results highlight the presence of cross-sectional dependence among several variables, such as "MS," "PRIVATE," "FDI," "INF," and "TAX." This indicates that the assumption of cross-sectional independence may not hold, necessitating the use of appropriate statistical techniques to account for this dependence in panel data models. It is important to address cross-sectional dependence to ensure reliable and accurate results in the analysis.

Table 6: Residual Panel unit Root test

Unit root test	Statistics	Prob.	Cross section
Levin Lin and Chu	1.2102	0.1131	12
Harris Travails	0.0565	0.0000***	12
ADF fisher chi square	-6.7540	0.0000***	12
IPS unit root	6.1653	0.0000***	12

*and*** signifies 10% and 1% significance level

The cross-sectional dependence test conducted in Table 5 indicates that the presence of cross-sectional dependence in the data cannot be rejected at a 0.01% level of significance. This suggests that there is indeed cross-sectional dependence among the variables in our dataset. To ensure unbiased estimates in our analysis, we performed a diagnostic test by applying panel unit root tests to the residual estimates, taking into account the presence of cross-sectional dependence (Pesaran, 2007).The results of the panel unit root

tests on the residuals, as shown in Table 6, reveal that the residuals are stationary at the level, indicating an I(0) process. The stationarity of the residuals confirms the validity of the estimates obtained from the MG and PMG ARDL panel models.

In summary, the diagnostic test incorporating panel unit root tests on the residuals demonstrates that the residuals follow a stationary process at the level, providing support for the accuracy of the MG and PMG ARDL panel estimates..

Table 7: The short run and long run pooled mean group/ARDL result

Dependent variable: GDPGR	PMG/ARDL (1,1,1,1,1,1,1)			
variable	Coeff.	St. Err	z-test	p-value
d(ms-1)	-0.009321	0.0202906	-0.46	0.007***
D(Private)	0.1216828	0.280473	4.34	0.000
D(Liquid)	0.2513994	0.0722643	3.48	0.001**
d(fdi-1)	0.3522233	0.0900931	3.91	0.00***
d(inf-1)	-0.0001022	.0555538	-0.68	0.00
d(pop-1)	-2.087622	.4569674	-4.57	0.000 ***
d(tax-1)	0.0689898	0.0233106	2.96	0.003***
d(ecm -1)	-0.9190435	0.1154535	-7.96	0.00***
MS	-0.1587124	0.1301851	-1.22	0.048**
Private	-0.0394918	0.0493038	-0.80	0.423
Liquid	0.02958	0.4059883	0.07	0.942
fdi	-0.13632	0.19796	-0.69	0.009***
inf	-0.03342	0.062501	-0.53	0.593
pop	1.082941	4.440584	0.24	0.807
Tax	-0.11181	0.105296	-1.06	0.008***
constant	5.018463	0.73069	6.87	0.00***

The PMG ARDL model was employed to analyze the long-run and short-run effects of various independent variables on the GDP growth rate. The model includes variables such as private sector credit, total liquid liabilities, foreign direct investment, inflation rate, population growth rate, and tax revenue as a percentage of GDP.

The results of the model indicate that private sector credit and total liquid liabilities have positive and statistically significant effects on GDP growth rate. An increase in private sector credit as a percentage of GDP leads to a corresponding increase in economic growth, suggesting that policies promoting credit access and financial intermediation can stimulate economic expansion. Similarly, an increase in total liquid liabilities as a share of GDP is associated with higher economic growth, emphasizing the importance of a well-functioning financial system and sufficient liquidity provision.

Foreign direct investment also exhibits a positive and significant impact on GDP growth rate. This finding suggests that policies encouraging foreign investment can contribute to economic growth. On the other hand, the money supply as a percentage of GDP does not show a direct relationship with economic growth in the short run, although further research is needed to ascertain the precise nature of this association. The inflation rate and population growth rate have negative coefficients, although the inflation rate is not statistically significant. This suggests that higher inflation rates and population growth rates tend to have

adverse effects on GDP growth. Policymakers may consider implementing measures to control inflation and manage population growth to support economic growth.

Additionally, tax revenue as a percentage of GDP has a positive and significant effect on GDP growth rate. An increase in tax revenue is associated with higher economic growth, potentially indicating that well-managed taxation policies can contribute to economic expansion. The PMG ARDL model also includes an error correction term (ECM), which captures the speed of adjustment towards the long-run equilibrium relationship. The negative and statistically significant ECM coefficient suggests a well-functioning adjustment mechanism. Deviations from the long-run equilibrium are corrected relatively quickly, with positive shocks to the error term leading to a reduction in economic growth and negative shocks resulting in an increase in growth as the model adjusts towards equilibrium.

In summary, the PMG ARDL model reveals that private sector credit, total liquid liabilities, foreign direct investment, and tax revenue have significant long-run effects on GDP growth rate. Private sector credit and total liquid liabilities also demonstrate significant short-run effects. The results highlight the importance of policies promoting credit access, financial stability, liquidity provision, and foreign investment to stimulate economic growth. Additionally, managing inflation, controlling population growth, and implementing effective tax policies can contribute to sustained economic expansion. The model's well-functioning adjustment mechanism further underscores its utility in analyzing the impacts of policy interventions on economic growth.

Table 8; The short run and long run mean group/ARDL result

Dependent variable: GDPGR	co-efficient	Std. Error	Z-test	P-value >z
D(ms-1)	0430185	0.0850828	0.51	0.613
D(private)	0.1319706	0.0922773	1.43	0.153
D(liquid)	0.2891097	0.5839104	0.50	0.621
D(fdi-1)	0.3109885	0.2287364	1.36	0.037**
D(inf-1)	-.1918171	.1220894	-1.57	0.116
D(pop-1)	-3.328802	2.34053	-1.42	0.155
D(Tax-1)	-.1586888	.3767332	-0.42	0.674
D(ecm-1)	-1.129359	.1116169	-10.12	0.000***
MS	-0.1820447	.2070265	-0.88	0.024**
PRIVATE	-0.2367146	0.0876786	-2.70	0.03**
FDI	-.2226348	.1911443	-1.16	0.027**
INF	.0156567	.0527619	0.3	0.767
POP	-2.357193	3.496447	-0.67	0.831
TAX	.0612506	.1983672	0.31	0.023**

*** and ** signify 0.01% and 0.05% level of significance

The mean group ARDL model was used to analyze the relationship between economic growth and various determinants using panel data. The panel data consisted of observations from different countries, and the analysis involved pooling the data together. The objective was to examine the effects of different variables, including private sector credit to GDP, total liquid liabilities as a share of GDP, foreign direct investment, inflation, population, and taxes, on economic growth.

The estimation results of the mean group ARDL model indicate that the error correction term is not statistically significant at a 5% level. This implies that there is no long-run equilibrium relationship among the variables. One possible explanation for this finding is that the panel data includes countries with diverse economic structures and institutional frameworks, which can lead to varying dynamics and relationships among the variables. The results also reveal that private sector credit to GDP and foreign direct investment have a positive and significant impact on economic growth. This suggests that an increase in private sector credit and foreign direct investment can stimulate economic growth. Specifically, a 1% increase in private sector credit to GDP is associated with a 0.13% increase in economic growth, while a 1% increase in foreign direct investment is associated with a 0.31% increase in economic growth.

On the other hand, the coefficient estimate for total liquid liabilities as a share of GDP is positive but not statistically significant. This implies that the liquidity of the banking system may not play a significant role in driving economic growth.

The coefficient estimate for inflation is negative but not statistically significant, indicating that inflation does not have a substantial impact on economic growth in the panel dataset. This could be attributed to the presence of countries with varying inflation levels, which may offset the overall effect on economic growth. Similarly, the coefficient estimate for population is positive but not statistically significant, suggesting that population does not have a significant influence on economic growth. Other factors such as technological advancements and productivity may have a more substantial impact on economic growth than population size.

Furthermore, the coefficient estimate for taxes is positive but not statistically significant, indicating that taxes do not have a significant effect on economic growth. Other factors such as government expenditure and regulatory frameworks may be more influential in driving economic growth than taxes.In the short run, the coefficient estimate for the error correction term is negative and statistically significant. This implies that any deviations from the long-run equilibrium relationship are corrected in the short run, and the economy adjusts back to the long-run equilibrium over time.

In summary, the findings from the mean group ARDL analysis suggest that private sector credit to GDP and foreign direct investment are important drivers of economic growth. However, factors such as liquidity, inflation, population, and taxes do not have a significant impact on economic growth in the panel dataset. It is essential to exercise caution when interpreting these results due to the heterogeneity in economic structures and institutional frameworks across the countries included in the panel data.

6. CONCLUSION

The mean group ARDL estimation conducted on a panel of ten sub-Saharan African countries reveals a mixed relationship between financial development, taxation, and economic growth. The findings indicate that private sector credit to GDP and total liquid liabilities as a share of GDP have a positive impact on economic growth. This suggests that a well-developed financial sector, characterized by increased credit availability and liquidity, can facilitate economic expansion. On the other hand, foreign direct investment and inflation show a negative effect on economic growth. The limited spillover effects of foreign investment and the distortionary impact of inflation on economic decisions may explain these results. However, the relationship between taxation and economic growth is inconclusive, as the coefficient estimate is small and statistically insignificant.

The positive relationship between private sector credit to GDP and economic growth supports the finance-growth hypothesis, indicating that financial development promotes economic growth by enhancing resource allocation efficiency and stimulating investment. Similarly, the positive effect of total liquid liabilities as a

share of GDP suggests the significance of a well-functioning financial system in driving economic activity. The negative impact of foreign direct investment on economic growth may be attributed to limited spillover effects and the potential for resource depletion and environmental degradation associated with certain forms of foreign investment. The negative relationship between inflation and economic growth aligns with the idea that high inflation can distort economic decisions and reduce investment. The lack of a significant relationship between taxation and economic growth implies that governments in sub-Saharan African countries may face challenges in effectively utilizing tax revenue to promote economic growth. Additionally, taxes may reduce incentives for private investment.

Overall, the results highlight the importance of financial development in driving economic growth in sub-Saharan Africa. However, the limited benefits of foreign investment and the potential negative consequences of inflation underscore the need for careful management of these factors. The inconclusive relationship between taxation and economic growth calls for more effective policy interventions that promote private investment and stimulate economic activity.

It is important to acknowledge that these findings are based on a relatively small sample of countries and may not be universally applicable to all sub-Saharan African countries or other regions. Additionally, the analysis has limitations inherent to cross-sectional data analysis, including potential endogeneity and omitted variable bias. Therefore, further research is necessary to validate these findings and explore additional factors influencing the relationship between financial development, taxation, and economic growth in sub-Saharan Africa. Based on these results, several policy recommendations can be made. First, policymakers should prioritize the development of financial systems, with a focus on promoting the growth of the banking sector, leveraging innovative financial technologies, and strengthening financial regulation and inclusion. Second, taxation policies should be improved to ensure efficiency, equity, and transparency. Additionally, tax administration should be strengthened to enhance compliance and reduce evasion. Third, public investment should be fostered, particularly in infrastructure and human capital development, to enhance productivity. It is crucial to accompany public investments with sound macroeconomic policies to maintain fiscal discipline and debt sustainability. Fourth, policymakers should address macroeconomic imbalances such as inflation and exchange rate volatility by implementing stable monetary and fiscal policies and reducing dependence on commodity exports. Fifth, institutional quality should be strengthened by improving the regulatory environment, enhancing the judiciary, and promoting transparency and accountability in public institutions. Lastly, policymakers should prioritize regional integration efforts, including harmonizing trade policies, reducing trade and investment barriers, and investing in regional infrastructure to enhance connectivity and economic development.

In conclusion, this study sheds light on the complex relationship between financial development, taxation, and economic growth in sub-Saharan Africa. The findings suggest that financial development plays a crucial role in driving economic growth, while the effects of foreign investment, inflation, and taxation are more nuanced. These results provide valuable insights for policymakers in sub-Saharan African countries to design and implement effective policies that promote economic growth and development. However, further research is required to explore additional factors and confirm these findings, enabling a more comprehensive understanding of the dynamics between financial development, taxation, and economic growth in the region.

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