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**FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH IN AFRICA:
A Cross-country Evidence**

**Thesis Submitted in Partial Fulfilment of Requirement for the Degree of
Master of Science (MSc) in Financial Economics**

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**February, 2023
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Thesis Title

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AFRICA: *A Cross-country Evidence*

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Declaration

I, Beidemaryam Wondwosen, declare that this study titled “FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH IN AFRICA: A Cross-country Evidence”, is my own work and I have carried out the research work independently with the guidance and support of my research advisor. This thesis is submitted to the Department of Economics at Addis Ababa University in partial fulfilment of the requirements for Master of Science (MSc) degree in Financial Economics. It has not been submitted for any Masters Degree program in this university or any other. The study and that all sources of materials used for the study have been duly acknowledged.

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Acronyms and Abbreviations

ADF = Augmented Dickey-Fuller Test
ARDL = Autoregressive Distributed Lag Model
BM = Broad Money Share of GDP
CAPF = Capital Formation Share of GDP
CPS = Credit to Private Sector v
CV = Control Variables
ECT = Error-Correction Term
FD = Financial Development
FDI = Foreign Direct Investment Inflow Share of GDP
FSD = Financial Sector Development Index
GDP = Gross Domestic Product
GMM = Generalized Method of Moments Estimation
GNP = Gross National product
GOV = Government Expenditure Share of GDP
HPJ = Half Panel Jackknife
IMF = International Monetary Fund
INF = Inflation Rate
IPS = Im., Pesaran and Shin Test
IV = Instrumental Variable Estimation
L. = Lag Operator of Variables
LLC = Levin, Lin and Chu Test
ln = Natural Logarithm of Variables
M2 = Broad Money Circulating in the Economy
OLS = Ordinary Least Square Estimation
OPEN = Trade Openness Share of GDP
PMG = Pooled Mean Group Estimation
PP = Philip and Perron
REGQ = Regulatory Index Variable
ROL = Rule of Law Index Variable
SAVE = Gross Domestic Saving Share of GDP
WB = World Bank Group
WDI = World Development Indicators
WGI = World Governance Indicators
W-Stat = Wald Statistics
2SLS = Two-Stage Least Square Estimation

Abstract

This study empirically examines the relationship between financial development and economic growth using a cross-country panel data analysis of 39 African countries. The aggregate economic growth indicator and the proxy variables for the financial development indicator are only considered for bank-based measures. To measure the level of financial development, the study uses two proxies, private sector credit to GDP and the index of financial development. Accordingly, the results show that the development of the financial sector has a positive and statistically significant effect on the economic growth of African countries for the two variables. The IV estimation results suggest that weak institutions and inadequate government regulation could distort economic decision-making and reduce productivity by hampering financial development. The finding also showed a significant positive coefficient attributed to the financial development indicator and the negative coefficient attributed to its squared value demonstrated the non-linearity of the relationship with financial development and growth. As a final point, the nonlinear relationship shows that when formulating economic growth strategies, we should consider the optimal level of financial development. The results for control variables suggests that foreign direct investment inflows, savings, trade openness, population and capital formation play important roles in boosting economic growth in African countries. However, increases in government size and inflation are detrimental to the economic growth of the same countries. Based on these findings, the study proposes the expansion of financial services through more lending to the private sector. The government should limit its size in the economy; savings in the economy should be channelled into productive investments; and it should manage the exchange rate and price of items in international trade to protect local producers and avoid imported inflation.

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

The financial sector is the legal and regulatory framework that enables transactions through a range of institutions, instruments, markets and credit. The development of the financial sector, the process of gathering information, enforcing contracts and reducing the cost of conducting transactions, has led to the emergence of financial contracts, markets and intermediaries. Finance is said to have a pioneering role in promoting economic growth. Broadly speaking, financial intermediation would make it easier to quickly direct the flow of savings and investment within the economy to pathways that can increase capital accumulation and also the production of goods and services.

Building a well-developed financial structure to stimulate economic growth has been a challenge for development economics discussion in recent decades. As Huang (2010) expressed, there is clearly a positive relation between financial depth and economic development. However, little is known about what determines financial developments and how financial markets are developed.

Studies on the role of financial development towards growth put forward diverse views. On one hand scholars such as Robinson (1952) are cited for stating that implicit financial development comes after the real sector growth requires for financing. While other competing literature reflects on how financial development primarily stimulate real sector economic growth. This body of knowledge is known for asserting that a well-organized financial construction offers higher financial services that could bring the economic development of nations; or conversely, less developed financial system could adversely slow existing economic progress. Third reading claims that there is a two-way relationship between financial development and economic growth. Still, some literatures such as Miller (1998) stated that the concept that financial markets contribute to economic growth may be a claim too obvious for serious discussion. This means that any strategy

aimed at promoting the development of a financial system would be a waste of resources and divert attention from more important economic policies.

Financial development in developing countries remains low although the rest of the advanced countries of the world have continued to grow in recent decades (Ibrahim & Alagidede, 2018). In particular, the financial sector in African countries remains comparatively underdeveloped and shallow. Estimation of the unbanked population in Africa is between 80 and 90 percent due to the fact that financial activity in Africa is characterized by few commercial banks which are government owned in most cases (DFID, 2004). The relative underdevelopment of the financial sector could be attributed to lack of institutional quality, existence of informality in economies, weak governance, political and economic instability as noted in Beck and Honohan (2007).

In this study we address a number of contentious issues in the empirical studies regarding the significant contribution of financial sector development to economic growth. The study delves into debates about causal relationships between finance-growth nexuses, e.g. whether African economic growth is induced through a finance-driven pathway or is growth-driven financing; Two-way or independent path. As a result, this study performs critical analysis to reveal the factors that contribute to economic growth while understanding and addressing the financial development challenges in African countries.

The development of a well-functioning financial sector is a crucial and powerful engine of economic growth. Financial easing initiatives are key issues in development efforts in many developing countries; especially when in the 1980s and 1990s there were far-reaching financial liberalization efforts by African countries. Accordingly, the drive behind the study of financial development in selected African countries is fascinated by the pursuit of increased economic development through improvements in the financial sector. Therefore, an analysis of the relationship between financial development and economic growth would shed light on how the extent of changes in the financial sector in the selected African countries has affected economic growth over the past few decades. Therefore, the motivation for this study is to examine economic growth in Africa and show how financial development drives economic growth along with other

control variables. We have attempted to create a unique approach to economic growth analysis for African countries by prudently studying several related empirical literature.

1.2. Statement of the Problem

The link between financial development and economic growth of nations has been a focus of dialogue in the field of development economics. There is no general agreement on the direction of causality between financial development and economic growth. As a result, the results bring different insights for different levels of development of the countries. This could be due to institutional differences and differences in capital allocation between and within economies. In the case of Africa, there was weak and very different economic development, characterized by underdeveloped capital markets and banking services, a lack of capacity and regulatory frameworks, and poor oversight (Beck and Honohan, 2007).

Although there are extensive literature on the relationship between finance and growth in advanced economies, only few studies target developing countries. The financial sector in developing countries lacks reliable markets and even includes a lesser degree of banking intermediation that is underdeveloped as compared to advanced economies. Among these developing countries, the focus of this paper is on African countries.

Empirical studies specific to African countries could be categorized according to the debates highlighted in the section above. The results of some of these studies are consistent with the hypothesis on the finance leads to economic growth (see Spears, 1992; Ghali, 1999; Abu-Bader and Abu-Qarn, 2008; Eita, 2007; Ngongang, 2015). Other African specific studies related to economic growth-to-finance literature are Agbetsiafa (2004) and Odhiambo (2004). Few African studies such as Akinboade (1998) and Odhiambo (2005) have found evidence consistent with a bidirectional relationship between financial development and economic growth. In this regard, empirical research studies on the relationship between financial development and economic growth in African countries are somehow insufficient.

In fact, the link between financial development and economic growth has been observed in some limited studies for African countries. However, the instrumental variable approach for institutions and the non-linearity of financial evolution to determine growth have been largely disregarded. Although previous studies did not explicitly mention the instrumental variable approach and the non-linearity of financial developments, they have considered a concave relationship between finance and growth. In particular, Ibrahim and Alagidede (2018), Law et al. (2018), Soedarmono et al. (2017) examined that financial development promotes economic growth up to a certain point, but above a certain level it has a negative impact. Using a panel data set from sample of African countries this study attempts to show how economic growth is associated with financial development.

A special feature of this work is that the author used institutional factors of the rule of law and regulatory quality as an estimation instruments based on a theoretical framework. In addition, the financial development was approximated by most widely used indicator; namely domestic credit to GDP (CPS). The study applies dynamic panel heterogeneity analysis, using the pooled mean group (PMG) dynamic panel estimator to estimate the short- and long-term relationship between finance and growth. To analyse the long-term effects of funding on growth, the two-stage least squares (2SLS) approach with instrumental variables is used.

As the economic growth model is a dynamic process, a dynamic panel approach is chosen. As indicators of financial development, the study selected the financial development index and credit issued to the private sector. In addition, education, FDI, trade openness, inflation, capital formation, savings and government spending are chosen as control variables. To the best of the researchers' knowledge, no academic research has yet been conducted in this area for the underlying African countries using the instrumental variable approach to address the reverse causality bias and the non-linearity of financial evolution to determine growth using squared value of financial development. Therefore, this study uses a different perspective on financial development to assess the relationship between financial development and economic growth and attempt to fill the research gap found in other studies.

1.3. Objective of the Study

1.3.1. General Objective

The main objectives of the study are to empirically examine the long-term relationship between financial development and economic growth; and to assess the direction of causality between financial development and growth in the designated African countries for the period 2002-2020.

1.3.2. Specific Objectives

The specific objectives to be addressed during this study are:

To find out whether or not financial development causes economic growth for African countries and the opposite.

To examine the two financial development variables (Credit to Private Sector and Financial Development Index) have impact on economic growth in African countries.

To examine if the squared (nonlinear) term for financial development has a positive impact on the economic growth of African countries.

Assess how the financial sector instrument variables contribute to economic growth in African countries.

1.4. Significance of the Study

Because of their enormous share in the economy, the impact of nations' financial development should be given more consideration by policy makers. Furthermore, it plays a key role alongside economic growth, economic stability and fiscal policy issues; and it is able to electrify immense fluctuations in the trade cycle within the economy. Even the worst of a full-blown crisis would ensue if not handled carefully. Therefore, examining how financial development can drive economic growth could be the fundamental topic for research. Therefore, the core of this study is to analyse the relationship between financial development and economic growth in African countries. In addition, the study looks at how the financial sector is supporting the current growth that developing countries are examining and derives recommendations supported by the resulting findings.

1.5. Scope of the Study

The purpose of this study is to analyse the relationship between financial development and economic growth in the African countries listed in the appendix. Due to time and resource constraints encountered by the researcher, this study was intended to use secondary data extracted from World Bank data from the World Development Indicators (WDI) database, released for open source in 2022; the IMF data for Financial Development Indicators and WB Governance Indicator data (for IV estimation). The study also includes eighteen years of data from 2002 to 2020.

1.6. Limitations of the Study

The author obviously recognizes the limited availability of data on financial development measures, particularly for developing countries to be implemented. Consequently, stock market indicators of financial development are not used in the study to examine the relationship between financial development and economic growth, i.e. only bank-based measures are used. Due to the lack of available recorded data on financial performance indicators, some of the 39 countries listed in the Annex may be subject to change under the future approach. Therefore, based mainly on data availability, the selection of financial development indicators can be narrowed down to the most widely used measures and additional measures of financial development indicators that are appropriate for the selected African countries.

1.7. Organization of the Study

The rest of this paper is organized as follows; Chapter two reviews the theoretical and empirical literature on financial development and economic growth issues. Chapter three presents the research methodology and data used alongside the model formulation of panel data analysis to measure economic growth. Then chapter four discusses the result and findings of this study. Finally, chapter five provides a conclusion of the findings with the recommendation.

CHAPTER TWO

LITERATURE REVIEW

2.1. Theoretical Review

This chapter thoroughly reviews literatures for theoretical and empirical work contributed by forerunner scholars and discusses different perspectives regarding financial development and growth. There seems to be neither a strong nor a common consensus on how financial development affects economic development. The broad argument documents that financial openness increases a country's capital accumulation, which in turn increases economic growth. Meanwhile, as recommended by Stiglitz (2000), this positive relationship between openness and economic growth can vary depending on the strength of a country's financial institutions.

The financial sector plays a positive role in fuelling economic growth through various channels. For example, by reducing information asymmetry, mobilizing savings, diversifying risks, reducing transaction and surveillance costs, and facilitating the exchange of goods and services. This leads to an additional economical allocation of resources, accumulation of human and physical capital and accelerates technological progress. Woodland and Jovanovic (1990) argued that financial intermediaries encourage investment activity and consequently promote economic growth. Financial intermediaries offer diversified investment portfolios to mitigate the risk associated with liquidity preferences. Together they also direct savings into investments with high returns. Therefore, the financial system could be a major growth accelerator by providing investment activity for a given economy by easing the gap between savers and investors.

According to Levine (1997), the primary function of the financial sector is to facilitate resource allocation across space and associated time in an uncertain environment. Levine (2005) then lists five broad functions provided by financial systems:

- Producing ex ante information about potential investments and capital allocation.
- Oversee investments and exercise corporate governance in the provision of finance.

- Facilitate trading, diversification and risk management.
- Mobilize and pool savings.
- Facilitate the exchange of goods and services.

The idea to link finance and growth with theoretical abstraction goes back over a century to two splendid contributions. To begin with, Bagehot (1873) argues that during Industrial Revolution in England finance played an important role by facilitating the mobilization of capital for "immense works." Later on, Schumpeter (1911) contends that efficient financial intermediaries spur technological progress by reallocating investment to entrepreneurs with the simplest possibilities of success in implementing innovative product. This method widely referred to as "creative destruction." Based on the literatures, the link that exists between financial development and the real sector growth showed mixed results.

The link between financial development and economic growth is varied because the direction of causality for the two variables could go either way. There is theoretical and empirical findings to support the link between financial development and economic growth. Some class of studies includes scholars such as Bagehot (1873), Schumpeter (1911), Gurley and Shaw (1955), Hicks (1969), Goldsmith (1969) and McKinnon (1973) in support of financial development cause growth. On the other hand, there is common evidence that it is economic growth that drives financial development instead as in the work of King and Levine (1993), Demetriades and Hussain (1996), Christopoulos and Tsionas (2004) Khadraoui and Smida (2012). It could also be a two-way (bidirectional) causal relationship like Greenwood and Jovanovic (1990), Wood (1993) and Woodland and Bruce (1997); or no relationship as in Miller (1998).

The link between financial development and growth differs from country to country due to vastly different economic and institutional conditions. Therefore, the four potential links between financial development and economic growth are discussed here in the following categories: *supply-leading (finance-led) growth*, *demand-following (growth-driven finance)*, *the causal relationship in both directions (feedback)*, and *no relationship (no link)*.

2.1.1. Supply-leading (finance-led) growth

The supply-leading growth hypothesis shows that financial development plays a significant role in economic growth and has a notable impact on the economy. Empirical evidence supporting the supply-leading hypothesis has been presented in the work of Schumpeter (1911), Goldsmith (1969), McKinnon (1973), King and Levine (1993), Arestis et al. (2001), Beck (2004), Levine (2005), Demirguc-Kunt (2006) and Luintel et al. (2014). Channels through which financial development drives growth within the economy include the efficient allocation of capital, mobilization of savings, and the reduction of the cost of information asymmetry.

An efficient financial sector is a supplier of limited credit resources from the surplus units to the deficit units. By following this path, the financial sector helps to drive efficient allocation of resources and promote economic growth. Spears (1992) used the Broad Money to GDP ratio as a proxy indicator of financial developments for ten countries in sub-Saharan Africa and applied the Grangers causality test. The study concludes that there is a robust connection between financial development and economic growth. The study by Berthelemg and Varoudakis (1996) achieved equivalent results using a massive sample of global data and concluded that financial development promotes growth through the mobilization of savings. Recently, Ndako (2017) also examined the impact of national financial development on economic growth in Nigeria. Apparently, the results revealed that financial development has a crucial impact on economic growth in Nigeria.

2.1.2. Demand-following (growth driven finance)

This phenomenon is supported by intellectuals such as Robinson (1952), who have argued that an increase in economic growth typically leads to intensified financial development. Reading Robinson (1952) it seems that she expressed where business enterprises lead, finance follows. Similarly, the work of Kuznets (1955) explained that financial markets begin to grow as the economy approaches the intermediate stage of the growth path and develop once the economy matures. In other words, this reading argued that the expansion of economic activity within each economy requires the emergence of financial institutions to provide services essential to economic growth.

As primary economic growth creates demand for financial instruments, and financial market arrangements will respond effectively to these demands and changes. Empirical studies supporting the demand-following hypothesis include Robinson (1952), Kuznets (1955), Stern (1989), Singh (1997), Beck et al. (2000a), Odhiambo (2008), Nazlolu et al. (2009), Ductor and Grechyna (2015). They jointly argued that doubling growth gradually leads to financial sector development. Recently, Bist's (2018) study revealed this demand-following relationship for the case of some African and other low-income countries, in agreement with the demand-following hypothesis.

2.1.3. Two-way causal relationship (Feedback)

This study falls somewhere between the two views above as Apergis et al. (2007) and Cevik and Rahmati (2013) which claims that finance and growth are mutually influenced. Another reading of Hassana et al. (2011) and Patrick (1966) mentioned that finance in the early stages of economic development brings about growth by stimulating real capital formation. That is, the direction of causality changes over the course of development. This body of knowledge is somewhat similar to Lewis' (1955) postulates of a mutual relationship between sectoral growths. This implies that the financial market develops as a consequence of economic growth, which successively acts as a stimulus to real growth. The economy is always in the growth phase and there will be an increasing demand for financial services. For this reason, it leads to the extension of the associate degree both in the financial sector and in the real sector.

Many studies have similarly identified this type of two-way causality outcome. These studies are found in the work of Wood (1993), Demetriades and Hussein (1996), Woodland and Bruce (1997), Akinboade (1998), Ghirmay (2004), Abu-Bader and Abu-Qarn (2008), Akinlo and Egbetunde (2010) and Shahbaz and Lean (2012). The causal relationship between financial development and economic growth in Africa is studied by Musamali et al. (2014) on fifty African countries for the period 1980-2008. An equivalent result on the interrelationship between financial development and economic growth was found in the work of Okpara et al. found. (2018) using cointegration and causality analyses in Nigeria from 1981 to 2014.

2.1.4. No relationship (no link)

The last category includes the most conflicting results related to financial development and growth literature. Some studies such as Favara (2003) and Acaravci (2009) argue that there are no relationships between financial development and economic growth. Acaravci (2009) and Andersen and Tarp (2003), using panel cointegration and panel GMM estimation for the causality relationship, found that there is no evidence of a long-run relationship between financial development and economic growth. Other studies that show no link between financial development and growth are Deidda and Fattouh (2002), Demetriades and James (2011), Kumar (2011), Soyta and Küçükkaya (2011), Hsueh, et al. (2013) and Kenza and Mohamed (2015) that are prominent. Notwithstanding the differences in methodology and data source used, this study would shed light on the incident that financial performance is unrelated to growth.

2.2. Empirical Review

Examining the long-term relationship between financial development and economic growth of states has been a center of dialogue for many intellectuals such as Jung (1986), Gregorio and Guidotti (1995), Khan and Senhadji (2000) and Arestis et al. (2014). But the results bring different insights among different countries. Empirical literature on finance and growth could be grouped into the following categories: *Bank versus Markets studies*, *Cross-country growth studies*, *Time series analyses*, *Panel studies*, and *Industry and Firm level studies*.

2.2.1. Bank versus Markets Studies

Studies in this category attempt to examine whether the financial development of countries with primary dependence on the banking sector or on capital market (market) has an impact on their growth. With a cross-national study, Arestis et al. (2001) used quarterly data on the growth and representative of the development of each stock exchange and banking sector. They showed that any form of financing boosts economic growth, regardless of the size of the result and sample. Another study by Tadesse (2002) suggests that in countries with developed financial sectors, market-based systems are superior to bank-based systems. Bank-based systems are much better in countries with underdeveloped financial sectors. Using a sample of 48 countries, Shen and Lee (2006) also find that stock market developments alone have a positive outcome, while banking developments have unfavourable, if not negative, effects on growth.

In the most recent work by Langfield and Pagano (2016), a negative correlation between growth and the ratio of bank- to market-based intermediation in Europe was witnessed. It was also previously stated by Gambacorta et al. (2014) that the relationships between economic growth per capita and different forms of financing. They have shown diminishing impact of banking sector development at higher levels of development due to increasing impact of securities markets at such stage of economic development. Some studies like Hsu et al. (2014) found that capital markets generate greater productivity gains, innovation and technological change than banking. The study used data for thirty-two developed and emerging markets with a fixed effects estimation model. They also showed that industries employing high-tech-intensive manufacturing in advanced economies have higher levels of innovation in countries with more developed stock markets.

The literature on the impact of monetary structures (market vs. bank-based) generally confirms that each of these structures exerts a positive outcome on economic growth. Studies show, however, that banks' marginal contribution to economic growth is declining. Whereas that of the capital markets will increase with economic development as market-based finance is healthier for stimulating innovation and productivity and funding new sources of growth.

2.2.2. Cross-Country Growth Studies

In the earlier work, Goldsmith (1969) used data on financial intermediaries' assets as a percentage of GDP and data on sums of bonds and securities for thirty-five countries. The study showed a failure to deal with different determinants of growth, a questionable choice of empirical proxies for financial development, and no effort to establish the direction of the relationship. While lacking in substantive observations, they find evidence of a positive association between financial performance and economic growth.

Thereafter, King and Levine (1993) arrange to improve Goldsmith's (1969) first methodology in many ways, such as large cross-sectional data from 77 countries over a fairly long period (1960-1989). They also consistently manage for many types of different country-specific financial development indicators by exploiting Barro's (1991) approach. These country-specific indicators are initial wealth, secondary school enrolment and population growth. The authors investigated

the causal relationship in the finance and growth nexus. In particular, they examine what proportion of the cross-country variation in average economic growth over the study period.

Following the study conducted by King and Levine (1993), various scholars extend the analysis of the relationship between finance and growth beyond bank credit and cover the non-bank sector of a country's financial system. Scientists like La porta et al. (2002) depart further from scale measures of economic depth and examine the degree of public ownership of the banking sector, which affects economic growth. Their cross-country regressions show that higher levels of public ownership of the banking sector are followed by slower growth during the 1960-1970s. The authors also dissect aggregate growth and find that government ownership of banks has a tiny and unobtrusively insignificant impact on future investment. It has an outsized negative impact on future productivity growth.

2.2.3. Panel Studies and Time-Series Analysis

The pioneering studies in this category are those of Beck et al., (2000). The authors use panel GMM estimators based on the work of Arellano and Bond (1991) and Arellano and Bover (1995). Using this analytical framework, the authors find that financial developments continue to have a positive and statistically significant impact on economic growth. In a subsequent study, Beck and Levine (2004) applied GMM dynamic panel techniques to see the impact of stock markets and banks on growth, using panel data for the period 1976-1998. They recognize that both stock markets and banks completely influence economic growth.

To account for parameter heterogeneity, Loayza and Ranciere (2006) use the panel's dynamic pooled mean estimator. This was developed by Pesaran and Smith (1995) and Pesaran et al. (1999) developed to allow financial development to have different effects across countries. In this method, there is a robust, significant, positive, long-term relationship between financial performance and growth. In the short term, however, this relationship turns negative for several countries. Arestis and Demetriades (1997) use Granger causality tests with a vector autoregression framework and show that the link between finance and growth is driven by reverse causality. Another example of this line of analysis is Rousseau and Wachtel (1998), who used data on five industrialized countries

from 1870 to 1929. They show that the link between finance and growth is mainly driven by financial intermediation variables that drive growth.

Using panel cointegration analysis and data from ten developing countries, Christopoulos and Tsionas (2004) find that the long-run relationship runs from financial development to growth, with no evidence of an inverse relationship. Demetriades and Hussein (1996) performed a time series analysis and overall patterns of relationships vary from country to country. However, empirical work on the connection between financial development and economic growth is rare due to insufficient time series data, especially for developing countries. Based on Schumpeter's growth theory, Ang and Madsen (2012) use panel data for 77 countries over the period 1965-2009. The study examines the role of risk, capital and private credit in stimulating information production. They recognized that countries with many developed financial systems tend to be more innovative.

In their current study, Laeven et al. (2015) develop a Schumpeterian growth model with disruptive financial innovations. To bring their model up to date with the available data, they develop a proxy for financial innovations. This has shown how quickly each country has established a private credit bureau to share information about potential borrowers. Using a panel GMM estimate, they find that financial innovation accelerates economic growth, especially for poor countries. Recently, Beck et al. (2016) also analysed a sample of thirty-two countries over the period 1996-2010. They recognize that they use vastly different measures of financial innovation, each capturing a broad construct and specific innovation; all are associated with faster growth.

2.2.4. Industry and Firm Level Studies

Using an industry-level analysis, Rajan and Zingales (1998) examined 36 industries in 42 countries for the period 1980-90. They tested industrial sectors that need comparatively more external financing to develop faster in countries with many developed financial markets. Their findings indicated that industries that are inherently serious users of external finance should benefit greatly from greater financial development. Another scholar, Wurgler (2000), used industry data for a 65 country, 28 industry and 33 year panel of gross capital formation and value added for the period 1963-95. The result shows that highly developed countries, as measured by the size of domestic

stock and credit markets relative to GDP, increase investment in growing industries and decrease investment in declining industries.

Dependent on financial structures Beck and Levine (2004) showed that greater financial development accelerates the expansion of financially dependent industries. Representing the country-wide mixture of bank and market financing, they find that the financial structure does not facilitate the different growth rates of the industries in the countries. In addition, Fishman and Love (2003) analysed the relationship between financial development and cross-industry resource allocation over short- and long-term timescales. They emphasized that financial developments facilitate the reallocation of resources to sectors with better growth opportunities in the short term. Economies with high rates of financial development can, in the long run, allocate comparatively many resources to industries that depend on external financing in order to gain a comparative advantage in these industries.

In the previous study, Demirguc-Kunt and Maksimovic (1998) tested whether greater financial development removes barriers to profitable growth opportunities. They estimated the external financing needs of each company from 26 countries for the period 1980-1991. Their result showed that any development of the banking system and stock market liquidity is entirely related to the overgrowth of companies. In addition, they found that the size of the stock market is not relevant to a company's growth. Demirguc-Kunt and Maksimovic (2002) show that growth at rates in excess of the rate a firm can achieve with retained earnings and borrowing is entirely related to overall financial performance. Considering the size of companies, Beck et al. (2005) that financial development reduces the impact of many obstacles to firm growth. They eventually found that small businesses benefit most from financial development because they can easily access finance.

2.3. Evaluation of Literature Review

Theoretical and empirical work on the relationship between financial development and economic growth was discussed. These theories illuminate many of the channels through which the emergence of financial instruments, financial markets, and institutions affect economic development, and vice versa. Much of the empirical literature shows a strong positive link between the functioning of the financial system and long-run economic growth. However, empirical evidence makes it difficult to conclude that the financial system is merely responsive to economic activity. It also points out that the financial structure is important and that the financial system is dominated by banks or financial markets based on the country's level of economic development. Finally, few of the above studies have focused on African countries.

In terms of empirical contribution, more ingenious researches need to be done on the causality of financial development with growth. In order to do that including factors that determine financial development in the finance-growth nexus model could be an advantage. There is a growing body of research examining the direct laws, regulations and macroeconomic policies that shape the operations of the financial sector.

A regulatory system that ensures the protection of property rights and the proper execution of contracts has been identified as essential to financial development (see La Porta et al., 1997; La Porta et al., 1998), pointing to the origins of the legal system significant impact on the treatment of creditors and shareholders and on the efficiency of contract enforcement. The wide range of studies also suggests that political, legal, cultural and even geographic factors influence the financial system and instrumental variable (IV) regression is required to better understand the role of financial development factors in the process of economic growth.

The aim of this study is to analyse the influence of factors on economic growth through the financial development of African countries with institutional instruments and control variables. In particular, the instruments of regulatory quality and accountability on the level of financial development in African countries is analysed to see their impact on economic growth. Additionally, this work provides little to address the non-linearity between financial development and growth, known as the too much finance hypothesis. The following chart below summarizes

the flow of how financial development factors along with other macroeconomic variables affect economic growth.

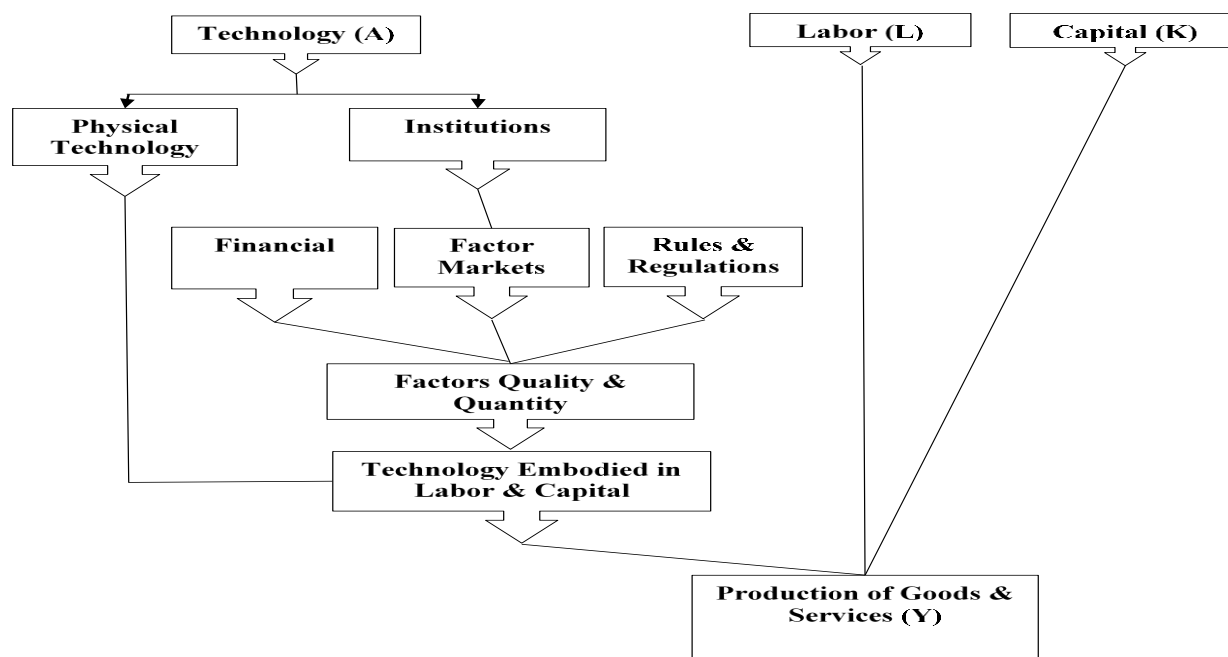


Figure 1: Conceptual Framework

The above figure summarizes the channels through which economic growth of countries is enhanced. Among these channels financial development is the central emphasis of this study along with the quality of institutional rules and regulations of countries. Countries that are more financially developed and having better institutions would exhibit higher technological innovation thus disproportionately higher growth. In the next chapter the Cobb-Douglas production function will be used to mathematically formalise this theoretical conceptualization in to empirically testable model.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Model Specification

Based on Solow's (1957) standard neoclassical growth model with capital and labour as factors of production, under the Cobb-Douglas production function we have equation (1). According to Aghion & Howitt (2007), the Solow model remains an unavoidable yardstick in growth economics for at least two reasons. First, it has two equations; the production technology and the capital accumulation equations that define the model of what a growth model should be. Second, the model shows that without technological advances it is impossible to achieve sustainable long-run growth as marginal productivity declines.

$$Y_{it} = A_{it}L_{it}^{\alpha}K_{it}^{\beta} \dots \dots \dots (1)$$

Where Y_{it} denotes output, A_{it} is technology, L_{it} is labor, K_{it} is physical capital. And (it) stands for country i in period t . Taking the natural logarithm of equation (1) gives the next log-linearized equation and after simplifying and adding the stochastic term, equation (2) is represented as follows;

$$\ln Y_{it} = \ln A_{it} + \alpha \ln L_{it} + \beta \ln K_{it} + u_{it} \dots \dots \dots (2)$$

From the conceptual framework we can take the financial development variable with in the Technology (A) part of Cobb-Douglas production function in to the model as follows;

$$\ln Y_{it} = \ln FD_{it} + \alpha \ln L_{it} + \beta \ln K_{it} + u_{it}$$

It can be extracted from the above function with an equation that captures the link between financial development and economic growth by combining the indicator variables of financial development (FD) with some control variables as defined in the next equation (3).

$$[Growth]_{it} = \alpha + \beta_1 [FD]_{it} + \beta_2 [CV]_{it} + u_{it} \dots \dots \dots (3)$$

Where FD is variables for financial development, CV stands for variables affecting economic growth apart from financial development (control variables) including lagged growth and u_{it} is an error term that includes both the individual effect, μ_i and residual, ε_{it} .

The most common methods to study the finance-growth nexus are cross-country regressions and panel data techniques. Panel data analysis allows us to examine the dynamic nature of economic growth and financial developments (Baltagi, 2005). In the following equations we consider the economic growth function as published in the literature by Levine (1997), Levine et al. (2000) and Beck et al. (2000).

$$y_{it} = f(FD, CV)_{it}$$

$$y_{it} = f(FSD, CPS, OPEN, GOV, INF, INVEST, SAVE, POP)_{it} \dots \dots \dots (4)$$

Where y_{it} stands for the GDP growth rate; the two indicators of financial development (FD) are Financial Sector Development (FSD) and Credit to the Private Sector as a Percentage of GDP (CPS); and the remaining variables OPEN, GOV, INF, INVEST, SAVE and POP are exogenous regressors for openness to trade, level of government spending, inflation, capital accumulation, saving, and population respectively. X_{it} stands for other control variables. The study made a check for the non-financial indicators that can also affect growth in the long term, resulting in a broad consideration of measuring a growth model that also aims to explain the impact of financial development. Therefore, equation (5) is specified as;

$$y_{it} = \alpha_{it} + \beta_{1i} \ln FD_{it} + \beta_{2i} \ln OPEN_{it} + \beta_{3i} \ln GOV_{it} + \beta_{4i} \ln INF_{it} + \dots + \beta_{ki} \ln X_{it}$$

$$+ u_{it} \dots \dots \dots (5)$$

We can easily rearrange the above equations into the following models for econometric analysis. The first model shows a dynamic representation of financial growth analysis using a proxy variables of financial development. Where Credit to the Private Sector (CPS) and Financial Development Indicator (FSD) are proxy indicators for financial development in Model-1 and Model-2.

Model [1]

$$(a) Y_{it} = \alpha_i + \rho Y_{it-1} + \beta_{1i}CPS_{it} + \beta_{2i}OPEN_{it} + \beta_{3i}GOV_{it} + \beta_{4i}INF_{it} + \beta_{5i}INVEST_{it} + \beta_{6i}SAVE_{it} + \beta_{7i}POP_{it} + v_i + \epsilon_{it} \dots \dots \dots (7)$$

Model [2]

$$(a) Y_{it} = \alpha_i + \rho Y_{it-1} + \beta_{1i}FSD_{it} + \beta_{2i}OPEN_{it} + \beta_{3i}GOV_{it} + \beta_{4i}INF_{it} + \beta_{5i}INVEST_{it} + \beta_{6i}SAVE_{it} + \beta_{7i}POP_{it} + v_i + \epsilon_{it} \dots \dots \dots (8)$$

3.2. Estimation Methods

The study attempts to relate the relationship between GDP growth in country i at time t to some exogenous factors. We follow a dynamic panel approach to account for potential endogeneity in the data. Such a dynamic panel adjustment is developed by applying the first difference transformation. Estimates of financial development indicators (β_{1i}) can be biased for a variety of reasons, of which measurement error, inverse causality and missing variable bias are the main causes. Therefore, an appropriate estimation method must be used to obtain unbiased, consistent, and efficient estimates of this coefficient. To deal with these biases, we will use dynamic panel regression with lagged values of endogenous explanatory variables as an instrument.

3.2.1. Panel Causality Estimation

i. Pooled Mean Group (PMG) Estimation

This study uses the PMG methodology to examine the short- and long-term effects of financial development on growth developed by Pesaran et al. (1999) to account for a lower degree of heterogeneity. Because the PMG method enforces uniformity in the long-run coefficients while allowing for heterogeneity in the short-run coefficients and error variance. The basic assumptions of the PMG estimator are: First, the error terms are uncorrelated and distributed independently of the regressors, i.e. that the explanatory variables can be considered exogenous; second, there is a long-term relationship between the dependent variable and the explanatory variables; and third, the long-term parameters are similar across countries. This estimator is also flexible to allow for uniformity of the long-run coefficients across a unique subset of regressors and countries. Pesaran et al. (1999) uses the ARDL model (p, q, q, ... q) as empirical structure.

It is the appropriate approach for our dynamic panel analysis because it accommodates the equilibrium of the long-run and heterogeneous dynamic adjustment process. The PMG approach can estimate the model by integration of pooling and averaging of the variable coefficients where the cross-sectional units are smaller than the period of time. It allows the short-run coefficients, intercepts, and error variances to vary across countries, but it restricts the coefficients of the long-run to be the same. PMG helps to resolve heterogeneity bias common in traditional panel fixed and random effects estimations. The assumption of all traditional panel models is that across them, at least some parameters are similar. Moreover, Pesaran et al. (1999) highlighted that in long periods, the technique of traditional panel leads to an inconsistent outcomes inclusive panel generalized method of moment, and a false estimation of the parameter's average values in dynamic panel data model, with an exception if the coefficients of the slope are similar.

Suppose given data over periods, $t = 1, 2, \dots, T$ and groups, $i = 1, 2, \dots, N$

$$y_{it} = \sum_{j=1}^p \lambda_{ij} y_{i,t-j} + \sum_{j=1}^p \delta'_{ij} X_{i,t-j} + \mu_i + \varepsilon_{it} \dots \dots \dots (9)$$

Where from; x_{it} ($k \times 1$) is the vector of explanatory variables (regressors) for group i ; μ_i represents the fixed effects; the coefficients of the lagged dependent variable, λ_{ij} , are scalars; and δ'_{ij} are $k \times 1$ coefficient vectors. T must be large enough so that we can estimate the model for each group separately. Then a re-parameterization of the above (9) is made to make it more convenient.

$$\Delta y_{it} = \phi_i Y_{i,t-1} + \beta'_i X_{it} + \sum_{j=1}^{q-1} \lambda^*_{ij} \Delta y_{it-j} + \sum_{j=1}^{q-1} \delta^{*'}_{ij} X_{i,t-j} + \mu_i + \varepsilon_{it} \dots \dots \dots (10)^1$$

¹ Where $\phi_i = -(1 - \sum_{j=1}^p \lambda_{ij})$; $\beta'_i = \sum_{j=1}^p \delta'_{ij}$; $\lambda^*_{ij} = \sum_{m=j+1}^p \lambda_{im}$ with $j = 1, 2, \dots, p-1$; and $\delta^{*'}_{ij} = \sum_{m=j+1}^p \delta'_{im}$ with $j = 1, 2, \dots, p-1$.

Investigation of the direction of the panel data to assess the causal relationships between financial developments and the considered variables of economic growth using the Pooled Mean Group (PMG) estimator by Pesaran et al. (1999) could be specified with an error correction ARDL model of the following:

$$\Delta Y_{it} = \alpha_0 + \alpha_{0t} + \beta_1 Y_{t-1} + \beta_2 X_{t-1} + \sum_{i=1}^{p-1} \phi_i \Delta Y_{t-i} + \sum_{i=1}^{q-1} \theta_i \Delta X_{t-i} + \omega \Delta X_t + \varepsilon_t \dots \dots \dots (11)$$

Where from; y_t represents the dependent variable, x_t represents a vector of long-run explanatory variables, 1 and 2 are the respective long-run multipliers, and i and i represent the short-run dynamic coefficients. By swapping y_t and x_t as the dependent and independent variables in the above regression equation, we can assess that under the null hypothesis we have no long-run relationship ($H_0: \beta_1=0$ and $\beta_2= 0$) and under the alternative hypothesis existence of a long-run relationship ($H_1: \beta_1 \neq 0$ or $\beta_2 \neq 0$), contingent or otherwise explanatory on the causal relationships between financial development and economic growth variables, depending on which variable is chosen.

Equation (11) above is restructured for this study of financial development versus economic growth in the ARDL model with a simple sequence of (1,1,1) followed by their respective error correction equations as follows:

$$I. \quad Y_{it} = \alpha_i + \alpha_{1i} F_{it} + \alpha_{2i} F_{it-1} + \alpha_{3i} F_{it+1} + \alpha_{4i} X_{it} + \alpha_{5i} X_{it-1} + \alpha_{6i} X_{it+1} + \alpha_{7i} Y_{it-1} + \varepsilon_{1it} \dots \dots \dots (12)$$

And the respective error correction equation will be:

$$\Delta Y_{it} = \emptyset(Y_{it} - \theta_{0i} + \theta_{1i} F_{it} + \theta_{2i} X_{it}) - \zeta_{1i} \Delta F_{it} - \zeta_{2i} X_{it} + \varepsilon_{2it} \dots \dots \dots (13)$$

$$II. \quad F_{it} = \beta_i + \beta_{1i} Y_{it} + \beta_{2i} Y_{it-1} + \beta_{3i} Y_{it+1} + \beta_{4i} X_{it} + \beta_{5i} X_{it-1} + \beta_{6i} X_{it+1} + \beta_{7i} F_{it-1} + \varepsilon_{3it} \dots \dots \dots (14)$$

Again the respective error correction equation will be:

$$\Delta F_{it} = \emptyset(F_{it} - \theta_{0i} + \theta_{1i} Y_{it} + \theta_{2i} X_{it}) - \zeta_{1i} \Delta Y_{it} - \zeta_{2i} X_{it} + \varepsilon_{4it} \dots \dots \dots (15)$$

ii. Granger Non-causality Estimation

The Panel Granger non-causality test is a test developed by Juodis et al. (2021). This test has two other useful properties; it can be used in multivariate systems and is powerful against both homogeneous and heterogeneous alternatives. To account for the Nickell bias of the pooled estimator, their test procedure uses the Half Panel Jackknife (HPJ) approach. Therefore, this study implements the Granger non-causality test of Juodis, Karavias and Sarafidis (2021) for models I and II above.

3.2.2. Model of Estimation with IV (2SLS)

Ordinary least squares (OLS) cannot consistently estimate the causal effect of the regressor on the dependent variable when one or more regressors are correlated with the error term. And we are able to find exogenous variables z_i correlated with the endogenous regressor but not with the error term. The variables z_i are called instrumental variables or simply instruments. If enough good such instruments exist, we can estimate the causal effect of the regressor on the dependent variable. Instrumental variable regression is used to solve the potential endogenous problem of omitted variables, simultaneity and reverse causality. The first developments of 2SLS appear in Theil (1953) and Basman (1957). However, Stock and Watson (2011) present an example of the instrumental variable method first published by Philip Wright in 1928. IV estimation is also known as two-stage least squares (2SLS).

Consider the multiple linear regression model for observations $i = 1, \dots, N$:

$$Y_{it} = X'_{it}\beta_i + u_{it} \dots \dots \dots (16)$$

Where Y_{it} is the dependent variable, X'_{it} is a $(K + M + 1)$ -dimensional row vector of a constant, K endogenous explanatory variables and M exogenous explanatory variables. β_i is a $(K + M + 1)$ -dimensional column vector of parameters, and u_{it} is an error term. Each observation is furthermore described by a $(L + M + 1)$ -dimensional row vector z'_{it} of a constant, L additional exogenous variables and the M exogenous regressors. The $(L + M)$ variables in z_{it} are called instruments. The L additional variables in z_{it} which are not included in x_{it} are called excluded instruments.

Sometimes only those L variables are called instruments. The whole sample is summarized in $y' = [y_1 \dots y_N]$, $X' = [x_1 \dots x_N]$ and $z' = [z_1 \dots z_N]$.

The instrumental variables estimator for β_i is:

$$\hat{\beta}_{IV} = (X'P_zX)^{-1}X'P_zy \dots \dots \dots (17)$$

Where $P_z = Z(Z'Z)^{-1}Z'$

If the number of excluded instruments is greater than the number of endogenous regressors, $L > K$, the IV estimator is said to be over-identified. If the number of excluded instruments equals the number of endogenous regressors, $L = K$, the IV estimator is said to be just identified and reduces to;

$$\hat{\beta}_{IV} = (Z'X)^{-1}Z'y \dots \dots \dots (19)$$

The IV estimator can be reformulated as

$$\hat{\beta}_{IV} = (\hat{X}'X)^{-1}\hat{X}'y = (\hat{X}'\hat{X})^{-1}\hat{X}'y \dots \dots \dots (20)$$

Where $\hat{X} = P_zX = Z(Z'Z)^{-1}Z'X$ and the matrix P_z is symmetric and idempotent. The columns in \hat{X} are the predicted values \hat{x}_k from a regression of x_k on Z. The IV estimator can in principal be calculated by regressing in a first stage each x_k on Z and calculating the predictions $\hat{x}_k = Z(Z'Z)^{-1}Z'x_k$ for all $k = 1, \dots, K$. The M exogenous regressors are perfectly predicted in this stage $\hat{x}_k = x_k$ for all $k = K + 1, \dots, K + M$. In the second stage, y is regressed on $\hat{X} = [1, \hat{x}_1, \dots, \hat{x}_{k+M}]$. IV estimation is therefore called two-stage least squares (2SLS). In order for the instrument variables to be valid they should be uncorrelated with the error term, Instrument Exogeneity assumption; and they have to be highly correlated with the endogenous regressors even after controlling for the exogenous regressors or Instrument Relevance assumption.

3.3. Description of Variables and Data Source

Identifying the key metrics for measuring financial development is an important step in examining the link between financial sector development and growth. Although there is no consensus on which variables to use to measure financial sector development, according to King and Levine (1993) the most commonly used variables in the literature are; Domestic financial sector credit to the private sector and Financial Development Index. We do not include stock market variables. In fact, stock markets in developing countries are not as well developed as in developed countries, and this is even more evident in the lack of data on stock market developments.

3.3.1. Dependent Variable

In this study, real GDP is the proxy variable measuring the economic growth of the selected African economies. Economic growth is the short-, medium- and long-term development of gross domestic product (GDP) (Ngongang, 2015). In this study, it is measured using the growth rate of real GDP. Throughout the estimation, we will use real GDP as the initial income, with its own annual lag, to regulate the steady-state convergence expected by the neoclassical growth model. Accordingly, we designed a log of real gross domestic product $\ln\text{GDP}$ for this study.

3.3.2. Financial Development

Identifying suitable indicators to measure the development of the financial sector is a very difficult task. The first indicator is the ratio of domestic private sector credit to GDP. This indicator measures the quality and quantity of investments financed by the banking sector. Researchers such as King and Levine (1993) use this index as an indicator of the development of the financial sector. They explained that financial development stimulates economic growth by increasing the rate of capital accumulation. The activity of the financial sector is expressed in terms of size; Ratio of credit to the private sector to GDP. The price of loans extended by banks to private companies and households divided by GDP is used as an indicator of economic depth and banking development.

As Favara (2003) and Levine and Zervos (1996) show, the value of credit extended to the private sector by cash banks and other financial sector institutions is a higher indicator of economic development. This equates to loans made exclusively to the non-public sector versus loans made to governments and other non-private entities. It also excludes loans issued by the central bank

and is therefore a more accurate measure of the savings that financial intermediaries pass on to the private sector. However, it is a sub-indicator for the economic development of national economies, since it only reflects developments within the banking sector and ignores the capital markets.

For the second measure, data from the International Monetary Fund (IMF) Financial Development Index is used. The index measures financial institution depth, financial institution access, financial institution efficiency, financial market depth, financial market access and financial market efficiency (see Svirydzenka, 2016). The higher the index, the stronger the development of the country's financial sector. The financial development of this study is therefore measured using two proxies; Total bank lending to the private sector divided by GDP per capita (CPS and the Financial Development Index (FSD).

3.3.3. Control Variables

The following control variables are used for the cross-country panel data regressions, as we believe they are widely used in the literature: for the data source, see the Appendix section:

Government final consumption expenditure (GOV) includes all current government expenditure on the purchase of goods and services. Including staff salaries and most national defence and security expenses. However, government military expenditures, which are part of government capital formation, are excluded.

Foreign direct investment (FDI) is the net investment inflows that acquire a permanent managerial interest (at least 10 percent of the voting shares) in a company that operates in an economy different from that of the investor. It is the sum of equity, reinvestment of earnings, other long-term capital and short-term capital as reported in the balance of payments. This series shows the net inflows (new investment inflows minus divestments) of foreign investors into the reporting country divided by GDP.

Gross capital formation (INVEST) consists of expenditure on additions to the economy's fixed assets plus the net change in inventories. Fixed assets include land improvements (fences, ditches, drains, etc.); purchase of plant, machinery and equipment; and the construction of roads, railways

and the like, including schools, offices, hospitals, private dwellings and commercial and industrial buildings. Inventories are stocks of goods held by companies to counteract temporary or unanticipated fluctuations in production or sales and work in progress. The net acquisition of valuables is also considered to be capital formation.

Gross domestic saving (SAVE) is GDP minus consumption expenditures, expressed as a percentage of GDP.

Inflation (INFL), as measured by the annual growth rate of the implicit GDP deflator, shows the rate of price change in the economy as a whole. The implied GDP deflator is the ratio of GDP in current national currency to GDP in constant national currency.

Trade openness is the sum of exports and imports of goods and services, measured as a share of GDP. International trade openness is indicated by the ratio of trade to GDP (OPEN) with an expected positive coefficient. Greater openness towards Hassana et al. (2011) promotes growth through increased competition and technological advances.

Total Population (POP) is total number of peoples that are nationals of the selected countries.

The two instrumental variables used in the IV regression are the Accountability Index (ACCOUNT) of countries and the Regulatory Quality Index (REGUL). These are average indices from -2.5 (weak) to 2.5 (strong) values, constructed by Kaufmann et al. (2010) for WB World Governance Indicators.

3.3.4. Data Source

The study uses secondary panel data from the World Banks World Development Indicators (WDI) 2022 database, the IMF Financial Development Index and the WB Governance Indicators Database; see section appendix. It covers a total of 39 African countries in the period 2002-2020. The data are annual and the countries included in the sample are listed in the appendix. Again, countries are selected based on the availability of data based on the variables discussed above.

3.4. Selection of Countries

This study will cover a group of 39 African countries classified based on the database maintained by the three data sources. Based on all available countries and indicators within the database, only selected financial development indicators and specifically 39 African countries are sorted out according to data availability for this study. The selection of the sample countries is therefore based on the data availability for the study period, which also depends on the data availability of observations for African countries. Therefore, the selection of these countries is based on evidence of their recorded data over the selected period.

CHAPTER FOUR

EMPIRICAL RESULTS AND DISCUSSION

4.1. Descriptive Statistics

4.1.1. Summary Statistics and Correlation Matrix

The summary statistics in Table (1) show the median GDP of 23.45 per year with a standard deviation of 14.75 percent. The minimum lnGDP is 20.36 and the maximum is 26.93 for the period 2002-2020. The main explanatory variables are credit to private sector and financial development index. The mean values of the first proxy variable is 2.74 percent (with a standard deviation of 96.62 percent). The mean of the financial development index is -2.12 with a standard deviation of 64.34. The summary statistics for the remaining variables are provided below in the table.

Variables	No. of Obs.	Mean	Std. Dev.	Min.	Max.
lnGDP	741	23.45651	1.475511	20.36659	26.93787
lnFSD	741	-2.12321	.6434278	-3.63843	-.4421569
lnCPS	741	2.744831	.9662954	-4.850431	4.958795
lnPOP	741	16.21743	1.347233	13.00122	19.16262
lnFDI	741	2.741809	.2807232	-3.58e ⁻⁰⁷	4.068586
lnGOV	741	2.563566	.4246233	-.049456	3.565321
lnSAVE	741	4.044992	.2925438	-2.38e ⁻⁰⁷	4.829128
lnINVEST	741	3.091423	.4059309	1.373376	4.374512
INFL	741	3.322901	.3745905	7.15e ⁻⁰⁷	5.389753
lnOPEN	741	4.08552	.5451291	-.2425417	5.055367
REGUL	741	-.588502	.5643092	-1.71	1.2
ACCOUNT	741	-.5627665	.7092572	-2	.97

Table 1: Summary Statistics of all Variables

The correlation matrix in (see the appendix) shows that there are some multicollinearity issues between the two proxy variables for financial development and two governance indicators. Domestic credit to the private sector and financial development index show a high degree of collinearity. Therefore, we used these proxy measures separately in the regression models.

4.1.2. Unit Root Test

The results below show the tests for unit roots presented in Table (5) to ensure that the order of integration they report is valid for the analysis of panels. The results show that the log GDP, proxy indicators of financial development, saving, government expenditure, trade openness, population and governance indicators are of order I (1) integrated, which means that after the first difference they are stationary. The other variables FDI, investment, inflation are stationary at level I (0). In the first difference, all variables have statistically significant values, rejecting the null hypothesis of the unit root. Therefore, this confirm that the data are stationary at the first difference. In other words, Levin, Lin & Chu t-stat; Im, Pesaran & Shin, W-stat; ADF-Fisher and PP-Fisher, chi-square statistic is less than critical value of 1 percent significance level confirm rejection of the null hypothesis. The results imply that the first-order variables I (1) are integrated for the respective African countries.

Variables	LLC		IPS		Fisher			
	Level	1 st Diff.	Level	1 st Diff.	ADF		Phillips-Perron	
					Level	1 st Diff.	Level	1 st Diff.
lnGDP [I(1)]	-4.4880*	-7.4098*	2.0258	-7.0088*	2.1049	-9.9826*	2.6526	-23.3658*
lnFSD [I(1)]	-4.3601*	-10.8354*	-0.4384	-8.6186*	-0.4101	-13.5068*	-0.9196	-21.7483*
lnCPS [I(1)]	-4.7564*	-6.1945*	-0.8457	-4.6142*	-0.9959	-5.9511*	-2.4655*	-19.0728*
POP [I(1)]	-4.0879*	-8.4096*	1.8125	-7.0125*	2.0148	-9.8869*	2.47260	-22.6424*
FDI [I(0)]	-5.2361*	-6.6220*	-3.4702*	-6.3539*	-4.4351*	-8.8881*	-7.7083*	-30.2125*
lnGOV [I(1)]	-3.1372*	-8.9152*	-0.6269	-6.9074*	-1.3267***	-10.0048*	0.2687	-20.1272*
SAVE [I(1)]	-	-8.7441*	0.2272	-7.0136*	0.3498	-10.9028*	-3.6571*	-23.8072*
lnCAPF [I(0)]	-4.1427*	-9.4900*	-2.1513**	-6.6219*	-2.4793*	-9.6663*	-2.8315*	-14.2733*
INFL [I(0)]	-10.8537*	-18.5452*	-8.4815*	-17.9828*	-12.8787*	-32.5126*	-15.6512*	-37.0773*
lnOPEN [I(1)]	-3.0879*	-8.2426*	-0.9929	-6.2212*	-1.5980***	-8.8681*	-0.8864	-18.7201*
ACCON T [I(1)]	-3.0413*	-8.1719*	-0.6352	-6.4590*	-0.5262	-9.3845*	-2.8969*	-22.5818*
REGQ [I(1)]	-2.0877**	-7.9839*	0.0308	-6.7650*	0.0194	-10.9654*	-1.9163**	-34.1292*

Note: *** Significant at 10% level, ** significant at 5% level, * significant at 1%.

Table 2: Unit root Test for Stationarity of Variables

4.1.3. Cointegration Test

A panel cointegration analysis is required to test the long-term relationship that exists between the underlying variables. The panel cointegration test in Table (3) below examines the existence of a long-term relationship between the variables in this study. The tests carried out support the results and confirm the existence of a cointegration between the considered variables. Therefore, the test rejects the null hypothesis of lack of cointegration and clearly indicates a statistically significant long-term relationship between other variables and the discussed financial variables under different models.

Test Methods	lnCPS	lnFSD
Pedroni's Cointegration Test		
Modified Phillips-Perron t	7.2034*	7.1440*
Phillips-Perron t	-5.2543*	-8.1562*
Augmented Dickey-Fuller t	-3.0842*	-7.0564*
Westerlund's Cointegration Test		
Variance ratio	5.3794*	5.8245*

Note: *** Significant at 10% level, ** significant at 5% level, * significant at 1%.

Table 3: Cointegration Test of Variables

The financial sector of African countries is primarily bank-dominated with a large number of commercial banks and only bank-based financial development measures are applicable. This can be observed using the Financial Development Index of countries (FSD) and the share of domestic lending to the private sector as a share of GDP. Figure 1 below shows that financial development has a growth-enhancing effect, although Africa's financial development index is still lower, even compared to other developing countries. See the Appendix section for the other proxy measure.

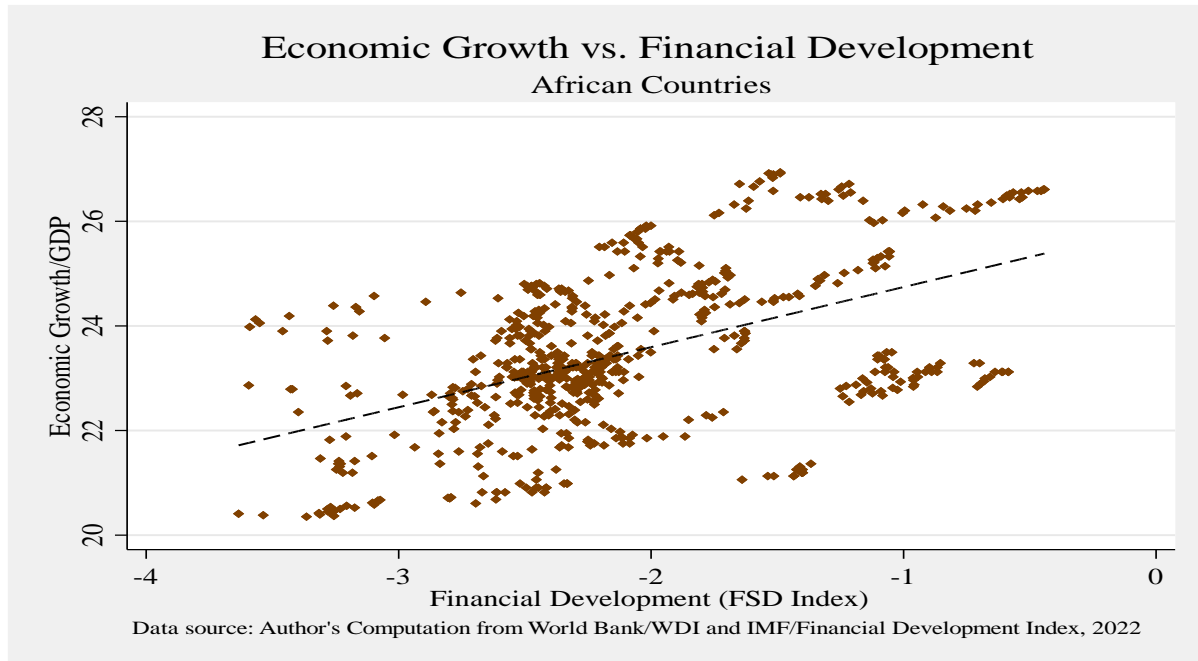


Figure 2: The linear relationship between Financial Development and Economic Growth

The figure above only captures the linear relationship between finance and growth. In practice, various non-linear relationships between finance and growth could exist. For example, countries in the early years of developing countries may need more real sector than financial products. In addition, after some stages of development where sophisticated financial intermediation is in place, financial development indicators may not reflect the usual linear path of finance and growth. Figure 2 below shows the non-linear relationship between the squared term of the financial development indicator and growth. The chart shows that although financial development promotes growth, it has a negative impact above a certain level. Hence, we could capture a non-linear relationship for the finance-growth nexus. For the other two indicators (see appendix) the slope is positive but less steep and shows a decreasing effect.

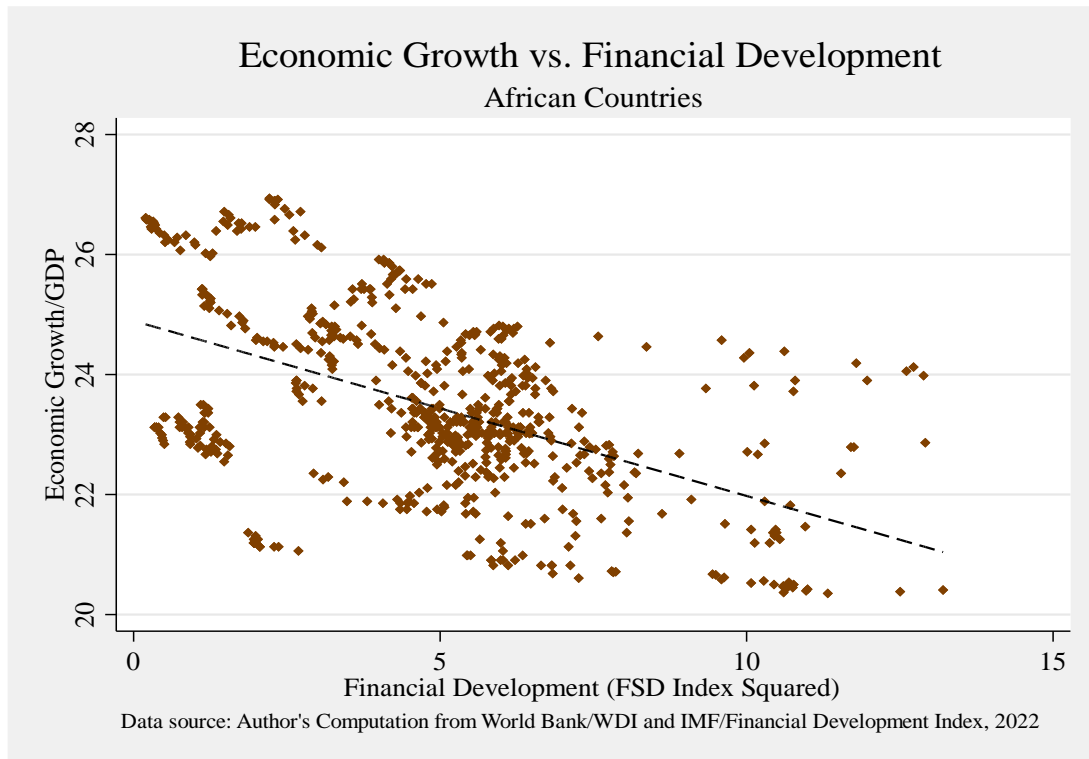


Figure 3: The non-linear relationship between Financial Development and Economic Growth

4.2. Estimation Result and Findings

4.2.1. Panel Causality Results

Table (4) shows the results when the variables "Credit to Private Sector" and "Financial Development Index" are used in the set of explanatory variables. These columnar results show that private sector credit has a positive impact on both long-term and short-term growth, confirming that financial performance plays an essential role in a country's growth. The coefficient for credit to the private sector of 0.238 indicates that a 1 percent growth in credit to the private sector is associated with long-term GDP growth of 0.24 percentage point. This suggests that more developed private sector credit expansion in African financial systems could direct resources to efficient projects that promote growth. A well-developed financial system also mobilizes savings, manages risk, and directs investment into the most efficient sectors of the economy; a result consistent with the studies by (Levine, Loyaza and Beck, 2000; King and Levine, 1993).

Variables	Credit to PS (lnCPS)		FD Index (lnFSD)	
	Coef.	Std. Err.	Coef.	Std. Err.
Long run coefficients				
lnFD	.2388491*	.0516017	.231106***	.1254362
lnGOV	.0344094	.0565994	.5810718*	.1406054
lnINVEST	.6836147*	.0751455	.1631964	.1196716
lnINFL	-.487601*	.086663	-.0496061	.0695929
lnOPEN	-.0759359**	.0349136	-1.724659*	.3510882
lnFDI	-.274671*	.0791151	-.2323122*	.0787843
lnPOP	.9501434*	.0990207	1.988701*	.227093
Short run coefficients				
ECM	-.0762532*	.0234225	-.0153628	.0151722
Δ lnFD	.0419493	.0285665	.0084407	.0218493
Δ lnGOV	-.1005529*	.0338644	-.1328814*	.033441
Δ lnINVEST	.0136714	.018798	.0269507	.0176593
Δ lnINFL	-.0009243	.0104326	-.0285399	.0092402
Δ lnOPEN	.0393944	.0315909	.0121262	.0209875
Δ lnFDI	.0223659	.0286583	.0376316	.0368424
Δ lnPOP	.0909309	.2079948	.1831823	.1431865
Intercept	.6123632*	.1823744	-.204774	.2383842
No. of Countries	39		39	
No. of Obs.	702		702	

Note: *** Significant at 10% level, ** significant at 5% level, * significant at 1%.

Table 4: Result for Pooled Mean Group Estimation

Our pooled mean group panel regression results provided evidence for a positive association between economic growth and financial deepening in Africa. The coefficient for the second indicator of financial development, Log of Financial Development, is significant in the long term, and is significant in the short term. It has a coefficient of 0.231, indicating that a 1 percent growth in the financial development index is associated with GDP growth of 0.23 percentage points in the long term. This suggests that a more developed financial sector in African financial systems could boost economic growth. The error correction term (ECT) is significant at the 1 percent level of significance and is negatively related to long-term economic growth. It shows the speed of adjustment from short-term imbalance to long-term equilibrium. The coefficient of ECT or rate of adjustment to equilibrium, i.e. for the first model estimate, is -0.07, indicating that the deviation of the variable from short- to long-term equilibrium is adjusted significantly for African countries, corrected by 0.07 percent annually.

As for the control variables, only in the first model were government spending is insignificant in the long run. Government expenditure coefficients are negatively associated with both long-run and short-run models, showing that government size is a constraint on growth. On the other hand, openness and FDI are found to be negatively correlated with economic growth in the long-run, while positively correlated with short-run growth. This means that both variables have growth-enhancing effects in the short run, while in the long run they are a cumulative drag on the economy. Conversely, openness is negatively associated with short-term growth and positively with long-term growth; this means that openness gradually leads to a comparative advantage over the rest of the world. Population growth is found to be positively related with economic growth as it could be a means for the growing labour force in African countries.

The results in Table (5) indicate a bi-directional causal relationship between economic growth and credit to the private sector, suggesting that credit is a determinant of growth. Therefore, increasing creditworthiness will increase economic growth in the long run. Focusing on increasing the number of banking entities in less developed areas will directly benefit economic growth. Accordingly, it emphasizes that policies that affect financial developments in the short or long term are also likely to affect economic growth and vice versa.

Dep. Var.	Exp. Var.	Coef.	Dep. Var.	Exp. Var.	Coef.	Direction of Causality
lnGDP	lnCPS	.0343445*	lnCPS	lnGDP	.3912561*	<i>lnGDP ↔ lnCPS</i>
lnGDP	lnFSD	-.0114523	lnFSD	lnGDP	.0849326*	<i>lnGDP → lnFSD</i>

Note: *** Significant at 10% level, ** significant at 5% level, * significant at 1%.

Table 5: Result for Granger Non-causality Estimation

Important insights result from the table above; first, the non-causality hypothesis for credit to the private sector and the financial development index is boldly rejected. Second, the causal relationship between financial development and growth is bidirectional and statistically significant for credit to the private sector, suggesting that financial development causes growth and in return growth promotes financial development. Therefore, credit to private sector and financial

development index are suitable proxies as an indicator of financial development for this study of African countries.

4.2.2. IV Estimation Results

According to the theoretical framework, improving financial development promotes economic growth. On the other hand, the continuous improvement of the real sector economic growth will also promote financial development. Therefore, there may be a reverse causation relationship between financial developments and economic growth, and some unobservable missing variables may result in an inconsistent parameter estimation due to the availability of data. Instrumental variable regression is used to solve the potential endogenous problem. This study selects the appropriate instrumental variables that are highly related to financial developments but not to other unobserved factors potentially affecting economic growth. The selected instrumental variables for financial development are in particular accountability index of the country, the regulation quality index along with other control explanatory variables as in Table (6) below.

Variables	lnCPS		lnFSD	
	Coef.	Std.Er.	Coef.	Std.Er.
lnFD	.1789513**	.070012	.1806127*	.0583905
lnFDSQ	-.0244637**	.0097128	.0365996*	.0130301
L. lnGDP	.9698236*	.0100644	.962186*	.0076607
lnFDI	.0272985	.0170736	.0030726	.0082528
lnGOV	-.0537907*	.0172126	-.0286003*	.0061666
lnSAVE	.0919328**	.0416077	.0702269*	.0211067
lnINFL	-.0204374	.0190978	-.006811	.0060019
lnINVEST	.023508**	.0109336	.0162097**	.0079323
lnOPEN	.0108732	.007823	.007756***	.0048068
lnPOP	.0244009*	.0080694	.0333423*	.0065402
Intercept	-.3048291**	.1497956	.2621466*	.1018222
No. of Obs.	702		702	
Wald chi2(10)	173433.04		500590.67	
R-squared	0.8899		0.9577	

Note: *** Significant at 10% level, ** significant at 5% level, * significant at 1%.

Table 6: Regression Results for Instrumental Variables Estimation

This study includes ten control variables and two instruments to account for other potential economic growth factors. Most previous studies of the finance-growth nexus used the underlying control variables. Foreign Direct Investment (lnFDI), Government Consumption Expenditure (lnGOV), Gross Domestic Saving (lnSAVE), Gross Investment (lnINVEST), Openness to Trade (lnOPEN), Inflation (lnINFL) and Population (lnPOP) are the control variables; and instrumental variables Accountability Index of Countries (ACCOUNT) and Regulatory Quality Index (REGUL). As a result, the study estimated two dynamic panel data models using two-stage least squares (2sls) estimation with instrumental variables for two financial development indicators, accounting for the ten control variables included in both models. Each of the two models was estimated using only one financial development indicator. Gross domestic product (lnGDP) is the dependent variable and all other independent variables are as previously defined. The names of the explanatory variables are listed in the first column.

The variable lag of GDP (L.lnGDP) is positive and significant in both models, which means that the year (t) real GDP growth rate depends positively and significantly on its previous lag. The first model uses private sector credit as a percentage of GDP (lnCPS), which essentially measures the impact of financial sector depth on economic growth. As a result, credit expansion to the private sector is found to have a positive coefficient of 0.17 and is statistically significant at the 5 percent level. This means that a 1 percent increase in credit to the private sector leads to a 0.17 percent increase in economic growth; This implies that the more credit made available to the private sector as a percentage of GDP, it will have a positive impact on the country's economic growth. In theory, this finding supports the supply leading hypothesis (see Dagim and Adisu, 2019; Thobeka and Karabo, 2019; Ibrahim and Alagidede, 2018).

For the same reason, the Financial Development Index (lnFSD) is used in Model-2, which essentially measures the level of development of the financial sector in the economy. In view of this, the improvement in the development of the financial sector is noted as a positive coefficient of 0.18 and statistically significant at the level of 1 percent. This means that a 1 percent increase

in financial sector development means an increase in economic growth of 0.18 percent; as the financial sector keeps getting better, it would have an encouraging effect on the country's economic growth. Since the two financial development indicators for both models are instrumented with institutional factors of regulation, financial development spurs growth in African countries with strong institutions and vice versa.

In addition, foreign direct investment (lnFDI) is positively associated with economic growth for both models, but is insignificant at the given percent level under both models. In both models, government spending (lnGOV) is negative and has significant impact on growth at 1 percent level. It shows that when the size of the government is so large, a country's economy is adversely affected as government spending in African countries is funded by raising taxes, borrowing, and printing more money to fund the economy. The inflation rate (INF) also has a negative effect on economic growth in both models, but is not significant in the models. Gross fixed capital formation (lnINVEST) has the expected positive sign and is significant at the 5 percent level. In addition, gross domestic saving (lnSAVE) is significant for the models and has a positive impact on growth. This could be because a higher savings rate can lead to higher investment and faster economic growth as individuals save more portion of their income and vice versa. Openness to Trade (lnOPEN) shows a positive association with growth in the selected African countries, as increasing openness to trade can improve economic growth through rising competition with the rest of world and within economies. Population growth (POP) is also found to be positively related with economic growth as it could be a means for the growing labour force in the selected African countries.

Finally, the nonlinear relationship between financial development and economic growth was captured by a squared variable of the Financial Development Indicator (lnFDSQ). The results suggest that the financial development indicator and its squared maturity are significant determinants when using the IV approach in the long run. The financial development coefficients and their squared maturity were positive and negative, respectively. This result suggests that financial developments, while supporting economic growth, have a negative impact above a certain level of maturity point. The result is consistent with the results of Ibrahim and Alagidede (2018), Law et al. (2018), Soedarmono et al. (2017) and Law and Singh (2014). This is due to the

fact that the huge growth of the financial system is not accompanied by a parallel development in the real sector of the country's national economy. It could shift resources from other productive sectors of the economy into the financial system, which could hamper current state of economic growth.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

This study empirically examines the relationship between financial development and economic growth using a cross-country panel data analysis of 39 African countries. The Granger causality results suggest that financial developments is a result of economic growth and reverse of it is also true. Our results support the standard demand-following hypothesis for the financial development index variable and two-way causation (reverse causation) for credit to the private sector proxy; which is in line with (Akinlo and Egbetunde, 2010; and Shahbaz and Lean, 2012; Musamali et al. 2014); and Okpara et al. 2018). The results provide some support for the argument that financial development will initially grow in response to services directed to the financial system to counteract the demand from economic growth. Once a certain stage of development is reached in the real sector, the direction of causality reverses and financial development directly stimulates economic growth.

The result of the IV estimation provides strong statistical evidence that financial development does not boost growth in most developing countries with weak institutions, as in the case of African countries. Suggesting that weak institutions and inappropriate government regulation could distort economic decision-making and reduce productivity. The results of this study also showed that the development of the banking sector, in particular the expansion of credit to the private sector, will lead to increased economic growth in Africa. In other words, the study found that the coefficient of the proxy variable for financial development, credit to the private sector as a percentage of GDP, and the financial development index are positive and statistically significant. Supporting the supply-leading hypothesis (development of the banking sector leads to economic growth) in agreement with McKinnon, (1973) and Shaw, (1973). This result is consistent with the original study by King and Levine (1993) and later studies by Luintel et al., 2014 and Ndako (2017).

Like many other studies, the results for control variables suggest that foreign direct investment inflows, savings, trade openness, population and gross capital formation (investment) play important roles in boosting economic growth in African countries. However, increases in government size and inflation, and are detrimental to the economic growth of the same countries. It shows that with such a large government, government spending is likely to be funded by raising taxes, borrowing, and printing more money to fund economies in African countries. The adverse effect of government size in the economies could also be that a higher leads to more inflation in the economy as individuals in most developing countries spend a larger proportion of their income on consumption of goods and services.

The analysis further found that the significant positive coefficient attributed to the financial development indicator and the negative coefficient attributed to its squared value demonstrates the non-linearity of the relationship with financial development and growth. Accordingly, from a certain level of development, additional financial resources tend to harm economic growth. Therefore, knowing how to channel financial resources efficiently and the optimal level of financial development to increase economic growth is crucial.

5.2. Recommendations

This study found a relationship between financial development and economic growth in African countries. As the primary source of funding for private investors, bank sector loans in African countries should drive strategies for the private sector to borrow and invest smoothly. In addition, African countries should take institutional measures to minimize rigidities and make the most of regulation in financial institutions by working on monitoring and assessment. The actors concerned are recommended to make the expansion of financial services through more lending to the private sector is mandatory. Also, the state should limit its size in the economy; Savings in the economy should be channelled into productive investments; and it should manage the exchange rate and price of items in international trade to protect local producers and avoid imported inflation.

Since country-level time-series studies contribute to understanding the role of financial sector development in stimulating economic growth in African countries, they should also be pursued. In addition, the other dimension of financial development proxy, market-based proxies, which is not

included in this study due to a lack of data, needs to be addressed in order to consider the impact of financial development on economic growth more broadly. To better understand the relationship between finance and growth in Africa, it is also important to use an empirical approach that takes into account and model the non-linear relationship found in this study that may be of vital interest. So that practitioners should consider the optimal level of financial development when formulating economic growth strategies.

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APPENDIX

A. List of Countries

c_id	Country	c_code
1	Algeria	DZA
2	Angola	AGO
3	Benin	BEN
4	Botswana	BWA
5	Burkina Faso	BFA
6	Burundi	BDI
7	Cabo Verde	CPV
8	Cameroon	CMR
9	Central African Republic	CAF
10	Chad	TCD
11	Congo, Dem. Rep.	COD
12	Congo, Rep.	COG
13	Cote d'Ivoire	CIV
14	Egypt, Arab Rep.	EGY
15	Equatorial Guinea	GNQ
16	Gabon	GAB
17	Gambia, The	GMB
18	Ghana	GHA
19	Guinea	GIN
20	Guinea-Bissau	GNB
21	Kenya	KEN
22	Madagascar	MDG
23	Mali	MLI
24	Mauritania	MRT
25	Mauritius	MUS
26	Morocco	MAR
27	Mozambique	MOZ
28	Namibia	NAM
29	Niger	NER
30	Nigeria	NGA
31	Rwanda	RWA
32	Senegal	SEN
33	Sierra Leone	SLE
34	South Africa	ZAF
35	Sudan	SDN
36	Tanzania	TZA
37	Togo	TGO
38	Tunisia	TUN
39	Uganda	UGA

B. Table of Correlation

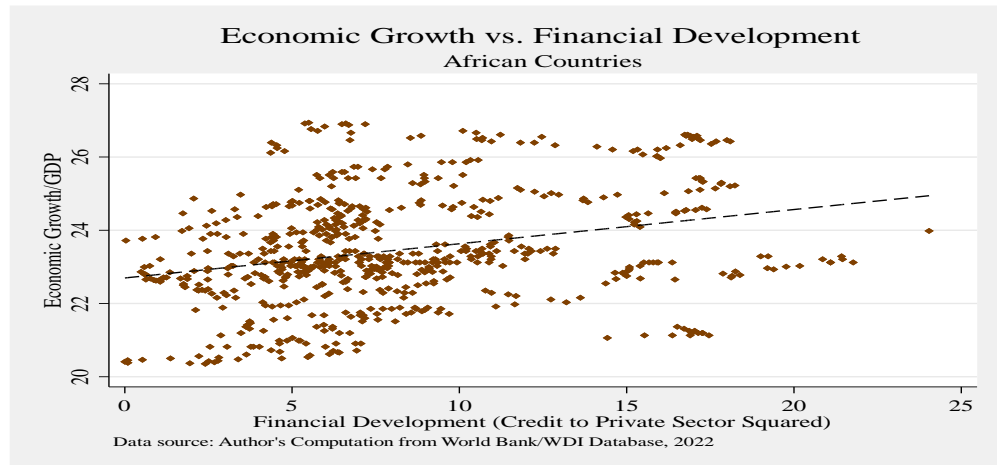
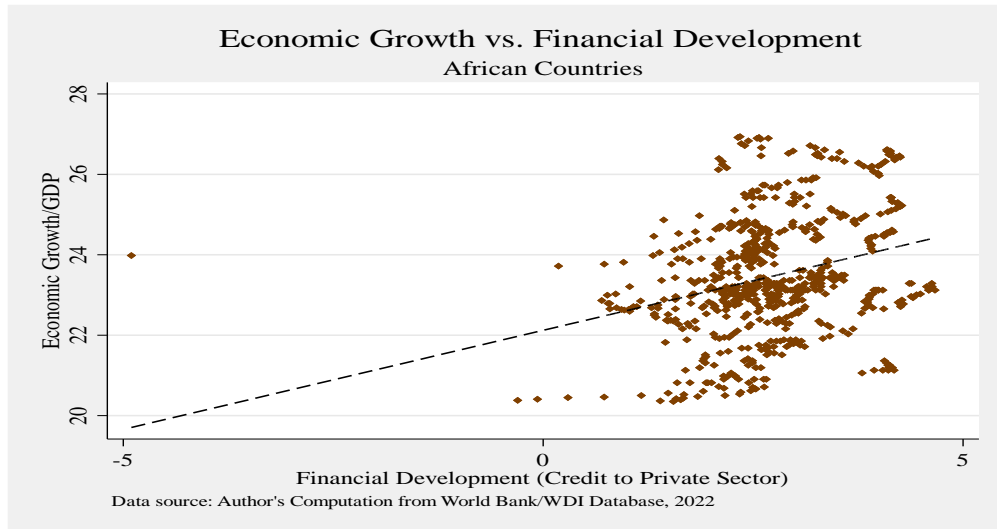
. corr lnGDP lnFSD lnCPS lnGOV lnINVEST lnSAVE lnINFL lnOPEN lnFDI lnPOP
(obs=741)

	lnGDP	lnFSD	lnCPS	lnGOV	lnINVEST	lnSAVE	lnINFL	lnOPEN	lnFDI	lnPOP
lnGDP	1.0000									
lnFSD	0.4615	1.0000								
lnCPS	0.2889	0.8160	1.0000							
lnGOV	-0.0855	0.3673	0.4965	1.0000						
lnINVEST	0.2439	0.1841	0.1676	0.1665	1.0000					
lnSAVE	0.3898	0.1458	0.0219	-0.0127	0.4674	1.0000				
lnINFL	0.1339	-0.0303	-0.1394	-0.1507	-0.0585	-0.0107	1.0000			
lnOPEN	-0.1342	0.1979	0.2202	0.1288	0.2408	0.1332	-0.2071	1.0000		
lnFDI	-0.1680	-0.0804	-0.0826	0.0473	0.3012	-0.0558	-0.0507	0.2403	1.0000	
lnPOP	0.7692	0.0444	-0.0185	-0.2388	0.0608	0.0401	0.2098	-0.3963	-0.1684	1.0000

C. Data Source and Variables

Variables	Description/Measure/Proxy	Source
GDP (lnGDP)	Gross Domestic Product (Annual)	World Development Indicators (WDI DataBase)
Financial Development Index (lnFSD)	Financial Development Index	IMF Financial Development Index (FDI Database)
Credit to Private Sector by Banks (lnCPS)	Credit provided for Private Sector by Banks to GDP Ratio	World Development Indicators (WDI DataBase)
POPULATION (POP)	Total Number of people in the Country	World Development Indicators (WDI DataBase)
Foreign Direct Investment (lnFDI)	Net Foreign Direct Investment Inflow to GDP Ratio	World Development Indicators (WDI DataBase)
Government Expenditure (lnGOV)	Government Expenditure to GDP Ratio	World Development Indicators (WDI DataBase)
Gross Domestic Saving (lnSAVE)	Gross Domestic Savings (GDS) to GDP Ratio	World Development Indicators (WDI DataBase)
Gross Capital Formation (lnINVEST)	Gross Capital Formation to GDP Ratio (Investment)	World Development Indicators (WDI DataBase)
Inflation (lnINFL)	Inflation Rate (Annual)	World Development Indicators (WDI DataBase)
Trade Openness (lnOPEN)	The Difference between Export and Import to GDP Ratio	World Development Indicators (WDI DataBase)
Accountability Index (ACCOUNT)	Rule of Law Index Aggregate Governance Indicators 1996-2021	World Governance Indicators (WGI DataBase)
Regulatory Quality Index (REGUL)	Regulatory Quality Index Aggregate Governance Indicators 1996-2021	World Governance Indicators (WGI DataBase)

D. Graphical Representation of the Relationship between Finance and Growth



E. Regression Results

```
. xtmg d.lnGDP d.lnCPS d.lnGOV d.lnINVEST d.lnINFL d.lnOPEN d.lnFDI d.lnPOP, lr (l.lnGDP lnCPS lnGOV lnINVEST lnINFL lnO
> PEN lnFDI lnPOP ) ec (ECT) replace pmg
```

```
Iteration 0: log likelihood = 1608.8924 (not concave)
Iteration 1: log likelihood = 1614.1401 (not concave)
Iteration 2: log likelihood = 1630.6024 (not concave)
Iteration 3: log likelihood = 1633.7437
Iteration 4: log likelihood = 1634.4554
Iteration 5: log likelihood = 1634.4807
Iteration 6: log likelihood = 1634.4808
```

Pooled Mean Group Regression
(Estimate results saved as pmg)

```
Panel Variable (i): c_id          Number of obs   =    702
Time Variable (t): year          Number of groups =    39
                                Obs per group: min =    18
                                avg   =   18.0
                                max   =    18
```

Log Likelihood = 1634.481

	D.lnGDP	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
ECT						
	lnCPS	.2388491	.0516017	4.63	0.000	.1377116 .3399867
	lnGOV	.0344094	.0565994	0.61	0.543	-.0765234 .1453423
	lnINVEST	.6836147	.0751455	9.10	0.000	.5363321 .8308972
	lnINFL	-.487601	.0866663	-5.63	0.000	-.6574574 -.3177446
	lnOPEN	-.0759359	.0349136	-2.17	0.030	-.1443653 -.0075064
	lnFDI	-.274671	.0791151	-3.47	0.001	-.4297338 -.1196082
	lnPOP	.9501434	.0990207	9.60	0.000	.7560664 1.14422
SR						
	ECT	-.0762532	.0234225	-3.26	0.001	-.1221604 -.030346
	lnCPS					
	D1.	-.0419493	.0285665	-1.47	0.142	-.0979386 .01404
	lnGOV					
	D1.	-.1005529	.0338644	-2.97	0.003	-.1669259 -.0341798
	lnINVEST					
	D1.	-.0136714	.018798	-0.73	0.467	-.0505148 .023172
	lnINFL					
	D1.	-.0009243	.0104326	-0.09	0.929	-.0213719 .0195233
	lnOPEN					
	D1.	.0393944	.0315909	1.25	0.212	-.0225226 .1013115
	lnFDI					
	D1.	.0223659	.0286583	0.78	0.435	-.0338032 .0785351
	lnPOP					
	D1.	.0909309	.2079948	0.44	0.662	-.3167314 .4985932
	_cons	.6123632	.1823744	3.36	0.001	.2549159 .9698105

```
. xtmg d.lnGDP d.lnFSD d.lnGOV d.lnINVEST d.lnINFL d.lnOPEN d.lnFDI d.lnPOP, lr (l.lnGDP lnFSD lnGOV lnINVEST lnINFL lnO
> PEN lnFDI lnPOP ) ec (ECT) replace pmg
```

```
Iteration 0: log likelihood = 1604.2739 (not concave)
Iteration 1: log likelihood = 1612.8499 (not concave)
Iteration 2: log likelihood = 1613.7552 (not concave)
Iteration 3: log likelihood = 1619.3041 (not concave)
Iteration 4: log likelihood = 1623.4457
Iteration 5: log likelihood = 1625.3719
Iteration 6: log likelihood = 1625.7881
Iteration 7: log likelihood = 1625.8028
Iteration 8: log likelihood = 1625.8029
```

```
Pooled Mean Group Regression
(Estimate results saved as pmg)
```

```
Panel Variable (i): c_id      Number of obs   =      702
Time Variable (t): year      Number of groups =      39
                               Obs per group: min =     18
                               avg   =     18.0
                               max   =     18
```

```
Log Likelihood = 1625.803
```

	D.lnGDP	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
ECT						
	lnFSD	.231106	.1254362	1.84	0.065	-.0147444 .4769563
	lnGOV	.5810718	.1406054	4.13	0.000	.3054902 .8566533
	lnINVEST	-.1631964	.1196716	-1.36	0.173	-.3977484 .0713555
	lnINFL	.0496061	.0695929	0.71	0.476	-.0867933 .1860056
	lnOPEN	1.724659	.3510882	4.91	0.000	1.036538 2.412779
	lnFDI	-.2323122	.0787843	-2.95	0.003	-.3867266 -.0778978
	lnPOP	1.988701	.227093	8.76	0.000	1.543607 2.433795
SR						
	ECT	-.0153628	.0151722	-1.01	0.311	-.0450998 .0143742
	lnFSD					
	D1.	.0084407	.0218493	0.39	0.699	-.034383 .0512645
	lnGOV					
	D1.	-.1328814	.033441	-3.97	0.000	-.1984246 -.0673383
	lnINVEST					
	D1.	.0269507	.0176593	1.53	0.127	-.0076608 .0615623
	lnINFL					
	D1.	-.0285399	.0092402	-3.09	0.002	-.0466504 -.0104293
	lnOPEN					
	D1.	.0121262	.0209875	0.58	0.563	-.0290086 .0532609
	lnFDI					
	D1.	.0376316	.0368424	1.02	0.307	-.0345782 .1098413
	lnPOP					
	D1.	.1831823	.1431865	1.28	0.201	-.0974581 .4638227
	_cons	-.204774	.2383842	-0.86	0.390	-.6719985 .2624505


```

. xtivreg lnGDP l.lnGDP lnFDI lnGOV lnSAVE lnINVEST lnINFL lnPOP lnOPEN lnFSDSQ ( lnFSD = ACCOUNT REGUL ), re
G2SLS random-effects IV regression          Number of obs   =       702
Group variable: c_id                        Number of groups =       39

R-sq:                                       Obs per group:
  within = 0.9577                          min =          18
  between = 0.9997                          avg =         18.0
  overall = 0.9986                          max =          18

Wald chi2(10) = 500590.67
corr(u_i, X)   = 0 (assumed)                Prob > chi2    =      0.0000

```

	lnGDP	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
lnFSD		.1806127	.0583905	3.09	0.002	.0661694 .295056
lnGDP	L1.	.962186	.0076607	125.60	0.000	.9471713 .9772006
lnFDI		.0030726	.0082528	0.37	0.710	-.0131027 .0192479
lnGOV		-.0286003	.0061666	-4.64	0.000	-.0406865 -.0165141
lnSAVE		.0702269	.0211067	3.33	0.001	.0288586 .1115952
lnINVEST		.0162097	.0079323	2.04	0.041	.0006626 .0317567
lnINFL		.006811	.0060019	1.13	0.256	-.0049526 .0185745
lnPOP		.0333423	.0065402	5.10	0.000	.0205237 .0461609
lnOPEN		.007756	.0048068	1.61	0.107	-.0016652 .0171771
lnFSDSQ		.0365996	.0130301	2.81	0.005	.0110611 .062138
_cons		.2621466	.1018222	2.57	0.010	.0625786 .4617145
sigma_u		0				
sigma_e		.13728962				
rho		0	(fraction of variance due to u_i)			

```

Instrumented: lnFSD
Instruments:  L.lnGDP lnFDI lnGOV lnSAVE lnINVEST lnINFL lnPOP lnOPEN
              lnFSDSQ ACCOUNT REGUL

```

```

. xtivreg lnGDP l.lnGDP lnFDI lnGOV lnSAVE lnINVEST lnINFL lnPOP lnOPEN lnFSDSQ ( lnFSD = ACCOUNT REGUL ), re
G2SLS random-effects IV regression          Number of obs   =       702
Group variable: c_id                        Number of groups =       39

R-sq:                                       Obs per group:
  within = 0.9577                          min =          18
  between = 0.9998                          avg =         18.0
  overall = 0.9987                          max =          18

Wald chi2(10) = 538103.68
corr(u_i, X)   = 0 (assumed)                Prob > chi2    =      0.0000

```

	lnGDP	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
lnFSD		.0828516	.0178494	4.64	0.000	.0478675 .1178358
lnGDP	L1.	.9665637	.0061533	157.08	0.000	.9545035 .978624
lnFDI		.0026831	.0079784	0.34	0.737	-.0129542 .0183204
lnGOV		-.0186076	.0059806	-3.11	0.002	-.0303294 -.0068857
lnSAVE		.0334339	.0158246	2.11	0.035	.0024183 .0644495
lnINVEST		.0102068	.0075228	1.36	0.175	-.0045377 .0249513
lnINFL		.0037102	.0058933	0.63	0.529	-.0078405 .0152608
lnPOP		.0291113	.0051937	5.61	0.000	.0189319 .0392907
lnOPEN		.015618	.0044458	3.51	0.000	.0069044 .0243317
lnFSDSQ		-.0062721	.001521	-4.12	0.000	-.0092533 -.0032909
_cons		.3751624	.1077041	3.48	0.000	.1640663 .5862586
sigma_u		0				
sigma_e		.100111				
rho		0	(fraction of variance due to u_i)			

```

Instrumented: lnFSD
Instruments:  L.lnGDP lnFDI lnGOV lnSAVE lnINVEST lnINFL lnPOP lnOPEN
              lnFSDSQ ACCOUNT REGUL

```