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INSTITUTIONAL QUALITY IN THE FINANCE-GROWTH NEXUS IN SUB-SAHARAN AFRICA

BY

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DECLARATION

I hereby declare that apart from certain documentary and other sources which I have cited and duly acknowledged, this submission is the result of my own research and that it has neither in whole nor in part been presented for another degree elsewhere. I also declare that neither my supervisor nor any other person but the author alone is responsible for whatsoever errors and omissions that might appear in the work.

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Adu-Darko Eunice Adwoa Date

ABSTRACT

This thesis investigates whether productivity can be enhanced by institutional quality through financial development in the sub-Saharan African region. Specifically, it seeks to achieve four main objectives: *first*, to capture both the market and non-market features of institutional quality in order to bring out the full contribution of institutional quality to economic growth within the framework of finance-growth nexus; *second*, to investigate the role of market and non-market institutions in the finance-growth nexus for a group of twenty-one SSA economies; *third*, to detect and account for structural breaks introduced by historical events to produce more reliable estimates in our investigation; and *fourth*, to consider the constant elasticity of substitution and the variable elasticity of substitution in addition to the Cobb-Douglas production function to not only relax the constraints but also check the robustness of the analysis. Total factor productivity is decomposed into two items: 1) pure technical progress; and 2) institutional quality linked efficiency gain, which captures financial development and institutional quality. Twenty-one sub Saharan African countries were selected to test this proposition using annual data from 1985 to 2015. Based on the Solow neoclassical framework, the Cobb-Douglas, Constant Elasticity of Substitution and Variable Elasticity of Substitution specifications of the production function are employed where the pure technical progress and institutional quality linked efficiency gain were incorporated. Both panel and time series cointegration techniques that account for structural breaks and cross-sectional dependence to increase the power of the regressions and avoid possible model misspecification are employed. The results indicate that there are significant and positive long-run associations between growth, capital, financial development and institutional quality that generate productivity gains over net factor productivity in the panel of 21 countries from sub-Saharan Africa only when structural breaks and cross-sectional dependence are considered within the Cobb-Douglas framework. The impact of institutional

quality through finance on productivity and growth is positive and significant for eight countries when there are no structural breaks but reduce to six countries with the incorporation of a full regime break. In the cases of the constant elasticity of substitution and the variable elasticity of substitution production functions, such productivity generating impact remained significantly positive and generally higher for the panel but insignificant for Mali, the case country tested. This study provides important policy implications in the effective strategies for stimulating economic growth via financial development and institutional quality in sub-Saharan Africa.

DEDICATION

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LIST OF ACRONYMS AND ABBREVIATIONS

ADF	Augmented Dickey Fuller
AFC	Asian Financial Crises
BC	Banerjee and Carrion-i-Silvestre
CD	Cobb-Douglas
CES	Constant Elasticity of Substitution
CIQLEG	Contribution of Institutional Quality Linked Efficiency Gain
CKPP	Capital Stock Per Person
DOLS	Dynamic Ordinary Least Squares
ECM	Error Correction Model
ECT	Error Correction Term
EG	Economic Growth
FD	Financial Development
FMOLS	Fully Modified Least Squares
GDP	Gross Domestic Product
GDPPC	Gross Domestic Product Per Capita
GFC	Global Financial Crises
GMM	Generalized Method of Moments
GNP	Gross National Product
HC	Human Capital Per Person
ICRG	International Country Risk Guide
IMF	International Monetary Fund
INS	Institutional Quality

IQLEG	Institutional Quality Efficiency Linked Gain
LPT	Liquidity Preference Theory
M2	Intermediate Money
MENA	Middle East and North African
MWR	Mankiw, Romer and Weil
NFP	Net Factor Productivity
NIE	New Institutional Economics
OLS	Ordinary Least Squares
PWT	Penn World Tables
SAPs	Structural Adjustment Programs
SSA	Sub-Saharan Africa
TFP	Total Factor Productivity
VAR	Vector Autoregression
VECM	Vector Error Correction Model
VES	Variable Elasticity of Substitution
WDI	World Development Indicators
WGI	World Governance Indicators

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CHAPTER ONE

INTRODUCTION

1.1 Background to the study

A well-functioning financial system offers many opportunities for growth by providing services to the real sector and hence providing a link to economic growth. Many researchers have confirmed that emphasis must be placed on financial development when economic growth is either desired or needs to be sustained (Murinde, 2012; Balach and Law, 2015; Levine, 2005; Enisan-Akinlo and Egbetunde, 2010; Popov, 2018) [1]

Opinions differ as to the nature of the relationship between financial development and economic growth where such a relationship exits (Bist, 2018; Cline, 2015; Murinde, 2012; Green, Kirkpatrick and Murinde, 2006; Levine, 2005; Gries, Kraft, and Meierrieks, 2010). The difference in opinion occurs in establishing whether there are phenomena that moderate or dictate the presence, direction and extent of this finance-growth relationship (Popov, 2018; Murinde, 2012; Pagano, 1993). One strand of literature sees financial development as influencing economic growth (Bijlsma, Kool and Non, 2017; Murinde, 2012; Schumpeter, 1911; Bagehot, 1873; Levine, 2005), while others view growth as influencing financial development (Robinson, 1952; Patrick, 1966; Greenwood and Jovanovich, 1990).

There is yet another strand that views the relationship as bi-directional (Bangake and Eggoh, 2011; Fry, 1997; Calderón and Liu, 2003). There is also the group that seems not to argue

[1] Arizala, Cavallo, and Galindo (2013), Ahmed (2010), Eng and Habibullah, 2011, Ahmed and Wahid (2011), King and Levine (1993a, b); Fisman and Love (2003) all emphasize the need for finance towards achieving growth

for any relationship between finance and growth (Arcand, Berkes and Panizza, 2015; Demetriades and Hussein, 1996; Rousseau and Wachtel, 2011; Rodrik and Subramanian, 2009; Lucas, 1988). Finally, with respect to the relationship, a few non-monotonic studies have shown the positive effect of financial development on growth reversing after a certain level of financial development and or during a specific period in a nation's life (Berkes, Panizza and Arcand, 2012).

These conflicting results call for further research into the relationship and to ascertain whether there are some moderating factors that influence the relationship between financial development and economic growth. Fundamentally, macroeconomic theory postulates financial development as a determinant of economic growth. Others have proposed the need to introduce factors that enhance the finance-growth relationship. According to Murinde (2012), one such factor is the quality of institutions. He stresses the need for further research on the role of institutional factors among others that may possibly be relevant and important to the finance-growth nexus (Huang, 2010; Fernández and Tamayo, 2015).

The most commonly used definition of institutions in recent literature stems from the seminal work of North (1993), who describes institutions as the rules of the game of a society[2]. Demetriades and Law (2006) state that institutions, which are often treated as 'social technologies' in the production of economic products, are the rules, laws and conventions that dictate the behaviour and form of economic interactions by economic agents. Institutions are the constraints put in place by humans as devices that help structure human interaction. Institutions are made up of formal constraints (rules, laws, constitutions), informal constraints (norms of behaviour, conventions, and self-imposed codes of conduct),

[2] See also Kunčič (2014) and Khan *et al.* (2019)

and their enforcement characteristics. Institutions, according to North, are made by humans, define incentive, structure and shape interaction in the form of formal and informal constraints and enforcement characteristics (North, 1994).

In attempting to investigate the relevance of institutional quality in financial development, Huang (2005) initially identified three groups of factors that moderate the growth and level of financial development. These are the institutions, the policy and the geography that prevail and define the jurisdiction under study. However, Huang (2005) concludes that the institutional environment emerges as the most important. Both Balach and Law (2015) and Demetriades and Law (2006) attest to the significance and importance of institutional quality in enhancing productivity in the finance–growth relationship.

Strong institutions, such as contract enforcement and a stable macroeconomic environment, tend to reduce information asymmetry, thus leading to a reduction in financial sector fragility and increasing efficiency through reduced information and transaction costs (Balach and Law, 2015; Demetriades and Law, 2006; Levine 1998; 1999; Haber, 2008; 2010; Rajan and Zingales, 2003). This study is therefore intended to examine the influence of institutional factors that impact the relationship between financial development and economic growth in sub-Saharan Africa (SSA) when capital, labour and technological advancement are all considered in the production framework.

With SSA consistently being characterized by relatively weak institutions (ICRG, 2017; World Governance Indicators, 2017; Knutsen, 2009; Shobee, 2017; Milo, 2007), it is important to investigate what specific institutional factors moderate financial development and hence economic growth in the region. Rodrik (2000), in his seminal presentation on institutions for high quality growth, maintains that markets need to be supported by non-market institutions in order to perform well and SSA markets are no exception (North and Weingast, 1989). These factors and others mentioned in the literature include the protection of rights of parties involved in a contract, the political environment, the quality of judicial enforcement, the effectiveness of social insurance, the macroeconomic stabilisation as well as institutions for conflict management and economic freedom (La Porta, Lopez-de Silanes and Shliefer, 1997; Beck, Clarke, Groff, Keefer, and Walsh, 2001).

Research on the role of finance in economic growth is essential for shaping future policy-oriented research and generates useful information that helps policy makers, regulators and governments prioritize effective financial sector policies in relation to economic growth. This is primarily because a large pool of evidence on the finance-growth relationship documents the significant transformations that have taken place in economies that have worked towards a more developed financial sector (Menyah, Nazlioglu and Wolde-Rufael, 2014; Gries, Kraft and Meierrieks, 2009; Levine, 2005).

Sub-Saharan Africa, without a doubt, needs to find the most viable and effective policies that will use the financial sector as a channel of enhancing productivity and economic growth[3]. A portion of the literature however suggests that financial sector reforms in the last few decades have not significantly and positively impacted economic growth. One attributable reason could be the lack a stable and effective institutional environment in the region. There is therefore, the need to identify institutional factors surrounding financial development in the region. The institutional factors and its quality reduce the transaction

[3] The World Bank's structural adjustment programs aimed at stabilisation, liberalisation, deregulation and privatization which runs on the top of financial reforms in SSA over the last three decades has been highly criticized as ineffective and retrogressive (Summers and Pritchett, 1993).

and information costs associated with financial intermediation, improve predictability as well as allocative efficiency and thus enhance productivity[4] (Murinde, 2012; Balach and Law, 2015; Demetriades and Law, 2006; Beck, Demekrug-Kunt and Levine, 2000; Chinn and Ito, 2005). Hence, based on the availability of data, a panel of 21 sub-Saharan African countries is studied in this research. These countries include Botswana, Congo Republic, Cote d'Ivoire, Gabon, Ghana, Kenya, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria, Senegal, Sierra Leone, South Africa, Sudan, Tanzania United Republic, Togo, Uganda, Zambia and Zimbabwe

1.2 Objectives of the study

It is well established in the literature that institutional quality plays a vital role in promoting economic growth by raising the efficiency level of the economic system. (Rodrik, 2000; 2002; North, 1991; Boettke and Coyne, 2009; Houkonou *et al.*, 2012; Glylfason, 2004; Berhane, 2018; Bass, 2019). A number of theoretical arguments underpin the efficiency-enhancing impact of institutions in the economy. Firstly, institutions are known to broaden the reach of economic analysis beyond traditional markets and are able to capture a more complete set of mechanisms by which resources are moved from one place to another (Hovenkamp and Coase, 2011; Williamson, 2000). Secondly, adequate institutions ensure that information and transaction costs associated with economic transactions are mitigated by reducing information asymmetry and adverse selection (Tamayo and Fernandez, 2015; Coase, 1936; 1984; North 1990; 1991; 1995; Grief, 1989; North and Weingast, 1989). Thirdly, institutions mediate particular economic relationships such as business firms and contractual agreements by serving as governance structures (Williamson, 1987; 1996; North

[4] Boyd and Prescott (1986) advance this discussion on transaction cost using finance itself (See also Bordo and Rousseau, 2006; La Porta, Lopez-de-Silane, Shleifer and Vishny, 1998;2000; Huang, 2005, 2007, 2010; Levchenko, 2007; Baltagi, Demetriades and Law, 2009; Arizala, Cavallo and Galindo, 2013; Kendall, 2012).

1996). Finally, in his seminal research, Rodrik (2000) summarises the role of adequate institutions by positing that they allow greater predictability and stability, are more resilient to shocks and deliver superior distributional outcomes. Better institutions therefore allow markets to work more efficiently.

This role of institutions is depicted in the finance-growth relationship as well by many researchers as adequately working institutions contribute to the positive impact of financial development towards enhancing economic growth (Demetriades and Law, 2006; Balach and Law, 2015; Acemoglu, Johnson and Robinson, 2001; Easterly and Levine, 2003; Huang, 2010; Murinde, 2012). Following a thorough review of existing literature, this study identifies several gaps in previous studies in this strand, which motivates the broad objective of this research as to examine whether institutional quality can work through financial development to contribute to higher productivity gains and hence GDP per capita growth. We provide a more detailed discussion on each specific objective and its rationale as follows.

First of all, existing studies on institution and economic growth often focus solely on market-based institutions (Demetriades and Law, 2006; Balach and Law, 2015; Issakson, 2007; La Porta *et al.*, 1997; Rajan and Zingales, 2003; Gries and Meirrekes, 2010). However, as emphasised by Rodrik (2000) and Williamson (2000) among others, the economic system has both market and non-market institutions. Indeed, a number of studies has emphasised that non-market institutions are as important as market institutions (Addison, Chowdhury and Murshed, 2002; Gries and Mereirrekes, 2010). Rodrik (2000) further states that non-market institutions play an irreplaceable role in promoting high quality economic growth. Overlooking the role of non-market institutions leads to an incomplete understanding of the productivity-enhancing effect of institutional quality. Therefore, the first objective of this study is to capture both the market and non-market features of institutional quality in order to bring out the full contribution of institutional quality to economic growth within the framework of finance-growth nexus.

Secondly, based on the economic catching-up literature, poorer economies grow at a faster rate than their wealthier counterparts so that per capita incomes will eventually converge (Solow, 1956; 1957). The SSA's economy has consistently been regarded as one of the most under developed regions in the world (WDI, 2017; Ssozi and Asongu, 2016). Thus, it holds huge potential for economic growth. Furthermore, in response to the call in Agenda 2063 of the African Union, which is tasked to ensure inclusive and sustainable economic growth and development in the region, it is important to enlist and examine institutional quality as an engine of economic growth in SSA. Yet, literature in this area is emerging but still rare, and studies that examine both market and non-market institutions within the finance-growth framework for the SSA region are non-existent. Therefore, it leads the second specific objective of this study as to investigate the role of market and non-market institutions in the finance-growth nexus for a group of twenty-one SSA economies.

Over the past few decades, many political and economic events have taken place across the globe, shaping the world's development years sometime decades after their occurrence. Given their profound influence, many researchers have emphasised to account for structural changes brought by these events for more accurate analysis (Westerlund, 2006a; Banerjee and Carrion-i-Silvestre, 2015; Lee and Strazicich, 2004). In the case of the SSA region, Structural Adjustment Programs (SAPs) instituted by the World Bank in the late 1980s, 1990s and early 2000s, which saw the liberalisation of closed financial systems, the adoption of flexible exchange rate regimes, the institutionalisation of trade openness and the democratisation over the years have induced unprecedented political and economic changes. The region has also witnessed various ethnic and tribal conflicts such as the Ivorian civil war in 2010, the 2008 and 2009 Boko Haram insurgency and Niger Delta conflicts in Nigeria and the Liberian civil war, which spanned over several years in the 1990s. It is against this background the third object of this study is to detect and account for structural breaks introduced by these historical events to produce more reliable estimates in our investigation.

Finally, despite being the most widely employed production function (Gerchet *et al.*, 2019; Demetriades and Law, 2006), the Cobb-Douglas production function has its own limitation including that fact that it only allows unitary elasticity of substitution, limited number of inputs and constant returns to scale among others. The constant elasticity of substitution (CES) and the variable elasticity of substitution (VES) production functions can suitable address some of these limitations by accommodating more inputs, allowing for different values of elasticities of substitution and, in the case of the VES, accommodating varied returns to scale properties (Karagiannis, Palivos, and Papageorgiou, 2004; Barro, Mankiw and Sala-i-Martin, 1992). Therefore, the final specific objective of this thesis is to consider CES and VES in addition to the Cobb-Douglas production function to not only relax the constraints but also check the robustness of our analysis.

1.3 Contribution to Knowledge

This thesis seeks to make four significant contributions to the existing literature. Firstly, previous analyses on the finance-institutions-growth nexus often focuses on market-based institutions alone and only very few have considered both market and non-market institutions. Our study presents a first study analysing market and non-market institutions within the framework of financial development and economic growth nexus. In particular, we employ the market and non-market institutions proposed by Rodrik (2000) and capture institutions induced efficiency gains via an innovative decomposition of TFP into pure technical progress and institutional quality linked efficiency gain within a production function.

Secondly, financial and economic reforms have occurred in many SSA countries to promote institutional development and efficiency in the past few decades and the region. As an underdeveloped region, SSA has huge potential for growth as indicated above. Several global initiatives have been put forward to promote development and growth in this region (e.g., Agenda 2063 of the African Union, 2030 Sustainable Development Goals). Yet, previous studies on the role of institutional quality in the finance-growth nexus have overlooked the SSA region. As such, this analysis enriches the literature by examining the role of institutional quality in the finance-growth nexus in the under-researched SSA region to provide valuable information to decision makers in terms of means to stimulate economic growth.

Thirdly, from an operational point of view, any analysis that does not consider structural breaks in the past few decades when clearly a range of influential historical events have taken place in the SSA region would be misleading. Indeed, for this group of countries, no study on finance, institutions and growth has considered the impact of single and multiple breaks. Hence, the analytical tools adopted that can account for historical and future events in the form of multiple structural breaks constitute a major contribution to the study.

Finally, available literature suggests that with respect to the financial development, institutional quality and productivity, the emphasis on the few studies that are available, has been on the Cobb-Douglas production framework. This study, for the first time compares the effect of IQLEG on productivity using the CES and VES in addition to the more widely employed Cobb-Douglas production. Doing so not only addresses the limitations of the Cobb-Douglas production, but also provide evidence in terms of whether the growth impact of institution quality is sensitive to the choice of production function.

1.4 Organization of the Study

The rest of the study is organized as follows. Chapter Two entails a discussion on the theoretical framework underpinning the research. The Neoclassical growth framework and the endogenous growth model are discussed following which the analytical framework in this research is presented. The three production functions under study are extended and derived through the decomposition of total factor productivity. The analytical determination of the efficiency gains from pure technical progress and institutional quality linked efficiency gain is highlighted. The empirical literature on the finance-institutions-growth linkage is reviewed in Chapter Three with the development of the research gaps and questions followed by the empirical methodology in Chapter Four. The empirical methodology is a discussion of the choice of data, sources of the data and the various econometric and analytical tools used in estimating the relationship under study.

In Chapter Five, the effect of financial development and institutional quality on productivity and economic growth without breaks is tested at both the panel and time series level. Chapter Six follows with the aim of testing the long run relationship between financial development, institutional quality and economic growth and determining efficiency gains when various structural breaks are introduced into both the time series and panel models. In Chapter Six, panel cointegration tests that have various types of multiple structural breaks whilst addressing cross-sectional dependency are used to test the long run relationships between variables. These include Westerlund (2006a) and Banerjee and Carrion-i-Silvestre (2015) cointegration tests. The time series estimators include Gregory and Hansen (1996) and Hatemi-J (2008) cointegration tests.

In Chapter Seven, the contribution of institutional quality and financial development to productivity is determined for the CES and VES production technologies. The robustness of the relationship is tested within the CES and the VES framework of the production function. Non-Linear Least Square Estimators are used to determine the relationship between the variables when the assumptions surrounding the Cobb-Douglass production framework are varied. Finally, the findings and conclusions are stated, policy recommendations are made and possible areas for future research are discussed in Chapter Eight

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CHAPTER TWO

THEORETICAL FRAMEWORK

2.1 **Introduction**

The role financial development plays in the growth process has theoretically been linked with the enhancement of capital accumulation (Levine, 2005; Murinde, 2012), increases in productivity levels (Demetriades and Law, 2006; Balach and Law, 2015) or both (Levine, 2005; Pagano, 1993). In this research, based on the formulation of the Cobb-Douglas, Variable Elasticity of Substitution (VES) and the Constant Elasticity of Substitution (CES) production functions, these production functions are extended by decomposing total factor productivity into two parts. The role finance and institutions play in productivity enhancement is explored by estimating the extended production functions and calculating efficiency levels. In view of the fact that the effect of financial development and institutional quality is expected to be felt through total factor productivity, the contribution of IQLEG to TFP is expected to be positive.

The model constructed for this research is derived for the work of neoclassical growth framework[5] Solow (1956, 1957) and draws on and utilizes the productive efficiency channel of growth depicted in the aggregate Cobb-Douglas production function in the equation,

$$Y(t) = \mathrm{K(t)}^{\alpha}(A(t)L(t))^{1-\alpha} \tag{2.1}$$

Where $Y(t)$ is output, $\mathrm{K(t)}$ is the stock of capital, $L(\mathrm{t})$ is the labour force, α and $\beta = 1 - \alpha$ are the physical and share of output whilst $A(t)$ reflects the role of technology and innovation. $A(t)$ is called Total Factor Productivity (TFP) and reflects the efficiency of capital and labour. TFP is an important element of the production function in the

[5] The basic concept of the neoclassical growth theory is explained in Section 2.2.2 of this Chapter

neoclassical framework as it is seen as the main driver of productivity and hence long-term growth. This research dwells on a modification of TFP

The main proposition made in this thesis is that TFP, which is viewed as the measure of technological advancement or the net productivity of factors of production, can be decomposed to reflect efficiency gains from other fundamental sources of growth. Financial development, enhanced by institutional quality, can be incorporated into the production function to generate higher productivity levels. Efficiency levels are enhanced when institution quality measures proposed by Rodrik (2000) interact with financial development through TFP. The level of productivity is thus proposed to be above that of pure technical progress in the Solow neoclassical framework. The decomposition of the technological advancement measure is vital to the efficiency of the production function's productivity in this thesis. Institutional quality modified financial development is thus viewed as a productivity-promoting component of economic growth (You and Sarantis, 2013; Demetriades and Law, 2006; Effiong, 2015).

It is important to note that a consideration of finance related growth studies using the neoclassical growth framework shows that some studies use an open economy-based approach by including trade openness, exchange rate and net export among others as control variables. These variables are usually introduced into models as additional inputs whose effect on the growth of the economy is measured in addition to the main variables of interest. They did not estimate the production function (Demetriades and Law, 2006; Balach and Law, 2015; Sadraoui et al, 2019). This research departs from the above approach by applying the method of You and Sarantis (2013). This method seeks to address the contribution of IQLEG to TFP by estimating the production function and measuring the contribution of FD and IQ to productivity. The effect of the factors that make the economy open is assumed to be captured in the NFP. With this goal in mind, the research is based on the neoclassical growth model in a closed economy.

This chapter firstly examines the major theories of economic growth, financial development and institutional quality. The different theoretical relationships between growth and financial development as well as growth and institutional quality are explored. Secondly, the main analytical framework that this thesis is based on is presented with the derivation of the extended production functions

2.2 **Overview Economic Growth**

Economic growth is defined as the steady process by which the productive capacity of the economy is increased over time to bring about rising levels of national output and income (Todaro and Smith, 2009; Khan and Khan, 2012, p. 24). Economic growth comes in two forms: an economy can either grow "extensively" by using more resources (such as physical, human, or natural capital) or "intensively" by using the same amount of resources more efficiently (productively). The components of economic growth include capital accumulation realized from savings, growth in population and technological progress (Todaro and Smith, 2009; Romer, 2006).

Traditionally various theories and associated models have been put forward by economists to explain growth and differences in income in the different economies of the world. These theories have spun from Adam Smith, David Ricardo, Karl Max, Robert Solow and many other Economists. Other interwoven theories and models include the classic theories such as Rostow's stages of growth model, the Harrod-Domar (The AK model) and Lewis' structural change model. The market fundamentalism theories and the neo classical theories of growth such as Robert Solow's neoclassical growth theories, the infinite horizon model, the overlapping generations' model and the endogenous growth theories are all classical economic growth theories. Contemporary models such as the Translog growth model are included on the list. A thorough examination of all these theories depicts certain commonalities and differences between them.

In spite of seeming differences in theoretical approaches, economic growth and development theories simply seek to explain the determinants or sources of economic growth. These theories are aimed at either explaining why some economies grow faster than others or why economies do not converge to a steady state level of growth. Kaldor (1963) examined commonly occurring features and characteristics about economic growth and listed a number of stylized facts that typically characterize the process of economic growth. These facts are growth in per capita output over time wherein the growth rate does not fall; growth in per worker capital over time with a near constant rate of growth of return to capital, labour and capital as a share of national income is almost constant; and a generally considerable disparity in growth rate of output per worker across countries.

These disparities in growth rate of output per worker, although seemingly small, add up over years and result in serious consequences for standards of living. As such, there is an urgent need to study and contribute to literature on government policy that affects long-term growth. Economic growth has, at its very centre, the welfare and standards of living of individuals in an economy and any finding that contributes to understanding the dynamics relating to growth should be of great importance to all stakeholders. Investigating the theories that help identify the determinants of growth is not just key but is imperative to forward the efforts at lessening world poverty.

Three main categories of modern theories can be identified under economic growth. These theories are the Classical, Neo Classical and the New Growth theories also termed the endogenous growth theory. The underlying framework of all these theories is that economic growth is needed for economies to experience higher levels of welfare. Secondly, economic growth, whether in the short or long run, is achieved as a result of changes in certain factors or phenomena. However, these schools of thought vary in their view on areas such as the constituents of these factors and whether they have long-run or short-run impacts on the rate of growth of an economy. Two of the main commonly used theories in the growth literature are briefly discussed below.

2.2.1 The Endogenous Growth Theory

The endogenous growth theory (EGT) was proposed out of the seeming inadequacy of the Solow (1956; 1957) neoclassical growth theory in addressing the problem of how other factors might contribute to growth, nor what impact might be made by market imperfections. What does this mean? It takes its roots from the Schumpeterian era and was thrust into prominence by Romer in the 1980s. The endogenous growth theory emphasises the key role played by knowledge, technical change and innovation, learning, human capital and institutions. According to Romer (1986), ideas are what fuel long term economic growth (See Romer, 1990; 1994; Aghion *et al.*, 1998; Schilirò, 2019)[6]

[6] Seminal theoretical advocacy and contributions to research on the endogenous growth theory include (MRW, 1992; Pagano, 1993; Lucas, 1988, Easterly and Levine, 2001, Barro, 1990; Barro and Sala-i-Martin, 1992; Peretto, 2017)

In the EGT framework, growth is endogenously determined through new knowledge. Agents' decisions that do not incorporate any outside technological progress, as stressed in the neoclassical growth theory, are a major determinant of long-run economic growth. This new knowledge, which is developed within the economic system, positively impacts on per capita growth and productivity. New knowledge is deemed an intangible capital good, which is a fundamental production input. An important property of new knowledge is that it has increasing marginal productivity. Another important feature of the EGT is the role of division of labour through specialisation. Romer thus stresses that in the EG framework, increasing returns are the results of specialization. Increasing returns are realized from specialization and this fuels long-term growth. The degree of specialisation in the economy is depicted by a multiplicity of intermediate goods. The growth inducing effect of learning by doing or positive externalities that technologically spill over from one agent to another is again a vital characteristic of the EGT.

Based on the aggregate production function, which has capital and labour as its inputs, the EGT, extends the one sector growth production framework to a boundless number of mechanisms for generating productivity increase. These mechanisms result in increasing returns to scale happening directly within the production function or through the application of produced R&D or through the production of human capital. The endogeneity of this growth theory also stems from the fact that parameters that generate growth are based on choice (Fine, 2000; Benos and Zotou, 2014).

Despite its seeming strengths, the EGT, which is based on the Cobb-Douglas production function, has not been without its fair share of criticism. Firstly, the EGT abstracts wrongly from reality by assuming a single product market or a symmetrical nature of different sectors of the economy. Variables that contribute to inefficiencies and impede economic growth are not considered in the concept. These include poor infrastructure, institutional inadequacies and imperfect markets, institutions, transaction costs and the political nature of innovations. Secondly, unlike the neoclassical growth framework, there's no distinction between the role of capital and that of technological progress in the EGT whilst it is plagued with problems of scale effects (Onyimadu, 2015). Thirdly, despite its widespread acceptance and usage, unlike the neoclassical framework, it is not validated empirically (See Cavusoglu and Tebaldi, 2006; Schilirò, 2019; Peretto, 2017). Romer (1994) advocates that if the assumption of exogenous technological change as well as the equality of the level of technological opportunities available to all nations of the Solow Neoclassical model were to be dropped, the problem of non-convergence in the EGT would be addressed.

2.2.2 The Neoclassical Growth Model

The model is built on the expansion of the Harod-Domar or AK formulation. Labour is added as a second factor of production and an independent variable, technology, is introduced. Unlike the AK model, which assumes constant returns to scale and a fixed coefficient, the neoclassical growth model (also termed Solow-Swan or Solow model) created by Solow (1956; 1957), assumes diminishing returns to labour and capital separately and constant returns to both factors jointly. It is the basic framework for the study of convergence across countries. The central concept of the model is that, given the same rates of depreciation, savings, labour force growth and productivity growth, economies will conditionally converge to the same level of income.

In Solow's model, the saving rates and the rate of population growth are exogenous and determine the steady state of income per capita. The model posits that capital accumulation cannot explain the vast long run growth in output per person and the differences in individual country's output per person. Capital accumulation affects output by making direct contributions to production for which it is paid its marginal product. If changes in capital accumulation lead to changes in output, Solow asserts that the change in real income or output over time and across countries is far too vast to be explained by changes in capital stock.

In effect, there are other potential sources of differences in real output. These potential sources, some of which are technological progress and positive externalities from capital are not explained by the model and are treated as exogenous or even altogether absent. There is no optimization in the Solow model as it takes the saving rate as constant and exogenous. The steady-state capital-labour ratio is related positively to the rate of saving and negatively to the rate of population growth. The central predictions of the Solow model concern the impact of saving and population growth on real income. Solow's model originally projects that, with respect to standards of living, real income is higher in countries with higher saving rates and lower in countries with higher values of population and depreciation growth rates. The model features four variables, namely output (Y), capital (K), labour (L) and knowledge or effectiveness of labour (A), which captures the effect of technology, also called total factor productivity. The model is theoretically stated as in equation (3.1)

Critics of the Solow Neoclassical model firstly question the assumption of that the unemployment rates of labour and capital are constant and find it largely unrealistic. Secondly, the neoclassical growth framework is supply based and has as one of its main set-backs, the absence of a well-structured aggregate demand side, which would have accounted for short-run and medium run economic fluctuations. The third challenge is that the neoclassical growth theory is limited by assuming that, in a steady state, it is the labour-augmenting technological progress that solely determines the growth rate per capita income (An Encyclopedia of Macroeconomics, 2002).

Notwithstanding these set-backs, the Solow model, which looks at the implications for the vast differences in standard of living over time and across countries for human welfare, has been widely applied in empirical research. One advantage of the Solow Neoclassical growth theory has over the EGT is that been theoretically and empirically validated (Cavusoglu and Tebaldi, 2006). Indeed, according to Romer (2006), the Solow model is the starting point of almost all analyses on economic growth. Research that aims at determining the role of TFP in growth has been based on the Neoclassical growth framework (You and Sarantis, 2013; Demetriades and Law, 2006; Balach and Law, 2015).

In addition to the above defence for the neoclassical theory of growth, when the basic Neoclassical Solow model is extended by being considered in different contexts such as within the Constant Elasticity of Substitution and Variable Elasticity production forms, it provides a more realistic and holistic impetus for its application and ensures robustness in the conclusions and findings generated. This thesis therefore dwells on the Solow Neoclassical Growth Theory. Prior to a discussion on the mathematical representation of the main theoretical framework, a discussion on financial development and institutional quality follows in the next sessions.

2.3 **Financial Development**

The 2012 World Economic Forum on Financial Development Report (p.7) defines financial development as ‘the factors, policies and institutions that lead to effective financial intermediation and markets as well as deep and broad access to capital and financial services. Levine (2005, p. 861) defines financial development as involving ‘improvement in the production of ex-ante information about possible investment, monitoring of investment and implant of corporate governance, trading, diversification and management of risk and exchange of goods and service’, stressing that each of the above financial functions may influence savings and investment decisions and hence, economic growth and may have different institutional settings. Financial development as a phenomenon becomes noteworthy if it is related to the overall economic goal of better or higher living standards measured by economic growth and development. The various theoretical postulations related to financial development have all been given within the context of the role played by the financial system and the related impact on economic growth.

The above definitions of financial development among others, suggests that financial development can be defined as the ability of an economy, through effectively working institutions, to consistently minimize investment risks, reduce the cost of information and transactions and allocate capital and investment into the most efficient use such that productivity is enhanced from improvements in financial intermediation, instruments and market activities, and there is a general increase in access to deep and broad financial services. In effect, discussing financial development without its end goal of impacting welfare and productivity is virtually impossible.

A well-developed financial sector, among others, is a key feature of economic growth (Gries, Kraft and Meierrieks, 2009; Menyah, Nazlioglu and Wolde-Rufael, 2014; Baltagi, Demetriades and Law, 2009; Cavallo and Galindo, 2013; Kendall, 2012; King and Levine, 1993a). The importance and relevance of financial development in the realisation of economic development has been extensively investigated (Fernández and Tamayo, 2015; Huang, 2010; Murinde, 2012; Levine, 2005). The ensuing discussion will consider the various theoretical underpinnings that relate to finance and growth; a relationship that has been extensively investigated and researched in the literature and has churned out a wide variety of opinions and hypotheses (Greenwood and Jovanovich, 1990; Pagano, 1993; Demetriades and Hussein, 1996; Levine, 1997; 2003; 2005; Rajan and Zingales, 1998; Levine, Loayza and Beck, 2000; Al-Yousif, 2002; Beck and Levine, 2004; Cline, 2015)[7].

2.3.1 Early Concepts of Financial Development

Economists have always sought to understand the dynamics and determinants of economic growth and the reasons for different rates of growth in various countries. Schumpeter (1911) pioneered the investigations into the possible role of finance in economic growth and development and argued that when financial intermediaries mobilise savings, evaluate projects, manage risk and monitor managers, they provide services that facilitate overall economic growth. Financial development theories have journeyed through various conceptual and theoretical phases to include the liquidity preference theory (LPT)[8] of Keynes (1936) that detected possibilities for negative or, at best, neutral effects of financial development on income levels.

[7] See also Bertocco (2008), Hasan, Koetter and Wedow (2009), Jalil, Feridun and Ma (2010), Rahaman (2011), Bijlsma, Kool and Non (2017), Valickova, Havranek and Horváth (2015), Khalifa Al-Yousif (2002) and Popov (2018).

[8] According to the LPT, liquidity preference tends to push the real interest rate above its full employment equilibrium level, which leads to income falling to equate savings and investment plans.

According to the LPT, liquidity preference tended to push the real interest rate above its full employment equilibrium level, which leads to income falling to equate savings and investment plans. Keynes recommends interest rate ceilings to limit liquidity preference and reduce the real interest rate. Tobin (1965), along the lines of financial repression, suggested that, by reducing the preference for liquidity as in financial repression, it can increase the capital/labour ratio and hence accelerate economic growth. In practice however, this financial repression-led growth formulation was not realistic. High rates of inflation and low fixed interest rates and other measures of financial repression did not accelerate growth. However, Goldsmith (1969), Shaw (1973) and McKinnon (1973), through their ground-breaking research work, provided the theoretical basis for countering the Keynes-Tobin school of thought.

Goldsmith (1969) submits what seems to be the furthering of the Schumpeterian view that the structure of the financial system contributes, albeit not decisively, to the growth rate of real national product. Goldsmith underscores the need to isolate the specific effects and impacts of financial factors in the economic growth process. Goldsmith used the financial interrelations ratio (FIR), which he found to be the most informative and single special measure of financial structure. The FIR was used to conduct a theoretical determination of specific characteristics of the financial structure that affected or are affected by economic growth. This enabled the determination of whether there were 'typical' financial structure characteristics that could be general to capitalist countries. Although the FIR measure, which consisted of dead-weight debt ratio and two layering ratios, was a sufficient measure, Goldsmith (1969) found it necessary to include further subdivisions of the FIR in order to capture differences in the financial structures between countries or over time.

In conclusion, Goldsmith found that the higher the level of FIR, the higher the level of growth of the financial sector, which in turn, translated into higher national output. The concept of dead weight debt in Goldsmith's submission was, however, criticized by Shaw (1973) who found the use of dead-weight debt statistically restrictive and observed that the central conclusions regarding dead-weight debt included bearing a high proportion to national assets and national wealth in most advanced countries and being largely responsible for the complex and powerful network of financial intermediaries in advanced countries. In 1973, Shaw and McKinnon independently proposed seminal theories, which have been combined to become a reference point for most finance-growth studies.

2.3.2 Later Concepts of Financial Development-The McKinnon-Shaw Framework

The economy analysed by McKinnon and Shaw is a financially repressed developing one and the basis of their argument is that, where there is financial repression, there will be random changes and distortions in prices, interest rates and exchange rates, which in turn, will reduce the real rate of growth and the real size of the financial system relative to non-financial magnitudes[9].

In this framework, because the money that is given to the private sector is backed by the internal debt in the same sector, it is called inside money. The role of financial institutions as usual is to bring savers and investors together through intermediation. Savings grow at the same rate as the economy and are positively related to the real interest rate and are distributed between tangible assets and deposits. These tangible assets are used to hedge against inflation and the deposits attract the nominal rate of interest. Financial repression

[9] The McKinnon-Shaw framework is thoroughly investigated by Fry (1988) who brings out the common and essential elements in the framework.

here refers to the fixing of the nominal interest rate by the government such that the real interest rate is always below its equilibrium level.

The actual investment in the society becomes less by being limited to the amount of saving that can be obtained at the real interest rate. Assuming the interest rate ceiling is only applied to the deposit rate, the investor's interest rate will be the one that clears the market given the fact that the supply of saving is limited; and since the banking system, although competitive, is regulated, the spread will be used on non-price competition.[10] Loan rate ceilings and deposit rate ceilings are fairly common in most financially repressed societies and this is accompanied by reductions in the demand for real money as the explicit real deposit interest rate decreases in a financially repressed economy. Financially repressed societies tend to have loan rate ceilings that are usually enforced by state owned financial institutions whilst private commercial banks, because of compensating balances, are able to evade them.

As long as loan rate ceilings are fully in effect, non-price rationing of loanable funds occur and the allocation of credit is mainly done according to transaction costs and not because of the risk or probability of default. Other things that could affect the allocation of loans include political pressures, loan size, the hidden or private benefit to loan officers, 'name' and quality of the collateral. Investments that could be potentially high yielding tend to be rationed as the use of loan rate ceilings decreases risk taking and thus the charging of risk premia. The yields on investments are generally not above the ceiling interest rate and the rate of return to investment is usually dispersed in a financially repressed economy.

[10] Such as branch opening and say, advertising services, which may not be at par with interest payments.

McKinnon (1973) highlights the need to consider the negative effects ‘great discrepancies’ in interest rates when economic development is measured merely in terms of the accumulation of capital that is homogenous and yields the same productivity levels and rates. Hence, economic development actually occurs when the variability in rates of return is reduced. The distortive effects of interest rate ceilings are seen in low deposit rates that can incorrectly lead to increases in current consumption and reduce future consumption, which means savings and investments are held below their socially optimum levels.

Prospective depositors may end up investing in low-yielding investments that will be directly arranged by them instead of depositing their funds in a bank that will, in turn, on-lend these funds to the best investors in higher yielding projects. Finally, investment that will be relatively capital-intensive will be increased as bank borrowers will take all the loans as they require a low interest rate on loans. Therefore, when the interest rates on loans and deposits are below the equilibrium level, the quality and quantity of investment will be likely to reduce thus constraining economic growth.

In the framework of McKinnon and Shaw, an increase in interest rate ceiling increases the saving and investment rates and levels. The saving rate is better and low-yielding projects are discontinued when the real rate changes, leading to an increase in average returns and the efficiency of investments. This leads to an increase in the rate of growth of the economy as the saving function increases with a rightward shift (McKinnon, 1973; Shaw, 1973). Policy makers in the McKinnon-Shaw financially repressed economy can correct the constrained rate of growth by either increasing interest rates or reducing the inflation rate or, better still, by abolishing interest rate ceilings and thus usher the economy into financial openness, optimizing the return on investments and increasing average efficiency further on investment.

The differences in the McKinnon and Shaw framework can be seen from their starting positions and the theoretical assumptions that underlie their propositions. McKinnon bases his analysis on the outside money model, which effectively implies that financing is limited to self-finance and that consumption expenditures are lower than investment expenditures. This means that, unless money balances have first been accumulated, investment cannot be undertaken. In other words, the demand for money is positively related to the share of investment in total expenditures - the outside money (commodity money) assumption held by Tobin in contradistinction to the Keynesians. In McKinnon's model, money supply conditions have a first order impact on savings showing that there is a complementarity between money and capital. This provides the link between savings and investments in the McKinnon model.

Shaw, on the other hand, stresses the role of the financial intermediation process. The chain of causality in Shaw begins with higher real institutional interest rate leading to increased financial intermediation between savers and investors, which in turn, raises real returns to savers and lowers real costs to investors. Thus, with Shaw, financial institutions perform their intermediation role of maturity preference transformation, risk pooling, economies of scale, lower information costs to both savers and investors, and increased operational efficiency. It precludes all notion of "outside money" (money not backed by private debt) and investment, postulating instead an "inside money" assumption, or money backed by private debt - for the most part productive investment loans. This emphasis on financial intermediation necessitates an increase in real returns on all forms of wealth, money included, in order to boost savings (Shaw, 1973).

The positions of both McKinnon and Shaw are in tandem when it comes to their assertion that low interest rates have a detrimental impact - according to McKinnon, because they depress savings and investments; and, according to Shaw, because they discourage financial intermediation. Under both assumptions, repressed financial markets will lead to lower growth and a suboptimal allocation of resources. The two views can, on the other hand, be considered complementary as has been done by Molho (1986) to the extent that McKinnon's argument applies to projects financed internally, while Shaw's applies to projects financed through borrowings: most projects tend to be financed in both ways simultaneously

The policy implications of the McKinnon-Shaw camp are that, generally, repressive regulation of the financial sector is unambiguously harmful in developing countries as it discourages both savings and investment; fosters an inefficient allocation of resources; encourages the coexistence of two levels of technology; and worsens income distribution. Financial liberalization (the removal or at least gradual phasing out of repressive regulation) is a high priority as it would alleviate the harmful effects of repressive regulation and set the country on a financial development course that would lead to higher savings, a better allocation of resources, balanced growth, and an improved income distribution.

Following the ground-breaking McKinnon-Shaw hypothesis, a plethora of work with varying conclusions has been produced on the dynamics and existence of a finance-growth relationship. These include the neoclassical growth framework and the endogenous growth models, which have already been discussed in Section 2.2 (Durusu-Ciftci, Ispir, and

Yetkiner, 2017; Bucci and Marsiglo, 2019). It is important to note, however, that to this day, research on the role of financial development in economic growth uses the seminal McKinnon-Shaw framework as a reference point whilst applying economic growth theories such as the neoclassical or endogenous growth concepts and their variants.

2.3.3 Financial Development and Economic Growth

Four main schools of thought emerge from the empirical literature with regards to the finance-growth relationship. The main strands of literature identified theoretically and tested empirically lean heavily towards an existing relationship between finance and growth, although the extent and direction of this relationship is largely inconclusive. With the causal relationship supply leading, the main hypothesis is that financial development has a positive effect on economic growth. According to this view, financial intermediation contributes to economic growth through two main channels: (1) by raising the efficiency of capital accumulation and in turn the marginal productivity of capital (Goldsmith, 1969); and (2) by raising the savings rate and thus the investment rate (McKinnon, 1973; Shaw, 1973). This view that higher levels of economic growth are in part due to higher levels of financial development has received considerable support from empirical studies (see Levine, 2000; Murinde, 2012; Pagano, 1993; Bencivenga and Smith, 1991; Greenwood and Jovanovich, 1990; Thakor, 1996)[11].

[11] More recently, Bijlsma, Kool and Non (2017) found a positive but decreasing effect of finance on growth. Popov (2018) demonstrates that finance can benefit growth and slow down growth; and Valickova, Havranek and Horváth (2015) found a positive and statistically significant effect.

The second strand of theory is the demand following the hypothesis introduced by Robinson (1952) where financial development changes as a result or consequence of economic growth. In Robinson's words, "where enterprise leads, finance follows" (Robinson, 1952, p. 86). Here, as the real side of the economy expands, demand for financial services increases, causing further growth in financial services. Hassan, Sanchez and Yu (2011) found causality running from growth to finance in South Asia and SSA supporting the hypothesis that growth leads to finance in developing countries because of the increasing demand for financial services. Other studies holding the growth led finance viewpoint include Demetriades and Hussein (1996) and Ireland (1994).

Thirdly, there is the view that the relationship between financial development and economic growth is mutually causal, that is, they have bidirectional causality. In the same studies, Hassan, Sanchez and Yu (2011) found a two-way causality between finance and growth in all regions of the world except SSA, East Asia and The Pacific. On the other hand, Acaravci, Ozturk and Acaravci *(*2009) found a bi-directional causality for a panel of 24 SSA countries. Other studies that confirm the bidirectional relationship between growth and financial development include Bangake and Eggoh (2011), Demetrides and Hussein (1996) and Greenwood and Smith (1997). Another strand of theory, which is relatively less popular and was advanced by Lucas (1988), is that financial development and economic growth are not causally related. Eichengreen, Gullapalli, and Panizza (2011; 2018) find that this role of financial factors in economic growth is rather being overemphasized[12].

[12] See also (Arcand, Berkes and Panizza, 2015; Demetriades and Hussein, 1996; Rousseau and Wachtel, 2011; Rodrik and Subramanian, 2009).

Patrick (1966) introduces another view point, which is termed the proposition of the stage of development hypothesis. According to this hypothesis, supply-leading financial development can induce real capital formation in the early stages of economic development. Innovation and development of new financial services opens up new opportunities for investors and savers and, in so doing, inaugurates self-sustained economic growth. As financial and economic development proceeds, the supply-leading characteristics of financial development diminish gradually and are eventually dominated by demand following financial development (Calderon and Liu, 2003). These non-monotonic studies have shown the positive effect of financial development on growth reversing after a certain level of financial development and or during a specific period in a nation's life.

This research is premised on the view that there is an existing relationship between finance and growth, which can be further enhanced by institutional quality. It wades into the determinants, promoters or moderators of the effects of financial development emphasizing the role institutional quality plays. The determinants of a well-functioning financial system are numerous (Pagano, 1993), one of which is the quality of the institutions that govern the policies and conduct of an economy. McKinnon (1973, p.1) states that extraordinary differences among nations in cultural heritage, natural resources, colonial experience and political structure seem to defy purely economic analysis. This study explores the role that institutional quality plays as determinant of the financial development in a society. In effect, will financial systems work adequately without the needed institutional setting and how do these institutions ensure that financial development is affecting economic growth positively?

2.4 **Institutional Quality**

The most commonly used definition of institutions in recent literature stems from North (1991; 1993), who describes institutions as the rules of the game of a society (Aluko and Ibrahim, 2020). North further states that institutions are the humanly devised constraints that structure human interaction. Institutional quality refers to the adequacy of institutions and their efficacy, which results in their role in resource allocation and enhancement of efficiency. A discussion on institutional quality is rooted in the concept or subject of institutional economics, which has long been in existence (Coase, 1937; 1960; Veblen, 1978; 2005; Commons, 1931; Wells, 1976; Foster, 1981). To understand the concept of institutional economics, later referred to as modern or new institutional economics, there is a need to consider the meaning of the word 'institutions' itself from existing literature.

Institutions are made up of formal constraints (rules, laws, constitutions), informal constraints (norms of behaviour, conventions, and self-imposed codes of conduct), and their enforcement characteristics. North describes a continuum with unwritten taboos, customs, and traditions at one end and constitutions and laws governing economics and politics at the other. Institutions, according to North, are made by humans, define incentive structure, and shape interaction in the form of formal and informal constraints and enforcement characteristics (North, 1994).

Prior to North's definition, Commons (1931) defined an institution as collective action in control, liberation and expansion of individual action with the view that a universal circumstance common to all behaviour is known as institutional. He defined collective action as ranging from unorganized custom to the many organized going concerns, such as the family, the corporation, the trade association, the trade union, the reserve system and the state. Furthermore, this control has the sole intention of resulting in either a gain or a loss to another or other individuals. Hodges (2006) states that institutions are the kinds of structures that matter most in the social realm. He goes on to extend the definition by stating that institutions are a set of systems established and prevalent social rules that structure social interactions. These definitions, although not the same, all refer to the existence of structures and systems in the social realm that impact the collective society's interactions, which range from non-market sectors to market sectors.

Institutions broaden the reach of economic analysis beyond traditional markets and are able to capture a more complete set of mechanisms by which resources are moved from one place to another. Hovenkamp and Coase (2011) explain that the first generation of institutionalists emphasized the importance of human-created institutions that serve to allocate power or resources, the rules that these institutions develop and employ, and their effect in the overall economy. Indeed, the gaps between economics and institutionalism are many. For example, the marginalists and neoclassicalists view that, within the context of institutionalism, social institutions wield a lot of power over individuals. Hence, individuals do not have infinite power and freedom to make exchanges as professed in the world of competition. This view is mainly criticized by early institutionalists for being too abstract and lacking empirical content.

The roots of institutionalism make the fact that neoclassicism stresses rationality over evolution as a device for explaining human choice unacceptable. Thirdly, institutionalism criticized what is typically termed as 'overly focused' on market exchange as the main method of social interaction. As such, institutionalism questions the scope of economics. A conscious effort has to be made to investigate the power that some social institutions wield over individuals and how this power affects economic interactions in the society.

2.4.1 The Concept of Institutional Economics

To further understand institutional economics, it is imperative to investigate the forces that shape economic institutions and the impact they make. Commons (1931) established the difficulty in defining exactly what an institution is and viewed institutional economics as covering a broad range of economic and legal issues that should not be considered as strictly stand-alone concepts. Commons (1931) underscores the need to conduct further research studies to establish the links between market transacting and the legal system and developed a theory of institutions as "going concerns" governed by "working rules", and whose principal resource deployment device was the "transaction".

In trying to determine the role of property rights in economic exchange, institutionalism has increased the level of economic analysis of the legal system. This has resulted in greater attention being paid to the relationship between economic markets and the legal systems within both the statutory and common law context. Common's work identified the need to marry economics and law as the main framework in institutional economics. Coase (1936) revolutionized research based the concept of transaction when institutional economics is extended within the framework of exploring the marriage between economics and institutions.

Coase (1936; 1984) extends the concept and idea of institutional economics by introducing what is called the New or Modern Institutional Economics (NIE) where emphasis is placed on the transaction and its cost. Just as Commons had earlier identified, Coase suggests that

Modern Institutional Economics has an impact on normative economics. He argues that there is the need to 'extract' institutional quality and its effects in order to answer the age-old question of why there are divergences in income levels of economies.

2.4.2 Coase's Concept of New Institutional Economics

The difference between NIE and institutional economics is the fact that new institutional economists recommend a realists' approach and with realistic benchmarks instead of the hypothetical benchmarking characterized by neoclassical approaches. It does not in any way eschew social phenomena such as corporate culture, organizational memory, and the like, but follows strict methodological individualism, always couching its explanations in terms of the goals, plans and actions of individuals. The rise of NIE saw an extension into the institutionalists' and neoclassicists' ideology in that attention began to be given to the relationship between institutions and economic transactions.

According to Coase, the major distinguishing feature between NIE and institutional economics is the ability to study man as he is, acting within the constraints imposed by real institutions. He further states that institutional economics have been greatly helped to be more realistic by being infused with legal material. Economic policy makers are therefore forced to analyse real choices in order to realize the richness of institutional alternatives. The institutional proposals and underpinnings of this research are rooted in the theories of new institutional economics (NIE) and will focus mainly on Coase's contribution to this discipline.

The main hypothesis made by Coase is that when the gains from abiding by a contract are more than gains from not abiding, the rational player can be bound, all things being equal.

Coase's idea is mainly based on the market and the essence of property rights with the argument that neoclassical theories in economics have endogenised institutional quality. Coase tries to establish a realist and tractable definition of the firm using the idea of substitution at the margin. He attacks the neoclassic doctrine that the economic system works itself and the assumption that the direction of resources depends directly on price mechanism.

Furthermore, unlike the neoclassical context, preferences are not simply accepted as given because the interest seemed to be in studying the sources of human preferences, emphasizing their links with either evolutionary biology or behaviourist psychology. Hence, when there are exchanges in the market that are voluntary, there is evidence of institutions that have evolved to move resources through the society. In examining the relationship of Coase's thought to neoclassicals and institutionalism, it is further concluded that first generation institutionalists do not subscribe to the notion that it is only the prerogative of the economic scientist to study individual preference. Indeed, in the world of scarce resources, which are very expensive to move, different types of institutions arise or evolve to determine the where and how resources are moved when individuals are forced to make trade-offs (p. 501). Coase emphasizes the role of transaction costs in the movement of resources without disregarding the fact that individual preference orderings and market exchange are the main movers.

The gap that new institutional economists sought to fill in a purely neoclassical regime of economic thought was to bring in the costs associated with moving resources from one place to another. This school of thought maintains that transactions are created by humans as vehicles to help them move resources. New intuitionalism merged marginalism and institutional economics. In the view of the neoclassical economists, the economic system largely operated without internal operations and decision making. The firm, for instance, made its presence on the market as purchaser and seller; but what actually happened for these to take place in the internal operations and workings were unknown or not considered (North, 1995).

Neoclassical marginalists depended on the presumption that equilibrium occurred when individuals, firms and markets arranged their own preferences and ignored the cost of moving resources from one place to another, resulting in very abstract reasoning in the view of institutional and neo-institutional economics. Coase therefore deduced that, from an ordinalist's view point, the concern of economics was properly limited to three things: (1) market exchange and the costs of the exchange process; (2) price theory, which employed a currency of constant value; and (3) the internal preferences exercised by the single economic actor, including the business firm, making decisions under scarcity. Thus, the firm was not different from the individual, and they both tended to maximize utility: although with the firm, the utility was replaced with profits and losses that could be quantified with price.

Coase's ideas were further extended to governments, interest groups, religions, families, labour unions etc. He differed from the first-generation institutionalists by using marginalists' behaviour in explaining the behaviour of economic agents and welfare-enhancing outcomes. To the extent that parties are able to bargain, at low cost, or the legal system is able to replicate and achieve the same outcome on behalf of individuals, welfare was being achieved. Welfare increases did not really include the transfer of wealth involuntarily from the wealthy to the poor. With a strong and consistent resistance to government intervention and strong support for voluntary exchanges in welfare maximization with low transaction costs, Coase took a purely neoclassical viewpoint. Hovenkamp and Coase (2011) conclude that Coase's ideas represented a neoclassical takeover of institutionalism.

2.4.3 North’s Concept of New Institutional Economics

North (1993) however rejects the assertion that the means to reduce transaction costs is by introducing institutions into a system and claims that looking at the historical and current capital as well as other markets, institutions have not played a credible role in reducing transaction costs. North suggests that organizations are the primary source of institutional change. He recommends that credibility will ensure adequate institutions. One of the major statements that North makes is that institutions will only work when both formal and informal rules (norms, conventions etc.) are placed side by side. He stated further that to restructure an economy successfully required, firstly, a correctly incentivized restructure of property rights; and secondly, participants who are conditioned mentally to take advantage of the corrected incentives.

Features of New Institutional Economics

The main features of NIE are identified as: (1) a focus on collective rather than individual action; (2) a preference for an ‘evolutionary’ rather than mechanistic approach to the economy; and (3) an emphasis on empirical observations over deductive reasoning. These ideas are further enhanced in the literature by Rutherford (1983), Langlois (1989) and Hodgson (1998). Klein (2000) attempts an exposition on new institutional economics by identifying the main constituents of NIE, which he identified as “a rapidly growing literature combining economics, law, organization theory, political science, sociology and anthropology to understand social, political and commercial institutions" (p. 32), the strongest and largest discipline being economics. He further identified two main categories of institutions - the institutional environment and the institutional arrangement.

An institutional environment refers to the background constraints, or 'rules of the game', that guide individuals' behaviour such as the legal environment. These can be both formal, explicit rules (constitutions, laws, property rights) and informal, often implicit rules (social conventions, norms) and institutional arrangements, which are typically specific guidelines - what Williamson (1987; 1996) calls 'governance structures' - designed by trading partners to mediate particular economic relationships such as business firms and contractual agreements. It is a marriage between Economics and Law. In effect, this is a probe into the mechanisms by which legal rules change. The institutional environment is thus the relationship between NIE and legal realism (North, 1995).

With NIE, there is an increased level of attention given to rules, social and legal norms that would not be considered as part of economics but that truly underlie economic activity. The field of economics was criticized as unrealistic and reductionist, however, in view of the fact that NIE brought, if you will, a human touch to neoclassical economics, its usefulness and impact continues to be felt in the literature on economics (newworldencyclopedia.org). The main aspects of law that are relevant to NIE are, firstly, contract and property laws. It is interesting to note that NIE, apart from the formal confines of the court system, regards private solutions as essential forms of holding or constraining behaviour. Without the informal rules that structure social conduct, institutionalizing rule of law and property rights would not be possible as these tend to impose constraints and shape choices (Klein, 2000).

With the evolution of NIE, the neoclassical paradigm of viewing economic growth and development as a gradual transformation from autarky to specialization and division of labour has shifted to the view that economic growth thus depends on the degree to which the potential hazards of trade (shirking, opportunism and the like) can be controlled by institutions, which reduce information costs, encourage capital formation and capital mobility, allow risks to be priced and shared and otherwise facilitate cooperation. An economic related problem such as that of agency-principal was solved through kinship or close social ties, and a threat of being ostracized was a disciplinary device. Standardized weights and measures, units of standardized weights and measures, units of account, media of exchange and procedures are used to resolve disputes.

These constraints usually support trade expansion and lower information costs (Greif, 1989; North and Weingast, 1989). Product and factor markets can only grow depending on established and secure property rights. Furthermore, as an economy industrializes, more and more commercial activity involves 'transacting': trade, finance, banking, insurance and management. Indeed, industrialization requires institutions to mitigate the costs associated with these transactions. In addition to contract and law, the environment and political institution serve as another facet of NIE. This is rooted in public choice and positive political theory. People decide which political institutions they would adopt. Here, the main idea is to determine the effect of political institutions on public policy, including macroeconomic policy, welfare policy, budgets, regulation and technology policy (Weingast, 1997).

Williamson (2000) attests to the fact that the neoclassical economists were dismissive of institutions and hence very little has been done with regards to coming up with a unified theory on institutions. Indeed, studying the complexity of institutions has been done under various ways and contexts; pluralism is what holds promise for overcoming our ignorance. Williamson (2000) mentions two propositions by Matthews (1986). First, "institutions do matter"; and second, "the determinants of institutions are susceptible to analysis by the tools of economic theory”. How then does NIE work?

Williamson’s Four Levels of Social Analysis

Williamson (2000) presents four levels of social analysis where the top level is the social embeddedness. At this level, the norms, customs, mores, traditions, etc. are located. Religion plays a large role at this level whilst the second level is referred to as the institutional environment. The structures observed here are partly the products of evolutionary processes, but design opportunities are posed. Beyond the informal constraints (sanctions, taboos, customs, traditions, and codes of conduct), which are found in the first level, formal rules (constitutions, laws, property rights as indicated in North (1991)) open up the opportunity for first-order economizing. This is done to get the formal rules of the game right.

Constrained by the shadow of the past, the design instruments at Level 2 include the executive, legislative, judicial and bureaucratic functions of government as well as the distribution of powers across different levels of government (federalism). The definition and enforcement of property rights and of contract laws are important features showing or suggesting that future success is likely. The third level is where the institutions of governance are located. Although property remains important, a perfectly functioning legal system for defining contract laws and enforcing contracts is not contemplated. Costless court ordering being a friction, much of the contract management and dispute settlement action is dealt with directly by the parties through private ordering. The need to come to terms with contract laws (plural), rather than an all-purpose law of contract (singular) is posed. The governance of contractual relations becomes the focus of analysis at this level.

At the fourth level, neoclassical analysis is assumed to work. Optimality apparatus, often marginal analysis, is employed, and the firm, for these purposes, is typically described as a production function. Adjustments to prices and output occur more or less continuously. Agency theory, which emphasizes ex ante incentive alignment and efficient risk bearing rather than ex post governance, nonetheless makes no provision for neoclassical complications, of which multi-tasking is one. Being an important omission, attention is given to technology at this level within the NIE framework. Williamson stresses that the governance of contractual relations becomes the focus of analysis.

In the context of this research, these are embodied in five main institutional categories proposed by Rodrik (2000). Rodrik (2000) identifies five main institutions that allow markets to perform adequately. Hence, in line with the fact that the definition of economic growth includes established and well-functioning financial markets, coupled with overwhelming evidence that the relation between finance and growth tends to be positive, irrespective of the direction (Murinde, 2012; Levine, 2005), the need to critically examine and establish a link between these institutional arrangements and quality, and financial development in the SSA region arises (Haber, 2008).

Rodrik's Institutions for High Quality Growth

Five types of market-supporting institutions have been identified by Rodrik (2000), namely property rights; regulatory institutions; institutions for macroeconomic stabilisation; institutions for social insurance; and institutions of conflict management. Consequently, for financial markets to play their role of financial inclusion and acceleration of economic growth in SSA, these five institutions must be adequately functioning. Rodrik further states that the most important question to ask in this context is: which particular institutions matter and how does one acquire them? The implication here is that there is a need to go beyond focusing on price reforms and looking into the institutional underpinnings of market economies, a situation revealed by the encounter between neoclassical economics and developing societies. Indeed, in the absence of adequate institutions, the probability for incentives to work will be very low and often generate perverse results.

Rodrik points out that a clearly delineated system of property rights; a regulatory apparatus curbing the worst forms of fraud, anti-competitive behaviour, and moral hazard; a moderately cohesive society exhibiting trust and social cooperation; social and political institutions that mitigate risk and manage social conflicts; the rule of law; and clean government are social arrangements that economists take for granted but which are conspicuous by their absence in poor counties. Rodrik (2000) identifies democracy as a base for building good institutions. He provides evidence that participatory democracies enable higher-quality growth: they allow greater predictability and stability, are more resilient to shocks, and deliver superior distributional outcomes.

There's a need to recognize the importance and uniqueness of the institutional arrangement in different countries is important. In effect there is no one size fits all institutional arrangement that must dominate for overall performance. Institutional diversity must be considered. There is no reason to suppose that modern societies have already managed to exhaust all the useful institutional variations that could underpin healthy and vibrant economies.

Two scenarios can be considered for adopting functional institutions. The first is by adopting what has occurred in advanced countries such as a blue print or manual (Rodrik, 2000); and the second is that institutions can be developed locally, relying on hands of experience, local knowledge and experimentation. Even under the best possible circumstances, an imported blueprint requires domestic expertise for successful implementation. Alternatively, when local conditions differ greatly, it would be unwise to deny the possible relevance of institutional examples from elsewhere. For regions like SSA, should countries then converge to western institutional arrangements or should they focus on institutional experimentation? Rodrik's view of these five is that they do cut across regional boundaries and promote growth.

The process of financial development making a positive impact on economic growth may in fact have its intended impact when it occurs in the presence of these institutional arrangements. The brief review on definition and features of economic growth, financial development and institutional quality is thus followed by a discussion on how financial development and institutional quality relates to growth based on the theoretical and empirical approach of the aggregated production function. The existing relationships between financial development and economic growth, institutional quality and growth, and financial development, institutional quality and economic growth will be discussed in that order.

2.5 Institutional Quality and Economic Growth

Based on existing literature, the role of institutional quality in economic growth cannot be overemphasized (Rodrik, 2000; Rodrik, Subramanian and Trebbi, 2002; North, 1991; Williamson, 1987; Boettke and Coyne, 2009). According to Rodrik (2002), rich countries are those that provide investors with a sense of security about their property rights. In rich countries, the rule of law prevails, private incentives are aligned with social objectives, monetary and fiscal policies are grounded in solid macroeconomic institutions, idiosyncratic risks are appropriately mediated through social insurance, and citizens have recourse to civil liberties and political representation. On the other hand, Rodrik (2002) continues, poor countries are marked by the absence or ill-formation of these arrangements.

It is important however to note that these institution-growth relations may not necessarily be uni-directional as high-quality institutions are perhaps as much a result of economic prosperity as they are their cause. Indeed, the fact that institutions exert a very strong determining effect on aggregate incomes is being increasingly confirmed in empirical research (Hall and Jones, 1999; Acemoglu, Johnson, and Robinson, 2001; Easterly and Levine, 2003; Rodrik, Subramanian and Trebbi, 2002). Rodrik, Subramanian and Trebbi. (2002) therefore hypothesise that institutions, in particular property rights and the rule of Law, account for the differences in income levels between the world's richest and poorest countries.

The evolution of economies does not necessarily assure economic growth. Rather, the incentive structure provided by the basic institutional framework creates opportunities for the consequent organizations to evolve. The economy at each stage involves increasing specialization and division of labour and consistently more productive technology. According to North (1991), transaction costs are lowered by innovations that consists of organizational changes, instruments, and specific techniques and enforcement characteristics that lowered the costs of engaging in exchanges and occur at three cost margins. These margins are those that reduce information costs, those that increased the mobility of capital and those that spread risk.

North (1991) argues that institutions have historically had a role in the performance of economies and in fact still do as they are meant to constrain human interaction and exchange. Exchange, which is the main activity underlying economics, takes resources as defined and enforced. North links the transactions cost associated with exchange and profit maximization to the presence of institutions. He writes:

'Even if everyone had the same objective function (like maximizing the firm's profits), transacting would take substantial resources; but in the context of individual wealth-maximizing behaviour and asymmetric information about the valuable attributes of what is being exchanged (or the performance of agents), transaction costs are a critical determinant of economic performance. Institutions and the effectiveness of enforcement (together with the technology employed) determine the cost of transacting. Effective institutions raise the benefits of cooperative solutions or the costs of defection, to use game theoretic terms. In transaction cost terms, institutions reduce transaction and production costs per exchange so that the potential gains from trade are realizable' (North, 1991, p. 98).

In production theory, it is hypothesised that reductions in costs with the same amount of resources is an indication of increasing efficiency and productivity. This, in turn, translates into increasing growth. The neoclassical aggregate production relationship confirms that, when they are adequate, institutional arrangements and environments induce productivity. Productivity is central to growth just as effective resource allocation is. It is important therefore for nation states to strive towards activities that induce productive efficiency for increased growth and overall welfare. It is important to note that unproductive activities lead to economic stagnation or decline (Boettke and Coyne, 2009). Institutions are thus regarded as being central to the enabling context created for productivity growth (Biggs, 2007; Hounkonnou *et al.*, 2012).

Williamson (1975, 1987) focuses on the role of institutions as providing efficient tools to solving the problems of a competitive organization or establishment. These efficient solutions include market exchange, franchising or vertical integration. However, these solutions do not explain why there are historical and current differences in the performance of economies. North (1991) attempts to explain how an economy achieves competitive markets that are efficient. The idea that political institutions ensure property rights and economic constraints needs to be given a second look because many economies have not been able to produce and enforce rules. Indeed, economic development and growth will be realised when there are political and economic institutions that create an economic environment that brings about increasing productivity.

Although traditional and modern growth theory such as the neoclassical and endogenous growth framework emphasizes the accumulation of capital and technological advancement as the main sources of growth, these proximate determinants of growth have often failed to provide answers to the reason why some societies manage to accumulate and innovate more rapidly than others. Institutions have been cited as one of the fundamental or deeper factors that determine which societies will innovate and accumulate, and therefore develop, and which will not.

2.6 **Financial Development, Institutional Quality and Productivity – Establishing the Theoretical Framework**

Financial development provides incentives for the participants of the financial system to enhance welfare through access to credit and other financial services at optimally determined transactions costs (Boyd and Prescott, 1986; Levine, Loayza and Beck, 2000; Aluko and Abrahim, 2020). Indeed, according to the seminal work in Levine (1999), the features of a well-developed financial system include an improved production of ex-ante information about possible investment, an adequately monitored investment and implant of corporate governance, trading, diversification and management of risk and exchange of goods and service. These features, Levine further states, are likely to influence savings and investment decisions and hence, economic growth.

By their very definition, institutions are targeted at enhancing efficient resource allocation and fairness. Rodrik (2000) emphasized that incentives would only result in adverse results when a society lacks the presence of institutions and adequate levels of institutional quality. Markets therefore need to be supported by non-market institutions in order to perform well. Indeed, Rodrik attributes the Asian financial crisis to allowing financial liberalisation to run ahead of financial regulation. Rodrik provides evidence to support his view that institutions such as participatory democracies enable higher-quality growth. By allowing a higher level of predictability, institutions ensure that these societies are more resilient to shocks, and deliver superior distributional outcomes.

In having the right level of quality of institutions, the effect of financial development will be felt in total factor productivity through the further reduction of transaction costs and hence improvement in efficiency of the financial system, which will thus affect productivity positively. The argument being made in this research is that, in spite of these concepts that place finance as a determinant of productivity, some economies do not benefit from these deliberate attempts to improve the economy because institutional quality is virtually non-existent or is weak. The role of institutional quality in further enhancing productivity with a developed financial system is that institutions reduce the cost of information and transactions since they reduce the probability of adverse selection and moral hazard.

Institutional quality enhances allocative efficiency already set in motion by the financial system as it develops. King and Levine (1993a) state that the financial system does not necessarily influence growth via the accumulation of capital. When financial systems actively assist the process of evaluating, managing and funding entrepreneurial activities, and thereby reduce the costs associated with these activities, productivity growth occurs as efficiency is enhanced. Issakson (2007) argues that both institutions and capital intensity and policies that encourage investment are major determinants of TFP growth. All these enhance the efficient allocation of resources, which is captured in structural change.

Thus well-developed financial systems link savings to high-return investments at a much lower cost and ensures allocative efficiency by increasing TFP; and adequately working institutions, which are deemed as determinants of TFP, complement the effectiveness of the financial system by ensuring higher efficiency levels through reductions in the costs associated with information and mitigating the incidence and impact of moral hazard and adverse selection in financial markets as it performs it functions. The functions include acquiring information about investment for efficient allocation of capital; risk amelioration; and monitoring and exerting corporate governance control on both managers and firms, respectively. Additional functions are mobilizing and pooling savings and facilitating exchange of goods and services. In the presence of quality institutions, these functions are efficiently carried out to further increasing productivity.

It is therefore essential to consider institutional quality as a productivity enhancing agent due to its hypothesized ability to impose constraints on human behaviour and interaction and thus ensure that contracts are enforced, rules and regulations are adhered to and property rights are secure among others (or the rules of the game are obeyed). Equally important is the need to reflect on the specific mix of institutions that maximize the effect of these reductions in transaction and information costs. This is where Rodrik's (2000) institutions for high quality growth discussed earlier comes in. The next section features a brief discussion of some of the empirical studies and findings on the link between institutional quality, growth and productivity and financial sector development in SSA.

As already stated, the Solow Neoclassical Growth theory is the main theoretical bedrock of this thesis. Like the EGT, the aggregate Cobb-Douglas production function is the main tool for explaining the Solow model. However, emphasis is placed on intensive economic growth by focusing primarily on the exogenous technological advancement and its assumed constituents in this research. Decomposing the technological advancement measure is vital to the efficiency of the production function's productivity in this thesis. It is expected that the growth rate of output will positively correlate with the Solow Residual (Comin, 2010; 2017; MRW, 1992). The main analytical framework is presented in the next section.

2.7 **Production Functions**

2.7.1 Derivation of the Modified Cobb-Douglas Production Function

The Cobb-Douglas production function, which was formulated by Charles Cobb and Paul Douglas in the second quarter of the20th century (Cobb and Douglas, 1928)[13] known to be the most applied production function in literature (Gerchet *et al.*, 2019). Briefly, it shows the relationship between inputs in the form of capital and labour, technological advancement

[13] See Cobb and Douglas (1928) and Barro, Mankiw and Salai-i-Martin (1992) for detailed discussions of the Cobb-Douglas production function

and output. It is framed upon the assumptions that it is homogenous of degree one, it has unitary elasticity of substitution, constant returns to scale and diminishing marginal returns to both capital and labour. An important feature of the Cobb-Douglas function is that it can be generalised have n factors of production and becomes linear in logarithms**.** The neoclassical growth model is presented using the standard AK model below:

$$y_{it} = A_{it}\, k_{it}^{\alpha} \qquad (2.2)$$

Where y_{it} is real output per labour and k_t real capital stock per labour. $A = A_{it}$ represents total factor productivity (TFP) and α, the capital share of income that is assumed to be less than 1 (indicating decreasing returns to capital) and g, the effect of pure technical progress. Financial development works through both capital accumulation such that capital per labour stock, k_{it} increases and through the level of technology or the social marginal productivity of labour, A_{it} or the TFP, which reflects the level of technology and efficiency, is both capital and labour-augmenting (Pagano, 1993; Demetriades and Law, 2006).

The effects of financial development on productivity is deemed to be further enhanced with the presence of adequately working institutions that produce efficiency levels over and above levels that could be obtained from improved financial development alone. This is true especially for sub-Saharan African economies that haven't benefitted much from financial development as a result of a general lack of a good institutional environment to promote productivity. Financial development enhanced by institutional quality can then be incorporated into the production function. From the AK model, A, which is TFP, is thus decomposed (You and Sarantis, 2013; Demetriades and Law, 2006) into pure technical progress or net factor productivity (NFP) and institutional quality linked efficiency gain (IQLEG). The production function in equation (2.2) then becomes:

$$y_{it} = e^{gt} k_{it}^{\alpha} \qquad (2.3)$$

The extended function is given by

$$y_{it} = TFPk_{it}^{\alpha} = (NFP)(IQLEG)k_{it}^{\alpha} \tag{2.4}$$

$A_{it} = Total\ factor\ productivity$

A_{it} evolves as : $A_{it} = A_0 e^{gt}.P_{it}^{\theta}$ (2.5)

Where $y\_it = real\ output\ per\ labour = Y_{it\_} / L_{it}$, $k_{it} =$ real capital stock per labour $= K_{it} / L_{it}$, $\theta =$ a vector of parameters , g= effect of technological progress, and $\alpha =$ capital share of income and P_{it}^{θ} is the combination of financial development, institutional quality that may influence the efficiency of technology. Taking natural logs of both sides results in

$$ln\ A_{it} = \ln A_0 + g.t + \theta ln P_{it} \tag{2.6}$$

The extended Cobb-Douglas theoretical model thus becomes

$$lny_{i,t} = A_i + g_i t + \theta_i' P_{i,t} + \alpha \ln k_{it} + v_{it} \quad = 1,2, \ldots 21,\ \ t = 1,2, \ldots ,31 \tag{2.7}$$

Decomposing P_{it} further,

$$P_{it}^{\theta} = (INS_{it}^{\gamma}.\ FD_{it}^{\tau})^{\ \theta} = IQLEG_{it}^{\theta} = INS_{it}^{\gamma\theta}.FD_{it}^{\tau\theta} \tag{2.8}$$

Taking natural logs of both sides

$$\ln P_{it}^{\theta} = \gamma\theta \ln INS_{it} + \tau\theta \ln FD_{it} \tag{2.9}$$

Hence, $\ln A_{it} = \ln A_0 + g.t + \gamma\theta \ln INS_{it} + \tau\theta \ln FD_{it}$ (2.10)

The empirical model thus becomes:

$$\ln y_{it} = C + \ln A_0 + g.t + \alpha \ln k_{it} + \gamma\theta \ln INS_{it} + \tau\theta \ln FD_{it} + v_{it} \tag{2.11}$$

Thus, based on the extension of the standard neoclassical model, decomposing TFP into a component of financial development-institutional quality and pure technical progress, equation (2.11) becomes the Cobb-Douglas based empirical model to be estimated.

Limitations of the Cobb-Douglas Production Function

In using the Cobb-Douglas production function, it is important to highlight its limitations and the appropriate mitigating measures employed. With respect to its appropriateness for measuring the production process, the Cobb-Douglas production function has been criticised on many fronts (Keen, Ayres and Standish, 2019; Ayres *et al.*, 2014; Bhanumurthy, 2002). According to Bhanumurthy (2002), the empirical applicability of the Cobb-Douglas production function has been primarily challenged on (a) the fact that it cannot handle a relatively large number of inputs, (b) the assumptions of perfect competition in the factor and product markets are restrictive (c) the assumption of constant returns to scale and the unrealistic assumption of unitary elasticity of substitution

With respect to its inability to handle a large number of inputs, the Cobb-Douglas production function has been generalised to accommodate more than two inputs (Mankiw, Weil and Romer, 1992; Salim, Yao and Chen, 2017; Keen, Ayres and Standish, 2019). Secondly, (Bhanumurthy, 2002) addresses the restrictiveness of the assumption of perfect completion by stating that this assumption is a non-essential one as it relaxing it does not does not affect the function and does not introduce any distortion on its own. Again, the application of the CES and VES framework complements the use of the Cobb-Douglas production function since the assumptions of constant returns to scale and unitary elasticity of substitution (You and Sarantis, 2013)[14].

Although the discussion of finance and economic growth in the presence of institutional quality has been mainly discussed in the empirical literature on the basis of the Cobb-

[14] See Bhanumurthy (2002) and Biddle (2012) for a detailed and comprehensive description of the critique of the Cobb-Douglas Production function

Douglas production function (Fernandez and Tamayo, 2015; Murinde, 2012; Pagano, 1993; Levine, 2005), research discussed in determinants of economic growth has successfully explored the possibility of other production forms in countries and extended work to reflect the more general VES and CES work. This extension of the research into other neoclassical production functions is essential to provide a more holistic view of the nature of the possible interactions and associations among these variables.

2.7.2 Derivation of the Constant Elasticity of Substitution Production Technology (CES)

This is part of a special class of the production functions and was introduced by Arrow, Chenery, Minhas and Solow (1961) and generalized to the n-factor case by Uzawa (1963) and McFadden (1963). Kmenta (1967) provided estimation techniques for the generalized form of the CES production function. This production technology assumes that s, the elasticity of substitution, is constant throughout. The CES production function, like the Cobb-Douglas, is homogenous of degree one and therefore has constant returns to scale. The average and marginal products in factors K and L are homogeneous of degree zero like all linearly homogeneous production functions. This implies that the isoquant for the CES production function, which is the marginal rate of technical substitution of capital for labour, is convex to the origin. Under the assumption of two inputs, labour and capital, it is of the form:

$$Y = F(K, L) = A[\omega K^{-\rho} + (1-\omega)L^{-\rho}]^{\frac{-1}{\rho}} \qquad (2.12)$$

Where $A > 0; 0 < \omega < 1; > -1$ and where ρ is the substitution parameter that determines the elasticity of substitution σ. ω is the distribution parameter; for any given value of σ (or ρ), ω determines the functional distribution of income. φ is the returns to scale parameter; the elasticity of substitution (σ) equals σ = 1/ (1+ρ) . When φ =1 and ρ =

0, equation collapses to the Cobb-Douglas production function. The advantages of the CES production function include the fact it takes a number of parameters into account, it is more general and covers all types of returns as well as taking account of raw materials among its inputs. Given equation (2.12), the CES framework in this research is derived as follows:

Decomposing TFP, we have equations (2.7) and (2.8). Therefore, the extended CES can be written as

$$Y = (NFP)(IQLEG)[\delta K^{-\rho} + (1-\delta)L^{-\rho}]^{\frac{-\varphi}{\rho}}, \qquad (2.13)$$

where, $(NFP)(IQLEG) = A_0 e^{gt}.P_{it}^{\theta}$

Hence as deduced from the above Cobb-Douglas case,

$$Y = A_0 e^{gt}.P_{it}^{\theta}\,[\delta K^{-\rho} + (1-\delta)L^{-\rho}]^{\frac{-\varphi}{\rho}} \qquad (2.14)$$

The extended production function per labour is written as

$$y_{it} = A_0 e^{gt}.P_{it}^{\theta}[\delta k^{-\rho} + (1-\delta)]^{\frac{-\varphi}{\rho}} \qquad (2.15)$$

Applying logarithm on both sides will yield the extended CES theoretical model below

$$lny_{i,t} = A_i + g_i t + \theta_i' P_{i,t} - \frac{\varphi}{\rho} ln\left[\delta k_{it}^{-\rho} + (1-\delta)\right] + v_{i,t} \quad i = 1,2,\dots 21, \; t = 1,2,\dots,31$$

(2.16)

Where $P_{i,t}$ is an $(T \times WN)$ dimensional matrix of the log of W independent variables and θ being the coefficient of the log of W independent variables. ρ is the substitution parameter that determines the elasticity of substitution σ. δ is the distribution parameter; for any given value of σ (or ρ), δ determines the functional distribution of income. φ is the returns to scale parameter; the elasticity of substitution (σ) is expressed as σ = 1/(1+ρ) . When φ =1 and ρ = 0, equation collapses to the Cobb-Douglas production function. To derive the empirical model,

Let $P_{it}^{\theta} = INS * FD$ = IQLEG

Equation (2.15) becomes

$$y_{it} = A_0 e^{gt}.\gamma\theta INS_{it}.\tau\theta FD_{it}\,[\delta k^{-\rho} + (1-\delta)]^{\frac{-\varphi}{\rho}} \tag{2.17}$$

Applying logarithm on both sides of (2.16) will yield the empirical model (2.18) below:

$lnY_{it} = c + lnA_0 + g.t + \gamma\theta \ln(INS_{it}) + \tau\theta \ln(FD_{it}) - \frac{\varphi}{\rho} \ln[\delta k^{-\rho} + (1-\delta)]$ Thus equation (2.18) is the basic empirical model that will be estimated.

Testing the CES production function has been severally applied in the literature under different contextual settings. Barro, Mankiw and Sala-i-Martin (1992) tested capital mobility among growth models and applied the use of the CES and Cobb-Douglas production function. Employing data from Penn World Tables 9.0 and Mankiw *et al.* (1992) for 84 countries, Daniels and Kakar (2017) assumed that aggregate income was determined by a normalized CES production function with three factors of production (physical capital, human capital and labour) and estimated a normalized CES production function. They employed a neoclassical growth model suggesting that the elasticity of substitution was weakly significant and below unity for both CES cases (See Klump and Preissler, 2000; Masanjala and Papageorgiou, 2004; Klump, McAdam and Willman, 2007).

2.7.3 The Variable Elasticity of Substitution Production Technology (VES)

Unlike the CES production function, the elasticity of substitution in the VES production function is assumed to have a linear function of the capital over labour ratio. The VES production function includes fixed coefficient models and is more general in function. The elasticity of substitution in the VES technology depends on the capital to labour ratio used in production, which enables the value to vary along different points of an isoquant. Since the capital-labour ratio is directly linked to an economy's growth rate. The VES form creates a link between the elasticity of substitution and economic growth. This implies that a change in the economy's per capita capital affects the elasticity of substitution between capital and labour. This change feeds back into the economy influencing capital accumulation and output (Karagiannis, Palivos, and Papageorgiou, 2004).

Following Revankar (1971), the VES production function:

$$Y = AK^{\omega\varphi}\,[L + \eta\omega K]^{(1-\omega)\varphi} \tag{2.19}$$

where φ is the return to scale parameter. Both ω and η determine the capital share and the labour share of income. The elasticity of substitution is derived as $\sigma = 1 + \eta\left(\frac{K}{L}\right)$ Hence σ varies linearly with the capital-labour ratio around unity. Output per labour is given as;

$$y_{it} = Ak^{\omega\varphi}\,[1 + \eta\omega k]^{(1-\omega)\varphi}$$

If φ =1 and /or η = 0, equation (2.19) collapses to the Cobb-Douglas production function. The VES production function becomes an empirical function of the form. Like the CES case, the total factor productivity is decomposed into net factor productivity and IQLEG;

$$(NFP)(IQLEG) = A = A_{it} = A_0 e^{gt}.P_{it}^{\theta}$$

Hence, the extended production function per labour is given as

$$y_{it} = A_0 e^{gt}.P_{it}^{\theta} * k^{\omega\varphi}\,[1 + \eta\omega k]^{(1-\omega)\varphi} \tag{2.20}$$

Applying logarithm on both sides will yield the extended VES theoretical model below

$$ln y_{i,t} = A_i + g_i t + \theta_i' P_{i,t} + \omega\varphi k_{it} + [(1-\omega)\varphi] ln[1 + (\eta * k_{it})] + v_{i,t}$$

$$i = 1,2, \ldots 21, \;\; t = 1,2, \ldots ,31 \tag{2.21}$$

Where $P_{i,t}$ is an $(T \times WN)$ dimensional matrix of the log of W independent variables and θ being the coefficient of the log of W independent variables. To derive the empirical model, Let $P_{it}^{\theta} = INS * FD$ = IQLEG

Equation (2.20) becomes

$$y_{it} = A_0 e^{gt}.\gamma\theta INS_{it}.\tau\theta FD_{it} * k^{\omega\varphi}\,[1 + \eta\omega k]^{(1-\omega)\varphi} \tag{2.22}$$

Taking the natural log of the VES production function after the decomposition of TFP into NFP and IQLEG, the empirical equation obtained is:

$$\ln y_{it} = \ln A_0 + g.t + \gamma\theta \ln INS_{it} + \tau\theta \ln FD_{it} + \omega\varphi \ln k_{it} + \left[(1-\omega)\varphi\right] \ln\left[1+\left(\eta * k_{it}\right)\right] \quad (2.23)$$

Thus equation (2. 23) is the basic empirical model that will be estimated.

2.8 **Determination of Productivity Levels**

Having derived the extended Cobb-Douglas, CES and VES production functions where TFP is decomposed to reflect the contribution of both NFP and IQLEG to productivity and hence growth in output, the next section presents the calculations used to estimate the efficiency levels from NFP and IQLEG. The goal here is to determine if IQLEG indeed makes a contribution to productivity over and above that of pure technical progress. Based on You and Sarantis (2013), it is expected that the average contribution of IQLEG (CIQLEG) will be positive. This is because a negative CIQLEG will be an indication that financial development in an economy with adequately working institutions has an adverse effect on productivity and growth. Again, when the average contribution of IQLEG is zero, the implication is that, financial development in an economy with adequately working institutions has no impact on productivity and growth. A positive CIQLEG is thus desired as it confirms the main position made in this thesis that institutional quality works through financial development to enhance productivity and economic growth.

2.8.1 Net Factor Productivity, Total Factor Productivity and Contribution of Institutional Quality Linked Efficiency Gain (CIQLEG) – The Case of the Cobb Douglas Production Function

Given the model of the Cobb Douglas function as

$\ln y_{it} = b_0 + b_{1t} + \alpha \ln k_{it} + \gamma\theta \ln INS_{it} + \tau\theta \ln FD_{it} + v_{it}$

The Net Factor Productivity (NFP), Total Factor Productivity (TFP) and Contribution of institutional quality and financial development (IQLEG) are derived as follows:

$$NFP_{it} = \ln y_{it} - \hat{\alpha} \ln k_{it} - \widehat{\tau\theta} \ln FD_{it} - \widehat{\gamma\theta} \ln INS_{it}, \qquad (2.24)$$

$$TFP_{it} = \ln y_{it} - \hat{\alpha} \ln k_{it} \qquad (2.25)$$

$IQLEG_{it} = TFP_{it} - NFP_{it}$ (3.26), respectively, where $i = 1, 2$ denoting before break and after break and $t = 1, 2, \ldots, 31$ from 1985 to 2015. For all production function estimations, average for each year across the 21 countries are computed to represent the estimated $\mathrm{NFP}_{it}, \mathrm{TFP}_{it}$ and IQLEG_{it} The Growth Rate $\mathrm{NFP}_{it}, \mathrm{TFP}_{it}$ and IQLEG_{it} are calculated as the first difference of the natural logarithms.

2.8.2 Net Factor Productivity, Total Factor Productivity and Contribution of Institutional Quality Linked Efficiency Gain (CIQLEG) – The Case of the CES Production Function

Given the model of the CES function as

$$\ln y_{it} = \ln A_0 + g.t + \gamma\theta \ln INS_{it} + \tau\theta \ln FD_{it} - \frac{\varphi}{\rho} \ln\left[\delta k_{it}^{-\rho} + (1-\delta)\right] + \upsilon_{it}$$

The Net Factor Production (NFP), Total Factor Production (TFP) and Contribution of institutional quality and financial development (IQLEG) is given as

$$NFP_{jit} = \ln y_{it} - \hat{\gamma}\theta \ln INS_{it} - \hat{\tau}\theta \ln FD_{it} + \frac{\hat{\varphi}}{\hat{\rho}} \ln\left[\hat{\delta} k_{it}^{-\rho} + \left(1-\hat{\delta}\right)\right], \qquad (2.27)$$

$$TFP_{jit} = \ln y_{it} + \frac{\hat{\varphi}}{\hat{\rho}} \ln\left[\hat{\delta} k_{it}^{-\rho} + \left(1-\hat{\delta}\right)\right] \quad (2.28) \text{ and}$$

based on equation (2.26) $IQLEG_{it} = TFP_{it} - NFP_{it}$

2.8.3 Net Factor Productivity, Total Factor Productivity and Contribution of Institutional Quality Linked Efficiency Gain (IQLEG) – The Case of the VES Production Function

Given the model of the VES function as

$$\ln y_{it} = \ln A_0 + g.t + \gamma\theta \ln INS_{it} + \tau\theta \ln FD_{it} + \omega\varphi \ln k_{it} + \left[(1-\omega)\varphi\right] \ln\left[1 + \left(\eta * k_{it}\right)\right]$$

The Net Factor Production (NFP), Total Factor Production (TFP) and Contribution of institutional quality and financial development (IQLEG) is given as

$$NFP_{jit} = \ln y_{it} - \hat{\gamma}\theta \ln INS_{it} - \hat{\tau}\theta \ln FD_{it} - \hat{\omega}\hat{\varphi} \ln k_{it} - \left[(1-\hat{\omega})\varphi\right] \ln\left[1 + \left(\hat{\eta} * k_{it}\right)\right], \quad (2.29)$$

$$TFP_{jit} = \ln y_{it} - \hat{\omega}\hat{\varphi} \ln k_{it} - \left[(1-\hat{\omega})\varphi\right] \ln\left[1 + \left(\hat{\eta} * k_{it}\right)\right] \quad (2.30) \text{ and}$$

based on and based on equation (2.26) $IQLEG_{it} = TFP_{it} - NFP_{it}$

respectively where $j = 1, 2$ denoting before break and after break, $i = 1, 2, \ldots 21$ for all the 21 counties and $t = 1, 2, \ldots, 31$ from 1985 to 2015. All the parameters were estimated from non-linear least square regression. The growth rate of NFP_{jt} , TFP_{jt} and $IQLEG_{jt}$ are calculated as the first difference of the natural logarithms.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

This chapter is a review of the relevant empirical research associated the economic growth, institutional quality and financial development relationship. From Adam Smith who sought to determine the sources of wealth of nations to Robert Solow who revolutionized the concept of the sources of growth and introduced what is termed as the Solow residual (which sparked a lot of debate and research into the inexplicable aspect of growth and then to modern economic theories such as the endogenous growth theories), the basic underlying question is 'what determines economic growth'?

The extant literature, as already stated, is filled with work on the theoretical underpinnings of economic growth, finance and the relationship between the two. This review is sectionalized as follows: in section one, economic growth is briefly discussed after which the Solow growth model is discussed in section two. Section three reviews the extant theoretical studies in financial development and economic growth, financial development, capital and economic growth whilst the fourth section investigates the possible role institutional quality can play in these relationships as a prelude to the next section, which focuses on institutional quality. The final section attempts to synthesize existing research that incorporates all these variables and provides a conclusion.

3.2 Financial Development and Economic Growth: An Empirical Review

3.2.1 Evidence for the Supply Leading Hypothesis

Support for the finance-growth supply-leading relationship started as far back as the Schumpeterian era of the early 1900s (Schumpeter, 1911). Notable among the support base was Goldsmith (1969) and McKinnon (1973) and Shaw (1973). Over the years, there's been an overwhelming array of literature that points to the fact that the role of finance cannot be overlooked in finding the determinants of economic growth. Among these are Neusser and Kugler (1998), Levine *et al.* (2000), Gurley and Shaw (1955; 1960), Levine (1997; 2003), Christopoulos and Tsionas (2004), Kendall (2012), Baltagi, Demetriades and Law (2009) and Demetriades and Hussein (1996).

These studies range from time series to panel cross-country studies. Again, on the empirical side, researchers have shown that a range of financial indicators are robustly and positively correlated with economic growth (Christopoulos and Tsionas, 2004; Kendall, 2012; Baltagi, Demetriades and Law, 2009; Demetriades and Hussein, 1996; Murinde, 2012; Menyah, Nazlioglu and Wolde-Rufael, 2014). Roubini and Sala-i-Martin (1992) investigated the effect of financial repression on economic growth while placing emphasis on the notion that an economy's savings and investment decisions geared towards productivity and the accumulation of capital mostly intermediated in the financial sector.

Roubini and Sala-i-Martin (1992) thus argue that inefficiencies in the sector would pose a fundamental risk to effective growth through low efficiency and hence productivity as well as encourage the misallocation of savings to investment projects. In their view, although many reasons are given for the weaker growth performance of Latin America in the literature, policies that systematically repress the financial sector are among the most convincing. They find, in line with theoretical arguments, that there is a systematic inverse relation between growth and several measures of financial repression as well as a negative relation between growth and inflation rates. Others that have found the supply-leading hypothesis plausible include Habibulla and Eng (2006) and Murinde (1994; 2012). More recently, Popov (2018), Bijlsma, Kool and Non (2017) and Valickova, Havranek and Horváth (2015) have confirmed the supply leading hypothesis

Increasingly, economists are thus associating with the idea that government policies toward financial institutions may have an important causal effect on long-run economic growth. King and Levine (1993a) identify two contrasting schools of thought where a group proposes that financial markets play a major role in economic growth: a second group believes that finance only responds passively to other factors that account for the differences in growth rates. This view that finance passively responds to other factors that account for the differences in growth rates is mainly highlighted by Robinson (1952), Lucas (1988) and Stein (1989).

However, there have been findings with mixed results; some of which affirm the demand following, bi-directional and no relationship views. Al-Yousif (2002), for instance, found that there is an elaborate two-way relationship between finance and growth, finding support for the hypothesis by Patrick (1966) as well an evidence of no existing relationship when he applied Granger causality on thirty developing countries from 1970 to 1999. De Gregorio and Guidotti (1995), Deidda (2006), Gries, Kraft and Meierrieks (2009), Odedokum (1996), Hassan, Sanchez and Yu (2011) and Luintel and Khan (1999) had mixed results after running tests on a number of countries. Some country and regional level studies have similarly yielded mixed results.

Abu-Bader and Abu-Qarn (2008) found that there is a bi-directional relationship between financial development and growth in Egypt when they use a Vector Error Correction methodology on data running from 1960 to 2001. Ang and Mckibbin (2007) ran a time series test on data in Malaysia from 1960 to 2001 and discovered a positive relationship between financial depth and economic growth but found support for Robinson (1952) that higher output leads to higher financial depth in the long run. Choe and Moosa (1999) found evidence that supports a supply-leading relationship between finance and growth in Korea, whilst Guarigla and Poncet (2007) confirmed the same in China.

Hao (2006) found evidence of finance-led economic growth in China from 1985 to 1999, when Generalized Method of Moments (GMM) techniques are applied. Hondroyiannis, Lolos and Papapetrou (2005) used VAR models on data that spanned from 1986 to 1999 in Greece and supports the existence of a bi-directional relationship between finance and growth. To date, there has been no clear consensus in the literature regarding the relationship between finance and growth. Although some research has confirmed the existence of two-way causality between finance and growth, some research has provided opposite conclusions.

Kar, Nazliogu and Agir (2011) is inconclusive on the causality between finance and growth on MENA countries with the panel causality testing approach in applying data from 1980 to 2007. Their findings support a country specific approach to determining the finance–growth relationship. Naceur and Ghazouani (2007) actually find a negative association between bank development and economic growth from eleven MENA countries using Dynamic Panel Data Models with GMM estimators. Demetriades and Rousseau (2016) found that financial depth is no longer a significant determinant of long-run growth by using data from 91 countries between 1971 and 2004, combined with indicators of financial liberalization with a measure of financial depth: that is, liquid liabilities less narrow money in a series of cross-sectional regressions that follow the King and Levine (1993a) style. They further conclude that certain financial reforms have sizeable growth effects, which may be positive or negative based on the adequacy of regulation and supervision of banks (Odhiambo, 2009; Rioja and Valev, 2004; Rousseau and Vuthipadadorn, 2005).

With respect to the various paradigms on the relationship between finance and growth, the evidence is mixed for SSA. Whilst Atindehou, Gueyie and Amenounve (2005) did not find any relationship between finance and growth in 12 SSA countries, Agbestiaf (2004) and Ghirmay (2004) support the demand following hypothesis of finance and growth using seven and 13 SSA countries, respectively. Evidence collected from Kenya and South Africa by Odhiambo (2009) suggests that finance follows economic growth. Finally, Akinboade and Kinfack (2014) found evidence to support a bi-directional relationship between finance and growth in Botswana using granger cauality analysis. It is important to stress that, currently, the relationship between financial development and growth in SSA (just like other parts of the world) is largely inclonclusive but seems to sway towards an insignificant one.

Various studies ranging from cross-country analysis, country level, firm level and regional level studies as well as studies that apply various time series, cross-sectional and longitudinal techniques and analysis have failed to yield a clear path for establishing the exact relationship between finance and growth. Objections that have been pointed out in finance-growth studies include, firstly, the inherent weaknesses in the measures or indicators of financial development and, to some extent, economic growth. Others find fault with the category of the data collected. Some advocate running tests with longitudinal data whilst others are inclined towards cross-section and or time-series data. Some studies believe this relationship should be conducted at the country level whilst a different group are of the opinion that the more countries studied, the better. There is, however, no doubt that the bulk of the literature has established a relationship between finance and growth.

It is important to note that analytical foundations of this finance-growth relationship have been challenged in the literature (Levine, 2005; Pagano, 1993). Although he subscribes to finance–led growth, Levine (2005) criticizes early work by Goldsmith (1969), Shaw (1973) and McKinnon (1973). The criticism is based on the lack of analytical foundations in explaining the relationship between finance and growth (Eschenbach, 2004; Levine, 2005; Moore, 2010).

Levine (2005) had issues with the size of the countries included in Goldsmith's study and the omission of other variables that could affect growth. Levine (2005) lists six problems associated with Goldsmith's work in 1969. These include the fact that the investigation involves only 35 countries; and there is a lack of systematic control for other factors that could affect growth. The reasons stated therefore make it difficult to conclusively state whether the associations with financial development are in terms of the theoretically established capital accumulation or productivity growth.

To correct these, Levine (1993) suggests the inclusion of more countries and more controls in order to improve predictability. Hence in King and Levine (1993a), which extends Goldsmith (1969), the impact that the level of financial development has on long-run economic growth, the accumulation of capital and productivity is investigated. This is done with seventy-seven economies and for a study period spanning 29 years (1960 to 1989) with other factors that are probably impactful to economic growth are systematically controlled. Furthermore, the study by King and Levine (1993a) attempts to differentiate the capital accumulation and productivity channels with respect to how financial development affects growth.

King and Levine (1993b) construct additional indicators of financial development to provide robustness in their work. They use measures of the size of financial intermediaries, relative degree to which the central bank and commercial banks allocate credit and credit to private enterprises (all expressed as ratios) and realize that the results across the different measures of financial development are consistent. Three growth indicators, namely the averages of real per capita GDP growth in total factor productivity also called the ‘Solow Residual’; and growth in capital stock per person averaged over the same time range, are used to examine averaged values of each of the indicators of financial development in order to test the existence and strength of any empirical relationship they may have with growth.

Regressions are then estimated over the seventy-seven countries and the other factors that could impact long-run growth (such as income per capita, education, political stability, indicators of exchange rate, trade, fiscal, and monetary policy) are used to condition the regressions. King and Levine (1993b) found from their research and additional robustness tests that financial development was able to adequately predict growth in these countries and have a positive relationship with growth, which was significant and strong. They however do not indicate the factors that influence the level and growth of financial development and the right channel through which finance positively impacts growth (La Porta, Lopez-de-Silanes and Shleifer, 2002).

The effect of financial development on growth varies according to the income status of countries as well as the level or threshold a country has achieved (Law, Azman Saini and Ibrahim, 2013; Rioja and Valev, 2004a, 2004b). On the one hand, low income countries do not seem to have a significant relationship existing between finance and growth whilst high income countries do (see Huang, 2009; Cecchetti and Kharroubi, 2012): on the other hand, in a few studies the reverse occurs (Huang and Lin, 2009).

Previous research concentrated on the notion of more finance, more growth; however, in the last decade, a lot of the finance growth studies have centred on the more accurate proposition of 'better finance, more growth'. This is due to the fact that, when a financial system is found in a politically and economically unstable and corrupt society, there is very little chance of it succeeding as there are tendencies for political interference and misallocation and diversion of credit and other financial assets into unproductive ventures, thus rendering them wasteful and ineffective.

Indeed, although the general assumption that strong financial systems reduce transaction costs associated with finding the right kind of investment (which in turn promotes growth), other studies have stressed the need for moderating factors claiming that the absence of factors such as quality institutions will impede these functions of finance in the growth process (Law and Balach, 2015; Demetriades and Law, 2006; Murinde, 2012; Beck, Levine and Loayza, 2000; Calderon and Liu, 2003; Beck and Levine, 2004; Chinn and Ito, 2005).

Additional caution has been raised with the measure of the financial development index. It seems that the gauge used for the functional system of finance was inaccurate such that the evidence provided was not able to ascertain the direction of causality. In addition, research has failed to determine the specific aspect of the financial system that matters for economic growth. Was it the financial market, the non-bank financial intermediaries or a mixture of these that were essential for growth? Moderating factors such as quality institutions may provide some answers.

This study leans towards the hypothesis that, although the role of finance in growth may be supply-leading, this role cannot be effectively impactful in promoting growth should the five main institutional categories proposed by Rodrik (2000) (namely property rights institutions, regulatory institutions, institutions for macroeconomic stabilisation, institutions for social insurance and institutions for conflict management) be inadequate. Hence, these institutions are deemed necessary and sufficient for finance to impact growth positively. This research seeks to emphasize that, although finance may play a role in economic growth in terms of the direction, magnitude or strength and significance of the relationship, there is growing evidence that various factors (including institutions, which are generally country or region specific) may come into play.

Indeed, the literature largely confirms that countries with sound institutional arrangements tend to better realize the effect of finance on growth compared to lowest income countries whose institutions are relatively weak. Law, Azman Saini and Ibrahim (2013) put it this way: *'in low-income economies, more finance without sound institutions may not succeed in delivering long-run economic development' (p 5374).*

Demetriades and Law (2006) and Al-Yousif (2002) both suggest that financial developed has larger positive effects on growth where institutional quality is at high levels as is the case of middle-income countries. In SSA, the scale tips towards a high number of low-income countries with institutional quality on the low side. There is a need to dig deeper into the possibilities for increased productivity and enhanced growth with 'better finance' through higher levels of institutional quality.

3.3 Institutional Quality, Financial Development and Economic Growth

The need to consider the role played by adequate institutional arrangements in financial development and economic growth has been extensively underscored in the literature (La Porta *et al.*, 1997; 2000; Milo, 2007; Murinde, 2012). Indeed, the development of a stable and trustworthy institutional environment paved the way for all the traditional factors of growth to have an effect on or to impact economic performance (Easterly, 2001). Rodrik (2000), in his seminal presentation on institutions for high quality growth, maintains the need for markets to be supported by non-market institutions in order to perform well and SSA markets are no exception (North and Weingast, 1989).

Rodrik (2000) proposes five main institutional factors. These factors include the protection of rights of parties involved in a contract; the regulatory environment; the effectiveness of social insurance; the macroeconomic stabilisation; institutions for conflict management; and extended by democracy (Rodrik, 2000; La Porta *et al.*, 1997; Beck, Levine and Loayza, 2001). Hence, there is the need for a closer look at these institutional factors with respect to financial and economic development in SSA. Glylfason (2004) argues that there is a need to consider institutional quality in growth issues since economic policies and institutions matter for growth (Rodrik, 2002; Acemoglu *et al.*, 2005; 2008).

Institutional quality has been named in literature as a determinant of financial development. Notable among these are La Porta *et al.* (1997; 1998), Beck, Demircrug-kunt and Levine

(2003), Rajan and Zingales (2003) and Stulz and Williamson (2003). La Porta *et al.* (1998) applied Johnson, Acemoglu and Robinson (2001) settler mortality hypothesis to financial development and contributed to the discussion on the legal determinants of financial development. Beck, Demicrug-kunt and Levine (2003) addressed how institutions matter for financial development by likewise applying the settler mortality hypothesis of Johnson, Acemoglu and Robinson (2001) to financial development.

Mohamed, Siadi and Zakaria (2012) attempt to clarify certain aspects of the concept of financial stability, and the role of the central bank in its preservation by attributing the need for such research to witness the rapid spread of relatively recent practices such as monitoring of micro and macro prudential indicators, in-depth evaluation of conditions in all segments of financial markets, the production and dissemination of resistance test and the publication of Financial Stability Reports (FSR), which has arisen to attempt to develop a number of analytical approaches and tools to assess the exposure of financial systems to actual or potential risks. They affirm the role of the central bank in ensuring financial stability.

Addison, Chowdhury and Murshed (2002) posit that financial development is vulnerable to social conflict. They observe that conflict reduces the demand for domestic currency as a medium of exchange and a store of value. Conflict may lead to poor quality governance, including weak regulation of the financial system, thereby undermining the sustainability of financial institutions. Conflict therefore reduces the social return to financial liberalization and other financial-sector reforms. Using data from 79 countries, they applied this to a model that integrates the effects of conflict and financial liberalization. In concluding, they found that conflict significantly reduces financial development.

In areas of conflict, legislation to protect the public interest is either not forthcoming or it is not enforced. Unsound banks are licensed, and unsound lending practices are not restrained. They observe that conflict takes many forms and that its intensity varies, often ranging from infrequent guerrilla attacks that inflict relatively minor damage on a country's institutions and economy to a full-blown civil war involving protracted and extended fighting together with mass population displacement.

Addison, Chowdhury and Murshed (2002) thus regard the effect of conflict on financial development in terms of its intensity. They observed that the general expectation was that conflict influenced the benefits and effectiveness of financial reforms negatively so that as conflicts intensified or became more pronounced, there were marked reductions in the effectiveness of reforms. They apply Tobin's (1969) portfolio-balance model to analyse the choices that agents make in holding domestic currency versus alternative stores of value (such as precious metals, foreign currency, and other hedges) in conflict-affected countries. Addison, Chowdhury and Murshed (2002) found that there is a significant reduction in financial development when there is conflict and this reduction is further impacted with increasing intensity of conflict.

The literature is scanty in the area of social conflict and financial development and this research seeks to investigate the moderating role it plays in the finance-growth nexus as an institution since SSA is one region in the world that is plagued by numerous social conflicts. Do the presence of these conflicts that range from infrequent guerrilla attacks to serious tribal wars, affect the role that institutions play in the economy and perhaps contribute to high information and transaction costs, which in turn lowers productivity and hence growth? They make the assertion that the international community would need to offer more support to the prevention and resolution of conflict through, better peace-keeping, broad-based reconstruction and democratization as their evidence supported the fact that, apart from being welcomed as a humanitarian gesture, conflict-reducing measures have a positive relationship with economic development.

The positive effects of financial reform will be higher in the presence of complementary conflict-reducing measures. This leads in turn to further reductions in the resolution of the conflict by dampening the intensity of the conflict. Ultimately, with conflict reducing measures, financial reforms benefit the countries undertaking the reforms even more and the effectiveness of aid in support of such reforms is pronounced. Gries and Meir ekes (2010) used data between 1984 and 2007 from nineteen SSA countries to find the relationship between institutional quality and financial development by reviewing the determinants of financial development in SSA. They argue that, although a vast number of studies have pointed to a positive relationship between financial development and economic growth, studies that concentrate on SSA do not confirm this. They find that SSA, as a region, is financially underdeveloped and has a relatively low level of financial openness.

Indeed, the slow economic growth rates recorded in the region have been repeatedly attributed to inadequate levels of financial development and openness. This, Gries and Meir ekes (2010) assert, is evidenced in SSA's pronounced market segmentation. In their view, a relatively insufficient number of financial products, very little financial innovation, a deeply fragmented market, large interest rate spreads and a generally large informal sector reveals the existence of a relatively high level of financial underdevelopment in SSA.

Gries and Meir ekes (2010) controlled for factors such as macroeconomic stability, bureaucracy and corruption and categorize these as such; but Rodrik (2000) viewed macroeconomic stability as a major institution that is needed for growth. This research further considers the stability of macro-economy as a main institutional quality. Indeed, financial underdevelopment may lead to low levels of factor accumulation and resource allocation may become inefficient, making economic development virtually impossible. Gries and Meir ekes (2010) used dynamic panel models in regarding financial development level as a function of quality institutions when they had eliminated the potential effects of other variables outside the institutional setting.

They use dynamic panel data analysis with a Least Square Dummy Variable estimator and take account of the issue of reverse causation. They apply the Granger causality in a panel VAR model; and using data from the International Country Risk Guide, they concentrated on protection of property rights, corruption and rule of law, political stability, democratic accountability and the quality of national bureaucracy. They found evidence to prove that, in the face of an underdeveloped financial system, resources allocation is inefficient and factors of production are less accumulated: a situation that restricts the level of economic development.

A typical example would be when rural communities and households as well as small businesses in SSA have access to little or no credit because of low levels of financial development; leading to the possibility of having negative implications for economic growth and development. They identify a causal link running from past institutional quality to present financial development. Their empirical analysis indicates that high levels of inflation and ethnic conflict may negatively influence financial development as relevant non-institutional determinants. These two add to the assertion by Rodrik (2000) that institutions for conflict management and macroeconomic stabilisation are essential for high quality growth: in this case, the growth of financial development.

Acemoglu, Johnson, and Robinson (2001) researched the relationship between colonial origins and development by exploiting the differences in European mortality rates to estimate the effect of institutions on economic performance. They observe, using multiple stage least squares regressions that, by controlling for the effect of institutions, the income levels of African countries or those closer to the equator are not comparatively lower. Beck and Levine (2005) dwelled on the concepts of the law and finance theory, attributing the low levels of financial development in certain countries to lack of adequate legal systems that enforce private property rights, support private contractual arrangements, and protect the legal rights of investors. Savers are consequently more willing to finance firms, and financial markets flourish.

Djankov, Mcliesh and Shleifer (2007), using a sample of 129 countries, observed that, when the legal system spells out creditor protection rights and there is information sharing institutions, private credit to gross domestic product ratios go up. However, creditor protection rights are more important in richer countries compared to information sharing institutions. This is because, having analysed legal reforms, they observed that credit rises after improvements in creditor rights and in information sharing. Using a joint application Bayesian Model Averaging and General-to-Specific methods of 107 countries in a bid to produce more reliable findings, Huang (2005) found that the level of financial development in a country is primarily determined by its institutional quality, government policies, geographic endowments, its income level and cultural characteristics.

Huang (2005) further established that that good institutional quality leads to the efficient supply of external finance while ill functioning institutions as well as particular cultural characteristics mainly form structural impediments to the supply of external finance. Huang (2010) investigated the links between political institutions and financial development. Dwelling on the fact that most developing countries had taken on institutional reforms towards democracies, he found that, especially in lower income countries, when institutional quality is improved, financial development increases in the short run. These results are consistent with ethnically divided and French legal origin countries. Ninety (90) non-transition economies were studied over the period of 1960–99 with five observations per country.

Huang (2010) compared more recently developed panel data techniques, including bias-corrected LSDV and system GMM estimators. For the lower income countries, the positive effect of institutional quality on financial development is expected to persist over longer horizons. Another finding obtained by Huang when he conducted a "before-and-after" analysis with respect to democratization of economies shows that, in general, democratic transitions are typically preceded by low financial development, but followed by a short-run boost in financial development and greater volatility of financial development. The findings affirm that institutional innovation has an influence on the supply side of financial development.

So far research in the finance development-institutional quality-economic growth context has largely focused on legal origins, political stability, macroeconomic stability, contract enforcement and property rights institutions either as determinants of financial development or joint determinants of growth with financial development. A plethora of studies have, in one way or another, included the institutional environment in the finance–growth debate and have largely concluded that, without adequately functioning institutions, financial development is not likely to have any significant impact on growth as theory suggests. However, borrowing the term from Huang (2005), even within this institutional setting, this research proposes that SSA has certain stylized facts that make it unique in its institutional setting. By and large, the literature indicates that there's a relationship that enables the financial sector to further influence the growth or development of the economy when institutional environments are adequate, especially when the productivity channel of the finance-growth relationship is being considered.

Indeed, the region is still battling with very low institutional standards, which include various conflicts and virtually non-existent social insurance policies. Adequately functioning institutions cannot be underscored in the bid to ensure economic growth irrespective of what channel of growth is being considered (Murinde, 2012). This research proposes that broadening the measures of institutional quality to include property rights; regulatory institutions; institutions for macroeconomic stabilisation; institutions for social insurance; and institutions of conflict management in one study is important. This is because the literature, to the best of my knowledge does not include the combination of the five institutions proposed by Rodrik (2000) as those that facilitate high quality growth. The outcome may provide insight into what will work for the SSA region in its bid to use financial inclusion as a measure to propel economic growth forward in the region.

3.4 Linking Financial Development, Institution Quality and Productivity

Indeed, markets will be marked by high levels of uncertainty and will not function well when there is a lack of respect and stability for rules coupled with undefined and unenforced property rights and contracts, a situation that will lead to inefficient resource allocation. This position has been implied many times in the institutions and growth literature (See Fernandez and Tamayo, 2015; Rodrik, 2000; 2002; North and Thomas, 1973; Weingast, 1997; Hall and Jones, 1999). An example is the study by Hall and Jones (1999) that cite the reasons for differences in output per worker, productivity and capital accumulation as being directly attributable to differences in government policies and institutions.

Institutions, to a large extent, allow the markets to work as they should. One such market in the financial development context is the financial market, which works when intermediaries play the all-important role of allocating resources to the most productive use and accumulating savings towards higher levels of investment (Goodhart, 2004; King and Levine, 1993; Menyah, Nazlioglu and Wolde-Rufael, 2014). The presence of adequate institutions in this case allows for the impact of financial development to be over and above that which is expected from the workings of an efficient financial system. This is due to the fact that the costs of legal enforcement and the typical transaction are reduced. Thus, financial markets are able to develop at a relatively faster rate and support real activity in economies where regulatory institutions enforce property rights, protect legal rights of investors and support private contractual agreements.

The fast and efficient development of financial markets has cost reduction implications with respect to transaction costs. When the costs of investing in information are reduced by law enforcers, enforcement efficiency is improved. Fernandez and Tamayo, (2015) observe that when it comes to financial contracts, regulating in favour of accounting standards, information-sharing schemes and disclosure practices, for example, may actually reduce the cost of overseeing bankruptcy procedures and hence improve efficiency. As Pagano and Jappelli (1993) show, the presence of adequate institutions would reduce adverse selection by the use of an information sharing scheme, as borrowers will adapt to a situation where they fully accept the fact that other lenders will have access to creditworthiness. This again, reduces transaction costs.

In addition to improving efficiency through such information sharing schemes that reduce transaction and information costs, institutions working adequately help in reducing financial frictions through their allocative tendencies. Another way of reducing these frictions is through risk-sharing. The effect of institutional quality on productivity is important due to the efficiency gains realized from them. Various studies on institutional quality and productivity have emphasized this. Table 3.1 highlights some of the notable empirical work in the literature that attempt to link financial development to productivity and hence growth within certain institutional frameworks.

Law, Azman-Saini and Ibrahim (2013) sampled 85 countries between 1980 and 2008 to investigate whether differing levels of institutional development has any implication for the growth effect of financial development under a Cobb-Douglas framework and concluded that economic growth responds differently to financial development indicators when considering institutional differences. Economic growth has a much stronger association with private sector credit than with liquid liabilities and commercial bank assets. Better institutional quality plays a pivotal role in ensuring the ability of financial institutions to facilitate efficient borrowing, hence, prevent credit divergence to unproductive investment activities. They found that, for countries with low levels of institutional development, there is no significant relationship between financial development (both private sector credit and liquid liabilities) and real GDP per capita.

Demetriades and Law (2006) found that, within a Cobb-Douglas production setting, when embedded within a sound institutional framework, financial development has larger effects on long-run economic development. Their work shows that countries that are poorer stand to gain (via direct and large effects) from improvements in institutions when they improve institutions than when they pursue financial development on its own. They however found evidence of greater impact of financial development in middle-income countries with particularly large impacts where institutional quality is high. Interestingly, from the study, a relationship was found that leads from institutional quality to economic development as well. These results that emphasize the role of institutional arrangements in the finance-growth relationship highlight the importance of institutional quality in growth as a whole.

The above findings are in line with early proponents of institutional arrangements in financial intermediation such as Law, Azman-Saini and Ibrahim (2013), Arizalla, Cavallo and Gallindo (2013), Filippidis and Katrakilidis (2015) and Heil (2017). Although the effect of structural breaks and the role of other forms of production technologies are absent, the preceding authors all find a strong positive link between finance and growth, and robustly so when institutions measured in various forms are present and adequate. Institutional quality therefore seems to have a productivity enhancing trait that propels productivity (and hence growth) further when introduced to factors that affect growth whether proximate or fundamental. In essence, institutions and their arrangement and adequacy reduce transaction costs to the barest minimum and help markets function

Table 3.1: Review of Some Existing Panel Studies on Financial Development, Institutional Quality and Productivity

Author (Year)	Objective/Aim	Theoretical Framework	Data/Measures	Estimation Technique	Findings & Conclusion
Levine and Zervos (1998) 47 and other 31 countries 1976 to 1993	Are measures of stock market liquidity, size, volatility, and integration with world capital markets robustly correlated with current and future rates of economic growth, capital accumulation, productivity improvements, and saving rates?	Cobb-Douglas in the Endogenous Growth Theory International capital asset pricing model and international arbitrage pricing theory.	Real per capita GDP growth, real per capita physical capital stock growth, productivity growth, and the ratio of private savings to GDP, Size-Capitalization, Liquidity indicators, International integration measures, Bank Credit	Cross country regressions controlling for initial income, inflation, government, social and political variables and cultural characteristics.	Stock markets provide different services from banks. Stock market size, volatility, and international integration are not robustly linked with growth. Financial indicators are not closely associated with private saving rates. Banking development and stock market liquidity are both good predictors of economic growth, capital accumulation, and productivity growth. The other stock market indicators do not have a robust link with long-run growth.
Beck, Levine and Loayza (2000) 63 countries 1960 to 1995	Examines whether the level of banking sector development exerts a causal impact "sources of economic growth	An augmented neoclassical Cobb-Douglas production function	Real output growth, TFP growth, saving ratio, physical capital accumulation. Legal origin indicators as instruments-	Arellano and Bover (1995) and Blundell and Bond (1997) GMM, PCSIVE	Higher levels of banking sector development produce faster rates of economic growth and total factor productivity growth. Results consistent with Schumpeterian view of finance and growth:
Bordo and Raussaeu (2006) 17 countries 1880 to 1997	Consider relationships between finance, growth, legal origin, and political environment	Cobb-Douglas Endogenous Growth theory	Broad money over GDP. financial depth. initial level of per capita income and initial inflation rate, dummy variables for legal origin and time, inflation and initial income	OLS regression framework development	Legal system positively related to financial development but not persistent over time. On the other hand, stable political variables are consistent with larger financial sectors and higher conditional rates of economic growth. Controlling for inflation and time periods with dummy variables in the pre-1929 period, both legal and political variables seem to matter
Huang (2010) 90 countries 1960–1999	Examines whether political institutional improvement promotes financial development	Cobb-Douglas	Institutional improvement on financial development, controlling for GDP, trade openness, aggregate investment, and black-market premium.	System GMM estimator and LSDV estimation	Positive effect of institutional improvement on financial development in the short-run, particularly for lower income countries. shed light on the strong and robust relationship

					between institutional quality and economic performance.
Rioja and Valev (2003) 74 countries 1961-1995	Does financial development have a larger effect on capital accumulation and productivity growth in developing countries than in industrial countries?	Neoclassical growth model Cobb-Douglas	Rate of growth of real per capita GDP, rate of growth of per capita physical capital stock and rate of growth of the residual as Five-year averaged: Private Credit, Liquid Liabilities Commercial versus Central Bank	GMM, dynamic panel techniques to deal with the possible simultaneity of finance and economic growth to control for country-specific effects	The effects of finance on economic growth may vary in different types of countries that finance has a strong positive influence on productivity growth primarily in more developed economies. Conversely, in less developed economies, the effect of finance on output growth occurs primarily through capital accumulation and not productivity.
Filippidis and Katrakilidis (2015) 52 (16 from SSA) developing economies 1985–2008.	Examine the role of institutions and human development in financial development at early stages of economic growth Investigate any structural components of economic institutions that impact more on financial development	Cobb-Douglas	Decompose institutions into economic, political and social; and economic institutions into quality of government, intervention of government, and quality of the legal system	GMM estimation (Greene, 2008). Two-step System-GMM estimator by Arellano and Bover (1995), and Blundell and Bond (1998) for more efficient and precise estimates.	A robust empirical relationship from institutions (economic and political) to financial development. Economic institutions are of fundamental for banking sector development more in developing countries, while political institutions are statistically significant in low and lower-middle income countries
Arizalla, Cavallo and Gallindo (2013) 26 manufacturing industries in 77 countries from 1963 to 2003	Estimates the impact of financial development on industry-level total factor productivity (TFP) growth	Cobb-Douglas	Three measures of TFP, industry-specific capital and labour coefficients, industry-time & country-time fixed-effects, industry i's share in country c of total value added in manufacturing at the beginning of the five-year period, Rajan and Ingalls's measure of industry i's dependence on external finance, country level financial development that varies over time	Cross Country Regressions	A significant relationship is found between financial development and industry-level TFP growth when controlling for country-time and industry-time fixed effects. The results are both statistically and economically significant. TFP growth can accelerate up to 0.6 percent per year, depending on the external finance requirement of industries, following a one standard deviation increase in financial development

Law, Azman-Saini and Ibrahim (2013)	Examines differences in growth effect of financial development in countries with distinct levels of institutional development	Neoclassical growth- Cobb-Douglas	Average years of secondary schooling and average growth rate, initial real GDP per capita and population growth, corresponding to two institutions	Threshold regression	There is a threshold effect in the finance-growth relationship. However, the impact of finance on growth is positive and significant only after a certain threshold level of institutional development has been attained
Demetriades and Law (2006) 72 countries 1978–200	Examines whether political institutional improvement promotes financial development	Neoclassical Growth Cobb-Douglas	GDP per capita, gross fixed capital formation, liquid liabilities, private sector credit and domestic credit provided by the banking sector, all expressed as ratios to GDP. Corruption, Rule of Law, Bureaucratic Quality, Government Repudiation, Risk of Expropriation	Pooled Mean Group. ARDL. OLS cross-country estimator	Financial development has larger effects on GDP per capita when the financial system is embedded within a sound institutional framework. Moreover, financial development is most potent in middle-income countries, where its effects are particularly large when institutional quality is high.
Balach and Law (2015) 4 countries within the South Asian Association for Regional Cooperation 1984-2008	Investigates the effects of financial development, institutional quality, and human capital on economic performance	Cobb-Douglas Neo-classical augmented Solow growth model	Real GDP per capita, gross fixed capital information, domestic credit supported by the banking sector is elaborated as ratios to GDP, liquidity liability, private credit by deposit money banks and other financial institutions as ratios to GDP. The initial year level of average years of secondary school enrolment is used for the human capital stock variable	Mean group (MG) and pooled mean group (PMG) estimations	Efficiency of financial development, institutional quality, and human capital in statistically determining long-term and short-term growth. Financial development plays an important role in economic performance when the financial system is equipped with a good institutional framework. Results also reveal that institutional quality has a large effect on economic performance

Studies on Finance, Growth and Institutional Quality (Compiled by Author, 2018)

3.5 Financial Development, Institutional Quality and Economic Growth in Sub-Saharan Africa – An Overview

Having discussed the financial development and institutional quality and the diverse ways in which they are proposed to relate with or impact economic growth, it is important to briefly reflect on economic growth, financial development and institutional quality in SSA, which is the main unit of analysis in this thesis. This sector therefore provides some background into the current interrelations between economic growth, institutional quality and financial development within the context of the submissions made in this thesis as per its objectives.

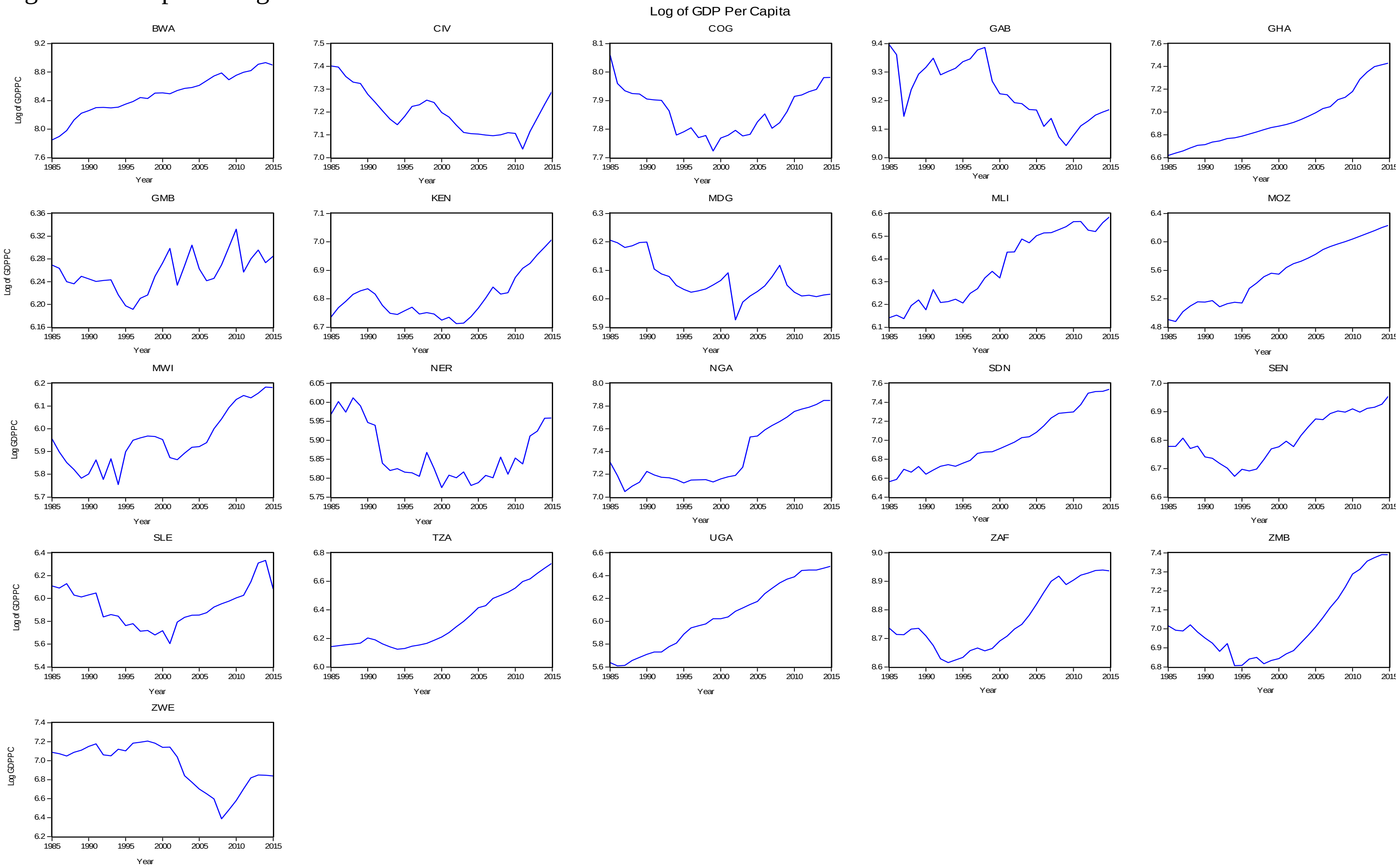
3.5.1 Economic Growth in Sub-Saharan Africa

SSA ranks about 10^{th} with respect to the size of its global economy. A notable feature of SSA is the fact that, in spite of reported consistent growth rates, the region has, over the last three to four decades, been plagued by conflicts, epidemics, political turmoil and major economic downturns among others. The sub-Saharan region is diverse with forty-eight countries. It has a population estimate of about 1.25 billion, which is growing at an average of 2.5% p.a. and a population density of 41.4 per square kilometre. There are various regions and sub-regions in the area. SSA has been grouped into four main sub-regions- Eastern Africa, Middle Africa, Southern Africa and Western Africa. SSA is described as one of the poorest regions in the world (World Bank, 2017)

Although SSA boasts of vast reserves of natural resources, the degree of poverty is high relative to other regions in Africa and the world (World Bank, 2017). The income level classifications and population sizes for the selected panel as at 2016 are presented in

Appendix A. Due to the lack of adequate data, only 21 out of the 48 nations could be included in this research. These include Botswana, Cote d'Ivoire, Congo, Gabon, Ghana, The Gambia, Kenya, Madagascar, Mali, Mozambique, Malawi, Niger, Nigeria, Sudan, Senegal, Sierra Leone, Tanzania, Uganda, South Africa, Zambia and Zimbabwe. The chart below (Figure 2.1) shows the GDP per capita of these 21 economies under study between 1985 and 2015. Interestingly, none of the countries under study can be classified as high income. Currently, 25 of the 30 poorest countries with an average income level of \$1,974.67(current) are from SSA with Burundi being the lowest with a GDP (PPP) of \$727.

Figure 2.1 Graph of Log of Annual GDDPC for the 21 Countries from 1985 – 2015



GDP Per Capita by country on the Vertical, 1985-2015, Years on the horizontal axis. Each country's series is presented each box with the country code above the box

3.5.2 Financial Development in Sub-Saharan Africa

Although the region's financial development level and depth is relatively much lower compared to other regions of the world, private sector credit to GDP, the most widely used indicator of financial development levels, has doubled in recent years from its 1995 level. According to the IMF (2016) financial development report (FDR) by Mlachila, Cui, Jaded, Newark, Radzewicz-Bak, Takebe, Ye, and Zhang (2016), SSA has the potential for levels of financial development to grow where its impact and contribution to annual growth will be an additional 1.5 percentage points higher than it currently is. To get a better understanding of financial sector development in SSA, a brief review of the composition and nature of the financial sector is appropriate.

The SSA financial system, as part of the African financial system (with the exception of South Africa), are dominated by traditional banking and informal finance (Allen, Otchere and Senbet, 2011). These financial systems having gone through extensive economic reforms over the last three decades and have innovatively expanded into the non-bank finance with microfinance and stock market operations are becoming relatively more visible in the region. According to Allen, Otchere and Senbet (2011) notable challenges that the SSA financial sector faces have to do with liquidity and depth. With respect to depth, although financial depth in the form of private credit increased from 10% in 1995 to 21% in 2014, the relative level is low compared to other developing regions (see McDonald and Schumacher, 2007). This is attributable, in part, to the high number of low-income countries in the region. Stock markets in particular face low capitalization and liquidity problems.

Before the global financial crisis of 2008, whilst the rest of the developing world averaged 32% to 43% (scaled by GDP) in terms of private credit as a ratio of GDP, SSA was averaging a private credit to GDP ratio of 17%. The story is no different for liquid liabilities as a percentage of GDP. However, although private sector credit o GDP is relatively lower compared to other regions, SSA's private sector credit to GDP has doubled from its 1995 position with respect to financial innovation. (World Bank, 2017). The financial development indicators generally show low levels for the region.

However, there have been notable feats including capitalization or size expansion and trading activity as a result of better regulatory and economic environments in the region recently. The make-up of the banking sector in SSA is usually a domination by state-owned banks, some public banks and or a few large, most often, foreign banks. However, the restructuring and reforms of the banking sector over the last three decades has led to privatization of state-owned banks in many SSA countries. Although the region experienced a drop-in market capitalization as a result of the financial crisis, the market capitalization of some SSA countries continued to improve beyond 2008.

Politically, after gaining independence between the late 1950s and 1970s, the region seemed to be ruled by one party governments and the military. These gave rise to many civil and ethnic wars. However, with the World Bank's structural adjustment programs (SAPs) of the late 1980s and early 1990s, the region began to evolve into a democratized dispensation with country after country conducting general elections often riddled with doubt, complaints and conflict. The SAPs saw a shift away from financial repression to financial liberalization and often complete changes in the financial structure of these SSA economies. Slowly, the sub-Saharan economy became more open in terms of trade, market and the financial system. The question then is how has financial development evolved in SSA. What significant contribution has the financial sector made to efforts aimed at reducing the volatility of economic growth rates? And, are there additional potential benefits to be made from financial development in SSA and how will these benefits be properly harnessed for the good of the sub region? The literature provides some answers.

3.5.2 Institutional Quality in Sub-Saharan Africa

Although SSA countries have made great effort in adopting measures and policies towards quick and sustainable economic growth and development, they seem to be inadequate in relation to the growth levels attained by the developed nations. These attempts have bordered on major reforms including the structural adjustment programs of the late 1980s and 1990s that witnessed liberalization of financial systems; trade openness; adopting flexible foreign exchange regimes; establishing the framework for increased levels of inward foreign direct investments; and democratization of political systems among others, which seem not to have yielded desired outcomes for many SSA countries. These changes were indeed meant to establish strong and robust economies through that would be growth-driven and lift the millions in this region out of poverty.

Unfortunately, in as much SSA's growth rate over the past few years have been encouraging, it is not just reflective of the income levels of these nations. It is important to consider the degree to which SSA's institutional environment and quality have played a role towards accelerated, sustainable and impactful growth (See Rodrik, Subramanian and Trebbi, 2002). Institutional quality measures for SSA over the past two and half to three decades are presented in the International Country Risk Guide (ICRG) composite risk and governance index. This database is one of the most reliable and used proxies of institutional quality.

Table 2.1 shows the composite index of risk and governance for thirty-two SSA countries. This measure of institutional quality shows annual averages of the composite risk rating scores based on aggregating the political, financial and economic ratings for each country's overall risk. This dataset has been widely applied in research on institutional quality since it was first published by Knack and Keefer (1995). Asiedu (2004; 2006), Demetriades and Law (2006), Balach and Law (2015) and Bräutigam and Knack (2004) have employed versions of the dataset to measure institutional quality. The composite scores range from zero to 100 and are broken into categories from the higher the risk, the less the quality level of institutions in a country[15].

The quality of institutions in SSA is not encouraging. Nine out of the thirty-two listed countries are below the world average quality level of institutions with five being in the very high-risk level, which by implication means they fall within the range of countries with the lowest quality of institutions. However, a look at the median score of 62.40 indicates that about 60% of the countries captured from SSA score below this median with respect to the quality of institutions. Congo's score of 38 is slightly higher than the world lowest of 35.11.

It is interesting to note that the highest score obtained by a SSA country is 81.35 in Senegal. Angola and Gabon follow as second and third for SSA with a scores of 80.69 and 70.77, respectively. There is a need to emphasize here that most of the countries that scored high marks, and are deemed low risk, are the developed and Western countries. Given that better

[15] Whilst the Political Risk Index is based on 100 points, Financial Risk is based on 50 points, and Economic Risk on 50 points. To get the composite index used here, the total points from the three indices are divided by two to produce the weights for inclusion in the composite country risk score

institutional quality is meant to complement efforts towards economic growth, SSA would need to work towards better quality institutions

Table 2.1: Composite Institutional Quality/Risk Index for SSA, 1990-2016

Country	ICRG Average Composite Index	Country	ICRG Average Composite Index
Angola	80.69	Malawi	57.35
Botswana	59.88	Mali	60.42
Burkina Faso	61.83	Mozambique	69.15
Cameroon	45.56	Namibia	67.15
Congo	38.33	Niger	58.69
Congo, DR	64.79	Nigeria	60.42
Cote d'Ivoire	67.04	Senegal	81.35
Ethiopia	69.00	Sierra Leone	57.75
Gabon	70.77	Somalia	63.88
Gambia	62.25	South Africa	63.42
Ghana	60.19	Sudan	49.71
Guinea	44.13	Tanzania	56.44
Guinea-Bissau	61.83	Togo	58.79
Kenya	63.65	Uganda	67.33
Liberia	59.52	Zambia	69.00
Madagascar	49.09	Zimbabwe	52.73

Note: Composite index of risk and governance for thirty-two SSA countries. This measure of institutional quality shows annual averages of the composite risk rating scores based on aggregating the political, financial and economic ratings for each country's overall risk. Computed from ICRG Dataset (2018). Very Low Risk (80 to 100 points) to Very High Risk (zero to 49.9 points)

In view of the relatively low level of the quality of institutions in SSA, it is important to determine if indeed an effort towards improving the institutional quality would be a good thing for SSA. Whether institutional quality is a substitute or a complement for the fundamental sources of growth (Effiong, 2015; Aron, 2000) that have been attempted by countries in the region their importance cannot be over emphasized (Asiedu, 2006; Balach and Law, 2015). It is important that various types of institutions are explored, especially where they have been proven to propel high quality growth (Rodrik, 2000; 2002). SSA is making strides to develop its financial system and the efficiency with which that happens is proposed to be enhanced by adequately working institutions. Institutional quality is being hypothesised to work through finance to improve productivity. The institutions proposed by Rodrik (2000) are both social and economic and may well provide the answer

It is important to indicate that this research's goal of investigation the role institutional quality and financial development play in SSA's economic growth ties well into the Agenda 2063 of the African Union. The Agenda 2063 of the African Union, just like the SDGs, is meant to ensure that Africa attains an inclusive and sustainable economic growth and development. This new path for sustainable economic growth and development was instituted in 2013 and is viewed as *'the strategic framework'* and the *'blueprint and master plan for transforming Africa into the global powerhouse of the future'* (www.au.int/agenda2063/overview). This research ties into some of the priority areas of this Agenda with respect to the goal of ensuring quality institutions are in place and there's an expansion of the financial monetary institutions on the continent.

The emphasis on institutional quality is first aimed at putting capable institutions and transformative leadership in place. This is enshrined in the priority areas of working towards and entrenching democratic values, practices, justice and the rule of law, ensuring stability, security and peace in African capital markets as well as ensuring an adequate social insurance and social protection to tackle inequality among others (www.au.int/agenda2063/goals). These institutions are among the major six portrayed in this study (Rodrik, 2000) as promoters of high-quality growth and their inclusion in the priority areas of the African continent's strategic framework for sustained and inclusive economic growth is noteworthy. In effect, a well-developed financial system situated within a stable and quality institutional environment is proposed to be an important driver of Africa's growth.

3.6 Studies on Financial Development and Economic Growth in Sub-Saharan Africa

In a region like SSA, the importance of financial development for growth is evident. According to the IMF (2016), some progress has been made with respect to the level and growth of financial development in SSA, although this progress may be relatively low. Moreover, despite the fact that the level is below benchmark, financial development has played a role in reducing growth volatility in SSA and has significantly contributed to growth (Sahay *et al.,* 2015). Nyamongo *et al*. (2012) sampled 36 African countries from 1980 to 2009 using panel econometric framework analysis to test the relationship between finance and economic growth. They conclude that the importance of finance in aiding economic growth in these countries is weak (Odhiambo, 2009; Rioja and Valev, 2004; Rousseau and Vuthipadadorn, 2012).

Mlachila *et al.* (2016) note that there is a gradual increase in the share of marketable instruments compared to non-marketable debt thus facilitating the establishment of more liquid bench marks for future corporate issuances. There has also been an increase in project bonds that finance infrastructural investment, and debt instrument maturities have become longer on the average. It must be emphasized that in SSA the development of the financial sector has occurred through both the financial institutions and the financial markets. Is deeper financial development for SSA? Even though the size and effect differ across SSA countries, financial development has been associated with high economic growth. Mlachila *et al*. (2016) found that enhancing financial inclusion by reducing borrowing constraints, participation cost and increasing intermediation efficiency reduces volatility of growth and increases the impact of finance on productivity and growth (Sahay *et al.*, 2015).

The relationship may tend to be mixed and even insignificant for SSA at times. Batuo, Mlambo and Asongu (2018) applied dynamic panel regression techniques and a system GMM estimation to 41 African countries between 1985 and 2010 to test the effects of financial liberalisation, financial development and economic growth on financial instability in Africa. They particularly investigated the impact of financial development on economic growth in African countries. They were interested in whether the financial development and liberalisation that has occurred in Africa is linked to financial instability as well as wanting to ascertain any significant differences in the relationship between financial development and financial stability during the pre-liberalisation or post-liberalisation era. Financial instability has a positive effect on financial liberalisation meaning the liberalisation process tends to increase financial instability. However, it has an inverse effect on economic growth, confirming some positions in the literature.

Batuo, Mlambo and Asongu (2018) further found that, although financial development's association with financial instability is positive and significant, its effect on economic growth is negative and significant. They however found that the marginal effect of financial development on financial instability is positive and more pronounced than that of financial liberalisation. Both have a favourable impact on financial instability with the effects of financial liberalisation being greater than the effect of financial development, while economic growth has an opposite effect. The positive link between financial instability and financial liberalisation and development tends to affect the nexus between finance and growth by damaging economic growth. The development and efficiency of the financial sector is riddled with continuous financial instability, leading to a lack of confidence from investors.

Indeed, the evidence is mixed with respect to the various paradigms on the relationship between finance and growth. Additional evidence suggests that, whilst Atindehou, Gueyie and Amenounve (2005) did not find any relationship between finance and growth in 12 SSA countries, Agbestiaf (2004) and Ghirmay (2004) support the demand-following hypothesis of finance and growth using 7 SSA countries and 13 SSA countries, respectively. Evidence from Odhiambo (2009) suggests that finace follows economic growth in Kenya and South Africa. Finally, Akinboade and Kinfack (2014) found eveidence to support a bi-directional relationship between finance and growth in Botswana using granger cauality analysis. Futhermore, some studies suggest different relationships at different levels of financial development for the same unit of analysis in SSA. According to Mlachila *et al.* (2016), the impact of finance on growth volatility is SSA is found to be negative and insignificant for a certain level of financial development and then beyond a certain threshold of financial development, the relationship reverses.

The above studies on SSA do not consider the specific role that finance and institutions play in productivity enhancement in the selected panel. Secondly, there's a possibility for problems of misspecification of models in the above studies owing to the fact that the possible presence of structural breaks and cross-sectional dependency were not factored into designing these tests. Boamah, Loudon, and Watts (2017) attempt to address these issues in SSA by examining structural breaks in the response of equity returns to global factors when they investigating the country and industry effects in African equity returns.

They explore the proportion of the variability in country index returns that are explained by global industry and country factors. By applying the Quandt test for unknown structural breaks method and the Bai and Perron (1998) test for structural breaks and variance decomposition techniques to investigate the response, Boamah, Loudon, and Watts (2017) focused on 11 African countries between January 1996 and January 2013 within the framework of the Cobb-Douglas production function, and observed that there is a presence of significant level and regime breaks in the relation between African index returns and the global industry factor around the period of the GFC and the AFC.

At the individual country level, using an ARDL bounds testing approach and incorporating trend and slope breaks in a trended model as well as a Zivot and Andrews (1992) unit root test with breaks, Adu, Marbuah and Tei Mensah (2013) found that, with or without structural breaks, whether financial development is good or bad for growth depends on the indicator used to proxy for financial development. Uddin, Sjö and Shahbaz (2013) however found a relationship between finance and growth in Ghana using a level break in an ARDL bounds testing approach over the period of 1971 to 2011. These studies highlight the need for structural breaks in studies situated in SSA.

The need to apportion possible reasons for these mixed results in SSA led many economists to focus on the institutional framework of SSA and how it contributes to the growth process of the region. These mixed results, according to Mlachila *et al.* (2016), reflect the low levels and insufficiency of SSA's institutional framework. Indeed, the absence of quality institutions may have impeded progress in many macroeconomic phenomena. Hence, in line with the proponents of the need for good quality institutions, it is important that the required level of legal, regulatory, policy, contract enforcement, property rights and other institutional quality frameworks are available in SSA to fully reap the gains from deeper levels of financial systems. Does SSA have the needed adequacy level of institutions for the significant benefits expected from them?

3.7 Studies on Institutional Quality, Financial Development and Economic Growth in Sub-Saharan Africa

A portion of the financial development growth literature has institutional quality as a driving force for growth to occur optimally. The argument is that when economic institutions are adequately working, the distribution of financial resources improves. For instance, Effiong (2015), using 21 SSA and OLS and SYS GMM in growth regressions, found that institutional quality rather propels growth whilst the interaction between finance and growth over the period 1986-2010 does not.

To the extent that there is a better institutional framework such as the protection of property and creditor rights; better regulatory frameworks supervision; macroeconomic stabilizing institutions; judicial enforcement; private credit to GDP ratios and access have tended to increase. Thus, the growth benefits of financial development will be realised. In their view, a relatively insufficient number of financial products, very little financial innovation, a deeply fragmented market, large interest rate spreads and a generally large informal sector reveals the existence of a relatively high level of financial underdevelopment in SSA. Effiong (2015) does not however consider the impact of structural beaks and integration on the dataset.

Acemoglu, Johnson, and Robinson (2001) researched the relationship between colonial origins and development by exploiting the differences in European mortality rates to estimate the effect of institutions on economic performance. Using multiple stage least squares regressions they observe that, by controlling for the effect of institutions, the income levels of African countries or those closer to the equator are not comparatively lower. The study, one again does not consider the role of structural breaks and other types of institutions that may have an impact of finance and growth.

Non-economic institutions are equally important for the finance-growth relationship in regions like SSA. Addison, Chowdhury and Murshed (2002) found that financial development is vulnerable to social conflict. They observed that conflict reduces the demand for domestic currency as a medium of exchange and a store of value. Conflict leads to poor quality governance, including weak regulation of the financial system, thereby undermining the sustainability of financial institutions. Conflict therefore reduces the social return to financial liberalization and other financial-sector reforms. Using data from 79 countries, they applied this to a model that integrates the effects of conflict and financial liberalization. In concluding, they found that conflict significantly reduces financial development.

Not much has been advanced in the area of social conflict and financial development this research seeks to investigate the moderating role it plays in the finance growth nexus as an institution since SSA is one region in the world that is plagued by numerous social conflicts. Does the presence of these conflicts that range from infrequent guerrilla attacks to serious tribal wars, affect the role that institutions play in the economy and perhaps contribute to high information and transaction costs, which in turn lowers productivity and hence growth? They make the assertion that the international community would need to offer more support to the prevention and resolution of conflict through better peace-keeping, broad-based reconstruction and democratization since they found evidence to support the fact that, apart from being welcomed as a humanitarian gesture, conflict-reducing measures have a positive relationship with economic development.

Sub-Saharan African countries have made substantial progress in financial development over the past decade, but there is still considerable scope for further development, especially compared with other regions. Indeed, until a decade or so ago, the level of financial development in a large number of sub-Saharan African countries had actually regressed relative to the early 1980s. With the exception of the region's middle-income countries, both financial market depth and institutional development are lower than that of other developing regions. The Rodrik (2000) growth-promoting institutional categories, namely property rights institutions, regulatory institutions, institutions for macroeconomic stabilisation, institutions for social insurance and institutions for conflict management may present some answers for SSA to better realize gains from financial development on growth.

3.8 Financial Development, Institutional Quality and Economic Growth in Sub-Saharan Africa

In the finance-growth discussion in SSA, institutional quality has been a point of focus in studies (Acemoglu, Johnson, and Robinson, 2004; Sahay *et al.*, 2015b; Anayiotos and Toroyan, 2009). Gries and Meirrekes (2010) use data between 1984 and 2007 from nineteen SSA countries to find the relationship between institutional quality and financial development by reviewing the determinants of financial development in SSA. They argue that, although a vast number of studies have pointed to a positive relationship between financial development and economic growth, studies that concentrate on SSA do not confirm this positive relationship to a large extent. They find that SSA, as a region, is financially underdeveloped and has a relatively low level of financial openness.

More recently, Mlachila, Park, and Yabara (2013) show that weak judicial enforcement is one of the major impediments to the region's banking system development. David, Mlachila, and Moheeput (2015) show that, in contrast to other developing countries, there is a weak link between international integration and financial development in the region, and this can be explained by relatively weak institutions in the region. Indeed, in addition to the statistics from the WGIs and ICRG composite index, the 2017 Doing Business Report ranks the region's quality of judicial processes index as 6.4 on a scale of 0 to 18. Contract enforcement at ranked at 132 on a scale of 0 to 199 whilst the strength of legal rights index is 5 on a scale of 0 to 12 hence giving the region an overall institutional quality score of 47.73 on a scale of 0 to 100. It is important therefore to pay attention to strengthening the institutional framework in SSA to harness optimal benefits of deliberate growth focused financial development.

Empirical evidence shows that firms are able to access external finance in countries where legal enforcement is stronger (La Porta *et al*., 1997; Beck, Demirguc-Kunt and Maksimovic, 2005), and that better creditor protection increases credit to the private sector (Djankov, McLiesh and Shleifer, 2005). Many SSA countries however record low levels of levels contract enforcement (ICRG, 2017). The Doing Business Report in 2019 rates SSA with an overall score of 48.14 out of 100 with respect to contract enforcement. More effective legal systems allow more flexible and adaptable conflict resolution, increasing firms' access to finance. In countries where the legal system is more effective, financial systems have lower interest rate spreads and are more efficient (Laeven and Majnoni, 2005). Indeed, due to low levels of property rights and contracts enforcement in many SSA countries, the financial systems often face challenges that produce friction and higher transaction costs hence causing a reduction in productivity.

Political stability and democracy ensure that efforts made to improve financial systems are positively impacting growth in terms of democracy, well-functioning macroeconomic policies on the part of government ensure better efficiency (Bencivenga and Smith, 1992; Huybens and Smith, 1999; Roubini and Sala-i-Martin, 1995). SSA's financial sector institutions need sound political institutions and independent central banks to achieve efficient financial development (Garriga, 2016). It is vital for SSA governments to allow these institutions to function adequately.

In economies where corruption, fraud and other anti-competitive behaviour generally goes unpunished or unsanctioned (as happens in many SSA countries), such regulatory institutions would be very few- and where they are present, they are not able to enforce fairness and equity in the financial system. Institutions for conflict management and social insurance need to be strengthened as these tend to impact the financial system. Addison, Chowdhury and Murshed (2002) observe that financial development is vulnerable to social conflict. Rajan (2006) observes that, at the household level, giving each individual a national identification number and creating credit registries where lenders share information about their clients' repayment records would help since all borrowers could then borrow using their future access to credit as collateral. SSA has the low levels of such institutions.

3.9 Financial development, Institutional Quality and Growth- Studies on the role of Alternative Production Functions- The CES and the VES

With respect to the finance-growth literature, a few partly related studies include Alfaro *et al.* (2010) who develop a theoretical framework with CES production technology among others. This CES framework formalizes a mechanism through which FDI may lead to a higher growth rate in the host country via backward linkages. Alfaro *et al*.'s (2010) framework rests on a mechanism that ensures efficiency through emphasising the role of local financial markets in enabling FDI to promote growth through the creation of backward linkages. Agénor and Canuto (2017) observed interactions between access to finance, product innovation, and labour supply, and concluded that, when innovators are backed by a policy that is aimed at continuously reducing constraints on access to finance, it may have the effect of promoting the production of ideas and improving incentives to invest in skills and hence propel growth.

Aghion, Bacchetta and Banerjee (2001) developed a framework for analysing the role of financial factors as a source of instability in small, open economies to examine the effects of financial liberalization on the stability of the macro economy in the CES framework among others. They detected that economies at the intermediate level of financial development may rather have destabilizing effects, inducing continuous phases of growth with capital inflows followed by collapse with capital flight. Hybuns and Smith (1999) presented a monetary growth CES model in which banks and secondary capital markets play a crucial allocative function.

With respect to the CES specification and institutional quality, the majority of research is based on international trade and agricultural production, which by and large seem to confirm the significance of institutional quality. An example is Álvarez, Barbero, Rodríguez-Pose, and Zofío (2018) who use a gravity framework based on constraints within a CES utility setting, and their framework assesses the role of institutions for trade, controlling for geographical distance, cultural proximity, regional trade agreements, and accounting for model economic determinants related to labour cost competitiveness in origin (involving productivity and wages), trade costs, sectoral prices, and income shares at destination.

The results from 186 countries over the period of 1996 to 2012 confirm the significance of institutional quality to trade (Macchiavello, 2009; Grossman and Helpman, 1991). These studies confirm the fact that the finance growth relationship is significant in the context of other production technologies, which may provide findings relevant for forecasting and policy making. However, there's a gap with respect to the role of institutions in finance via efficiency enhancement in the CES and VES framework

3.10 Research Gaps and Summary of the Literature

Following a thorough review of the existing literature, there's ample evidence that SSA has not fully exploited the possible productivity gains from growth-promoting institutions such as that proposed in Rodrik (2000) as their governments make continuous efforts towards effective financial development. Although the role of institutional quality in the finance-growth relationship is not a subject without debate (Tamayo and Fernandez, 2015; Huang, 2010), the evidence leans heavily towards a significant one (Murinde, 2012; Rodrik, Subramanian and Trebbi, 2002; Levine and Beck, 2004; Milo, 2007; Mohamed, Siadi and Zakaria, 2012; Law, Azman-Saini and Ibrahim, 2013; Demetriades and Law, 2006; Balach and Law, 2015). Institutional quality has been identified as a growth and efficiency-promoting source of overall economic growth (Williamson, 2000; Glylfason, 2004; Hovenkamp and Coase, 2011; Ugur, 2014; Berhane, 2018; Bass, 2019; Houkonou *et al.*, 2012; Rodrik, 2000;2002; North, 1991; Boettke and Coyne, 2009).

This efficiency-promoting feature of institutions is mainly through (a) broadening the reach of economic analysis beyond traditional markets and are able to capture a more complete set of mechanisms by which resources are moved from one place to another (Hovenkamp and Coase, 2011; Williamson, 2000), (b) ensuring that information and transaction costs associated with economic transactions are reduced by reducing information asymmetry and adverse selection (Tamayo and Fernandez, 2015; Coase, 1936; 1984; North, 1990; 1991; 1995; Grief, 1989; North and Weingast, 1989) and (c) mediating particular economic relationships such as business firms and contractual agreements by serving as governance structures (Williamson, 1987; 1996; North, 1995). By so doing, institutions ensure predictability and stability are facilitated through higher symmetries in information.

In line with the theory of convergence (Solow, 1956; 1957), SSA has been largely identified as the region with considerable growth potential (Ssozi and Asongu, 2016; IMF, 2013; World Bank, 2019; Jones, 2002). However, available statistics and evidence suggest that SSA is consistently at the bottom of the growth and financial development pyramid (see WDIs; WGIs). Indeed, the SSA region has experienced some the slowest economic growth rates compared to other regions in the world, with high poverty levels. Hence, an investigation into what may or may not work with respect to economic growth in the sub-region is imperative. Given the importance of institutions to the growth process, applying Rodrik's (2000) institutions for high quality growth on SSA will contribute to determining the institutions that work within the SSA context since previous studies have emphasized other institutions such as rule of law, political stability and corruption. Indeed, the public and private institutional frameworks of many African countries are inadequate, weak and porous (ICRG, 2017; WGI, 2017; Rodrik, Subramanian and Trebbi, 2002; Mensah, Bokpin, and Boachie-Yiadom, 2018).

In addition, although evidence from global cross-country studies is important, the dearth and lack of strength of both macroeconomic and institutional data for many developing countries has made it difficult to make robust policy interpretations on SSA countries and regions (Aron, 2000; Effiong, 2015). Again, the uneven levels of financial development and institutional quality in the world necessitates the use of a sample of countries from a geographic region with some similarities in terms of geographic and economic characteristics due to the formation of regional and sub-regional integrated bodies (Huang, 2010; Demetriades & Law, 2006). The literature reviewed so far points to the fact that the institutions proposed by Rodrik (2000) have not been tested in countries from SSA. The decomposition of TFP for this study clearly delineates the actual contribution of institutional quality and financial development to higher efficiency. Testing these measures and their impact on SSA's production functions through total factor productivity is therefore essential.

Furthermore, the literature on the finance-institution-growth relationship in SSA is even more scanty (Mlachila *et al.*, 2016; Addison, Chowhury and Murshed, 2002). This is especially evident when such studies incorporate individual and multiple structural breaks (Boamah, Loudon and Watts, 2017; Adu, Marbuah and Tei-Mensah, 2013). Africa and by extension SSA, is one of the regions that has witnessed many political, economic and sociocultural events that have seemingly affected the trajectory of the sub-region's growth (www.worldbank.org). As stated previously, at the sub-regional level, the 2007/2008 global financial crisis did not spare the region of its effects. The Structural Adjustment Programs instituted by the World Bank in the 1990s and early 2000s as well as the Ebola crisis in West Africa from 2013 to 2016 are events that have the potential to change the structure of the economy. At the individual country level, Liberia, Mali, Sudan, Congo and Niger have all not been spared their share of political, civil and tribal conflicts and very serious natural disasters among other such events (Addison, Chowdhury and Murshed, 2002; Boamah, Loudon and Watts, 2017)

Consequently, the need for structural breaks in SSA studies cannot be overemphasized since many structure changing events occur in the region. These events, when captured in estimations, depict a relatively more realistic situation for finance and growth, and mitigate the probability of model misspecification errors and incorrect forecasting and policy formulation (Hatemi-J, 2008; Gregory and Hansen, 1996; Im, Lee and Tieslau, 2005 and 2010; Narayam and Symth, 2010; Westerlund, 2006a; Banerjee and Carrion-i-Silvestre, 2015; Lee and Strazicich). Presently, the evidence available suggests that this is the first study that has attempted to test the relationships and interactions between financial development, economic growth and the specific mix of Rodrik's (2000) institutions whilst incorporating the effect of structural breaks.

Finally, a careful study of the literature shows the lack of usage of multiple forms of the production function in SSA and indeed beyond SSA studies within the finance-institutions-growth context. Indeed, most of the existing studies have been premised on the Cobb-Douglas production function (Law, Azman-Saini and Ibrahim, 2013; Balach and Law; 2015; Demetriades and Law, 2006; Levine and Zervos, 1998; Filippidis and Katrakilidis, 2015; Gerchet et al., 2019; Arizalla, Cavallo and Gallindo, 2013). As simple as the Cobb-Douglas production function is, it is important to note that it is based on certain assumptions. These assumptions, which include constant returns to scale, unitary elasticity of substitution and homogeneity of a single degree among others, have been criticised rather heavily in the literature (Aryes *et al*., 2014; Biddle, 2012; Evans, Green, and Murinde, 2000; Østbye, 2010; Minhas and Solow, 1961; Kmenta, 1967; Barro, Mankiw and Salai-i-Martin, 1992).

A variation in any of the underlying assumptions of the Cobb-Douglas production function therefore may provide other insights into, and make room for testing the model under seemingly more realistic conditions. Although a few studies on the finance-growth relationship have applied the use of the Translog (Evans, Green, and Murinde, 2000; Østbye, 2010) and the CES production functions (Ageno and Canuto, 2017; Aghion, Baccetta and Banerjee, 2005; Hybuns and Smith, 1999), employing the Cobb-Douglas, CES and VES production specification in the finance-growth study in the presence of structural breaks within the SSA framework is important since two alternative forms address some of the concerns raised about the Cobb-Douglas form.

Comparing the outcomes of the Cobb-Douglas, CES and VES production functions provides theoretical and empirical insights into to the importance of the elasticity of substitution for economic growth models in SSA. It is against this background that this section is dedicated to testing the financial development-institutional quality-economic growth relationship using the Constant Elasticity of Substitution and Variable Elasticity of Substitution production specifications. The Constant Elasticity of Substitution (CES) and the Variable Elasticity of Substitution (VES) production functions are explored as tools to check the robustness of the claims being made in this research.

3.11 Research Questions

Four research questions are derived in accordance with the research gaps identified above. Firstly, what effect do market and non-market institutions have on productivity when combined with financial development? To address this question, institutional variables are incorporated as an important contributory factor to economic growth. Specifically, the institutions proposed by Rodrik (2000) to induce high-quality growth are extended by including democracy and creating an index of institutional quality, which is interacted with financial development to form Institutional Quality Linked Efficiency Gain. Thus, productivity levels and efficiency gains associated with Institutional Quality Linked Efficiency Gain for an economy can be generated.

Secondly, does the role of institutional quality in enhancing financial development to promote growth in SSA based on its uniqueness and relatively low level of economic development differ from other regions? To address this question, a panel of 21 SSA countries, which has not been previously applied in such a context, is selected. In addition, individual countries are tested to complement the results from the panel and highlight unique features of these economies within the finance-institutions-growth framework. Furthermore, both time series and panel cointegration techniques including Engle and Granger (1987), Johansen (1991;1995) and Pedroni (1999; 2004) cointegration estimations are employed.

The third research question is that to what extent do historical and future events in the form of single and multiple structural breaks impact the role of institutional quality linked efficiency gain and productivity in the panel and selected individual SSA countries? Hence, multiple structural breaks are accounted for in the analysis. In particular, a range of both time series and panel cointegration analysis that are capable of identifying endogenous structural breaks are employed. These methods include the Gregory and Hansen (1996) and the Hatemi-J (2008) cointegration tests with structural breaks for the time series estimations and the Westerlund (2007a) and Banerjee and Carrion-i-Silvestre (2015) cointegration tests with multiple structural breaks for the panel.

The final research question is: what are the similarities and differences in the role played by IQLEG on productivity in the panel of SSA within the Cobb-Douglas, CES and VES production frameworks? Comparing the efficiency levels generated within the Cobb-Douglas, CES and VES production framework provides the needed responses to these questions and determine the degree of robustness that the CES and VES give to the results from the Cobb-Douglas case. In the CES and VES production specifications, non-linear least squares estimators are employed to estimate the relationship between financial development, institutional quality and economic growth in the 21 SSA countries with and without structural breaks.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Introduction

The main goal of this research was to determine whether the institutional setting in SSA with respect to the five main institutions proposed by Rodrik (2000) in the presence of democracy aides the financial sector in providing services to the real sector and hence provide a link to economic growth. Based on the specific objectives outlined in Chapter One, this chapter therefore provides the analytical models that underpin this research and the steps that have been taken to achieve these objectives. Specifically, it identifies a variety of appropriate empirical models derived from investigating the relationship between financial development, institutional quality and economic growth in sub-Saharan African countries accounting for structural breaks.

This research assumes an epistemological stance where theoretical and empirical underpinnings on the finance-institutions-growth nexus are tested (Levine, 2000; Solow, 1956; 1957). Epistemology is defined as the branch of philosophy that investigates the origins, scope, nature, and limitations of knowledge (Boyd *et al*., 1991; Sosa, 2017). It can also be seen as being concerned with possibilities, nature, sources and limitations of knowledge in the field of study. In effect, epistemology is focused on what is known to be true. Within the finance-growth framework, there's evidence or existing knowledge that there's a relationship between financial development and economic growth although the nature and direction of this relationship varies.

The fact that this relationship can be depicted through the production function via both the allocative and productivity channels of the production function is also existing knowledge sourced by making empirical and authoritarian sources the basis for the research process. The specific research philosophy adopted within the epistemological worldview of this research is positivism. This is due to the properties being applied here such as the explanatory, cause and effect approach used, the application of secondary observed and measured quantitative data, and the use of statistical applications to test extensions to existing theories (Dudovskiy, 2018; Saunders, Lewis and Thornhill, 2012)

The research is embedded in the framework of the Solow (1956, 1957) neoclassical growth model as presented by Barro and Salai-i-Martin (2004). The study extends the methodology of You and Sarantis (2013) by decomposing TFP into pure technical progress (NFP) and institutional quality linked efficiency gain (IQLEG) in depicting how the presence and quality of institutions contribute to an increase in efficiency levels and hence to increasing productivity and growth over and above productivity gains from pure technical progress. By generating efficiency levels attributable to IQLEG and NFP within the Cobb-Douglas, CES and VES production functions, the claim of additional efficiency gains linked to IQLEG is investigated. The rationale for setting the study in the Solow (1956) growth framework is that it is the modern reference point of all growth studies (Demetriades and Law, 2006; Law and Balach, 2015). The scope of the research is a group of sub-Saharan African countries and involves the 21 (out of 49) countries that are listed on the website of the World Bank due to data availability.

To estimate the models, panel data estimation techniques, which allow for both cross-section and time series variations in all variables, are adopted. The advantages of using panel data are that it adds more power to the test and is able to capture both group and individual effects. It is typically more efficient, has more variability and tends to generate more information that time series or cross-sectional data. The advantage of applying time series techniques is that the uniqueness of each country is made evident. Unsystematic information peculiar to each country is thus generated for decision making (Wooldridge, 2016).

A plethora of econometric techniques and tests have been employed in finance-growth studies at both the theoretical and empirical levels (Levine, 2005; Murinde, 2012; Tamayo and Fenandez, 2015; Bist, 2018). Huang (2005) employs Bayesian Model Averaging and General to- specific approaches are jointly applied in studying the determinants of cross-country differences in financial development in 64 countries. Levine and Zervos (1998) applied cross-country regressions on 47 countries to determine whether measures of stock market liquidity, size, volatility, and integration with world capital markets robustly correlated with current and future rates of economic growth, capital accumulation, productivity improvements, and saving rates (See also Arizalla, Cavallo and Gallindo, 2013; Bordo and Raussaeu, 2006)

Beck, Levine and Loaza (2000) in a bid to understand cross –country cross-country differences in both the level and growth rate of total factor productivity, examines whether the level of banking sector development exerts a causal impact on real per capita GDP growth, capital per capita growth, productivity per capita growth and private saving rates. They apply Arellano and Bover (1995) and Blundell and Bond (1997) GMM. Many more studies have applied various GMM specifications in determining the relationship between finance, growth and institutions. Huang (2010), tests the effect of political institutional improvement on financial development by applying a System GMM estimator and a LSDV estimator in a panel of 90 developed and developing countries from 1960–1999. Filippidis and Katrakilidis (2015) studied 52 developing economies, 16 of which were from SSA with data from 1985 to 2008 (See also Greene, 2008; Rioja and Valev, 2003). The advantages associated with applying the above include the fact that they are dynamic panel techniques that mitigate the known problems of heterogeneity and endogeneity of the traditional techniques and study the dynamics of adjustment (Baltagi, 2009).

However, it is important to note that although the above cross-country regressions and dynamic models tend to ignore the integration properties of these series (Bist, 2018; Christopoulos and Tsionas, 2004). The importance or advantage of applying both integration and dynamic models in such macroeconomic analysis is that integration properties that tend to depict structural long run equilibrium properties in the relationship between variables. The use panel and time series cointegration techniques along with dynamic panel and time series long-run estimations ensures that all properties of the series are adequately accounted for in modelling possible relationships (Gries, Kraft and Meirrieks, 2008; Menyah, Nazliogu and Wolde-Rufael, 2014; Deluvaite and Sineiviciene, 2014). In this study, both integrated and dynamic properties are explored with the econometric tools applied.

Two categories of panel cointegration estimators are used to determine possible long-run associations to determine the relationship between finance, growth, capital and institutional quality in the 21 SSA countries under study. The first does not involve any structural breaks whilst the second category does. With respect to the various forms of the production function, whilst estimations involving the Cobb-Douglas specification are conducted using cointegration techniques, the CES and VES specifications are estimated with panel non-linear least squares estimators due to their non-linearity and in line with You and Sarantis (2013).

It is commonly assumed that disturbances in panel data models are cross-sectionally independent, especially when the cross-section dimension (N) is large. There is, however, considerable evidence that cross-sectional dependence is often present in panel regression settings. Ignoring cross-sectional dependence in estimation can have serious consequences, with unaccounted for residual dependence resulting in estimator efficiency loss, bias and invalid test statistics (Westerlund, 2006a; Banerjee and Carrion-i-Silvestre, 2015; Banerjee and Carrion-i-Silvestre, 2017; Pesaran, 2007) emphasize the importance of accounting for cross-sectional dependency in panel studies. Four different cross-sectional dependency tests are performed in this study along with unit root and cointegration tests that incorporate and account for cross-sectional dependency. These tests are discussed later in this Chapter.

Studies have shown that the effect of structural breaks cannot be ignored when studying data over time. When breaks are ignored in tests, we lose power (Lee and Stratizicich, 2001; Im, Lee and Tieslau, 2005; 2010; Carrion-i-Silvestre, del Barrio-Castro and López-Bazo, 2005). Indeed, Perron (1989; 1994) among others, point out the need to include structural breaks in unit root tests to avoid the risk of misspecification in the trend function. This may lead to a bias in the standard unit root tests, which may tend to render a series non-stationary, although the series may actually be stationary.

Tests may be inconsistent when structural breaks are ignored (Lee, Huang and Shin, 1997). Furthermore, Lee and Strazicich (2001) established that not allowing for breaks under the null can lead to serious size distortions and spurious rejections under the null. With respect to cointegration tests, the advantages of structural breaks in tests are that, unlike the conventional tests, they have more power and allow users to consider the possibility of cointegrating when the cointegrating model has shifted once or more at an unknown point. It is therefore imperative that, for this study, the effects of structural breaks are considered in reaching conclusions (Westerlund, 2006a; Gregory and Hansen, 1996).

4.2 Data

4.2.1 An Overview of the Data

A panel of observations for these 21 countries makes up the data set for the period 1985-2015. Extending Demetriades and Law (2006), annual data on real GDP per capita, capital stock, the cumulative institutional quality index created from Rodrik's (2000) set of institutions and sourced from the International Country Risk Guide and the World Governance Indicators (WGI) and an index of financial development constructed from Principal Component Analysis (PCA) are used. The financial development index constructed included the liquid liabilities, private sector credit, M2 and domestic credit from the banking sector, all expressed as ratios to GDP collected from the World Development Indicators (WDI).

The financial development index created followed and extended Menyah, Nazlioglu, and Wolde-Rufael (2014). The capital stock measure was obtained from the Penn World tables 9.0 (PWT 9.0). However, the time frame for this data set is from 1985 to 2015 due to the availability of data. The 21 countries used in the research are Togo, Burkina Faso, Cote d'Ivoire, Ghana, Sierra Leone, Senegal, Nigeria, Mali, Niger, Kenya, Sudan, Uganda, United Republic Tanzania, Gabon, Congo Republic, Botswana, Mozambique, Zambia, Zimbabwe, South Africa, Malawi and Madagascar. Although the choice of the 21 countries is due to data availability, it is interesting to know that they come from the west, eastern, central and southern parts of SSA. This is an advantage to the research in terms of the representativeness of the sample.

4.2.2 Variable Measurement

Economic Growth

Economic growth is the dependent variable and the measure used is Gross Domestic Product per capita (GDPPC). It is measured as gross domestic product (GDP) divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2010 U.S. dollars. It is aggregated using a weighted average method and was sourced from the WDI (2018). It is expected that GDP will have a positive relationship with all the independent variables, namely financial development, institutional quality and capital.

Capital Stock

Built up from investment data by asset, this factor of production is made up of estimated information for four assets: structures (including residential and non-residential); machinery (including computers, communication equipment and other machinery); transport equipment; and other assets (including software, other intellectual property products, and cultivated assets). The capital detail file includes information on investment at current national prices (the Ic variables), the investment deflator (Ip), the current-cost net capital stock (Kc), the capital stock deflator (Kp) and capital consumption at current prices (Dc).

The relationship is given as: Investment at constant national prices for asset a: $I_{at} = Ic_{at}/Ip_{at}$ Capital stock at constant national prices for asset a: $K_{at} = (1 - \delta_{at}at)K_{at-1} + I_{at}$ Current-cost net capital stock: $Kc_{at} = Kp_{at} \times K_{at}$ Depreciation rate of asset: $\delta_{at}at = Dc_{at}/Kc_{at}$. Theoretically, the capital stock is expected to have a positive relationship with GDPPC and is sourced from the PWT 9.0.

Financial Development

A composite indicator of financial development is constructed in order to capture both the reach (size) and depth of financial sector development in SSA (See Gries, Kraft and Meierrieks, 2009; Menyah, Nazlioglu, and Wolde-Rufael, 2014; Huang, 2010). Indeed, there are various proxies for financial sector development making it a very highly multidimensional indicator. In order to capture these, Gries, Kraft and Meierrieks (2009) used Principal Component Analysis (PCA) to construct a measure for financial development. Huang (2010) and Menyah, Nazlioglu, and Wolde-Rufael (2014) do the same to construct a suitable measure for financial sector development. Principal Component Analysis (PCA) is commonly employed to reduce data sets to lower dimensions while retaining as much information of the original sets as possible (Kumbhakar and Mavrotas, 2005; Ang and McKibbin, 2007).

The use of PCA tends to mitigate the adverse effects of the multidimensional nature of financial sector development measures and proxies. These different measures usually have close interrelations between them resulting in higher correlations among them. These can cause or lead to some redundancy of information and may result in incidences of multicollinearity, which can lead to misleading inferences and conclusions (Huang, 2010; Menyah, Nazlioglu, and Wolde-Rufael, 2014). Huang (2010) and Gries, Kraft and

Meierrieks (2009) use PCA to construct an aggregate measure of financial development. Focusing on data from financial intermediary development, they construct a measure that is based on three widely used indicators of financial intermediary development.

In this thesis, the measure constructed is based on four widely used indicators of financial development (Menyah, Nazlioglu, and Wolde-Rufael, 2014). These are liquid liabilities calculated as the liquid liabilities of banks; and non-bank financial intermediaries (currency plus demand and interest-bearing liabilities) as a ratio of GDP. Liquid liabilities are also known as broad money, or M3. They are the sum of currency and deposits in the central bank (M0), plus transferable deposits and electronic currency (M1), plus time and savings deposits, foreign currency transferable deposits, certificates of deposit, and securities repurchase agreements (M2), plus travellers' cheques, foreign currency time deposits, commercial paper, and shares of mutual funds or market funds held by residents. It measures the size, relative to the economy, of financial intermediaries including three types of financial institutions: the central bank, deposit money banks, and other financial institutions.

The second is private credit defined as the credit issued to the private sector by banks and other financial intermediaries divided by GDP, excluding the credit issued to government, government agencies, and public enterprises, as well as the credit issued by the monetary authority and development banks. This captures general financial intermediary activities provided to the private sector. Private credit by deposit money banks and other financial institutions to GDP is a common measure of financial development and is an indicator of financial depth and access.

The third is Commercial-Central Bank, which measures the ratio of commercial bank assets over the sum of commercial bank and central bank assets. It can be defined as deposit money bank assets to deposit money bank assets and central bank assets (%). It is the total assets held by deposit money banks as a share of sum of the deposit money bank and Central Bank claims on the domestic non-financial real sector. Assets include claims on the domestic real non-financial sector, which includes central, state and local governments, non-financial public enterprises and the private sector. Deposit money banks comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits. It proxies the advantages of financial intermediaries in channelling savings to investment, monitoring firms, exerting corporate governance, and undertaking risk management relative to the central bank.

The fourth, which is applied in Menyah, Nazlioglu, and Wolde-Rufael (2014), is M2 to GDP. Broad money is the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveller's cheques; and other securities such as certificates of deposit and commercial paper. All the indicators for financial development are weighted averages.

The first principal component is adopted for the measure of financial sector development (FD)[16]. The data for these indicators was obtained from the World Bank, Global Financial Development Database (2016). As already stated, the banking sector dominates the financial sector in SSA and hence these indicators are expected to sufficiently reflect the

[16] Based on the eigenvalues, the first principal component was broad money. Broad money dominated the first component which exhibited 99.7% of the initial variance. The first component thus possessed 99.7% of fitting characteristics and provided a significant amount of information on financial development. The Kaiser-Meyer-Olk (KMO) measure of sampling adequacy was 1.000 for each variable and 1.000 for the complete model.

developments and characteristics of the financial sector of SSA countries. This constructed index is termed FD and is expected to have a positive relationship with GDPPC.

Institutional Quality Measures

Property Rights Institutions are legal frameworks aimed at reducing the consequence of asymmetric information (adverse selection and moral hazard) and asymmetric bargaining power with respect to minority versus majority controlling shareholders, monopoly versus consumers (Fernandez and Tamayo, 2015). The aggregate measure for Law and Order from the 2017 version of the International Country Risk Guide (ICRG) is used to measure the strength of property rights institutions. Although the law and order indicator is a single component, its two elements are assessed separately, with each element being scored from zero to six points with six being the best score. To assess the “Law” element, the strength and impartiality of the legal system are considered, while the “Order” element is an assessment of popular observance of the law.

Regulatory Institutions are those that regulate the conduct in goods, services, labour, assets, and financial markets (WGI, 2018). The institutional strength and quality of the bureaucracy is another shock absorber that tends to minimize revisions of policy when governments change. Therefore, high points are given to countries where the bureaucracy has the strength and expertise to govern without drastic changes in policy or interruptions in government services. In these low-risk countries, the bureaucracy tends to be somewhat autonomous from political pressure and to have an established mechanism for recruitment and training. Countries that lack the cushioning effect of a strong bureaucracy receive low points because a change in government tends to be traumatic in terms of policy formulation and day-to-day administrative functions. Sourced from the ICRG, it is measured between 0 and 4 and is weighted.

Institutions for Macroeconomic Stabilisation are the fiscal and monetary institutions that perform stabilizing functions; monetary policy through the resulting level and predictability of inflation; and fiscal policy through the reduction of public deficit (Rodrik, 2000; Fernandez and Tamayo, 2015). It is measured by the budget balance as a percentage of GDP. The estimated central government budget balance (including grants) for a given year in the national currency is expressed as a percentage of the estimated GDP for that year in the national currency. The risk points are then assigned as 10 from 4% plus to 0 when the balance as a percentage of GDP is -30 and below. It is sourced from the ICGR (2017) and is calculated as a weighted average

Institutions for Social Insurance are defined as comprising of programs that reduce the adverse effect and impact of economic shocks on individuals and families (Rodrik, 2000; World Bank, 2016). Social insurance programs are as a result of institutions set up to establish and coordinate publicly provided or mandated insurance schemes against old age, disability, death of the main household provider, maternity leave and sickness cash benefits, and social-health insurance. Beneficiaries of these benefits and services are those who have usually made contributions to an insurance scheme since these programs are contributory.

The Atlas of Social Protection - Indicators of Resilience and Equity (ASPIRE): performance indicators from the World Bank's data base will provide the indicators for this measure. The research adopts the public spending on all social assistance programs (PSOSAP) as the most appropriate measure or indicator of the extent and strength of institutions for social insurance. Here it is not just the social insurance indicators that are being examined but an extension is made to include all social assistance programs (SIAP), which includes social insurance (World Bank, 2016). In view of the fact that all social assistance programs were included, it was more appropriate to create a dummy variable to represent social insurance such that, during the period under review, if any of these economies undertook any such program, it was represented by 1 and zero otherwise.

Institutions for Conflict Management are those that reduce social conflict, which is harmful since it leads to misallocation of resources by diverting resources from economically productive activities and breeding uncertainty, which ends up discouraging productive activities. Political Stability and Absence of Violence/Terrorism, which is assigned values between 0 (weak) to 4 (strong) is an assessment of political violence in the country and its actual or potential impact on governance.

The highest rating is given to those countries where there is no armed or civil opposition to the government and the government does not indulge in arbitrary violence, direct or indirect, against its own people. The lowest rating is given to a country embroiled in an on-going civil war. The risk rating assigned is the sum of three subcomponents, each with a maximum score of four points and a minimum score of 0 points. A score of 4 points equates to very low risk and a score of 0 points to very high risk. It is sourced from the ICRG (2017).

As democracy is deemed the base institution upon which these five institutions propel high-quality growth, democracy is included as one of the institutional quality variables asserted by Rodrik to induce high quality growth. To measure the quality of democracy in these countries, data on Democratic accountability, which is a measure of democracy and civil liberty valued between 0 (weak) to 6 (strong) is used. This is a measure of how responsive government is to its people on the basis that the less responsive it is, the more likely it is that the government will fall, peacefully in a democratic society, but possibly violently in a non-democratic one.

The points in this component are awarded on the basis of the type of governance enjoyed by the country in question. The highest number of risk points (lowest risk) is assigned to Alternating Democracies, while the lowest number of risk points (highest risk) is assigned to Autarchies. To obtain the measure of institutional quality (INS), all six measures are rescaled and added to establish uniformity in the index created. Table 4.1 provides a summary of all the variables discussed and used in the econometric estimations.

Table 4.1: Indexes Created and Measures used in Econometric Analysis

Measure /Symbol	**Name /Identity**	**Source**	**Description**
GDPPC	Per Capita GDP	WDI (2017)	Gross domestic product divided by midyear population
FD	Financial Development	WDI/AUTHOR	This is the created measure of financial development obtained from PCA
INS	Institutional Quality	ICRG (2017) AUTHOR	This is created measure of institutional quality obtained by adding all five institutional quality variables and democracy
IQLEG	Institutional Quality Linked Efficiency Gain	AUTHOR	The interaction between the constructed index of institutional quality and the financial development index
CKPP	Capital Stock	PWT 9.0	The relative price of the capital stock is built up from investment data by asset

Note: Summary of indicators used in analysis of data. All variables were logged

4.3 Empirical Methodology

With the goal of exploring and establishing country specific relationships and associations between variables being tested, time series estimations are conducted. It is important to note that panel and time series unit root and stationarity tests with and without structural breaks were conducted to determine the suitability of cointegration among variables (in the case of panel estimations) and for each country (in the case of time series estimations). In establishing cointegration, the adjustment coefficients as well as cointegration coefficients were determined to establish both long-run and short-run causality, whilst long-run elasticities were determined. Finally, these elasticities and structural breaks were used to estimate production functions to determine the contribution of IQLEG to the growth process in all specifications of the production function under study in this thesis. Having decomposed the TFP into NFP and IQLEG, the estimation techniques are discussed below.

4.3.1 Production Functions

Upon establishing significant long-run associations among the variables under study, production functions are estimated to ascertain the contribution of IQLEG to productivity and productivity growth. The levels of NFP and TFP are determined and used to calculate the contribution of IQLEG in the Cobb-Douglas production function as well as the CES and VES functions. These estimations are conducted at both the time series and panel levels when there are no structural breaks and after structural breaks are incorporated.

To justify the main assertion being made in this research, the contribution of IQLEG to productivity and hence growth should be greater than zero. An efficiency calculation of zero for IQLEG would imply that TFP is equal to NFP, which would implicitly mean that financial development and institutional quality do not have any effect on productivity. In the same manner, a negative IQLEG efficiency will indicate a harmful effect of IQLEG on productivity. Based on the extension of the theoretical Cobb-Douglas, CES and VES production functions derived in Chapter Two, Section 2.7, where, TFP is decomposed to have both NFP and IQLEG. The corresponding empirical equations are (2.11), (2.18) and (2.23) for the Cobb-Douglas, CES and VES production functions, respectively. The efficiency level estimation techniques are highlighted in Chapter Two, Section 2.8. The next section presents a discussion of the econometric tools applied in the thesis to estimate the extended production functions.

4.3.2 Test for Cross-sectional Dependence

It is commonly assumed that disturbances in panel data models are cross-sectionally independent, especially when the cross-section dimension (N) is large. There is, however, considerable evidence that cross-sectional dependence is often present in panel regression settings. Ignoring cross-sectional dependence in estimation can have serious consequences, with unaccounted for residual dependence resulting in estimator efficiency loss and invalid test statistics. The cross-section test used for the study were Breusch-Pagan (1980) LM, Pesaran (2004) scaled LM, Baltagi, Feng, and Kao (2012) bias-corrected scaled LM and Pesaran (2004) CD. [17]The general null hypothesis of no cross-section dependence may be stated in terms of the correlations (ρ_{ij}) between the disturbances in different cross-section units: $H_0: \rho_{ij} = Corr(\mu_{it}, \mu_{jt}) = 0$ (4.1)

[17] For a complete and thorough discussion of the cross-sectional dependency tests in this thesis, refer to Breusch and Pagan (1980), Pesaran (2004) and Baltagi, Feng, and Kao (2012)

Breusch-Pagan LM

The most well-known cross-section dependence diagnostic is the Breusch-Pagan (1980) Lagrange Multiplier (LM) test statistic. In a seemingly unrelated regressions context, Breusch and Pagan show that, under the null hypothesis in Equation (4.1), a LM statistic for dependence is given by: $LM = \sum_{I=1}^{N-1} \sum_{j=i+1}^{N} T_{ij}\hat{\rho}_{ij}^2 \to X^2 \frac{N(N-1)}{2}$ (4.2)

where the $\hat{\rho}_{ij}$ are the correlation coefficients obtained from the residuals of the model as described above. The asymptotic X^2 distribution is obtained for *N* fixed as $T_{ij} \to \infty$ for all (i , j), and follows from a normality assumption on the errors.

Pesaran Scaled LM

It is well known that the standard Breusch-Pagan LM test statistic is not appropriate for testing in large *N* settings. To address this shortcoming, Pesaran (2004) proposes a standardized version of the *LM* statistic $LM_S = \sqrt{\frac{1}{N(N-1)}} \sum_{I=1}^{N-1} \sum_{j=i+1}^{N} (T_{ij}\hat{\rho}_{ij}^2 - 1) \to N(0\,,1)$ (4.3)

which is asymptotically standard normal as first $T_{ij} \to \infty$ and then $N \to \infty$. Pesaran notes one shortcoming of the scaled LM, which is that $E(T_{ij}\hat{\rho}_{ij}^2 - 1)$ is not centered at zero for finite, so that the statistic is likely to exhibit size distortion for small T_{ij}, and that the distortion will worsen for larger *N*.

Pesaran CD

To address the size distortion of LM and LM_S , Pesaran (2004) proposes an alternative statistic based on the average of the pairwise correlation coefficients $\hat{\rho}_{ij}$:

$$CD_p = \sqrt{\frac{2}{N(N-1)}} \sum_{I=1}^{N-1} \sum_{j=i+1}^{N} (T_{ij}\hat{\rho}_{ij}^2 - 1) \to N(0\,,1) \qquad (4.4)$$

which is asymptotically standard normal for $T_{ij} \to \infty$ and $N \to \infty$ in any order. k is the number of regressors. Further, Pesaran points out that, for a wide array of panel data models, the mean of CD is exactly equal to zero for all $T_{ij} > k + 1$ and all N, so that the CD test is likely to have good properties for both N and T_{ij} small, and he provides Monte Carlo evidence to support this claim

Bias Corrected Scaled LM Test

Due to incorrect centering with large N in the Pesaran CD and Breush Pagan tests, Batalgi, Fenn and Kao design a test and derive the asymptotic distribution of the LM statistic under the null as $(N, T) \to \infty$. The proposed bias corrected LM test is

$$LM_{BC} = LM_{BC} - \frac{N}{2(T-1)} \to N(0\,,1) = \sqrt{\frac{1}{N(N-1)}} \sum_{I=1}^{N-1} \sum_{j=i+1}^{N} \left(T_{ij}\hat{\rho}_{ij}^{2} - 1\right) - \frac{N}{2(T-1)} \to N(0\,,1) \qquad (4.5)$$

Given that cross-sectional dependency exists in the data, it is important that estimators and tests applied in this research accommodate and mitigate the potential unwanted effects of CSD. The tests and estimators applied therefore have such advantages built into them. With respect to the nonlinear least square regression estimations, the Driscoll and Kraay heteroscedasticity and autocorrelation consistent (HAC) robust standard errors are applied to counter the effects of CSD (Hoechle, 2007).

The Driscoll and Kraay (1998), extend the work of Newey and West (1987) by building standard errors that are heteroskedasticity and autocorrelation consistent (HAC). This means that the standard errors are robust against autocorrelation and heteroscedasticity in the data. In addition, the Driscoll and Kraay robust standard errors are able to address cross-sectional dependency in panel data (Hoechle, 2007; Vogelsang, 2011; Bilgili *et al.*, 2017). Driscoll and Kraay (1998) multiply the residuals by the independent variables use, strike their averages, the use the averaged values in a weighted HAC estimator to obtain standard errors. These standard errors have proven to be robust to cross sectional dependence for both linear and non-linear models (Hoechle, 2007). These standard errors by Driscoll and Kraay are preferable to other robust standard errors such as Huber White standard errors or Newey West standard errors.

4.3.3 Time Series Unit Root Tests without Structural Breaks

Theoretically, for cointegration to be applied in any analysis, it is required that all the variables in the cointegrating models be integrated of order one. To confirm these integral properties of gross domestic product per capita, financial development, institutional quality and capital stock gain across all 21 countries, both panel and time series unit root and stationarity tests were employed to ascertain the stationary properties of the variables under investigation. The first set of unit root tests were conducted without any structural breaks. The power of the unit root and cointegration tests improves in a panel compared to time series and cross-sectional data (Narayan and Smyth, 2008; Christopoulos and Tsionas, 2004). The unit root tests applied in this study are thus performed at both the panel and individual level. In testing for the unit root each variable per country, times series unit root used were Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests[18].

[18] See Said and Dickey (1984) and Philips and Perron (1988) for details of the ADF and PP unit root tests, respectively.

The Augmented Dickey-Fuller (ADF) Test

The standard DF test is estimated by expressing the time series variable in an $AR(1)$ as shown below:

$$y_t = \rho y_{t-1} + x_t' \delta + \epsilon_t, \qquad (4.6)$$

where x_t, are optional exogenous regressors, which may consist of constant, or a constant and trend, ρ and δ are parameters to be estimated, and the $\in_t$ are assumed to be white noise. Then after subtracting y_{t-1} from both sides of the equation, the equation becomes:

$$\Delta y_t = \alpha y_{t-1} + x_t' \delta + \epsilon_t \qquad (4.7)$$

where $\alpha = \rho - 1$. The null and alternative hypotheses may be written as, $H_0: \alpha = 0$ and $H_1: \alpha < 0$. Using the conventional t-statistic, the test statistic for α:

$t_\alpha = \hat{\alpha}/(se(\hat{\alpha}))$ (4.8)

where $\hat{\alpha}$ is the estimate of α, and se ($\hat{\alpha}$) is the coefficient standard error. where $\alpha = \rho - 1$. where $\hat{\alpha}$is the estimate of α, and se ($\hat{\alpha}$) is the coefficient standard error. Dickey and Fuller (1979) show that, under the null hypothesis of a unit root, the critical value is generated by MacKinnon (1991, 1996). However, if the series is not an AR (1) model and correlated at its lags then the Augmented Dickey-Fuller (ADF) test is preferred. The ADF correct the correlations of the series with its lags by adding p lagged difference terms of the variable y to the right-hand side of the test regression:

$$\Delta y_t = \alpha y_{t-1} + x_t'\delta + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + \cdots + \beta_p \Delta y_{t-p} + v_t \qquad (4.9)$$

The Phillips-Perron (PP) Test

Phillips-Perron (PP) unit root test is a unit roots test that control series with higher correlation when testing for a unit root. The PP test is based on the statistic:

$$t_\alpha = t_\alpha \left(\frac{\gamma_0}{f_0}\right)^{1/2} - \frac{T(f_0-\gamma_0)(se(\hat{\alpha}))}{2f_0^{1/2}s} \tag{4.10}$$

where $\hat{\alpha}$ is the estimate, and t_α the t-ratio of α, $se(\hat{\alpha})$ is coefficient standard error, and δ is the standard error of the test regression. In addition, γ_0 is a consistent estimate of the error variance calculated as $(T-k)s^2/T$, where k is the number of regressors. The remaining term, f_0, is an estimator of the residual spectrum at frequency zero.

4.3.4 Time Series Unit Root Tests with Structural Breaks

The Im, Lee and Tieslau Unit Root Test with Structural Breaks

The unit root test involving structural breaks adopted for this research is the LM unit root test by Im, Lee and Tieslau (2010) tests with both trend and level shifts (ILT, 2010) henceforth. They suggest an LM-based unit root test for panel data that allows for breaks in both the level and trend of the series under investigation. This LM unit root test is based on the univariate LM unit root test. The major advantages in adopting the ILT 2010 tests are that, firstly, the set-back from nuisance parameters are avoided as the asymptotic distribution of Lagrange Multiplier test as it is an extension of the test proposed by Amsler and Lee (1995) who showed that, due to the invariance property of LM, tests do not depend on the size or location of any level shifts and, thus, are free of nuisance parameters even when a finite number of dummy variables for level shifts are included in the LM unit root testing regression. As such, unlike the Dickey Fuller based unit root tests, it is unnecessary to simulate critical values for the test at all possible break-point locations (ILT, 2010).

Secondly, this test is above the ILT (2005) test because, apart from levels, it provides for breaks in trends. Thirdly, there is invalidity of the LM test when there are breaks in the trend for both level and regime shifts. They therefore adopt a simple transformation approach with relevant asymptotic results in order to obtain a modified test statistic whose asymptotic distribution depends on neither the size nor the location of trend-shifts. They adopted a univariate LM-type unit root test that depends only on the number of breaks, not the size or location. Thus, although the ILT tests are valid for level shifts, their transformed panel LM unit root test offers the distinct advantage of being invariant to nuisance parameters.

Fourthly, a key feature of ILT (2010) statistics is that, since test statistics do not depend on the location of breaks, there is no need for mean and variance values for different locations of breaks. Finally, to control for cross-correlations, ILT (2010) adopt the method suggested by Choi (2006) who generalized the de-meaning procedure and proposed a two-way error components model as a means of controlling for cross-correlations in the panel, although it might be too restrictive for the case of heterogeneous panels. In conducting the test, the dataset is first logged.

Additionally, the need to use ILT (2010) is that it makes use of properties from tests such as Amsler and Lee (1995) and Schmidt and Philips (1992), which are commonly suited for unit root tests involving structural breaks. The unit root test results allow us to decide if some countries need to be dropped in the time series tests as theoretically, cointegration cannot be used if some countries have series that are not integrated of some order. The LM unit root test statistic is defined by:

$$\tilde{\tau} = t - statistic\ for\ the\ null\ hypothesis\ \phi = 0 \qquad (4.11)$$

To correct from serially correlated and heterogeneously distributed innovations, we include the terms $\Delta\tilde{S}_{t-j}, j = 1, \dots, k$ to correct for serial correlation in the usual augmented type tests:

$$\Delta y_t = \delta_i' \Delta Z_t + \phi\tilde{S}_{t-1} + \sum_{j=1}^{k} d_j\ \Delta\tilde{S}_{t-j} + e_i, \quad i = 1, \dots N \qquad (4.12)$$

The test statistic is given by

$$\bar{t} = \frac{1}{N}\sum_{i=1}^{N} \tilde{\tau}_i^* \qquad (4.13)$$

Where $\tau^* = -\frac{1}{2}{}_{j-1}^{R+1}[\int_0^1 V_i(r)^2 dr]^{\frac{-1}{2}}$

Note that $V_i(r)$ is defined as the weak limit of partial sum residual process $\tilde{S}_t$ in the model.

The Lee and Strazicich Unit Root Test with a Level Break

The Lee and Strazicich (2004) unit root test is applied in this research. The data generating process (DGP) based on the unobserved components model is given by:

$$y_t = \delta' Z_t + X_t \,, \quad X_t = \beta X_{t-1} + \varepsilon_t \tag{4.14}$$

where Z_t contains exogenous variables, X_t is the variable of interest ($lnGDPPC$, $lnINS, lnFD \text{ and } lnCKPP$) . The unit root null hypothesis is described by $\beta = 1$. If $Z_t = [1, t]'$, then the DGP is the same as that shown in the no break LM unit root test of Schmidt and Phillips (SP, 1992).

The unit root null hypothesis is described by $\emptyset = 0$ and the LM t-test statistic is given by:

$\tilde{t}$= *t*-statistic testing the null hypothesis $\emptyset = 0$.

To correct for autocorrelated errors, augmented terms $\Delta\tilde{S}_{t-j}, j = 1, \dots, k$ are included as in the standard ADF test. Ng and Perron (1995) suggest utilizing a general to specific procedure to determine the optimal number of k augmented terms. The location of the break (TB) is determined by searching all possible break points for the minimum (i.e., the most negative) unit root test t-test statistic as follows:

$$Inf\ \tilde{\tau}(\tilde{\lambda}) = Inf_{\lambda}\tilde{\tau}(\lambda), \quad \text{where } \lambda = T_B/T \tag{4.15}$$

4.3.5 Panel Unit Root Tests without Structural Breaks

The panel test combines all 21 cross-sections over the thirty-one-year period in order to take advantage of increased power for the test. These include commonly used Levin, Lin and Chu (LLC) t* (2002) test, Im, Pesaran and Shin (IPS) W-stat (2003) test, ADF - Fisher Chi-square (1999) test, Philips Peron (PP) - Fisher Chi-square (1987) test and the Breitung t-Test (2000). While the LLC (2002) and Breitung (2000) tests have a null of unit root and assume common unit root processes, the IPS (2003), ADF (1999) and PP (1999) tests have a null of unit root and assume individual unit root processes. The tests are run for each variable across all 21 countries. The LLC (2002) test, although designed to address the issue of cross-sectional dependence and heteroscedasticity, has the limitation of being restrictive in its hypothesis: a limitation that the IPS (2003) test claims to have improved upon by being viewed as a more generalized test and is argued to be a more powerful test than the LLC (2000) test.

Although both the IPS (2003) test and the LLC (2000) test have identical null hypotheses, each has its own alternative hypothesis. The LLC (2000) tests are based on pooled regressions, which are based on homogeneity of the autoregressive parameter (although there is heterogeneity in the error variances and the serial correlation structure of the errors). Data is not pooled in the IPS (2003) test, which is an asymptotic test, and is a combination of different independent tests rather based on heterogeneity of the autoregressive parameter. Unlike the Fisher tests, the IPS (2003) tests are non-parametric. Both the Fisher (1999) and IPS (2003) tests aim at combining the significance of different independent tests.

According to Maddala and Wu (1999), the distribution of the t-bar statistic involves the mean and variance of the t-statistics used. IPS (2003) computes this for the ADF (1999) test statistic for different values of the number of lags used and different sample sizes. However, these tables are valid only if the ADF (1999) test is used for the unit root tests. If the length of the time series for the different samples is different, there is a problem using the tables prepared by IPS (2003). The Fisher test, which is the exact test, does not have any such limitations. It can be used with any unit root test; and even if the ADF (1999) test is used, the choice of the lag length for each sample can be separately determined.

In addition, there is no restriction of the sample sizes for different samples (they can vary according to availability of the data). The asymptotic validity of the tests depends on different conditions. Whilst the IPS (2003) test's asymptotic results depend on N going to infinity, the Fisher (1999) test's asymptotic results depend on T going to infinity. It is important to note that the Fisher (1999) test is based on combining the significance levels of the different tests, and the IPS (2003) test is based on combining the test statistics. Which is better is the question. Both the Fisher (1999) test and IPS (2003) test are based on combining independent tests.

The Breitung (2000) test considers a panel version of the Augmented Dickey-Fuller (ADF) unit root test that restrict α to be identical across cross-sectional units, but allows the lag order for the first difference terms to vary across cross-sectional units. Given the model

$$y_{it} = \rho_i y_{it-1} + x_{it}\delta_i + \varepsilon_{it} \tag{4.16}$$

$$\Delta y_{it} = \alpha_i y_{it-1} + \sum_{j=1}^{\rho_i} \beta_{it} \Delta y_{it-j} + x'_{it}\delta_i + \varepsilon_{it} \qquad \text{where, } \alpha = \rho - 1$$

The null hypothesis of unit roots then becomes $H_0 : \alpha = 0$ and the alternative, $H_1 : \alpha < 1$

The panel unit root test for the null hypothesis proposed by Breitung (2000) is to reject the null for the small values of the following statistic

$$\beta_{nT} = \left(\frac{\hat{\sigma}^2}{nT^2} \sum_{i=1}^{n} \sum_{t=2}^{T-1} \left(y_{it-1}^{*} \right)^2 \right)^{-1/2} \frac{1}{\sqrt{nT}} \sum_{i=1}^{n} \sum_{t=2}^{T-1} \left(\Delta y_{it} \right)^{*} y_{it-1}^{*} \tag{4.17}$$

The subscript $i = 1, \ldots, N = n$ indexes the 21 countries while $t = 1, \ldots, T$ indexes the 31 years period (1985 to 2015) and y is the variable of interest ($lnGDPPC$, $lnINS, lnFD$ and $lnCKPP$). The difference between the Levin, Lin, and Chu (2002) test and the Breitung (2000) test is that the former requires bias correction factors to correct for cross-sectionally heterogeneous variances to allow for efficient pooled OLS estimation, while the latter achieves the same result by appropriate variable transformations.

One of the drawbacks of the Breitung (2000) and Levin, Lin, and Chu (2002) test is that it is restricted to be identical across countries under both the null and alternative hypotheses. The t-bar test proposed by Im, Pesaran, and Shin (2003) has the advantage over the Breitung (2000) test in that it does not assume that all countries converge towards the equilibrium value at the same speed under the alternative hypothesis and thus is less restrictive. There are two stages in constructing the $t - bar$ test statistic. First, calculate the average of the individual ADF t-statistics for each of the countries in the sample. Second, calculate the standardized $t - bar$ statistic according to the following formula:

$$t_{iT} = \frac{\hat{\beta}_{iT} \left(y_{i,-1}' M_{\tau} y_{i,-1} \right)^{1/2}}{\hat{\sigma}_{iT}} \tag{4.18}$$

Where $\hat{\beta}_{iT}$ is the OLS estimator of β_i and $M_{\tau} = I_T - \tau_T \left(\tau_T' \tau_T \right)^{-1} \tau_T'$ $\hat{\sigma}_{iT}^2 = \frac{\Delta y_i M_X \Delta y_i}{T - 2}$ which is the standard deviation of the error term

The subscript $i = 1, \ldots, N$ indexes the 21 countries while $t = 1, \ldots, T$ indexes the 31 years period (1985 to 2015). A potential problem with the $t - bar$ test is that when there is cross-sectional dependence in the disturbances, the test is no longer applicable. However, Im, Pesaran and Shin (2003) suggest that, in the presence of cross-sectional dependence, the data can be adjusted by demeaning and that the standardized demeaned $t - bar$ statistic converges to the standard normal in the limit. Luintel (2001) suggests that the demeaning procedure dramatically reduces cross-sectional dependence, even when the observed data are highly correlated.

4.3.6 Panel Stationarity Test with Structural Breaks

Both unit root and stationarity tests have the sole aim of establishing whether a series is stationary or not. The reversal of the null and alternative hypothesis allows all possible scenarios to be considered. Hence, stationarity test versions of unit root tests with structural breaks are conducted. These are the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) (1992) panel stationarity test by Hadri (2000) extended by Carrion-i-Silvestre, del Barrio-Castro and López-Bazo (2005b) with two level breaks in the trend function. Indeed, it is argued that, in the testing of economic problems, the null of stationarity proves to be more natural than the null of a unit root. Hence, as is typical, there has to be strong evidence against trend stationarity to conclude in favour of the non-stationarity of the panel (Bai and Ng, 2004; Carrion-i-Silvestre, Barrio-Castro and Lopez-Bazo, 2005).

The Carrion-i-Silvestre, Barrio-Castro and Lopez-Bazo (2005) test is designed as a stationarity test that takes multiple structural breaks into account. The test, which is based on the univariate KPSS test developed by Hadri (2000), is a generalization of existing proposals in the field of stationarity testing in the presence of structural breaks. However, the KPSS test has a limiting distribution that is affected by the presence of structural breaks. The Carrion-i-Silvestre, Barrio-Castro and Lopez-Bazo (2005) approach, in its generality, allows for the structural changes to shift the mean and/or the trend of the individual time series. Another advantage of this test is the fact that each individual in the panel can have a different number of breaks located at different dates. These truly allow testing individual effects in the panel.

In this test, the option of two-level breaks in the trend function is chosen. Carrion-i-Silvestre, Barrio-Castro and Lopez-Bazo (2005) allows each time series to have different numbers of breaks located at different dates. Where the estimate of the dates of the breaks computed from:

$$(T^i_{b.1},\ldots,T^i_{b.m_i}) = \arg\min_{T^i_{b.1},\ldots,T^i_{b.m_i}} SSR(T^i_{b.1},\ldots,T^i_{b.m_i}) \tag{4.19}$$

Given the null hypothesis of stationarity, the test statistic for the testing for the stationarity with the estimated break is defined as

$$Z(\hat{\lambda}) = \frac{\sqrt{N}(LM(\hat{\lambda}) - \xi)}{\bar{\varsigma}} \tag{4.20}$$

where $\xi = N^{-1}\sum_{i=1}^{N}\xi_i$ and $\bar{\varsigma}^2 = N^{-1}\sum_{i=1}^{N}\varsigma_i^2$ represent the individual means and variances of the long-run residual respectfully. $Z(\hat{\lambda})$ has a standard normal distribution.

4.3.7 Time Series Cointegration Tests without Structural Breaks

The Johansen Cointegration Test

VAR-based cointegration tests using the methodology developed in Johansen (1991, 1995) performed using a Group object or an estimated VAR object. Consider a VAR of order *p*:

$$y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + Bx_t + \epsilon_t \tag{4.21}$$

where y_t is a k-vector of non-stationary I (1) variables ($lnGDPPC$, $lnINS, lnFD\ and\ lnCKPP$), x_t is a *d*-vector of deterministic variables, and ϵ_t is a vector of innovations. We may rewrite this VAR as,

$$\Delta y_t = \Pi y_{t-1} + \sum_{t=1}^{p-1} \Gamma_i \Delta y_{t-1} + Bx_t + \epsilon_t \qquad (4.22)$$

where:

$$\Pi = \sum_{i=1}^{p} A_i - I, \qquad \Gamma_i = -\sum_{j=i+1}^{p} A_j \qquad (4.23)$$

Granger's representation theorem asserts that, if the coefficient matrix Π has reduced rank $< k$, then there exist k x r matrices α and β each with rank r such that $\Pi = \alpha\beta'$and $\beta' y_t$ is I (0). r is the number of cointegrating relations (the cointegrating rank) and each column of β is the cointegrating vector. As explained below, the elements of α are known as the adjustment parameters in the VEC model. Johansen's method is to estimate the Π matrix from an unrestricted VAR and to test whether we can reject the restrictions implied by the reduced rank of Π.

The Engle-Granger Cointegration Test

The Engle-Granger (1987) residual-based test for cointegration are simply unit root test applied to the residuals obtained from cointegrating equation. The Engle-Granger test uses a parametric, augmented Dickey-Fuller (ADF) regression of the form

$$\Delta \hat{u}_{1t} = (\rho - 1)u_{1t-1} + \sum_{j=1}^{p} \delta_j \Delta u_{1t-j} + v_t \qquad (4.24)$$

Where, u is the residuals obtained from the cointegrating equation. The number of lagged differences p should increase to infinity with the (zero-lag) sample size T but at a rate slower than $T^{1/3}$.

The Engle-Granger employed two standard ADF test statistics, one based on the t-statistic for testing the null hypothesis of nonstationarity ($\rho = 1$) and the other based directly on the normalized autocorrelation coefficient $\widetilde{\rho}-1$ and given as

$$\hat{T}=\frac{\hat{\rho}-1}{se(\hat{\rho})} \qquad (4.25)$$

$$z=\frac{T(\hat{\rho}-1)}{(1-\sum_j \hat{\delta}_j)} \qquad (4.26)$$

where $se(\hat{\rho})$ is the usual OLS estimator of the standard error of the estimated $\hat{\rho}$

$$se(\hat{\rho})=s_v(\textstyle\sum_t u_{1t-1}^2)^{-1/2} \qquad (4.27)$$

4.3.8 Time Series Cointegration Tests with Structural Breaks

Gregory and Hansen Cointegration Test with One Structural Break

To test the null hypothesis of no cointegration Gregory and Hansen (1996) used standard methods that are residual based with a candidate cointegration relation that is estimated by Ordinary Least Squares. Adopting a more realistic approach of unknown break points, Gregory and Hansen (1996) used ADF t-Test and Phillips test. The Phillips test statistics can be defined as:

$$Z_\alpha(\tau)=n(\hat{\rho}_r^*-1) \qquad (4.28)$$

$$Z_t(\tau)=\frac{(\hat{\rho}_r^*-1)}{\hat{s}_r},\ \ \hat{s}_r^2=\frac{\hat{\sigma}_r^2}{\sum_{t=1}^{n-1}\hat{e}_{t\tau}^2} \qquad (4.29)$$

Where $\hat{\rho}_r^*$, is given

$$\hat{\rho}_r^*=\frac{\sum_{t=1}^{n-1}(\hat{e}_{t\tau}\hat{e}_{tr+1\tau}-\hat{\lambda}_\tau)}{\sum_{t=1}^{n-1}\hat{e}_{t\tau}^2} \qquad (4.30)$$

The Augmented Dickey-Fuller (ADF) statistic is calculated by regressing the residuals ($\Delta\hat{e}_{t\tau}$ upon $\hat{e}_{t-1\tau}$, and $\Delta\hat{e}_{t-1\tau},\ldots,\Delta\hat{e}_{t-K\tau}$) for some suitably chosen lag truncation K . The ADF statistic is the t-statistic for the regressor $\hat{e}_{t-1\tau}$, is denoted as;

$$ADF(\tau) = tstat(\hat{e}_{t-1\tau}) \tag{4.31}$$

These test statistics are now standard tools for the analysis of cointegrating regressions without regime shifts. The statistics of interest, however, are the smallest values of the above statistics, across all values of $\tau \in T$. The smallest values are examined since small values of the test statistics constitute evidence against the null hypothesis. These test statistics are $(lnGDPPC,\ lnINS, lnFD\ and\ lnCKPP)$

$$Z_\alpha^* = \inf_{\tau \in T} Z_\alpha(\tau) \tag{4.32}$$

$$Z_\alpha^* = \inf_{\tau \in T} Z_t(\tau) \tag{4.33}$$

$$ADF^* = \inf_{\tau \in T} ADF(\tau) \tag{4.34}$$

Hatemi-J Cointegration with Two Structural Breaks

In estimating for structural breaks in intercept and the slope coefficients, Hatemi-J (2008) for two structural breaks was adopted. To test the null hypothesis of no cointegration, the modified ADF test extended from Gregory and Hansen (1996) is calculated by the corresponding *t*-test for the slope of $\widehat{u}_{t-1}$ in a regression of $\Delta\widehat{u}_t$ on $\widehat{u}_{t-1}$, $\Delta\widehat{u}_{t-1}, \ldots, \Delta\widehat{u}_{t-k}$, where $\widehat{u}_t$ signifies the estimated error term. The Z_a and Z_t (both modified) test statistics are based on the calculation of the bias-corrected first-order serial correlation coefficient estimate $\widehat{\rho}*$, defined as:

$$\widehat{\rho}* = \frac{\sum_{t=1}^{n-1}(\widehat{u}_t\widehat{u}_{t+1} - \sum_{j=1}^{B} w(j/B)\hat{\gamma}(j)}{\sum_{t=1}^{n-1}\hat{u}_t^2}. \tag{4.35}$$

where *w(·)* is a function providing kernel weights meeting the standard conditions for spectral density estimators, *B* (itself a function of n) is the bandwidth number satisfying the conditions $B \to \infty$ and $B/n^5 = O(1)$, and $\hat{\gamma}(j)$ is an autocovariance function. The autocovariance function is defined by

$$\hat{\gamma}(j) = \frac{1}{n}\sum_{t=j+1}^{T}(\hat{u}_{t-j} - \hat{\rho}\hat{u}_{t-j-1})(\hat{u}_t - \hat{\rho}\hat{u}_{t-1}) \tag{4.36}$$

where $\hat{\rho}$ is the OLS estimate of the effect (without intercept) of $\hat{u}_{t-1}$ on $\hat{u}_t$. The Z_a and Z_1 test statistics are defined as

$$Z_\alpha = n(\hat{\rho}^* - 1) \tag{4.37}$$ and

$$Z_t = \frac{(\hat{\rho}^* - 1)}{\hat{\gamma}(0) + 2\sum_{j=1}^{B} w(j/B)\hat{\gamma}(j) / \sum_{t=1}^{n-1}\hat{u}_t^2} \tag{4.38}$$

where $\hat{\gamma}(0) + 2\sum_{j=1}^{B} w(j/B)\hat{\gamma}(j) / \sum_{t=1}^{n-1}\hat{u}_t^2$ is the long-run variance estimate of the residuals of a regression of $\hat{u}_t$ on $\hat{u}_{t-1}$. These three test statistics have nonstandard distributions. It should be mentioned that the asymptotic distribution of the ADF test statistic is identical to the distribution of the Z_t statistic. The applicable test statistics are the smallest values of these three tests across all values for τ_1 and τ_2, with $\tau_1 \in T_1(0.15, 0.70)$ and $\tau_2 \in T_2(0.15 + \tau_1, 0.85)$. The idea behind choosing the smallest value for each test statistic is that the smallest value represents the empirical evidence against the null hypothesis. These test statistics are defined as

$$ADF^* = \inf_{(\tau_1,\tau_2)\in T} ADF(\tau_1, \tau_2), \tag{4.39}$$

$$Z_t^* = \inf_{(\tau_1,\tau_2)\in T} Z_t(\tau_1, \tau_2), \tag{4.40}$$

$$Z_\alpha^* = \inf_{(\tau_1,\tau_2)\in T} Z_\alpha(\tau_1, \tau_2), \tag{4.41}$$

Where $T = (0.15n, 0.85n)$. The idea to truncate the data by 15% on each side follows the foot-steps of Gregory and Hansen (1996). Based on the same logic, the distance between the two regime shifts is allowed to be at least 15%.

4.3.9 Panel Cointegration without Structural Breaks

Upon establishing the presence of panel unit root in variables, it is important to test whether there exists a long-run equilibrium relationship between the variables. Panel cointegration techniques are first conducted using the panel cointegration methodology developed by Pedroni (1999) and Westerlund (2005)[19]. Cointegration refers to a linear combination of nonstationary variables implying that their stochastic trends must be linked as a long-run equilibrium. Cointegration becomes expedient and necessary when, in econometric estimations, two or more series that are integrated of order one have a linear combination, which is integrated of order zero. The problem of spurious regression is thus eliminated hence establishing the fact that there is a long-run relationship among variables. Cointegration between two series implies a particular kind of model, called an error correction model, for the short-term dynamics with an adjustment factor for long-run disequilibrium situations.

Pedroni Residual Based Panel Cointegration

The Pedroni (1999) methodology allows one to test for the presence of long-run equilibria in multivariate panels while permitting the dynamic and even the long-run cointegrating vectors to be heterogeneous across individual members (Apergis, Filippidis and Economidou, 2007). Pedroni (1999; 2004) derive the asymptotic distributions and explores

[19] Results from the Westerlund (2007) cointegration test not indicated in this thesis which is also residual based and an extension of the Pedroni (1999) test confirm the Pedroni (1999; 2004) and Westerlund (2005) tests.

the small sample performances of seven different statistics: the panel v-statistic, panel rho-statistic, panel PP-statistic (nonparametric), panel ADF-statistic (parametric), group rho-statistic, group PP-statistic (nonparametric) and group ADF-statistic (parametric).

The Pedroni (1999; 2004) test has the advantage of firstly, allowing the testing of for cointegration in heterogenous and multivariate panels unlike previous test. Secondly, the test is constructed to remove common time effects before performing the tests. Hence it tackles and mitigates the possible adverse effects to cross-sectional dependency. Secondly, the Pedroni panel cointegration test is suited for any data set since it contains both parametric and non-parametric estimators. The test permits the dynamic and long run cointegrating vectors to be heterogenous across individual members of the panel. In effect, the test is appropriate for heterogeneous dynamics, endogenous regressors, fixed effects, and individual-specific deterministic trends. The Pedroni equations that serve as test statistics are as follows:

Panel v: $T^2N^{3/2}Z_{\hat{v}_{N,T}} \equiv T^2N^{3/2}\left(\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^{2}\right)^{-1}$

Panel ρ: $T\sqrt{N}Z_{\hat{\rho}_{N,T^{-1}}} \equiv T\sqrt{N}\left(\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^{2}\right)\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}(\hat{e}_{i,t-1}\Delta\hat{e}_{i,t} - \hat{\lambda}_i)$

Panel t: $Z_{t,N,T} \equiv \left(\tilde{\sigma}_{N,T}^{2}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^{2}\right)^{-1/2}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}(\hat{e}_{i,t-1}\Delta\hat{e}_{i,t} - \hat{\lambda}_i)$

Panel t: $Z_{t\,N,T}^{*} \equiv \left(\tilde{s}_{N,T}^{*2}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^{*2}\right)^{-1/2}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^{*}\Delta\hat{e}_{t}^{*}$

Group ρ: $TN^{-1/2}\tilde{Z}_{\tilde{\rho}_{N,T^{-1}}} \equiv TN^{-1/2}\sum_{i=1}^{N}\left(\sum_{t=1}^{T}\hat{e}_{i,t-1}^{2}\right)^{-1}\sum_{t=1}^{T}(\hat{e}_{i,t-1}\Delta\hat{e}_{i,t} - \hat{\lambda}_i)$

Group t: $T^2N^{3/2}Z_{t_{N,T}} \equiv N^{-1/2}\sum_{i=1}^{N}\left(\hat{\sigma}_i^2\sum_{t=1}^{T}\hat{e}_{i,t-1}^{2}\right)^{-1/2}\sum_{t=1}^{T}\left(\hat{e}_{i,t-1}\Delta\hat{e}_{i,t} - \hat{\lambda}_i\right)$

Group t: $N^{-1/2}\hat{Z}_{t\,N,T}^{*} \equiv N^{-1/2}\sum_{i=1}^{N}\left(\sum_{t=1}^{T}\hat{s}_i^{*2}\hat{e}_{i,t-1}^{*2}\right)^{-1}\sum_{t=1}^{T}\hat{e}_{i,t-1}^{*}\Delta\hat{e}_{t}^{*}$ (4.42)

Where,

$$\hat{\lambda}_i = \frac{1}{T}\sum_{s=1}^{k_i}\left(1 - \frac{s}{k_i+1}\right)\sum_{t=s+1}^{T}\hat{\mu}_{i,t}\hat{\mu}_{i,t-s}\,,\ \hat{s}_i^2 \equiv \frac{1}{T}\sum_{t=1}^{T}\hat{\mu}_{i,t,}^{2}\tilde{\sigma}_i^2$$

$$= \hat{s}_i^2 + 2\hat{\lambda}_i, \hat{\sigma}_{N,T}^2 \equiv \frac{1}{N}\sum_{t=1}^{N} \hat{L}_{11i}^{-2}\hat{\sigma}_i^2$$

$$\hat{s}_i^{*2} \equiv \frac{1}{t}\sum_{t=1}^{T} \hat{\mu}_{i,t,}^{*2}, \tilde{s}_{N,T}^{*2} \equiv \frac{1}{N}\sum_{t=1}^{N} \hat{s}_i^{*2}, \hat{L}_{11i}^2$$

$$= \frac{1}{T}\sum_{t=1}^{T} \hat{\eta}_{i,t}^2 + \frac{2}{T}\sum_{s=1}^{k_i}\left(1 - \frac{s}{k_i + 1}\right) \sum_{t=s+1}^{T} \hat{\eta}_{i,t}\hat{\eta}_{i,t-s}$$

And where the residuals $\hat{\mu}_{i,t}$, $\hat{\mu}_{i,t}^*$ and $\hat{\eta}_{i,t}$ are obtained from the regression below:

$$\hat{e}_{i,t} = \hat{\gamma}_i\hat{e}_{i,t-1} + \hat{\mu}_{i,t}, \ \hat{e}_{i,t} = \hat{\gamma}_i\hat{e}_{i,t-1} + \sum_{k=1}^{k_i} \hat{\gamma}_{i,k}\Delta \hat{e}_{i,t-k} + \hat{\mu}_{i,t}^*,$$

$$\Delta y_{i,t} = \sum_{m=1}^{M} \hat{b}_{mi}\, \Delta x_{mi,t} + \hat{\eta}_{i,t} \quad (4.43)$$

It is important to note that the Pedroni tests investigate whether there is cointegration or not, but does not provide an estimate for the long-run. This is done in a second step, where Panel FMOLS (Philips and Hansen, 1990) and OLS are estimated to determine elasticities in the long-run. For the cointegration result (first step), stationary variables do not play a role, as they cannot include the same stochastic trend as I (1) variables, by definition. However, as in practice, where the need arises, stationary variables can be considered in the estimation of the cointegration elasticities as they assist in obtaining more efficient estimates of the long-run parameters.

Westerlund (2005) Panel Cointegration Test

This residual-based test is based on a model with an AR parameter, which is the same or either a panel specific over the panels. All panels have unique slope parameters in this model with panel -specific cointegrating vectors. The panel-specific-AR test statistic is used to test the null hypothesis of no cointegration against the alternative hypothesis that some panels are cointegrated. The same-AR test statistic is used to test the null hypothesis of no cointegration against the alternative hypothesis that all the panels are cointegrated. The VR test statistics test the null hypothesis is no cointegration against an alternative that all panels are cointegrated. The panel-specific AR test statistic is given by

$$VR = \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{E}_{it}^{2} \hat{R}_{i}^{-1} \quad (4.44)$$

The same-AR test statistic is given by

$$VR = \sum_{i=1}^{N} \sum_{t=1}^{T} \left(\sum_{i=1}^{N} \hat{R}_{i}\right)^{-1} \quad (4.45)$$

Where $\widehat{E_{it}} = \sum_{j=1}^{t} \widehat{e_{ij}}$, $\hat{R}_{i} = \sum_{t=1}^{T} \widehat{e_{it}^{2}}$ and $\widehat{e_{it}}$ are residuals from the panel-data regression model being used. After the relevant standardization, the asymptotic distribution of the Westerlund (2005) test statistics converges to the standard normal distribution N(0,1)[20]. The Westerlund (2005) cointegration test allows for an even higher degree of heterogeneity in the panel as well as capable of accommodating a large presence of cross-sectional dependency. In view of the strong cross-sectional dependency identified in the data, these tests are suited to detect any form of cointegration among the variables.

4.3.10 Panel Cointegration with Structural Breaks

Several tests have been developed that can automatically take into account one or more than one structural break. In this study, the Westerlund (2006a) and Banerjee and Carrion-i-Silvestre (2015) panel cointegration with structural breaks were employed to analyse the cointegration with structural breaks in panels. Whilst the Gregory and Hansen (1996) test and Hatemi-J (2008) are conducted on a panel, they generate individual country results. The Westerlund (2006a) test produces results for the entire panel whilst indicating break dates for individual countries. The Banerjee and Carrion-i-Silvestre (2015) test however generates results for both the panel and the individual countries.

[20] For details and in-depth analyses of cointegration tests, see Westerlund (2005) and Pedroni (1999; 2004)

The set of data used allows the Gregory and Hansen test to shift for the intercept and shift for the intercept with trend whilst the Hatemi-J (2008) considers two shifts in both the intercept and cointegrating vector. Both the Gregory and Hansen (1996) test and the Hatemi-J (2008) test help to determine the stability of the dataset and associated models. The assumption of time invariance for the cointegration vector is therefore overcome with these tests.

Whilst the Westerlund (2006a) cointegration test has no nuisance parameters under its null and has small size distortions with reasonable power, it is invariant with respect to the number of breaks and location of breakpoints. This invariance renders the test convenient as there is no need to compute different critical values for all possible patterns of break points. In addition, the Westerlund (2006a) test allows cross-sectional dependence and does not impose any common-factor restrictions. The Banerjee and Carrion-i-Silvestre (2015) has the advantage of allowing cointegration at both the panel and individual levels with structural breaks. It allows users to avoid possible misspecification errors by taking proper account of the presence of structural breaks unlike the Pedroni (1999) test, which it is based on. Furthermore, the test allows for dependence among cross-sectional units of the panel and goes further to carry out a common factor test.

Although the Westerlund (2006a) test addresses the issue of cross-sectional dependence it does not build a cross-sectional dependency test that highlights the common factors into the test. An important advantage of the Banerjee and Carrion-i-Silvestre (2015) test is that tests for cross-sectional dependence are incorporated and factored into cointegration estimations where relevant. Furthermore, the test is based on the Pedroni (1999, 2004) cointegration test, which makes it consistent with the panel cointegration test without breaks. Again, whilst the Westerlund (2006a) test allows for multiple structural breaks in the level and trend, the Banerjee and Carrion-i- Silvestre (2015) test extends the level and trend breaks and accounts for multiple regime shifts as well.

One issue with both the Westerlund (2006a) cointegration test and the Banerjee and Carrion-i-Silvestre Cointegration test is that they only generate individual country break dates. As such, to find a plausible estimate for the entire panel, the modal break estimate (s) from the Banerjee and Carrion-i-Silvestre test is adopted. Then a Chow test by Chow (1960) to ascertain the presence of a break in those years is conducted (Park, 2011). Given that the Chow test provides evidence of breaks in those years, they are incorporated as the estimated panel break locations.

The Westerlund Panel LM Test with Multiple Structural Breaks

The panel LM test of Westerlund (2006a) is used to test for cointegration between the variables (Narayan and Smyth, 2008; Narayan, 2010). Given the empirical model as:

$$\ln GDPPC_{it} = Z_{it}^{'}\lambda_{it} + \alpha \ln CKPP_{it} + \gamma\theta \ln INS_{it} + \tau\theta \ln FD_{it} + v_{it} \qquad (4.46)$$

Consider the multidimensional time-series variable y_{it}, which is observable for $i = 1, \ldots, N$ cross-sectional and $t = 1, \ldots, T$ time-series observations. The data generating process (DGP) for y_{it} is given by the following system of equations

$$lnGDPPC_{it} = Z_{it}^{'}\lambda_{it} + \alpha_i \ln CKPP_{it} + \rho_i \ln INS_{it} + \psi_i \ln FD_{it} + e_{it}$$

$$e_{it} = r_{it} + u_{it} \qquad (4.47)$$

$$r_{it} = r_{it-1} + \emptyset_i u_{it} \qquad (4.48)$$

Where, the index $j = 1, \ldots, M_i + 1$ is used to denote the structural breaks. There can be at most M_i such breaks, or $M_i + 1$ regimes, that are located at the dates $T_{i1}, \ldots, T_{iM_j}$, where

$T_{i0} = 1$ and $T_{iM+1} = T$. Furthermore, the initial value of r_{it} is assumed to be zero, which entails no loss of generality as long as Z_{it} includes an individual-specific intercept.

Westerlund (2006a) determines the break points endogenously using the Bai and Perron (2003) technique, which globally minimizes the sum of squared residuals to obtain the location of breaks;

$$\widehat{T_\iota} = arg \min_{T_i} \sum_{j=1}^{M_i+1} \sum_{i=T_{ij-1}+1}^{T_{ij}} (y_{it} - z_{it}' \hat{\gamma}_{ij} - x_{ij}' \hat{\beta}_i)^2 \quad (4.49)$$

where $\widehat{T_\iota} = (\widehat{T_{\iota 1}}, \ldots, \widehat{T_{\iota M_\iota}})'$is the vector of estimated break points, $\hat{\gamma}_{ij}$ and $\widehat{\beta_\iota}$ are the estimates of the cointegration parameters based on the partition $\widehat{T_\iota} = (\widehat{T_{\iota 1}}, \ldots, \widehat{T_{\iota M_\iota}})'$ and τ is a trimming parameter such that $\lambda_{ij} - \lambda_{ij-1} > \tau$, which imposes a minimum length for each subsample at $0.15T$. Because the minimization is taken over all possible partitions of permissible length, the break-point estimators are said to be global minimizers. The minimization of the sum of squared errors is performed iteratively as suggested by Bai and Perron (2003) by using the Schwartz Bayesian criterion. The maximum number of allowable breaks is set at three.

The null hypothesis that all the countries variables are cointegrated is therefore:

$H_0: \emptyset_i = 0 \; and \; for \; all \; i = 1, \ldots, N,$

Against

$H_1: \emptyset_i \neq 0 \; for \; i = 1, \ldots, N_1 \; and \; \emptyset_i = 0 \; for \; i = N_1 + 1, \ldots, N$

In words, the hypothesis can be stated as:

H_0: Cointegration that allows for structural breaks in both level and trend of panels between FD, IQ and EG in SSA

H_1: No cointegration that allows for structural breaks in both level and trend of panels FD, IQ and EG in SSA

This formulation of the alternative hypothesis allows $\emptyset_i$ to differ across the cross-sectional units, and is more general than the homogenous alternative hypothesis that $\emptyset_i = \emptyset \neq 0$ for all *i*, which is implicit in the testing approach of McCoskey and Kao (1998). The panel LM test statistic is defined as follows

$$Z(M) \equiv \sum_{i=1}^{N} \sum_{j=1}^{M_i+1} \sum_{t=T_{ij-1}+1}^{T_{ij}} (T_{ij} - T_{ij-1})^{-2} \omega_{i1.2}^{-2} S_{it}^{2} \tag{4.50}$$

The Banerjee and Carrion-i-Silvestre Panel Cointegration with Structural Breaks and Cross-sectional Dependency

It is important to consider the fact that political, economic and often social integration among countries within a region or sub-region is likely to yield a certain degree of interdependency among countries in the SSA region. Acknowledging and investigating the possible existence of certain interdependencies as well as controlling such cross-sectional dependency helps in avoiding bias in the panel unit root and cointegration tests (Westerlund, 2007; Pesaran, 2007; Fang and Chang, 2016; Salim, Yao and Chen, 2017).

To determine such cross-sectional dependencies and account for them in subsequent models, four tests are applied. The first is the Breusch and Pagan (1980) Lagrange multiplier (LM) test. The second is the Pesaran (2004) cross-sectional dependence test. The Pesaran (2004) scaled LM test and the Bias-Corrected scaled LM test by Baltagi, Feng and Kao (2012) are the third and fourth tests, respectively. Each of these tests has a unique role it plays as a test. For example, the Breusch and Pagan (1980) Lagrange multiplier (LM) test is appropriate for a smaller number of cross-sectional units (n) and a long period of time (T) whilst the Pesaran CD test is used even when N is large.

Since cross-sectional dependence might be a possibility, in addition to the panel unit root tests performed without structural breaks such as the LL, IPS and Breitung, to account for both cross-sectional dependence and structural breaks in the panel unit root test, the Carrion-i-Silvestre, Barrio-Castro and Lopez-Bazo (2005) test, which accounts for both cross-sectional dependence and multiple structural breaks is conducted to establish the order of integration of the variables whilst capturing any occurrences that could have impacted them significantly in the region.

The panel statistics, namely the pseudo t-ratio statistic $Z_{\hat{t}NT}(\hat{\lambda})$ and normalised bias statistic $Z_{\hat{\rho}NT}(\hat{\lambda})$ were given in Banerjee and Carrion-i-Silvestre (2015) as:

$$\begin{cases} Z_{\hat{t}NT}(\hat{\lambda}) = \sum_{i=1}^{N} t_{\hat{\rho}_i}(\hat{\lambda}) \\ Z_{\hat{\rho}NT}(\hat{\lambda}) = \sum_{i=1}^{N} T\hat{\rho}_i(\hat{\lambda}) \end{cases} \tag{4.51}$$

Where $\hat{\rho}_i(\hat{\lambda}_i)$ and $t_{\rho_i}(\hat{\lambda}_i)$ are the estimated coefficient from estimated residuals. Given an unknown break point, the $Z^e_{\tilde{t}NT}(\lambda) = N^{-1}\sum_{i=1}^{N} t_{\tilde{\rho}_i}(\lambda)$ statistic is then computed for each break point using the idiosyncratic disturbance terms and estimate the break point as the argument that minimizes the sequence of standardized $Z^e_{\tilde{t}NT}(\lambda)$ statistics. Thus, the test statistic that is used to test the null hypothesis of non-cointegration for the idiosyncratic disturbance term is given by

$$Z^e_{\tilde{t}NT}(\tilde{\lambda}) = \inf_{\lambda \in \Lambda} \left(\frac{N^{-1/2} Z^e_{\tilde{t}NT}(\lambda) - \Theta^e_2(\lambda)\sqrt{N}}{\sqrt{\Psi^e_2(\lambda)}} \right) \tag{4.52}$$

Where $\Psi_2^e(\lambda)$ is the long-run variance estimate of the residuals. If the moments again depend on the specification of the deterministic term, the estimated break date denoted $\hat{T}_b$ is given by:

$$\hat{T}_b = \arg\min_{\lambda\in\Lambda}\left(\frac{N^{-1/2}Z_{\hat{t}NT}^e(\lambda)-\Theta_2^e(\lambda)\sqrt{N}}{\sqrt{\Psi_2^e(\lambda)}}\right) \tag{4.53}$$

The break date is then used to compute MQ tests for the common factors, which is given as:

$$MQ_c^d(q) = T\left[\tilde{v}_c^d(q)-1\right] \tag{4.54}$$

for the case of no change in the trend and

$$MQ_c^d(q,\lambda) = T\left[\tilde{v}_c^d(q,\lambda)-1\right] \tag{4.56}$$

for the case of a change in the trend. q is the number of common stochastic trends, λ representing the change in trend and $\tilde{v}_c^d(q,\lambda)$ representing be the smallest eigenvalue.

4.3.11 Error Correction and Long-run Elasticities for Individual Countries

Error Correction Term (ECT)

An error correction (EC) model is a restricted VAR designed for use with nonstationary series that are known to be cointegrated. The cointegration term is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. Engle-Granger (1987) two-step procedure was used to estimate the error correction model and derive the error correction term. The cointegration vectors were estimated using OLS and FMOLS estimators for each country that was cointegrated. The estimations were conducted firstly without structural breaks and then with structural breaks (See Engle and Granger, 1987 for details).

4.3.12 Panel Error Correction Model and Long-run Elasticities

Pooled OLS and Pooled FMOLS

For both the no structural break and structural break cases, a panel pooled OLS estimation and a pooled FMOLS estimation as outlined by Phillips and Moon (1999) were employed. The pooled FMOLS is a straightforward extension of the standard Phillips and Hansen estimator that produces asymptotically unbiased, normally distributed coefficient estimates. Both estimators were estimated with the option of accounting for cross-sectional dependence. Given estimates of the average long-run covariances, $\hat{\Lambda}$ and $\hat{\Omega}$, the modified dependent variable and serial correlation correction terms may be defined as

$$\bar{y}_{it}^{+} = \bar{y}_{it} - \widehat{\omega}_{12}\hat{\Omega}_{22}^{-1}\hat{u}_{2} \quad (4.57)$$ and

$$\hat{\lambda}_{12}^{+} = \hat{\lambda}_{12} - \widehat{\omega}_{12}\hat{\Omega}_{22}^{-1}\hat{\lambda}_{22} \quad (4.58)$$

where $\bar{y}_{it}$ and X_{it} are the corresponding data purged of the individual deterministic trends (pooled with heterogenous effect), and $\widehat{\omega}_{1.2}$ is the long-run average variance of $u_{1\,it}$conditional on $u_{2\,it}$. In the leading case of individual specific intercepts, $y_{it} = y_{it} - \bar{y}_{i}$ and $X_{it} = X_{it} - \bar{X}_{i}$ are the demeaned variables. The pooled FMOLS estimator is then given by:

$$\hat{\beta}_{FP} = \left(\sum_{i=1}^{N}\sum_{t=1}^{T} X_{it}X_{it}'\right)^{-1}\sum_{i=1}^{N}\sum_{t=1}^{T}\left(X_{it}\bar{y}_{it}^{+} - \hat{\lambda}_{12}^{+'}\right) \quad (4.59)$$

It is worth noting the pooled estimator simply sums across cross-sections separately in the numerator and denominator. In estimating the pooled FMOLS, Mark and Sul (2003) propose a sandwich form of this estimator, which allows for heterogeneous variances:

$$\hat{V}_{FP} = \widehat{M}_{FP}^{-1} \,.\, \widehat{D}_{FP} \,.\, \widehat{M}_{FP}^{-1} \quad (4.60)$$

Where,

$$\widehat{M}_{FP} = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{1}{T^{2}}\sum_{t=1}^{T} X_{it}X_{it}'\right) \quad (4.61)$$

and the long-run variance estimates $\widehat{\omega}_{1.2i} = \widehat{\omega}_{11\,i} - \widehat{\omega}_{12i}\widehat{\Omega}_{22i}^{-1}\widehat{\omega}_{21i}$ are computed for each cross-section. Note that degree-of-freedom corrections may be applied to the $\widehat{\omega}_{1.2}$ and $\widehat{\omega}_{1.2i}$ for comparability with standard regression standard error of the regression estimators.

Dynamic Fixed Effects

The dynamic fixed effects (DFE) estimator, like the pooled mean group (PMG) estimator, restricts the coefficients of the cointegrating vector to be equal across all panels. The fixed effects (FE) model further restricts the speed of adjustment coefficient and the short-run coefficients to be equal. Given a model

$$y_{it} = \delta_{10i}x_{pit} + \delta_{20i}x_{pit-1} + \lambda_{20i}y_{it-1}\mu_i + \varepsilon_{it} \qquad (4.62)$$

Where p, refers to each regressor, i refers to the number of countries and t refers to time (31). The Dynamic Fixed Effect allows panel-specific intercepts. An allowance for intragroup correlation in the calculation of standard errors is made with the cluster or entity

$$\Delta y_{it} = \phi_i\left(y_{i,t-1} - \delta_{10i}x_{pit} + \delta_{20i}x_{pit-1}\right) + \delta_{11i}\Delta x_{pit} + \delta_{21i}\Delta x_{pit-1} + \varepsilon_{it} \qquad (4.63)$$

where $\phi_i$is the speed of adjustment and $\delta_{10i}\ and\ \delta_{20i}$ represent the long-run coefficient of the regressors while $\delta_{11i}\ and\ \delta_{21i}$ represent the short-run coefficient of the regressors. The Dynamic Fixed Effect model is used to estimate the adjustment factor for the panel.

4.4 Conclusion

The research is embedded in the framework of the Solow (1956; 1957) neoclassical growth model and extends the methodology of You and Sarantis (2013) by decomposing TFP into pure technical progress (NFP) and institutional quality linked efficiency gain (IQLEG) in depicting how the presence and quality of institutions contribute to an increase in efficiency levels and hence to increasing productivity and growth over and above productivity gains from pure technical progress. The rationale for setting the study in the Solow (1956) growth framework is that it is the modern reference point of all growth studies (Demetriades and Law, 2006; Law and Balach, 2015). The scope of the research is a group of sub-Saharan African countries and involves the 21 (out of 49) countries that are listed on the website of the World Bank due to data availability.

Within the confines of the Cobb-Douglas specification, individual country and panel cointegration techniques and dynamic models that account for cross-sectional dependency and multiple structural breaks are used to examine the possible existence of long-run relationships. Alternative production specifications in the form of the CES and VES are also employed in the presence of structural breaks in non-linear least square estimations to provide robustness and complement the use of the Cobb-Douglas specification when certain assumptions are relaxed. All three production functions are estimated and the contribution of IQLEG is calculated. The methodological contributions and advantages associated with the tools applied in this thesis have been acknowledged and discussed in this and previous chapters.

CHAPTER FIVE

FINANCIAL DEVELOPMENT, INSTITUTIONAL QUALITY AND ECONOMIC GROWTH IN SUB-SAHARAN AFRICA - A COINTEGRATION ANALYSIS

5.1 Introduction

This chapter focuses on investigating the role of institutional factors in the finance-growth relationship using a panel of 21 SSA countries between 1985 and 2015 at both the panel and individual country levels. Using panel cointegration techniques, the goal is to establish a long-run relationship between finance and growth within the framework of productivity in the Cobb-Douglas production function. The role of the econometric estimator used in determining the finance-growth relationship has been discussed in the literature (Murinde, 2012; Levine, 2005; Tamayo and Ferdinand, 2015: Bijlsma, Kool, and Non, 2018). These techniques have been proposed to have an impact on the outcomes of the relationship.

Both the finance-growth and the finance-institutions-growth literature have been tested with a diverse array of tools. These as earlier discussed in the methodology chapter, include cross country regressions (Arizalla, Cavallo and Gallindo, 2013), GMM estimators, LSDV estimators and many others (See Huang, 2010; Filippidis and Katrakilidis, 2015). These estimators although valid and dynamic, often tend to ignore the integrated properties of the dataset given the fact that they spun different time periods (Bist, 2018; Gries, Kraft and Meierrieks, 2008; Hyun, 2010).

Ignoring the integrated properties of variables can result in spurious parameter estimates (Wooldridge, 2013). To address this shortcoming, mitigative measure includes differencing the variables under study. However, differencing variables limits the information of the series. A more appropriate option is to use cointegration, which is a technique used to find a possible long run relationship between level panel and time series processes (Jalil and Rao, 2019). This study adopted the use of unit root and cointegration techniques to depict all forms of integration in the underlying structure of the data as this tends to impact the kind of associations between variables.

The results for this study show that, at the panel level, even in the presence of adequately working institutions, financial development is not associated with economic growth in the long-run. However, a study of the individual countries shows that some countries in the sub-region have cointegration relationships among financial development, institutional quality, capital stock and economic growth. In these countries, the results indicate that the system is able to adjust itself back to equilibrium in the event of destabilisation. The evidence also shows that, with the exception of Zimbabwe, IQLEG contributes positively on the average to total factor productivity for these countries.

This chapter is organized as follows: a summary of the empirical methodology applied in this chapter is provided in the next section. The fourth section entails estimations followed by the presentation and analysis of the findings for the panel and the time series estimations in that order. The last section concludes and recommends ways in which the research could be extended and conducted in the future.

5.2 Empirical Methodology

5.2.1 Data

As indicated in Chapter Four, Section 4.2, GDPPC from the WDI (2017), CKPP from the PWT 9.0, FD from the WDI (2017) and an institutional quality index with measures from the World Bank's ASPIRE database and the ICRG (2017) formed the data used in this thesis. The construction of the index and the measurement of variables are as described in Section 4.2.2 of Chapter Four. A comprehensive description of the source of the data can be found in **Appendix D**

5.2.2 Econometric Techniques

The Production Function

Based on the derivation of the production function in Chapter 2, Section 2.7.1 the empirical model for the Cobb-Douglas production function applied in estimating the relationship between institutional quality, financial development and economic growth for the panel of 21 countries used in the study ranged from 1985 to 2015was derived for the panel as

$$\ln GDPPC_{it} = C + \ln A_0 + g.t + \alpha \ln CKPP_{it} + \gamma\theta \ln INS_{it} + \tau\theta \ln FD_{it} + v_{it} \quad (5.1)$$

The time series version therefore is given as

$$\ln GDPPC_t = C + \ln A_0 + g.t + \alpha \ln \mathrm{CKPP}_t + \gamma\theta \ln INS_t + \tau\theta \ln FD_t + u_t \quad (5.2)$$

The derivation of the productivity levels within the panel for the Cobb-Douglas framework is given as:

$$NFP_t = \ln GDPPC_t - \hat{\alpha} \ln CKPP_t - \widehat{\tau\theta} \ln FD_t - \widehat{\gamma\theta} \ln INS_t, \quad (5.3)$$

$$TFP_t = \ln GDPPC_t - \hat{\alpha} \ln CKPP_t \quad (5.4)$$

$$IQLEG_t = TFP_t - NFP_t \quad (5.5),$$

respectively, where $i = 1, 2$ denotes the individual country units and $t = 1, 2, \ldots, 31$ from 1985 to 2015. The average for each year across the 21 countries is computed to represent the estimated the pooled time observation for the panel. As previously indicated, it is expected that the average CIQLEG is greater than 0. A brief discussion of the econometric tools used in this chapter follows.

Panel Univariate Cross-Sectional Dependency Test

An important point to practically consider in dealing with panel data, in addition to is the issue of cross-sectional dependence in the units of the panel. Ignoring CSD of errors may yield adverse outcomes such as misleading inferences and inconsistent estimators depending gravity of CSD. Cross sectional independence may not be the case when practically looking at relationships especially for a region that has created some common bodies for specific policy goals (See Bai and Ng, 2004; Westerlund, 2007; Salim, Yao and Chen, 2017; Camarero, Gómez and Tamarit, 2014; Pesaran, 2007).

Following Salim, Yao and Chen (2017), panel univariate cross-sectional dependence tests are conducted to ascertain the presence of cross-sectional dependence. The tests applied in this vein include the Breush Pagan (1980) Lagrange Multiplier test, the Pesaran (2004) scaled LM test, the Pesaran (2004) cross-sectional dependence (CD) test and the Bias-Corrected scaled LM test by Baltagi, Feng and Kao (2012). Upon determining the presence of CSD in the series, they need to be addressed by the application of integrated models that are robust enough to capture these interdependencies and correlations and mitigate their possible adverse effects. The panel cointegration tests adopted in this chapter have been constructed with properties that mitigate the effects of cross-sectional dependence.

Unit Root Tests

Theoretically, for cointegration to be applied in any analysis, it is required that all the variables in the cointegrating models be integrated of order one. To confirm these integral properties of gross domestic product per capita, financial development, institutional quality and capital stock across all 21 countries, both panel and time series unit root and stationarity tests were employed to ascertain the stationary properties of the variables under investigation.

To determine the integrated properties of the series, unit root tests are conducted for each variable per country and as a panel. Three time series unit root tests are applied. These are the Augmented Dickey-Fuller (ADF) test by Said and Dickey (1984) and the Phillips-Perron (PP) test by Phillips and Perron (1988). The corresponding panel unit root tests, also discussed in include the commonly applied Im, Pesaran and Shin (IPS) W-stat (2003) test, ADF - Fisher Chi-square (1999) test, Philips Peron (PP) - Fisher Chi-square (1987) test and the Breitung t-Test (2000). Sections 4.3.1 and 4.3.2 of Chapter Five contains a discussion of these tests and the corresponding test statistics for each test.

Cointegration Tests

For the time series estimations, the countries whose variables exhibit unit root properties are individually used to test for cointegration among variables. The VAR-based cointegration tests using the methodology developed in Johansen (1991, 1995) and the residual based Engle and Granger (1987) cointegration tests were applied in the time series framework whilst the Pedroni (1999, 2004) and Westerlund (2005) panel cointegration tests were conducted to determine the existence of long run relationships between the variables in the production function. Sections 4.3.7 and 4.3.9 of Chapter Four contains a discussion of these tests, the rational for employing them in this research and the corresponding test statistics for each test.

Cointegration Relationship and Speed of Adjustment

As discussed in Sections 4.3.11 and 4.3.12 of Chapter Four, upon establishing evidence of cointegration, for both the panel and the individual countries that provide evidence of cointegration, the cointegration vectors are then determined as a second step, where Panel FMOLS (Philips and Hansen, 1990) and pooled OLS are estimated to determine elasticities in the long-run. Next, the adjustment factor for the model is estimated by specifying a panel (and where applicable, a time series) ECM for FD, INS, CKPP and GDPPC. Having estimated, significant long run parameters at both the panel and time series levels, the production function is estimated and the TFP derived to determine the efficiency gains attributable to IQLEG

5.3 Results and Findings

5.3.1 Descriptive Statistics

The variables used in finding a relationship between financial development, institutions and economic growth are presented in descriptive statistics from the 21 sub-Saharan African countries that have all the available relevant variables. Table 5.1 presents initial descriptive statistics from the available data covering the 21 sub-Saharan African countries. In view of the fact that all the variables are logged, the description is on the logged variables. Due to the low levels of data collection in some SSA countries, the number of observations is based on available institutional variables of interest for the data spanning 1985 to 2015 since the econometric approach being adopted requires the use of a balanced panel dataset.

The number of observations for each variable in the panel is 651. There are quite a number of observations that are negative for institutional quality and, by extension, institutional quality linked efficiency gains as well as capital per person. The negative values are quite typical given the fact that SSA is the region in question. The reported mean for capital per person of 1.231 is low compared to that of LGDPPC and LFD. LINS and LFD are all negatively skewed whilst LGDPPC and LCKPP are positively skewed but only moderately. The LINS variable recorded a skewness of -2.032 indicating a high skew to the left whilst LFD is moderately skewed to the left. Interestingly LCKPP is fairly normal with skewness values of 0.155.

Table 5.1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Skewness	Kurtosis	Min	Max
LGDPPC	651	6.8952	0.9926	0.8256	3.0076	4.8801	9.3962
LFD	651	4.1878	0.4655	-0.7320	4.1263	2.4800	5.2722
LINS	651	3.0105	0.2660	-2.0323	9.1026	1.3429	3.4246
LCKPP	651	1.2314	1.1162	0.1551	2.9163	-1.1576	4.2484

Note: This table shows a summary statistic of the log of GDPPC, FD, INS and CKPP the entire panel of 21 SSA countries over the 31-year period. For Kurtosis, negative values indicate platykurtic and positive values reflect leptokurtic. The LGDPPC and LFD are moderately skewed. LCKPP is normal

With respect to kurtosis, LGDPPC and LCKPP were the closest to normality in terms of the shape of the distribution of the sample since they were closest to 3. LINS recorded the highest measure of kurtosis with a value of 9.102 exhibiting leptokurtic distribution of the sample. With respect to the LINS, Mali produced estimates with the highest number of negatives. The variable with the highest range was LGDPPC whilst institutional quality estimated had the lowest range.

5.3.2 Cross-sectional Dependence Tests Results

All four tests for cross-sectional dependence strongly reject the null hypothesis of cross-sectional independence. The Breusch-Pagan LM, Pesaran scaled LM, Bias-corrected scaled LM and the Pesaran CD tests strongly suggest evidence of non-spatial cross-sectional dependence for all variables at all levels of significance. The results from Table 5.2 lend credence to the argument that the financial systems and economies of countries in the SSA region have underlying interdependencies.

Table 5.2: Cross-sectional Dependence (CSD) Tests

Variables	**Breusch-Pagan LM**	**Pesaran scaled LM**	**Bias-corrected scaled LM**	**Pesaran CD**
LGDPPC	2916.822***	131.0547***	130.705***	22.366***
LCKPP	3578.980***	163.365***	163.015***	54.282***
LFD	2467.349***	109.123***	108.773***	40.441***
LINS	1412.670***	57.660***	57.310***	17.245***

Null hypothesis is cross-sectional independence. Tests are conducted following the fixed effect estimation
(***), (**) and (*) denote rejection at 1%, 5% and 10%, respectively

These spatial CSD based on the use of different countries, and non-spatial dependencies[21] that often highlight some common factors among cross-sections, may be as a result of many factors some of which are that these economies have formed unions and sub-regional bodies for effective and specific policy making and effective trade relations among others (Sarafidis and Wangsbeek, 2012; Bai and Ng, 2004; Bailey, Holly and Pesaran, 2016). An example is the West African Monetary Union that cuts across all countries in the West

[21] According to Sarafidis and Wangsbeek (2012), non-spatial dependence assumes presence of unobserved common components in the disturbances which are linear combinations of a fixed number of factors while spatial dependencies assume the unobserved common component in the disturbance are spatially (locally) correlated (See also Batalgi and Pesara, 2007; Bilgili *et al.*, 2017)

African region. There are various bodies of the sort in East and Southern Africa. Common policy agenda often imply that reforms in one country are likely to have an impact in another country over the years. As already stated above, the panel models address the challenges associated with cross-sectional dependence.

5.3.3 Unit Root Testing Results

Time Series Unit Root Results

It is a fact that individual countries may have specific features that may not be systematic. To provide some insight into the individual country relationship between finance, institutional quality and economic growth, the results for the univariate estimations are discussed in this section. The results of the univariate unit root tests shown on Table 5.3, Panels A and B indicate that 10 out of the 21 countries exhibited I (1) properties at the 5% level of significance for all variables except capital that exhibited I (1) properties at 10% level of significance for Kenya, Madagascar and Malawi (Table 5.3 -Panels A and B).

Although the results for unit root at level showed that all variables were not stationary, the test, when conducted on the first difference of the variables, showed that Botswana, Cote d'Ivoire, Gabon, Ghana, Niger, Sudan, Senegal, Uganda and South Africa were not stationary. As such, in line with cointegration theory that requires variables to be integrated of the first order, all these countries had to be dropped from the cointegration estimations (Westerlund, 2006a; Narayan and Smyth, 2008). Hence, cointegration was conducted for Gambia, Kenya, Madagascar, Mali, Malawi, Nigeria, Sierra Leone, Tanzania, Zambia and Zimbabwe.

Table 5.3: Panel A: Individual Unit Root Tests

Country	LGDPPC		LFDI		LINS		LCKPP	
	ADF	PP	ADF	PP	ADF	PP	ADF	PP
Botswana	-3.184[0] *	-3.240*	-0.269[1]	-0.204	-0.734[1]	-0.134	0.116[1]	0.092
Cote d'Ivoire	-0.379[1]	-0.302	-0.814[0]	-1.168	-1.014[0]	-2.998	0.222[1]	-0.708
Congo	-1.917[3]	-1.939	-0.617[1]	-1.233	1.979[1]	-1.755	5.237[1]	3.590
Gabon	-2.266[0]	-2.439	-2.138[0]	-2.149	0.234[4]	0.092	0.834[0]	0.092
Ghana	-0.131[0]	-0.407	-0.892[0]	-0.741	-2.344[4]	-0.952	-1.039 [1]	2.096
Gambia	-3.358[1]*	-3.272*	-1.007[1]	-1.405	-0.092[2]	-0.336	0.369[0]	0.096
Kenya	-0.296[0]	-0.178	-0.688[0]	-0.569	-0.135[0]	-0.179	0.809[1]	0.098
Madagascar	-2.448[2]	-2.387	-0.950[0]	-0.968	-2.947[0]*	-2.416	-2.953[0]*	-1.907
Mali	-2.589[0]	-2.656	-0.379[0]	-0.330	-1.710[0]	-1.531	-0.928[1]	-0.809
Mozambique	-2.262[1]	-2.477	-2.410[1]	-2.657	-1.149[1]	-1.982	9.413[4]	8.962
Malawi	-3.005[0]	-3.004	-1.995[0]	-1.949	-1.523[0]	-1.697	-0.280[0]	-0.505
Niger	-0.812[1]	-0.530	-0.386[0]	-1.047	-1.432[0]	-1.739	-1.090[0]	-1.381
Nigeria	-2.714[1]	-2.664	-0.876[0]	-1.078	-0.589[0]	-0.324	-0.022[1]	-0.676
Sudan	-1.665[0]	-1.410	-0.824[1]	-1.286	-2.034[0]	-2.065	2.331[1]	1.341
Senegal	-1.621[0]	-1.648	0.599[4]	0.170	-2.163[2]	-2.239	-2.259[1]	-1.813
Sierra Leone	-1.636[0]	-1.535	-0.663[0]	-0.672	-1.017[0]	-1.275	-1.858[0]	-1.743

Tanzania	-0.818[0]	-0.949	-0.628[0]	-0.601	0.869[5]	0.997	-1.316[6]	-1.679
Uganda	-3.276[0]	-1.944	-0.282[2]	-0.374	-0.021[6]	0.995	4.845[0]	2.962
South Africa	-1.979[1]	-1.944	-0.902[1]	-0.944	-2.234[0]	-2.248	3.155[0]	1.529
Zambia	-1.254[1]	-1.258	-0.286[0]	-0.737	-1.556[0]	-1.571	-0.566[2]	-0.817
Zimbabwe	-1.194[1]	-1.709	-0.815[0]	-0.801	-0.5471[1]	-0.479	-0.221[0]	-0.977

Notes: Unit root results for level variables in each country. Optimal lag in square brackets [ ] for ADF test. PP tests the automatic bandwidth - Newey West. (***), (**) and (*) denote rejection at 1%, 5% and 10%, respectively

Table 5.3 Panel B: Unit Root Tests Differenced Data

Country	DLGDPPC		DLFDI		DLINS		DLCKPP	
	ADF	PP	ADF	PP	ADF	PP	ADF	PP
Botswana	-4.621[0] ***	-4.594 ***	-4.879[0] ***	-4.856 ***	-4.796[0] ***	-4.850***	-3.392[0] **	-3.224**
Cote d'Ivoire	-3.620[0] **	-3.658 **	-3.644[0] ***	-3.655***	-6.693[0] ***	-7.122***	-2.401[0]	-2.426
Congo	-6.313[2] ***	-7.423***	-2.629[0] *	-2.624*	-3.616[1] ***	-3.400***	-1.765[0]	-1.634
Gabon	-5.369[1] ***	-5.399***	-3.782[0]***	-3.650 ***	-5.841[1]***	-5.871***	-2.147[0]	-2.119
Ghana	-3.462[0] **	-3.439**	-5.712[0]***	-6.132***	-4.392[0]***	-4.378***	-1.386[1]	-1.263
Gambia	-6.014[0] ***	-6.467***	-2.972[1]**	-2.941**	-4.535[1]***	-4.635***	-3.236[0]**	-3.250**
Kenya	-3.677[1] **	-3.565**	-6.150[0]***	-6.294***	-4.657[1]***	-4.602***	-2.635[0]*	-2.707*
Madagascar	-6.278[0] ***	-6.496***	-3.748[0]***	-3.783***	-5.336[0]***	-5.655***	-2.727[0]*	-2.753*
Mali	-8.178[0] ***	-8.099***	-4.476[1]***	-4.432***	-5.547[0]***	-5.619***	-2.993[0]**	-3.026**
Mozambique	-5.502[1]***	-5.501***	-4.970[1]***	-4.955***	-4.202[0]***	-4.118***	-1.470[1]	-1.344*
Malawi	-6.944[0]***	-6.837***	-4.943[0]***	-5.082***	-4.569[0]***	-4.507***	-2.715[1]*	-2.756*
Niger	-7.638[0]***	-7.980***	-1.957[0]	-2.062	-3.270[0]**	-3.168**	-1.502[0]	-1.311
Nigeria	-4.389[ ]***	-4.332***	-4.151[]***	-4.099***	-5.832[0]***	-6.040***	-3.584[0]***	-3.668***

Sudan	-6.113[ ]***	-6.710***	-2.306[]	-2.252	-4.723[0]	-4.688***	-2.326[0]	-2.221
Senegal	-5.407[ ]***	-5.449***	-3.615[]***	-3.547***	-4.299[1]***	-4.152***	-2.507[0]	-2.563
Sierra Leone	-4.758[1]***	-4.396***	-4.669[0]***	-4.620***	-3.780[0]***	-3.776***	-3.122[0]**	-3.138**
Tanzania	-3.448[0]**	-3.486**	-4.749[1]***	-4.741***	-4.047[1]***	-4.039***	-5.348[0]***	-5.589***
Uganda	-4.784[0]***	-4.799***	-4.145[0]***	-4.312***	-3.971[0]***	-3.860***	-1.784[1]	-1.731
South Africa	-2.635[0]	-2.711	-3.742[0]***	-3.644***	-5.625[0]***	-5.633***	-1.695[1]	-1.631
Zambia	-5.067[0]***	-5.120***	-3.722[1]***	-3.805***	-5.351[0]***	-5.356***	-2.914[0]*	-2.946*
Zimbabwe	-3.417[0]**	-3.467**	-4.119[0]***	-3.967***	-3.614[0]***	-3.453***	-2.894[0]**	-2.902**

Notes: Unit root results for the first difference of variables in each country. Optimal lag in square brackets [ ] for ADF test. PP tests the automatic bandwidth selection- Newey West. (***), (**) and (*) denote rejection at 1%, 5% and 10%.

Panel Unit Root Test Results

The results of the panel unit root test presented in Table 5.4 indicate that all variables exhibit I (1) properties. There is evidence of unit root for all variables in the panel at the 5% significance level. The results indicate that when taken as a panel, LGDPPC, LFD, LINS and LCKPPC are not stationary at level but become stationary when their first differences are taken. Table 5.4 is a presentation of the results of the panel unit root tests. All variables are therefore taken as being integrated of order one. This condition of variables possessing I (1) properties in all the tests theoretically allows for panel cointegration estimation.

Table 5.4: Panel Unit Root Tests

	ADF - Fisher Chi-square (1999)	PP - Fisher Chi-square (1999)	Im, Pesaran and Shin W-stat (2003)	Breitung t-test (2000)	Levin, Lin and Chu t*stat (2002)
LGDDPC	29.8961	38.6969	1.9895	2.9606	-0.1249
	(0.9192)	(0.6168)	(0.9767)	(0.9985)	(0.4503)
ΔLGDPPC	149.311***	477.161***	-8.4802***	-4.2727***	-6.1769***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
LINS	29.2009	25.7276***	-1.4253	-0.6179	-1.2099
	(0.9773)	(0.0001)	(0.923)	(0.2683)	(0.1132)
ΔLINS	207.591***	669.400***	-12.0400***	-14.101***	-12.912***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
LFD	30.8007	21.9946	-1.1749	-1.1104	-1.2239
	(0.1105)	(0.8992)	(0.8800)	(0.1334)	(0.1105)
ΔLFD	-176.751***	262.310***	-10.1400***	-9.0682***	-10.680***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
LCKPP	27.6047	40.9728	4. 1464	8.64375	1.2849
	(0.9575)	(0.516)	(1.0000)	(1.0000)	(0.9006)
ΔLCKPP	55.5972*	78.2210***	-1.8385**	-3.4371***	-1.6545**
	(0.0779)	(0.0006)	(0.0330)	(0.0003)	(0.0490)

Notes: Panel unit root testing results. Trend assumption: Deterministic intercept and trend; User-specified lag length: 1; Newey-West automatic bandwidth selection and Bartlett kernel. (***), (**) and (*) denote rejection at 1%, 5% and 10%, respectively

5.3.4 Cointegration Testing Results

Individual Country Results

Estimates from the Engle-Granger cointegration test presented on Table 5.5 shows that five out of the ten countries had variables that were cointegrated. These include Gambia and Madagascar at the 5% level of significance; Mali and Nigeria at the 10% level of significance and Tanzania at 1% significance level. The results for the Johannsen cointegration tests presented in Table 5.5 indicate that, whilst eight out of the ten countries have variables that are cointegrated at the 5% level of significance, two countries (Kenya and Zimbabwe) depict cointegration at 10% level of significance based on the MacKinnon (1990; 2010) probability values (Cheung and Lai, 1993). The eight countries include Gambia, Mali, Madagascar, Malawi, Nigeria, Sierra Leone, Tanzania and Zambia.

Using the Trace statistics, Gambia and Tanzania had two cointegrating and three cointegrating equations, respectively. All the rest had only one cointegration equation. The Maximum Eigenvalue statistics indicated that Gambia, Tanzania and Madagascar had two cointegration equations whilst Mali, Malawi, Sierra Leone, Nigeria and Zambia have one cointegration relationship. Hence, for the individual estimations, the results showed that, out of 21 SSA countries, about a third rejected the null of no cointegration when TFP was decomposed to include an enhanced financial development measure called IQLEG. These results are in line with the findings of Abu-Bader and Abu-Qarn (2008), Ang and Mckibbin (2007), Choe and Moosa (1999) and Odedokum (1996).

Table 5.5: Time Series Cointegration Testing Results

Country	Johansen						Engle-Granger
	Trace Statistics	Probability	Number of Cointegrated	Max-Eigen Statistics	Probability	Number of Cointegrated	Z(t) Statistics
Gambia	77.5153***	0.0024	2	33.7554**	0.0313	2	-4.938**
Kenya	70.8148**	0.0116	1	30.9549*	0.0688	2	-2.714
Madagascar	86.6986***	0.0002	2	44.7245***	0.0009	2	-4.855**
Mali	64.0730**	0.0481	1	36.0533**	0.0156	1	-4.623**
Malawi	69.6722**	0.0150	1	34.2848**	0.0267	1	-3.639
Nigeria	82.2223***	0.0007	2	40.4811***	0.0038	1	-3.499
Sierra Leone	70.4624**	0.0126	1	42.9532***	0.0016	1	-2.670
Tanzania	96.318***	0.0000	3	39.5329***	0.0052	3	-3.764
Zambia	75.5469***	0.0038	1	36.0509**	0.0157	1	-3.055
Zimbabwe	60.7774*	0.0887	1	29.9820*	0.0891	1	-2.417

Note: This table presents the results of individual country cointegration tests: (***), (**) and (*) denote rejection at 1%, 5% and 10%, respectively. The Engle-Granger critical values from MacKinnon (1990, 2010) are -5.289 for 1%, -4.483 for 5% and -4.095 for 10%. P-values in the Johansen tests indicate the presence of cointegration.

Panel Cointegration Tests Results

The results of the Pedroni (1999, 2004) panel cointegration test conducted (Table 5.6) support the hypothesis that there is no cointegration between the variables. More importantly, these results do not support the Rodrik (2000) hypothesis regarding institutions for high quality growth. There is rather an indication that financial development does not have a long-run association with economic growth in the selected SSA countries. The result further shows that, even when enhanced by institutional quality, financial development is still not cointegrated with growth within the framework of enhancing the efficiency and productivity of factors of production and hence growth. Indeed, based on the results from five out of the seven Pedroni (1999) statistics, there is no significant association between per capita gross domestic product, financial development, institutional quality and capital in the selected countries.

Table 5.6: Pedroni (1999, 2004) Panel Cointegration Test

Test	Statistic	Probability
Panel v-Statistic	0.6284	0.2649
Panel rho-Statistic	1.7295	0.9581
Panel PP-Statistic	-0.4158	0.3388
Panel ADF-Statistic	-0.1777	0.4295
Group rho-Statistic	2.8299	0.9977
Group PP-Statistic	-2.4498	0.0071
Group ADF-Statistic	-1.8161	0.0347

Trend assumption: Deterministic intercept and trend; User-specified lag length: 1; Newey -West automatic bandwidth selection and Bartlett kernel. (***), (**) and (*) denote rejection at 1%, 5% and 10%, respectively.

Westerlund Cointegration Test Results

In line with the school of thought that finds no relationship between finance and growth, the Westerlund (2005) cointegration test results presented on Table 5.7 provide further support for the hypothesis that there is no cointegration between finance and growth even when conditioned on institutional quality for the 21 African countries when taken as a panel. The probability values indicate that there is no significant long-term relationship among the variables.

Table 5.7: Westerlund (2005) Cointegration Test Results

	Statistic	p-value
Panel-specific-AR	-0.448	0.3271
Same-AR	-0.3238	0.3731

Trend assumption: Deterministic intercept and trend. Trend assumption:
(***), (**) and (*) denote rejection at 1%, 5% and 10%, respectively

The panel results support the findings of Menyah, Nazlioglu and Wolde-Rufael (2014) and conflicts with the findings of Akinci, Akinci and Yilmaz (2014) for OECD member countries from 1980-2011. The assertion by Murindhe (2012) on institutional factors that, although banks play the special role as financial intermediaries and information processors, their incentives, capacity and efficiency to carry out their function are subject to the rules that govern and shape the interactions among banks, borrowers and other players in the market place, would be questioned based on the results.

The results neither support nor uphold Rodrik's (2000) hypothesis that the institutions used in the model are institutions for high quality growth. The non-association between the variables in the long-run can be assessed from the peculiar characteristics associated with the geographic region the panel comes from. SSA is marked by many structure changing events including wars, political instability, natural disasters, disease outbreaks and economic booms and dooms among others. Perhaps, neglecting the effect of these events in estimations may have an impact on the outcomes.

These results for the entire panel of 21 countries therefore, bring the issue of structural breaks into question. The need to test for panel cointegration with the same data and variables in the presence of structural breaks cannot be overemphasized. With respect to the overall objective of the thesis, the results indicate that the panel of variables, namely financial development, institutional quality and capital stock, are not cointegrated with economic growth as measured by GDP per capita for the 21 sub-Saharan African countries between 1985 and 2015 in the Cobb-Douglas production framework based on the Solow (1956) model. Hence, the hypothesis of finance catalysing the growth of the economy through productivity when enhanced by adequately working institutions, is not supported.

Indeed, the assertion by Robinson (1952), Lucas (1988) and Stein (1989) that finance and growth have no significant relationship is supported. This finding is in line with Shan and Morris (2002) who found no association between finance and growth in 19 OECD nations and China. Boulila and Trabelsi (2004) do not find any associations between finance and growth in MENA countries as well as Nyamongo, Misati, Kipyegon and Ndirangu (2012) who found very weak evidence in support of the finance-growth relationship in a sample of 36 African countries.

Comparing this result further to the school of thought in the literature that a well-developed financial sector is a key feature of economic growth, is not supported. Given that the presence of cointegration implies a long-run association and relationship among variables, the expectation was that these SSA countries would demonstrate such a positive association among the production function variables and enhance efficiency. It is important to note that, although broad consensus among economists has been reached on the positive relationship between a country's level of financial development and its rate of economic growth, there is less consensus on explaining the high degree of variance in financial development across countries (Haber, 2008).

5.3.4 Cointegration Regression Coefficients and Error Correction

The results from the individual country cointegration estimations provide support for the lack of a significant panel cointegration relationship among the variables. This is because 11 out of the 21 countries did not provide evidence of cointegration among variables. The 10 countries that found cointegration among variables are thus estimated for the cointegration long-run relationships among variables with both an OLS and a FMOLS estimator. Table 5.8 provides details of the existing relationships between variables in Gambia, Kenya, Madagascar, Mali, Malawi, Nigeria, Sierra Leone, Tanzania, Zambia and Zimbabwe.

Time Series Cointegration Relationship

Results from the OLS and FMOLS estimators presented in Table 5.8 indicate that, for Nigeria, Kenya and Zambia, all parameters are highly statistically significant in line with theoretical predictions from the Solow Neoclassical growth model and empirical findings of Demetriades and Law (2006), Rodrik (2000) and Levine (2005) among others. The results from the FMOLS estimator for Tanzania show that all variables are statistically significant. The financial development indicator was not significant in Madagascar and Gambia for the FMOLS estimator.

With respect to the institutional quality measure, no significant relationship was found for Sierra Leone, Malawi and Gambia for both estimators while the OLS results further indicated that institutional quality was not significantly associated with growth in Zimbabwe, Tanzania and Mali. Capital was found to be insignificant under the FMOLS estimator in Mali and Zimbabwe. It is interesting to note that, for every country and in applying both estimators, the coefficient of technological progress, which is the time trend, is positive and highly statistically significant, although the magnitudes of the parameters are relatively small.

In contrast to theoretical predictions, financial development in Kenya, Nigeria and Zimbabwe had a negative but significant relationship with economic growth. This is in line with the findings of Bezemera, Grydakib and Zhanga (2014), Rousseau and Wachtel (2011) and Ketteni, Mamuneas, Stengos and Savvides (2007). Reasons attributed for such findings include the possibility of changing the focus of credit away from non-financial business and towards real estate asset markets, accumulated short-run effects of financial crises and the vanishing effect of financial development when the relationship is possibly non-linear (Arcand, Berkes and Panizza, 2015; Ketteni *et al.*, 2007). Valickova, Havranek, and Horvath (2015) attribute the negative or insignificant effect of financial development on growth to a phenomenon that started in the 1990s as a possible of increasing sophistication of financial systems, which in turn increased the risks of adverse effects.

For Kenya and Gambia, institutional quality was found to have a negative but statistically significant relationship with growth. These findings are in line with Kandi (2009) and Olson (1992; 1996). The negative and statistically significant coefficient indicates deterioration in institutional quality, a situation that may provide opportunities for connected businesses from the politically elite and interest groups who have motivation to lobby the government in solely their favour, affecting the state effectiveness to deal with market failure and potentially adversely affect economic prosperity. The Akaike Information Criterion (AIC) and the Bayesian Information Criterion are used to select the best model for each country. The results indicated that the OLS estimator was the better model for Gambia, Kenya, Madagascar, Mali and Zambia. The FMOLS estimator was thus the better model for Tanzania, Zimbabwe, Sierra Leone, Malawi and Nigeria.

Table 5.8: Time Series Cointegration Regression for Cointegrated Variables

Country	OLS					FMOLS				
	LFD	LINS	LCKPP	TIME TREND	AIC BIC	LFD	LINS	LCKPP	TIME TREND	AIC BIC
Gambia	0.1918**	0.0	-0.1914***	0.0045***	**-2.8170**	0.1412	-0.0957	-0.1987***	0.0048***	-2.7577
	(0.0927)	(0.1550)	(0.0162)	(0.0004)	**-2.6320**	(0.0922)	(0.1405)	(0.0143)	(0.0004)	-2.5975
	[2.0700]	[0.0825]	[-11.8517]	[11.4673]		[1.5308]	[-0.6816]	[-13.8772]	[12.7940]	
Kenya	-0.4903***	-0.3098***	0.2601***	0.0048***	**-3.3245**	-0.5069***	-0.3927***	0.2355***	0.0050***	-2.9166
	(0.1118)	(0.0988)	(0.0450)	(0.0003)	**-3.1394**	(0.1465)	(0.1292)	(0.0586)	(0.0004)	-2.7565
	[-4.3840]	[-3.1364]	[5.7871]	[16.2354]		[-3.4599]	[-3.0400]	[4.0219]	[12.7683]	
Madagascar	0.0526	0.2697***	-0.2022***	0.0026***	**-3.8096**	0.1264	0.2890***	-0.2304***	0.0024***	-3.1854
	(0.0936)	(0.0680)	(0.0377)	(0.0002)	**-3.6245**	(0.0940)	(0.0669)	(0.0392)	(0.0002)	-3.0252
	[0.5621]	[3.9644]	[-5.3617]	[11.3169]		[1.3448]	[4.3206]	[-5.8823]	[10.5382]	
Mali	0.6847***	0.0962	0.0463	0.0016***	**-3.4915**	0.7836***	0.1643**	0.0136	0.0012***	-3.0121
	(0.1275)	(0.0681)	(0.0327)	(0.0003)	**-3.3064**	(0.1316)	(0.0710)	(0.0339)	(0.0003)	-2.8519
	[5.3686]	[1.4135]	[1.4160]	[4.6817]		[5.9539]	[2.3151]	[0.4000]	[3.6335]	
Malawi	0.3672***	-0.0295	0.1595***	0.0022***	-2.5398	0.4133***	-0.0020	0.1628***	0.0021***	**-2.5864**
	(0.1055)	(0.0904)	(0.0391)	(0.0002)	-2.3548	(0.0846)	(0.0732)	(0.0312)	(0.0002)	**-2.4262**
	[3.4805]	[-0.3263]	4.0805	[9.7503]		[4.8883]	[-0.0278]	[5.2246]	[11.4854]	
Nigeria	-0.2821***	0.3743***	0.2534***	0.0036***	-2.3252	-0.2932**	0.4829***	0.2612***	0.0035***	**-2.4877**
	(0.1241)	(0.1116)	(0.0263)	(0.0003)	-2.1402	(0.1330)	(0.1228)	(0.0283)	(0.0004)	**-2.3275**
	[-2.2724]	[3.3523]	9.6339	[11.1219]		[-2.2053]	[3.9310]	[9.2334]	[9.8178]	
Sierra Leone	0.1677***	0.0896	-0.0975***	0.0026***	-1.4552	0.2349***	0.0425	-0.0853***	0.0025***	**-1.9343**
	(0.0582)	(0.0917)	(0.0238)	(0.0001)	-1.2702	(0.0678)	(0.1074)	(0.0295)	(0.0001)	**-1.7742**
	[2.8817]	[0.9773]	[-4.0941]	[31.2040]		[3.4640]	[0.3955]	[-2.8896]	[26.2199]	
Tanzania	0.7216***	0.1249	0.1640***	0.0013***	-3.1490	0.7061***	0.1446***	0.1842***	0.0013***	**-3.2326**
	(0.0945)	(0.0767)	(0.0260)	(0.0001)	-2.9640	(0.0816)	(0.0619)	(0.0235)	(0.0001)	**-3.0724**
	[7.6396]	[1.6296]	[6.3025]	[10.4137]		[8.6499]	[2.3367]	[7.8450]	[11.8268]	
Zambia	0.2692***	-0.4038***	0.1568***	0.0035***	**-2.9167**	0.2810***	-0.4497***	0.1831***	0.0035***	-2.6935
	(0.0251)	(0.0970)	(0.0292)	(0.0002)	**-2.7316**	(0.0257)	(0.0992)	(0.0298)	(0.0002)	-2.5333
	[10.7045]	[-4.1635]	[5.3682]	[22.4675]		[10.9420]	[-4.5352]	[6.1480]	[22.1607]	
Zimbabwe	-0.9314***	-0.3783	0.2800**	0.0060***	-0.0153	-0.7548*	-0.1396	0.2251	0.0053***	**-1.2154**
	(0.2744)	(0.2426)	(0.1233)	(0.0009)	0.1698	(0.4220)	(0.3728)	(0.1904)	(0.0013)	**-1.0552**
	[-3.3937]	[-1.5592]	[2.2709]	[6.9657]		[-1.7888]	[-0.3745]	[1.1820]	[3.9866]	

Notes: Individual cointegration relationships. (***), (**) and (*) denote rejection at 1%, 5% and 10%, respectively, HAC Newey-West st. errors in ( ) and t-statistics in [ ]

Error Correction Term

The error correction term for all ten countries that are found to have a cointegrating relationship provide support for a long-run equilibrium relationship (Table 5.9). All the nine countries show that, in the long-run, the speed of adjustment for variables towards equilibrium is negative, less than one and significant. The country with the highest adjustment factor was Gambia, which shows that 89.6% of disequilibrium in the system is corrected within a year. Madagascar followed with a high speed of adjustment of 86.9%. The lowest error correction term is for Zimbabwe, which shows that only 37.6% of disequilibrium is corrected within a year at the 5% level of significance. The error correction modelling therefore supports the notion of convergence for variables to reach the equilibrium point in the long-run, albeit at different speeds (Westerlund and Edgerton, 2008; Maysami and Koh, 2003).

Table 5.9 Speed of Adjustment for Individual Countries

Country	ECT	T-Statistic	Country	ECT	T-Statistic
Gambia	-0.896***	-4.94	Nigeria	-0.395***	-3.50
Kenya	-0.410**	-2.71	Sierra Leone	- 0.395**	-2. 67
Madagascar	-0.869***	-4.62	Tanzania	-0.647***	-3.05
Mali	-0.572***	-3.64	Zambia	-0.481***	-3.05
Malawi	- 0.590***	-3.50	Zimbabwe	-0.376**	-2.42

Note: ****, ** and * denote statistic significant at 1%, 5% and 10% level, respectively. ECT refers to Error correction term or speed of adjustment.

5.3.5 The Cobb-Douglas Production Function-TFP, NFP and Contribution of IQLEG to Productivity for Individual Countries

To establish the role of IQLEG in contributing to higher productivity levels over that attributable to pure technical progress, the Cobb-Douglas production function in each country whose variables are cointegrated is estimated. The levels of productivity due to institutional quality linked efficiency gain (CIQLEG), technical progress (NFP) and total factor productivity (TFP) are calculated based on the coefficients from the regression in Table 5.9. The results for three countries, Mali, Tanzania and Zimbabwe are presented in Table 5.10- Panels A, B and C and Figures 5.1, 5.2 and 5.3. The remaining tables and graphs can be found in Appendix C. The choice of these three countries is as a result of randomly selecting one country whose variables were found to be cointegrated from the western, eastern and southern parts of SSA.

TFP, NFP and Contribution of IQLEG to Productivity in Mali

Table 5.10 Panel A reports the levels and growth rates of TFP, NFP and IQLEG. The contribution of IQLEG is further depicted in Figure 5.1. The level of IQLEG in TFP was about 50.98%. This contribution of IQLEG to TFP is relatively consistent throughout the period under study for Mali with the highest contribution in terms of magnitude being in 2014 followed by 2007. The contribution of IQLEG to total factor productivity increased steadily from 1997 to 2015. However, the contribution dropped during the 1989 to 2000 period after which it started rising consistently until 2013 when it fell marginally in 2014 and 2015.

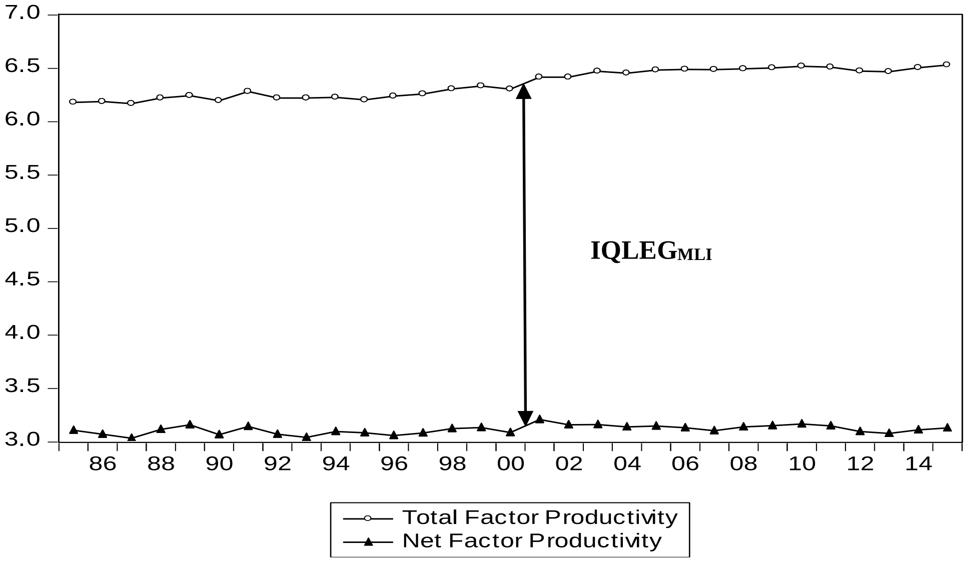
Table 5.10 Panel A**:** Productivity Estimations for Mali

Levels of NFP, TFP and CIQLEG				**Growth Rates of NFP, TFP and CIQLEG**			
Year	TFP_{MLI}	NFP_{MLI}	$IQLEG_{MLI}$	Year	$GTFP_{MLI}$	$GNFP_{MLI}$	$GIQLEG_{MLI}$
1985	6.1806	3.1087	3.0719	1985	na	na	na
1986	6.1874	3.0718	3.1157	1986	0.0068	-0.037	0.0438
1987	6.1685	3.0348	3.1337	1987	-0.0189	-0.0369	0.0180
1988	6.2224	3.1174	3.1050	1988	0.0539	0.0826	-0.0287
1989	6.2442	3.1607	3.0836	1989	0.0218	0.0433	-0.0215
1990	6.1964	3.0685	3.1279	1990	-0.0478	-0.0922	0.0443
1991	6.2823	3.145	3.1373	1991	0.0859	0.0765	0.0094
1992	6.2221	3.0713	3.1507	1992	-0.0603	-0.0737	0.0134
1993	6.2215	3.0418	3.1797	1993	-0.0006	-0.0295	0.0289
1994	6.2271	3.0973	3.1298	1994	0.0056	0.0555	-0.0499
1995	6.2040	3.0862	3.1178	1995	-0.0231	-0.0111	-0.0120
1996	6.2398	3.0608	3.1791	1996	0.0358	-0.0255	0.0613
1997	6.2598	3.0840	3.1758	1997	0.0200	0.0232	-0.0033
1998	6.3060	3.1255	3.1805	1998	0.0462	0.0415	0.0046
1999	6.3338	3.1346	3.1991	1999	0.0278	0.0091	0.0187
2000	6.3044	3.0884	3.2160	2000	-0.0294	-0.0462	0.0168
2001	6.4172	3.2097	3.2075	2001	0.1128	0.1213	-0.0084
2002	6.417	3.1611	3.2559	2002	-0.0002	-0.0485	0.0483
2003	6.4723	3.1629	3.3094	2003	0.0553	0.0018	0.0535
2004	6.4543	3.1399	3.3144	2004	-0.0181	-0.0231	0.0050
2005	6.4828	3.1477	3.3351	2005	0.0285	0.0078	0.0207
2006	6.4902	3.1322	3.3581	2006	0.0074	-0.0155	0.0229
2007	6.4865	3.1044	3.3821	2007	-0.0038	-0.0278	0.0240
2008	6.4954	3.1411	3.3543	2008	0.0089	0.0367	-0.0278
2009	6.5036	3.153	3.3506	2009	0.0082	0.0119	-0.0038
2010	6.5185	3.1692	3.3493	2010	0.0149	0.0161	-0.0012
2011	6.5114	3.1496	3.3618	2011	-0.0072	-0.0196	0.0124
2012	6.4742	3.0971	3.3771	2012	-0.0372	-0.0525	0.0153
2013	6.4672	3.0807	3.3865	2013	-0.007	-0.0164	0.0095
2014	6.5045	3.1128	3.3917	2014	0.0374	0.0322	0.0052
2015	6.5315	3.1305	3.4010	2015	0.027	0.0177	0.0093
Mean rate	6.3557	3.1158	3.2399	Mean rate	0.0117	0.0007	0.011

Note: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. Note: GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

The highest contribution to the growth of TFP occurred in 1986 with the lowest occurring in 1994. On the average, net factor productivity (NFP) was quite steady and remained above 6 for most of the years. Generally, the productivity growth was positive over the period since about 94% of the growth in TFP is due to growth in levels of IQLEG, all things being equal.

Figure 5.1: TFP, NFP and Contribution of IQLEG to Productivity in Mali



TFP, NFP and Contribution of IQLEG to Productivity in Tanzania

The levels and growth rates are further depicted in Figure 5.2, which indicates the contribution of IQLEG to TFP. IQLEG for Tanzania contributed steadily to TFP in the period under study. From 1985 to 2015 the contribution of IQLEG to TFP rose and increased on the average. The highest contribution in terms of magnitude occurred in 2009 whilst the lowest was in 1986. IQLEG contributed on average to 56.29% of TFP whilst NFP accounted for the rest.

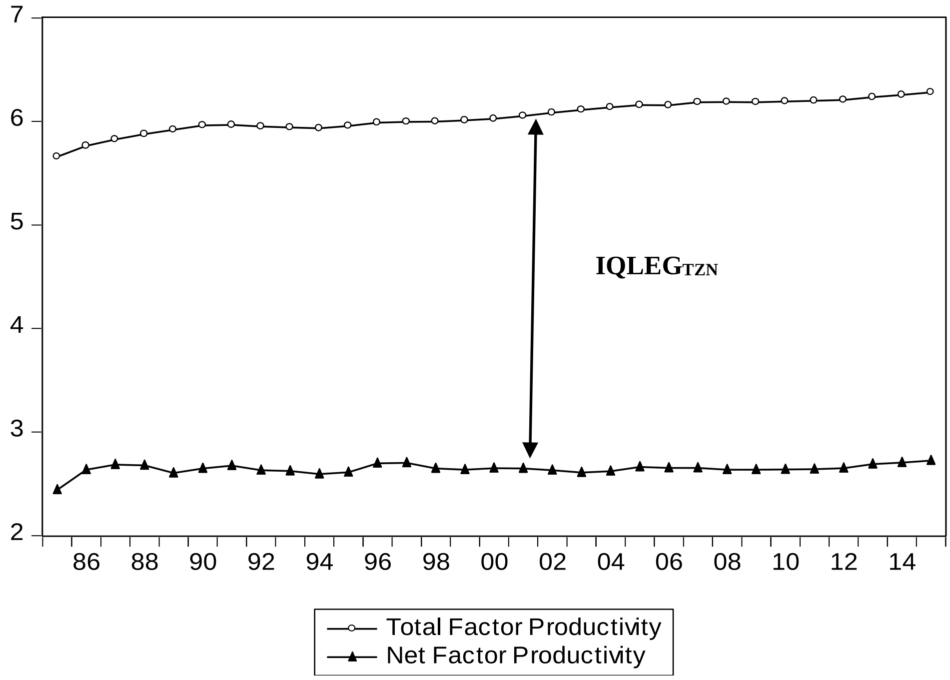
Table 5.10 Panel B: Productivity Estimations for Tanzania

Levels of NFP, TFP and CIQLEG				Growth Rates of NFP, TFP and CIQLEG			
Year	TFP_{TZA}	NFP_{TZA}	$IQLEG_{TZA}$	Year	$GTFP_{TZA}$	$GNFP_{TZA}$	$GIQLEG_{TZA}$
1985	5.6585	2.4425	3.2161	1985	na	na	na
1986	5.7650	2.6349	3.1300	1986	0.1064	0.1925	-0.0861
1987	5.8266	2.6846	3.1419	1987	0.0616	0.0497	0.0119
1988	5.8761	2.6774	3.1987	1988	0.0495	-0.0073	0.0568
1989	5.9184	2.6044	3.3140	1989	0.0423	-0.0730	0.1153
1990	5.9613	2.6472	3.3141	1990	0.0429	0.0428	0.0001
1991	5.9654	2.6750	3.2904	1991	0.0041	0.0278	-0.0237
1992	5.9514	2.6304	3.3210	1992	-0.0140	-0.0445	0.0306
1993	5.9408	2.6230	3.3178	1993	-0.0106	-0.0074	-0.0032
1994	5.9348	2.5942	3.3406	1994	-0.0060	-0.0288	0.0228
1995	5.9551	2.6109	3.3442	1995	0.0203	0.0167	0.0036
1996	5.9873	2.6974	3.2900	1996	0.0322	0.0864	-0.0542
1997	5.9950	2.7030	3.2920	1997	0.0077	0.0056	0.0021
1998	5.9980	2.6469	3.3510	1998	0.0029	-0.0561	0.0590
1999	6.0107	2.6352	3.3755	1999	0.0128	-0.0117	0.0245
2000	6.0258	2.6510	3.3748	2000	0.0151	0.0158	-0.0007
2001	6.0510	2.6486	3.4024	2001	0.0252	-0.0024	0.0276
2002	6.0851	2.6302	3.4549	2002	0.0341	-0.0183	0.0525
2003	6.1103	2.6076	3.5027	2003	0.0252	-0.0226	0.0478
2004	6.1365	2.6217	3.5148	2004	0.0262	0.0140	0.0121
2005	6.1576	2.6630	3.4946	2005	0.0211	0.0414	-0.0202
2006	6.1543	2.6522	3.5021	2006	-0.0033	-0.0108	0.0076
2007	6.1855	2.6519	3.5336	2007	0.0312	-0.0003	0.0315
2008	6.1875	2.6356	3.5520	2008	0.0020	-0.0163	0.0183
2009	6.1841	2.6347	3.5494	2009	-0.0034	-0.0008	-0.0026
2010	6.1922	2.6386	3.5535	2010	0.0080	0.0039	0.0041
2011	6.1995	2.6396	3.5599	2011	0.0074	0.0009	0.0064
2012	6.2068	2.6508	3.5559	2012	0.0073	0.0113	-0.0040
2013	6.2336	2.6900	3.5436	2013	0.0269	0.0392	-0.0123
2014	6.2572	2.7048	3.5525	2014	0.0236	0.0148	0.0089
2015	6.2817	2.7235	3.5582	2015	0.0245	0.0187	0.0057
Mean rate	6.0449	2.6436	3.4014	Mean rate	0.0208	0.0094	0.0114

Note: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. Note: GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

With respect to the growth rate of TFP, IQLEG accounted for about 54.81% of the growth. Although the contribution of IQLEG to TFP growth was negative in certain years, the overall contribution was positive in Tanzania over the period. These outputs show that, overall, the institutional quality in Tanzania was important for finance-led productivity over the period.

Figure 5.2: TFP, NFP and Contribution of IQLEG to Productivity in Tanzania



TFP, NFP and Contribution of IQLEG to Productivity in Zimbabwe

The results for Zimbabwe presented in Table 5.10 Panel C shows the levels, contribution and growth rates of IQLEG to TFP. The contribution of IQLEG is further depicted in Figure 5.3. Interestingly, the average contribution of IQLEG to TFP was negative with an average of -3.8103 against a very high NFP averaging 10.6198.

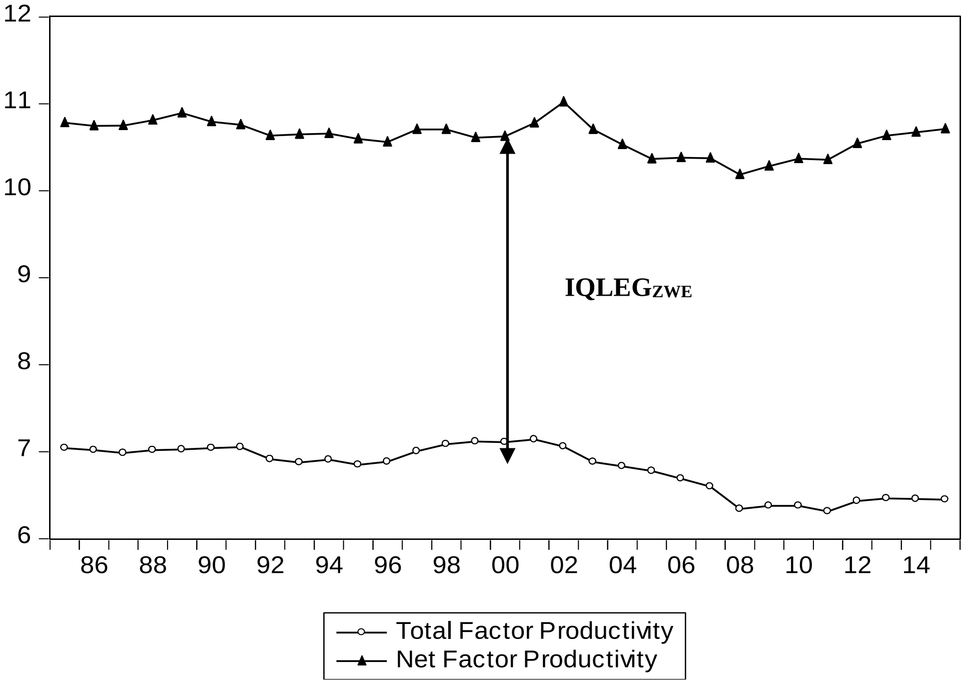
Table 5.10 Panel C**:** Productivity Estimations for Zimbabwe

Levels of NFP, TFP and CIQLEG				**Growth Rates of NFP, TFP and CIQLEG**			
Year	TFP_{ZWE}	NFP_{ZWE}	$IQLEG_{ZWE}$	Year	TFP_{ZWE}	NFP_{ZWE}	$IQLEG_{ZWE}$
1985	7.0403	10.7816	-3.7414	1985	na	na	na
1986	7.0166	10.7486	-3.7319	1986	-0.0236	-0.0331	0.0094
1987	6.9855	10.7499	-3.7644	1987	-0.0311	0.0014	-0.0325
1988	7.0154	10.8107	-3.7952	1988	0.0300	0.0607	-0.0308
1989	7.0250	10.8942	-3.8692	1989	0.0096	0.0835	-0.0739
1990	7.0412	10.7936	-3.7524	1990	0.0162	-0.1006	0.1168
1991	7.0510	10.7593	-3.7084	1991	0.0098	-0.0342	0.0440
1992	6.9132	10.6343	-3.7210	1992	-0.1378	-0.1251	-0.0127
1993	6.8738	10.6496	-3.7758	1993	-0.0395	0.0153	-0.0548
1994	6.9081	10.6578	-3.7497	1994	0.0343	0.0083	0.0261
1995	6.8489	10.5957	-3.7468	1995	-0.0592	-0.0622	0.0030
1996	6.8844	10.5618	-3.6774	1996	0.0356	-0.0338	0.0694
1997	7.0036	10.7053	-3.7017	1997	0.1192	0.1435	-0.0243
1998	7.0856	10.7047	-3.6191	1998	0.0820	-0.0006	0.0826
1999	7.1161	10.6125	-3.4964	1999	0.0304	-0.0922	0.1227
2000	7.1081	10.6264	-3.5183	2000	-0.0080	0.0140	-0.0220
2001	7.1399	10.7787	-3.6388	2001	0.0318	0.1523	-0.1205
2002	7.0577	11.0231	-3.9653	2002	-0.0821	0.2444	-0.3265
2003	6.8796	10.7048	-3.8252	2003	-0.1781	-0.3182	0.1401
2004	6.8299	10.5332	-3.7033	2004	-0.0497	-0.1716	0.1219
2005	6.7774	10.3663	-3.5889	2005	-0.0525	-0.1669	0.1144
2006	6.6901	10.3823	-3.6922	2006	-0.0873	0.0160	-0.1033
2007	6.5982	10.3766	-3.7784	2007	-0.0919	-0.0057	-0.0862
2008	6.3416	10.1871	-3.8455	2008	-0.2566	-0.1895	-0.0671
2009	6.3767	10.2852	-3.9085	2009	0.0351	0.0981	-0.0630
2010	6.3773	10.3699	-3.9926	2010	0.0006	0.0847	-0.0841
2011	6.3124	10.3572	-4.0448	2011	-0.0649	-0.0127	-0.0522
2012	6.4317	10.5430	-4.1113	2012	0.1193	0.1858	-0.0665
2013	6.4618	10.6344	-4.1727	2013	0.0301	0.0914	-0.0614
2014	6.4559	10.6723	-4.2165	2014	-0.0059	0.0379	-0.0438
2015	6.4457	10.7131	-4.2675	2015	-0.0102	0.0408	-0.0510
Mean rate	6.8094	10.6198	-3.8103	Mean rate	-0.0198	-0.0023	-0.0175

Note: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. Note: GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

not surprising considering the fact that Zimbabwe has persistently experienced hyperinflation together with other weak macroeconomic indicators and unstable political environment. Within the period, Zimbabwe became a dollarised economy with persistent devaluations of its currency (ww.worldbank.org). Indeed, the results from the cointegration regressions showed a significant but negative relationship between growth and financial development. Overall, the growth rate of TFP, NFP and IQLEG were all negative. Figure 5.3 shows that the contribution of IQLEG is indeed negative as the graph reveals that NFP is higher than TFP.

Figure 5.3: TFP, NFP and Contribution of IQLEG to Productivity in Zimbabwe



5.4 Conclusion

The aim of this chapter was to explore the role played by institutional factors in the finance-growth relationship by estimating the Cobb-Douglas production function using panel and time series cointegration analyses. Twenty-one SSA countries were tested between 1985 and 2015 at both the panel and individual country levels. Using time series and panel cointegration techniques, the research was aimed at establishing a long-run relationship between finance and growth. The research was also purposed to determine the long-run elasticities and the speed of adjustment within the framework of productivity in the Cobb-Douglas production function. The role of institutional quality was examined at both the individual country and panel levels.

With the time series study, 10 out of the 21 countries were tested based on the unit root properties of variables. The results confirmed the theoretical foundations of a relationship between productivity and financial development when institutional quality improves. All the 10 SSA countries provided support to establish a long-run causal relationship between financial development, institutional quality and economic growth. However, with respect to the contribution of IQLEG to higher efficiency levels, the evidence shows the deteriorating role of financial development and institutional quality in Zimbabwe when the Cobb-Douglas production function was estimated. The remaining 9 countries depicted average contributions to IQLEG that is positive.

With respect to the panel estimations however, financial development does not seem to have a significant association with economic growth in the selected SSA countries. This result contrasts the findings of Fernández and Tamayo (2015), Gries, Kraft and Meierrieks (2009), Baltagi, Demetriades and Law (2009), Cavallo *et al*, (2017), Kendall (2012) and King and Levine (1993a). Indeed, based on the definition of financial development by Levine (2005), at the panel level, the results do not direct policy makers to the need for better and more finance to ensure the economic goal of improving living standards as measure by economic growth and development.

The fact that, even when finance is conditioned on adequately working institutions, there is still no relationship at the panel level is significantly important. Interestingly, at the individual country level, eight countries provide proof of cointegration between economic growth, financial development, capital stock and institutional quality. Based on the 10 countries used, the time series results are in agreement with the relationship between finance and growth school of thought (Levine, Loayza and Beck, 2000; Pagano, 1993; Demetriades and Law, 2006).

Regarding the role institutional quality is meant to play, that is, reducing the transaction costs and subsequent risks associated with allocating resources and enhancing efficiency through TFP, the results are contrary to Acemoglu, Johnson and Robinson (2004), Djankov, McLeish and Shleifer (2007) as well as Anayiotos and Toroyan (2009) to mention a few who support the notion that institutions have a positive effect on finance, which then translates into higher and better growth. The results support the findings of Gries, Kraft and Meierrieks (2010) and Menyah, Nazlioglu and Wolde-Rufael (2014) that financial development and economic growth do not share a significant long-run relationship for most of the countries taken from SSA even in the presence of institutions. These results contrast both the theoretical and empirical school of thought that the variations in the performance and development of the financial markets across countries is mainly due to the strength of a country's institutions (Shleifer and Vishny, 1997; Osili and Paulson, 2008; Levine, Loayza and Beck, 2000, 2000).

Firstly, there is a possibility that the structure of the financial systems in each of these countries may be organized differently. Another reason could be the fact that the type of institutions applied in tests could be different from others both in measure and content. Thirdly, it is possible that the absence of structural breaks in the dataset and model could adversely impact the true outcomes of the study. Since the countries involved, and indeed the SSA region as a whole, witnessed many unanticipated and unplanned events that can be identified as structure-changing for their economies (civil wars, ethnic conflicts, political instability and regime changes, democratization, financial and economic liberalization and natural disasters among others), it is important to include the effect of these events in modelling the relations and associations among variables.

From a sub-regional policy perspective, seeking to make financial development more effective by solely concentrating on institutional environment may not yield the desired results. Although it is necessary for SSA, fundamental determinants of growth such as the development of the financial system and adequately working institutions may need to be viewed in line with historical and possible future events in order to fully glean the benefits of growth for the sub-region as whole. With regards to policy on a country by country basis, some countries (e.g. Senegal) may need to pay attention to the quality of the financial system through adequately working institutions such as those proposed by Rodrik (2000) to increase productive efficiency and overall high-quality growth.

CHAPTER SIX

INSTITUTIONAL QUALITY IN THE FINANCE-GROWTH NEXUS IN SUB-SAHARAN AFRICA - A COINTEGRATION ANALYSIS WITH STRUCTURAL BREAKS

6.1 Introduction

This chapter is an investigation into the finance, institutions and growth relationship in the presence of structural breaks and cross-sectional dependency. Panel and individual country cointegration analyses with endogenously determined single and multiple unknown level, trend and regime structural breaks are estimated for financial development, institutional quality, capital and economic growth. Cross sectional dependency is incorporated into modelling the cointegration relationship at a deeper level by estimating and accounting for common factors in panel estimations. The Cobb-Douglas production function with structural breaks is estimated and the productivity levels estimated. (You and Sarantis, 2013; Banerjee and Carrion-i-Silvestre, 2015; Gregory and Hansen, 1996; Hatemi-J, 2008). The goal here is to determine whether IQLEG contributes to productivity higher productivity levels over and above that of pure technical when structural breaks are considered for the panel of 21 SSA countries and for some individual countries.

The results of the tests reveal that, at the panel level, with the inclusion of structural breaks in the level and trend of the data, the null of non-cointegration cannot be rejected. However, upon taking cross-sectional dependence into account, the results change to establish the presence of cointegration with both a level break and a regime shift. However, tests applied to the individual countries provide evidence for cointegration in only four out of ten countries with a level, trend and regime shift and six out of ten countries when the regime shift is increased to two. Apart from evidence of long-run relationships among economic growth, financial development, institutional quality and capital stock, the research confirmed that the level of productivity for the panel increases with IQLEG making significant contributions to TFP in SSA over the period.

The rest of the chapter is sectionalized as follows: the analytical model and a brief empirical methodology will be discussed. The next section entails estimations followed by the presentation and analysis of the findings. The last section will conclude and recommend ways in which the research could be extended and conducted in the future.

6.2 Empirical Methodology -Summary

Based on the empirical methodology discussed in Chapter Four, this section presents a summary of the analytical tools and techniques used to estimate the main analytical framework, which is the Cobb-Douglas production function with TFP decomposed into NFP and IQLEG. The extension to the previous chapter is the incorporation of structural breaks and cross-sectional dependency. In the presence of structural breaks, the models to be estimated are stated below:

Model 1: Constant, time trend with change in level

$y_{i,t} = \mu_i + \beta_i t + \alpha_i D_{i,t} + \delta_i' X_{i,t} + e_{i,t} \quad i = 1,2,\dots,N$ and $t = 1,2,3,\dots,T$ (panel data)

$y_t = \mu + \beta t + \alpha D_t + \delta' X_t + e_t \qquad t = 1,2,3,\dots,T$ (time series)

Model 2: Constant, time trend with change in both level and regime

$y_{i,t} = \mu_i + \beta_i t + \alpha_i D_{m,i,t} + \delta_i' X_{i,t} + \gamma_i' X_{i,t} D_{m,i,t} + e_{i,t}$ $i = 1,2,\dots,N,$ $m = 1,2$ and $t = 1,2,3,\dots,T$ (panel data)

$y_t = \mu + \beta t + \alpha D_{m,t} + \delta' X_t + \gamma X_t D_{m,t} + e_t$ $t = 1,2,3,\dots,T$ (time series)

Where y_{it} is the dependent variable for each i at time t $(lnGDPPC)$; $X_{i,t}$ is an $(T \times 3N)$ dimensional matrix of 3 independent variables $(lnINS, lnFD\ and\ lnCKPP)$, μ is the intercept term, δ is the slopes of $(T \times 3N)$ dimensional matrix of 3 independent variables, γ the slope of the shift in the coefficient vector and *t* represents the time index. m is the number of breaks, $D_{i,t}$ are dummy variables with τ being the break point are defined as $D_{i,t} = \begin{cases} 0 & if \quad t \le \tau \\ 1 & if \quad t > \tau \end{cases}$

Based on the estimation of these models, the contribution of IQLEG to TFP will be determined at the panel and time series levels by calculating the relevant efficiency level as discussed in Section 2.8 of Chapter Two. A summary of the econometric analyses used is provided next.

6.2.1 Unit Root and Stationarity Tests

Time Series Unit Root Tests with a Structural Break

Both the individual and panel unit root tests and stationarity tests are conducted to ascertain the presence of unit roots in the series appropriately cater to the possibility of cross-sectional dependence and structural breaks. For the individual countries, the already performed panel IPS (2003) panel unit root test was constructed to partially address the issue of cross-sectional dependence. Secondly, the ILT (2010) test with a break in level has the property to address cross-sectional dependence and the Lee and Strazicich (2004) unit root tests with one structural break in the level of the series is conducted (Salim, Yao and Chen, 2017). At the panel level, the Carrion-i-Silvestre, Barrio-Castro and Lopez-Bazo (2005) test, which is adjusted for cross-sectional dependence. This test is general enough to allow for the structural changes to shift the level and the trend of the individual time series. In this test, the option of two-level breaks in the trend function is adopted.

6.2.2 Stability Tests

To establish the need to include structural breaks in the model, the strategies used by Westerlund (2006a), Narayan (2010), You and Sarantis (2012) and Banerjee and Carrion-i-Silvestre (2015) to test for evidence of parameter instability are adopted. First, the Gregory and Hansen (1996) test for a structural change in the cointegration relationship was used to test for parameter instability with one structural break that affects the level of the model. Then the Engle-Granger ADF t-ratio from the previous section without breaks was compared to the ADF t-ratio and Z_t statistic from the Gregory and Hansen test. These tests provide a unit by unit analysis of the need to allow for the inclusion of structural breaks in the cointegration analysis. The results from the two tests were then compared to the Sup-F instability and Mean-F statistics of Hansen (1992). Having established the presence of parameter instability, conducting the cointegration tests that include structural breaks was justified.

6.2.3 Cointegration Tests with Structural Breaks

Time Series Cointegration tests with Structural Breaks conducted are the Gregory and Hansen (1996) tests involved a break in the level, level with trend and a full structural break (option C/T/S). The Hatemi-J (2008) test involves cointegration in the with two regime shifts. Two panel cointegration tests are conducted. The first is the Westerlund (2006a) with the panel LM test a level break and a level and trend break. Next, the Banerjee and Carrion-i-Silvestre (2015) cointegration test which accounts for both structural breaks and cross-sectional dependence was employed.

Two model specifications were used. The first was the model with a time trend and a change in level but stable cointegrating vector and the second, the model with a time trend and change in both level and cointegrating vector (the slope of trend does not change). In view of the fact that both the Westerlund (2006a) cointegration test and the Banerjee and Carrion-i-Silvestre cointegration test only generate individual country break dates, a Chow test is conducted on the two most frequent structural dates which are then exogenously incorporated as break point estimates for the panel to determine breaks dates across the entire panel.

6.2.4 Long-run Coefficients and Error Correction Term

Having established cointegration, it is important to determine the speed of adjustment as well as the long-run elasticities associated with the cointegration relationships. The speed of adjustment is estimated dynamic fixed effect estimators (DFE) following Pesaran, Shin and Smith (1999), Weinhold (1999) and Salim, Yao and Chen, (2017). The DFE maintains constant slope parameters in the long and short-run. Having established cointegration at the panel and time series levels, the long-run parameters are estimated with panel FMOLS.

6.2.5 Calculation of Efficiency Levels

With the establishment of the presence of two regime breaks through a Chow test, the last stage of the analysis was to estimate the structural break incorporated aggregate Cobb-Douglas production function from which the levels of TFP, NFP and the contribution of (CIQLEG) are determined. Secondly the growth rates of TFP (GTFP), NFP (GNFP) and IQLEG (GCIQLEG) are calculated to provide evidence of the role IQLEG plays in efficiency gains as well as its growth rate in the 21 SSA countries (See Chapter Two, Section 2.8).

6.3 Results

6.3.1 Unit Root Test with Structural Breaks Results

Individual Country Unit Root Test Results

Results from the three-time series unit root tests (Table 6.1 Panels A, B, C, D), namely the Lee and Strazicich (2004) LM unit root test with a level break, the Im, Lee and Tieslau (2010) transformed LM statistic unit root test with a break in level and the ILT (2010) Cross-sectionally Augmented unit root test with a break in the level of a trended model. Ten out of twenty-one countries provided evidence of unit root properties for all variables. Kenya, Mali, Tanzania and Zimbabwe are the countries that exhibit unit root properties with and without structural breaks. The rest of the countries are Cote d'Ivoire, Gabon, Mozambique, Niger, Sudan and South Africa. The importance of structural breaks is confirmed as the results show that structural breaks make a difference in the unit root testing as five countries from the no break tests are eliminated when breaks are introduced.

Table 6.1: Panel A: Unit Root Tests with One Level and Trend Break for LGDPPC

	ILT (2010) Transformed LM			ILT (2010) Cross-sectionally Augmented LM			Lee and Strazicich (2004)		
Country	Transformed LM	Lag	Trend Break	CA	Lag	Trend Break	LM stat	lag	Level Break
Botswana	-5.344	0	2007	-4.795	0	2007	-1.983	1	2008
Cote d'Ivoire	-2.665	0	2007	-2.751	0	2007	-2.108	4	2010
Congo	-3.630	0	2001	-3.538	0	2001	-3.386*	8	2006
Gabon	-2.666	0	2010	-3.802	0	2010	-3.322*	7	2007
Ghana	-5.344	0	2001	-4.984	0	2001	-2.989	5	2010
Gambia	-7.220	4	1992	-7.438	4	1992	-3.357*	0	1998
Kenya	-2.793	0	2005	-2.697	0	2005	-2.670	5	2012
Madagascar	-2.674	3	1997	-2.327	3	1997	-2.856	0	2007
Mali	2.995	3	2009	3.375	3	2009	-3.004	3	2000
Mozambique	-0.334	2	2003	-0.638	2	2003	-3.022	2	2000
Malawi	-5.830	4	1992	-5.877	4	1992	-1.779	7	2000
Niger	-2.945	0	2004	-2.628	0	2004	-1.946	2	1999
Nigeria	-8.387	4	1996	-12.65	4	1996	-2.725	8	2003
Sudan	2.493	2	2008	3.161	2	2008	-2.093	6	2008
Senegal	-0.399	2	2000	-1.196	2	2000	-2.313	2	1996
Sierra Leone	-4.948	4	1995	-4.728	4	1995	-1.993	7	2001
Tanzania	-3.124	0	2003	-2.659	0	2003	-2.683	5	2010
Uganda	-8.278	4	1995	-12.64	4	1995	-1.748	1	2010
South Africa	3.300	3	2007	2.616	3	2007	-2.998	7	2005
Zambia	-4.634	0	1999	-4.614	0	1999	-6.140***	8	1996
Zimbabwe	-4.330	4	1993	-3.943	4	1993	-2.523	5	2011

The critical values for the ILT (2010) tests are -4.904, -3.950 and -3.635 for the 1%, 5% and 10% significant levels, respectively. The Lee and Strazicich (2004) test has -4.239, -3.566 and -3.211 critical values for the 1%, 5% and 10% significant levels, respectively.

Table 6.1: Panel B Unit Root Test with One Level and Trend Break for LFD

	ILT (2010) Transformed LM			ILT (2010) Cross-sectionally Augmented LM			Lee and Strazicich (2004)		
Country	Transformed LM	Lag	Trend Break	CA	Lag	Trend Break	LM stat	lag	Level Break
Botswana	-2.835	0	2006	-3.083*	0	2006	-3.0876*	7	2002
Cote d'Ivoire	-2.130	3	2001	-1.227	3	2001	-2.6096	4	1995
Congo	-4.716**	0	1993	-4.706**	0	1993	-2.7163	3	2008
Gabon	-1.595	0	2002	-1.444	0	2002	-5.3096***	1	2011
Ghana	-2.510	3	1993	-2.220	3	1993	-3.1913	1	1996
Gambia	-1.438	3	2006	-0.958	3	2006	-3.2435*	3	1997
Kenya	-2.215	1	1998	-1.553	1	1998	-3.2858*	6	1997
Madagascar	-4.716**	0	2006	-4.657**	0	2006	-2.5411	3	2003
Mali	2.207	2	2003	1.419	2	2003	-2.0962	4	2002
Mozambique	0.009	2	1994	-0.150	2	1994	-3.1107	8	1999
Malawi	-1.062	1	2006	-1.062	1	2006	-3.1893	7	2000
Niger	-1.280	0	1995	-1.297	0	1995	-3.2829*	6	2004
Nigeria	-4.924***	0	2005	-4.803**	0	2005	-3.3489*	8	2007
Sudan	-1.654	0	1999	-2.910	0	1999	-1.9807	1	2008
Senegal	-4.718**	0	1993	-4.656**	0	1993	-3.4126*	8	1995
Sierra Leone	1.976	2	2006	1.883	2	2006	-2.6029	7	1998
Tanzania	-2.041	3	1998	-0.964	3	1998	-4.2872***	1	2004
Uganda	-5.118***	0	2004	-4.965***	0	2004	-4.7096***	8	2006
South Africa	1.908	2	2001	1.758	2	2001	-2.3888	5	2006
Zambia	-0.006	3	1993	-0.118	3	1993	-2.7668	2	1996
Zimbabwe	-1.009	3	2006	-0.878	3	2006	-3.5357*	1	2009

The critical values for the ILT (2010) tests are -4.904, -3.950 and -3.635 for the 1%, 5% and 10% significant levels, respectively. The Lee and Strazicich (2004) test has -4.239, -3.566 and -3.211 critical values for the 1%, 5% and 10% significant levels, respectively

Table 6.1: Panel C: Unit Root Test with One Level Break for LINS

	ILT (2010) Transformed LM			ILT (2010) Cross-sectionally Augmented LM			Lee and Strazicich (2004)		
Country	Transformed LM	Lag	Trend Break	CA	Lag	Trend Break	LM stat	lag	Level Break
Botswana	-2.836	0	2006	-5.023***	0	2006	-4.6141***	8	2004
Cote d’Ivoire	-1.418	0	1997	-1.925	0	1997	-2.3558	1	2009
Congo	-4.713**	0	1993	-4.578**	0	1993	-1.5889	2	1998
Gabon	-2.030	0	2001	-3.969**	0	2001	-2.9976	2	1991
Ghana	-2.590	0	1993	-2.394	0	1993	-2.1971	1	2002
Gambia	-3.600	0	2005	-5.148***	0	2005	-6.3738***	1	1997
Kenya	-1.336	0	1996	-1.700	0	1996	-3.9800**	4	1995
Madagascar	-4.713**	0	1993	-4.568**	0	1993	-2.2548	8	2004
Mali	-1.819	0	2000	-3.440**	0	2000	-2.4508	7	2011
Mozambique	-2.044	1	1992	-0.718	1	1992	-2.8548	7	2001
Malawi	-3.048	0	2004	-5.067***	0	2004	-3.2384*	8	2001
Niger	-1.278	0	1995	-1.748	0	1995	-5.3590***	8	2005
Nigeria	-4.504**	0	1992	-4.356**	0	1992	-2.7590	8	2010
Sudan	-1.652	0	1999	-2.862	0	1999	-4.4002***	8	1995
Senegal	-5.290***	0	1996	-5.220***	0	1996	-3.6508*	5	2000
Sierra Leone	-2.622	0	2003	-4.743	0	2003	-2.0123	5	2010
Tanzania	-1.238	0	1994	-1.714	0	1994	-2.2085	6	1995
Uganda	-4.291**	0	1991	-4.254**	0	1991	-1.6041	6	2000
South Africa	-1.523	0	1998	-2.331	0	1998	-2.7961	7	1995
Zambia	-5.114***	0	1995	-4.950***	0	1995	-2.7961	7	1995
Zimbabwe	-2.292	0	2002	-4.396	0	2002	-3.1325	1	2004

The critical values for the ILT (2010) tests are -4.904, -3.950 and -3.635 for the 1%, 5% and 10% significant levels, respectively. The Lee and Strazicich (2004) test has -4.239, -3.566 and -3.211 critical values for the 1%, 5% and 10% significant levels, respectively

Table 6.1: Panel D Unit Root Test with One Level and Trend Break for LCKPP

	ILT (2010) Transformed LM			ILT (2010) Cross-sectionally Augmented LM			Lee and Strazicich (2004)		
Country	Transformed LM	Lag	Trend Break	CA	Lag	Trend Break	LM stat	lag	Level Break
Botswana	-2.835	0	2006	-4.645**	0	2006	-1.8997	1	1996
Cote d'Ivoire	1.824	4	2002	0.562	4	2002	-3.0422	1	2011
Congo	-4.929***	0	2005	-5.075***	0	2005	-2.8579	1	1995
Gabon	-2.029	0	2001	-2.041	0	2001	-2.3748	1	1997
Ghana	-2.592	0	1993	-2.861	0	1993	-2.9140	3	1995
Gambia	-3.595	0	2005	-6.739***	0	2005	--2.3940	1	2005
Kenya	1.746	2	1999	1.297	2	1999	-2.3670	6	2006
Madagascar	-4.717**	0	2006	-4.726**	0	2006	-2.6615	7	2006
Mali	1.781	2	2003	3.172	2	2003	-1.5313	7	1996
Mozambique	0.013	3	1994	0.063	3	1994	-2.8839	2	2012
Malawi	-3.043	0	2004	-4.681**	0	2004	-2.7744	2	2009
Niger	2.153	2	1998	1.672	2	1998	-3.6301*	6	2001
Nigeria	-4.927***	0	2005	-5.107***	0	2005	-1.4986	5	2000
Sudan	-2.108	2	2000	-2.099	2	2000	-3.5649*	7	2004
Senegal	0.010	3	1993	0.078	3	1993	-3.1263	8	2005
Sierra Leone	-1.957	2	2004	-2.78	2	2004	-1.5993	7	1998
Tanzania	2.924	3	1997	1.962	3	1997	-1.0297	8	2005
Uganda	-5.120***	0	2004	-5.371***	0	2004	-3.3799*	1	1995
South Africa	2.931	3	2001	2.131	3	2001	-2.9746	1	1995
Zambia	0.003	4	1994	0.391	4	1994	-2.1900	1	1997
Zimbabwe	-2.289	0	2002	-2.883	0	2002	-2.2398	1	2011

The critical values for the ILT (2010) tests are -4.904, -3.950 and -3.635 for the 1%, 5% and 10% significant levels, respectively. The Lee and Strazicich (2004) test has -4.239, -3.566 and -3.211 critical values for the 1%, 5% and 10% significant levels, respectively

It is interesting to note that the number of countries that exhibit unit root properties are 10 when there are no breaks and 10 when there are breaks. The elimination of certain countries buttresses the assertion that structural breaks often render non-stationary series more stationary (See Ben-David and Papell 1998; ILT, 2010; Amsler and Lee, 1995; Carrion-i-Silvestre, Barrio-Castro and Lopez-Bazo, 2005). Whilst the Lee and Strazicich (2004) tests resulted in the selection of 11 countries, the ILT (2010) transformed test (TLM) yielded a total of 10 whilst the ILT (2010) cross-sectional augmented test (CALM) yielded 7 countries. To provide confirmation, only countries that had unit root properties in at least two tests were selected.

Panel Stationarity Test Results

The results for all variables on the panel front depicted in Table 6.2 indicate that the null hypothesis of stationarity is strongly rejected in favour of the alternative of unit root when the test is run providing for two structural breaks in the level of the panel with a trend in the model. Thus, the Carrion-i-Silvestre, Barrio-Castro and Lopez-Bazo (2005) panel stationarity test provided evidence in support of the unit root with a p-value of the test statistic being 0.000 for both the Bartlett and the Quadratic spectral kernel regardless of the assumption concerning the heterogeneity in the long-run variance estimate.

These results indicate that the null hypothesis of panel stationarity is strongly rejected. The LWZ information criteria was used to determine the breaks. The result of the panel stationarity test with breaks confirmed the results from the panel unit root tests without structural breaks. The evidence however seemed to be stronger for the test that included level breaks, which were determined at the individual country level. The conclusion drawn from the two tests is that, at the panel level, all the variables have unit root with or without structural breaks and cross-sectional dependence.

Table 6.2: Carrion-i-Silvestre, Barrio-Castro and Lopez-Bazo (2005) Panel Stationarity Test with Breaks

Variable	Bartlett Test (p-value)		Quadratic Test (p-value)	
	Homo	Hetero	Homo	Hetero
LGDPPC	7.795***	19.162***	7.235***	15.406***
LFD	6.889***	6.104***	10.175***	14.938***
LINS	3.073***	3.883***	2.0431**	5.995***
LCKPP	6.895***	6.325***	35.2814***	90.864***

Note: The null hypothesis is that variables are stationary. The panel is made up of 21 SSA countries over 31 years. Break points are estimated based on LWZ information criteria and allowing for a maximum of mm" = 2 Structural breaks. The long-run variance is estimated using both the Bartlett and the Quadratic spectral kernel with automatic spectral window bandwidth selection as in Andrews (1991), Andrews and Monahan (1992) and Phillips and Sul (2003) as conducted in Carrion-i-Silvestre, Barrio-Castro and Lopez-Bazo (2005). (***), (**) and (*) denote rejection at 1%, 5% and 10%, respectively

Evidence of Stability Test

A country by country analysis of the need to include structural breaks in the cointegration analysis shows that the Engle-Granger ADF t-ratio statistic rejects the null of non - cointegration for only 10% at the 5% significance level and 30% at the 10% significance level. However, the Gregory and Hansen (1996) ADF *t*-ratio test shows that, with a single regime shift, 40% of the sample rejects the null hypothesis of cointegration at the 5% level of significance. The inclusion of a single structural break thus changes the cointegration status of the selected countries considerably. To further complement the above tests, results from the mean-F statistic and sup-F statistic from Hansen (1992) result in 90% and 90% rejection of the null at 10% significance level, respectively. The outcome of the various tests for stability therefore makes an initial case for including structural breaks in the cointegration models (Banerjee and Carrion-i-Silvestre, 2015).

6.3.2 Cointegration Test Results

Individual Country Results

Results from the Gregory and Hansen (1996) test for the level break with trend (C/T), the regime change, and the full structural break (C/T/S) models are presented in Table 6.3. These results suggest that, for the C/T break, both the ADF*(t) and Phillips (Z_t) statistics suggest the presence of cointegration in Mali, Mozambique, Niger and Sudan with the cointegration test, with break dates of 2010, 2009, 1992 and 2009, respectively. These four countries again significantly rejected the null of no cointegration for the full structural break model (C/S/T).

The full structural break model reported structural breaks in 2005, 1996, 1995 and 2006 for the Phillips (Z_t) for the four countries, respectively, and 2005, 2001, 2004 and 1992, respectively, for the four countries with the ADF*(t) statistic. However, for the regime shift, Gabon, Mali, Mozambique, Niger and Tanzania are the countries that rejected the null of no cointegration with 2009, 1999, 2003, 2006 and 1999 as the break date estimates. It is interesting to note that, for the Gregory and Hansen cointegration test, out of the 10 countries, Mali, Mozambique, Niger and Sudan significantly rejected the null of no cointegration for each type of structural break, although the break dates varied.

Six countries rejected the null of no cointegration in the Hatemi-J (2008) cointegration test. The Hatemi-J (2008) cointegration test extends the Gregory and Hansen (1996) test by considering two regime shifts. Results presented on Table 6.4 are indicative of the fact that the break affects both the level and slope of the cointegrating vector of the model. Results from applying this test for the Modified ADF*(t) test (MADF), Cote d'Ivoire, Gabon, Mali, Mozambique, Niger and Sudan suggest evidence of cointegration with break estimates of 1995 and 2004, 1999 and 2003, 1997 and 2005, 1996 and 2004, 1996 and 2003, and 2001 and 2004, respectively.

Mali, Mozambique, Niger and Sudan strongly rejected the null of no cointegration in the presence of two structural breaks. Kenya, South Africa, Tanzania and Zimbabwe did not reject the null of no cointegration. The Modified Philips (Z_t) statistic indicates that, apart from Gabon, all the countries that had cointegrated variables in the Gregory and Hansen (1996) test, were still cointegrated. Cote d'Ivoire, Mali and Mozambique reported the same break dates as in the Modified ADF*(t) test.

Sudan's estimated break dates were 1995 and 2001. It is interesting to note that with the introduction of two structural breaks, the evidence in support for cointegration becomes stronger. This implies that more countries reject the null especially for the Modified ADF*(t) test when two structural breaks are considered. The incorporation of events that shift the intercept and the slope of the cointegrating vector leads to higher rejections of the null.

Table 6.3: Gregory and Hansen (1996) Cointegration with a Structural Break

Country	C/T				C/S				C/S/T			
	ADF	BREAK	Zt	BREAK	ADF	BREAK	Zt	BREAK	ADF	BREAK	Zt	BREAK
Cote d'Ivoire	-3.32	2008	-2.92	1990	-4.01	1993	-3.20	2003	-4.93	2005	-3.72	2002
Gabon	-4.29	2010	-4.87	2006	-5.59*	2009	-4.98	2000	-5.67	2004	-4.97	2004
Kenya	-4.25	1992	-4.70	1989	-5.64	1995	-4.25	1993	-5.29	1993	-5.38	1993
Mali	-5.80**	2010	-5.9**	2010	-5.97*	1999	-6.7***	1999	-9.25***	2005	-9.41***	2005
Mozambique	-71.19***	2009	-5.27	1990	-18.34***	2003	-8.45***	1996	-23.86***	2001	-8.46***	1996
Niger	-5.35*	1992	-5.44*	1992	-5.72	2006	-5.82*	1996	-6.28*	2004	-6.39**	1995
Sudan	-5.35*	2009	-4.99	2010	-6.45	2001	-5.14	1998	-7.14***	1992	-6.31*	2006
South Africa	-4.4	1990	-3.97	2002	-5.06	2005	-4.91	1998	-5.28	2005	-5.11	2000
Tanzania	-4.85	2003	-4.64	2003	-5.92*	1996	-6.31**	2010	-4.95	2004	-4.93	2003
Zimbabwe	-4.3	2002	-3.55	2005	-5.06	2002	-4.75	2003	-4.72	2004	-4.69	2003

Critical Values for Gregory and Hansen (1996) for C/T are Z_{-t} at 1%=-6.05, 5%= -5.57 and 10%= -5.33 for C/S; Z_{-t} at 1% = -6.51 5% = -6.00 and 10% is -5.75 and critical values for C/S/T; 1% = -6.89, 5%= -6.32 and 10%= -6.16 (H_0: No Cointegration). (***), (**) and (*) denote rejection at 1%, 5% and 10%, respectively

Table 6.4: Hatemi-J (2008) Cointegration Test

Country	C/S				
	Modified ADF*(t)	AR	Breaks	Zt	Breaks
Cote d'Ivoire	-7.1480*	0	(1995,2004)	-7.270*	(1995,2004)
Gabon	-9.3827***	4	(1999,2003)	-5.702	(1991,1993)
Kenya	-6.0789	3	(1996,2005)	-6.160	(1993,2002)
Mali	-8.3276***	0	(1997,2005)	-8.470***	(1997,2005)
Mozambique	-7.9608***	0	(1996,2004)	-9.349***	(1996,1996)
Niger	-8.8661***	0	(1996,2003)	-9.781***	(1996,2001)
Sudan	-8.0725***	2	(2001,2004)	-8.942***	(1995,2001)
South Africa	-7.0594	3	(1989,1999)	-6.033	(1990,1998)
Tanzania	-7.0672	1	(1993,2002)	-5.165	(1994,2004)
Zimbabwe	-5.8728	0	(1994,2003)	-5.973	(1996,2001)

Note: Null hypothesis is no cointegration. Hatemi-J Critical Values 1% = -7.833 5% = -7.352 and 10% is -7.118. (***), (**) and (*) denote rejection at 1%, 5% and 10%, respectively

The results from the individual countries suggest that when institutions for high quality growth are incorporated into TFP in the Cobb-Douglas production framework, financial development and economic growth have a long-run association. The preceding statement holds for Cote d’Ivoire, Gabon, Mali, Mozambique, Niger and Sudan in the presence of different types of structural breaks. The results support the finance-institutions-growth hypothesis as proposed by Demetriades and Law (2006), Murinde (2012), Balach and Law (2015) and Demirgüç-Kunt and Maksimovic (1998). However, this association does not hold for Kenya, South Africa, Tanzania and Zimbabwe and so does not support Law, Azman-Saini and Ibrahim (2013), Pagano and Jappelli (1993) and Levine (2005).

Panel Cointegration with Structural Breaks Results

With the establishment of panel unit roots in variables, the results for the panel cointegration tests are presented. The Westerlund (2006a) cointegration test rejects its null hypothesis of cointegration even when there are multiple structural breaks. The results presented in Table

6.5 show that, for the SSA selected countries, institutional quality as per Rodrik (2000) has no significant relationship with financial development, capital and economic growth even when level and trend structural breaks are accounted for. This result confirms the outcomes of the Pedroni (1999) and Westerlund (2005) cointegration tests conducted in the previous section without structural breaks. Evidence from Menyah, Nazlioglu, and Wolde-Rufael, (2014) and Gries and Meierrieks, (2013), support the result of no cointegration among financial development and economic growth in a group of SSA countries.

The Westerlund (2006a) results are however contrary to the school of thought that views institution quality as the game changer for financial development to make significant positive impact on growth in developing countries based on the experience of the developed world that have seemingly robust financial systems. These include Acemoglu, Johnson and Robinson (2004), Djankov, McLeish and Shleifer (2007), Anayiotos and Toroyan (2009), Osili and Paulson (2008), Beck, Levine and Loayza, (2000).

Table 6.5: Westerlund (2006a) Panel Cointegration Test with Breaks

Model	One break	Two breaks
break in constant	21.701	19.829
break in constant and trend	15.837	25.416

Note: Null hypothesis: Cointegration. Breaks are for individual countries. Critical values are on the left tail of the standard normal distribution. (***), (**) and (*) denote rejection at 1%, 5% and 10%, respectively

It is important to state that the results of the Westerlund (2006a) cointegration test for a single level break with trend, as well as that for two breaks in level and trend seem to confirm the Gregory and Hansen (1996) level and trend break test results. That is because, only four out of 21 countries rejected the null of cointegration whilst the Hatemi-J (2008) test with two regime shifts performed slightly better. This may be partly due to the fact that the Westerlund (2006a) cointegration test does not make room for regime shifts. An important issue for consideration could be that of regime shifts with a trend at the panel level. It is important to incorporate cross-sectional dependence as the panel has clearly exhibited the existence of cross-sectional dependence at the univariate level. It is against this background that the Banerjee and Carrion-i-Silvestre (2015) test is considered next.

Panel Cointegration with Structural Breaks and Cross-Sectional Dependence

The results for the panel cointegration test by Banerjee and Carrion-i-Silvestre (2015) are presented in Table 6.6. The results indicate that for all models estimated, both the Pseudo t-ratio and the Bias rho-tests for LGDPPC, LFD, LINS and LCKPP reject the null of no cointegration at all levels of significance and conclude that cointegration exists among the variables. Indeed, Model A, which includes a level break with a time trend, indicates that 42.86% of the individual countries reject the null of cointegration at the 5% level of significance; whilst in Model B, which includes a regime shift, 52.38% rejected the null at the 5% level of significance.

With respect to the presence of common stochastic trends, both the parametric and non-parametric MQ tests strongly support the presence of common factors. This is confirmed when both tests yield the maximum number of common factors, 12. This implies that it is of paramount importance to account for any common factors as conducted by the BC (2015) test to avoid any misspecification or incorrect results. Indeed, with the inclusion of common factors and two regime shifts, the results contrast what was depicted in the Westerlund

(2006a) LM statistic. This may be an indication that the Westerlund (2006a) cointegration test may be relatively inadequate to accommodate strong cross-sectional dependence.

Table 6.6: Banerjee and Carrion-i-Silvestre (2015) Cointegration in Panel Data with Breaks and Cross-section Dependence

	Model A	Model B
Pseudo-t	-13.6080	-4.2411
Bias rho-test	-21.3534	-11.9865
% Individual rejections at the 5% level of sig	52.38%	42.86%
Common stochastic trends		
MQ test (Non - parametric)	-29.5177	-28.8943
$\hat{r}_{NP}$: Number of common factors (Non parametric)	12	12
MQ test (Parametric)	-29.6621	-28.6889
$\hat{r}_{P}$: Number of common factors (Parametric)	12	12

Note: Parametric Statistics for the Panel Cointegration Test. Sample: 1985-2015. The null hypothesis is no cointegration. Under the null hypothesis both statistics have an N (0, 1) distribution. Full panel (N=21), Cross-section dependence. Model A includes a level shift with a time trend and model B includes two regime shifts with a time trend. Modal common breaks were identified in 1989 and 2009

The BC (2015) test thus provides strong evidence in favour of a stable long-run relationship between GDPPC, FD, INS and CKPP. The most common break dates identified are 1989 and 2009, which is similar to the dates from the Carrion-i-Silvestre, Barrio-Castro and Lopez-Bazo (2005) test and Chin and Eto (2005). The Chow test results from Table 6.7 further confirms the existence of the break dates of 1989 and 2009. Overall, the BC (2015) test has confirmed the hypothesis that institutional quality linked efficiency gains are made in the finance-growth nexus in the SSA panel when structural breaks and cross-sectional dependence are accounted for.

Table 6.7: Chow Testing for the Common Break Points

Test	Statistics	df	p-value
Chow test	35.4739***	4,643	0.0000

Note: Null no breaks at specified break points. The rejection of the null provides evidence to support the presence of structural breaks at stated years. (***), (**) and (*) denote rejection at 1%, 5% and 10%, respectively.

The importance of structural breaks needs to be stressed here. The Westerlund (2006a) cointegration test does not make provision for a regime Shift. It may be conjectured that; the presence of regime shifts as indicated by Banerjee and Carrion-i-Silvestre (2015) may have made the impact of structural beaks significant. Again, the depiction of common-factors is an indication that a property that corrects for non- spatial CSD was built into the BC (2015) test. According to BC (2015), this property is strong enough to allow for a greater effect on the adverse effects of CSD compared to other similar tests. Based on this, even the level break model in the BC test is able to capture the significant effect of structural breaks. In addition, the time series cointegration test results make a strong case for the importance of structural breaks given that both the Hatemi-J (2008) and Gregory and Hansen (1996) cointegration tests generate entirely different sets of countries with cointegration variables from the Engle-Granger (1987) and Johannsen (1999) cointegration tests.

This result brings to the fore the importance and effect of structural breaks on economic phenomena and interactions and relations among economic variables. These results support the hypothesis that financial development, enhanced financial development and institutional quality have a long-run relation or association with economic growth as propelled by higher productivity levels. Work done by Akinci, Akinci and Yilmaz (2014), Huang (2005), Bordo and Raussaeu (2006), Huang (2010), Acemoglu, Gallego and Robinson (2014), Balach and Law (2015) and Demetriades and Law (2006) affirm this position, while Papaioanno (2007) contrasts these findings. However, these results are not based on models with structural breaks except for Huang (2010) who conducts before and after studies.

6.3.3 Structural Breaks in SSA

Individual Country Structural Break Analysis

The level break with trend shift estimates in the Gregory and Hansen (1996) test show that Congo was marked by very series political and tribal wars mainly involving the Tsutsi rebels in the 1998-2000 era and the country was renamed the Democratic Republic of Congo. The president, Laurent-Desire Kabila installed as president in 1997 was overthrown and shot in 2001. In Mali, the year 1999 specified for both test statistics is close to the year 2000 when the ban on political parties was lifted in the country after a military coup imposed the ban in 1994. Mozambique becoming a member of the Commonwealth in 1995 seemed to be a plausible reason for a regime break in the estimated year of 1996.

Senegal is estimated to have had a regime break in 1996, which is close to the era when the military wing of the *Movement of Democratic Forces of Casamance* (MFDC) began an armed rebellion against the government of Senegal. Finally, under the Gregory and Hansen (1996) test with a regime break, the estimated break year of 1997 in Sierra Leone reflects a coup d'état in May 1995. The army deposed President Kabbah, the constitution was suspended and a ban was placed on demonstrations whilst political parties were abolished. In 1997, the Commonwealth suspended Sierra Leone and sanctions were imposed by the UN. The supply of arms and petroleum products was barred (www.bbc.com).

In terms of the Hatemi-J (2008) test of cointegration with two regime shifts, the results show that more countries experience breaks in both level and slope. Since the Hatemi-J (2008) cointegration with two breaks is an extension of the Gregory and Hansen (1996) test, the findings from both tests are compared. The first country of interest was Congo, which recorded regime changes in 2000 and 2003 in both tests. The same can be said for Mali, Mozambique and Senegal. Congo was quite turbulent in the 2001 period.

Due to political unrest and tribal conflicts, the United Nations Security Council drafted a 5,500-strong United Nations' force to monitor the ceasefire between rebels and government forces, and between Rwandan and Ugandan forces although the fighting continued. The war was estimated to have taken two and a half million lives. In the same year, Congo's president, Laurent Kabila was assassinated. On the flip side, Gabon reports two regime shifts in the Hatemi-J (2008) test with a cointegrating relationship among variables whilst the results were not significant for same in the Gregory and Hansen (1996) test. Interestingly, Gabon moved from being insignificant under one break to significant under two regime breaks.

Having found evidence of cointegration from the individual country tests, panel cointegration tests are conducted to increase the power of the tests. It must be noted that in the time series analysis, some countries were removed from the sample as a result of stationarity properties of their data at levels. It is interesting to note that the panel unit root and stationarity tests yielded evidence of non-stationarity for the dataset when taken together as a panel. For this purpose, the Pedroni (1999, 2004) and Westerlund (2005) panel cointegration tests that did not allow for any structural breaks were first employed and then we applied panel cointegration tests in the presence of structural breaks.

Panel Structural Breaks Analysis

The importance of structural breaks in studies and analyses premised in SSA cannot be overemphasized as the region is characterized by several occurrences that have the potential to change the structure of the economy. The 1980s to early 2000s were years characterized by the World Bank's structural adjustment programs for countries such as those in the SSA and especially the West African zone. Ghana and Nigeria in West Africa, and Zambia, which is in eastern SSA, are the commonly cited ones.

These structural adjustments, which affected the whole continent as they were adopted by many countries in the region, came with conditions such as financial liberalization. This liberalization typically saw many countries changing their financial structure and opening their economies to higher levels of international trade as well as moving away from fixed foreign exchange regimes. Many countries transitioned from military rule into democracies during the 1990s and early 2000s. On the other side of structural changes, SSA countries continued to experience armed tribal wars and ethnic conflicts, which affected the structure of the economy. The Liberian war, Rwandan genocide and Burundi wars in the 1990s had a toll on the continent as many countries joined the war.

In the late 1980s and up to the mid-1990s, the southern region of the continent underwent many transformations. Notable among these transformations were the creation of a decolonized Namibia; the end of apartheid in South Africa; Boko Haram insurgency and Niger Delta conflicts in Nigeria in 2009; the Ivorian civil war in 2010; the Tuareg insurgency rebellion in Mali in the 2007 to 2009 period; and the Azawad insurgency in Niger from 2007 to 2009.

The financial crises of 2006 to 2008 in Europe and North America took its toll on the African continent as a whole and may have resulted in a shift in the structure of the continent's financial sector and economy as a whole. Essers (2013) and Allen and Giovannetti (2011) among others attest to the effects of the financial crises on SSA. Indeed, this was a period when Africa, as a continent, moved from post-colonization unstable political regimes, closed and repressive economic system to democratization, open and liberal economic systems and the continent began to embrace globalization at a fast pace.

The underlying fact is that the model, without structural breaks, may have been misspecified as the results change when a single break among the many, which may have affected SSA and more specifically these 21 countries, is recognized. The overall conclusion from this section is that financial development and institutions have long-run associations with economic growth. However, for a region like SSA, neglecting the role played by structural breaks may distort the outcome of this long-run association and thus affect both policy and economic outcomes.

6.3.4 Cointegration Regressions and Error Correction

Individual Country Long-run Coefficients and Error Correction

To examine the relationship between growth, financial development, institutional quality and capital stock at the individual country level, the four countries that are cointegrated in both the Gregory and Hansen (1996) and the Hatemi-J (2008) cointegration tests were selected. The selection of countries was based on the Z_t statistics as the test has the advantage of allowing for general forms of serial correlation when compared to the ADF statistic. It is also the best in terms of size and power (You and Sarantis, 2012).

Considering the fact that the Gregory and Hansen (1996) full break model incorporates all three types of structural breaks, we selected the model that represents this full break and estimate an OLS regression and an error correction term using the Engle-Granger (1987) two-step method. These countries include Mali, Mozambique, Niger and Sudan. The long-run relationships between variables are investigated in each of these countries to ascertain the speed of adjustment as well as the elasticities associated with each of the variables. Table 6.8 reports the regression coefficients and ECT.

The adjustment coefficients for all four countries are between 0 and -1, strongly significant and higher in magnitude compared to the no-break case. Indeed, Mali's error correction term of -0.877 is significantly higher than the -0.572 in the no break case. These relatively higher speeds of adjustment indicate that, when structural breaks are incorporated into specifying long-run dynamic relationships between economic growth, financial development and institutional quality, the system adjusts to equilibrium much more quickly than when there are no structural breaks. Mozambique had the highest adjustment factor of 93.95% to show that 93.95% of disequilibrium in the system is corrected within a year. The rest of the countries also exhibited very high speeds of adjustment and thus further established the long-run causal relationships among financial development, institutional quality, capital and economic growth in these four countries.

With respect to the various elasticities estimated from the least squares regressions, the coefficient of technological progress is positive and highly significant before the trend break. However, it becomes insignificant in Mali and Sudan after the break. A negative NFP could be because Mali underwent some political instability, severe food shortage due to locust infections and a prolonged conflict fuelled by rebels in the 2004 and 2006 period. Sudan faced a major war period from 2005 and beyond. Before and after the structural break, Mali, Mozambique and Sudan's institutional quality variable was not significantly associated with growth whilst it was highly significant in Niger. However, after each country's structural break, institutional quality development was found to be significant in Mali, Sudan and Niger, although the relationship seems to be negative in Sudan.

However, only Mali and Niger have the break parameter associated with financial development to be negative. Interestingly, Niger's financial development and institutional quality after the break have a negative effect with economic growth. Bezemera, Grydakib and Zhanga (2014) attribute a negative but significant financial development to a shift in the composition of credit in recent decades, away from non-financial business and towards real estate asset markets. Rousseau and Wachtel (2011) state that it is because the short-run effect may be negative as a result of the financial crisis. Both the shift from non-financial business and financial crises are viable explanations for Niger and Mali (Ketteni, Mamuneas, Stengos and Savvides, 2007).

Both financial Development and institutional quality were insignificant in Mozambique before and after the break, while only institutions are insignificant in Mali and Sudan. These findings are in line with Kandi (2009) and Olson (1992; 1996). The negative and statistically significant coefficient indicates deterioration in institutional quality, a situation that may provide opportunities for connected businesses from the politically elite and interest groups who have motivation to lobby the government solely in their favour, affecting the state effectiveness to deal with market failure and potentially adversely affect economic prosperity. Capital stock in Niger was found to be insignificant before and after the break. This does not conform to *apriori* expectations as proposed by Pagano (1993) and Demetriades and Law (2006).

For the panel, Table 6.9 indicates for the OLS estimator, all parameters were significant before and after the breaks, although the signs were different. Interestingly, for both the FMOLS and the OLS estimators, the slope shifts in 2009 revealed a negative parameter was significant. The effect of the 2008 global financial crisis could be evident here. The estimates for institutional quality were also negative in slope shift of the 1989 for both estimators. This could also be attributable to the weak institutional framework that propelled the need for the economic recovery programs in SSA. Capital was found to have a significantly positive association with growth in the pooled OLS estimation whilst only the first regime was significant for capital in the FMOLS estimator.

Whilst the level shift in 1989 was positive for both estimators that of 2009 was negative. For both estimators, the time trend was negatively associated with GDPPC growth. This negative parameter estimate indicates that, on average, the value of GDP per capita growth fell in the panel. Effectively the results indicate that FD, INS and CKPP have a significant and positive relationship with economic growth in the SSA region. Thus, the proposed role of IQLEG conforms to theoretical standpoints. The speed of adjustment is negative, significant and the value falls between zero and negative one. The value shows that the economy of the panel is able to go back to its equilibrium position 9.98% of the time. This is interesting since it is an indication that even when structural breaks are considered, with adequately working institutions and better financial development, about 90% of the system at the panel level remains in disequilibrium by the next period.

Table 6.8: Time Series Regression Coefficients and ECT with a Structural Break in Level, Trend and Coefficient Slope

COUNTRY	MALI		MOZ		NIGER		SUDAN	
	coeff.	std. error	coeff.	std. error	coeff.	std. error	coeff.	std. error
D1	8.2055*	4.5690	-0.8751	1.7565	2.7088***	0.6321	-0.7898	4.3376
TREND	0.0022***	0.0004	0.0035***	0.0004	0.0019***	0.0002	0.0038***	0.0001
TRENDD1	0.0859	0.0578	0.0551***	0.0160	0.0083**	0.0038	0.0101	0.0535
LFD	0.5518***	0.1503	-0.1123	0.0787	0.3090**	0.1369	-0.1391***	0.0371
LINS	-0.1511	0.1113	0.0255	0.0657	0.2149***	0.0653	0.0007	0.0362
LCKPP	0.1772***	0.0588	1.9484***	0.3792	0.1173	0.1971	0.2677***	0.0344
LFDD1	-2.5425*	1.3031	-0.0551	0.2938	-0.4626***	0.1525	-0.0313	0.8274
LINSD1	1.1536	0.7927	-0.0714	0.1845	-0.3763***	0.1165	0.3791	0.3602
LCKPPD1	-0.7616*	0.4364	-2.0544***	0.4003	0.1026	0.2496	-0.1609	0.1608
ECT	-0.8771***	(0.3068)	-0.9395***	(0.1859)	-0.8261***	(0.1786)	-0.8832***	(0.1784)

Note: (***), (**) and (*) denote rejection at 1%, 5% and 10%, respectively. Standard errors in (). The break date (D1) for Mali is 2005, Niger, 1996, Mozambique, 1995 and Sudan, 2006. FMOLS estimation

Table 6.9: Panel Cointegration Vectors and Error Correction Models

Variable	Pooled OLS	FMOLS	ECT
Speed of Adjustment			-0.0998***
			(0.0209)
LFD	0.2444***	0.2316***	
	(0.0079)	(0.0106)	
LFD1989	0.0144**	0.0229**	
	(0.0068)	(0.0105)	
LFD2009	-0.0807***	-0.0876***	
	(0.0076)	(0.0125)	
LINS	0.3920***	0.4187***	
	(0.0136)	(0.0160)	
LINS1989	-0.2694***	-0.2894***	
	(0.0143)	(0.0172)	
LINS2009	0.1964***	0.2331***	
	(0.0249)	(0.0308)	
LCKPP	0.0943***	0.0974***	
	(0.0026)	(0.0047)	
LCKPP1989	0.0352***	0.0365	
	(0.0023)	(0.0044)	
LCKPP2009	0.0043*	-0.0015	
	(0.0025)	(0.004)	
D1989	0.6978***	0.7173***	
	(0.0316)	(0.0485)	
D2009	-0.2137**	-0.2816***	
	(0.0715)	(0.1042)	
TIME TREND	-0.0024***	-0.0028***	
	(0.0004)	(0.0003)	
AIC	1.9434	-0.1632	
BIC	2.1363	-0.0058	

Notes: The results are based on the two break point estimates derived from Banerjee and Carrion (2015) cointegration test with a regime shift and trend. (***), (**) and (*) denote rejection at 1%, 5% and 10%, respectively. Standard errors in (). Error Correction Term (ECT) was obtained from a dynamic fixed effects model estimation.

These results are similar to Esso (2010) who studies the cointegrating and causal relationship between financial development and economic growth in the ECOWAS sub-region between 1960 and 2005. Esso (2010) reveals a long-run relationship between financial development and economic growth in six countries, namely Burkina Faso, Cape Verde, Cote d'Ivoire, Ghana, Liberia and Sierra Leone. The results are obtained from the application of the Gregory and Hansen cointegration tests with level, level with trend as well as regime shifts. The results are consistent with Prochniak and Wasiak (2017) and Bist and Bista (2018).

6.4 Productivity Generation

6.4.1 The Cobb-Douglas Production Function-TFP, NFP and Contribution of IQLEG to Productivity with Structural Break in Individual Countries

The annual contribution of IQLEG to TFP for Mali, Mozambique, Niger and Sudan are discussed in this section. These tables depict the estimated role played by financial development conditioned on institutional quality towards the overall productivity of the production function framework each year in each country holding all other variables constant whilst the figures provide a pictorial view of the estimates. Whilst the results for all four countries are discussed in the main text, only the table and figure for Mali are presented in the main text with the rest provided in Appendix D.

TFP, NFP and Contribution of IQLEG to Productivity in Mali with a Break

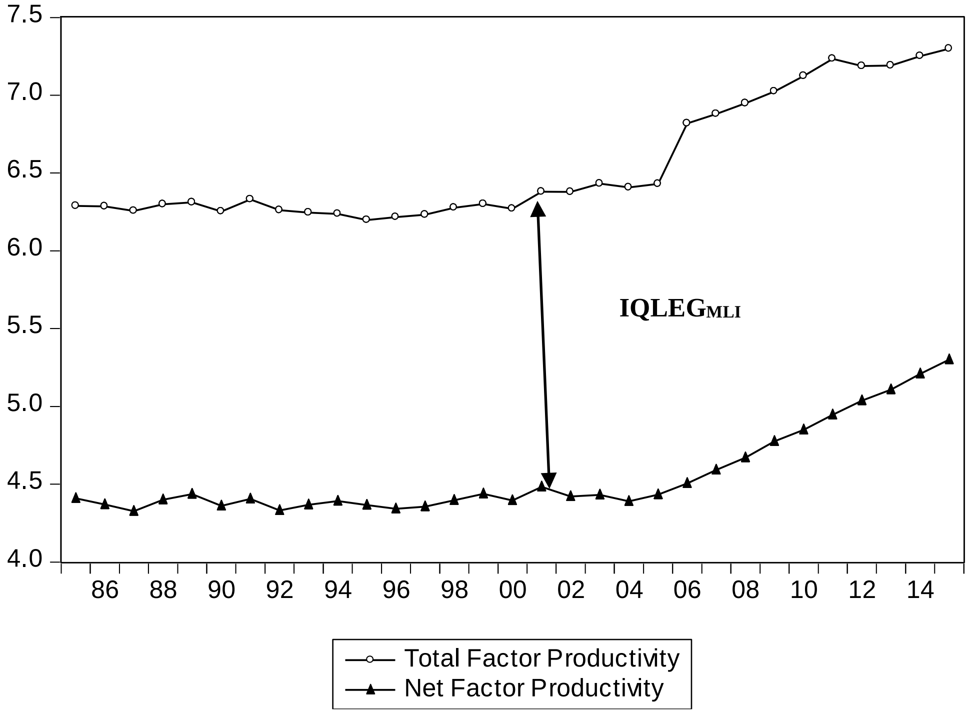
The highest level of IQLEG was in 2011 whilst the lowest was in 1995 when the contribution was 1.8322. Before the break (1985-2005), the average contribution of IQLEG to productivity was 30.27% whilst it increased slightly to 30.95% after the break (Table 6.10).

Table 6.10**:** Productivity Estimations with a Break for Mali

Levels of TFP, NFP and CIQLEG				Growth Rate of TFP, NFP and CIQLEG			
Year	TFP	NFP	IQLEG	Year	TFP	NFP	IQLEG
1985	6.2895	4.4092	1.8804	1985	Na	na	na
1986	6.2846	4.3689	1.9156	1986	-0.0050	-0.0402	0.0353
1987	6.2559	4.3257	1.9302	1987	-0.0287	-0.0432	0.0145
1988	6.3000	4.3999	1.9001	1988	0.0441	0.0742	-0.0301
1989	6.3119	4.4358	1.8761	1989	0.0119	0.0358	-0.0239
1990	6.2529	4.3612	1.8917	1990	-0.0590	-0.0745	0.0156
1991	6.3297	4.4050	1.9248	1991	0.0768	0.0438	0.0330
1992	6.2612	4.3309	1.9302	1992	-0.0686	-0.0741	0.0055
1993	6.2454	4.3680	1.8773	1993	-0.0158	0.0371	-0.0529
1994	6.2380	4.3919	1.8460	1994	-0.0074	0.0239	-0.0313
1995	6.1985	4.3662	1.8322	1995	-0.0395	-0.0257	-0.0138
1996	6.2162	4.3412	1.8750	1996	0.0177	-0.0250	0.0427
1997	6.2321	4.3547	1.8774	1997	0.0159	0.0135	0.0024
1998	6.2760	4.3966	1.8794	1998	0.0439	0.0419	0.0020
1999	6.3016	4.4384	1.8632	1999	0.0256	0.0418	-0.0162
2000	6.2703	4.3949	1.8755	2000	-0.0313	-0.0435	0.0123
2001	6.3805	4.4831	1.8974	2001	0.1102	0.0882	0.0220
2002	6.3786	4.4215	1.9571	2002	-0.0020	-0.0616	0.0597
2003	6.4312	4.4304	2.0007	2003	0.0526	0.0090	0.0436
2004	6.4079	4.3898	2.0180	2004	-0.0233	-0.0406	0.0173
2005	6.4294	4.4324	1.9970	2005	0.0215	0.0426	-0.0210
2006	6.8185	4.5061	2.3124	2006	na	na	na
2007	6.8794	4.5906	2.2888	2007	0.0609	0.0845	-0.0236
2008	6.9485	4.6705	2.2780	2008	0.0692	0.0799	-0.0108
2009	7.0242	4.7761	2.2481	2009	0.0757	0.1057	-0.0299
2010	7.1238	4.8503	2.2736	2010	0.0996	0.0741	0.0255
2011	7.2340	4.9455	2.2884	2011	0.1101	0.0952	0.0149
2012	7.1872	5.0364	2.1507	2012	-0.0468	0.0909	-0.1377
2013	7.1903	5.1071	2.0831	2013	0.0031	0.0707	-0.0676
2014	7.2505	5.2094	2.0411	2014	0.0602	0.1023	-0.0420
2015	7.2995	5.2998	1.9997	2015	0.0490	0.0904	-0.0414
Mean rates in selected periods				**Mean growth rates in selected periods**			
(1985 – 2005)	6.2996	4.3927	1.9069	(1985 – 2005)	0.0070	0.0012	0.0058
(2006 – 2015)	7.0956	4.8992	2.1964	(2006 – 2015)	0.0534	0.0882	-0.0347

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain. Break Date of 2005 is from the Gregory and Hansen (1996) full break test.

Figure 6.1: TFP, NFP and Contribution of IQLEG to Productivity in Mali with a Break



Source: Author, 2019

Implicitly, the occurrence of the break did not change the level of IQLEG by much. NFP was consistent over the period and increased slightly after the break. The evidence supports a positive contribution of IQLEG towards the growth rate of TFP before the break but a negative contribution after the break. In terms of the growth rates, interestingly, negative growth rates were experienced for CIQLEG in the second regime, although that was the highest average contribution period in terms of magnitude. This shows that during the second regime, NFP was high whilst IQLEG was negatively impacting productivity. Figure 6.1 depicts the levels of the average NFP and TFP. The gap between the two lines provides a visual idea of the contribution of IQLEG.

The figure shows that Mozambique's IQLEG level was negative throughout the period under study. It is interesting to note that IQLEG was rather decreasing productivity significantly over the period. TFP was decreased by about 5.59% and 13.27%, respectively, before and after the break. Maybe the occurrence and aftermath of a sixteen-year civil war crippled the nation's financial system. The contribution of IQLEG to the nation's productivity was negative. IQLEG contribution slowed down the growth of TFP by decreasing NFP growth by approximately 86% and 8% in the first and second regime, respectively. Sudan's IQLEG followed the same pattern as Mozambique with an average contribution of negative 7.24% and negative 5.52% before and after the break, respectively. Generally, although IQLEG contributed negatively to TFP, it increased over the period under study (Appendix D, Tables D1 and D3 and Figures D1 and D3).

The contribution of IQLEG to Niger's TFP was positive but reduced in magnitude over the period. Indeed, the contribution of financial development conditioned on quality institutions fell in magnitude over the period following the structural break. The average contribution before the break was 1.9038 compared to 3.8595 for NFP whilst it reduced to 1.6021 after the break. The contribution to the growth of TFP was negative for both periods. It is interesting to note that whilst TFP's growth was negative in the first regime, it become positive after the break. Table D2 in Appendix D and Figure D2 from the same Appendix show the decreasing gap between NFP and TFP

6.4.2 The Cobb-Douglas Production Function- Panel TFP, NFP and Contribution of IQLEG to Productivity with Structural Breaks

The average annual contribution of IQLEG to TFP is listed on Table 6.11 whilst Figure 6.2 presents a graphical view of the contribution of IQLEG. In terms of magnitude, the highest level of IQLEG was in 2010 whilst the lowest was in 1991 when the contribution was 2.1097. In the first regime (1985-1989) the average contribution of IQLEG to TFP was 31.81% whilst it contributed to 70.69% of the growth of TFP. In the second regime, TFP fell slightly, although the average contribution of IQLEG rose slightly. This implies that NFP decreased slightly in the second regime. The highest TFP level was realised in the third regime for the entire panel, although NFP continued to fall on the average. The highest contribution of IQLEG to the growth of TFP was in the second regime when NFP was interestingly growing negatively. The lowest was the contribution of IQLEG occurring in the third regime. This shows that during the third regime, the contribution of NFP to productivity was high whilst that of IQLEG was low.

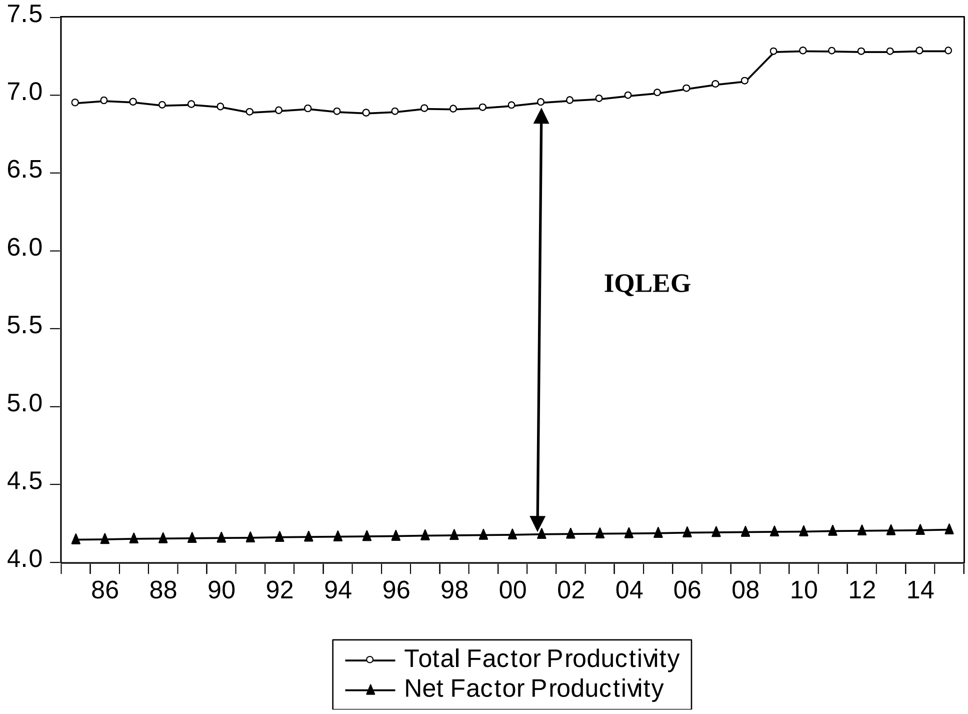
Figure 6.2 shows that the contribution of IQLEG to TFP was fairly stable until when the third regime begun. The wider gap shows that, from 2009, the panel of countries on the average increased the role of financial development and institutional quality played in productivity enhancement and growth. This era is the immediate aftermath of the global financial crisis of 2007/2008 and the beginning of the recovery period. In this third regime, oil prices fell from about $147 to $32 in 2008, which made net importers of oil benefit.

Table 6.11: Levels of Panel NFP, TFP and CIQLEG with Two Regime Breaks

Levels of NFP, TFP and CIQLEG				**Growth Rate of NFP, TFP and CIQLEG**			
Year	TFP	NFP	IQLEG	Year	TFP	NFP	IQLEG
1985	6.7309	4.5897	2.1413	1985	na	na	na
1986	6.7218	4.5805	2.1413	1986	-0.0091	-0.0092	0.0001
1987	6.7181	4.5763	2.1418	1987	-0.0037	-0.0042	0.0005
1988	6.7385	4.5856	2.1530	1988	0.0204	0.0093	0.0111
1989	6.7540	4.5964	2.1576	1989	0.0155	0.0108	0.0047
1990	6.7235	4.6109	2.1126	1990	na	na	na
1991	6.7269	4.6172	2.1097	1991	0.0034	0.0063	-0.0029
1992	6.6804	4.5638	2.1165	1992	-0.0465	-0.0534	0.0068
1993	6.6781	4.5495	2.1286	1993	-0.0023	-0.0143	0.0121
1994	6.6541	4.5371	2.1170	1994	-0.0240	-0.0124	-0.0116
1995	6.6544	4.5420	2.1124	1995	0.0002	0.0048	-0.0046
1996	6.6719	4.5530	2.1189	1996	0.0175	0.0110	0.0065
1997	6.6859	4.5531	2.1328	1997	0.0140	0.0001	0.0139
1998	6.6998	4.5724	2.1274	1998	0.0139	0.0194	-0.0055
1999	6.7011	4.5682	2.1328	1999	0.0013	-0.0042	0.0055
2000	6.6993	4.5584	2.1409	2000	-0.0018	-0.0099	0.0081
2001	6.7094	4.5533	2.1561	2001	0.0101	-0.0051	0.0152
2002	6.7077	4.5491	2.1586	2002	-0.0017	-0.0042	0.0025
2003	6.7187	4.5511	2.1676	2003	0.0111	0.0021	0.0090
2004	6.7340	4.5490	2.1850	2004	0.0152	-0.0021	0.0174
2005	6.7371	4.5399	2.1972	2005	0.0031	-0.0091	0.0122
2006	6.7457	4.5287	2.2170	2006	0.0086	-0.0112	0.0198
2007	6.7606	4.5259	2.2347	2007	0.0149	-0.0028	0.0178
2008	6.7623	4.5153	2.2469	2008	0.0017	-0.0106	0.0122
2009	6.7607	4.5069	2.2538	2009	-0.0016	-0.0084	0.0068
2010	6.7819	4.4856	2.2963	2010	na	na	na
2011	6.7809	4.4778	2.3031	2011	-0.0010	-0.0078	0.0068
2012	6.8128	4.5045	2.3083	2012	0.0319	0.0267	0.0051
2013	6.8375	4.5255	2.3119	2013	0.0247	0.0210	0.0037
2014	6.8515	4.5484	2.3031	2014	0.0141	0.0229	-0.0088
2015	6.8455	4.5440	2.3015	2015	-0.0060	-0.0044	-0.0016
Mean rates in selected periods				**Mean growth rates in selected periods**			
(1985 – 1989)	6.7312	4.5899	2.1413	(1985 – 1989)	0.0058	0.0017	0.0041
(1990 – 2009)	6.7099	4.5492	2.1607	(1990 – 2009)	0.0020	-0.0055	0.0074
(2010 – 2015)	6.8256	4.5200	2.3056	(2010 – 2015)	0.0127	0.0117	0.0010

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain. Break Dates of 1989 and 2009 are based on the Banerjee and carrion-i- Silvestre (2015) regime break test with a trend

Figure 6.2: TFP, NFP and Contribution of IQLEG to Productivity



Source: Author, 2019

6.5 Conclusion

The objective of this chapter was to determine the role financial development enhanced by institutional quality as determined by Rodrik (2000) plays in productivity within the framework of the Cobb-Douglas production function when structural breaks are considered. Using panel and individual country cointegration analysis with endogenously determined single and multiple unknown level, trend and regime structural breaks, TFP was decomposed into net factor productivity and institutional quality linked efficiency gain. The goal was to establish whether IQLEG induced productivity levels over and above that of pure technical progress when structural breaks are present in this panel of countries (You and Sarantis, 2013; Banerjee and Carrion-i-Silvestre, 2015; Gregory and Hansen, 1996; Hatemi-J, 2008).

Annual financial development, institutional quality and economic growth data were used at both the individual country and panel levels to conduct cointegration tests. Selected countries and the panel were used to estimate long-run relationships and speeds of adjustment. Production functions in the Cobb-Douglas framework were estimated for the selected countries as well as the panel to determine the contribution of IQLEG to productivity level and growth. The contribution of IQLEG to productivity at the panel level was positive for all regimes. Whilst the panel without structural breaks could not provide evidence of a long run relationship between the variables, the introduction of structural breaks while accounting for CSD, resulted in positive CIQLEG. Structural breaks are therefore essential.

The realisation of contributions from IQLEG over and above that of NFP within the Cobb-Douglas framework with regime breaks whilst accounting for strong cross-sectional dependency suggests that the assertion by Rodrik (2000) that institutions are fundamental to high quality growth is confirmed here for the 21 SSA countries. We suggest that, by the very nature and organisation of their economies, these countries are positioned to possess and to benefit from institutional quality unlike SSA, which is often politically and economically unstable. The implications for all these tests are, however, the same: political instability, inadequate social insurance, poor regulation, conflicts and unstable macroeconomic conditions among others are likely to cause countries not to benefit from the positive outcomes of improving the financial sector.

CHAPTER SEVEN

INSTITUTIONAL QUALITY IN THE FINANCE – GROWTH-NEXUS IN SUB-SAHARAN AFRICA - AN ESTIMATION OF THE CONSTANT ELASTICITY OF SUBSTITITION AND THE VARIABLE ELASTICITY OF SUBSTITUTION PRODUCTION FUNCTIONS WITH STRUCTURAL BREAKS

7.1 Introduction

The main argument in this study has been premised on the fact that, when institutions are adequately working, they work through financial development to improve efficiency and productivity levels. Premised on an extension of the neoclassical growth framework, this increase in productivity levels increases TFP beyond that generated by pure technical progress thus leading to higher growth. In the Chapters Five and Six, TFP was decomposed into pure technical progress and IQLEG within the Cobb-Douglas framework with the latter incorporating the effect of structural breaks and cross-sectional dependency.

However, regarding the role of finance and institutions as growth enhancing through catalysing productive efficiency[22], many studies have been premised on the Cobb-Douglas production specification (Bist, 2018; Demetriades and Law, 2006; Balach and Law, 2015; Pagano, 1993). Indeed, the Cobb-Douglas production function has been the basis for previous sections in this research. As important and simple as the Cobb-Douglas specification is, it was conceptualised on some assumptions. These assumptions include constant returns to scale, a unitary elasticity of substitution and homogeneity of a single

[22] Shleifer and Vishny (1997), Osili and Paulson (2008), Beck, Levine, and Loayza (2000)

degree among others. Again, there are a few draw backs of the Cobb-Douglas production function.

These draw backs, as mentioned in Chapter Two of this thesis primarily include its inability handle a large number of inputs, the restrictiveness of the assumption of perfect competition and the fact that it is largely unrealistic by assuming constant returns to scale. In this thesis, to overcome the possible unwanted effects of the limitations of the Cobb-Douglas function, alternative production functions in the form of the CES and VES are adopted to determine the long run relationship between finance, institutional quality, capital and growth when the underlying Cobb-Douglas assumptions are varied. assumptions are varied. This is done to provide additional insights into, and make room for testing the model under other circumstances that may arise in the real world and SSA specifically. It is against this background that this section is dedicated to testing the financial development-institutional quality-economic growth relationship using the Constant Elasticity of Substitution (CES) and Variable Elasticity of Substitution (VES) production specifications.

The CES and the VES production functions are explored as tools to check the robustness of the claims being made in this research. In this section, the level of extra efficiency gained from decomposing TFP into pure technical progress and IQLEG when the CES and VES production functions are being considered for the panel of 21 countries in SSA is explored. It is important to note that, the desired contribution is for the average contribution of CIQLEG > 0. Secondly, the relationship is examined with and without two regime structural breaks. This study therefore contributes both theoretically and empirically to the importance of the nature of the production function for economic growth models within the finance and institution literature for SSA.

The rest of the chapter is organized as follows: a brief empirical methodology is discussed. The fourth section entails estimations followed by the presentation and analysis of the findings for the panel estimations. The last section concludes and recommends ways in which the research can be extended and conducted in the future.

7.2 Empirical Methodology

7.2.1 Models

The dataset described in Chapter Four, Section 4.2 is used for estimations. Based on the derivations from Chapter Two, Sections 2.7 and 2.8 and the years for the structural breaks used in estimating the coefficient relationships in Chapter Six[23], the empirical models to be estimated are stated below:

The extended CES model without structural breaks is given as

$$lnGDPPC_{it} = \alpha_0 + \alpha_1 g.t + \alpha_2 lnINS_{it} + \alpha_3 lnFD_{it} - \frac{\varphi}{\rho} ln\left[\delta CKPP_{it}^{-\rho} + (1-\delta)\right] + v_{it}, \quad i = 1,2,\ldots 21, \quad t = 1,2,\ldots,31 \quad \text{(Panel data).} \qquad (7.1)$$

$$lnGDPPC_{t} = \alpha_0 + \alpha_1 g.t + \alpha_2 lnINS_{t} + \alpha_3 lnFD_{t} - \frac{\varphi}{\rho} ln\left[\delta CKPP_{t}^{-\rho} + (1-\delta)\right] + v_{t}, \quad t = 1,2,\ldots,31 \quad \text{(Time series).} \qquad (7.2)$$

Where, α_0 is the constant, α_1 is the coefficient of the time trend, α_2 is the coefficient of institutional quality, α_3 is the coefficient of financial development, φ is the elasticity of

[23] Following You and Sarantis (2013), the structural breaks applied in the CES and VES framework are exogenous.

substitution between capital and labour with δ, ρ as constant parameters and v_{it} the error term.

The empirical model for the extended CES with two regime structural breaks is presented below:

$$lnGDPPC_{it} = \alpha_0 + \alpha_1 D_{1989} + \alpha_2 D_{2009} + \alpha_3 g.t + \alpha_4 lnINS_{it} + \alpha_5 lnINSD_{1989_{it}} + \alpha_6 lnINSD_{2009_{it}} + \alpha_7 lnFD_{it} + \alpha_8 lnFDD_{1989_{it}} + \alpha_9 lnFDD_{2009_{it}} - \frac{\varphi}{\rho} ln\left[\delta CKPP_{it}^{-\rho} + (1-\delta)\right] + v_{it}\ , \quad i = 1,2,\dots 21,\ \ t = 1,2,\dots,31 \quad \text{(Panel data)} \qquad (7.3)$$

$$lnGDPPC_{t} = \alpha_0 + \alpha_1 D_{1989} + \alpha_2 D_{2009} + \alpha_3 g.t + \alpha_4 lnINS_{t} + \alpha_5 lnINSD_{1989_{t}} + \alpha_6 lnINSD_{2009_{t}} + \alpha_7 lnFD_{t} + \alpha_8 lnFDD_{1989_{t}} + \alpha_9 lnFDD_{2009_{t}} - \frac{\varphi}{\rho} ln\left[\delta CKPP_{t}^{-\rho} + (1-\delta)\right] + v_{t}\ , \quad t = 1,2,\dots,31 \ \text{(Time series)} \qquad (7.4)$$

Where, α_0 is the constant, α_1 is the coefficient of first break at level, α_2 coefficient of second break at level, α_3 is the coefficient of the time trend, α_4 is the coefficient of institutional quality, α_5 the coefficient of first shift in institutional quality, α_6 the coefficient of second shift in institutional quality, α_7 is the coefficient of financial development, α_8 the coefficient of first shift in financial development, α_9 the coefficient of the second shift in financial development, φ is the elasticity of substitution between capital and labour with δ, ρ as constant parameters and v_{it} the error term. The extended VES without Structural Breaks

$$lnGDPPC_{it} = \alpha_0 + \alpha_1 g.t + \alpha_2 lnINS_{it} + \alpha_3 lnFD_{it} + \omega\varphi lnCKPP_{it} + [(1-\omega)\varphi]\ ln[1 + (\eta * CKPP_{it})] + v_{it} \quad i = 1,2,\dots 21,\ \ t = 1,2,\dots,31 \quad \text{(Panel data)} \qquad (7.5)$$

$$lnGDPPC_{t} = \alpha_0 + \alpha_1 g.t + \alpha_2 lnINS_{t} + \alpha_3 lnFD_{t} + \omega\varphi lnCKPP_{t} + [(1-\omega)\varphi] ln[1 + (\eta * CKPP_{t})] + v_{t} \quad t = 1,2,\dots,31 \ \text{(Time series)} \qquad (7.6)$$

where, α_0 is the constant, α_1 is the coefficient of the time trend, α_2 is the coefficient of institutional quality , α_3 is the coefficient of financial development, φ is the elasticity of substitution between capital and labour with $\omega, \varphi\ and\ \eta$ denoting constant parameters. The extended VES with Structural Breaks is given as

$$lnGDPPC_{it} = \beta_0 + \beta_1 D_{1989} + \beta_2 D_{2009} + \beta_3 g.t + \beta_4 lnINS_{it} + \beta_5 lnINSD_{1989_{it}} + \beta_6 lnINSD_{2009_{it}} + \beta_7 lnFD_{it} + \beta_8 lnFDD_{1989_{it}} + \beta_9 lnFDD_{2009_{it}} + [(1-\omega)\varphi]ln[1 + (\eta * CKPP_{it})] + v_{it} \quad i = 1,2, \ldots 21, \quad t = 1,2, \ldots ,31 \qquad \text{(Panel data)} \qquad (7.7)$$

$$lnGDPPC_t = \beta_0 + \beta_1 D_{1989} + \beta_2 D_{2009} + \beta_3 g.t + \beta_4 lnINS_t + \beta_5 lnINSD_{1989_t} + \beta_6 lnINSD_{2009_t} + \beta_7 lnFD_t + \beta_8 lnFDD_{1989_t} + \beta_9 lnFDD_{2009_t} + [(1-\omega)\varphi]ln[1 + (\eta * CKPP_t)] + v_t \quad t = 1,2, \ldots ,31 \qquad \text{(Time series)} \qquad (7.8)$$

where, β_0 is the constant, β_1 is the coefficient of first break at level, β_2 coefficient of second break at level, β_3 is the coefficient of the time trend, β_4 is the coefficient of institutional quality, β_5 the coefficient of first shift in institutional quality, β_6 the coefficient of second shift in institutional quality, β_7 is the coefficient of financial development, β_8 the coefficient of first shift in financial development, β_9 the coefficient of second shift in financial development, φ is the elasticity of substitution between capital and labour with $\omega, \varphi\ and\ \eta$ denoting constant parameters and v_{it} the error term. As discussed in Chapter Four, Driscoll and Kraay HAC standard errors are applied against cross-sectional dependency in the nonlinear least square estimations.

7.2.2 Generation of Productivity Levels and the Contribution of IQLEG

The contribution of IQLEG is determined based Section 2.8 of Chapter Two with equations (2.26), (2.27) and (2.28) and for the CES production function and equations

(2.26), (2.29) and (2.30) for the VES production function. The productivity levels are generated when structural breaks are considered and when they are not

7.3 Estimation Results and Findings for the CES Production Specification

7.3.1 Non-linear Least Squares Parameter Estimates without Breaks in Mali-CES

The results from the non-linear least squares estimation for Mali presented in Table 7.1 indicate that, apart from institutional quality, the time trend and the intercept, all other variables are not significantly linked to growth. Indeed, financial development within CES framework for Mali, although positive is not significant. Within the Cobb-Douglas framework however, all variables in Mali were found to be significantly associated with economic growth. Interestingly institutional quality was found to be negatively associated with growth in Mali within the CES framework.

Table 7.1: NLLS Regression Estimates for CES in Mali without Structural Breaks

Variables	Coefficient	Std. error	z-value	p-value	[95% Conf. interval	
Constant	-32.2312	7.1635	-4.50	0.0000	-47.016	-17.4465
Time trend	0.0192	0.0040	4.83	0.0000	0.0110	0.0274
LINS	-0.1672	0.0806	-2.08	0.0490	-0.3336	-0.0009
LFD	0.1699	0.1591	1.07	0.2960	-0.1583	0.4982
φ	-0.6710	2.7876	-0.24	0.8120	-6.4243	5.0822
ρ	-6.1590	13.387	-0.46	0.6500	-33.789	21.471
δ	0.0014	0.0094	0.15	0.8800	-0.0180	0.0209
Wald Test						
$\varphi=1$	$\rho=0$					
0.36	0.21					
$p.value = 0.5545$	$p.value = 0.6496$					

Notes: Non-linear least squares estimates are Driscoll and Kraay heteroscedasticity and autocorrelation-consistent (HAC) standard errors. The Wald Test –Chi-square (1) statistics value is used and probability in brackets.

The Wald test indicates that the CES production function for Mali is not significantly different from that of the Cobb-Douglas in Mali. This is because we fail to reject constant returns to scale ($\varphi = 1$) and the unitary elasticity of substitution ($\rho = 0$) hypotheses. In the absence of structural breaks, the CES production technology for Mali supports the IQLEG hypothesis proposed in this thesis.

7.3.2 Panel Non-linear Least Squares Parameter Estimates without Breaks – CES

The findings for the CES production form on Table 7.2 indicates that the coefficient of time trend is significant, revealing that there is a significant effect of technological progress. The institutional quality and financial development were both significant. This implies that both financial development and institutional quality significantly influence the efficiency of technology positively. The results obtained from the Wald test rejects the hypothesis that there are constant returns to scale, that is, ($\varphi = 1$) and again rejects the claim that there is unity elasticity of substitution $(\rho = 0)$. Hence, the production function cannot suggest unity elasticity of substitution for CES making it significantly different from the Cobb-Douglas production form. As such, the CES provides robust confirmation for the long-run relationship among LGDPPC, LFD, LCKPP and LINS for the panel of 21 countries from SSA.

Table 7. 2: Panel NLLS Regression Estimates for CES without Structural Breaks

Variables	Coef.	Std. Err.	Z-value	P-value	[95% Conf. Interval]	
Time trend	0.0027	0.0001	23.04	0.0000	0.0024	0.0029
LINS	0.1754	0.0280	6.26	0.0000	0.1205	0.2304
LFD	0.2304	0.0215	10.69	0.0000	0.1881	0.2726
δ	-79.6082	5.8211	-13.68	0.0000	-91.017	-68.199
ρ	-0.0029	0.0002	-11.71	0.0000	-0.0034	-0.0024
φ	-0.0010	0.0001	-9.47	0.0000	-0.0012	-0.0008
Wald Test						
φ =1	$\rho = 0$					
857	137.17					
p-value=0.000	*p-value=0.000*					

Notes: Non-linear least squares estimates are Driscoll and Kraay heteroscedasticity and autocorrelation-consistent (HAC) standard errors. The Wald Test –Chi-square (1) statistics value is used and probability in brackets.

7.3.3 Non-linear Least Squares Parameter Estimates with a Break in Mali – CES

The findings for the CES production form on Table 7.3 indicate that the constant in the first regime was still significant and negative. The trend coefficient in the second regime was insignificant whilst the significant coefficient in the first regime confirms positive technological advancement between 1985 and 2005 in Mali. Institutional quality is weakly significant but negative before the break and insignificant after the break. The results for Mali are similar to the CES without breaks as the general observation is that IQLEG is not statistically significant in the CES with a full structural break.

This implies that both financial development and institutional quality significantly influence the efficiency of technology positively. The results obtained from the Wald test fails to reject the hypothesis that there are constant returns to scale, that is, φ =1. The Wald test also fails to rejects the claim that there is unity elasticity of substitution

$(\rho = 0)$. The production function cannot suggest unity elasticity of substitution for CES with a full regime change, making it significantly similar to the Cobb-Douglas production form in Mali.

Table 7.3: NLLS Regression Estimates for CES in Mali with a Structural Break

	Coefficient	Std. error	z-value	p-value	[95% Conf. interval	
Constant	-74.8535	13.9700	-5.360	0.0000	-103.994	-45.713
D_{2005}	3.6260	55.1113	0.070	0.9480	-111.334	118.586
Time trend	0.0412	0.0073	5.670	0.0000	0.0260	0.0564
Time $trend_{2005}$	-0.0007	0.0278	-0.020	0.9810	-0.0587	0.0574
$LINS$	-0.1380	0.0785	-1.760	0.0940	-0.3017	0.0258
$LINSD_{2005}$	0.5801	0.4602	1.260	0.2220	-0.3798	1.5400
LFD	-0.1731	0.1725	-1.000	0.3280	-0.5329	0.1867
$LFDD_{2005}$	-0.8931	0.5949	-1.500	0.1490	-2.1341	0.3478
φ	-0.5833	11.4404	-0.050	0.9600	-24.448	23.2809
ρ	0.3931	7.2544	0.050	0.9570	-14.7393	15.5255
δ	0.4649	9.1624	0.050	0.9600	-18.6476	19.5773
Wald Test						
$\varphi = 1$	$\rho = 0$					
0.02	0.00					
$p.value = 0.8913$	$p.value = 0.9573$					

Notes: Non-linear least squares estimates are Driscoll and Kraay heteroscedasticity and autocorrelation-consistent (HAC) standard errors. The Wald Test –Chi-square (1) statistics value is used and probability in brackets. Mali's full regime break occurred in 2005.

7.3.4 Non-linear Least Squares Parameter Estimates with Two Regime Shifts – CES

To determine the effect of structural breaks on the model specification for the CES production function, the first step was to analyse the results from the non-linear least squares regression with structural breaks in 1989 and 2009 as was done in the Cobb-Douglas case. The results are presented in Table 7.4. Both level breaks in 1989 and 2009 are highly significant and have a positive effect on growth. The results also indicated that, for the CES specification, institutional quality was significant in both the first and second regimes. However, in the third regime, the effect of institutional quality on economic growth was negative. Interestingly, financial development was not significant in the second regime. The slope of the time trend in the CES was also positive and significant indicating that IQLEG positively influenced efficiency.

Table 7.4: Panel NLLS Regression Estimates for CES with Two Regime Shifts

Variables	Coef.	Std. Err.	Z-value	P-value	[95% Conf. Interval]	
D_{1989}	0.5547	0.1465	3.79	0.0000	0.2676	0.8417
D_{2009}	0.9565	0.3956	2.42	0.0160	0.1810	1.7319
Time trend	0.0023	0.0001	18.91	0.0000	0.0021	0.0026
$LINS$	0.4007	0.0521	7.70	0.0000	0.2987	0.5028
$LINSD_{1989}$	-0.2368	0.0567	-4.18	0.0000	-0.3479	-0.1258
$LINSD_{2009}$	-0.1175	0.1109	-11.06	0.2890	-0.3349	0.0999
LFD	0.2397	0.0357	6.71	0.0000	0.1697	0.3098
$LFDD_{1989}$	0.0208	0.0350	0.59	0.5520	-0.0478	0.0895
$LFDD_{2009}$	-0.1400	0.0475	-2.94	0.0030	-0.2332	-0.0468
δ	-0.0010	0.0001	-9.92	0.0000	-0.0013	-0.0008
ρ	-0.9359	0.0792	-1.82	0.0000	-1.0911	-0.7808
φ	-33.385	7.1973	-4.64	0.0000	-47.4917	-19.279
Wald Test						
$\varphi = 1$	$\rho = 0$					
35.87	112.87					
$p.value = 0.000$	$p.value = 0.000$					

Notes: Non-linear least squares estimates are heteroscedasticity and autocorrelation-consistent (HAC) standard errors. The Wald Test –Chi-square (1) statistics value is used and probability in brackets

In the CES context, both financial development and institutional quality are strongly positive in parameters before the break. Again, this result is interesting as it confirms the importance of IQLEG for productivity and hence growth in the 21 SSA countries as depicted by the Cobb-Douglas specification. The results obtained from the Wald test shows that the hypothesis that the returns to scale parameter, φ showing a constant return to scale, i.e. φ =1 was rejected in the CES production function with breaks. Hence, the CES production function with breaks does not suggest unity elasticity of substitution as hypothesized in the Wald test leading to the conclusion that, overall, in the presence of two regime structural changes, there is enough evidence that the CES production function estimated here is significantly different from the Cobb-Douglas production function.

7.4 Estimation Results and Findings for the VES Production Specification

7.4.1 The VES Non-linear Least Squares Parameter Estimates without Breaks in Mali

In the absence of structural breaks, the VES production's non-linear least squares estimates indicate that all parameters are significantly related to growth. The significant time trend is an indication of technological progress that was advancing in Mali over the period. The Wald test provides evidence to support the fact that the VES without breaks is significantly different from the Cobb-Douglas production technology. The results support those of the Cobb-Douglas framework without structural breaks. Overall, the VES production function robustly confirms the results obtained for Mali supporting the IQLEG hypothesis. The results are presented in Table 7.5.

Table 7.5: NLLS Regression Estimates for VES in Mali without Structural Breaks

	Coefficient	Standard error	z-value	p-value	[95% Conf. interval	
Constant	-29.0088	14.7466	-1.97	0.0610	-59.4442	1.4266
Time trend	1.7805	0.0077	231.66	0.0000	1.7647	1.7964
LINS	0.2767	0.0788	3.51	0.0020	0.1141	0.4392
LFD	0.5017	0.1700	2.95	0.00 0	0.1509	0.8526
ω	0.9868	0.0653	15.11	0.0000	0.8520	1.1216
φ	-0.2530	0.1103	-2.29	0.0310	-0.4806	-0.0253
η	-0.2959	0.0000	-210000.00	0.0000	-0.2959	-0.2959
Wald Test						
$\varphi=1$	$\eta=0$					
129.04	4300000					
$p.value=0.000$	$p.value=0.000$					

Notes: Non-linear least squares estimates are Driscoll and Kraay heteroscedasticity and autocorrelation-consistent (HAC) standard errors. The Wald Test –Chi-square (1) statistics value is used and probability in brackets

7.4.2 Panel VES Non-linear Least Squares Parameter Estimates without Breaks

The outcome of the Wald test in the panel VES framework presented in Table 7.6 provides evidence for the rejection of the hypothesis that there are constant returns to scale ($\varphi=1$). The hypothesis that there is unity elasticity of Substitution $\eta=0$ is also rejected. Hence, the production function cannot suggest unity elasticity of substitution for the VES making the VES estimator significantly different from the Cobb-Douglas specification. The results from the VES production function suggest that the coefficients of institutional quality and financial development are both positive and significant. This implies that both financial development and institutional quality significantly positively influence the efficiency of technology and subsequently economic growth in SSA. The time trend whose coefficient is a measure of technological advancement was also positive and significant.

Table 7.6: Panel NLLS Regression Estimates for VES without Structural Breaks

Variables	Coef.	Std. Err.	Z-value	P-value	[95%Conf.Interval]	
Time trend	0.0023	0.0001	44.25	0.0000	0.0022	0.0024
LINS	0.2506	0.0316	7.92	0.0000	0.1886	0.3127
LFD	0.3235	0.0483	6.69	0.0000	0.2288	0.4183
ω	0.0714	0.0445	1.60	0.1090	-0.0159	0.1587
φ	-0.1272	0.0486	-2.62	0.0090	-0.2225	-0.0319
η	0.8437	0.0763	11.06	0.0000	0.6941	0.9932
Wald Test						
$\varphi = 1$	$\eta = 0$					
537.32	122.28					
$p.value = 0.1421$	$p.value = 0.000$					

Notes: Non-linear least squares estimates are Driscoll and Kraay heteroscedasticity and autocorrelation-consistent (HAC) standard errors. The Wald Test –Chi-square (1) statistics value is used and probability in brackets

7.4.3 The VES Non-linear Least Squares Parameter Estimates with a Break in Mali

When a structural break was introduced in the level, trend and cointegration slope of the model within the VES framework, the Wald test in Mali provides evidence that the VES with a break is significantly different from the Cobb-Douglas function. Table 7.7 shows that, in the first regime, only financial development is not significant. However, after the break, both financial development and institutional quality were significant. Financial development, however, had a negative coefficient. Unlike the VES without structural breaks in Mali, the results for the VES with structural breaks do not fully support that of Mali. In the structural break case, the IQLEG hypothesis is not fully supported in all regimes. The significant time trend in the first regime is an indication of technological progress that is advancing in Mali over the period.

Table 7.7 Panel NLLS Regression Estimates for VES in Mali with a Structural Break

Parameters	Coefficient	Std. error	z-value	p-value	[95% Conf. interval]	
Constant	-73.2370	13.6840	-5.35	0.0000	-101.7813	-44.6926
D_{2005}	2.3467	38.7227	0.06	0.9520	-78.4274	83.1208
Time trend	0.0403	0.0071	5.65	0.0000	0.0255	0.0552
Time trend$_{2005}$	0.0007	0.0189	0.03	0.9730	-0.0388	0.0401
$LINS$	-0.1408	0.0760	-1.85	0.0790	-0.2993	0.0178
$LINSD_{2005}$	0.6038	0.3956	1.53	0.1430	-0.2214	1.4289
LFD	-0.1408	0.1664	-0.85	0.4070	-0.4879	0.2062
$LFDD_{2005}$	-1.2200	0.4850	-2.52	0.0210	-2.2316	-0.2083
ω	0.9451	0.1465	6.45	0.0000	0.6394	1.2507
φ	-0.2948	0.1089	-2.71	0.0140	-0.5220	-0.0676
η	-0.2945	0.0092	-31.90	0.0000	-0.3137	-0.2752
Wald Test						
$\varphi = 1$	$\eta = 0$					
141.29	1017.76					
$p.value = 0.000$	$p.value = 0.000$					

Notes: Non-linear least squares estimates are Driscoll and Kraay heteroscedasticity and autocorrelation-consistent (HAC) standard errors. The Wald Test –Chi-square (1) statistics value is used and probability in brackets

7.4.4 The Panel VES with Two Regime Shifts

Applying a non-linear least squares estimator to the VES production function with two regime breaks in 1989 and 2009, the results are presented in Table 7.8. The estimated results indicate that, for the VES production function when two regime breaks are applied, the coefficient of the time is negative but significant implying that technological advancement slowed down. The changes in level of the model for both regimes are both positive and significant. The coefficients institutional quality in the first regime is not significant whilst it is negative and insignificant in the second regime. It is, however, negative but significant in the third regime. Thus, the first and second regimes are similar to the results obtained in the case when there are no structural breaks in the Cobb-Douglas function.

Financial development in the first regime has a positive association with growth confirming that, whilst the relationship is negative in the second regime, it is insignificant in the third regime. These results confirm the position of the non-uniform or linear relationship between finance and growth (Berkes, Panizza and Arcand, 2012). The VES with breaks results thus supports the CES and Cobb-Douglas results in the presence of breaks. Indeed, all three production specifications emphasize the importance of IQLEG for productivity and hence growth in SSA. A careful study of the Wald test results provides evidence for the strong rejection of the null of unity elasticity of substitution but the non-rejection of the null of constant returns to scale. The VES production function is thus significantly different from the Cobb-Douglas production function.

Table 7.8: Panel NLLS Regression Estimates for VES with Two Regime Shifts

Variable	Coef.	Std Err	Z-value	P-value|	[95%Conf.Interval]	
Constant	49.9987	9.4117	5.3100	0.000	31.5171	68.4803
D_{1989}	2.4601	0.6262	3.9300	0.000	1.2304	3.6897
D_{2009}	5.7209	1.5721	3.6400	0.000	2.6338	8.8080
Time trend	-0.0239	0.0047	-5.0600	0.000	-0.0332	-0.0146
$LINS$	0.1216	0.2231	0.5400	0.586	-0.3166	0.5597
$LINSD_{1989}$	-0.1737	0.2427	-0.7200	0.474	-0.6502	0.3028
$LINSD_{2009}$	-1.6829	0.4629	-3.6400	0.000	-2.5918	-0.7740
LFD	0.8332	0.1370	6.0800	0.000	0.5642	1.1022
$LFDD_{1989}$	-0.4394	0.1497	-2.9400	0.003	-0.7334	-0.1454
$LFDD_{2009}$	-0.1837	0.1956	-0.9400	0.348	-0.5677	0.2003
ω	-0.4296	0.2403	-1.7900	0.074	-0.9014	0.0422
φ	-5.8736	4.6765	-1.2600	0.210	-15.057	3.3097
η	-0.6661	0.1233	-5.4000	0.000	-0.9082	-0.4240
Wald Test						
$\varphi = 1$	$\eta = 0$					
2.16	29.20					
$p.value = 0.1421$	$p.value = 0.000$					

Notes: Non-linear least squares estimates are Driscoll and Kraay heteroscedasticity and autocorrelation-consistent (HAC) standard errors. The Wald Test –Chi-square (1) statistics value is used and probability in brackets

7.5 Production Function Productivity Levels for the CES Function

7.5.1 Panel CES Production Function without Structural Breaks

The coefficients of the non-linear least squares estimators described and applied in the production of results in Table 7.2 were used in the determination of the productivity levels and growth rates of the CES production specification. The level of productivity in the form of TFP, NFP and the contribution of financial development and institutional quality (CIQLEG) are presented in Table 7.9, while the graphical representation of the contribution of IQLEG can be seen in Figure 7.1.

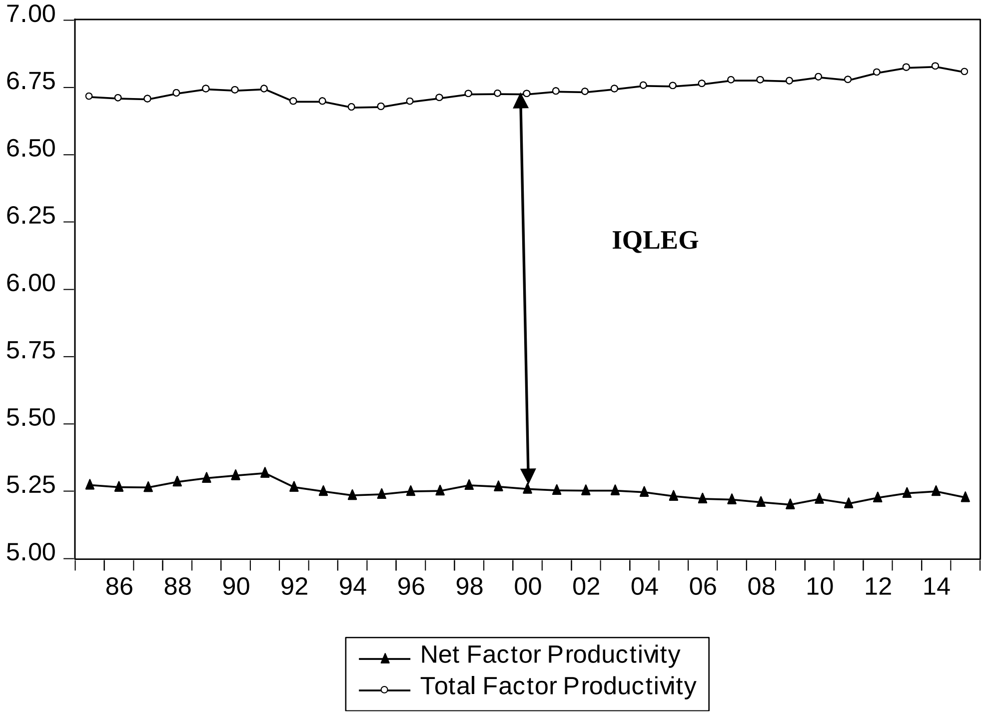
The general observation in the CES framework is that, compared to the Cobb-Douglas framework, the average contribution of IQLEG to productivity was higher at 31.80% with the mean contribution to economic growth from IQLEG to the growth of TFP within the CES being 70%. To confirm the negative trend coefficient, the average contribution of NFP to growth over the period was negative. The CES production function in Mali was not estimated since the model was not significantly different from the Cobb-Douglas function in Mali (You and Sarantis, 2013).

Table 7.9: Productivity Levels for Panel CES Production Function - No Structural Breaks

Levels of TFP, NFP and CIQLEG				**Growth Rate of TFP, NFP and CIQLEG**			
Year	TFP	NFP	IQLEG	Year	TFP	NFP	IQLEG
1985	6.7141	5.2727	1.4414	1985	na	Na	na
1986	6.7082	5.2646	1.4437	1986	-0.0058	-0.0082	0.0023
1987	6.7058	5.2642	1.4416	1987	-0.0024	-0.0003	-0.0021
1988	6.7269	5.2851	1.4418	1988	0.0211	0.0209	0.0002
1989	6.7428	5.2982	1.4446	1989	0.0159	0.0131	0.0028
1990	6.7382	5.3085	1.4297	1990	-0.0047	0.0103	-0.0149
1991	6.7424	5.3173	1.4251	1991	0.0043	0.0089	-0.0046
1992	6.6970	5.2650	1.4320	1992	-0.0454	-0.0524	0.0069
1993	6.6966	5.2490	1.4476	1993	-0.0004	-0.0160	0.0156
1994	6.6746	5.2345	1.4401	1994	-0.0220	-0.0145	-0.0075
1995	6.6766	5.2382	1.4385	1995	0.0020	0.0037	-0.0017
1996	6.6956	5.2496	1.4459	1996	0.0189	0.0114	0.0075
1997	6.7099	5.2513	1.4585	1997	0.0143	0.0017	0.0126
1998	6.7242	5.2717	1.4525	1998	0.0144	0.0204	-0.0060
1999	6.7255	5.2672	1.4583	1999	0.0012	-0.0045	0.0058
2000	6.7237	5.2582	1.4655	2000	-0.0018	-0.0090	0.0072
2001	6.7336	5.2527	1.4808	2001	0.0099	-0.0055	0.0154
2002	6.7317	5.2523	1.4794	2002	-0.0019	-0.0004	-0.0015
2003	6.7424	5.2525	1.4899	2003	0.0107	0.0002	0.0105
2004	6.7561	5.2463	1.5098	2004	0.0137	-0.0062	0.0199
2005	6.7541	5.2318	1.5223	2005	-0.0020	-0.0145	0.0125
2006	6.7619	5.2213	1.5406	2006	0.0078	-0.0105	0.0184
2007	6.7756	5.2192	1.5564	2007	0.0137	-0.0021	0.0157
2008	6.7756	5.2086	1.5670	2008	0.0000	-0.0106	0.0106
2009	6.7720	5.2001	1.5720	2009	-0.0035	-0.0085	0.0050
2010	6.7868	5.2205	1.5663	2010	0.0147	0.0205	-0.0057
2011	6.7767	5.2044	1.5722	2011	-0.0101	-0.0161	0.0060
2012	6.8036	5.2258	1.5778	2012	0.0270	0.0214	0.0056
2013	6.8221	5.2419	1.5802	2013	0.0185	0.0161	0.0024
2014	6.8261	5.2496	1.5765	2014	0.0040	0.0076	-0.0037
2015	6.8056	5.2267	1.5788	2015	-0.0205	-0.0228	0.0023
Mean rate	6.7428	5.2500	1.4928	Mean rate	0.0030	-0.0015	0.0046

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

Figure 7.1: Levels of Panel NFP, TFP and CIQLEG for the Panel CES form without Breaks



Source: Author, 2019

7.5.2 Panel CES Production Function with Two Regime Structural Breaks

The coefficients of the non-linear least squares estimators with two regime shifts described and applied in the production of results in Table 7.4 were used in the determination of the productivity levels and growth rates of the CES production specification in the presence of structural breaks. The level of productivity in the form of TFP, NFP and the contribution of financial development and institutional quality (CIQLEG) are presented in Table 7.10. The general observation is that, over the period, CIQLEG decreased whilst NFP increased

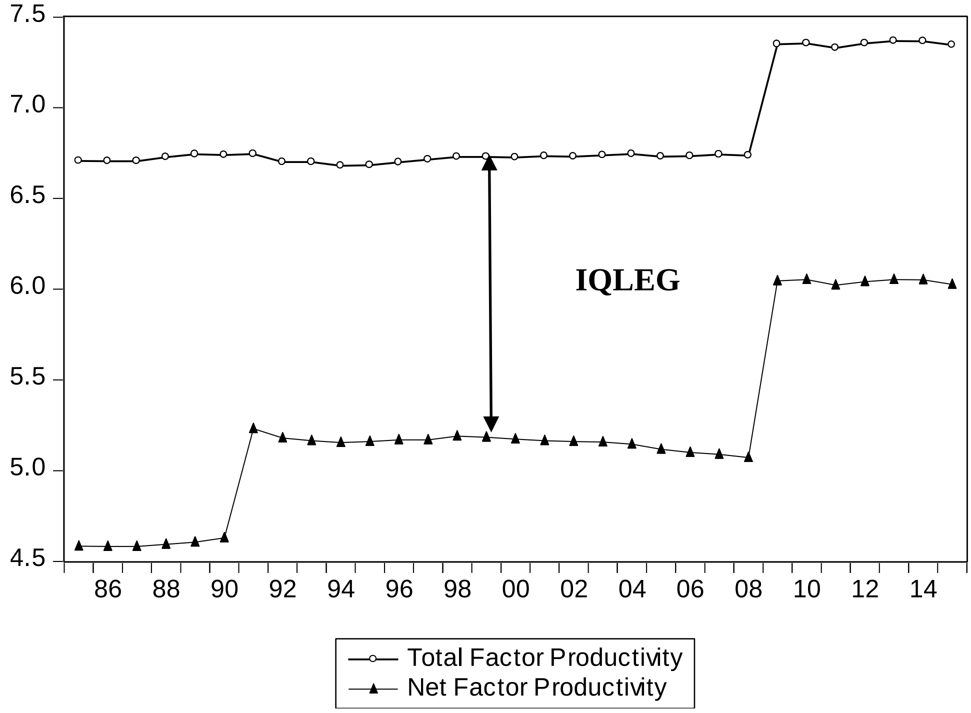
Table 7.10: Productivity Levels for Panel CES Production with Two Regime Shifts

Levels of TFP, NFP and CIQLEG				**Growth Rate of TFP, NFP and CIQLEG**			
Year	TFP	NFP	IQLEG	Year	TFP	NFP	IQLEG
1985	6.7070	4.5841	2.1230	1985	Na	na	na
1986	6.7058	4.5824	2.1233	1986	-0.0012	-0.0016	0.0004
1987	6.7049	4.5814	2.1235	1987	-0.0008	-0.0010	0.0002
1988	6.7270	4.5934	2.1336	1988	0.0220	0.0120	0.0101
1989	6.7438	4.6056	2.1381	1989	0.0168	0.0122	0.0046
1990	6.7398	4.6284	2.1114	1990	Na	na	na
1991	6.7450	5.2307	1.5143	1991	0.0052	0.6023	-0.5971
1992	6.7008	5.1791	1.5217	1992	-0.0442	-0.0516	0.0074
1993	6.7016	5.1651	1.5366	1993	0.0008	-0.0140	0.0149
1994	6.6806	5.1542	1.5264	1994	-0.0211	-0.0108	-0.0102
1995	6.6826	5.1597	1.5230	1995	0.0021	0.0054	-0.0034
1996	6.6995	5.1690	1.5305	1996	0.0169	0.0093	0.0075
1997	6.7143	5.1695	1.5448	1997	0.0148	0.0005	0.0143
1998	6.7284	5.1898	1.5386	1998	0.0141	0.0203	-0.0062
1999	6.7288	5.1842	1.5446	1999	0.0004	-0.0056	0.0060
2000	6.7259	5.1730	1.5528	2000	-0.0029	-0.0111	0.0082
2001	6.7341	5.1648	1.5693	2001	0.0082	-0.0082	0.0164
2002	6.7301	5.1603	1.5698	2002	-0.0040	-0.0045	0.0005
2003	6.7377	5.1574	1.5803	2003	0.0076	-0.0029	0.0105
2004	6.7452	5.1449	1.6003	2004	0.0075	-0.0125	0.0200
2005	6.7309	5.1173	1.6136	2005	-0.0143	-0.0276	0.0133
2006	6.7336	5.0995	1.6341	2006	0.0027	-0.0178	0.0205
2007	6.7420	5.0899	1.6521	2007	0.0084	-0.0096	0.0180
2008	6.7360	5.0717	1.6644	2008	-0.0059	-0.0182	0.0123
2009	7.3507	6.0451	1.3056	2009	0.0043	0.0073	-0.0030
2010	7.3551	6.0524	1.3026	2010	na	na	na
2011	7.3302	6.0224	1.3078	2011	-0.0249	-0.0301	0.0052
2012	7.3548	6.0414	1.3134	2012	0.0247	0.0191	0.0056
2013	7.3676	6.0528	1.3148	2013	0.0128	0.0114	0.0014
2014	7.3659	6.0513	1.3146	2014	-0.0017	-0.0015	-0.0002
2015	7.3461	6.0267	1.3193	2015	-0.0199	-0.0245	0.0047
Mean rates in selected periods				**Mean growth rates in selected periods**			
(1985 – 1989)	6.7177	4.5894	2.1283	(1985 – 1989)	0.0092	0.0054	0.0038
(1990 – 2009)	6.7544	5.1727	1.5817	(1990 – 2009)	0.0000	0.0237	-0.0237
(2010 – 2015)	7.3529	6.0389	1.3140	(2010 – 2015)	-0.0018	-0.0051	0.0033

NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. ‘G’ implies growth rate of each variable (NFP, TFP and CIQLEG)

During the first regime, the average contribution of IQLEG to the level of TFP is 31.69%. The average contribution decreased consistently for the second and third regimes with 23.45% and 17.87%, respectively. In terms of the contribution of growth of IQLEG to growth of TFP, the results indicate that TFP did not grow during the second regime due to IQLEG completely countering any growth in NFP, 35.20% contributed to the negative growth of TFP whilst NFP contributed positively to TFP growth. During the third regime, growth in IQLEG was positive although NFP and TFP grew at negative rates. Only the first regime recorded a positive contribution by IQLEG of 41.30% to TFP.

Figure 7.2: Levels of Panel NFP, TFP and CIQLEG for the CES with Two Regime Shifts



Source: Author, 2019

The general observation in the CES framework with breaks as depicted in Figure 7.4 is that, compared to the Cobb-Douglas framework with breaks, the contribution of IQLEG to the level of productivity through TFP was higher in the Cobb-Douglas context. For all three regimes, the contribution to TFP in the Cobb-Douglas function was averaged at about 33% whilst it was about 24% in the CES case with regime shifts. Although the contribution of NFP grew in each regime, the fall in growth rate of TFP could be attributed to the global financial crises and the negative effects of the structural adjustment programs in the 1990s.

7.6 Production Function Productivity Levels for the VES Function

7.6.1 The VES Production Function in Mali without Structural Breaks

The highest level of IQLEG was in 2011 whilst the lowest was in 1995 when the contribution was 1.8322. Before the break (1985-2005), the average contribution of IQLEG to productivity was 30.27% whilst it increased slightly to 30.95% after the break (Table 7.11). Implicitly, the occurrence of the break did not change the level of IQLE by much. NFP was consistent over the period and increased slightly after the break. The evidence supports a positive contribution of IQLEG towards the growth rate of TFP before the break but a negative contribution after the break.

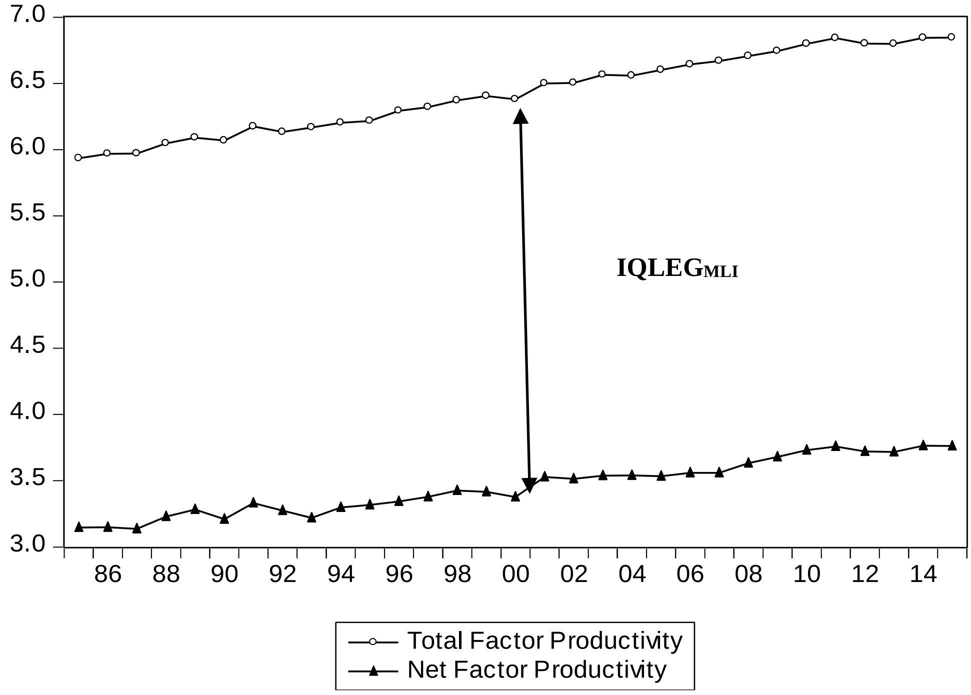
In terms of the growth rates, interestingly, negative growth rates were experienced for CIQLEG in the second regime although that was the highest average contribution period in terms of magnitude. This shows that, during the second regime, NFP was high whilst IQLEG was negatively impacting productivity. Figure 7.3 depicts the levels of the average NFP and TFP. The gap between the two gives a visual idea of the contribution of IQLEG. The figure shows that the levels of NFP and TFP increased significantly after the break compared to the period before the break.

Table 7.11: Productivity Levels for VES in Mali without a Break

Levels of TFP, NFP and CIQLEG				Growth Rate of TFP, NFP and CIQLEG			
Year	TFP	NFP	IQLEG	Year	TFP	NFP	IQLEG
1985	5.9020	6.8487	-0.9466	1985	Na	na	na
1986	5.9334	6.8890	-0.9557	1986	0.0333	0.0012	0.0321
1987	5.9700	6.9294	-0.9594	1987	0.0032	-0.0101	0.0132
1988	6.0125	6.9697	-0.9572	1988	0.0760	0.0907	-0.0147
1989	6.0538	7.0100	-0.9563	1989	0.0441	0.0539	-0.0097
1990	6.0743	7.0504	-0.9760	1990	-0.0228	-0.0734	0.0506
1991	6.1262	7.0907	-0.9645	1991	0.1065	0.1226	-0.0161
1992	6.1610	7.1311	-0.9701	1992	-0.0416	-0.0562	0.0146
1993	6.1551	7.1714	-1.0164	1993	0.0338	-0.0562	0.0899
1994	6.2103	7.2118	-1.0014	1994	0.0350	0.0795	-0.0445
1995	6.2510	7.2521	-1.0011	1995	0.0137	0.0188	-0.0051
1996	6.2752	7.2925	-1.0173	1996	0.0766	0.0256	0.0509
1997	6.3189	7.3328	-1.0139	1997	0.0290	0.0360	-0.0069
1998	6.3573	7.3731	-1.0158	1998	0.0513	0.0463	0.0050
1999	6.3773	7.4135	-1.0362	1999	0.0327	-0.0092	0.0418
2000	6.4135	7.4538	-1.0403	2000	-0.0252	-0.0387	0.0135
2001	6.4708	7.4942	-1.0234	2001	0.1188	0.1509	-0.0321
2002	6.5122	7.5345	-1.0223	2002	0.0038	-0.0129	0.0167
2003	6.5418	7.5749	-1.0331	2003	0.0614	0.0227	0.0388
2004	6.5881	7.6152	-1.0271	2004	-0.0064	0.0020	-0.0083
2005	6.6042	7.6556	-1.0513	2005	0.0442	-0.0050	0.0492
2006	6.6530	9.0054	-2.3524	2006	0.0404	0.0240	0.0164
2007	6.6698	9.0464	-2.3766	2007	0.0262	0.0012	0.0250
2008	6.7193	9.0874	-2.3681	2008	0.0368	0.0718	-0.0350
2009	6.7470	9.1284	-2.3815	2009	0.0392	0.0486	-0.0093
2010	6.8016	9.1694	-2.3679	2010	0.0535	0.0508	0.0026
2011	6.8439	9.2104	-2.3665	2011	0.0439	0.0266	0.0173
2012	6.8069	9.2514	-2.4445	2012	-0.0411	-0.0373	-0.0038
2013	6.8087	9.2924	-2.4838	2013	-0.0029	-0.0034	0.0005
2014	6.8256	9.3334	-2.5078	2014	0.0458	0.0463	-0.0005
2015	6.8408	9.3744	-2.5336	2015	0.0031	-0.0013	0.0045
Mean rates in selected periods				**Mean growth rates in selected periods**			
(1985 – 2005)	6.2528	7.2521	-0.9993	(1985 – 2005)	0.0334	0.0194	0.0140
(2006 – 2015)	6.7717	9.1899	-2.4183	(2006 – 2015)	0.0245	0.0227	0.0018

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

Figure 7. 3: Levels of NFP, TFP and CIQLEG for the VES in Mali



Source: Author, 2019

7.6.2 Panel VES Production Function without Structural Breaks

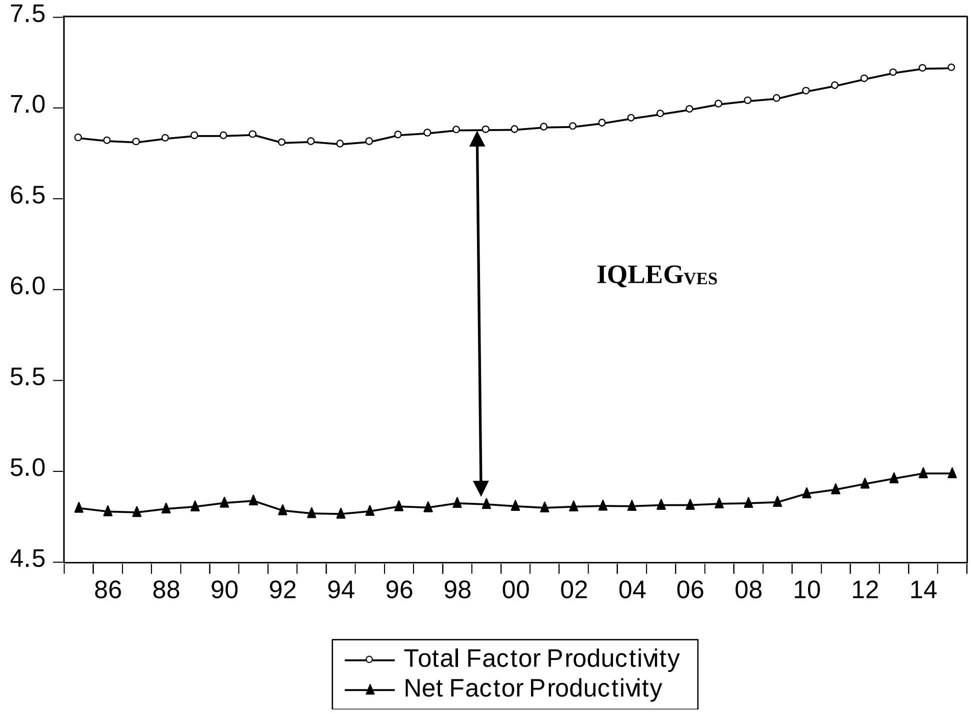
The coefficients of the non-linear least squares estimators described and applied in the production of results in Table 8.4 were used in the determination of the productivity levels and growth rates of the VES production specification. The level of productivity in the form of TFP, NFP and the contribution of financial development and institutional quality (CIQLEG) are presented in Table 7.12 while the graphical representation of the contribution of IQLEG can be seen in Figure 7.4. The general observation in the VES framework is that IQLEG contributed significantly to productivity and its growth. The results indicate that NFP and IQLEG contributed almost equally to productivity growth.

Table 7.12: Productivity Levels for Panel VES Production Function - No Structural Breaks

Levels of TFP, NFP and CIQLEF				**Growth Rate of TFP, NFP and CIQLEG**			
Year	TFP	NFP	IQLEG	Year	TFP	NFP	IQLEG
1985	6.8341	4.7976	2.0365	1985	Na	na	na
1986	6.8179	4.7782	2.0397	1986	-0.0162	-0.0195	0.0032
1987	6.8103	4.7735	2.0369	1987	-0.0076	-0.0047	-0.0029
1988	6.8304	4.7931	2.0373	1988	0.0200	0.0196	0.0004
1989	6.8460	4.8047	2.0413	1989	0.0156	0.0116	0.0040
1990	6.8455	4.8254	2.0201	1990	-0.0005	0.0207	-0.0212
1991	6.8511	4.8376	2.0135	1991	0.0056	0.0122	-0.0066
1992	6.8078	4.7844	2.0233	1992	-0.0433	-0.0532	0.0098
1993	6.8134	4.7679	2.0455	1993	0.0057	-0.0165	0.0222
1994	6.7998	4.7645	2.0353	1994	-0.0137	-0.0034	-0.0103
1995	6.8134	4.7803	2.0331	1995	0.0137	0.0159	-0.0022
1996	6.8500	4.8062	2.0437	1996	0.0365	0.0259	0.0106
1997	6.8610	4.7996	2.0614	1997	0.0110	-0.0067	0.0177
1998	6.8766	4.8237	2.0529	1998	0.0156	0.0241	-0.0086
1999	6.8785	4.8175	2.0610	1999	0.0020	-0.0062	0.0082
2000	6.8790	4.8079	2.0712	2000	0.0005	-0.0096	0.0101
2001	6.8923	4.7994	2.0928	2001	0.0132	-0.0085	0.0217
2002	6.8955	4.8050	2.0905	2002	0.0033	0.0056	-0.0023
2003	6.9144	4.8089	2.1055	2003	0.0188	0.0039	0.0150
2004	6.9420	4.8083	2.1337	2004	0.0277	-0.0006	0.0282
2005	6.9644	4.8131	2.1513	2005	0.0224	0.0048	0.0176
2006	6.9908	4.8136	2.1771	2006	0.0264	0.0006	0.0258
2007	7.0204	4.8211	2.1992	2007	0.0296	0.0075	0.0221
2008	7.0379	4.8238	2.2141	2008	0.0176	0.0027	0.0149
2009	7.0508	4.8297	2.2210	2009	0.0128	0.0059	0.0069
2010	7.0903	4.8774	2.2129	2010	0.0395	0.0476	-0.0081
2011	7.1210	4.8996	2.2214	2011	0.0307	0.0223	0.0084
2012	7.1588	4.9296	2.2292	2012	0.0378	0.0300	0.0078
2013	7.1920	4.9595	2.2326	2013	0.0333	0.0299	0.0034
2014	7.2156	4.9883	2.2273	2014	0.0235	0.0288	-0.0053
2015	7.2185	4.9880	2.2305	2015	0.0029	-0.0003	0.0032
Mean rate	6.9393	4.8299	2.1094	Mean rate	0.0128	0.0063	0.0065

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

Figure 7. 4**:** Levels of Panel NFP, TFP and CIQLEG for the VES

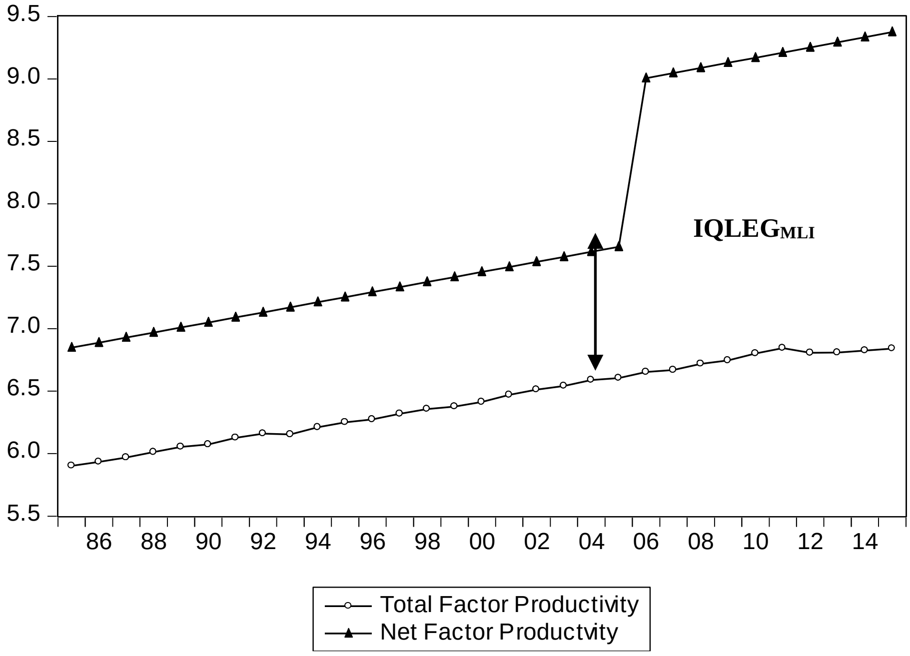


Source: Author, 2019

7.6.3 The VES Production Function in Mali with a Structural Break

The contribution of IQLEG in Mali was negative overall thus reducing NFP instead of enhancing it. The results presented on Table 7.13 indicate that the negative contribution of IQLEG increased in size over the period under study. NFP was consistent and increased over the period. In terms of the growth rates, the negative contribution of IQLEG adversely affected the growth of TFP. Indeed, in both regimes, NFP was high whilst IQLEG was negatively impacting productivity. Figure 7.5 depicts the levels of the average NFP and TFP, whilst the gap between the two gives a visual idea of the contribution of IQLEG. Due to the negative contribution of IQLEG in Mali, TFP is below NFP. The gap also widens considerably after the break. The productivity levels again prove that the IQLEG hypothesis was not supported for Mali under the VES framework when a full regime break was introduced.

Figure 7.5: Levels of NFP, TFP and CIQLEG for the VES with a Structural Break in Mali



Source: Author, 2019

Table 7.13: Productivity Estimations for VES with a Break in Mali

Levels of TFP, NFP and CIQLEG				**Growth Rate of TFP, NFP and CIQLEG**			
Year	TFP	NFP	IQLEG	Year	TFP	NFP	IQLEG
1985	5.9020	6.8487	-0.9466	1985	Na	na	na
1986	5.9334	6.8890	-0.9557	1986	0.0313	0.0403	-0.0090
1987	5.9700	6.9294	-0.9594	1987	0.0366	0.0403	-0.0037
1988	6.0125	6.9697	-0.9572	1988	0.0425	0.0403	0.0022
1989	6.0538	7.0100	-0.9563	1989	0.0412	0.0403	0.0009
1990	6.0743	7.0504	-0.9760	1990	0.0206	0.0403	-0.0198
1991	6.1262	7.0907	-0.9645	1991	0.0519	0.0403	0.0115
1992	6.1610	7.1311	-0.9701	1992	0.0348	0.0403	-0.0056
1993	6.1551	7.1714	-1.0164	1993	-0.0059	0.0403	-0.0463
1994	6.2103	7.2118	-1.0014	1994	0.0553	0.0403	0.0149
1995	6.2510	7.2521	-1.0011	1995	0.0406	0.0403	0.0003
1996	6.2752	7.2925	-1.0173	1996	0.0242	0.0403	-0.0161
1997	6.3189	7.3328	-1.0139	1997	0.0437	0.0403	0.0033
1998	6.3573	7.3731	-1.0158	1998	0.0385	0.0403	-0.0019
1999	6.3773	7.4135	-1.0362	1999	0.0200	0.0403	-0.0204
2000	6.4135	7.4538	-1.0403	2000	0.0362	0.0403	-0.0042
2001	6.4708	7.4942	-1.0234	2001	0.0573	0.0403	0.0170
2002	6.5122	7.5345	-1.0223	2002	0.0414	0.0403	0.0010
2003	6.5418	7.5749	-1.0331	2003	0.0296	0.0403	-0.0107
2004	6.5881	7.6152	-1.0271	2004	0.0464	0.0403	0.0060
2005	6.6042	7.6556	-1.0513	2005	0.0161	0.0403	-0.0242
2006	6.6530	9.0054	-2.3524	2006	na	na	na
2007	6.6698	9.0464	-2.3766	2007	0.0168	0.0410	-0.0242
2008	6.7193	9.0874	-2.3681	2008	0.0495	0.0410	0.0085
2009	6.7470	9.1284	-2.3815	2009	0.0276	0.0410	-0.0134
2010	6.8016	9.1694	-2.3679	2010	0.0546	0.0410	0.0136
2011	6.8439	9.2104	-2.3665	2011	0.0423	0.0410	0.0013
2012	6.8069	9.2514	-2.4445	2012	-0.0370	0.0410	-0.0780
2013	6.8087	9.2924	-2.4838	2013	0.0017	0.0410	-0.0393
2014	6.8256	9.3334	-2.5078	2014	0.0169	0.0410	-0.0241
2015	6.8408	9.3744	-2.5336	2015	0.0152	0.0410	-0.0258
Mean rates in selected periods				**Mean growth rates in selected periods**			
(1985 – 2005)	6.2528	7.2521	-0.9993	(1985 – 2005)	0.0351	0.0403	-0.0052
(2006 – 2015)	6.7717	9.1899	-2.4183	(2006 – 2015)	0.0209	0.0410	-0.0201

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

7.6.4 Panel VES Production Function with Two Regime Structural Breaks

The results for the VES in the presence for two regime shifts are quite different from the CES and the Cobb-Douglas framework, but are consistent with that of the CES. During the period before the first regime change, the average contribution of IQLEG to the level of TFP was 40.26%. The average contribution for the second and third regimes is 40.05 % and 42.25%, respectively. These figures are higher than the average of 24% in the CES framework and 32% in the Cobb-Douglas function with breaks. Table 7.14 shows that, in terms of the contribution of growth of IQLEG to growth of TFP, the results indicate that CIQLEG to growth of TFP was negative in the first and third regimes. Interestingly, the CES framework generated the direct opposite of the results for the VES when it came to the growth rates of NFP, TFP and CIQLEG. Whereas the contribution of IQLEG to TFP was negative in the second regime of the CES form, it was 89.06% in the VES form. Figure 7.6 shows that the gap between NFP and TFP, the contribution of IQLEG to productivity widened in the third regime.

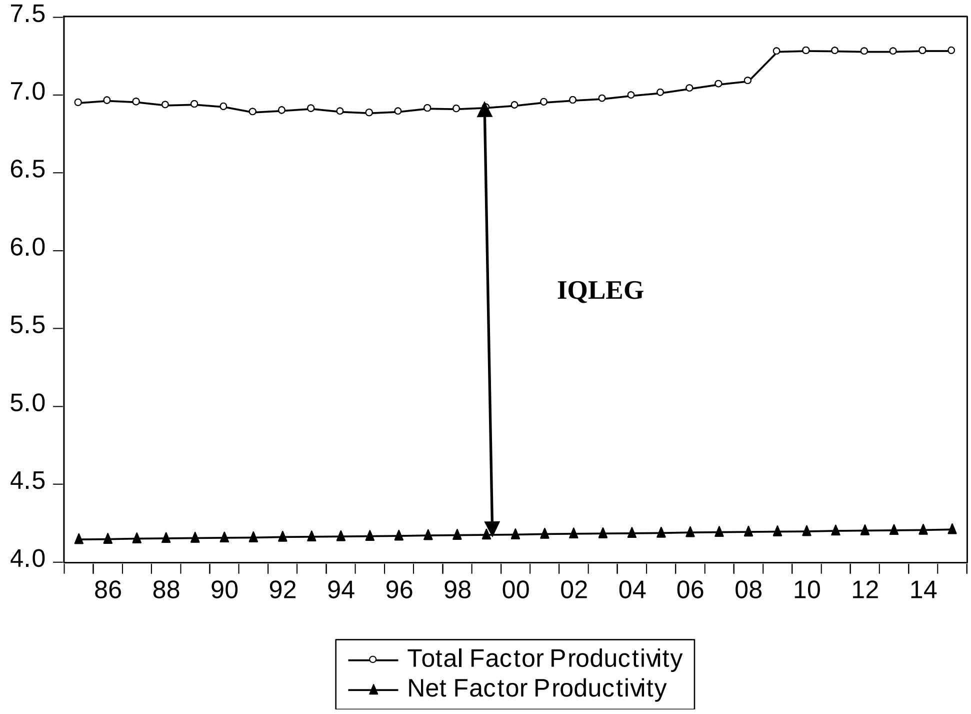
These results are in line with Demetriades and Law (2006) who worked with the Cobb-Douglas production function to find that institutional quality enhances growth when applied in TFP. The outcome, however, does not confirm the findings of Cecchetti and Kharroubi (2012) who conclude that the faster the financial sector grows, the slower the economy and thus productivity as a whole grows. The general finding here is that large and speedily growing financial sectors may tend to be very costly for the rest of the economy by negatively pulling in essential resources and thus slowing growth at the aggregate level for 21 OECD countries from 1980–2009.

Table 7.14*: Panel Productivity Estimations for VES with Two Regime Shifts*

Levels of TFP, NFP and CIQLEG				**Growth Rate of TFP, NFP and CIQLEG**			
Year	TFP	NFP	IQLEG	Year	TFP	NFP	IQLEG
1985	6.9488	4.1457	2.8032	1985	na	na	na
1986	6.9628	4.1478	2.8150	1986	0.0139	0.0021	0.0119
1987	6.9532	4.1498	2.8033	1987	-0.0096	0.0021	-0.0117
1988	6.9319	4.1519	2.7800	1988	-0.0212	0.0021	-0.0233
1989	6.9386	4.1540	2.7846	1989	0.0067	0.0021	0.0046
1990	6.9232	4.1561	2.7671	1990	na	na	na
1991	6.8874	4.1582	2.7292	1991	-0.0358	0.0021	-0.0379
1992	6.8978	4.1603	2.7376	1992	0.0105	0.0021	0.0084
1993	6.9096	4.1624	2.7472	1993	0.0117	0.0021	0.0096
1994	6.8907	4.1645	2.7263	1994	-0.0188	0.0021	-0.0209
1995	6.8825	4.1666	2.7159	1995	-0.0082	0.0021	-0.0103
1996	6.8912	4.1686	2.7226	1996	0.0087	0.0021	0.0066
1997	6.9128	4.1707	2.7421	1997	0.0216	0.0021	0.0195
1998	6.9089	4.1728	2.7361	1998	0.0085	0.0021	0.0064
1999	6.9174	4.1749	2.7425	1999	0.0085	0.0021	0.0064
2000	6.9310	4.1770	2.7540	2000	0.0136	0.0021	0.0115
2001	6.9519	4.1791	2.7728	2001	0.0209	0.0021	0.0188
2002	6.9632	4.1812	2.7820	2002	0.0113	0.0021	0.0092
2003	6.9742	4.1833	2.7909	2003	0.0110	0.0021	0.0089
2004	6.9941	4.1854	2.8087	2004	0.0199	0.0021	0.0178
2005	7.0111	4.1874	2.8236	2005	0.0170	0.0021	0.0149
2006	7.0402	4.1895	2.8506	2006	0.0291	0.0021	0.0270
2007	7.0677	4.1916	2.8761	2007	0.0276	0.0021	0.0255
2008	7.0876	4.1937	2.8939	2008	0.0198	0.0021	0.0178
2009	7.2762	4.1958	3.0804	2009	0.1887	0.0021	0.1866
2010	7.2822	4.1979	3.0843	2010	na	na	na
2011	7.2797	4.2000	3.0797	2011	-0.0025	0.0021	-0.0046
2012	7.2772	4.2021	3.0752	2012	-0.0024	0.0021	-0.0045
2013	7.2777	4.2042	3.0735	2013	0.0004	0.0021	-0.0017
2014	7.2818	4.2062	3.0756	2014	0.0041	0.0021	0.0020
2015	7.2814	4.2083	3.0730	2015	-0.0004	0.0021	-0.0025
Mean rates in selected periods				**Mean growth rates in selected periods**			
(1985 – 1989)	6.9471	4.1498	2.7972	(1985 – 1989)	-0.0026	0.0021	-0.0046
(1990 – 2009)	6.9659	4.1760	2.7900	(1990 – 2009)	0.0192	0.0021	0.0171
(2010 – 2015)	7.2796	4.2042	3.0754	(2010 – 2015)	-0.0002	0.0021	-0.0023

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

Figure 7.6**:** Levels of Panel NFP, TFP and CIQLEG for the VES with Two Regime Shifts



Source: Author, 2019

7.7 Conclusion

As a means of determining the robustness of the produced output, which resulted in the establishment of an existing relationship between finance and growth when institutions and structural breaks are considered, the CES and VES production specifications are estimated using non-linear least squares regression techniques. Both time series estimations with Mali as a case and panel estimations were considered with and without structural breaks. Mali was tested with one break in the level, trend and the cointegration vector using the Gregory and Hansen (1996) method. In the case of the panel, two common regime shift points are determined based on the results from the Banerjee and Carrion-i-Silvestre (2015) cointegration test applied to the model (You and Sarantis, 2013). The estimated break dates were found to be 1989 and 2009.

The results from Mali, the CES results showed that there was no significant difference between the CES function and the Cobb-Douglas function. With the VES, Mali's results provide evidence although the contribution of IQLEG to productivity is positive, the introduction of a full regime shift significantly negates the impact of IQLEG on productivity. As such, the presence of the structural breaks shows that, unlike the Cobb-Douglas case, institutional quality and financial development were not able to move the Malian economy to a higher level.

The CES result confirms the need for IQLEG or, better still, the role played by IQLEG in the finance-growth relationship. Unlike the Cobb-Douglas framework without structural breaks, the CES establishes a positive and significant association between financial development, institutional quality and economic growth. The contribution of IQLEG to productivity was positive. With the introduction of structural breaks, the CES confirms the outcome of the Cobb-Douglas framework, especially in the first regime. However, the contribution of IQLEG to growth, although positive, shrinks on average relative to when there were no breaks. Whilst the time trend in the Cobb-Douglas is negative but significant, it is positive in the CES framework. The outcomes of the Wald test on the elasticity of substitution also indicate that the CES framework is significantly different from the Cobb-Douglas framework in this panel. The results indicated that, overall, with the contribution of IQLEG to TFP was positive.

When structural breaks were absent from the VES estimation, the results provided evidence of a positive and significant relationship between financial development, institutional quality and economic growth. The VES results thus confirmed that of the CES. The coefficient of the time trend parameter is likewise positive in the VES framework. Again, the contribution of IQLEG to productivity is positive. With the introduction of structural breaks, the institutional quality was found to be insignificant in the first regime. However, financial development was significant and positive as happened in the Cobb-Douglas and CES production function. Overall, the VES model parameters with structural breaks provide evidence in support of institutional quality and structural breaks. Indeed, the VES with two regime breaks provided evidence of a slightly higher contribution of IQLEG relative to when the breaks were absent. The VES's elasticity of substitution showed that it is significantly different from the Cobb-Douglas framework.

It is important to note that both finance development and institutional quality significantly contributed to productivity growth in the models without structural breaks although they were reported as insignificant in the Cobb-Douglas specification without breaks in Chapter Five. Indeed, the second alternative production specification, the VES function, confirms the need for institutional quality enhanced financial development. The results of the CES and VES with structural breaks, buttressed the results from the Cobb-Douglas framework with structural breaks

It is therefore important for policy makers to pay close attention to sudden unexpected events that have the potential to transform the structure of the economy. A typical example is the onset of the global pandemic which started at the end of 2019. Another would be the 2007-2008 Global financial crises. Such events tend to affect economic outcomes in countries and should be significantly considered in policy making with respect to their propensity to have shift typical outcomes. structural breaks and the extent of impact they may have on the financial systems in SSA given that policy makers are working to improve the institutional environment.

For policy makers therefore, determining the underlying macroeconomic inputs-output relationships and the relevant elasticity of substitution ensures that scarce economic resources are not wasted in inefficiently determining productivity and growth. Like the Cobb-Douglas case, the CES and VES results indicated that the contribution of IQLEG and its growth rate needs to be of interest to policy makers in regions like SSA. It is important that other production forms are considered within the SSA context. The fact that financial development and institutional quality play a role, no matter how small, in productivity enhancement is worth stressing. With respect to the role of structural breaks, the general inference is that, placed within the different production forms, events that affect the structure of the economy of SSA countries may have significant impacts on growth and productivity

CHAPTER EIGHT

CONCLUSION

8.1 Introduction

The aim of this research is to examine whether institutional quality can work through financial development to contribute to higher productivity gains and hence GDP per capita growth. Specifically, the thesis sought to achieve four main goals. These are firstly, to capture both the market and non-market features of institutional quality in order to bring out the full contribution of institutional quality to economic growth within the framework of finance-growth nexus. The second goal was to investigate the role of market and non-market institutions in the finance -growth nexus for a group of twenty-one SSA economies. Thirdly, this thesis sought to detect and account for structural breaks introduced by these historical events to produce more reliable estimates in our investigation. The final goal of this research was to consider the constant elasticity of substitution and the variable elasticity of substitution in addition to the Cobb-Douglas production function to not only relax the constraints but also check the robustness of the analysis.

This thesis is premised on the proposition that productivity is enhanced with the interaction of institutions on financial development over and above that of pure technical progress in the Solow (1956) neoclassical framework. The Cobb-Douglas, constant elasticity of substitution, and variable elasticity of substitution specifications of the production function were all considered. The thesis is situated in 21 SSA countries spread across the region. Existing research in the finance-growth nexus shows that SSA does not make the most out of the introduction and application of higher levels of financial development as do many advanced societies (Gries, Kraft, and Meierrieks, 2010; Menyah, Nazlioglu and Wolde-Rufael, 2014). The reasons assigned include the neglect of sound institutions that would ensure that finance is not only developing in levels or quantity but is also in quality through adequately working institutions.

Rodrik (2000) hypothesizes that there are five main institutions that promote high-quality growth. These institutions are the protection of rights of parties involved in a contract; regulatory institutions; institutions for macroeconomic stabilisation; institutions for social insurance; and institutions of conflict management as well as institutions for economic freedom or democracy. Again, the literature emphasizes the role played by structural breaks and cross-sectional dependence in avoiding possible misspecification of models. In this thesis, by decomposing TFP into NFP and IQLEG using the Rodrik (2000) mix of institutions and financial development in the presence of level and regime structural breaks and cross-sectional dependence, the role of institutional quality in the finance-growth was investigated.

In this study, using annual data from the WGI, WDI and the ICRG, the role of institutional factors as proposed by Rodrik (2000) was investigated for 21 SSA countries. Firstly, based on the Solow Neoclassical growth model, total factor productivity in the Cobb-Douglas framework was decomposed into pure technical progress and institutional quality linked efficiency gain. Panel and time series cointegration tests with variables that provided evidence of being integrated of the first order were used to determine possible long-run associations between variables. Models were estimated without structural breaks, with structural breaks and then with structural breaks and cross-sectional dependence. Upon determination of cointegration, the speed of adjustment and long-run cointegration coefficients were estimated to determine the size and direction of elasticities. Finally, the production functions were estimated to determine the contribution of IQLEG to TFP levels and growth rates to establish the empirical role of IQLEG in the financial development-economic growth relationship.

8.2 Contribution to Literature

As already previously discussed in the first Chapter, four main contributions to knowledge are generated in this thesis. Based on the available literature, research on the finance-institutions-growth nexus that captures both market and non-market features of institutional quality as proposed by Rodrik (2000) is rare, especially in the case of SSA. This research makes an initial attempt to combine both types of institutions within the finance-growth framework by testing the relationships between financial development, economic growth and economic and market and non-market institutions as proposed by Rodrik (2000) and democracy to capture efficiency gains through an extension of the Cobb-Douglas production function when TFP is decomposed into pure technical progress and institutional quality linked efficiency gain.

The second contribution is that, although there's some research work within the finance-growth -institutions context premised on SSA, they are quite rare and have been focused on different groups of countries. In this study applies a group of countries that have not been used before in such a study. Indeed, based on the available literature, this is the first study in the finance-growth context in SSA that has applied the five institutions for high-quality growth proposed by Rodrik (2000) and democracy to capture the market and non-market features of institutional quality at the panel and individual country level.

Thirdly, as important as structural breaks are to analyses, previous studies within SSA, have rarely considered the impact of historical and possibly, future events in the form of structural breaks. the use of structural breaks in multivariate panel and individual unit root cointegration and non-linear least squares techniques within the finance-institutions-growth relationship is another contribution to the best of my knowledge. No study has applied the Westerlund (2006 a) as well as the Banerjee and Carrion-i-Silvestre (2015) cointegration techniques, which incorporates multiple structural breaks and cross-sectional dependence in SSA in the finance-growth nexus. The use of structural break models in the form of Gregory and Hansen (1996) and Hatemi-J (2008) cointegration tests in time series studies for the finance-institutions-growth studies for individual countries in SSA is also a contribution.

The final contribution involves the use alternative production functions in the form of the CES and VES production functions. In view of the fact that previous work has been mainly focused on the Cobb-Douglas production framework, this thesis makes both a theoretical and empirical contribution to literature on the importance of the elasticity of substitution for efficiency gains in the finance-institutions-growth context. This study, for the first time compares the effect of IQLEG on productivity using the CES, VES and Cobb-Douglas production properties. Furthermore, the use of alternative production frameworks within the SSA has the added provides robustness to the analysis conducted.

8.3 Findings

Five important findings can be summarized from the analysis in this study. Firstly, institutional quality as proposed by Rodrik (2000) works through financial development to generate higher productivity gains for the panel within the Cobb-Douglas framework only when structural breaks and cross-sectional dependence are considered. Secondly, the results for the panel CES and VES production functions suggests that, institutional quality was able to work through financial development to generate higher productivity levels without structural breaks. Thirdly, with the introduction of two regime shifts, the contribution of institutional quality through financial development is mixed. However, overall, the panel results for the CES and VES with and without structural breaks provide strong support for associations between financial development, institutional quality and economic growth with the contribution of IQLEG to productivity in the VES framework being the highest. With and without structural breaks, the institutional variables and financial development as well as capital have a stable long-run relationship with growth per capita as described in the Cobb-Douglas production function. The panel CES production and the VES production technologies were also found to be significantly different from the Cobb-Douglas production function.

The fourth finding is that, in the case of the time series cointegration estimations without structural breaks, 10 SSA countries provided support to establish a long-run causal relationship between financial development, institutional quality and economic growth. The results confirmed the theoretical foundations of a relationship between productivity and financial development when institutional quality improves. With the exception of Zimbabwe, Zambia and Kenya, the results for the other seven countries indicated that institutional quality works through financial development to generate higher productivity levels. The evidence showed a deteriorating role of financial development and institutional quality in Zimbabwe when the Cobb-Douglas production function was estimated. Upon the introduction of structural breaks, Mali and Niger provide evidence of FD and IQ generating higher productivity levels.

Lastly, in the case of the time series, the CES production function, results from Mali, the case country indicated firstly that, there's no significant difference between the CES and the Cobb-Douglas production functions whether or not structural breaks are considered. In addition, the case of the VES, although institutional quality works through financial development to generate higher productivity levels when there are no structural breaks, productivity is reduced when the structural break is introduced.

8.4 Conclusions

This research has demonstrated that the relationship between finance and growth in SSA over the period 1985 to 2015 using institutional quality represented by the high-quality growth institutions proposed by Rodrik (2000) is significant. This relationship works when the effect of structural breaks and cross-sectional dependence are incorporated into the panel framework. Indeed, the relationship between finance, institutional quality and economic growth is significantly positive to the extent that institutional quality further enhances the effect of finance in TFP to produce additional productivity levels over and above what would have been realized from pure technical progress alone. The study further confirms the importance of this relationship by estimating three alternative specifications of the production function to arrive at the conclusion that decomposing TFP into NFP and the effect of institutional quality linked with efficiency gain from financial development increases productivity and hence growth for the countries in SSA.

The CES production function and the VES production functions robustly confirm the need for improving the institutional environment even without structural breaks and increasing the productivity and hence growth levels and rates in SSA. Structural breaks however, make the effect of finance and institutions on growth more pronounced as they depict a more realistic reflection of the SSA economy. Effectively, when taken as a single panel, the results do not change from when the research is done on a time series basis for individual countries. Working on the financial sector and financial systems without paying attention to the institutional environment in SSA countries will not be beneficial.

For all three production specifications, the contribution of IQLEG and its growth rate need to be of interest to policy makers in regions like SSA; and the fact that financial development and institutional quality play a role, no matter how small, in productivity enhancement is worth mentioning. Additionally, certain structure-changing events have a direct influence on the financial markets and affect subsequent efficiency through TFP when institutions are adequately working in the economy. Recent happenings with the global health pandemic created by the onset of the Novel Coronavirus (2019-nCoV) and its initial impact on the global economy is a typical example of a structural break. It is therefore important to capture the effect of different structural breaks on the finance growth relationship in SSA in formulating and implementing policy and forecasting since the absence of structural breaks will render many finance-growth related policies in SSA ineffective.

8.5 Policy Recommendations

An important and paramount role of finance is producing and allocating capital as well as enhancing productivity of capital. There are large information costs associated with evaluating firms, managers, and market conditions before making investment decisions by individual investors and this may keep capital from flowing to its highest value use. Adequately working institutions would play the role of enhancing finance's ability to mitigate these costs. When the macro economy is stable, there is an absence of conflicts and wars, the rule of law is evident, and the states are politically stable, financial systems will operate in conducive environments to achieve desired results. The cost of acquiring and processing information by financial intermediaries will fall and hence improve resource allocation. Growth is accelerated when access to information is efficient. SSA countries need to place some emphasis on building adequate institutions that will complement the financial system's efforts at making financial information less costly and more efficient. Good institutions will ensure that stock markets play their role effectively to ensure faster productivity levels (Osman, Alexiou, and Tsaliki, 2011).

From a policy perspective, the results in this study are consistent with the finance-growth hypothesis however are modified by improvements in the institutional environment, suggesting that financial development conditioned on institutional quality is a major factor influencing productivity and economic growth in the selected SSA as a whole. Again, in policy making, emphasis should be given to the strengthening of all forms of institutions such as those described by Rodrik as growth-promoting, which in themselves will eliminate or mitigate the events and phenomena that disrupt the underlying structure of the economy to achieve high and sustainable growth. The institutional quality needs to be strengthened (Karimi and Daiari, 2018).

The essence of adequately working institutions whilst not being tampered down would only be evident when structural breaks are brought into SSA’s economic growth determination. Again, to effect higher productivity and efficiency levels, nation states in SSA should emphasize the improvement of the institutional environment. Attention should be given to maintaining democratic dispensations devoid of conflicts. Again, the social insurance systems should be implemented and managed to ensure equity and fairness; whilst regulatory and contract enforcement institutions should be devoid of government interference and corruption. Additionally, institutions that manage the macro economy should institute policies that ensure a stable economy in terms of both fiscal and monetary policies.

To realize stronger growth and sustain the improvements in financial conditions, indeed, the right mix of policies will remain one of the most important strategies that will help policy makers to achieve growth, strength and stability in the financial sector in SSA. Vital to this are policies that ensure that corporate or business investments are increased and that invigorates economic risk taking within strong institutional environments, which ensure that risks and costs associated with financial stability and development are not increased. Secondly, it is important to ensure a more resilient and robust domestic financial sector. These can be realised through formalising the sector with the right regulatory and monitoring apparatus in place and encouraging small-scale financial institutions such as microfinance institutions, especially in the largely small business and rural sector. This is likely to mitigate the impact of domestic and external imbalances that reduce resilience.

8.6 Limitations and Areas for Future Research

The research is limited in the sense that not all SSA countries had available data to enable them to be part of the sample. Again, with data collection, it would have been more desirable for the period under study to have been longer than the 31 years under consideration. It is believed that, if the study had covered a longer time, some important structural events that may have occurred in the panel would have been captured to assist in policy formulation. It is recommended that future research be carried out on a global scale with many more developing countries included in the sample. Secondly, the research considered the institutions as an aggregate measure. It would be interesting to investigate the impact of each individual institution suggested by Rodrik (2000) in the finance-growth framework in SSA. This is because it is likely that the effect of some institutions may be different across countries. The contribution each institution makes to productivity in the panel should be determined to help in identifying the specific role and weight that should be assigned to each institution in policy making.

Future research may include individual institutional variables and the additional important areas within the financial sector such as microfinance sector, the non-bank financial institution sector, the stock markets and the insurance markets. The most prominent area of study for SSA has been, and still continues to be, the banking sector. However, there is the need to pay attention to the abovementioned sectors with respect to their cumulative or unique contribution to efficiency enhancement in SSA since these sub-sectors of the financial sector are steadily gaining prominence. This analysis should be extended to firm level data as well as to help in productivity enhancement across industries and firms. Finally, to engage all types of production functions in research as this would further illuminate the decisions and policies that may come out of it.

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APPENDIX

APPENDIX A: List of Countries with Relevant Data in SSA

Table A1: List of Countries with Relevant Data in SSA

COUNTRY	COUNTRY CODE	REGION
Botswana	BWA	Southern
Congo, Rep	COG	Central
Cote d'Ivoire	CIV	Western
Gabon	GAB	Central
Gambia	GMB	Western
Ghana	GHA	Western
Kenya	KEN	Eastern
Madagascar	MDG	Southern
Malawi	MLW	Southern
Mali	MLI	Western
Mozambique	MOZ	Southern
Niger	NIG	Western
Nigeria	NGA	Western
Senegal	SEN	Western
Sierra Leone	SLE	Western
South Africa	ZAF	Southern
Sudan	SDN	Eastern
Tanzania United Rep.	TZA	Eastern
Uganda	UGA	Eastern
Zambia	ZMB	Southern
Zimbabwe	ZWE	Southern
Total	21	

Compiled by Author (2018)

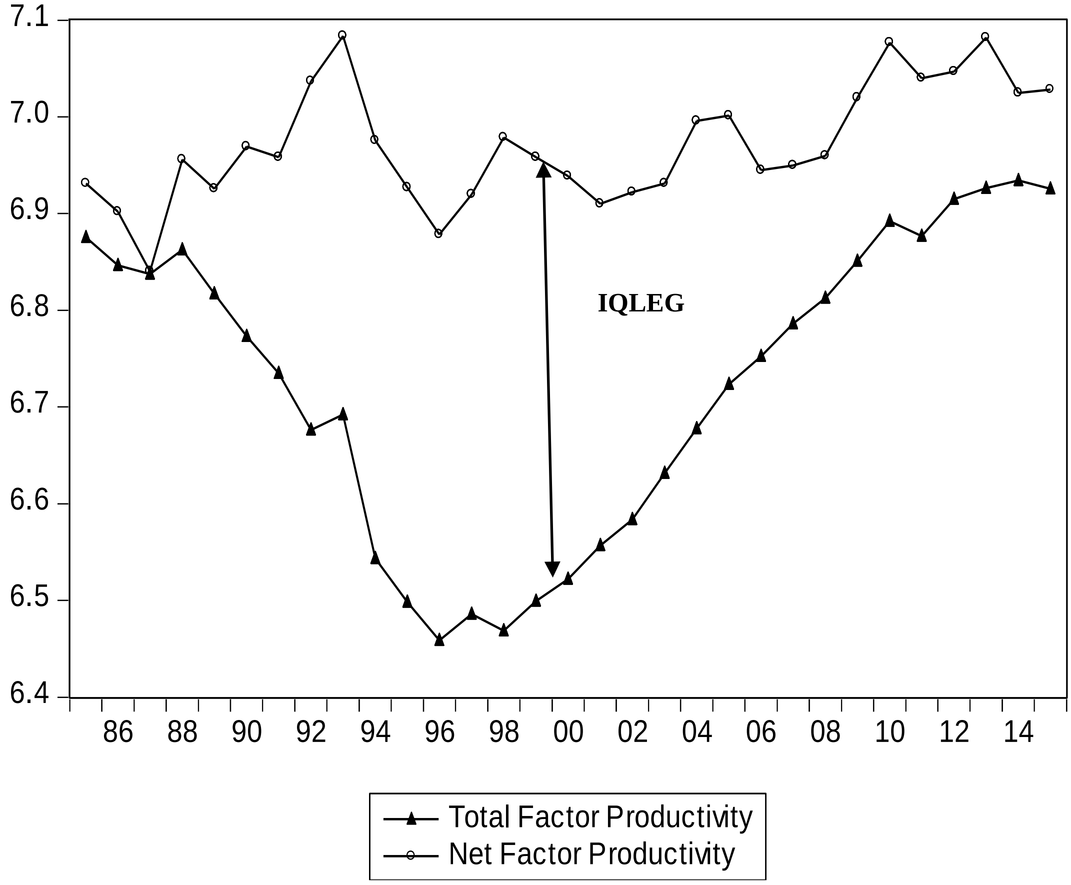
APPENDIX B: NFP, TFP and CIQLEG for the Cobb-Douglas Production Function without Breaks

Table B1: Zambia

Levels of TFP, NFP and CIQLEG				Growth Rate of TFP, NFP and CIQLEG			
Year	TFP_{ZMB}	NFP_{ZMB}	$IQLEG_{ZMB}$	Year	TFP_{ZMB}	NFP_{ZMB}	$IQLEG_{ZMB}$
1985	6.8754	6.9310	-0.0555	1985	na	na	na
1986	6.8463	6.9020	-0.0557	1986	-0.0292	-0.0290	-0.0001
1987	6.8374	6.8402	-0.0029	1987	-0.0089	-0.0618	0.0528
1988	6.8627	6.9558	-0.0931	1988	0.0254	0.1156	-0.0902
1989	6.8170	6.9254	-0.1084	1989	-0.0457	-0.0304	-0.0153
1990	6.7730	6.9694	-0.1964	1990	-0.0440	0.0439	-0.0880
1991	6.7349	6.9583	-0.2235	1991	-0.0381	-0.0110	-0.0271
1992	6.6762	7.0367	-0.3605	1992	-0.0587	0.0783	-0.1370
1993	6.6921	7.0837	-0.3916	1993	0.0158	0.0470	-0.0312
1994	6.5434	6.9754	-0.4320	1994	-0.1487	-0.1083	-0.0404
1995	6.4983	6.9271	-0.4288	1995	-0.0450	-0.0483	0.0033
1996	6.4587	6.8784	-0.4197	1996	-0.0396	-0.0487	0.0091
1997	6.4858	6.9196	-0.4338	1997	0.0271	0.0412	-0.0141
1998	6.4686	6.9785	-0.5099	1998	-0.0172	0.0589	-0.0761
1999	6.4994	6.9582	-0.4588	1999	0.0308	-0.0203	0.0511
2000	6.5220	6.9388	-0.4167	2000	0.0226	-0.0194	0.0420
2001	6.5569	6.9101	-0.3532	2001	0.0348	-0.0287	0.0635
2002	6.5837	6.9220	-0.3383	2002	0.0269	0.0119	0.0149
2003	6.6315	6.9312	-0.2997	2003	0.0478	0.0092	0.0386
2004	6.6777	6.9960	-0.3183	2004	0.0462	0.0648	-0.0186
2005	6.7236	7.0014	-0.2777	2005	0.0459	0.0054	0.0406
2006	6.7523	6.9449	-0.1926	2006	0.0287	-0.0565	0.0852
2007	6.7862	6.9496	-0.1634	2007	0.0339	0.0047	0.0292
2008	6.8128	6.9596	-0.1468	2008	0.0266	0.0100	0.0166
2009	6.8509	7.0200	-0.1690	2009	0.0381	0.0604	-0.0222
2010	6.8923	7.0767	-0.1844	2010	0.0414	0.0568	-0.0154
2011	6.8765	7.0399	-0.1633	2011	-0.0158	-0.0369	0.0211
2012	6.9149	7.0468	-0.1319	2012	0.0383	0.0069	0.0314
2013	6.9264	7.0819	-0.1555	2013	0.0115	0.0351	-0.0236
2014	6.9342	7.0248	-0.0906	2014	0.0078	-0.0571	0.0649
2015	6.9255	7.0282	-0.1027	2015	-0.0088	0.0034	-0.0121
Mean rate	6.7238	6.9713	-0.2476	Mean rate	0.0017	0.0032	-0.0016

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

Figure B1: Zambia - Levels of Panel NFP, TFP and CIQLEG without Breaks



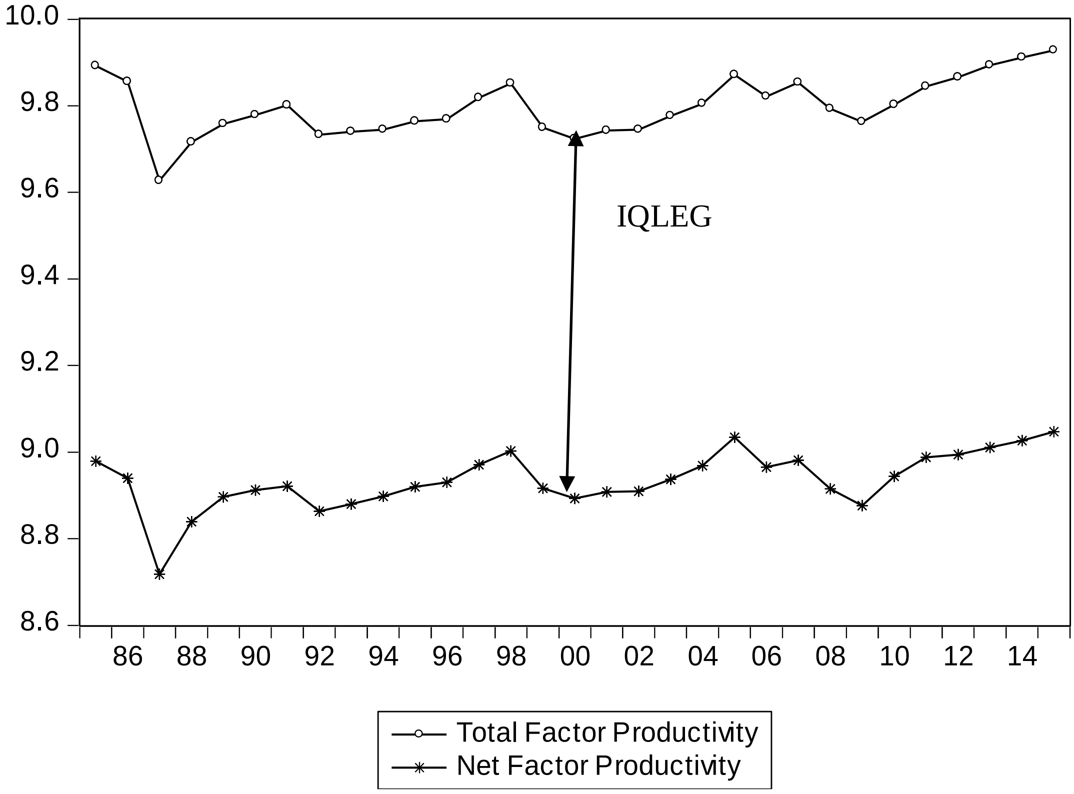
Source: Author, 2019

Table B2: Gambia

Levels of TFP, NFP and CIQLEG				Growth Rate of TFP, NFP and CIQLEG			
Year	TFP_{GMB}	NFP_{GMB}	$IQLEG_{GMB}$	Year	TFP_{GMB}	NFP_{GMB}	$IQLEG_{GMB}$
1985	9.8924	8.9791	0.9133	1985	na	na	na
1986	9.8558	8.9398	0.9159	1986	-0.0366	-0.0392	0.0026
1987	9.6271	8.7181	0.9090	1987	-0.2287	-0.2218	-0.0069
1988	9.7160	8.8391	0.8768	1988	0.0889	0.1211	-0.0322
1989	9.7583	8.8963	0.8062	1989	0.0423	0.0572	-0.0149
1990	9.7783	8.9126	0.8657	1990	0.0200	0.0163	0.0037
1991	9.8015	8.9210	0.8804	1991	0.0232	0.0084	0.0148
1992	9.7331	8.8632	0.8699	1992	-0.0684	-0.0578	-0.0106
1993	9.7399	8.8801	0.8597	1993	0.0068	0.0169	-0.0101
1994	9.7448	8.8978	0.8470	1994	0.0049	0.0177	-0.0127
1995	9.7640	8.9200	0.8440	1995	0.0192	0.0223	-0.0030
1996	9.7691	8.9300	0.8391	1996	0.0051	0.0099	-0.0048
1997	9.8189	8.9709	0.8479	1997	0.0497	0.0409	0.0088
1998	9.8517	9.0026	0.8491	1998	0.0328	0.0317	0.0011
1999	9.7497	8.9161	0.8336	1999	-0.1020	-0.0865	-0.0155
2000	9.7236	8.8928	0.8308	2000	-0.0261	-0.0233	-0.0028
2001	9.7426	8.9081	0.8345	2001	0.0190	0.0153	0.0038
2002	9.7450	8.9095	0.8355	2002	0.0024	0.0014	0.0009
2003	9.7765	8.9369	0.8396	2003	0.0315	0.0274	0.0042
2004	9.8046	8.9689	0.8357	2004	0.0280	0.0320	-0.0039
2005	9.8715	9.0345	0.8370	2005	0.0669	0.0656	0.0013
2006	9.8214	8.9655	0.8559	2006	-0.0501	-0.0690	0.0189
2007	9.8539	8.9812	0.8727	2007	0.0326	0.0157	0.0169
2008	9.7933	8.9148	0.8786	2008	-0.0606	-0.0665	0.0058
2009	9.7627	8.8765	0.8862	2009	-0.0306	-0.0383	0.0077
2010	9.8026	8.9440	0.8586	2010	0.0399	0.0675	-0.0277
2011	9.8444	8.9883	0.8561	2011	0.0418	0.0442	-0.0024
2012	9.8660	8.9945	0.8715	2012	0.0216	0.0062	0.0154
2013	9.8937	9.0107	0.8830	2013	0.0277	0.0162	0.0115
2014	9.9117	9.0267	0.8849	2014	0.0180	0.0161	0.0019
2015	9.9282	9.0473	0.8809	2015	0.0165	0.0206	-0.0041
Mean rate	9.7981	8.9351	0.8631	Mean rate	0.0012	0.0023	-0.0011

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

Figure B2: Gambia - Levels of Panel NFP, TFP and CIQLEG without Breaks



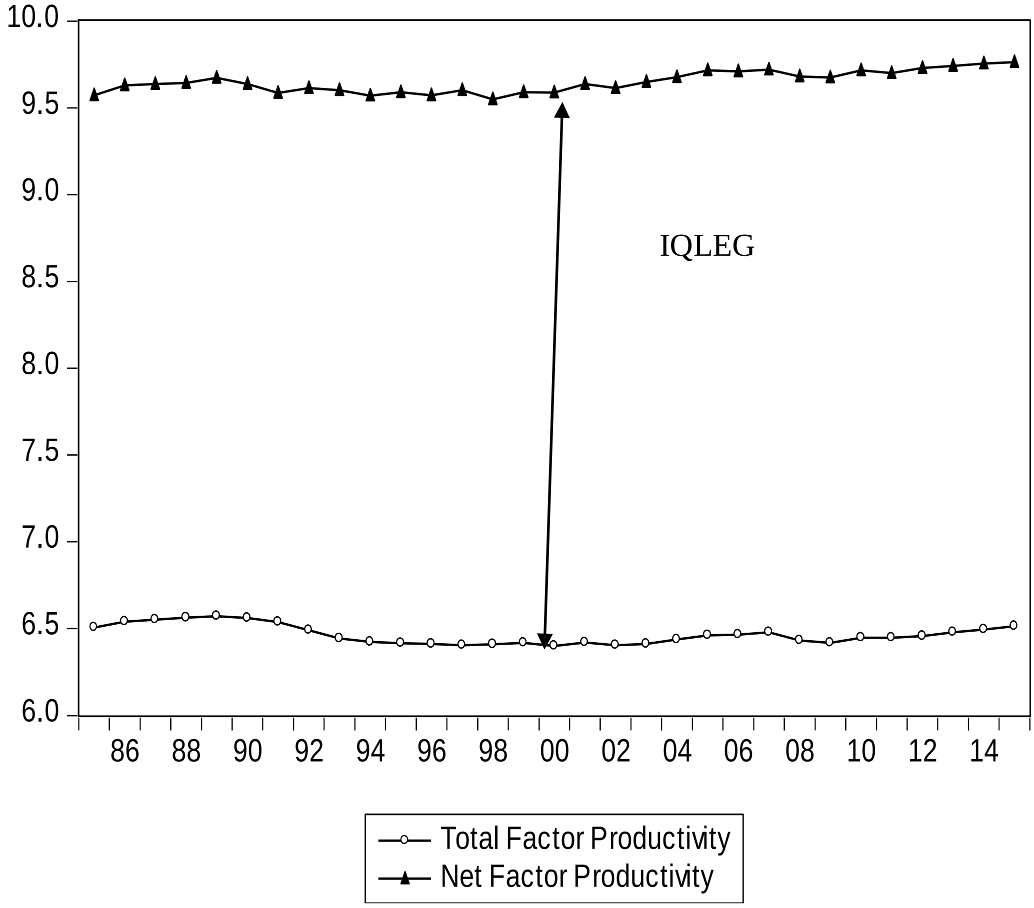
Source: Author, 2019

Table B3: Kenya

Levels of TFP, NFP and CIQLEG				Growth Rate of TFP, NFP and CIQLEG			
Year	**TFP_{KEN}**	**NFP_{KEN}**	**$IQLEG_{KEN}$**	**Year**	**TFP_{KEN}**	**NFP_{KEN}**	**$IQLEG_{KEN}$**
1985	6.5057	9.5729	-3.0672	1985	na	Na	Na
1986	6.5398	9.6288	-3.0891	1986	0.0341	0.0559	-0.0218
1987	6.5513	9.6361	-3.0847	1987	0.0116	0.0073	0.0043
1988	6.5640	9.6435	-3.0794	1988	0.0127	0.0074	0.0053
1989	6.5713	9.6717	-3.1004	1989	0.0072	0.0282	-0.0210
1990	6.5614	9.6371	-3.0757	1990	-0.0098	-0.0346	0.0248
1991	6.5384	9.5866	-3.0482	1991	-0.0231	-0.0505	0.0275
1992	6.4904	9.6131	-3.1227	1992	-0.0479	0.0266	-0.0745
1993	6.4441	9.6010	-3.1569	1993	-0.0463	-0.0122	-0.0341
1994	6.4249	9.5701	-3.1452	1994	-0.0192	-0.0309	0.0117
1995	6.4154	9.5897	-3.1743	1995	-0.0095	0.0196	-0.0291
1996	6.4121	9.5717	-3.1596	1996	-0.0033	-0.0180	0.0146
1997	6.4051	9.6025	-3.1974	1997	-0.0069	0.0308	-0.0377
1998	6.4109	9.5480	-3.1371	1998	0.0057	-0.0545	0.0602
1999	6.4175	9.5907	-3.1731	1999	0.0067	0.0427	-0.0360
2000	6.4011	9.5873	-3.1861	2000	-0.0164	-0.0034	-0.0130
2001	6.4202	9.6374	-3.2172	2001	0.0190	0.0501	-0.0311
2002	6.4045	9.6129	-3.2084	2002	-0.0157	-0.0246	0.0089
2003	6.4130	9.6488	-3.2358	2003	0.0086	0.0360	-0.0274
2004	6.4375	9.6772	-3.2397	2004	0.0245	0.0284	-0.0039
2005	6.4609	9.7152	-3.2544	2005	0.0233	0.0380	-0.0147
2006	6.4650	9.7106	-3.2455	2006	0.0042	-0.0047	0.0088
2007	6.4782	9.7197	-3.2414	2007	0.0132	0.0091	0.0041
2008	6.4321	9.6805	-3.2484	2008	-0.0462	-0.0392	-0.0069
2009	6.4188	9.6740	-3.2552	2009	-0.0132	-0.0064	-0.0068
2010	6.4473	9.7148	-3.2675	2010	0.0284	0.0407	-0.0123
2011	6.4482	9.7005	-3.2523	2011	0.0010	-0.0142	0.0152
2012	6.4577	9.7304	-3.2727	2012	0.0095	0.0299	-0.0204
2013	6.4790	9.7416	-3.2625	2013	0.0213	0.0111	0.0101
2014	6.4947	9.7546	-3.2598	2014	0.0157	0.0130	0.0027
2015	6.5146	9.7635	-3.2489	2015	0.0199	0.0090	0.0109
Mean rate	6.4653	9.6494	-3.1841	Mean rate	0.0003	0.0064	-0.0061

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

Figure B3: Kenya- Levels of Panel NFP, TFP and CIQLEG without Breaks



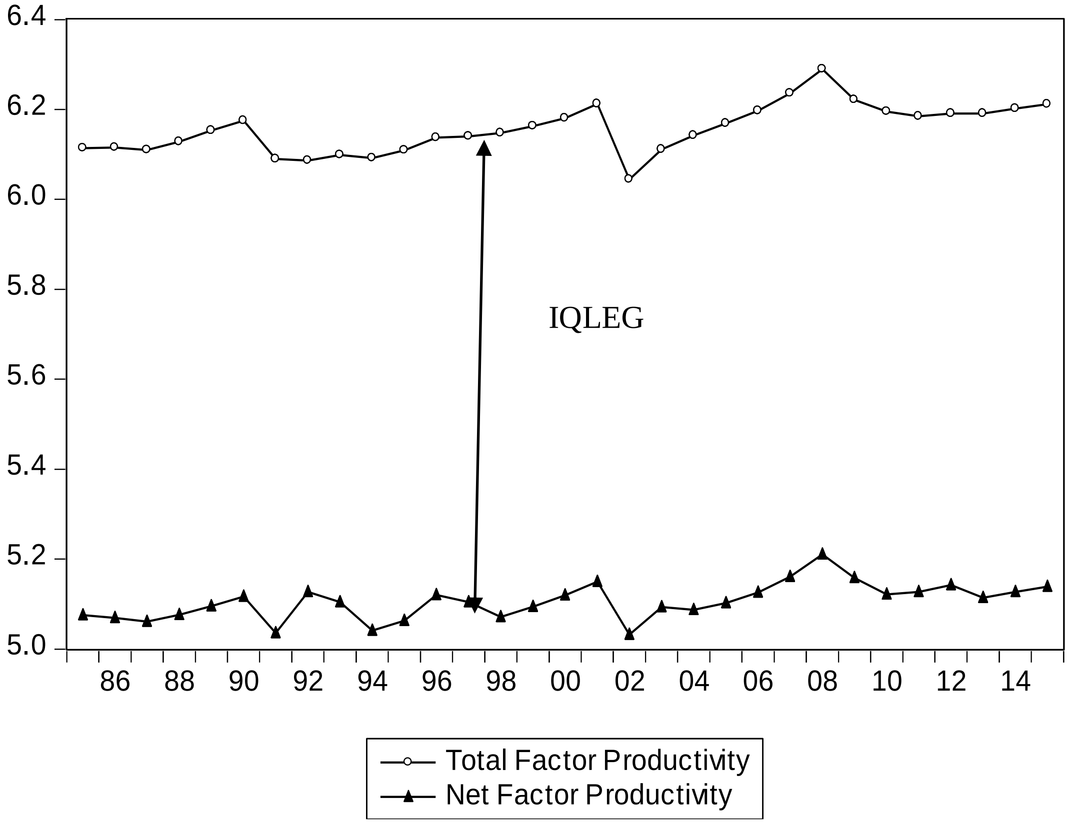
Source: Author, 2019

Table B4: Madagascar

Levels of TFP, NFP and CIQLEG				Growth Rate of TFP, NFP and CIQLEG			
Year	TFP_{MDG}	NFP_{MDG}	$IQLEG_{MDG}$	Year	TFP_{MDG}	NFP_{MDG}	$IQLEG_{MDG}$
1985	6.1142	5.0756	1.0386	1985	na	na	na
1986	6.1155	5.0693	1.0462	1986	0.0014	-0.0063	0.0077
1987	6.1094	5.0610	1.0485	1987	-0.0061	-0.0083	0.0023
1988	6.1282	5.0760	1.0522	1988	0.0188	0.0151	0.0037
1989	6.1533	5.0952	1.0581	1989	0.0251	0.0192	0.0059
1990	6.1755	5.1166	1.0589	1990	0.0222	0.0214	0.0008
1991	6.0897	5.0353	1.0545	1991	-0.0858	-0.0813	-0.0045
1992	6.0862	5.1270	0.9592	1992	-0.0035	0.0918	-0.0953
1993	6.0985	5.1044	0.9942	1993	0.0123	-0.0227	0.0350
1994	6.0920	5.0408	1.0512	1994	-0.0066	-0.0636	0.0570
1995	6.1093	5.0633	1.0460	1995	0.0173	0.0225	-0.0052
1996	6.1370	5.1200	1.0170	1996	0.0277	0.0567	-0.0290
1997	6.1398	5.1041	1.0358	1997	0.0029	-0.0159	0.0187
1998	6.1479	5.0710	1.0770	1998	0.0081	-0.0331	0.0412
1999	6.1630	5.0937	1.0693	1999	0.0151	0.0227	-0.0076
2000	6.1805	5.1198	1.0607	2000	0.0175	0.0261	-0.0086
2001	6.2124	5.1500	1.0624	2001	0.0319	0.0302	0.0017
2002	6.0442	5.0319	1.0123	2002	-0.1682	-0.1181	-0.0501
2003	6.1110	5.0934	1.0176	2003	0.0668	0.0615	0.0053
2004	6.1418	5.0868	1.0550	2004	0.0308	-0.0066	0.0373
2005	6.1692	5.1024	1.0668	2005	0.0274	0.0156	0.0118
2006	6.1975	5.1254	1.0722	2006	0.0283	0.0229	0.0054
2007	6.2355	5.1606	1.0748	2007	0.0379	0.0353	0.0027
2008	6.2897	5.2102	1.0794	2008	0.0542	0.0496	0.0046
2009	6.2216	5.1578	1.0637	2009	-0.0681	-0.0524	-0.0157
2010	6.1950	5.1216	1.0734	2010	-0.0266	-0.0362	0.0096
2011	6.1848	5.1269	1.0579	2011	-0.0101	0.0053	-0.0154
2012	6.1908	5.1420	1.0489	2012	0.0060	0.0151	-0.0091
2013	6.1907	5.1138	1.0769	2013	-0.0001	-0.0282	0.0281
2014	6.2022	5.1269	1.0753	2014	0.0115	0.0132	-0.0017
2015	6.2116	5.1390	1.0727	2015	0.0095	0.0120	-0.0026
Mean rate	6.1561	5.1052	1.0509	Mean rate	0.0032	0.0021	0.0011

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

Figure B4: Madagascar- Levels of Panel NFP, TFP and CIQLEG without Breaks



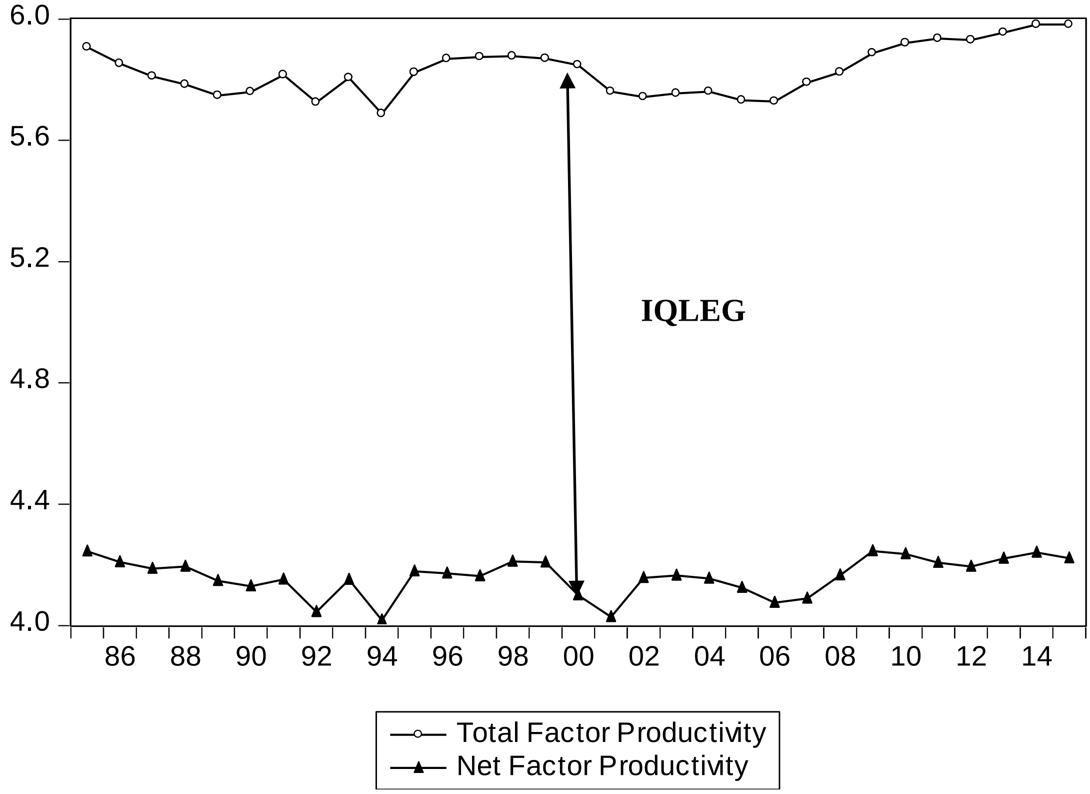
Source: Author, 2019

Table B5: Malawi

Levels of TFP, NFP and CIQLEG				**Growth Rate of TFP, NFP and CIQLEG**			
Year	TFP_{MLW}	NFP_{MLW}	$IQLEG_{MLW}$	Year	TFP_{MLW}	NFP_{MLW}	$IQLEG_{MLW}$
1985	5.9072	4.2446	1.6625	1985	na	na	na
1986	5.8526	4.2088	1.6438	1986	-0.0546	-0.0359	-0.0188
1987	5.8108	4.1870	1.6238	1987	-0.0418	-0.0218	-0.0200
1988	5.7840	4.1939	1.5901	1988	-0.0267	0.0069	-0.0336
1989	5.7473	4.1467	1.6006	1989	-0.0368	-0.0473	0.0105
1990	5.7593	4.1292	1.6301	1990	0.0120	-0.0175	0.0295
1991	5.8157	4.1520	1.6637	1991	0.0564	0.0228	0.0336
1992	5.7252	4.0443	1.6810	1992	-0.0904	-0.1077	0.0173
1993	5.8062	4.1513	1.6549	1993	0.0809	0.1070	-0.0261
1994	5.6875	4.0176	1.6699	1994	-0.1187	-0.1337	0.0150
1995	5.8235	4.1789	1.6446	1995	0.1360	0.1613	-0.0253
1996	5.8684	4.1719	1.6965	1996	0.0449	-0.0070	0.0519
1997	5.8747	4.1625	1.7122	1997	0.0063	-0.0094	0.0158
1998	5.8777	4.2112	1.6665	1998	0.0030	0.0487	-0.0457
1999	5.8697	4.2083	1.6614	1999	-0.0080	-0.0029	-0.0051
2000	5.8482	4.0995	1.7488	2000	-0.0215	-0.1088	0.0873
2001	5.7608	4.0282	1.7326	2001	-0.0875	-0.0713	-0.0162
2002	5.7430	4.1568	1.5862	2002	-0.0178	0.1286	-0.1464
2003	5.7544	4.1646	1.5898	2003	0.0114	0.0078	0.0036
2004	5.7603	4.1553	1.6050	2004	0.0059	-0.0093	0.0152
2005	5.7322	4.1249	1.6074	2005	-0.0281	-0.0304	0.0023
2006	5.7278	4.0756	1.6521	2006	-0.0045	-0.0492	0.0448
2007	5.7901	4.0893	1.7008	2007	0.0623	0.0137	0.0487
2008	5.8243	4.1653	1.6590	2008	0.0342	0.0760	-0.0418
2009	5.8875	4.2452	1.6423	2009	0.0632	0.0799	-0.0167
2010	5.9203	4.2354	1.6850	2010	0.0328	-0.0099	0.0427
2011	5.9359	4.2075	1.7284	2011	0.0155	-0.0279	0.0434
2012	5.9310	4.1944	1.7367	2012	-0.0048	-0.0132	0.0083
2013	5.9548	4.2206	1.7342	2013	0.0237	0.0262	-0.0025
2014	5.9822	4.2404	1.7418	2014	0.0274	0.0198	0.0077
2015	5.9819	4.2223	1.7596	2015	-0.0003	-0.0181	0.0178
Mean rate	5.8305	4.1624	1.6681	Mean rate	0.0025	-0.0007	0.0032

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

Figure B5: Malawi - Levels of Panel NFP, TFP and CIQLEG without Breaks



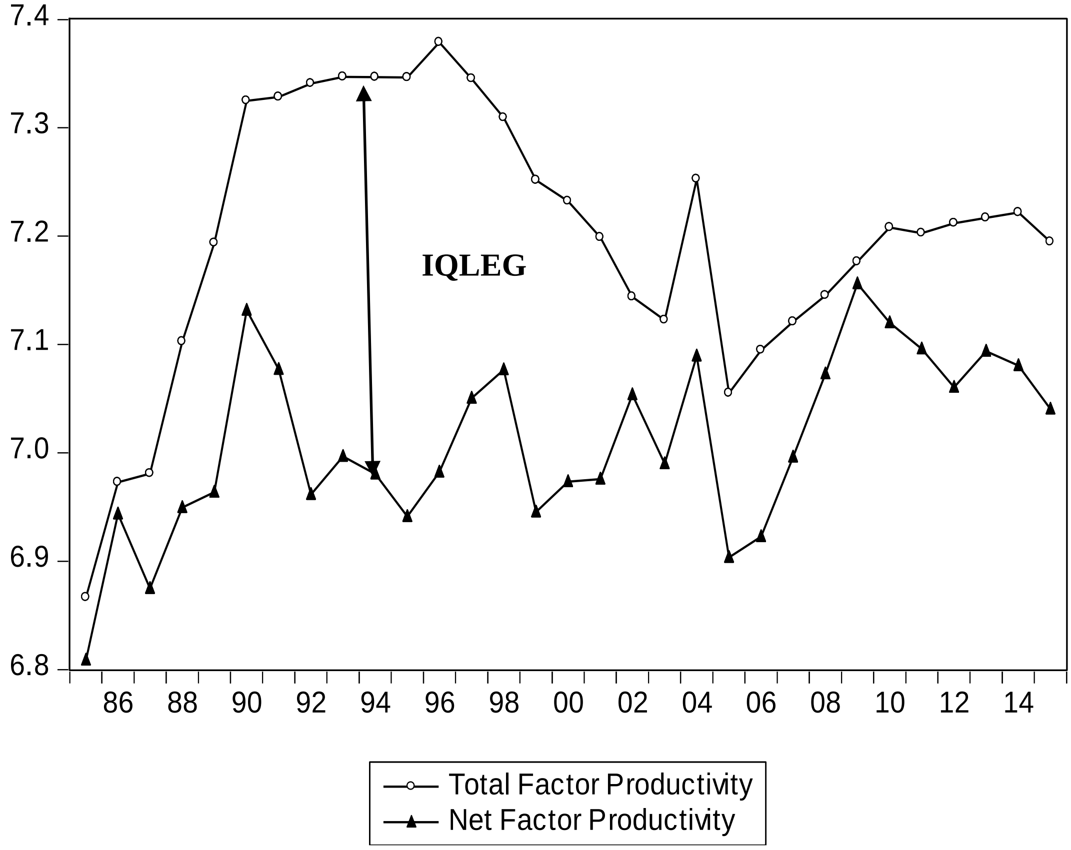
Source: Author, 2019

Table B6: Nigeria

Levels of TFP, NFP and CIQLEG				Growth Rate of TFP, NFP and CIQLEG			
Year	TFP_{NGR}	NFP_{NGR}	$IQLEG_{NGR}$	Year	TFP_{NGR}	NFP_{NGR}	$IQLEG_{NGR}$
1985	6.8666	6.8088	0.0579	1985	Na	na	na
1986	6.9728	6.9437	0.0291	1986	0.1061	0.1349	-0.0288
1987	6.9809	6.8747	0.1062	1987	0.0081	-0.0690	0.0772
1988	7.1027	6.9494	0.1533	1988	0.1218	0.0747	0.0471
1989	7.1936	6.9637	0.2300	1989	0.0909	0.0143	0.0767
1990	7.3248	7.1315	0.1933	1990	0.1312	0.1679	-0.0367
1991	7.3283	7.0770	0.2513	1991	0.0035	-0.0545	0.0580
1992	7.3410	6.9615	0.3795	1992	0.0126	-0.1155	0.1281
1993	7.3470	6.9967	0.3503	1993	0.0061	0.0352	-0.0291
1994	7.3468	6.9804	0.3664	1994	-0.0003	-0.0163	0.0161
1995	7.3464	6.9411	0.4053	1995	-0.0004	-0.0393	0.0389
1996	7.3788	6.9822	0.3966	1996	0.0324	0.0411	-0.0087
1997	7.3454	7.0503	0.2951	1997	-0.0334	0.0681	-0.1015
1998	7.3093	7.0766	0.2326	1998	-0.0361	0.0264	-0.0625
1999	7.2516	6.9452	0.3063	1999	-0.0577	-0.1314	0.0737
2000	7.2323	6.9733	0.2590	2000	-0.0193	0.0281	-0.0473
2001	7.1988	6.9758	0.2229	2001	-0.0335	0.0025	-0.0361
2002	7.1441	7.0536	0.0905	2002	-0.0547	0.0778	-0.1324
2003	7.1225	6.9899	0.1326	2003	-0.0216	-0.0637	0.0421
2004	7.2526	7.0894	0.1632	2004	0.1301	0.0995	0.0306
2005	7.0551	6.9035	0.1516	2005	-0.1974	-0.1858	-0.0116
2006	7.0948	6.9226	0.1722	2006	0.0397	0.0191	0.0206
2007	7.1208	6.9962	0.1247	2007	0.0260	0.0736	-0.0476
2008	7.1453	7.0730	0.0723	2008	0.0244	0.0768	-0.0524
2009	7.1765	7.1561	0.0204	2009	0.0312	0.0831	-0.0519
2010	7.2079	7.1201	0.0878	2010	0.0314	-0.0360	0.0674
2011	7.2027	7.0958	0.1068	2011	-0.0052	-0.0242	0.0190
2012	7.2119	7.0606	0.1514	2012	0.0092	-0.0353	0.0445
2013	7.2169	7.0938	0.1231	2013	0.0050	0.0332	-0.0282
2014	7.2218	7.0806	0.1412	2014	0.0048	-0.0132	0.0180
2015	7.1948	7.0405	0.1543	2015	-0.0269	-0.0401	0.0132
Mean rate	7.2011	7.0099	0.1912	Mean rate	0.0109	0.0077	0.0032

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

Figure B6: Nigeria - Levels of Panel NFP, TFP and CIQLEG without Breaks



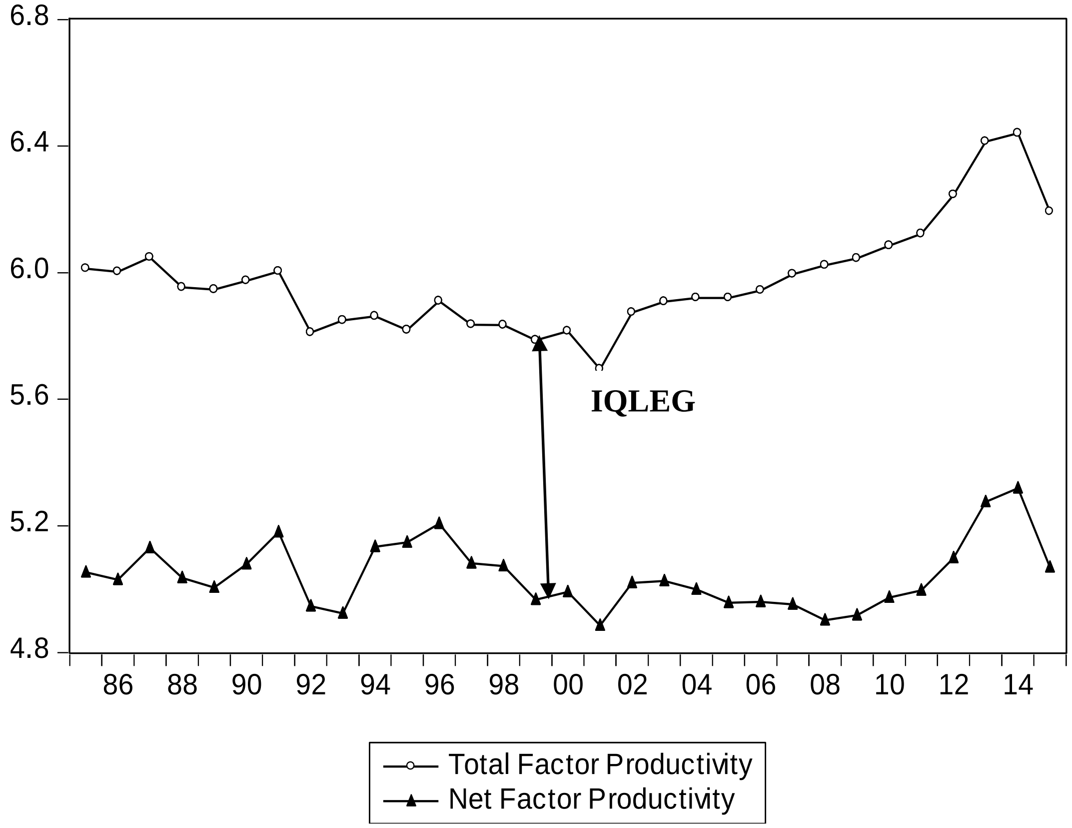
Source: Author, 2019

Table B7: Sierra Leone

Levels of TFP, NFP and CIQLEG				**Growth Rate of TFP, NFP and CIQLEG**			
Year	TFP_{SLE}	NFP_{SLE}	$IQLEG_{SLE}$	Year	TFP_{SLE}	NFP_{SLE}	$IQLEG_{SLE}$
1985	6.0130	5.0534	0.9596	1985	na	na	na
1986	6.0030	5.0297	0.9733	1986	-0.0100	-0.0238	0.0137
1987	6.0481	5.1299	0.9182	1987	0.0451	0.1002	-0.0551
1988	5.9532	5.0354	0.9178	1988	-0.0949	-0.0945	-0.0004
1989	5.9467	5.0050	0.9416	1989	-0.0065	-0.0303	0.0238
1990	5.9738	5.0788	0.8950	1990	0.0271	0.0737	-0.0467
1991	6.0040	5.1801	0.8239	1991	0.0303	0.1013	-0.0711
1992	5.8109	4.9466	0.8644	1992	-0.1931	-0.2335	0.0405
1993	5.8492	4.9232	0.9261	1993	0.0383	-0.0234	0.0617
1994	5.8624	5.1345	0.7279	1994	0.0131	0.2113	-0.1982
1995	5.8190	5.1477	0.6713	1995	-0.0433	0.0132	-0.0565
1996	5.9103	5.2072	0.7031	1996	0.0912	0.0595	0.0317
1997	5.8356	5.0816	0.7540	1997	-0.0747	-0.1256	0.0509
1998	5.8342	5.0727	0.7615	1998	-0.0014	-0.0089	0.0076
1999	5.7865	4.9667	0.8198	1999	-0.0477	-0.1060	0.0583
2000	5.8146	4.9910	0.8235	2000	0.0280	0.0243	0.0037
2001	5.6944	4.8852	0.8092	2001	-0.1201	-0.1058	-0.0143
2002	5.8741	5.0197	0.8544	2002	0.1797	0.1345	0.0452
2003	5.9085	5.0257	0.8829	2003	0.0344	0.0059	0.0285
2004	5.9200	4.9990	0.9210	2004	0.0115	-0.0267	0.0382
2005	5.9200	4.9565	0.9635	2005	0.0000	-0.0425	0.0425
2006	5.9438	4.9594	0.9844	2006	0.0238	0.0029	0.0209
2007	5.9945	4.9518	1.0427	2007	0.0506	-0.0077	0.0583
2008	6.0232	4.9015	1.1217	2008	0.0287	-0.0503	0.0790
2009	6.0454	4.9174	1.1280	2009	0.0222	0.0159	0.0063
2010	6.0851	4.9740	1.1111	2010	0.0396	0.0566	-0.0169
2011	6.1227	4.9965	1.1262	2011	0.0376	0.0225	0.0151
2012	6.2454	5.0988	1.1466	2012	0.1227	0.1024	0.0204
2013	6.4141	5.2758	1.1383	2013	0.1687	0.1770	-0.0083
2014	6.4400	5.3190	1.1210	2014	0.0259	0.0432	-0.0173
2015	6.1923	5.0692	1.1231	2015	-0.2477	-0.2498	0.0021
Mean rate	5.9770	5.0430	0.9340	Mean rate	0.0060	0.0005	0.0055

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

Figure B7: Sierra Leone - Levels of Panel NFP, TFP and CIQLEG without Breaks



Source: Author, 2019

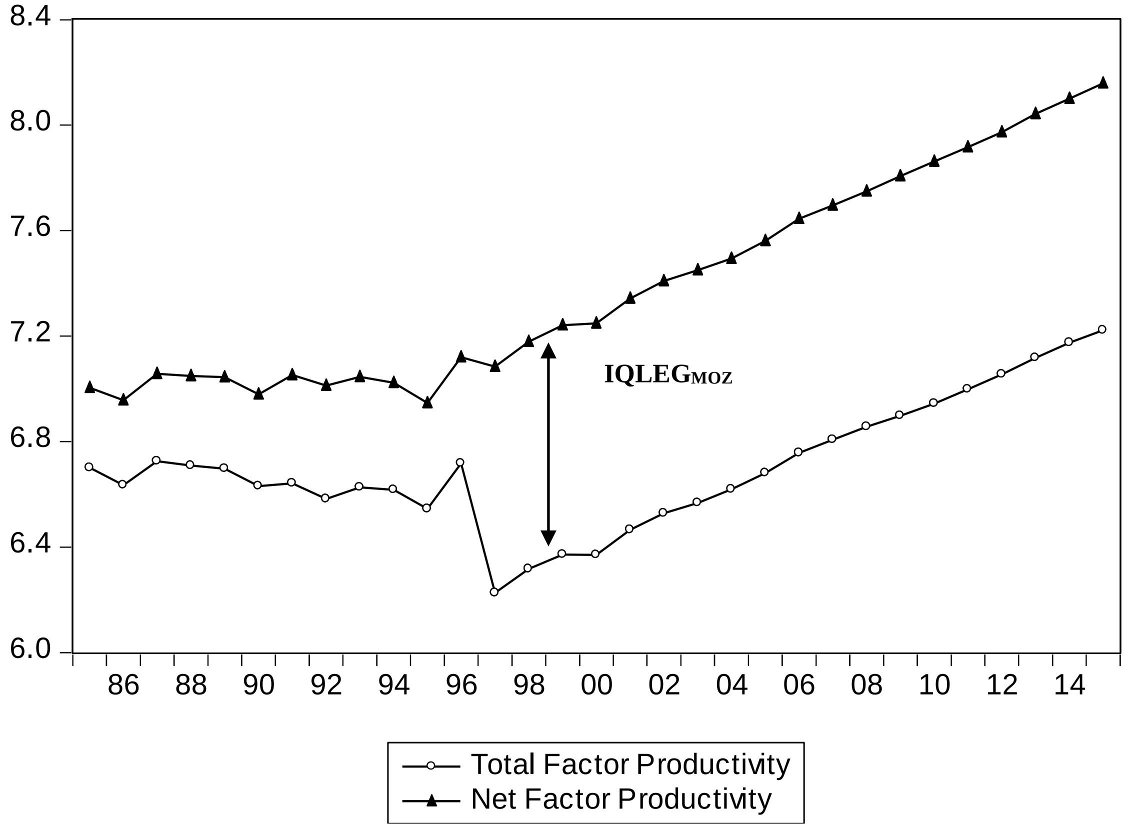
APPENDIX C: NFP, TFP and CIQLEG for the Cobb-Douglas Production Function with a Break

Table C1: MOZAMBIQUE

Levels of TFP, NFP and CIQLEF				Growth Rate of TFP, NFP and CIQLEG			
Year	TFP	NFP	IQLEG	Year	TFP	NFP	IQLEG
1985	6.7003	7.0035	-0.3032	1985	na	na	na
1986	6.6345	6.9565	-0.3219	1986	-0.0658	-0.0470	-0.0188
1987	6.7251	7.0571	-0.3320	1987	0.0906	0.1006	-0.0100
1988	6.7088	7.0486	-0.3397	1988	-0.0163	-0.0085	-0.0077
1989	6.6965	7.0440	-0.3475	1989	-0.0123	-0.0045	-0.0078
1990	6.6308	6.9793	-0.3485	1990	-0.0657	-0.0648	-0.0010
1991	6.6419	7.0527	-0.4109	1991	0.0111	0.0735	-0.0624
1992	6.5824	7.0118	-0.4294	1992	-0.0595	-0.0409	-0.0186
1993	6.6264	7.0452	-0.4188	1993	0.0441	0.0334	0.0107
1994	6.6164	7.0235	-0.4071	1994	-0.0100	-0.0217	0.0117
1995	6.5451	6.9464	-0.4013	1995	-0.0713	-0.0771	0.0058
1996	6.7170	7.1202	-0.4032	1996	0.1719	0.1739	-0.0020
1997	6.2263	7.0840	-0.8577	1997	na	na	na
1998	6.3168	7.1783	-0.8614	1998	0.0905	0.0942	-0.0037
1999	6.3715	7.2411	-0.8695	1999	0.0547	0.0628	-0.0081
2000	6.3707	7.2483	-0.8776	2000	-0.0009	0.0072	-0.0081
2001	6.4662	7.3434	-0.8771	2001	0.0956	0.0951	0.0005
2002	6.5283	7.4089	-0.8806	2002	0.0620	0.0655	-0.0035
2003	6.5674	7.4502	-0.8828	2003	0.0391	0.0413	-0.0022
2004	6.6191	7.4934	-0.8743	2004	0.0517	0.0432	0.0085
2005	6.6811	7.5614	-0.8803	2005	0.0620	0.0680	-0.0060
2006	6.7568	7.6453	-0.8885	2006	0.0756	0.0839	-0.0082
2007	6.8072	7.6952	-0.8880	2007	0.0504	0.0499	0.0005
2008	6.8559	7.7494	-0.8935	2008	0.0487	0.0542	-0.0055
2009	6.8976	7.8065	-0.9089	2009	0.0416	0.0571	-0.0154
2010	6.9444	7.8620	-0.9176	2010	0.0468	0.0556	-0.0088
2011	6.9975	7.9161	-0.9186	2011	0.0531	0.0541	-0.0010
2012	7.0545	7.9735	-0.9190	2012	0.0569	0.0573	-0.0004
2013	7.1175	8.0427	-0.9251	2013	0.0631	0.0692	-0.0061
2014	7.1746	8.1002	-0.9256	2014	0.0571	0.0576	-0.0005
2015	7.2221	8.1581	-0.9359	2015	0.0475	0.0578	-0.0103
Mean rates in selected periods				**Mean growth rates in selected periods**			
(1985 – 1996)	6.6521	7.0241	-0.3720	(1985 – 1996)	0.0015	0.0106	-0.0091
(1997 – 2015)	6.7356	7.6294	-0.8938	(1997 – 2015)	0.0553	0.0597	-0.0043

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

Figure C1: MOZAMBIQUE- Levels of Panel NFP, TFP and CIQLEG with a Break



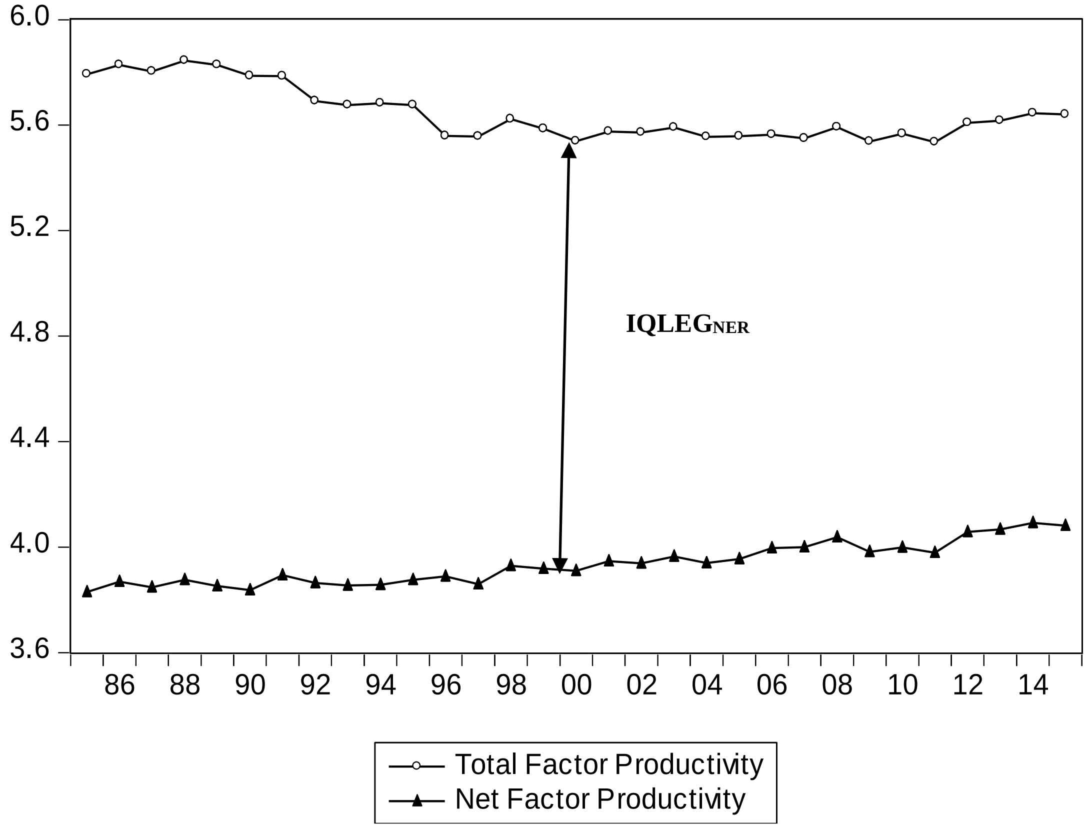
Source: Author, 2019

Table C2: Niger

Levels of TFP, NFP and CIQLEF				Growth Rate of TFP, NFP and CIQLEG			
Year	TFP	NFP	IQLEG	Year	TFP	NFP	IQLEG
1985	5.7925	3.8299	1.9627	1985	na	na	na
1986	5.8279	3.8681	1.9599	1986	0.0354	0.0382	-0.0028
1987	5.8032	3.8474	1.9558	1987	-0.0247	-0.0207	-0.0041
1988	5.8446	3.8762	1.9684	1988	0.0414	0.0288	0.0126
1989	5.8283	3.8524	1.9759	1989	-0.0163	-0.0238	0.0075
1990	5.7870	3.8366	1.9504	1990	-0.0413	-0.0158	-0.0255
1991	5.7858	3.8928	1.8929	1991	-0.0013	0.0562	-0.0575
1992	5.6914	3.8642	1.8272	1992	-0.0944	-0.0287	-0.0657
1993	5.6755	3.8548	1.8206	1993	-0.0159	-0.0093	-0.0066
1994	5.6829	3.8563	1.8266	1994	0.0074	0.0014	0.0060
1995	5.6761	3.8753	1.8009	1995	-0.0068	0.0190	-0.0258
1996	5.5596	3.8882	1.6714	1996	na	na	na
1997	5.5564	3.8590	1.6974	1997	-0.0032	-0.0293	0.0261
1998	5.6230	3.9284	1.6946	1998	0.0666	0.0694	-0.0028
1999	5.5858	3.9182	1.6676	1999	-0.0373	-0.0103	-0.0270
2000	5.5394	3.9096	1.6297	2000	-0.0464	-0.0085	-0.0379
2001	5.5751	3.9461	1.6290	2001	0.0357	0.0365	-0.0008
2002	5.5720	3.9384	1.6336	2002	-0.0030	-0.0077	0.0046
2003	5.5909	3.9643	1.6265	2003	0.0188	0.0259	-0.0071
2004	5.5551	3.9391	1.6161	2004	-0.0357	-0.0253	-0.0105
2005	5.5581	3.9542	1.6039	2005	0.0030	0.0151	-0.0121
2006	5.5641	3.9963	1.5679	2006	0.0060	0.0421	-0.0360
2007	5.5496	3.9995	1.5502	2007	-0.0145	0.0032	-0.0177
2008	5.5927	4.0371	1.5555	2008	0.0430	0.0376	0.0054
2009	5.5382	3.9819	1.5564	2009	-0.0544	-0.0553	0.0008
2010	5.5676	3.9985	1.5692	2010	0.0294	0.0166	0.0128
2011	5.5352	3.9778	1.5574	2011	-0.0324	-0.0206	-0.0118
2012	5.6081	4.0569	1.5511	2012	0.0728	0.0791	-0.0063
2013	5.6174	4.0666	1.5508	2013	0.0093	0.0096	-0.0003
2014	5.6458	4.0918	1.5540	2014	0.0284	0.0252	0.0031
2015	5.6406	4.0814	1.5592	2015	-0.0052	-0.0104	0.0052
Mean rates in selected periods				**Mean growth rates in selected periods**			
(1985 – 1996)	5.7632	3.8595	1.9038	(1985 – 1996)	-0.0116	0.0045	-0.0162
(1997 – 2015)	5.5787	3.9767	1.6021	(1997 – 2015)	0.0043	0.0102	-0.0059

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

Figure C2: Niger- Levels of Panel NFP, TFP and CIQLEG with a Break



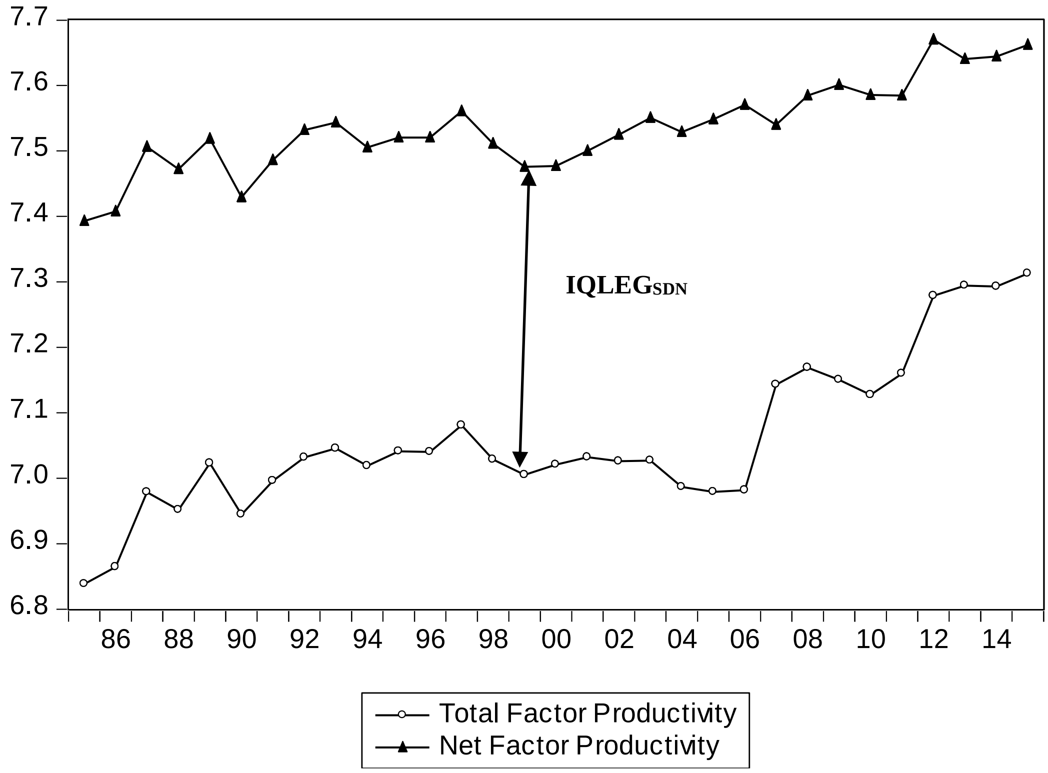
Source: Author, 2019

Table C3: Sudan

Levels of TFP, NFP and CIQLEF				Growth Rate of TFP, NFP and CIQLEG			
Year	TFP	NFP	IQLEG	Year	TFP	NFP	IQLEG
1985	6.8383	7.3928	-0.5545	1985	6.8383	7.3928	-0.5545
1986	6.8645	7.4078	-0.5433	1986	6.8645	7.4078	-0.5433
1987	6.9787	7.5063	-0.5276	1987	6.9787	7.5063	-0.5276
1988	6.9518	7.4723	-0.5206	1988	6.9518	7.4723	-0.5206
1989	7.0228	7.5186	-0.4957	1989	7.0228	7.5186	-0.4957
1990	6.9446	7.4295	-0.4849	1990	6.9446	7.4295	-0.4849
1991	6.9959	7.4859	-0.4900	1991	6.9959	7.4859	-0.4900
1992	7.0319	7.5321	-0.5002	1992	7.0319	7.5321	-0.5002
1993	7.0453	7.5436	-0.4983	1993	7.0453	7.5436	-0.4983
1994	7.0190	7.5053	-0.4863	1994	7.0190	7.5053	-0.4863
1995	7.0412	7.5205	-0.4793	1995	7.0412	7.5205	-0.4793
1996	7.0402	7.5207	-0.4805	1996	7.0402	7.5207	-0.4805
1997	7.0807	7.5607	-0.4800	1997	7.0807	7.5607	-0.4800
1998	7.0287	7.5111	-0.4824	1998	7.0287	7.5111	-0.4824
1999	7.0051	7.4759	-0.4708	1999	7.0051	7.4759	-0.4708
2000	7.0205	7.4769	-0.4564	2000	7.0205	7.4769	-0.4564
2001	7.0320	7.5002	-0.4682	2001	7.0320	7.5002	-0.4682
2002	7.0259	7.5251	-0.4992	2002	7.0259	7.5251	-0.4992
2003	7.0271	7.5506	-0.5235	2003	7.0271	7.5506	-0.5235
2004	6.9868	7.5287	-0.5420	2004	6.9868	7.5287	-0.5420
2005	6.9789	7.5483	-0.5693	2005	6.9789	7.5483	-0.5693
2006	6.9818	7.5703	-0.5885	2006	6.9818	7.5703	-0.5885
2007	7.1429	7.5399	-0.3970	2007	7.1429	7.5399	-0.3970
2008	7.1691	7.5847	-0.4156	2008	7.1691	7.5847	-0.4156
2009	7.1504	7.6011	-0.4507	2009	7.1504	7.6011	-0.4507
2010	7.1274	7.5854	-0.4580	2010	7.1274	7.5854	-0.4580
2011	7.1597	7.5847	-0.4250	2011	7.1597	7.5847	-0.4250
2012	7.2787	7.6700	-0.3913	2012	7.2787	7.6700	-0.3913
2013	7.2943	7.6403	-0.3460	2013	7.2943	7.6403	-0.3460
2014	7.2928	7.6444	-0.3516	2014	7.2928	7.6444	-0.3516
2015	7.3128	7.6622	-0.3494	2015	7.3128	7.6622	-0.3494
Mean rates in selected periods				**Mean growth rates in selected periods**			
(1985 – 2006)	6.9973	7.5038	-0.5064	(1985 – 2006)	6.9973	7.5038	-0.5064
(2007 – 2015)	7.2142	7.6125	-0.3983	(2007 – 2015)	7.2142	7.6125	-0.3983

Notes: NFP: net factor productivity (technical progress); TFP: total factor productivity; CIQLEG: Contribution of institutional quality linked efficiency gain to total factor productivity. All series are in natural logarithm. GNFP: growth rate of net factor productivity (technical progress); GTFP: growth rate of total factor productivity; GIQLEG: growth rate of contribution of institutional quality linked efficiency gain

Figure C3: Niger- Levels of Panel NFP, TFP and CIQLEG with a Break



Source: Author, 2019

APPENDIX D: DATA SOURCES

1. The World Governance Indicators (WGI)

***U**sually* used as indicators of institutional quality, they are collated by the World Bank and consists of the traditions and institutions by which authority in a country is exercised. This includes the process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound policies; and the respect of citizens and the state for the institutions that govern economic and social interactions among them. The data covers six main dimensions. These indicators are voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, and rule of law as well as control of corruption (Kaufmann and Kraay, 2010). The database provides data for over 200 countries, 48 of which are SSA countries. With over 30 metrics, it summarises views on the quality of governance provided by a large number of enterprise, citizen and expert survey respondents in industrial and developing countries. Updated annually, it currently has annual data from 1960 to 2016. Indicators made up of individual and composite measures (www.wdi.worldbank.org/tables). This ordinal measurement is based on perceptions with values ranging from 2.5 as the weakest to 2.5 as the strongest. Karimi and Daiari (2018) and Law and Azman Saini (2012) employed the WGI in notable research.

2. The International Country Risk Guide (ICRG)

The ICRG is a source of institutional quality and risk data. The risk involved measures the loss of control over ownership or loss of benefit of enterprise due to government action. Twenty-two variables in three sub-categories are developed by the ICRG. These three are political, economic and financial risk. The Political Risk Services Group (PRSG) developed this database with Knack and Keefer (2011) as the main authors. One hundred and forty countries are featured on the ICRG and 32 of these are from sub-Saharan Africa. Covering over 30 metrics, the database provides a global clientele with political, economic, and financial risk ratings and forecasts for its universe of 140 developed, emerging, and frontier markets. The ICRG makes its risk assessments relevant by quantifying its forecasts and ratings across 140 countries, over a 40-year period, and applying them to the behaviour and protection of assets. There are over 40 years of data beginning from 1980. The database has both composite (weighted) and individual indicators (n www.epub.prsgroup.com). Indicator values range from very low risk (80 to 100 points) to very high risk (zero to 49.9 points) for composite risk per country. Whilst the political risk index has 12 components with 100 points, the financial risk index has five components with 50 points and the economic risk index has five components with 50 points. Measures are based on perceptions and measured in percentages. Researchers who have applied the ICRG data include Law *et al.* (2013), Asiedu (2004, 2006), Gadzar and Sherif (2015), Balach and Law (2015), and Bra¨utigam and Knack (2004).

3. The World Development Indicators (WDI)

The WDI offers indicators on global development with about 19 dimensions. The data is generated by the World Bank Group and provides development data for 217 countries of which 48 are from SSA. It is the primary World Bank collection of development indicators, compiled from officially-recognized international sources. It presents the most current and accurate global development data available, and includes national, regional and global estimates. The data is from 1960 to 2018 and is collected and updated annually. The indicators are usually in percentages and the data reflects both actual measurements and perceptions (see www.wdi.com). Donou-Adonsou and Sylvester (2016), Naceur, Blotevogel, Fischer and Shi (2017), Bra¨utigam and Knack (2004), Baltagi, Demetriades and Law (2009) and Chin and Ito (2005) have all applied the WDI in notable research work in finance-growth related contexts.

4. ***Penn World Tables (PWT)***

The PWT uses the results of detailed price surveys from the International Comparison Program (ICP), which is run from the World Bank, and combines these with National Accounts data on GDP and its components (consumption, investment, trade) to arrive at real GDP for most countries in the world as far back as 1950. The quality of PWT depends on the price comparisons of ICP, The National Accounts data and how these are combined. It provides information on living standards: production, income and prices with seven dimensions and 43 measures. It is produced by the University of Pennsylvania with Feenstra, Inklaar and Timmer (2015) as the main authors and provides information for up to 189 countries with 46 of them being SSA. The data collected begins from 1950 and goes to 2016 and it is frequently updated. It is made up of individual indicators as well as composite measures. The measures are actual measurements and are presented as ratios or percentages. The PWT is a standard data source for those interested in comparing living standards across countries and explaining differences in cross-country growth (www.febpwt.webhosting.rug.nl). The version used in this research was PWT 9.0. Evans, Green and

Murinde (2000); Bangake and Eggoh (2011) and Naceur, Blotevogel, Fischer and Shi (2017) applied the PWT in research work.