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Danışmanı: PROF.DR. MURAT ÇOKGEZEN

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ÖZET

Kurumsal Değişkenlerin Ekonomik Büyüme Üzerindeki Etkisi: Afrika Örneği

Bu tezin temel amacı kurumların—ülke ve bölgesel düzeyde—hem makro hem de mikro değişkenler üzerindeki etkisini analiz etmektir. Bu bağlamda, Afrika ülkeleri için Dünya Bankası'ndan ikincil veri kümesi kullanılmış ve çeşitli tahmin yöntemleri yardımıyla analizler yapılmıştır. Bu ampirik araştırmalardan üç önemli sonuç çıkarılmıştır. İlk olarak, firmaların inovasyon ve verimlilik kapasitelerini ve bunun sonucunda da Afrika'nın ekonomik büyümesini arttırmak için hem ülke hem de bölgesel düzeydeki kurumların kalitesini geliştirmek önemli olduğu sonucuna varılmıştır. İkincisi, ekonomik büyüme ve kurumlar arasındaki nedensel ilişki ülkenin ekonomik gelişme düzeyine bağlı olduğu tespit edilmiştir. Üçüncüsü, kurumların çeşitliliğine göre farklı etkisi olmasına ilişkindir. Örneğin, yatırımları teşvik eden ve demokratik kurumlar ekonomik büyümeyi hızlandırmak için en önemliyken; yolsuzluğun kontrol edilmesi ve hukuki üstünlüğünün korunması ise firma inovasyonu için en önemli unsur olduğu söylenebilir. Bu nedenle, politikayı belirleyenler, ilk önce, Afrika ekonomisi üzerinde daha büyük etkisi olacak, daha iyi kurumlar oluşturmak için bu kurumsal düzenlemeleri geliştirmeliler.

Anahtar Kelimeler: Afrika, kurumlar, büyüme, yenilik, verimlilik

ABSTRACT

The Impact of Institutional Change on Economic Growth: The Case of Africa

The main aim of this dissertation is to empirically examine the impact of institutions—at the country and regional level—on both macro and micro variables. To this end, a secondary dataset from the World Bank was used for African countries and analyzed using various estimation methods. Three important conclusions have been drawn from these empirical investigations. First, improving the quality of institutions both at the country and regional level is imperative to enhance innovation and productive capacity of firms and economic growth of the region as a result. Second, the causal relationship between economic growth and institutions depends on the level of economic development of the country. Third, the effect of different types of institutions is not the same. For instance, investment-promoting and democratic institutions matter the most for accelerating economic growth; controlling corruption and maintaining rule of law appeared to matter the most for firm innovation. Therefore, policymakers could start by improving these institutional arrangements to build better institutions that would have a greater impact on the economy of Africa.

Keywords: Africa, institutions, growth, innovation, productivity

JEL classification: D02, D24, E02, L019, L26, O31, O55

PROLOGUE

The role of institutional quality has been extensively studied in recent years, yet the focus has been on global samples and macroeconomic variables. It is against this backdrop that this dissertation attempts to uncover the impact of institutions on both macro and micro variables. The dissertation consists of four independent research articles, which are provided in chapters 2-5. Chapter 1 begins by discussing the theoretical perspective of the nexus between institutions and economic growth, and in the later section, provides an overview of the post-colonial historical synopsis of economic growth and institutional change in SSA. This chapter leaves us with some questions as to whether and to what extent the institutional reform affects the economic growth of the region. Thus, chapter 2 examines the impact of different dimensions of institutional quality indices on the economic growth of SSA countries for the period 1991-2015 using a two-step system-GMM estimation. The empirical results indicated that both investment-promoting and democratic & regulatory institutions significantly affect the economic growth of the region; however, the effect of conflict-preventing institutions is negligible.

Whether economic growth is the cause or the consequence of improved institutional quality has been a controversial issue in the last two decades. To throw light on this debate, chapter 3 explores the nature and the direction of causality between institutional quality and economic growth using a heterogeneous panel non-causality approach for a panel data of 30 SSA countries for the period 1990-2015. The empirical results indicate a significant heterogeneity across the countries based on the income level. In low-income countries, there exists a unidirectional causality that runs from institutional quality to growth but the direction of causality is reversed for lower-middle-income countries. For upper-middle-income countries, the evidence suggests a bidirectional causality.

Although the role of institutions on economic growth has long been acknowledged to be that of promotion of innovation and productivity, empirical evidence on this realm has lagged and been limited to the developed world. It is against this background that chapters 4 and 5 asses the significance of institutional quality using firm-level datasets on microeconomic variables-innovation and productivity. More specifically, chapter 4 examines the role of regional institutional quality and compare the relative importance of three different institutional arrangements on the propensity of firm innovation using WBES of firms from 19 African countries. The empirical investigation using multilevel logistic regression indicate that the

innovation performance of firms is significantly affected by regional institutional quality. Among different regional institutional arrangements, reducing corruption and maintaining rule of law appeared to matter the most for firm innovation.

Chapter 5 examines empirically the extent to which innovation the quality of regional institutions affects firms' productivity. Using a firm-level dataset from 15 African countries and the three-step CDM approach, we found that both innovation and regional institutional quality have a significant positive impact on firms' productivity. Furthermore, we found that regional institutional quality is more important for firms at low productivity distribution.

Finally, chapter 6 concludes the paper and provides suggestions for future research. Since all chapters of this dissertation, except the first and the last chapters, are an independent research article, some explanations and literature are repeated at different sections of the dissertation.

ÖNSÖZ

Kurumsal kalitenin ekonomik gelişmedeki rolü son yıllarda kapsamlı bir şekilde incelenmiştir, ancak ele alınan çalışmalar küresel örnekler ve makroekonomik değişkenler üzerinde durulmuştur. Dolayısıyla bu tezde, kurumların hem makro hem de mikro değişkenler üzerindeki etkisini analiz etmek amaçlanmıştır. Tez, 2-5 bölümlerde yer alan dört bağımsız makaleden oluşmaktadır. Birinci bölümde, kurumlar ve ekonomik büyüme arasındaki ilişki teorik perspektifini tartışılmıştır ve daha sonra Sahra Altı Afrika ülkelerinin sömürge sonrası ekonomik büyümesi ve kurumsal değişimi ile ilgili kısaca bilgi verilmiştir. Bu bölüm sonucunda, kurumsal reformun bölgenin ekonomik büyümesini etkileyip etkilemediğine ve eğer etkilediyse onun ne ölçüde olduğuna dair bazı sorular ortaya çıkmıştır. Bu nedenle, ikinci bölümde, kurumsal kalite endekslerinin farklı boyutlarının ekonomik büyüme üzerindeki etkisi incelenmektedir. Bu bağlamda, 31 Sahra Altı Afrika ülkesinin 1991-2015 dönemi yıllık verileriyle Genelleştirilmiş Momentler Metodu (GMM) kullanılarak ampirik analiz yapılmıştır. Elde edilen sonuçlar, hem yatırımı teşvik edici kurumlar hem de demokratik ve düzenleyici kurumlar bölgenin ekonomik büyümesi için etkili olduğu sonucuna varılmıştır. Bununla beraber, çatışmayı önleyen kurumların istatistiksel olarak anlamlı bir etkisi olmadığı tespit edilmiştir.

Ekonomik büyüme, geliştirilmiş kurumsal kalitenin nedeni mi yoksa sonucu mu? Bu soru son yirmi yıldır tartışılanı bir konudur. Bu tartışmaya katkıda bulunmak için tezin üçüncü bölümünde, 30 Sahra Altı Afrika ülkesi için heterojen bir panel nedensellik yaklaşımı kullanılarak, kurumsal kalite ve ekonomik büyüme arasındaki nedenselliğin doğası ve yönü araştırılmıştır. Ampirik sonuçlar, gelir düzeyine bağlı olarak ülkeler arasında önemli bir heterojenliği göstermiştir. Düşük gelirli ülkelerde, kurumsal kaliteden büyümeye doğru tek yönlü bir nedensellik ilişkisi vardır, ancak düşük orta gelirli ülkeler için nedensellik yönü tersine çevrilmiştir. Üst-orta gelirli ülkeler için, çift yönlü bir nedensellik ilişkisi olduğu sonucuna varılmıştır.

Kurumların ekonomik büyüme üzerindeki rolü uzun zamandır inovasyon ve üretkenliği desteklediği yönünde ele alınsa da, bu konudaki ilgili ampirik çalışmalar gelişmiş ülkeler ile sınırlı kalmıştır. Bu bakımdan 4 ve 5 bölümlerde, mikroekonomik değişkenler olan inovasyon ve üretkenlik konusunda firma düzeyinde veri kümeleri kullanılarak kurumsal kalitenin önemi değerlendirilmiştir. Daha spesifik olarak, 4. bölümde bölgesel kurumsal kalitenin rolü incelenmekte ve 19 farklı Afrika ülkesindeki firmaların WBES'i kullanılarak üç farklı kurumsal

düzenlemenin firma yeniliğinin eğilimi üzerindeki göreceli önemi karşılaştırılmaktadır. Çok düzeyli lojistik regresyon analizi kullanılarak yapılan ampirik araştırma sonucunda, firmaların inovasyon performansı bölgesel kurumsal kaliteden önemli ölçüde etkilendiğini gösterilmiştir. Farklı bölgesel kurumsal düzenlemeler arasında yolsuzluğun azaltılması ve hukuki üstünlüğünün korunması firma inovasyonu için en önemli unsur olduğu tespit edilmiştir.

5. Bölümde firmaya özgü eylem, yenilik ve dış faktör olan bölgesel kurumların kalitesinin firmaların verimliliğini ne ölçüde etkilediği ampirik olarak incelenmektedir. 15 Afrika ülkesinden firma düzeyinde bir veri kümesi ve üç aşamalı CDM yaklaşımı kullanılarak hem inovasyonun hem de bölgesel kurumsal kalitenin firmaların verimliliği üzerinde önemli bir olumlu etkisi olduğu tespit edilmiştir. Ayrıca, bölgesel kurumsal kalitenin düşük verimlilik dağılımına sahip firmalar için daha önemli olduğu tespit edilmiştir.

Son olarak, 6. Bölümde tezin sonuçları yer almakta ve gelecekteki araştırmalar için öneriler yer almaktadır. Tezin birinci ve son bölümleri hariç tüm bölümleri bağımsız bir araştırma makalesi olduğundan, tezin bazı bölümlerinde bazı açıklama ve kaynakları tekrarlanmaktadır.

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Mohammed Seid HUSSEN

İstanbul, 2020

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Acronyms

2SLS	Two-stage least square
3SLS	Three-stage least square
AR	Arellano–Bond
BERI	Bureaucratic Efficiency Ratings Index
CDM	Crépon, Duguet, and Mairessec
CIS	Community Innovation Survey
EPRDF	Ethiopian People's Revolutionary Democratic Front
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
GNI	Gross National Income
ICRG	International Country Risk Guide
ISI	Import Substitutions Strategies for industrialization
IV	Instrumental Variable
KMO	Kaiser-Meyer-Olkin
LDCs	Less Developed Countries
MDGs	Millennium Development Goals
NIE	New Institutional Economics
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
PCA	Principal Component Analysis
SAP	Structural Adjustment Programs
SSA	Sub-Saharan African
TFP	Total Factor Productivity
UNCTAD	United Nations Conference on Trade and Development
USSR	Union of Soviet Socialist Republics
VAR	Vector Autoregression
WB	World Bank
WBES	World Bank Enterprise Survey
WGI	World Governance Indicator

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CHAPTER ONE

1. GENERAL INTRODUCTION

1.1. Economic growth model

There is widespread agreement among development economists and international organizations that economic growth is the biggest contributor to worldwide poverty reduction and improved standard of living. While extreme poverty has declined in countries that have registered sustained economic growth, the number of people who live below poverty has significantly increased in countries that have failed to grow (Dollar, Kleineberg, & Kraay, 2016). These cross-country variations attracted the attention of economists since the period of Adam Smith. Several theories have been developed since then but fewer consensus exists as to the factors that make countries richer or poorer. The main aim of this sub-section is thus to provide a brief overview of the determinants of economic growth from the theoretical perspective. It begins with a short review of the neoclassical and endogenous growth models, and later discusses the deep determinants of growth giving special emphasis to the institutional factors.

1.1.1. Why are some countries poor and others rich?

The cross-country variations between rich and poor countries are enormous. The GDP per capita of countries like Luxemburg, Singapore, and Ireland is about 100 times that of Central Africa, Burundi, and DR Congo.[1] Not only income per se but these countries also differ in people's quality of life. People in poor countries live in acute poverty, without clean water, proper education & health services, and dies of preventable diseases at a younger age, to mention a few. On the contrary, people in rich countries have higher wealth, bigger employment opportunities, better education and health, and dies of chronic diseases at an older age. Identifying the factors that cause these gaps has been one of the main focuses of economists since the publication of Adam Smith's seminal book. Several theories have been emerged since then but fewer consensus exists as for the determinant of growth and income. For instance, for Adam Smith, the division of labor was one of the main reasons that make some societies richer while others poorer. Karl Marx, on the other hand, underscored the

[1] According to World Development Indicator, the GDP per capita (PPP) of rich countries Luxemburg, Singapore, and Ireland in 2017 was $107,641, $94,105, and $76,745 respectively. The GDP per capita (PPP) of poor countries Central Africa, Burundi, DR Congo in 2017 was $727, $735, and $889.

importance of capital accumulation as the engine of economic growth in the capitalist economic system. Joseph Schumpeter argued that it is innovation, and the resultant 'creative destruction', that drive economic progress around the world. The lack of consensus is unfortunate because knowing what a country can do to grow faster would have contributed to the fight against extreme poverty and deprivation.

Since the 1950s, the debate on the determinants of cross-country economic differences continued from empirical perspectives. A range of growth models has been suggested that can be structured into two main strands: neoclassical and endogenous growth models. The neoclassical growth models are based on Solow (1956)'s seminal work and argued that saving or investment ratio is the most important factor for short-run growth. It suggests that an increase in saving rate increases short-run growth above the long-run rate and the economy moves to the new equilibrium. Long-term growth, however, is independent of saving but determined by the rate of technical progress, which is assumed to be exogenous. Since diminishing marginal return to capital is assumed in the model, it is expected that low-income countries grow faster than high-income countries; hence, countries will converge in the long-run.

However, subsequent empirical studies on convergence hypothesis have produced mixed results. Using macroeconomic data, they showed that only a handful of countries were managed to take-off and reach the development ladder. For most countries, however, the observed difference has rather widened, contrary to the prediction of the Solow-type growth models. This led to a reconsideration of the concept of the "factors of production" and the inclusion of additional factors. The most notable extension was the augmented Solow model of Mankiw, Romer, and Weil (1992). Mankiw et al. (1992) extended the Solow model by including human capital as another input, in addition to Solow factors, into the production function. The authors argued that the convergence hypothesis still holds but it is conditional to the level of the human capital of the country. Countries with a high level of human capital grow faster than those with a low level of human capital. More specifically, the authors indicated that human capital, population growth and investment explain more than 80 percent of the cross-country variation in per capita income with a 2 percent rate of convergence.

Although the augmented neoclassical growth model was able to handle some of the limitations of the Solow model, its greater emphasis on human capital and the 2 percent convergence has been questioned by several studies. For instance, (Islam, 1995; Pritchett, 2001) found that the education variable is insignificant in growth regression over time. In

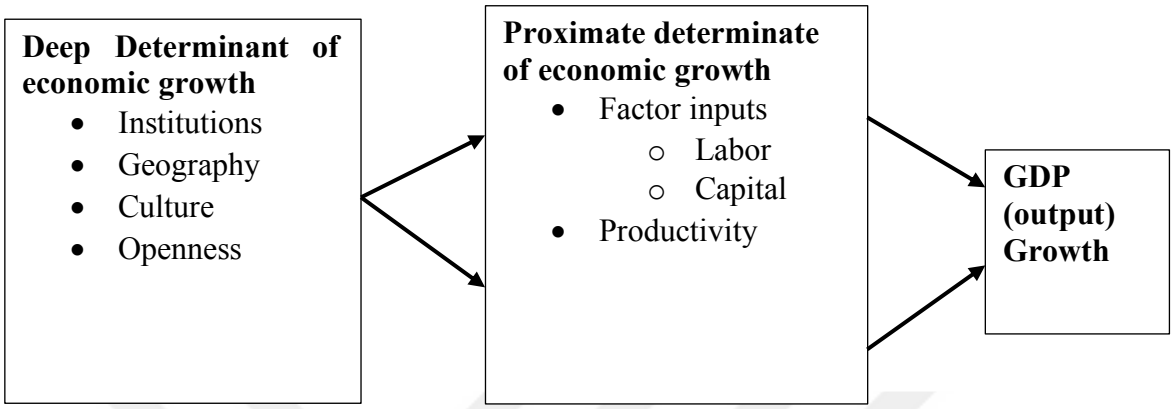
addition, Islam (1995) indicated a convergence rate between 4 and 6 while Caselli, Esquivel, and Lefort (1996) suggested even more than 10 percent.

The failure of the neoclassical growth model to fully explain the world-wide difference in income and growth leads to the emergence of a more radical approach to the study of growth known as the 'endogenous growth model'. Two important improvements have been included in this growth model. First, it assumes a constant return to capital—rather than diminishing return like Solow—implying that doubling capital would double production. Therefore, according to this model, less developed countries may not necessarily grow faster than more developed ones. Second, technological change is considered to be endogenous. Although the pioneering work of Arrow (1962) has influenced this line of analysis, the endogenous growth model embraces the diverse body of theoretical and empirical works that emerged in the 1980s such as (Lucas, 1988; Romer, 1986, 1990). This growth model has two important contributions. First, it helps to explain worldwide income differences by assuming technological progress as endogenous. Second, it offers a more relevant explanation of the role of innovation and R&D in economic growth.

1.1.2. Fundamental determinants of growth and income

It goes without saying that the variation in the level of investment and innovation create differences in income; however, the question of why is that only certain countries and societies succeeded in acting to promote investment and innovation while others have failed remains unanswered. If innovation, capital accumulation, education, etc. are important factors of economic progress, why all countries are not working towards that end? All growth models hitherto have not provided a compelling explanation to this question because growth models have explained only the "mechanics" or "correlates" of growth but not "fundamental" determinant of growth (North & Thomas, 1973). In this regard, factors that are identified by growth models such as physical capital, human capital, innovation, education are 'proximate' determinants, and they are influenced by other factors: fundamental (deep) determinants of growth (Bloch & Tang, 2004). In the literature, four fundamental determinants have been identified: geography (Jeffrey Sachs, 2001, 2003), culture (Tabellini, 2010; Weber & Parsons, 1913), openness (Dollar & Kraay, 2001; Rodrik, Subramanian, & Trebbi, 2004), and institution (Acemoglu, Johnson, & Robinson, 2001; North & Thomas, 1973).

Figure 1.1: The Economic Growth Framework



The geography thesis is associated with studies such as (Bloom, Canning, & Sevilla, 2004; Bloom, Sachs, Collier, & Udry, 1998; McCord & Sachs, 2013; Jeffrey Sachs, 2001, 2003; Jeffrey Sachs & Warner, 1997). It is argued that differences in geographical location means variation in regional temperature which in turn affects human capital and productivity. In this respect, countries located in the tropics are prone to tropical diseases such as malaria that decreases labor productivity and increases health-related costs. The proponent of this thesis argued that rich countries should provide foreign aid in order to stimulate growth and lift poor peoples out of poverty. Cultural thesis, on the other hand, argued that "If we learn anything from the history of economic development, it is that culture makes almost all the difference." (Landes, 2000). The cultural thesis has its root to the work of Weber and Parsons (1913) and argued that poor countries were unlucky that their culture and history was unfavorable for progress. Openness thesis argued that the main problem of poor countries is that these countries are not open to the international market and trade less internationally. Finally, the institutional thesis dismisses the above three theses and argued that it is the existence of 'extractive institutions' that hinder the quest of poor countries to economic prosperity.

1.1.3. Institutional factor

Although the above four fundamental determinants of growth were identified, a significant body of literature has indicated the prominence of institutions than others. Except for the institutional factors, all the above-discussed thesis has been dismissed to be "theories

that don't work" (Acemoglu & Robinson, 2013, p. Cahpter 2). It has been argued that the three deep determinants affect economic growth through its effect on institutions. For instance, Acemoglu, Johnson, and Robinson (2005) examine the explanatory power of the three fundamental determinants of economic growth: institutions, geography and culture, and they maintained that institutions are "the fundamental cause of differences in economic development".

The institutional economists argued that the comparison between North vs South Korea, East vs West German, and Nigeria vs Singapore is a natural experiment that implies the prominence of institutions on the economic outcome than other fundamental determinants (Acemoglu, 2008, p. 20). South Korea was an example of a poverty-stricken country half a century ago, even poorer than its Northern counterpart—North Korea. In the last 50 years, however, South Korea has registered an outstanding economic growth while North Korea has undergone through one of the most devastating economic performances. As of now, not only does South Korea 44 times richer than its Northern counterpart but its per capita income is greater than some European countries such as Spain and Italy. Both South and North Korea are located in the same geographical location, temperate zone, and their culture, at least initially, resembles, refuting the geography and culture thesis. However, the two Koreas differ in the political and economic institutions installed in each country after the Korean War. North Koreans have lived under an oppressive regime where political and economic institutions are poor whereas South Koreans have lived in a situation where economic and political institutions have been 'inclusive'.

Similar to the South and North Korea perspective, both East and West Germany were at the same level of economic development after the Second World War. However, when the two Germans split in 1948, Eastern Germany moved from fascism to communism until the fall of the Berlin Wall in 1991. During this period the economy of East Germany had grown by 1.3 percent per annum on average (Maddison, 2003, p. 28). Conversely, Western Germany moved from fascism to liberal economic system where both political and economic institutions were established and functioned properly. As a result of this, the economic growth rate of West Germany was threefold than that of East Germany during the same period. With $1.2 trillion GDP, West Germany became the third biggest economy in the world in 1991. Like the two Koreas, there was no significant difference in geography or culture of the two Germany, but they differed in institutional quality.

Another prominent example is Singapore and Nigeria. Although both countries are located in the tropical region, the per capita income of the former is 25 times higher than the latter. In a nutshell, there is no significant geographical and cultural difference between South and North Korea, West and East Germany, and Nigeria and Singapore; however, the institutional framework " were favorable to economic growth in South Korea and Singapore, but not in Nigeria" and North Korea (Acemoglu, 2008, p. 21). Therefore, the divergent path of economic development between poor and rich countries is the direct result of divergent in institutional arrangement. Economic development trajectories are affected by institutional quality because institutions influence the rate of investment and technological innovation. Thus, countries with-high quality institutions that allowed private property and free enterprise oversaw an economic 'miracle' while countries endowed with poor institutions have shown decades of stagnation and poverty.

Since the 1980s, many scholars (Alchian & Demsetz, 1972; Coase, 1937; North, 1990; North & Thomas, 1973; O. Williamson, 1985) engaged in theory making to respond to institutional neutral neoclassical economics, which leads to the birth of the 'New Institutional Economics' (NIE). The work of NIE has been important in reviving economists' interest in institutions. The role of institutions in explaining worldwide income difference has been discussed through empirical studies as well (Acemoglu et al., 2001; Acemoglu, Johnson, & Robinson, 2002; Hall & Jones, 1999; Knack & Keefer, 1995; Rodrik et al., 2004), and a large number of other related works.

1.1.4. Definition of institutions

North (1990, p. 3) defines institutions as: "…the rules of the game in a society or, more formally, are the human-devised constraints that shape human interaction. In consequence, they structure incentives in human exchange, whether political, social, or economic." Three important conclusions can be drawn from this definition. First, unlike other fundamental determinants such as geography and culture, which is outside human control, individuals can control the emergence, existence, and sustenance of institutions. Second, institutions are "the rules of the game" which set "constraints" on human behavior. Thus, the choices available for individuals are constrained by institutions. These constraints take two forms: formal constraints which include constitutions, laws and judicial rules and informal constraints which include conventions and codes of behavior. Third, the effect of institutions is through structuring the incentive mechanisms.

A closer definition of institutions was also provided by Lin and Nugent (1995) as "…a set of humanly devised behavioral rules that govern and shape the interactions of human beings, in part by helping them to form expectations of what other people will do." According to them, institutions refer to complex rules which manage the fundamental problems of social life such as control of conflicts, family interactions, and economic production. These rules are deeply embedded in human consciousness through education and socialization and are moved from generation to generation. Acemoglu et al. (2005), alternatively, define institutions as a set of rules that smooth the playing field for economic agents, therefore, they provide incentives to save, invest, and innovate so that problems would be solved through collective action. For instance, the enforceability of property rights was considered as one kind of institutional arrangement, and, if guaranteed, significantly determines individuals' decision to save, invest, and innovate.

Acemoglu and Robinson (2010a) identified three important features of institutions. First, like North's view, they stated that institutions are constraints formulated by human beings. Therefore, it is possible to establish, change and improve institutions. Second, institutions are also the rule of the game with certain enforcement mechanisms, hence, they provide an instrument of punishing cheaters and rewarding beholders of the rules. Finally, institutions govern the incentive structure in society. It is because of these important features that institutions are considered as the key determinants of not only economic growth, but also economic development: poverty and inequality. While a variety of definitions have been suggested for, this paper will use the definition first suggested by North (1990, p. 3) who described it as the rule of the game.

North (1990, p. 4) indicated that institutions are not a synonym for organizations. The author explained that organizations are actors influenced by rules and incentives i.e. by institutions. For example, political parties and parliament are political organizations, not political institutions. Similarly, corporations and trade unions are economic organizations, not economic institutions. Whereas, institutions are the rules of the game that determine the behavior of human beings. Therefore, they are important to society and the country as it defines the way the game is played. Institutions govern the circumstances within which organizations arise, grow, and work.

1.1.5. Classification of institutions

Different classifications of institutions are discussed in the literature. For instance, Joskow (2008) classified institutions into four categories based on the subject category: legal, political, economic, and social institutions. Legal institutions are a specific form of legal structure that governs societal structure. This type of institution includes a wide variety of rules and could be devised by the state or by the private sector. Political institutions are rules that determine the allocation of political power. It includes, but not limited to, constraints on political elites, limited government, and rules related to elections. Economic institutions are rules that frame economic incentives, contracts, and distribution. An example of economic institutions includes property rights, contract enforcement, etc. Social institutions, on the other hand, resembles North's informal institutions and include norms, beliefs, trust, etc.

Institutions are also classified based on the extent of whether they are formal or informal. This approach of classifying institutions directly follows from North's definition of institutions. Formal institutions include formal rules such as laws, constitutions and regulations that are codified and enforced by the state. Informal institutions are norms, beliefs, conventions, codes of conduct, trust, etc. that are not written and not enforced by the state rather through interpersonal relationships.

Rodrik (2005) classified institutions into four. The first classification is market-creating institutions that help the interaction, transaction, and production of goods and services by agents of the market within the economy and assure market agents that their economic return from such activities would lie in their control. In this regard, the security of property rights, the credibility of rule of law, and enforceability of contracts are essential in providing incentives for economic agents to accumulate, innovate, and participate in the marketplace. If these arrangements are not in place, the incentive structure of the economy will be utterly deteriorated.

The second classification is market-regulating institutions that provide rules and regulations upon the market in a situation where markets are known to fail. Rodrik (2005) indicated that since markets are not self-regulating, it requires comprehensive rules and regulations in order to minimize abuse of market power, reducing negative externalities, information asymmetry, and establish standardization and safety products, etc. The third classification is market-stabilizing institutions that deal with monetary, fiscal, and other

arrangements to stabilize the macroeconomic problem of the country including unemployment, inflation, and business cycles. Last but not least classification is market-legitimizing institutions. These institutional arrangements tackle the problem of distributions of economic outcomes after production.

Table 1.1: A Taxonomy of Market-Sustaining Institutions

Market-creating • Property rights • Contract enforcing	Market-regulating • Regulatory bodies • Others
Market-stabilizing • Fiscal & Monetary institutions • regulation and supervision	Market-legitimizing • Democratic institutions • Social protection and insurance

Source: Rodrik (2005)

Another classification of institutions is provided by (Acemoglu & Robinson, 2013). The author classified institutions into two major types: economic and political. Economic institutions consist of rules such as property rights law and contract and exchange law, and it determines who gets the profits and revenues. In a country where such economic institutions prevail the return of investment is secured, the reward of innovation is acknowledged, and resources are efficiently allocated. Therefore, investment raises, innovation triumphs, efficient allocation of resources abounds; consequently, the country prospers. Political institutions are institutions that constrain the political executive and determine political power distributions. In this regard, political institutions affect even economic institutions and it shapes the distribution of resources.

1.1.6. Institutions and economic outcome: Why do institutions matter?

Discussion on the importance of institutions dates back to the work of Adam Smith. He indicated that the presence of institutions such as property rights and rule of law affect investment rate, hence growth.

> "*In all countries where there is tolerable security, every man of common understanding will endeavor to employ whatever stock he can command in procuring either present enjoyment or future profit.*" (Smith, 1776, pp. 284-285)

It thus indicates that the willingness of households and firms to save and invest depends on the level of security. In countries where the level of security is high but risk of expropriation is low, investment rises, so does economic growth. Subsequent growth models, however, ignored this early insight for many years and had sought to explain economic growth as capital accumulation.

After a long silence on the role of institutions in economic development, the importance of sound and efficient institutions for long-term growth has been established in several research contributions since the 1970s. In the early 1970s, the development of an efficient economic system and well-defined property rights had already been shown to be a key factor in allowing western economies to raise their wealth compared to the rest of the world (North & Thomas, 1973).

Even the Industrial Revolution that was considered to be the starting point of modern industrial society and economic prosperity was considered as a manifestation, not the starting point, of modern economic growth. According to North & Thomas (1973) favorable circumstances had happened before the Industrial Revolution.

> *"A structure of property rights had developed in the Netherlands and England which provided the incentives necessary for sustained growth……The industrial revolution was not the source of modern economic growth. It was the outcome of raising the private rate of return on developing new techniques and applying them to the production process."* (North & Thomas, 1973, p. 157)

The presence of good quality institutions affects long-run growth through the provision of incentives and the reduction of uncertainty to engage in productive activities. A country is said to have good quality institutions if contracts are enforced, private properties are protected, the rule of law is respected, and an independent judiciary has existed. According to NIE (Acemoglu et al., 2001, 2002, 2005; Acemoglu & Robinson, 2013; North, 1990; North & Thomas, 1973), long-term economic growth could not be achieved without a progressive, pluralistic, politically desirable, and legally protected institutional environment. For instance, using several historical incidents in developed and less developed countries, Acemoglu et al. (2005) revealed that enforceability of property rights has determined individuals' incentives to invest in physical and human capital, and encourage peoples to adopt more efficient technologies in the production process. Thus, one mechanism by which institutions affect

economic growth and long-run economic performance is through its effect on the proximate determinant of economic growth. Poor institutions, on the other hand, inhibits investment in both physical and human capital.

In addition, good institutions also lower macroeconomic volatility and crises. Countries with weaker institutions may exhibit economic growth, but it is very hard for them to sustain growth over long periods. Acemoglu, Johnson, Robinson, and Thaicharoen (2003) found that countries with poor quality institutions that do not limit political power, infringe property rights, and encourage corruption have suffered more volatility than countries endowed with strong institutions. In this regard, the author argued that countries that experienced greater volatility and economic crises in the last six decades are those that inherited "extractive" institutions from their colonial past. Rodrik (1999) reached the same conclusion that the negative impact of external shocks on economic growth is higher in countries with poor institutional arrangements. In contrast, the negative effect of external shock could be controlled in countries with strong political and economic institutions. In addition, high-quality institutions and economic structures also reduce the probability of crises. This indicates that countries with the weakest institutions are significantly more vulnerable to external shocks and economic crises than countries with strong institutions.

Another essential mediating mechanisms whereby institutions affect economic growth is through improving technical change (Bloch & Tang, 2004). The existence of good institutions improve efficiency in the use of resources and accelerate technical progress and innovation, which in turn result in faster economic growth. Weak institutions, on the other hand, raises uncertainty about long-run productive investments in both physical and human capital. The risk associated with long-term productive investment would divert the much-needed finance from the productive sectors of the economy to short-term unproductive speculative projects.

1.1.7. Measuring institutional quality

As indicated in the previous section, institutions are multifaceted and finding a good indicator for measuring institutional quality has been one of the most difficult tasks of NIE. North (1990, p. 107) maintained that "we cannot see, feel, touch or even measure institutions." Quantifying the rule of law, property right, judiciary, and so forth is not straightforward. As a result, most of the institutional quality measures are provided by international organizations

such as the WB, think tanks, and multilateral agencies. These measures are based on the perception of business people, academicians, experts, etc. Among these, the most popular and widely used indicators in institutions-growth empirical literature are the ICRG dataset of Political Risk Services Group (PRS) and the WGI of the WB.

ICRG datasets are indicators of institutional quality constructed by PRS for more than 140 countries since 1984. This indicator has been used in previous empirical studies such as, but not limited to, (Acemoglu et al., 2001; Knack & Keefer, 1995; Jeffrey Sachs & Warner, 1997) and others. The indicator quantified after collecting the subjective assessments of risk for international investors and classified the risk into three categories: political, financial, and economic. Each of the three categories included several subcategories consisting of more indices.

The WGI dataset is available for 215 countries and territories since 1996. It captures the six dimensions of governance: voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, control of corruption. All measures range from -2.5 to 2.5 and the higher the indicator, the better institutional quality it represents. This indicator of institutional quality has been used by many researchers like (Akinlo, 2016; Rodrik et al., 2004) in their empirical study.

Other indicators widely quoted in the academic literature are World Economic Forum's the Global Competitiveness Index (GCI), Transparency International's Corruption Perceptions Index (CPI), Fraser Institute's Economic Freedom of the World (EFW), the Economic Freedom Index (EF) of the Heritage Foundation, the Freedom House's Freedom in the World, and Polity IV project.

It is worth noting that despite their use, institutional quality indicators have been criticized for not reflecting the permanent rule of the game, rather they show the actual working of the economy. For instance, Glaeser, La Porta, Lopez-de-Silanes, and Shleifer (2004) argued that the political risk dataset of ICRG data doesn't reflect the political constraints, the permanent rules that would create a form of check and balance. The measures of economic institutions are also do not reflect what they supposed to measure. In countries where the economy is growing, the survey result tends to show that institutional quality is higher and vice versa. Similarly, at the time when the economy of a particular country is in good shape, the

perception based institutional indicator would show improving institutional quality than the bad period.

In this regard, H.-J. Chang (2011) argued that not only that subjective measure of institutional quality is inaccurate but also failed to separate the cause from the effect. It is difficult to separate what causes what: is it a good economic performance that causes institutional indicators to reveal a high score? Or is it really an improvement in institutional quality that leads the country to score a high measure of institutional quality? The author provided the experience of East Asian countries in this realm. The author maintained that many experts had thought that institutions of East and the Southeast Asian countries were quite good and improving until 1997. However, after the financial crises of 1997, experts suddenly started criticizing the institutional deficiencies of these countries; accordingly, institutional measures sharply declined. Thus, all indicators that assess the quality of institutions encounter considerable measurement error.

1.2. Economic growth and institutional quality: insights from SSA

Although SSA countries are bestowed with natural resources, their economic performance in the last half-century has been unsatisfactory. For this reason, it was considered by many as an example of a 'chronic failure of growth'. Nonetheless, this assertion is misleading because the economic performance of the region has never been consistently gloomy, it has rather been volatile. The region has shown a period of both progress and regress, and ups and downs. In this sub-section, this sporadic nature of the region's economic growth is discussed. It begins with a post-colonial synopsis of economic growth and development policies of the region, and later compares the region's economic performance with the rest of the world. Special emphasis was given to the period after the 1990s, and descriptive analysis on the driver of the recent resurgence of the region's economic growth was presented. Thereafter institutional change and its relation with the economic performance of the region were discussed. Looking into the pattern of growth and institutional quality of the region, this sub-section concludes that there is a seemingly positive relationship between the two. However, it recommends a rigorous empirical investigation if the nexus between institutions growth has to be established.

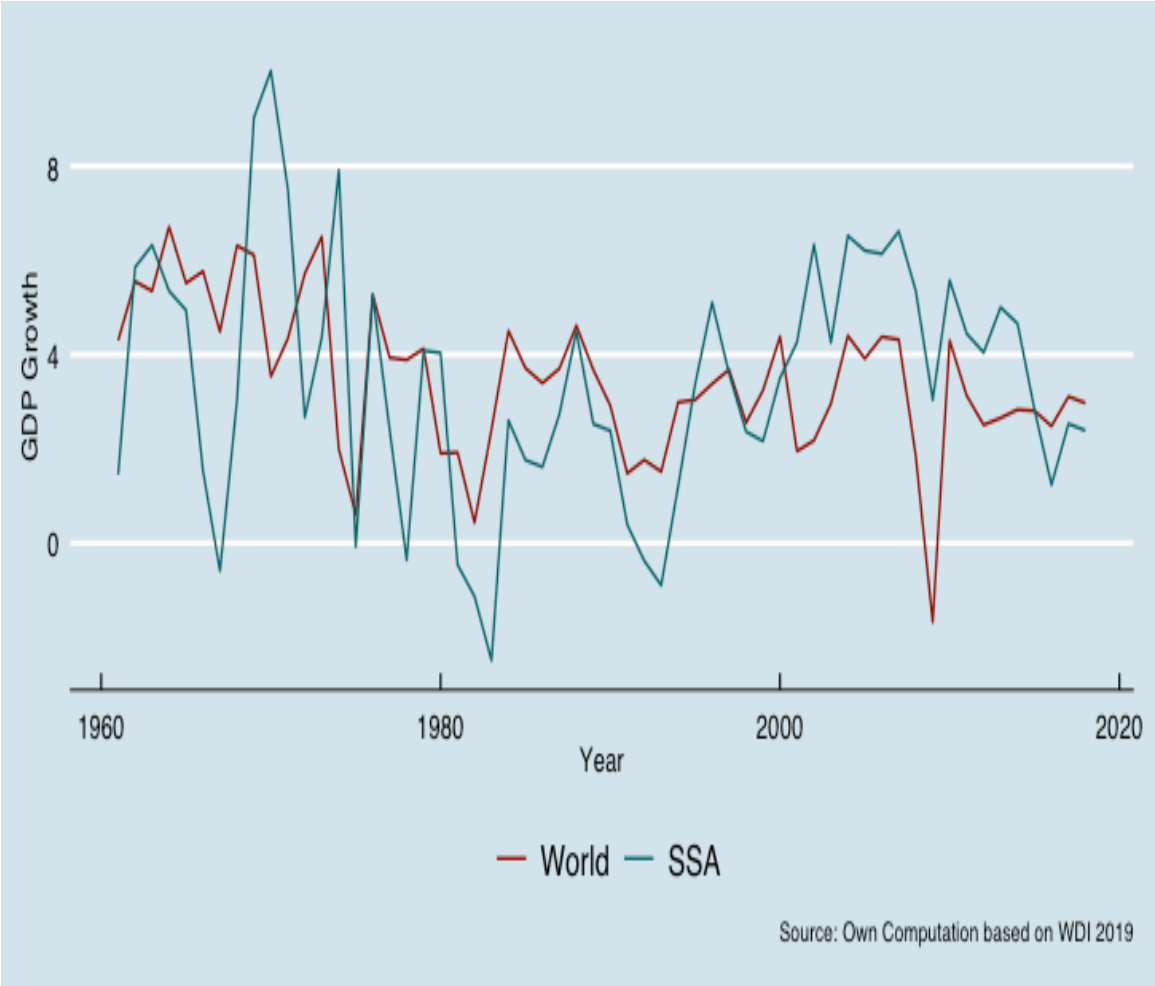
1.2.1. Patterns of economic growth in SSA

Shortly after independence, there was high expectation that SSA countries could grow even faster than their East Asian counterparts. This was due to the fact that the per capita income of most countries of the region was higher than in East Asian countries, and unlike East Asian countries, they are bestowed with abundant natural resources. The spirit of Africans was also similar to experts expectation as the slogan "Africans must run while the others walk" represents the passion of Africans during that period (Heidhues & Obare, 2011; World_Bank, 1989, p. 16).

The first generation of African leaders drafted a development plan which envisioned to accelerate the economic transformation of their respective country with a special emphasis on infrastructure development and industrialization. They believed that the government had to play a major role in the economy, so governments invested in state-run large manufacturing companies, enacted a comprehensive regulation of price and foreign exchange, drafted trade policies that restrict import but encourages export (Heidhues & Obare, 2011). The focus was to reduce the dependency on the export of primary products and import of manufacturing products by implementing Import Substitutions Strategies for industrialization (ISI). As noted by Mkandawire (2001), these and similar policies led to an increase in the GDP of growth of the region for the first 15 years of the post-independence period.[2] The following figure (Figure 1.3) displays the average GDP growth of SSA countries and the world for the period between 1960 and 2018.

[2] In addition to this, external factors had also played a significant role for the good performance of the region during this period, especially, increased price of agricultural products, which constitutes a large portion of the region's export.

Figure 1.3: GDP growth of SSA and the world



It is evident from the above figure that GDP growth, both in the region and the world, shows significant variation from year to year, but the economic growth of SSA and the world was quite similar until mid-1970. The GDP growth of the region during this period (between 1961 and 1975) was approximately 4.6 percent, slightly lower than the world average, which was 4.8 percent. During this period, the region had shown a growth shortfall of only 0.2 from the world average, which may not be considered significant for at least two reasons. First, most SSA countries got independence around 1960. Second, initial conditions were very different from other parts of the world because of the negative effect of colonialism. For instance, as noted by Sender (1999) gross primary enrolment, which is considered as the main driver of economic growth in the economics literature, was 6 percent in French West Africa, 10 percent in Tanzania, and 16 percent in Nigeria in the 1950s. Whereas Taiwan's primary school enrolment rate was 80 percent in the late 1930s, and Korea's 45 percent by the early 1940s.

Country-level data also shows the remarkable performance of SSA countries during that period. For instance, as indicated by Mkandawire (2001) between 1967 and 1980, 10 countries in Africa had grown by an average of 6% per annum, which was higher than the rate of growth both Indonesia and Malaysia. The growth engine of the region, however, started to slow down in the early 1970s and by the mid-1970s GDP growth was close to zero and GDP per capita growth was negative. Both internal and external factors were to be blamed for the region's growth performance in the mid-1970s.

Externally, the price of petroleum soared, whereas the export price of agricultural products declined. Since most countries in SSA generate foreign currency by exporting agricultural products, the decline of agricultural product prices at the international market reduced export revenue, thereby creating a large balance of payment deficit. Similarly, oil-importing countries in the region also affected by the increase in the price of oil because of the fact that they need more foreign currency to pay for imports. Domestically, import substitution strategy and state-led development plan required huge investment that couldn't be financed through domestic sources i.e. tax, creating a budget deficit. Because accessing the international market was difficult and expensive for SSA countries, they had to look for an alternative way of financing these deficits. The only alternative available was to request for grants and/loans from the Britton Wood institutions: The World Bank and IMF.

Although both internal and external factors contributed to the decline of region's growth in the mid-1970s, as noted earlier, the Bretton Wood Institutions claimed that the Import Substitutions Strategies for industrialization (ISI) strategy followed by SSA countries were the root cause of the problem. Therefore, they insisted that SSA countries should abandon their previous development plan to 'market-oriented' development strategies which often called Structural Adjustment Programs (SAPs). Implementing these policies were made a prerequisite to get loans and grants from these institutions. The policy recipe provided for each SSA countries varies but the fundamental contents resemble across countries. John Williamson (1990) labeled these policies as 'Washington Consensus' and listed them as:

Table 1.2: Structural Adjustment Programs (SAPs)

Fiscal discipline	Trade liberalization
Reorientation of government spending	Openness to FDI
Tax reform	Privatization
Liberalized Interest rate liberalization	Deregulation
Competitive exchange rates	Secure property rights

Source: John Williamson (1990)

It was claimed by the architect of these policies, such as World_Bank (1981), that implementing these policies would foster private investment, accelerate economic growth, and reduce poverty as a result. Persuaded by these, SSA countries implemented these policies until the late 1990s. However, the economic performance of the region during the SAPs period was not as the advocates of these policies had hoped. Rather than growth, there was a decline; rather than prosperity, there was rampant poverty; rather than progress, there was regress. As shown in the above figure (Figure 1.1), the average economic growth in the region was 1.9 percent between 1975 to 1995, while the average growth of the world was 3.4 percent. As clearly asserted by Rodrik (2005), East Asian countries that adopted the exact opposite of Washington Consensus were managed to succeed, whereas Latin America and SSA countries that implemented every policy advice of IMF and WB were failed to exhibit any progress. The dismal performance of the region was triggered by both domestic policies rooted from SAPs and external factors including the fall of commodity prices. Few studies, however, refute the claim that SAPs were the reason for the region's failure. They rather blame the "incomplete and half-hearted implementation" of the prescribed panaceas (see Rozenwurcel (2007)).

In conclusion, it is interesting to note that SSA countries implemented two successive and quite conflicting strategies of economic development after independence. The first one was the state-driven development strategy using ISI, and the second was the so-called SAPs (Washington Consensus) approach, advocating market-oriented industrialization policies. The discussion so far has shown that neither the first nor the second strategies deliver sustained economic growth in the region. Despite good economic performance initially, excessive

reliance on the state-driven approach of ISI lead to government-failure. True enough, SSA countries did grow between 1961 and 1975 than the subsequent period, but it was at the expense of a huge budget deficit, public debt, inflation, and macroeconomic mismanagement. Thus, it has proved to be unsustainable to continue with ISI policies in the long run. Similarly, the 'Washington Consensus' approach to economic development implemented in the region after the failure of the first approach also produced dismal results.

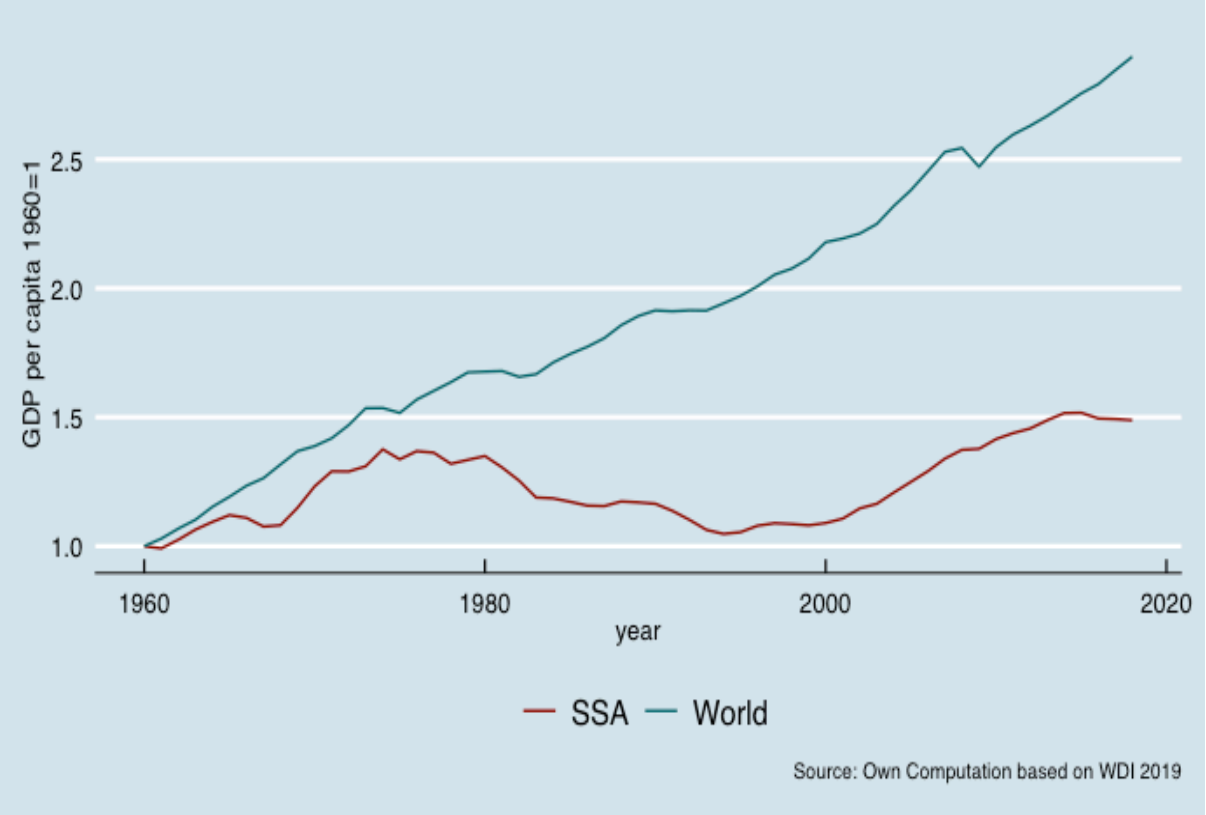
In the early 1990s, it became evident that both strategies of economic development had failed to deliver the promised economic outcome. It has been argued that policy reform would not produce the required result if institutional quality has not been improved. It was claimed that the failure of prior development strategies was due to the fact that these strategies did not incorporate the institutional reform agenda in their policy prescription. Therefore, 'institutional reform' becomes the third wave of development strategies provided for SSA countries as a solution for slow growth. Convinced by this post-Washington consensus of economic development and other internal factors, most SSA countries embarked on institutional reform program in the mid-1990s.

Institutional reform in the last two decades intertwined with the resurgence of economic growth in the region. Between 1996 and 2018, for instance, the region has registered economic growth of 4.3% per annum on average, while world GDP growth was 2.9. Despite a strong growth performance in the last two decades, the region's reliance on primary commodities has not changed. For instance, the region registered its worst outcome in more than two decades in 2016 with 1.3% GDP growth and negative per capita growth. This low economic growth rate was triggered by problems that occurred in the region's giant countries: Angola, Nigeria, and South Africa. According to World_Bank (2017) Angola's economy was contracted in 2016 because of the decline in oil production. In Nigeria, GDP growth was negative, -1.5 percent, because of tight liquidity condition, budget implementation delays, and militant attacks on oil pipelines. South Africa's economy shrank by 0.3 percent in 2016 because of a decline in mining and manufacturing output and drought. Nonetheless, the average economic growth of non-resource intensive countries in SSA remained high. In fact, if we exclude these three countries from growth rate calculation, the growth of the region would have been 4.1 percent. Thus, the average growth rate masks the considerable heterogeneity of the region.

The discussion so far indicates that there seems to be no compelling reason to argue that the region is an example of a 'chronic failure of growth' if the period is divided and growth

performance is assessed accordingly. It rather shows the growth performance of the region has rather been volatile. In order to further clarify the sporadic nature of the region's economic growth and how and when it lagged behind other parts of the world, a line graph was plotted by using GDP per capita of 1960 as 1 for both SSA and the world as presented in the following figure (Figure 1.4)

Figure 1.4: GDP per capita of SSA and the world



Looking at the figure above (Figure 1.4), it becomes clearer that the gap between SSA and the world was small in the period between 1960 and 1975, but the gap widened afterward: it continued to grow for the world but declined for SSA. The decline of per capita output of SSA continued to the extent that GDP per capita of the region in 1995 equates its per capita output of 1960.

The aggregate picture discussed so far hides the heterogeneity in growth patterns across countries and sub-regions. In fact, treating the region as if it were a collection of homogenous countries and shared similar growth experience is misleading. This is indeed due to the fact that region-wide data explains the average outcome, not country-level performance. Within sub-Saharan Africa, some countries had grown rapidly even during the dismal performance of

the 1970s and 1980s. Therefore, the number of countries with their GDP and GDP per capita growth in different decades is provided in Table 1.3. The table reveals that the long-term economic performance of the region exhibited different forms in different countries of the region. This long-term analysis of the economic performance of each country shows that the growth experience of most countries of the region is volatile and countries have been in and out from one growth range to another.

The first row of table 1.3, both in GDP and GDP per capita growth table, shows the number of countries that registered 5 percent or more growth rate, the second row between 2 percent and 5 percent, etc. Between 1961 and 1970, The GDP of 9 countries in SSA grew by more than 5 percent, while 4 countries, namely Botswana, Gabon, Mauritania, and Togo, recorded more than 5 percent GDP per capita growth during this period. Although no country recorded negative GDP growth, 7 countries registered negative growth in per capita terms during this period which includes countries like Senegal, Niger, Chad, and Somalia. This was a good period for the region as more than half of the countries in the region registered positive per-capita growth.

As shown in the table below, more countries registered lower per capita growth from 1971 to 2000. Nearly half of the countries in the region experienced negative GDP per capita growth during this period. Only a handful of countries such as Botswana, Seychelles, and Mauritius were able to maintain sustained per capita growth throughout the whole period. Nonetheless, since 2000 both GDP and GDP per capita have broadly rebounded in most countries of the region, except few countries like Zimbabwe, Togo, and Madagascar.

Table 1.3: GDP & GDP per capita growth dynamics of SSA

Growth rate (percent)	1961-70	1971-80	1981-1990	1991-2000	2000-2010	2010-18
GDP growth rate						
Greater ≥ 5	9	11	8	9	18	16
Between ≤2 and 5	18	12	22	20	24	26
Between ≤0 and 2	5	11	13	13	4	2
Negative growth	0	1	2	3	1	3
Missing (no data)	16	13	3	3	1	1
GDP per capita growth rate						
Greater ≥ 5	4	4	3	3	7	2
Between ≤2 and 5	11	8	7	9	17	21
Between ≤0 and 2	10	11	12	12	15	17
Negative growth	7	12	23	21	8	7
Missing (no data)	16	13	3	3	1	1

Source: own computation based on World Bank World Development Indicator 2019.

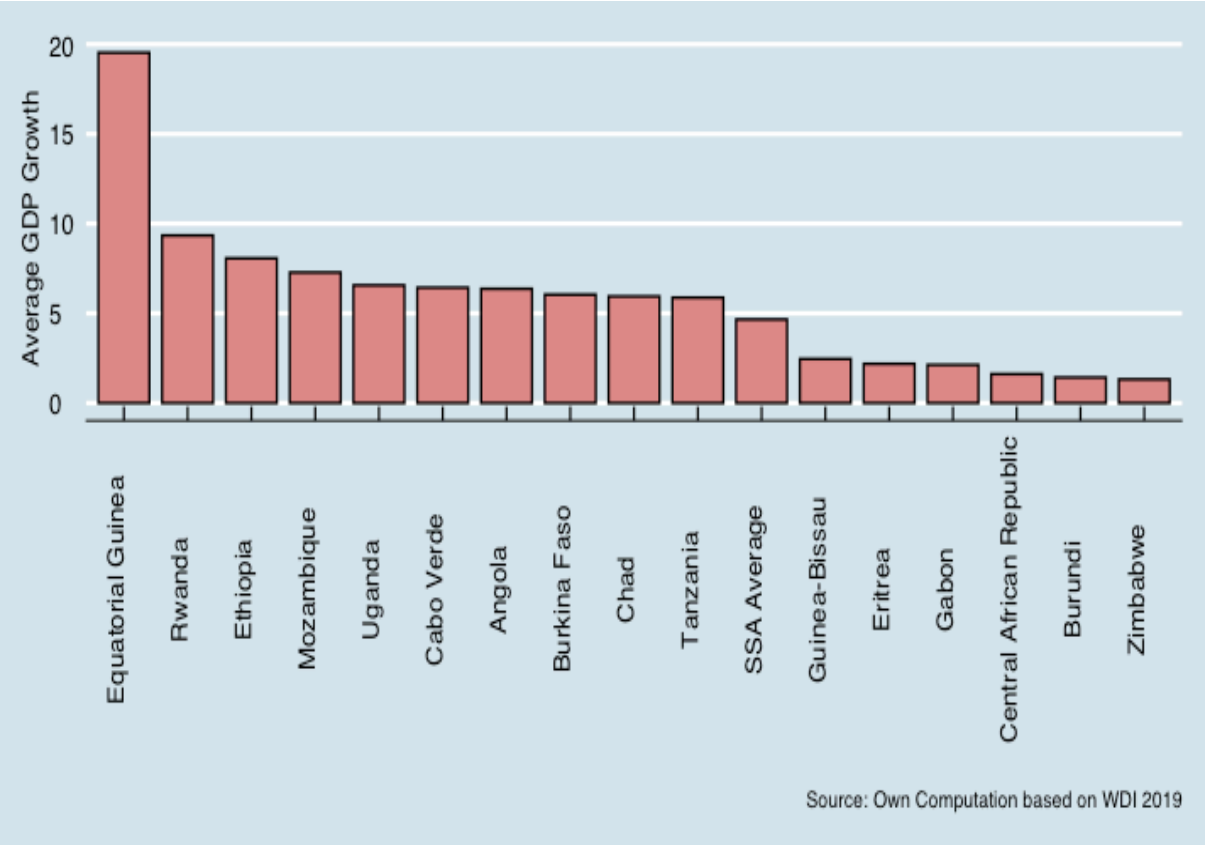
In a nutshell, the economic performance of SSA countries has been heterogeneous over the past six decades. It is only for a handful of countries that growth has been persistent, but growth in the majority of the countries has been volatile. In the last two decades, however, most economies of the region have experienced modest growth.

1.2.2. The current resurgence of economic growth in SSA

To recall, the region has registered sustained economic growth in the last two decades, but the growth experience of countries within the region varies. The substantial variation in the growth performance of the region is shown in the figure below. Figure 1.5 presents both the fastest and the slowest growing countries of SSA during the period 1995-2018. The average growth of each of the countries was measured by calculating the mean growth rate of GDP of each country between 1995 and 2018. Fast-growing countries of the region are presented on the left side, whereas slow-growing countries are presented on the right side. As can be noticed

from the figure, average annual GDP growth during this period ranged from 19.5 percent (Equatorial Guinea) to 1.3 percent (Zimbabwe).

Figure 1.5: Average economic growth of Selected SSA countries



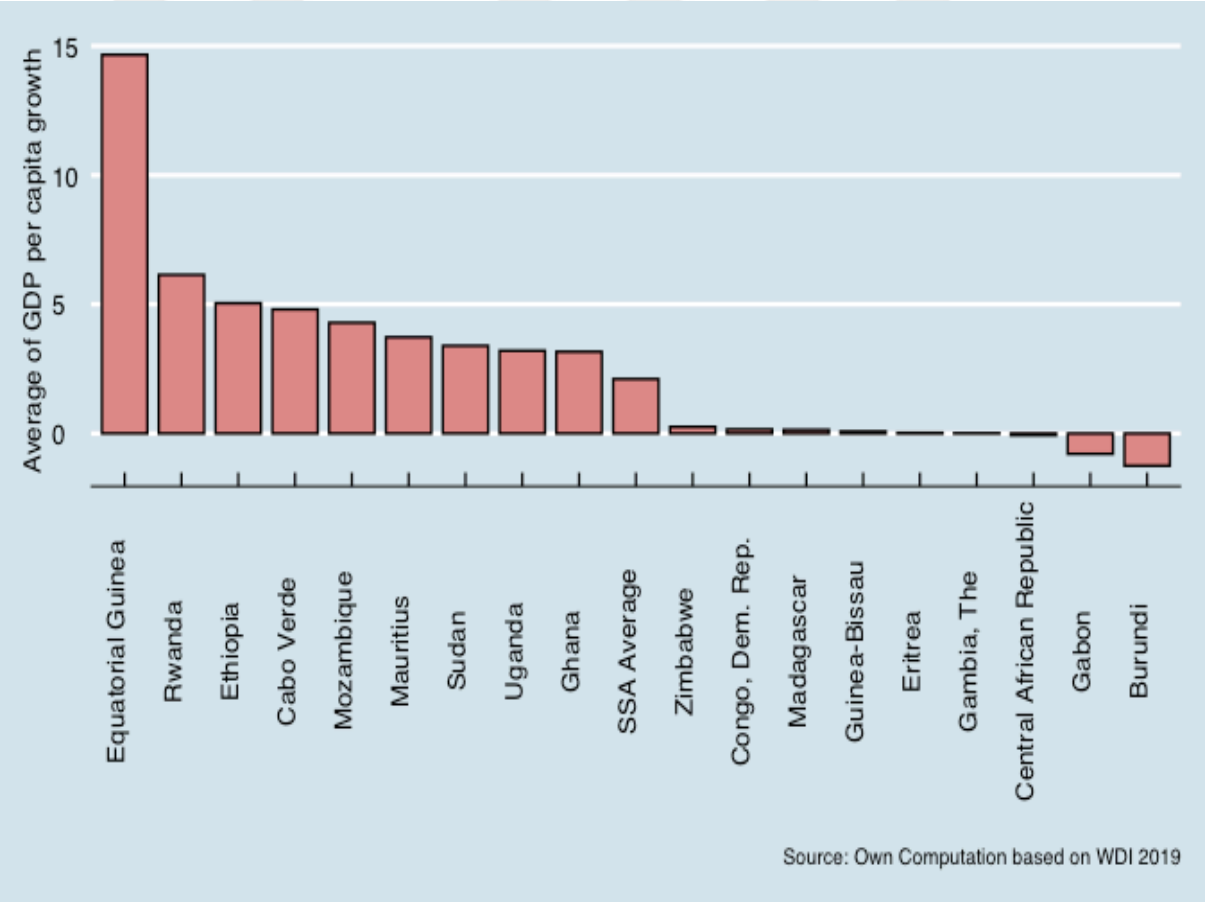
By growing 19.5 percent per annum on average, Equatorial Guinea is the fast-growing country in the region between 1995 and 2018. Its GDP per capita growth has also grown at a rate of 14 percent per year on average (see Figure 1.6) – more than double the rate of China. Nevertheless, Equatorial Guinea's economic growth in the last two decades has been triggered by the discovery of oil in 1996. As H.-J. Chang (2014, p. Chapter 7), "Had oil not been discovered, the country would have reduced to one of the poorest in the world once again, which it used to be, as it cannot produce much else." In fact, despite being one of the richest countries in the region, with a per-capita income of $23,671 measured in terms of constant purchasing power of 2010, it is ranked 136th on the UN Human Development Index.

Yet countries of the region such as Liberia, Mozambique, Rwanda, Ethiopia, and Angola have significantly grown by more than 6 percent on average over the last two decades. In addition to these countries, some countries in the region like Chad, Uganda, Cape Verde,

Nigeria, and Tanzania have exhibited consistently high economic growth performance. On the contrary, Zimbabwe is the slowest growing country in the region during this period followed by Burundi, Central Africa, Guinea-Bissau, Eritrea, and Gabon.

Although the average GDP growth of the region between 1995 and 2018 was over 4.6 percent per annum, as mentioned before, its per capita growth rate of GDP was only 2.1 mainly because of the rapid growth of the population in the region. The figure below (Figure 1.6) compares the average GDP per capita growth rate of selected SSA countries for the period between 1995 and 2018. The left panel of the figure lists fast-growing economies of the region while the right panel reveals the least growing countries.[3]

Figure 1.6: Average GDP per capita of selected SSA countries



As shown in the figure above, Burundi's per capita GDP contracted by almost 1 percent while Gabon's GDP per capita shrank approximately by 0.8 percent during this period. On the

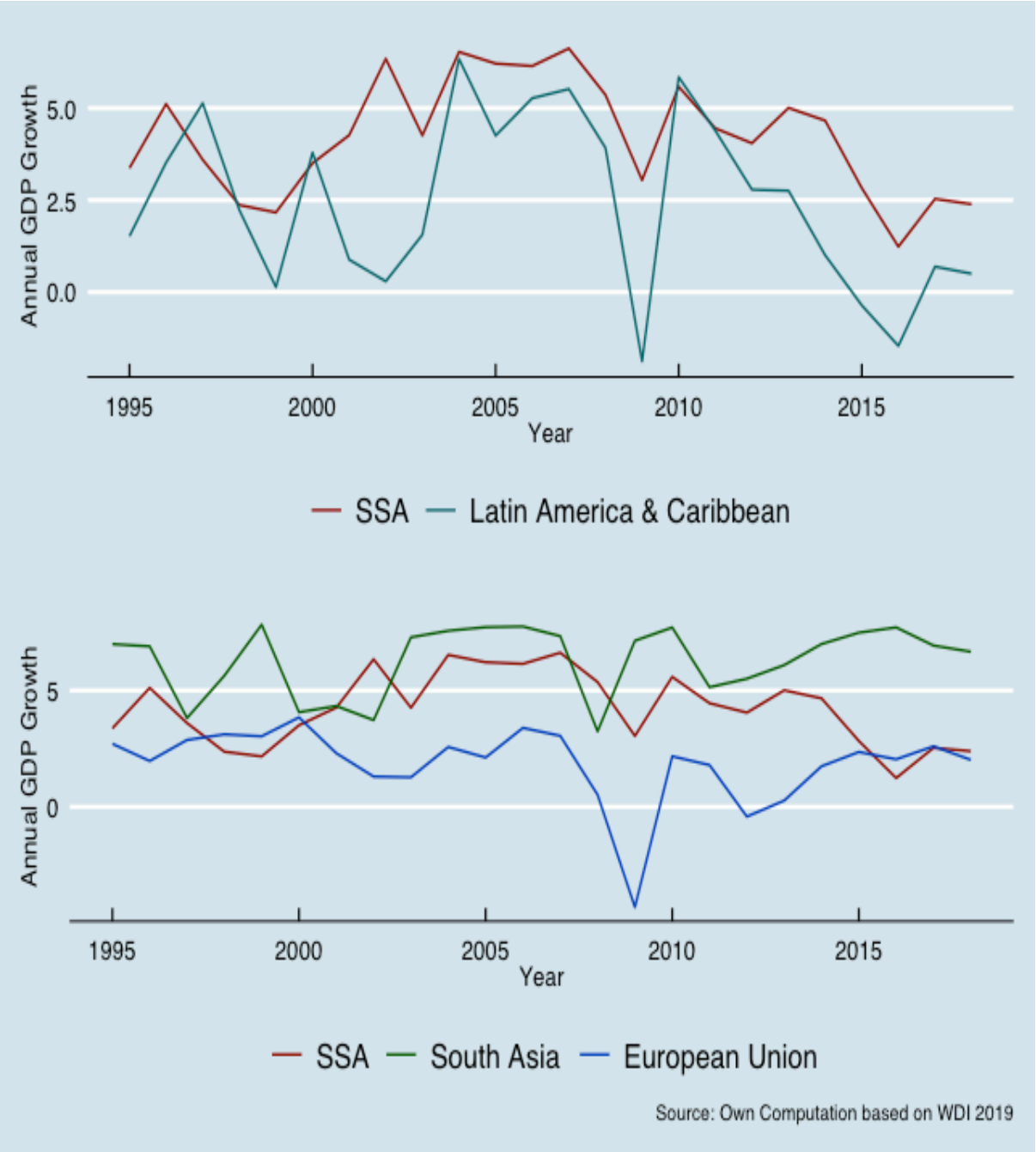
[3] Note that GDP per capita growth is measured by calculating the mean of GDP per capita growth rate of each country between 1995 and 2018

contrary, countries such as Liberia, Mozambique, Ethiopia, Rwanda, and Cape Verde were managed to attain an average growth rate of per capita GDP greater than 4 percent per annum. Per capita growth in the region is not as profound as GDP growth even for best-performing countries, indicating the necessity to restrict the growth of population.

1.2.3. Recent Economic Growth of SSA in Comparative Perspectives

This section compares the recent economic performance of the region to other regions of the world. The figure below (Figure 1.7) compares the average growth rate of GDP of SSA to other regions of the world, namely the Euro area, Latin America & Caribbean, and South Asia over the period between 1995 and 2018.

Figure 1.7: GDP growth of SSA compared to other regions



As shown in the above figure, the average growth rate of SSA, which was 4.6, has exceeded the world average growth rate of 2.9, Euro area of 1.5, and Latin America & Caribbean of 2.7 growth rate over the last two decades, but it has fallen short of the average growth rate of South Asia counties. Except for 2004 and 2008, the average growth rate of South Asian countries has been astonishingly higher than SSA. A closer look at the data also indicates that the average growth rate of SSA countries was closer to South Asian countries in the period between 2000 and 2008. During this period average growth rate of SSA was 6.1, close to south

Asian countries and double to the world average. Growth in the Euro area remains low at 1.8 percent during this period, and the growth of Latin America & Caribbean countries was close to the world average. But the growth rate of SSA countries was disappointing during 1996-2000, the average growth rate of SSA was half of the average growth of South Asian countries and close to the world average. Even though growth has slowed to 3.8 percent in SSA in the last seven years and lower than South Asian countries, which registered an average growth rate of 6.9 percent per year, the growth rate has been consistently greater than the world average (2.4 percent), Latin America and the Caribbean, and Euro area (0.4 percent). In nutshell, the economic growth of SSA not only performed well in terms of its past experience but also did well as compared to other regions of the world except South Asia.

Overall, not only growth has been revived in the last two decades but also the incidence of poverty has declined, albeit marginally. Having seen the renewed spurt of both GDP per capita and GDP growth of the region over the last decade, The Economist changed the title of its cover page from that of the "hopeless continent" to the "hopeful continent".[4] SSA countries like Ethiopia, Rwanda, Mozambique, and Tanzania dominates the list of fastest countries in the world in the last 20 years. Indeed, in 2011 the *Economist* reported that over between 2000 and 2010 "seven out of ten fastest-growing economies are in [SSA]".[5] Similarly, they predicted that six of the worlds ten fastest will also be countries of SSA.

1.2.4. The driver of the recent economic growth of the region: Temporary Vs Durable factors

After looking at the growth resurgence of the region and its variation across countries, the major question is thus what triggered the recent boom of the region's economy. Unfortunately, although the good economic performance of the region is widely recognized, the driver of this growth remains controversial. This sub-section discusses the view of economist on the current resurgence of the region's economic performance grouping into two: temporary and durable factors.

The proponent of temporary factors argued that rising oil and commodity prices contributed to the recent resurgence of economic growth in the region (see for instance Arndt,

[4] In its May 11th, 2000 publication, The Economist infamously labeled Africa on its cover "The hopeless continent". However, in its December 3rd, 2011 publication, the headline of the magazine was "The hopeful continent".
"The hopeless continent" accessed from http://www.economist.com/node/333429
"The hopeful continent" accessed from http://www.economist.com/node/21541015
[5] https://www.economist.com/blogs/dailychart/2011/01/daily_chart

McKay, and Tarp (2016, p. 3) & Onyeiwu (2015, p. 11)). As shown in the following graph (Figure 1.8) oil price has significantly increased since 2000, although it plummeted in 2008 and recently in 2016. It is needless to say that this increase has boosted the economic growth of oil-producing countries in SSA such as Angola, Equatorial Guinea, Nigeria, and Sudan.

Figure 1.8: Crude oil price in the USA ($ per barrel).

During this period, not only did the price of oil soared but also the price of commodities. The buoyancy of commodity price was shown in the following figure (Figure 1.9). The figure shows the index of global prices of all commodities, which includes the price of both fuel and non-fuel commodities, using the 2005 price as a base. As shown in the figure, there had been a sharp increase in the price of commodities until 2014, with a slight decline in 2008.

Figure 1.9: Global price index of all commodities

As SSA countries are heavily dependent on agricultural products and minerals such as copper, gold, zinc, and iron ore for its export, the rise of commodity prices since the mid-1990s in the international market is one of the factors that contributed for the resurgence of economic growth in the region.

The durable factors view, on the other hand, provide another explanation for the recent resurgence of economic growth of the region. It has been argued that the recent economic performance of the region is neither temporary nor simply the result of favorable commodity prices. Rather more durable factors have played significant roles. Radelet (2010) summarized these durable factors into five: i) improve in democracy and accountability; ii) better economic policies; iii) reduction in debt; iv) adoption of new technologies; v) new generation of policymakers and leaders.

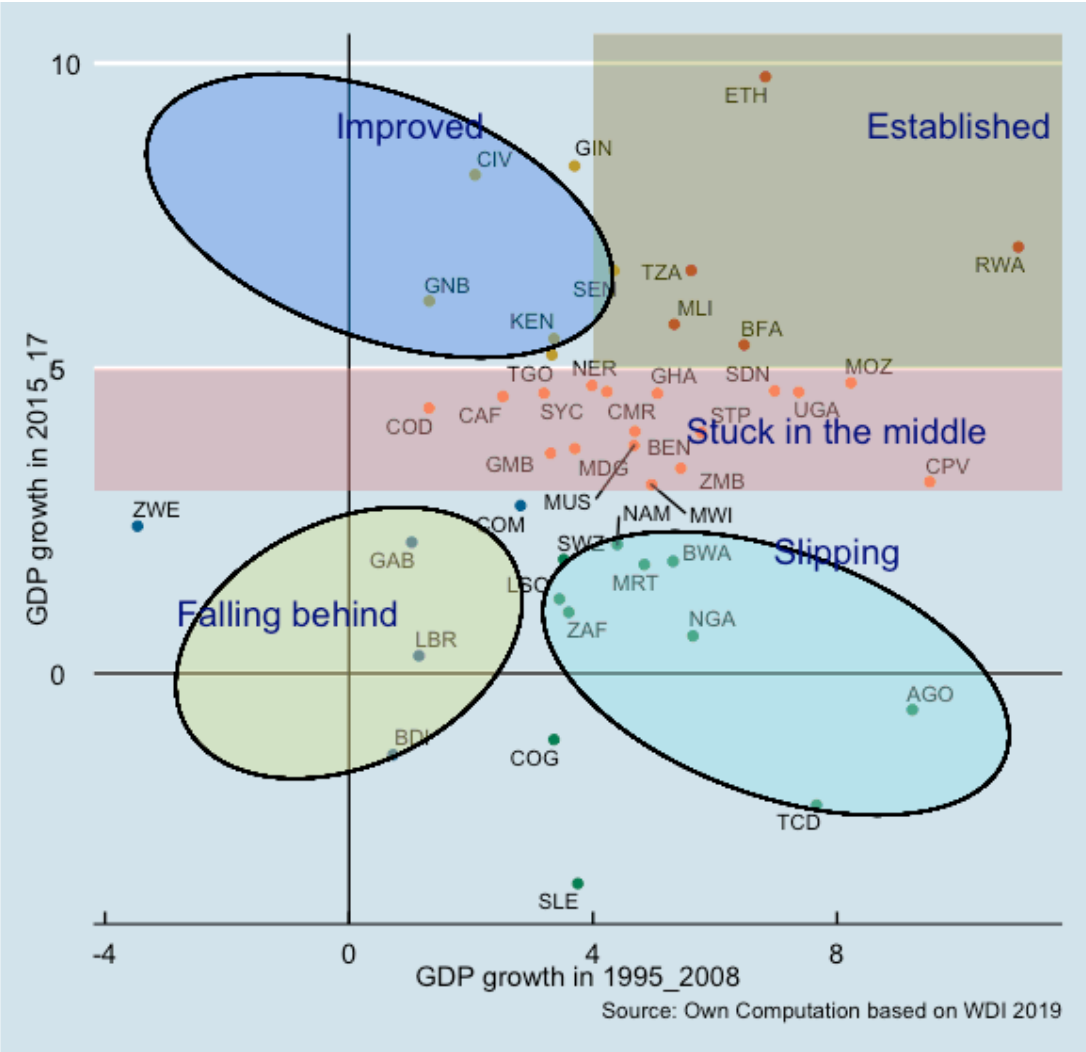
However, the recent economic performance of the region cannot be attributed to a single factor: neither temporary nor or durable factors can entirely explain the recent economic performance of the region. It is clear from the above discussion that the combination of

different factors-both durable and temporary factors-have played important roles in igniting the economic growth of the region. Although the influence of commodity prices should not be ignored, rising prices of commodity alone cannot explain the whole story of sources of economic growth of the region. In fact, Roxburgh et al. (2010) estimated that resources accounted for only about a third of the recent growth of the region, the remaining two-third resulted from internal structural change and reform. It is interesting to note that the largest portion of countries that recorded lower economic growth are those which are affected by political instability and other internal factors than being resource-scarce, refuting commodity price causes recent growth hypothesis.

To recall, the region faced external economic difficulties in 2015 and 2016 because of the fall in commodity prices in the international market. However, if we compare the average annual GDP growth rate of countries during 1995-2008 (a period when commodity price and oil price had been increasing) with the growth rate of 2015-2017 (both commodity and oil price plummeted), we do find no less than seven countries has recorded robust growth even with external difficulties. This, in fact, shows that these countries are resilient to external shock and volatility. Figure 1.10 compares the growth rate of 44 SSA countries during 1995-2008 (X-axis) to the growth rate of 2015-2017(Y-axis). These 44 countries are then classified, comparing their growth rate during the two periods, as established, improved, falling behind, slipping, and stuck in the middle using the top and bottom GDP growth rate of 5 and 3 percent as threshold growth rate.

It is apparent from the following figure that countries, namely, Ethiopia, Mali, Rwanda, Burkina Faso, and Tanzania have achieved a growth rate higher than the upper threshold level of 5 percent per year in both periods, confirming the fact that durable factors contributed for sustained growth of these economies. World_Bank (2017, p. 20) asserted that these countries generally control their macroeconomy from high inflation and rising budget and balance of payment deficit by reducing spending and mobilizing domestic revenue. Several countries, however, lied in the middle of the threshold levels and categorized under stack in the middle. Although these countries were affected by the recent decline of commodity price, they have managed to sustain a modest growth rate between the upper (5) and lowest (3) threshold level of growth. Therefore, it can be argued that both durable and temporary factors played a significant role in determining the growth of these countries.

Figure 1.10: GDP growth of SSA countries: 2015–17 versus 1995-2008



Resource-rich countries like Chad, Equatorial Guinea, and Nigeria was hit hard by the recent fall in the price of the commodity as they fall in the category of slipping. Although they had grown by an average rate of more than 4 percent during 1995-2008, their growth rate declined below 2 percent per annum between 2015 and 2017. This is evident that the economy of these countries is vulnerable to the external environment, and one might suspect that temporal factors may have contributed a significant role in boosting the economic performance of these countries. On the contrary, the lower-left section of the upper figure lists countries such as Zimbabwe, Burundi, Republic Congo, and Gabon that falls under the category of falling behind, implying that these countries lagged behind other nation of the region and their economic performance was gloomy in both periods.

The above figure thus seems to validate the view that both temporary and durable factors contributed to the current resurgence of the economic growth of the region. In the

section that follows, the progress of SSA in terms of human capital and population growth was discussed.

1.2.5. Institutional Changes and Transitions over the Past Decades in SSA

The question of why SSA possesses low-quality institutions compared with other parts of the world has attracted extensive research in the last few years. The most widely cited explanation on this topic is provided by Acemoglu's various works on the link among colonialism, geography, and post-colonial institutions (Acemoglu et al., 2001, 2002, 2005; Acemoglu & Robinson, 2010b, 2013). In their seminal study, Acemoglu et al. (2001), and later in their book, Acemoglu and Robinson (2013), argued that the different forms of European colonization strategy are the main reason for the current cross-country institutional difference. In places where the climate was conducive for European settlers, such as the USA, New Zealand, Austria, and Canada, Europeans settled in large numbers and established 'inclusive institutions' that promoted democracy and fair distribution. Such institutions support the protection of property rights and the rule of law by constraining the power of the local elites and rulers. These 'inclusive institutions' persisted to this day. On the contrary, in places where the settlement was difficult for Europeans during the period of colonization due to tropical climate and disease, such as Uganda, Malawi, Nigeria, and Mali, the colonizers established 'extractive institutions' to ensure the extraction of natural resources and control of colonies. Since institutions are persistent, the 'extractive institutions' installed during colonization remained till today. As a consequence, countries in the northern hemisphere ended up with low-quality institutions. Since the tropical climate of SSA was not comfortable for European settlers, as indicated by Herbst (2000, p. 63), they established 'extractive institutions' in almost all parts of the region. After the end of colonialism, the newly independent countries of SSA countries inherited low-quality institutions, which is characterized by infringement of property rights, among others continued to persist till today.

Contrary to the view that institutions are 'persistent', others argued that institutions are the outcome of human decisions therefore they can be changed through political action. Therefore, several factors – both internal and external – have affected the post-colonial institutional arrangement of the region. In this regard, Roland (2004) classified institutions as slow-moving, institutions which change slowly and incrementally, and fast-moving, institutions that change rapidly. The author considered political institutions as fast-moving institutions because they can even change nearly overnight when there are revolutionary

moments whereas informal institutions such as social norms and values are an example of slow-moving institutions because they change very slowly. A typical example to understand that institutions are not persistent is the experience of transition economies. As indicated by recent studies (see for instance Eicher and Schreiber (2010) and Opper (2008)), former members of the USSR practically changed their institutions overnight and these institutions have continued to evolve rapidly.

There is no shortage of examples of the adaptability of the institutions in the region as well. Although most SSA countries inherited similar 'extractive' institutions from their colony, colonial institutions did not apply uniformly in the region nor did it last permanently. Some countries have experienced different paths of institutional development after independence than others even though they inherited similar institutions from their colonial powers. For instance, both Zambia and Botswana were a British colony. As it is the case for most SSA countries, Britain installed extractive institutions in both countries that support the extraction of natural resources. However, these two countries experienced a very different path of institutional development after independence that enabled Botswana to have high-quality institutions while Zambia with low-quality institutions (Du Plessis & Du Plessis, 2006). Although Zambia's per-capita income was twice that of Botswana during independence, by now the average Botswanan gets six times more income than his/her counterpart in Zambia. Similarly, Bates (1981) noted that despite having a similar colony in the past, SSA countries have followed different policy choices that lead them to have different institutional arrangements. The author argued that although the marketing board was a colonial innovation, how they were used after independence depends on the post-colonial political economy in which some SSA countries tended to have a policy regime that favored agricultural exports while other regimes discriminated against them.

The above account and example appear to suggest that institutions in post-colonial SSA have never been static but rather been changing over the years. Several factors can be identified as an intervening variable in the process of intuitional arrangement in the region. Among the many factors that affected the institutional environment and governance structure of the region was the cold war. The post-colonial period was characterized by a global rivalry between the superpowers, namely the USA and USSR, and the consequent search for allies— until the collapse of the Soviet Union in 1991. During this period, the SSA region was turned much into a domain of political struggle between the two dominant powers in order to promote their

ideologies. As pointed out by Herbst (2000, p. 108) the USA and the Soviet Union supported political regimes and leaders intent on preventing the development of effective institutions and good governance in many instances. But, when the threat of communist block comes to an end with the collapse of the USSR, the foreign policy of the west was no longer based on containment of the Soviet bloc. Thus, improvement in institutional quality becomes one of the primary advices of the west.

The shift from the neoliberal understanding of economic development towards post-Washington economic development and the support it gets from Bretton Woods institutions have also influenced the institutional framework of the region. As Rodrik (2005) claimed that "development policy has always been subject to fads and fashions". During the 1950s & 1960s, import substitutions development strategies and 'big-push' were considered as a solution for underdevelopment. These ideas lost ground when 'market-oriented' strategies of 'Washington-consensus' were advocated as a panacea for the problem of less developed countries in the late 1970s and 1980s. Since the 1990s, however, the Washington Consensus has been criticized for not having incorporated institutional reforms. Improving institutional quality becomes the central theme of both international organization and development economists. They recommended that developing countries should improve the institutional arrangement in order to foster growth and reduce poverty. For instance, the World Bank report suggests that strengthening institutional arrangement should be the priority of poor countries because the economy of these countries is impeded by weak institutions.

> *"Without land-titling institutions that ensure property rights, poor people are unable to use valuable assets for investment and income growth. Without strong judicial institutions that enforce contracts, entrepreneurs find many business activities too risky. Without effective corporate governance institutions that check managers' behavior, firms waste the resources of stakeholders. And weak institutions hurt the poor especially*." (World Bank, 2002, III)

The recently published World Bank (2017b) report, entitled "Governance and the Law", underline the importance of improving governance structure for effective policy intervention to achieve sustainable improvement in development outcomes. Therefore, Institutional reform remains at the center of today's conventional understanding of economic development, albeit with its flaws and many critics.

International organizations and scholars have made direct or indirect references to the important role of institutions and suggested that the principal problem faced by SSA in their quest for development is the absence of good quality institutions. It has been argued that both political and economic institutions are weak compared to the rest of the world. For instance, Nganje (2015) contends that most countries in SSA do not have efficient property rights regimes and independent judiciaries that respect the rule of law and guarantee security and stability. Thus, the poor growth performance of SSA in the late 1970s and 1980s was attributed to weak institutions, and on the policy front, SSA countries were prompted to actively engage in institutional reforms.

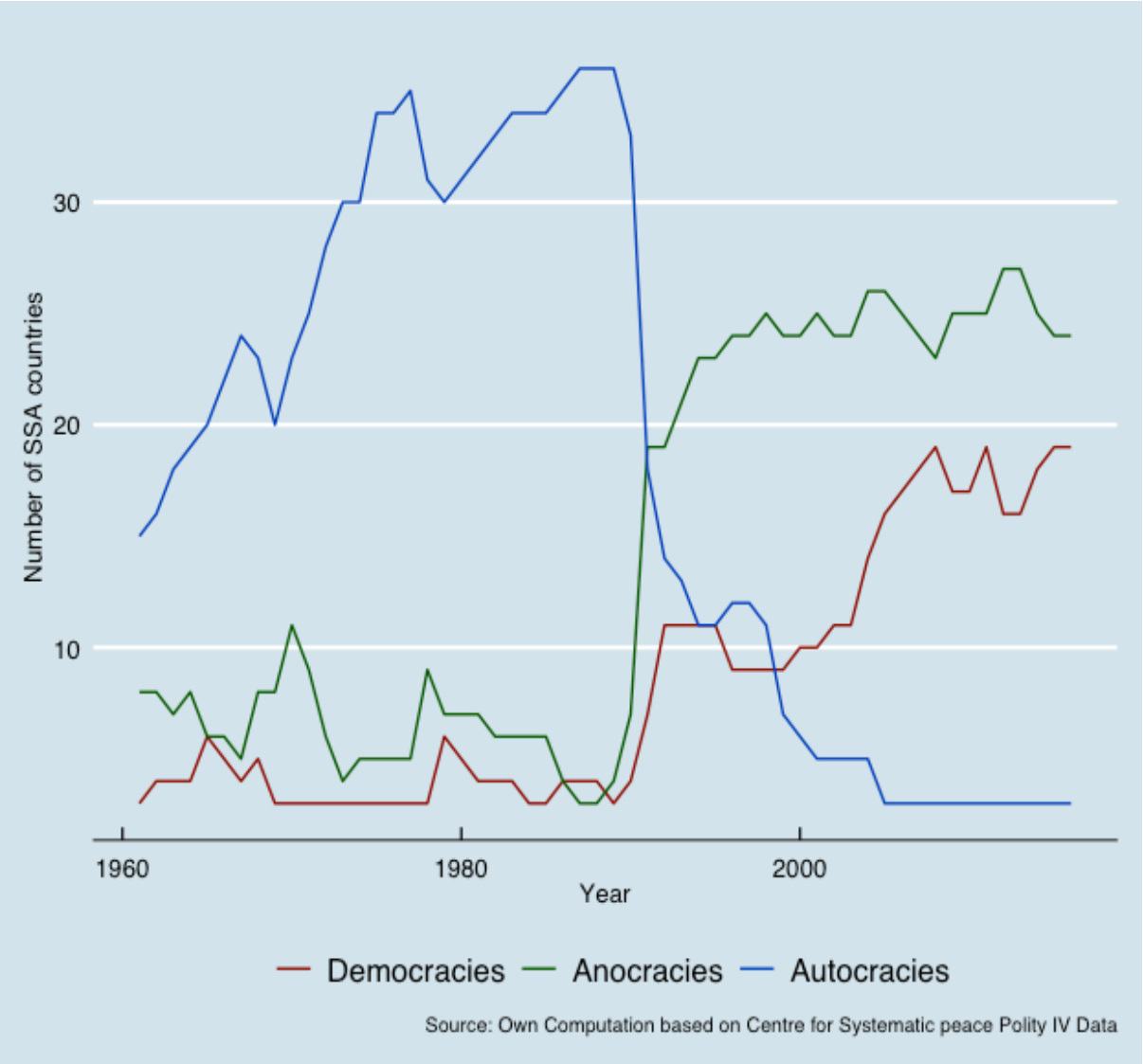
And it was undeniably the case that internal pressure for better governance also contributed to improvement in institutional quality and governance structure of the region since the early 1990s. There were upsurges in demands for greater democracy and popular participation across Africa. People were gathered in Cotonou, Abidjan, Lusaka, and Dar es Salaam (the capital city of SSA countries) demanding greater democracy, improved living standards, and against maladministration and corruption (Somerville, 1999).

In response to the above mentioned internal and external pressures, many SSA countries have embarked on institutional reform which includes reorganizing property rights, enforcement of contracts, and democratic governance. Regardless of the institutional indicator used, the quality of institutions in SSA has improved in the last two decades. The following figure (Figure 1.11) compares the score of Economic Freedom (EF) of SSA, the World, Euro area, and Asia-Pacific for the last two decades (1995-2017). EF index ranks countries based on a compiled index of twelve indicators which ranges from 1 (lower) to 100 (higher). As shown in the figure, the EF index of SSA has improved from 51 in 1995 to 55 in 2017, implying that SSA is the second most improved region in the world during this period next to the European region.

Figure 1.11: Index of economic freedom of different regions

The widely used indicator as a measure of political institutions in economic literature is the Polity2 score of the Centre for Systematic peace Polity IV project. The Polity2 score ranges from -10 indicating complete autocracy to +10 representative complete democracy. Thus, to provide additional perspectives on the transformation of the region's political institutions in the last two decades, the following figure (Figure 1.12) is drawn. In the figure, countries are classified as democratic, anocracies, and autocratic based on their polity scores and the number of SSA countries was assessed in each year. Countries whose polity score is from -10 to -6 are categorized as autocracies while countries with polity scores between -5 and +5 are anocracies. Democracies include all regimes with polity scores between +6 and +10.

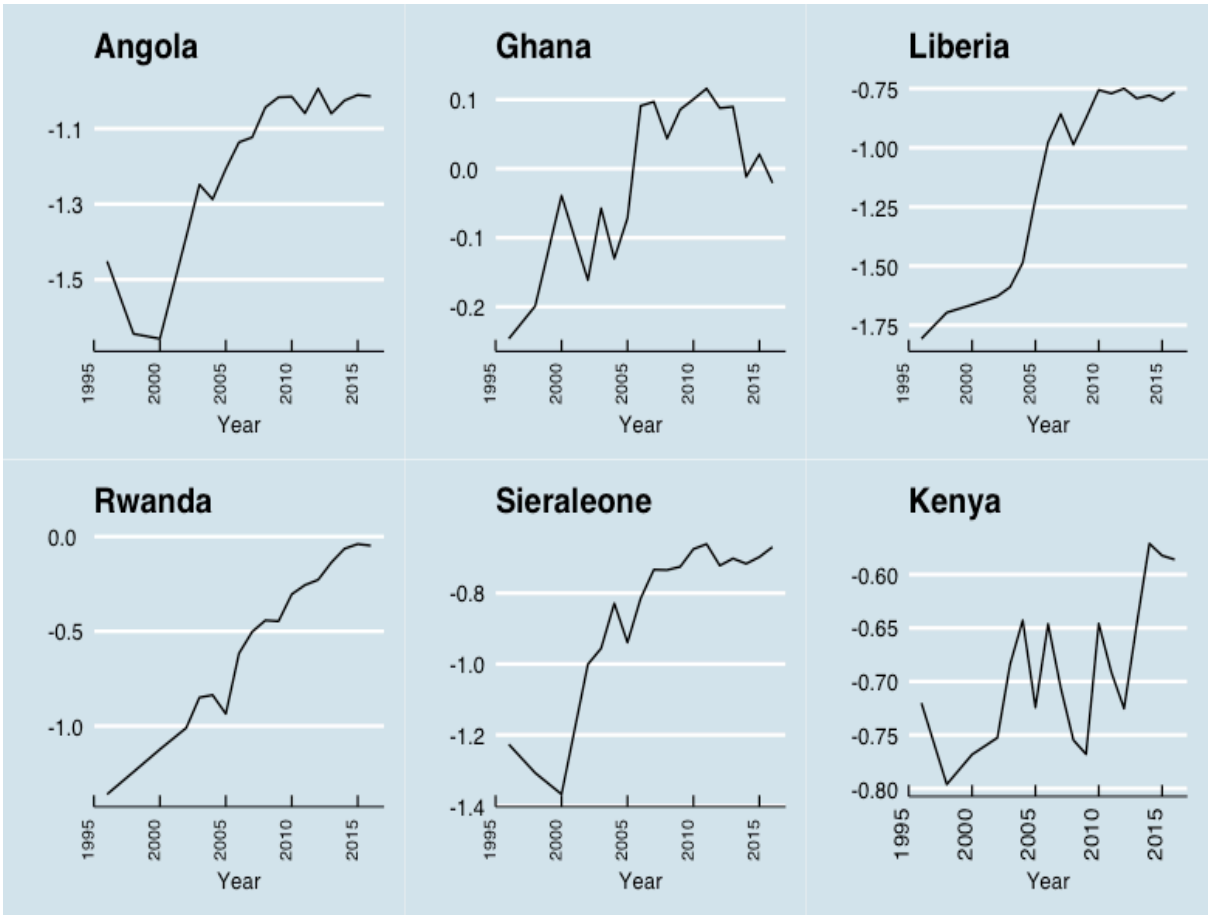
Figure 1.12: Regime type SSA countries



As shown in the figure above (Figure 1.12) there were very few democratic countries in SSA that could be counted on the finger of one hand until the early 1990s. Based on this index, less than 5 countries out of 48 SSA countries were considered as democracies during this period. Worse yet, only two countries i.e. Mauritius and Botswana have been under democracy consistently since 1961 while others have been in and out from one regime type to another. However, the number of democracies has risen steadily following the collapse of communism in 1991, albeit anocracy remained the most common form of regime type in the region. Not only democratic institutions have strengthened but also political stability has improved in the last two decades. For instance, the frequency of both coup d'etat and civil war has significantly reduced during this period. As noted by Fosu (2017), the frequency of civil war was 18 in 1991 but this number has declined to 8 in 2008.

Regardless of which institutional measure one used, institutional quality has been improving in the region in the last two decades but it has not been even across countries. Some countries have shown remarkable achievement in institutional quality while some others failed. For example, World Governance Indicator has improved considerably for countries such as Angola, Ghana, Liberia, Rwanda, Sierra Leone, Kenya (see Figure 1.16). The WGI is an institutional indicator prepared by the World Bank and ranges from -2.5, representing low quality institutions to 2.5, indicating high governance performance/institutional quality.

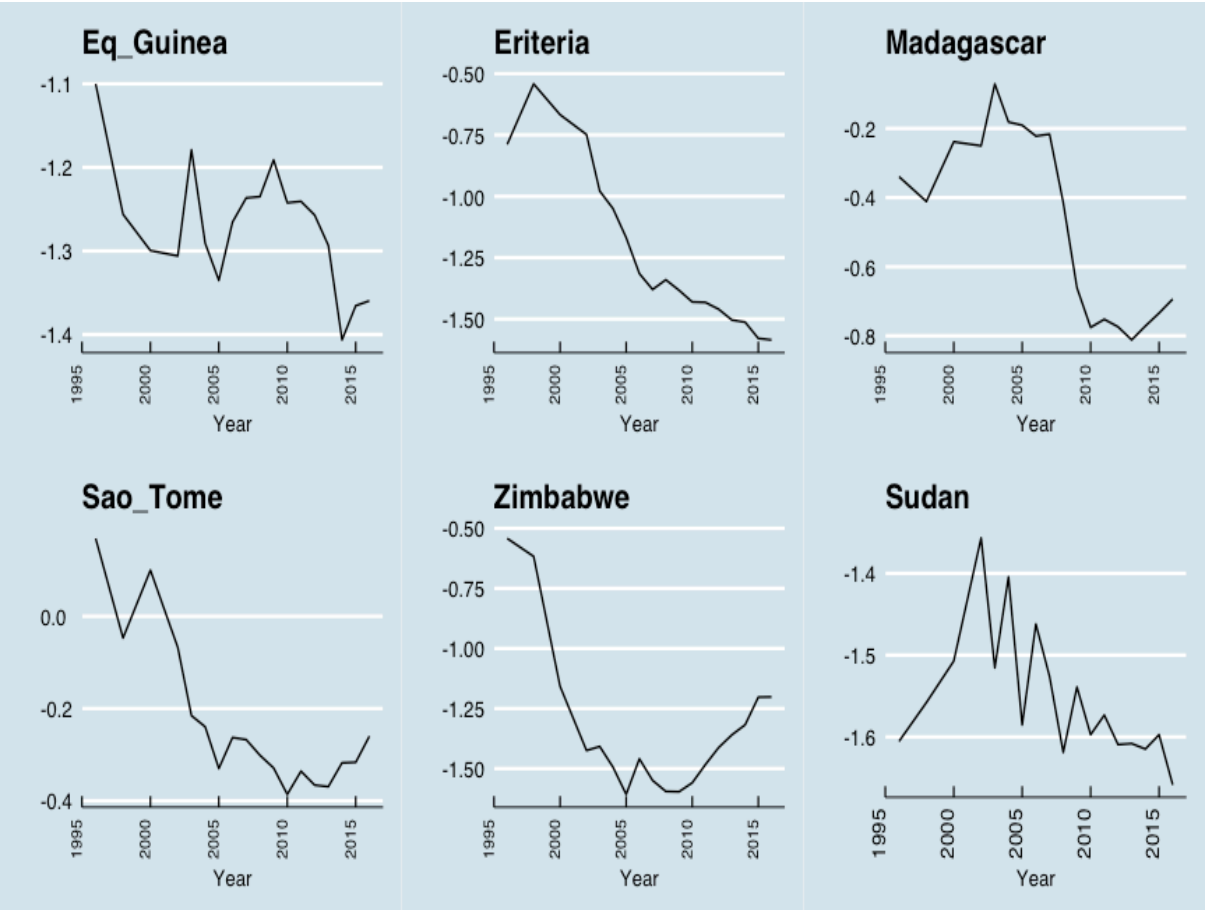
Figure 1.13: Institutional quality index of selected SSA countries (High Performing)



Source: own computation based on WGI

On the other hand, institutional quality has deteriorated considerably for countries like Eritrea, Madagascar, and Zimbabwe (see Figure 1.14).

Figure 1.14: Institutional quality index of selected SSA countries (Low performing)



Source: own computation based on WGI

Of course, some might object and concerned about the ongoing institutional reform in the region. Their argument has been marked by, among others, on a one-size-fits-all approach to institutional reform and its failure of not considering the historical and local context. Nganje (2015) contended that most of the region's institutions are predominantly imported from the West and do not reflect the economic, social and cultural realities of the region. Therefore, the author argued, although western-type institutions could be established, these institutions would be dysfunctional because of lack determined leadership, incapability of the state to implement laws and rules, and inadequate economic possibilities, which would promote economic agents or groups to pervert the established institutions for an illegitimate accumulation of wealth.

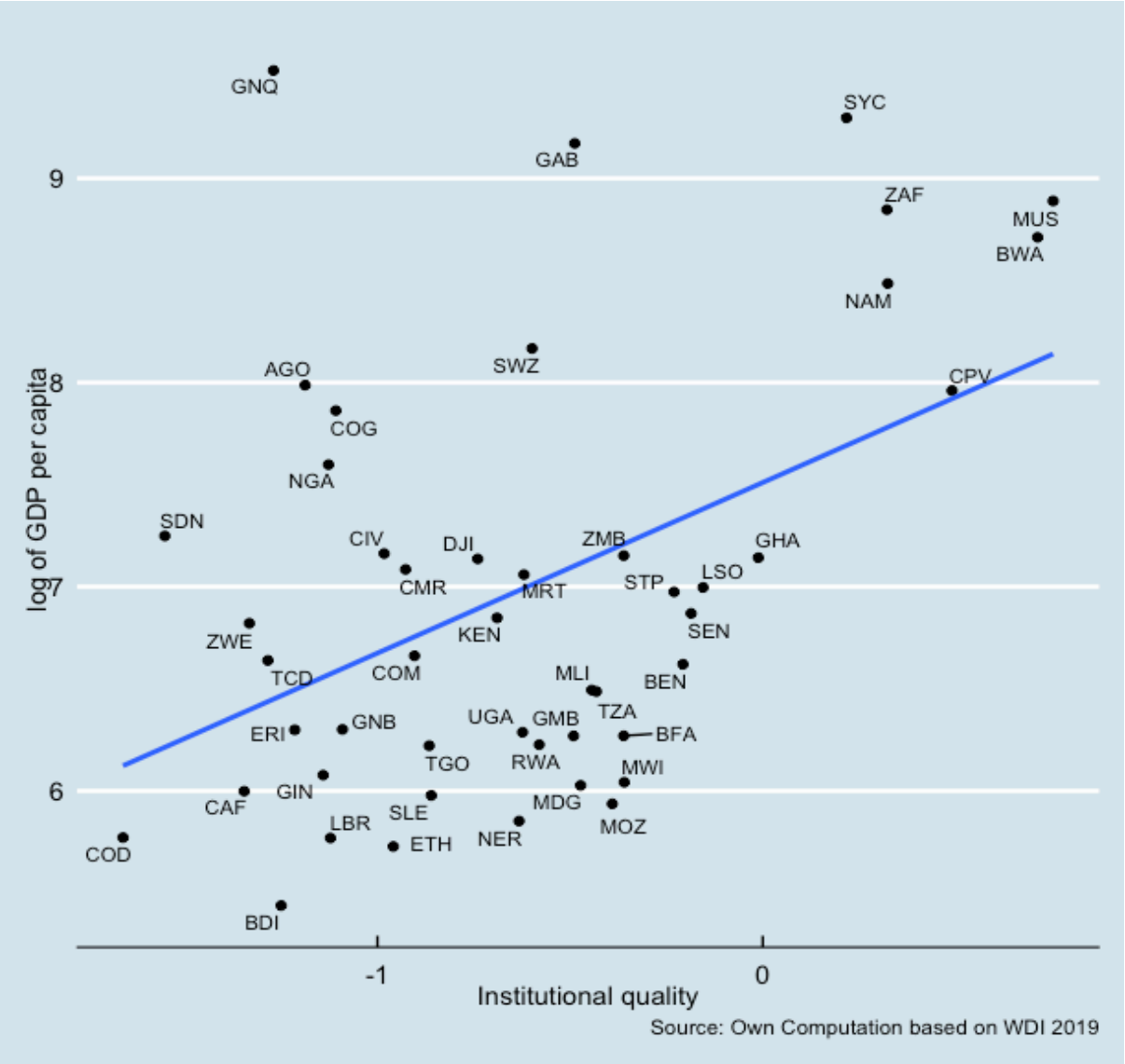
As noted earlier, the recent resurgence of economic growth coincided with the improvement of the region's political and economic institutions. According to New institutional economics change in political institutions would likely lead to changes in the

policies of its government that would be conducive for investment and economic growth. Thus, one likely explanation for the current resurgence of economic growth would be that of improvement in both political and economic institutions of the region in the last two decades. Several studies also indicated that institutional development has significantly contributed to the improved performance of the region's economy in recent years (Bates & Block, 2013; Fosu, 2013a, 2013b).

1.2.6. Institutional quality and development outcomes in SSA

As noted above, there exist significant variations both in institutional and economic performance within SSA. In this section, an attempt was made to examine the link using a simple plot as shown in Figure 1.18. This figure plots the results of an OLS regression of the log of average per capita GDP between 1996 and 2016 against the World bank's governance indicator (average score of each country between 1996 and 2016). It is clear from the figure that countries that have scored higher institutional quality are those that have higher GDP per capita, indicating differences in institutional quality leads to differences in income. Although R-squared of the regression is low (0.2), the correlation is significant and positive (0.84), implying the close interrelationship between institutional quality and income. Based on this evidence, it seems fair to suggest that although bad institutions may not explain the entire difference in per capita income within SSA, they do explain a substantial fraction of it.

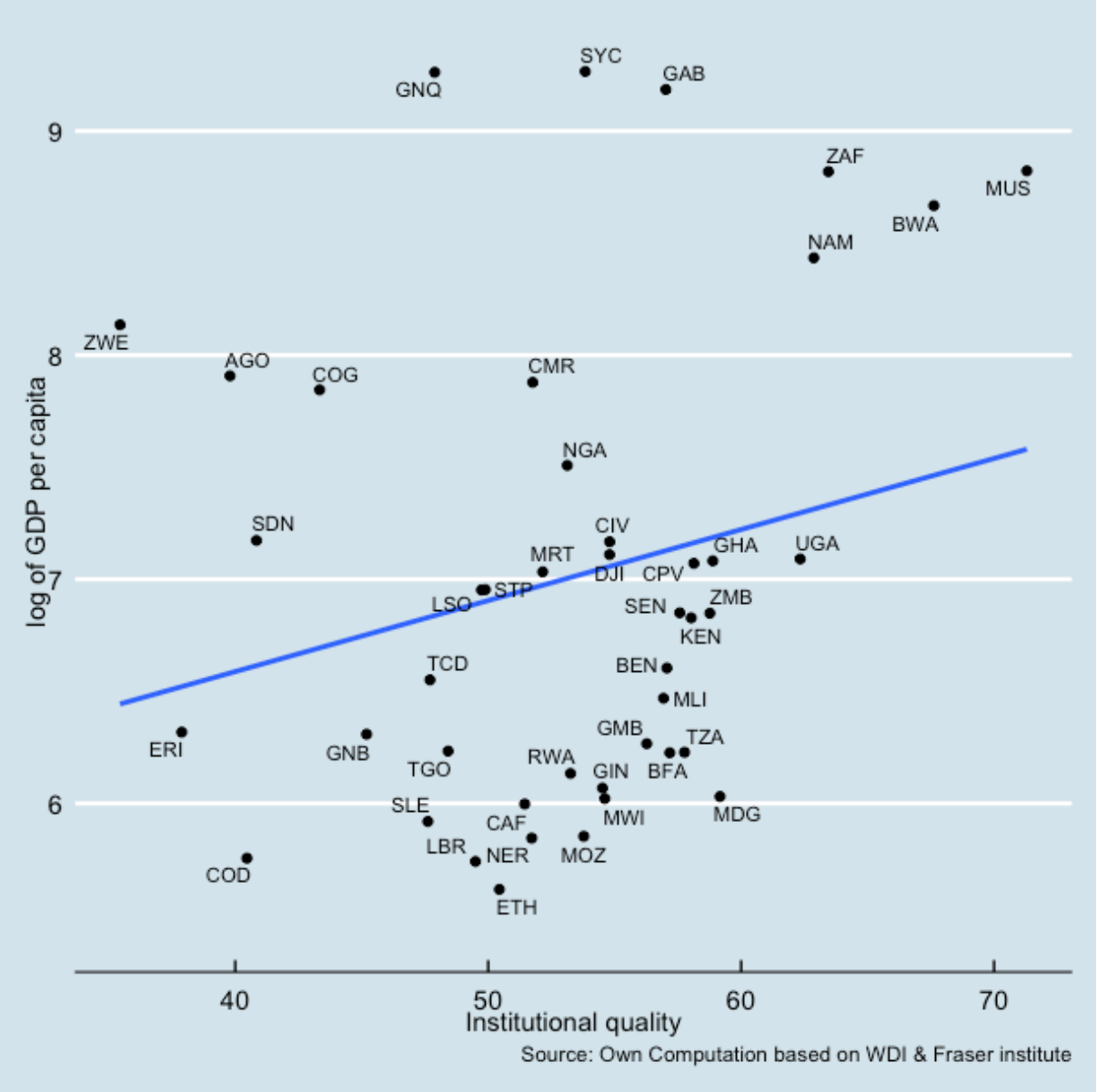
Figure 1.15: Institutional quality and economic performance in SSA



For the sake of further elaboration on the nexus between institutions and economic outcomes, a similar figure was plotted but using another measure of institutional quality from the Fraser institute (Figure 1.16). Similar to the previous figure, the log of average GDP per capita (between 1996 and 2016) for each SSA country is placed in the y-axis while the measure of the quality of institutions in the x-axis. Countries at the bottom left corner of the scatter plot are countries that rank low on Fraser's institutional indicator. These include poor countries such as Burundi, Eritrea, Guinea Bissau, and the Central Africa Republic. At the upper right corner of the scatter plot are countries such as Botswana, Seychelles, and Namibia that score higher institutional quality. Again, the patterns of the scatter plots show a positive correlation between institutional quality and economic outcomes measured by per capita GDP. Although further analysis is needed to ascertain causality, it is clear that countries that have built strong

institutions achieved higher economic performance. In short, the figure provides confirmatory evidence that there exists a seemingly positive relationship between institutional quality and income level.

Figure 1.16: Institutions (Fraser Institute) and economic performance in SSA



In a nutshell, the descriptive analysis so far has shown a seemingly positive nexus between institutional quality and economic growth. This implies that countries with high-quality institutions in SSA tend to have high per-capita income and/or grow faster than countries that have low-quality institutions. The next step is to confirm the presence of this alleged link using econometrics analysis by including other growth determinants. This is essential not only because many variables affect economic growth but also the nexus between

institutions and growth might be altered by including other determinants of economic growth. Thus, the next chapter of the dissertation discusses the result of this econometrics analysis.

1.3. Concluding Remarks

It is widely recognized that sustained growth is a panacea for worldwide poverty. While poverty has declined in countries that register sustained growth, it has increased significantly in countries that failed to achieve sustainable growth. Thus, identifying the factors that influence the economic performance of countries has been at the heart of the entire discipline of economics since the period of Adam Smith. Several theories have been developed since then but fewer consensus exists as to which factor matters the most for economic growth. The main aim of this chapter is thus to discussed briefly on determinants of economic growth from the theoretical perspective. Moreover, it also aims to provide an overview of post-colonial historical synopsis of economic performance, development policies, and institutional quality of SSA.

The most obvious finding to emerge from this chapter is that the economic performance of SSA over the last six decades has been sporadic. The region has shown a period of both progress and regress, and booms and busts. Not only that many countries registered respectable economic growth until the mid-1970s but also the region's average per-capita growth was comparable to that of the world's average. Then comes the period of the dismal economic performance of the late 1970s and 1980s when both per capita GDP growth was negative and GDP was declining; again, the resurgence of the economy since the mid-1990s.

It is also worth noting that SSA countries implemented three successive strategies of economic development after independence. The first one was a state-driven development strategy using Import Substitution to industrialization, and the second was the so-called SAPs (Washington Consensus) approach, advocating market-oriented industrialization policies. Since the mid-1990s, most SSA countries embarked on institutional reform programs. Although both the first and the second strategies of economic development had failed to deliver the promised economic outcomes, the institutional reform in the last two decades intertwined with the resurgence of economic growth in the region. A simple descriptive analysis also indicated that a seemingly positive relationship between improvement in institutional quality and economic growth in the region. Nonetheless, since many factors influence economic performance, we shouldn't conclude that the mere improvement in the institutional quality has

caused the recent spurt of the region's economy without rigorous empirical analysis. Hence, it is worth exploring to what extent the economy of the region has been affected by improvement in the institutional quality of the region. The following chapter examines the effect of institutions on economic growth of the region using an advanced econometrics methodology.

CHAPTER 2

2. INSTITUTIONAL QUALITY AND ECONOMIC GROWTH IN SUB SAHARAN AFRICA: A PANEL DATA APPROACH

Abstract

The main aim of this chapter is to investigate the impact of different dimensions of institutional quality indices on economic growth of Sub-Saharan Africa (SSA) countries for the period 1991-2015. Unlike previous studies that either use composite measure of institutions or a single intuitional indicator in isolation, this study has employed Principal Component Analysis (PCA) to extract fewer institutional indicators from multivariate institutional indices. Accordingly, three institutional indicators, namely, investment-promoting, democratic & regulatory, and conflict-preventing institutions have been identified and their impact on economic growth is analyzed using a two-step system-GMM estimation method. The empirical results indicate that investment-promoting and democratic & regulatory institutions significantly affect growth but the effect of conflict-preventing institutions is insignificant. Thus, our findings suggest that countries in the region should continue the institutional reform in order to enhance the economic growth of the region. Specifically, institutions promoting investment and democracy & regulatory quality are crucial.

***Keywords*:** Institutional quality, economic growth, SSA, Panel data, PCA, system GMM

JEL classification: O11, O43, O55, C33

2.1 Introduction

Despite endowed with abundant natural resources and a huge amount of foreign aid received over the last six decades, SSA constitutes the highest number of poor countries in the world. Out of 48 countries of the region, 24 countries are under the category of low-income with a GNI per capita of $1,025 or less. An average individual in SSA gets a GNI per capita income of 7 times lower than the world average in 2018.[6] Macroeconomic figures of individual countries also reflect a similar disparity. Luxemburg, with 356 times smaller in terms of landmass and 317 times lesser in terms of population size than Nigeria, has a GDP per capita that is forty-eight times higher than Nigeria. Ghana's GDP per capita was higher than Thailand and comparable to Malaysia in 1960; however, it was seven times lower than Malaysia and four times lower than Thailand in 2016. Sixty years ago, an average Korean used to get the same amount of annual income to her Kenyan counterpart, but in 2016 twenty times more. The main question is thus why is it Kenya, Nigeria, and Ghana are poor, whereas South Korea, Luxemburg, and Malaysia are rich; why Kenya has grown slowly while South Korea achieved remarkable economic growth; What explains the failure of Ghana and the success of Malaysia in terms of economic development? These questions have attracted the attention of economists since Adam Smith's period, but no consensus has been achieved about what is causing these variations across countries or regions.

According to neoclassical Solow (1956) and endogenous Romer (1990) growth models, determinants such as capital accumulation, human capital and innovations explain the variation in economic growth of countries. Although these growth theories hitherto are relevant for understanding cross-country growth difference, a crucial question still remains unanswered: if innovation, capital accumulation, human capital, etc. are a source of economic progress, why countries such as Kenya, Ghana, Nigeria, are not working towards that end? As discussed by Bloch and Tang (2004) it is because these variables themselves are induced by deep economic growth determinants.

Although several deep determinants have been suggested in the literature such as geography, culture & openness, none of them have received considerable attention in many theoretical and empirical studies in the last three decades than institutional factors. It has been argued that countries with high-quality institutions that allowed private property and free

[6] https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

enterprise oversaw an economic 'miracle', while countries endowed with poor institutions have shown decades of stagnation and poverty (Acemoglu et al., 2005). For instance, even though the two Koreas are located in similar geographical locations and have the same culture, the divergent institutional framework installed in the two countries after the Korean War ended up the North to be 44 times poorer than its southern counterpart. Similarly, the transformation from a fascist economy to a relatively freer economy after the second world war helped West Germany to register an average annual growth rate of 4.4 percent and to become the third biggest economy in the world with $1.2 trillion GDP in 1991. East Germany, located in a similar geographical location and whose culture resembles the west, was able to grow only by 1.3 percent per annum (Maddison, 2003, p. 28) Singapore, which is a tropical country like Nigeria, has registered a remarkable growth rate for the last 40 years while Nigeria has shown no significant progress. Today, the per-capita income of Singapore is 25 times higher than that of Nigeria. These comparisons demonstrate that there was one big difference between these countries: the institutional framework " were favourable to economic growth in South Korea and Singapore" and Western Germany, "but not in Nigeria" North Korea, and East Germany (Acemoglu, 2008, p. 21).

Several studies have been conducted in this realm and demonstrated empirical evidence in support of institutional factors in recent years. These empirical studies vary depending on the institutional variable included in the model, the number of countries taken as a sample, the sample period taken into consideration, the estimation method employed, and the nature of the dataset (cross-section, time series, and panel). For instance, prior studies on the topic such as (Acemoglu et al., 2001; Hall & Jones, 1999; Knack & Keefer, 1995) relies on a global sample, cross-country data, and OLS/IV estimation method. Recent studies such as (Afonso & Jalles, 2016; K. Lee & Kim, 2009; Nawaz, Iqbal, & Khan, 2014; Valeriani & Peluso, 2011), however, used reduced sample (sub-sample based the level of income), more than one institutional variable, and panel data analysis. Although earlier studies have documented evidence in support of institutional factor, later studies have reported mixed results as sampled countries are reduced and various institutional indicators are used. Thus, the debate continues as to which of the institutional arrangements affect growth more than others and whether the impact of institutions varies for sub-sample of countries.

Although the recent resurgent of economic growth and improvement in institutional quality makes SSA an interesting case study, relatively little research has been done on this

realm.[7] The existing few studies (Amin, 2013; Aubeeluck, 2013; Bräutigam & Knack, 2004; Fosu, 2013b; Hashim, Alexiou, & Tsaliki, 2011; Kilishi, Mobolaji, Yaru, & Yakubu, 2013), have failed to explore the impact of different institutional arrangements on the economic growth. In addition, number of studies have been subjected to methodological problems concerning causality and endogeneity (see for instance Hashim et al. (2011)). Hence, it is worth exploring the extent to which improvement in institutional quality contribute to the economic growth of the region, and which of the institutional arrangement matter most.

The main aim of the present study is thus to contribute to the debate on the nexus between institutions and growth by concentrating on the following questions: a) to what extent institutional quality matters for the economic growth of SSA? b) Which of the institutional arrangement matter most to stimulate growth in the region? To this end, a panel data of 31 SSA countries for the period 1991-2015 is used, and the growth model is estimated using a two-step system-GMM estimation method. The results of the empirical analysis suggest that institutional quality matters for economic growth but different institutional arrangements have a different impact. Specifically, institutional arrangements relating to investment-promoting and democratic & regulatory institutions appeared to matter most in improving the economy of the region. Once these institutions accounted for, the effect of conflict-preventing institutions is negligible.

This paper extends the literature in three ways. First, unlike most previous studies on the topic, this study addresses the problem of instrument proliferation and business cycle effects. Although the system GMM estimator is considered to be more efficient than the difference GMM for analyzing growth determinants, it is also exposed to instrument proliferation, especially if the time period is long. To circumvent this problem, we followed the strategy suggested by Roodman (2009).[8] Moreover, in order to overcome business cycle effects and account for the slow change of institutional variables, annual data of the variables are converted into five-year averages; thereby, non-overlapping five-year periods (1991-1995…2011-2015) were used for analysis. Second, this paper provides important insights into

[7] Over the last twenty years, SSA countries have registered an average GDP growth of above 5% and real GDP per capita growth of approximately 2% per annum. Similarly, within this period, institutional quality has improved. Nonetheless, both economic growth and improvement in institutional quality have been far from uniform across countries.

[8]System GMM augments the difference GMM by making an additional assumption that the first differences of instrument variables are uncorrelated with the fixed effects. Thus, not only the lagged value but also the lag of the first difference of the endogenous variable is used as an additional instrument. Although using more instruments believed to dramatically improve efficiency, too many instruments, compared to the sample size, can overfit endogenous variables, produce biased coefficients and invalid specification tests.

the distinct role of different clusters of institutions on economic growth. Except for very few studies, institution-growth literature either consider only one indicator or a composite indicator by aggregating various indicators as a measure of institutions. The main limitation of the former approach is that other institutional indicators that could alter the significance of the relationship were excluded. In the latter case, various indicators have been combined based on the subjective decision of the researcher. Unlike these two methods, this study employed a PCA approach to extract fewer institutional indicators from multivariate institutional indices. In doing so, this study was able to untangle the distinct impact of each cluster of institutions on growth. Third, the current study provides additional evidence on the importance of institutions in the case of SSA where studies on the topic are rare.

The remaining section of this chapter structure as follows. The following part discusses the empirical literature in relation to the present study. Section 2.3 provides the empirical methodology and data used for this study. Section 2.4 presents empirical results and discussion. Finally, section 2.5 provides conclusions and recommendations and suggests potential areas for future research.

2.2 Literature Review

The question of "why some countries are more developed economically than others?" has attracted the attention of economists since the publication of Adam Smith's book. Several theories have been emerged since then, although fewer consensus exists as for the determinant of cross-country income gaps. For instance, while Adam Smith considers the division of labor as the main driver of the wealth of the nation, Karl Marx emphasizes on capital accumulation as the engine of growth in the capitalist economic system. For Joseph Schumpeter innovation, and for Harrod and Domar saving and investment were considered as the main reason that makes some societies richer and other societies poorer.

In the 1950s and 60s, economists engaged in developing a growth model that explains the variation in cross-country growth under the banner of 'neoclassical economics'. This neoclassical growth model, whose foundations stem from Solow (1956), stresses the significance of saving and capital accumulation in determining the growth performance of countries. The principal prediction of this model is that less developed countries will grow faster than developed countries, so countries converge in the long-run. Consequent cross-sectional empirical studies, however, documented otherwise. This led to a reconsideration of

the concept of the "factors of production" to include other factors. The most notable contribution is that of Mankiw et al. (1992). The authors illustrated that when human capital is taken into consideration, the prediction of long run convergence still holds. Even with this extension, the Solow growth model was criticized, especially with regard to its assumption. First, the principal assumption of diminishing return to capital was proved to be unrealistic. Second, technology is no longer assumed to be exogenous, rather technological change was considered to be endogenous.

With the aim of addressing the criticism of Solow growth model, a new wave of empirical studies emerged that goes by the name 'endogenous growth theory'. Although the pioneering work of Arrow (1962) has influenced this line of analysis, this growth model embraces the diverse body of theoretical and empirical works of (Lucas, 1988; Romer, 1986, 1990), to mention a few. In this growth theory, human capital, innovations, and technology considered to be the main determinants of growth.

Needless to say, investment and technological difference among countries create differences in income level; however, the question of why some countries have more physical capital and better technology than the others remain unanswered. The limitation of growth model hitherto in this realm give rise to investigation of other deep determinants of growth. It has been argued that growth models hitherto have revealed only the "mechanics" or "correlates" of growth, but they failed to identify the fundamental determinant of growth (North & Thomas, 1973). Thus, many scholars get involved in theory making and empirical study to discover the fundamental determinants of growth and four deep determinants have been identified: geography or endowment (Jeffrey Sachs, 2003), cultural and history (Tabellini, 2010), trade and openness (Dollar & Kraay, 2001; Rodrik et al., 2004), and institution (Acemoglu et al., 2001, 2005).

Although these four determinants of growth have been suggested, the current discourse has been on the relative importance of geographical and institutional factors. A proponent of geography factors has argued that poor countries are poor because they are located in geographical disadvantageous positions (Bloom et al., 2004; Bloom et al., 1998; Collier, 2008; McCord & Sachs, 2013; Jeffrey Sachs, 2003). This hypothesis, however, has been refuted as "theories that don't work" (Acemoglu & Robinson, 2013Chapter 2). Institutional economists claimed that the geography variable is insignificant if institutional variables included in the growth equation (Rodrik et al., 2004) and the different avenue of economic development

between poor and rich countries is the direct result of divergent institutional arrangements. Economic development trajectories are affected by institutional quality because institutions influence the rate of investment and technological innovation (Acemoglu et al., 2005). Thus, countries with high-quality institutions that allowed private property and free enterprise oversaw an economic 'miracle', while countries endowed with poor institutions have shown decades of stagnation and poverty.

North (1990, p. 3), the founders of the New Institutional Economics (NIE), defines institutions as: "…the rules of the game in a society or, more formally, are the human-devised constraints that shape human interaction. In consequence, they structure incentives in human exchange, whether political, social, or economic." From this definition, three important implications can be drawn. First, unlike other fundamental determinants such as geography and culture, which is outside human control, institutions in North's definition characterized as 'human devised'. It would mean that human beings can control the emergence, existence, and sustenance of institutions. Second, institutions are "the rules of the game" which set "constraints" on human behavior, implying that the choices available for individuals are constrained by institutions. These constraints take two forms: formal and informal. Formal constraints incorporate written laws such as constitutions, contracts, judicial rules while informal constraints include conventions and codes of behavior. Third, the effect of institutions is through structuring the incentive mechanisms. In other words, institutions act as a motivator, while also setting the limits of acceptable behavior within particular socio-economic contexts.

The pioneering empirical study on institutions and economic growth was conducted by Knack and Keefer (1995). The authors used institutional quality indicator by averaging five ICRG's index for the years 1986–1995 and found a significant and positive coefficient of institutional variable. Therefore, they concluded that differences in institutional arrangement explain the worldwide differences in growth performance. Similarly, using a global sample, Barro (1996) found that maintenance of the rule of law had consistent impact on growth. Sala-i-Martin (1997) attempted the experiment of evaluating the potential determinant of economic growth in his work entitled "I Just Ran Two Million Regressions". The author included more than sixty independent variables that possibly affect economic growth and concluded that political variables which include the rule of law, democratic and civil rights are good for economic growth. Furthermore, Dawson (1998)'s empirical finding using a panel of several countries indicates that institutional quality spurs economic growth. The author indicated that

institutions influence growth in two ways: directly via improving Total Factor Productivity (TFP) and indirectly via expanding private investment. An empirical study by Hall and Jones (1999) also reveals that the cross-country difference in productivity is the result of differences in institutional arrangements.

The seminal paper by Acemoglu et al. (2001) also concludes that institutions are a significant cause of contemporary cross-country income differences. The authors employed a two-stage least square (2SLS) estimation method to account for the reverse using settler mortality as an instrument for institutions. They found that settler mortality determined the types of institutions -extractive or inclusive- installed during the period of colonialism that persist until these days, which in turn affects the economic performance countries today. Rodrik et al. (2004) analyzed the contribution of institutional quality, geographical factors, and trade in determining the income levels of the countries. Like Acemoglu et al. (2001), the authors claim that the institutional variable is endogenous, so they used 3SLS to resolve the problem. The empirical result of their study shows that institutions affect growth the most.

Most of the aforementioned studies used cross-section data and growth equations are estimated using OLS and/or IV. However, there are notable problems concerning the cross-section econometrics method of estimations. Omitted variable bias is one of the most obvious problems of cross-country growth regression. Cross-country growth regression often neglects the country-specific feature of economic growth, and if this country-specific idiosyncratic term correlated with the error term, the estimated coefficient may be biased. Another challenge is the problem of finding exogenous instruments that can be associated only with institutional indicator. This could be one of the reasons that many studies have used the same instrument, specifically settler mortality. In addition to the fact that only a few instruments available, most of the instruments have been criticized for not capturing what it is supposed to explain (Albouy, 2012).

That's why studies that employ panel data growth regression have flourished in the last three decades. Employing a panel data approach, K. Lee and Kim (2009) documented the significant positive effect of institutions on growth, but the author argued that its impact differs for different income groups. Similarly, Valeriani and Peluso (2011) analyzed the nexus between institutions on growth at different stages of development for a panel data of 181 countries over the period of 1950-2009. Although institutions had a positive impact on the whole sample, the authors found that the positive impact of institutions on high-income

countries is higher than low-income countries. Nawaz (2015) also gets a similar result that institutions have a higher significant positive impact on developed countries than in developing countries.

Jellema and Roland (2011) attempted to empirically unravel the impact of different institutional variables on economic growth. Using PCA, they were able to find a cluster of institutions to assess which are the most important factor for long-run economic performance. Like the previous literature, the empirical result of the study shows that institutions significantly affect economic growth, especially check and balance and democratic institutions. Likewise, Siddiqui and Ahmed (2013) employed PCA to extract factors from 31 institutional indicators for 84 countries and documented the positive and significant relationship between institutions and economic growth. In addition, the study underscores the importance of institutions and policy than political rents and risk-reducing technologies for developing countries. Taking a panel of 39 countries for the period 1983-2009, Slesman, Baharumshah, and Ra'ees (2015) analyzed the effect of different clusters of institutions on economic growth of the sampled countries. The authors found that political institutions are the most prominent institutional framework to accelerate economic growth. The effects of economic institutions, however, depend upon political institutions: economic institutions influence growth provided that the quality of political institutions is reached to a certain level. Conflict preventing institutions, in contrast, are found to be insignificant.

The studies reviewed so far have relied on a global sample and they indicated that effect of intuitions varies depending on income-level, institutional indicator used and regions. In this regard, although the recent resurgent of economic growth and improvement in institutional quality makes African an interesting case study, empirical studies on the impact of institutions on economic growth are very few. An early example is Naudé (2004) who analyzed the effect of institutions and geography on the economic growth of 44 African countries for the period 1970-1990 using both OLS and GMM estimation methods. The author concludes that both institutions and geography affect economic growth of African countries. Even though this study is a highly influential paper, the data used in this study is rather outdated (1970-1990), in that it does not elucidate the recent resurgence of economic growth and improved institutional performance of the region. Hashim et al. (2011) explored the nexus between institutional quality and economic growth of selected SSA countries for the period 1984-2003 and found

that improving institutional quality could help SSA countries to achieve a higher economic outcome. The major drawback of this study is its failure to address the problem of endogeneity.

A study by Kilishi et al. (2013) was able to solve the endogeneity problem that arises in the institutions-growth literature by using GMM estimation method for SSA. The empirical result of their study supports the notion "institutions matters"; however, the study failed to address instrumental proliferation that may arise from the use of System-GMM using the strategy suggested by Roodman (2009). Akinlo (2016) investigated the relationship between the quality of institutions and output growth for a panel of 30 African countries for the period 1980-2011. The author used pooled OLS and dynamic GMM estimation method and surprisingly concluded that institutional quality indicator has a significant negative impact on economic growth, but this study could have been suffered from misspecification of the model and quantification of institutional variables.

In a nutshell, studies on the nexus between institutional quality and economic growth vary depending on the institutional variable included in the model, number of countries taken as a sample, the sample period taken in to consideration, the estimation method employed, and the nature of the dataset (cross-section, time series, and panel). As a consequence, the empirical results of these studies are not uniform. As discussed above, although most of the studies documented the positive impact of institutional quality on economic growth, the debate continued regarding the mechanism through which institutions affect growth, the extent, the type of institutions, and the direction of causality.

Table 2.1: Summary of selected prior empirical papers

Authors	**Study period/sample**	**Institutional quality measures &data source**	**Econometric technique**	**Major findings**	**limitations**
Acemoglu et al. (2001)	64 countries	ICRG/ protection against expropriation risk	2SLS / cross-section	+ve &significant	- instrument for institutions - only one index of institution
Rodrik et al. (2004)	64/79/ 137 countries	WGI / rule of law	3SLS	+ve & significant	- instrument for institutions - only one index of institution
Khalil, Ellaboudy, and Denzau (2007)	1990-2003 30 OECD countries	Economic Freedom of the World	Fixed-effects (within)	+ve & significant	-endogeneity not mitigated -focus on developed countries
K. Lee and Kim (2009)	1965-2002 64 countries	Polity IV	fixed-effect and system GMM	+ve& significant for LIC +ve & insignificant for HIC	- only one index of institution - small African sample
Bhattacharyya (2009)	1980-2004/ 127 countries	ICRG/ Polity IV	2SLS /GMM	Mixed result depending on institutional variable	- instrument proliferation - small African sample
Vieira, MacDonald, and Damasceno (2012)	1980-2004 91 countries	Law, Corruption, Profile, gov't consumption	LIML cross-section GMM for Panel	Mixed result depending on institutional variable	-small African sample
Bhattacharjee and Haldar (2015)	4 South Asia countries 1996-2010	WGI	System GMM	Two institutional variables significant	-inappropriate methodology
Naudé (2004)	1970-1990/ 44 African countries	Ethno-linguistic political instability, corruption, urbanization	Cross-section & Panel/ OLS and GMM	+ve & and significant	- does not shed light on recent improvement

Hashim et al. (2011)	1984-2003/ 27 SSA countries	public's satisfaction, corruption, stay in office and racial tension	Difference GMM	+ve & significant	-institutional index questionable - rather outdated data -estimation method
Kilishi et al. (2013)	1996-2010/ 36 SSA countries	WGI of World Bank	system GMM	+ve & significant	- instrument proliferation
Amin (2013)	1980-2011/ 26 African countries	Combined indexes from Hall and Jones (1999) & Political Risk Services database	2SLS	+ve & significant	- reverse causality not fully mitigated -institutional index
Akinlo (2016)	30 African countries	WGI of the World Bank rule of law	pooled OLS & GMM	-ve & significant	- misspecification -quantification of institutional variable

2.3 Data and Empirical Methodology

2.3.1 Data

In order to explore the impact of institutional quality and economic growth, a secondary dataset for SSA countries are collected from various sources. The data on macroeconomic variables are derived from World Development Indicators while variables on institutional quality are from Polity IV projects and International Country Risk Guide (ICRG). The data set is for 31 SSA countries throughout 1991–2015; thus, the study is based on a balanced panel data. As already noted, the five-year average, rather than annual data, is used account for the slow change of institutional variables and to circumvent the business cycle effects. Therefore, the sample period is divided into five non-overlapping periods i.e. 1991-1995~ 2011-2015.[9]

2.3.2 Model specification and Empirical Strategy

In order to investigate the effect of institutional arrangements on economic growth, the standard growth model, widely used in empirical growth literature, was followed (Barro, 1991; Islam, 1995; Levine & Renelt, 1992; Mankiw et al., 1992) as:

$$y_{it} - y_{it-1} = \beta_1 y_{it-1} + \beta_2 INST_{it} + \beta_3 X_{it} + \eta_t + u_{it} \quad \text{----------} \quad 2.1$$

Where y represent the log of GDP per capita (measured in 2010 $US), $INST$ is the measure institutional quality, and X represent the matrix of control variables for i = 1, 2, . . . N (country) and t = 1, 2, . . . T (time), and $\mu_i = country\ fixed\ effect..$ and $\eta_t = period\ effec.$

This can be written as follows:

$$y_{it} = (1 + \beta_1) y_{it-1} + \beta_2 INST_{it} + \beta_3 X_{it} + \eta_t + \mu_i + u_{it} \quad \text{----------} \quad 2.2$$

Or if we assume $\tilde{\beta} = 1 + \beta_1$, the above equation can be written as:

$$y_{it} = \tilde{\beta} y_{it-1} + \beta_2 INST_{it} + \beta_3 X_{it} + \eta_t + \mu_i + u_{it} \quad \text{----------} \quad 2.3$$

[9] The name of countries used in the analysis is given in the appendex

The main control variables incorporated in the baseline estimation are secondary school enrollment, domestic saving, and population growth as a measure of human capital, physical capital, and labor force growth.

After using the logarithm of some variables, our baseline model would be expanded as follows:

$$lny_{it} = \tilde{\beta} lny_{it-1} + \beta_2 INST_{it} + \beta_3 pop_{it} + \beta_4 \ln(school)_{it} + \beta_5 \ln(save)_{it} + \eta_t + \mu_i + u_{it} \quad \text{----------} \quad 2.4$$

y_{it-1} in equation 4 represent the lag of the dependent variable GDP per capita to capture the initial real GDP. This variable is useful to test the existence of convergence as claimed by the neoclassical growth model. Solow (1956) type growth empirics estimated that poor countries grew faster than rich countries, but later studies, including Mankiw et al. (1992), support conditional convergence that it depends on some factors like human capital and institutional factors. In this study, we assume conditional convergence, depending on institutional factors. Therefore, if we follow equation 2.4 specification, as in Islam (1995), value between 0 and 1 represent conditional convergence.[10]

Another control variable is population growth (**pop**). The neoclassical growth model, both Solow (1956) and augmented growth models of Mankiw et al. (1992), indicated that population growth negatively affects per capita growth since its growth leads to a reduction in the capital stock per worker (dilution effect)[11]. The endogenous growth model suggests that population growth could have a positive effect on economic growth (Peterson, 2017). Similar to the theoretical argument, the empirical studies have also found contradictory results: positive (Sethy & Sahoo, 2015), negative (Li & Zhang, 2007; Yip & Zhang, 1996), and insignificantly different from zero (Barlow, 1994; Jeffrey Williamson, 2003). Despite the mixed empirical results of previous literature, there is a widely held view that uncontrolled population growth might retard economic growth, especially in SSA. Therefore, we expect an inverse relationship between population growth and economic growth.

Saving (**save**) measured by domestic saving as a percentage of GDP has also been considered to be one of the determinants of growth. In prior literature, higher domestic saving

[10] If equation 2.1 specification is followed, β_1 value between 0 and 1 represent conditional convergence.
[11] See Bucci, Eraydın, and Müller (2019) for more detail on dilution effect of population growth.

has been associated with superior growth performance[12]. For instance, in the neoclassical growth model, countries with a higher rate of domestic saving can reach their steady-state level of income faster than those whose rate of saving is lower as it promotes growth by increasing investment. Many empirical works also confirm the existence of a strong positive relationship between domestic saving and economic growth, especially in LDCs (see Aghion, Comin, Howitt, and Tecu (2016)). Therefore, the expected sign of the domestic saving variable is positive.

The other growth determinant widely considered as an engine of economic growth is human capital (**school**). Previous empirical studies have used school enrolment as a measure of human capital; thus, following their lead secondary school enrolment was used in this study. It has been confirmed that countries with a high rate of school enrolment have grown faster than otherwise. In the same vein, countries that have managed to increase the enrolment rate over many years was able to sustain consistent economic growth (Barro, 2003). Therefore, we expect a significant positive sign of human capital

INST, in equation 2.4, represents institutional quality. In order to get a good index of this variable, PCA analysis was employed and three clusters of institutional quality indices were extracted as briefly discussed below.

2.3.3 Principal Component analysis

Finding a proper indicator for it has been one of the most daunting tasks for researchers. In general, prior studies quantified the level of institutional quality in two different ways. One strand of the literature uses a single institutional indicator, collected from international organization such as WGI, ICRG, in isolation. Several limitations can be pointed out regarding this approach including overlooking the existence of other institutions that could alter the significance of the relationship. For instance, Slesman et al. (2015) argued that the positive effect of economic institutions is depends on the existence of good quality political institutions. Second, since institutions are multifaceted, one indicator in isolation couldn't measure the institutional level of a country. As indicated by Kunčič (2014) it is difficult, if not impossible, to find one indicator that represents the institutional quality of the economy. Third, comparing the relative importance of one type of institution than the others are also problematic with this

[12] We intend to use investment variable measured by fixed capital formation but the data has many missing values for many countries in our sample. Therefore, following the lead of previous studies such as Siddiqui and Ahmed (2013), we used domestic saving as a proxy for investment.

approach. According to the "hierarchy of institutions" argument, the growth effect of different types of institutions varies (Hartwell, 2018). For instance, comparing the effect of contracting and property right institutions, Acemoglu and Johnson (2005) indicated that the growth effect of the latter outweighs the former. Since most institutional indicators are highly correlated to each other, it is unfeasible to include two or more institutional variables in a single growth regression. That's why studies such as Kaufmann and Kraay (2002) and Kilishi et al. (2013) used only one indicator at a time in their model to avoid the risk of multicollinearity.

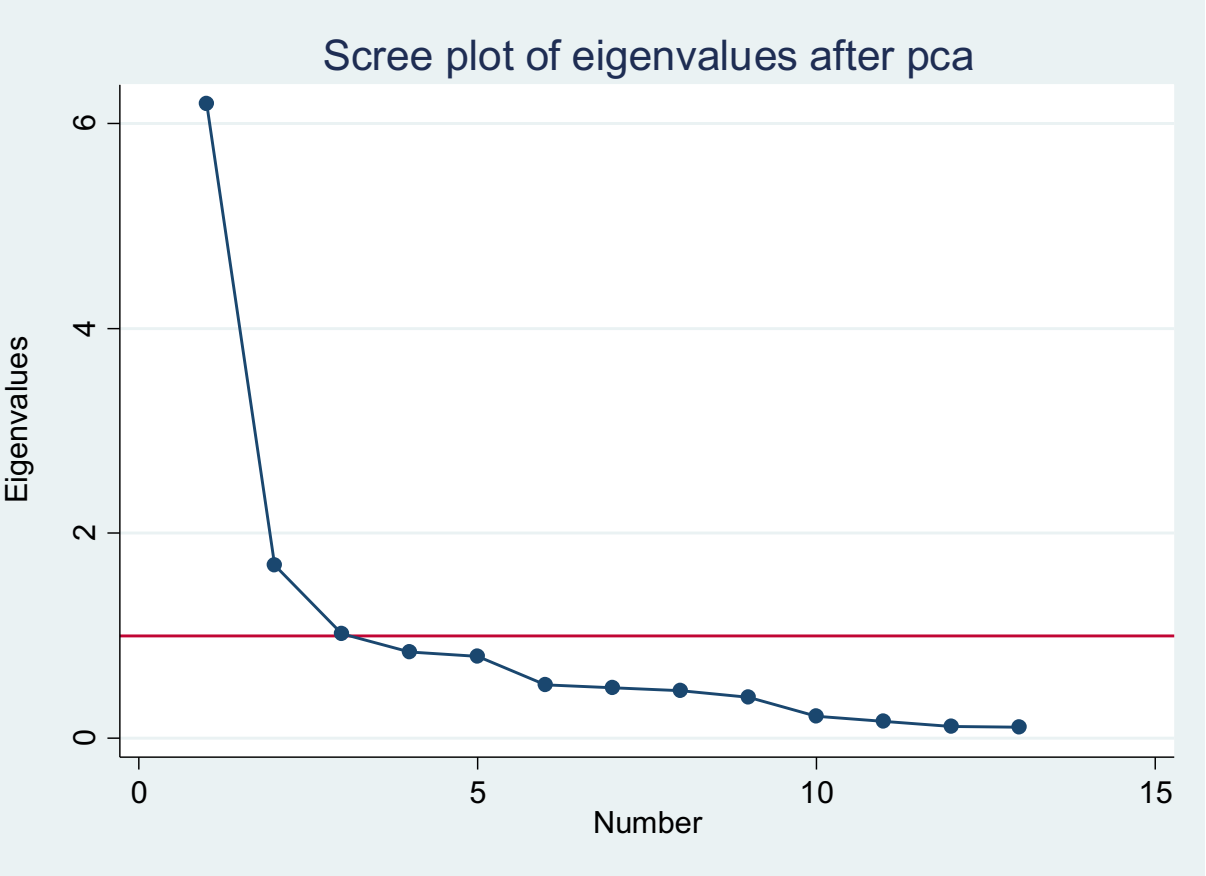
Another strand of literature has used a composite measure of institutions by aggregating various institutional measures using either simple or weighting average. For instance, Knack and Keefer (1995) used an aggregate value of 5 indicators from the ICRG dataset and 2 indicators from BERI. Similarly, Rodrik et al. (2004) used the composite indicator of property rights and the rule of law. A recent study by Law, Lim, and Ismail (2013) also used the mean of 5 ICRG institutional variables to measure the quality of institutions. Although these studies have attempted to take into account the multidimensional nature of institutions, they have still combined various indicators based on the subjective decision of the researcher.

With the aim of addressing the limitation of the above two approaches, recent studies have employed statistical methods, more specifically principal component analysis, to retrieve various components of institutions that are uncorrelated to each other using objective measures (Jellema & Roland, 2011; Langbein & Knack, 2010; Siddiqui & Ahmed, 2013; Slesman et al., 2015). PCA is a method of reducing multiple variable data into fewer components that capture the maximum possible information (variation) from the original multiple variables (Abdi & Williams, 2010). This approach has several advantages than the other two methods discussed above. First, unlike the composite measure that combine institutional indicators based on subjective decision of the researcher, different institutional indicators in this approach are grouped based on objective measures. Second, two or more institutional indicators can be included in the regression without the problem of multicollinearity; therefore, it is possible to identify which of the institutional arrangements are more relevant to growth. It is precisely for these reasons that the present study employed PCA to compute the different clusters of institutions

To construct clusters of institutions, ICRG political risk dataset, which incorporates 12 indicators with different ranges, and Polity data was used.[13]Due to variation in scaling, we first rescale all indicators to the range of 0 to 10, where the higher value of the indicators represents the better institutional quality. Although the PCA approach is straightforward for a cross-sectional dataset, it is complicated in the case of panel datasets. In this respect, Kunčič (2014) noted two alternatives to address the problem: PCA analysis for all countries in each year or PCA analysis for every country over time. The present study applied the former approach as it was more preferred than the other by prior studies (Kunčič, 2014);thus, PCA was performed for each period for all courtiers.

The following figure displays the number of components and their corresponding eigenvalue. According to Kaiser (1974), components whose eigenvalues (λ) are greater than 1 should be considered while components with eigenvalues (λ) less than 1 should be dropped from further analysis.

Figure 2.1: Number of Component and corresponding Eigenvalues



[13] A detailed definition and scale of each of the indicators are presented in the Appendix.

As shown in the above figure, the eigenvalues (λ) of the first three components are greater than 1; thus, based on Kaiser's rule, three components are retained and these components will be used for further analysis. The retained components explain 68.5% of the total variance, with the first component explaining 47.5%, the second component explaining 13%, and the last component explains 8% of the total variance. Then Promax rotation procedure is employed in order to distribute component loading among the three components. This rotation procedure has an advantage because it aligns the component axes as closely as possible to the groups of the original variables (Richman, 1986). The component loading after rotation is presented in Table 2.2.

Table 2.2: Component loading after rotation

Variable	Comp1	Comp2	Comp3
Government Stability	0.0214	-0.0092	**0.7065**
Socioeconomic condition	**0.5246**	-0.2111	0.0851
Investment Profile	**0.4258**	-0.0484	0.0873
Internal Conflict	0.228	0.251	-0.0832
External Conflict	0.1744	0.275	**-0.3505**
Corruption	-0.2077	**0.4388**	0.2849
Military in politics	0.2682	0.2004	-0.1028
Religious tension	0.0501	0.2789	0.044
Law and order	0.1966	0.0342	**0.496**
Ethnic tension	0.1405	0.2493	0.0707
Democratic accountability	0.0168	**0.3307**	0.0949
Bureaucracy quality	**0.5387**	-0.2481	-0.013
polity2	-0.2952	**0.5996**	-0.0732

Notes: Promax rotation procedure is employed in order to distribute component loading among the three components. The highlighted numbers

indicate the corresponding loading of each variable on the components.

It is apparent from the table above that the first component (Comp1) is mainly explained by socioeconomic condition, investment profile, and Bureaucracy quality. These indicators are essential to create a conducive business environment and attract investment in the country and mainly related to the economic situation; therefore, we call component 1 as "*investment-promoting economic institutions*". The second component (Comp2), on the other hand, is heavily loaded by democratic accountability, corruption, and polity2, which reflects the quality of the political system of the country. Thus, simply this component can be expressed as "*democratic & regulatory institutions*". The last component (Comp3) profoundly loaded with government stability, external conflict, and law & order. These indicators measure the capability of the country to preclude cross-border and internal conflicts. On account of this, we call the third component as "*conflict-preventing institutions*"

Finally, in order to make sure that the data in use is suitable for conducting PCA, KMO measure of sampling adequacy is calculated both for each variable and complete model. The calculated KMO results are presented in the following table (Table 2.3)

Table 2.3: KMO measure of sampling adequacy

Variable	**kmo**
Government Stability	0.611
Socioeconomic condition	0.8053
Investment Profile	0.8325
Internal Conflict	0.8161
External Conflict	0.8251
Corruption	0.7507
Military in politics	0.8348
Religious tension	0.8352
Law and order	0.7545

Ethnic tension	0.8455
Democratic accountability	0.9333
Bureaucracy quality	0.7289
polity2	0.6398
Overall	**0.7958**

The rule of thumb in the KMO test is that the KMO value must be greater than 0.5 both for each variable and the complete model to ascertain sampling adequacy (Kaiser & Rice, 1974). As can be seen in Table 2.4, the KMO values for each of the variables included in the PCA model are greater than 0.5. Moreover, the overall KMO measure is approximately 0.8, indicating sample adequacy and appropriateness of the PCA approach.

2.3.4 Econometric Technique and Estimation

In the dynamic panel model, like ours as stated in equation 2.4, today's economic growth is assumed to be influenced by the growth of the previous years. Thus, growth equation with institutional indicator and other control variables can be written as follows:

$$lnY_{it} = C + \gamma lnY_{it-1} + \delta INST_{it} + \lambda lnX_{it} + \mu_i + \eta_t + u_{it} \quad \text{----------} \quad 2.5$$

For i = 1, 2, . . . N and t = 1, 2, . . . T

$\mu_i = country\ fixed\ effect\ \ \eta_t = period\ effect$

Since lnY_{it-1}, in equation 2.5 is correlated μ_i, estimating the above growth equation using pooled OLS produces biased estimate. One alternative to circumvent this problem is to use the difference of the variables than original data as follows:

$$\Delta lnY_{it} = \gamma \Delta lnY_{it-1} + \delta \Delta INST_{it} + \lambda \Delta lnX_{it} + \Delta\eta_t + \Delta u_{it} \quad \text{----------} \quad 2.6$$

By differencing the original model, we get rid of country fixed effect μ_i, and the constant term C but it creates another problem: correlation between ΔlnY_{it-1} and Δu_{it}. This is because lnY_{it-1} in ΔlnY_{it-1} is a function of the u_{it-1} which is also in Δu_{it}. Thus, even the above equation (equation 2.6) cannot be estimated using OLS. In addition, institutional variable

is believed to be endogenous, thus not only does the coefficient of the model be inconsistent but it is also biased if estimated using OLS.

The classical way of addressing endogeneity problem is to use the Instrumental Variable (IV) estimator. Yet, finding exogenous instruments that are related to the variable but not to the error term is the main drawback of the IV method is challenging. It is more difficult for institution-growth literature because most of the instruments of the institutional indicator are considered to be not valid even Acemoglu et al. (2001)'s settler's mortality[14]. The more complex and difficult it becomes as more endogenous variables are included in the right-hand side. In this case, the recommended estimator is Arellano and Bond (1991) first difference GMM and/or Arellano and Bover (1995) & Blundell and Bond (1998) system GMM estimator. GMM estimator uses the lagged value of the variable in the sample as an instrument; thus, the coefficients of the model are estimated more efficiently than IV estimates of the dynamic panel data model. Another advantage of GMM estimation method is that it deals with the unobservable country-specific effects. The most important of all is that the possibility that all explanatory variables can be endogenous in the model yet the estimator is unbiased (Bond, Hoeffler, & Temple, 2001; Caselli et al., 1996).

Two types of GMM estimation methods exists: difference GMM and system GMM. The difference GMM, developed by Arellano and Bond (1991), uses the lagged values of endogenous variables as instruments while system GMM estimator, developed by Arellano and Bover (1995) & Blundell and Bond (1998), uses not only the lagged value of the endogenous variable but also the lag of first difference. One of the potential weakness of difference GMM is that the lagged values of the variables are often rather poor instruments, especially if the variables are close to a random walk (Blundell & Bond, 1998). In this regard, system GMM enhances the efficiency of the estimator by using additional instruments. Bond et al. (2001) have shown that the system GMM estimator is more efficient and preferable for empirical analysis of economic growth than difference GMM.

Although the system GMM estimator is more efficient, it is vulnerable to problem of instrument proliferation. As the time dimension of the panel data increases, the number of instruments to be used for the endogenous variable in system GMM would be too many. Roodman (2009) warned about this problem and argued that some asymptotic results and

[14] see (Albouy, 2012; Glaeser et al., 2004) for more detail on the critics of institutions instruments.

specification tests are not valid if this is the case. Instrumental proliferation can be detected by comparing the number of instruments with the number of cross-sections (countries). It has been suggested that there is a high probability of instrumental proliferation if the number of instruments used for endogenous variable is greater than the number of cross-sections.

In this study, employed system GMM estimation method to estimate the growth equation stated in equation 2.4, unlike previous studies that ignore the instrument proliferation problem, we also followed the empirical strategy recommended by Roodman (2009) to tackle the problem of instrument proliferation.

2.4 Discussion and Empirical result of the study

2.4.1 Descriptive Statistics

Summary statistics

Table 2.4 reports the summary statics of the variables included in this study. Because annual data was transformed into a five-year average, the summary statistics reported in this table indicate the statistics after such transformation. Moreover, except for population growth, institutional index, and inflation, both independent and dependent variables are transformed into logarithm form.

Table 2.4: Summary Statistics

VARIABLES	N	mean	sd	min	max
GDP per capita	155	6.794	0.982	5.137	9.320
Gov expenditure (%GDP)	145	2.596	0.379	1.694	3.803
School enrolment	122	3.317	0.670	1.675	4.586
Openness	148	4.139	0.398	2.701	5.194
Population growth	155	2.702	0.771	-0.228	6.603
Inflation	149	131.1	880.0	0.682	8,504

Domestic saving (% GDP)	136	2.296	1.119	-4.330	4.018
Domestic credit (% GDP)	152	2.383	0.915	-0.255	5.013
Investment- promoting Inst	155	-2.81e-09	2.047	-5.811	5.141
Democratic & Regul. Inst.	155	2.83e-09	1.798	-5.388	3.522
Conflict preventing inst.	155	-2.50e-09	1.496	-4.425	4.086

Correlation matrix

Table 2.5 present the correlation matrix of the variables included in this study. As shown, the correlation between log of per capita GDP and all the three institutional indicators is significant and positive, indicating the importance of these institutional arrangements on economic growth. This result of the correlation matrix appears to confirm to our prior expectations. All the remaining control variables have the expected sign and significance.

Table 2.5: Correlation matrix

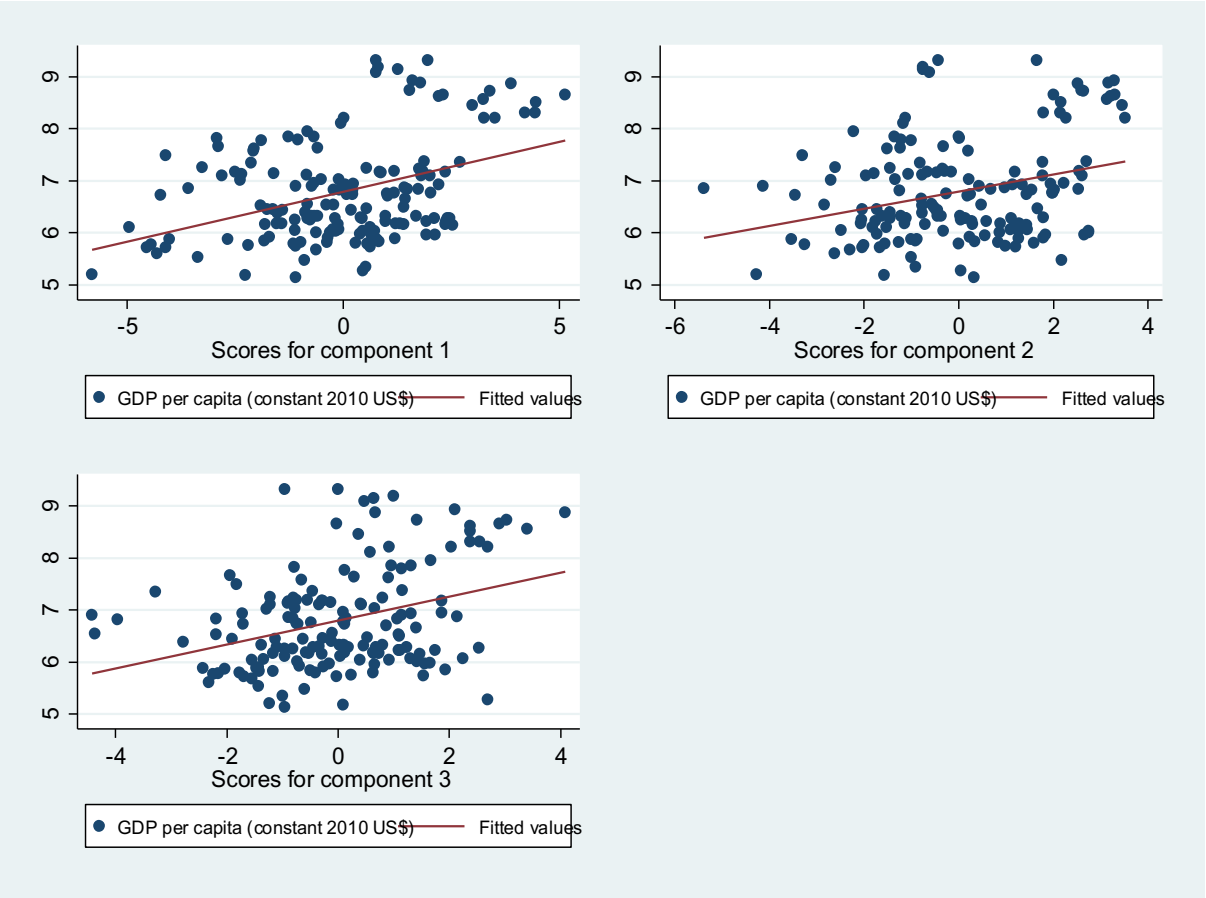
	lngdpper	Inv_inst	Democ_inst	Conf_inst	pop	lngov	lnschool	lnopeness	lnsave	inf	lnfinance
lngdpper	1										
Inv_inst	0.282**	1									
Democ_inst	0.249*	0.627***	1								
Conf_inst	0.319***	0.555***	0.419***	1							
pop	-0.392***	-0.236*	-0.156	-0.0129	1						
lngov	0.316**	0.402***	0.311**	0.338***	-0.0642	1					
lnschool	0.628***	0.177	0.231*	0.162	-0.424***	-0.0157	1				
lnopeness	0.383***	0.143	0.120	0.259**	-0.102	0.319***	0.339***	1			
lnsave	0.610***	0.00202	0.0178	0.174	-0.0581	0.248*	0.302**	0.174	1		
inf	-0.0569	-0.304**	-0.138	-0.0927	0.157	-0.00950	-0.0614	-0.0782	-0.0258	1	
lnfinance	0.470***	0.380***	0.393***	0.269**	-0.374***	0.283**	0.506***	0.131	0.238*	-0.316**	1

Note: *** p<0.01, ** p<0.05, * p<0.1

Source: own computation

The following figure (Figure 2.2) shows the nexus between the dependent variable and the three institutional indicators (after clustering). To give a clear illustration of the relationship, the fitted line of the OLS regression result is plotted. As shown in the graphs, all three institutional quality measures seem to affect economic growth positively.

Figure 2.2: Relation between GDP per capita and institutional variables



In a nutshell, both the correlation matrix and the above graph shows a seemingly positive association. The following step is to confirm the existence of this alleged link using econometrics analysis by including other growth determinants. This is essential not only because many variables affect economic growth but also the nexus between institutions and growth might be altered when other determinants are included.

2.4.2 Estimation results

Baseline regression result

The estimation results of the above growth equation (Equation 2.4) are reported in Table 2.6. To demonstrate the robustness of the estimation method used in this study, we start estimating the growth equation with pooled OLS and latter with GMM. Thus, the first column of Table 2.6 reports the results of pooled OLS, the second column fixed effects, the third column difference GMM, and finally, the last column presents the results of the system GMM estimators. As mentioned earlier, there are many reasons why we should not rely on pooled OLS results to investigate the nexus between growth and institutions. One such reason is that the lagged value of the dependent variable is correlated to the error term, violating one of the assumptions of classical OLS estimation. The OLS estimator thus attributes the country fixed effect to GDP per capita (t-1); therefore, the coefficient of the lagged dependent variable is higher than other estimators. One way to address this problem is to employ a panel fixed effect estimator that accounts for country heterogeneity as presented in column 2 of Table 2.6. Although the fixed effect estimator removed country fixed effects, still the lagged dependent variable is endogenous and correlated to the error term. As a result, the coefficient of the lag dependent variable is downward biased. As (Bond et al., 2001; Roodman, 2009) points out, the true parameter must lie between the coefficient of OLS and fixed effect. Another limitation of the fixed effect estimator is that it can't handle the problem of endogeneity of other regressors.

The potential estimator that address both endogeneity and country heterogeneity is difference GMM. Difference GMM transforms the data into first-difference, removing the fixed effect, and uses the lagged value of the endogenous variable to circumvent the problem of endogeneity. The estimation results of our growth equation using difference GMM is presented in the third column of Table 2.6. One of the problems of this estimator is that the lagged value of the variables are poor instruments, and most of all, the coefficient of lagged dependent variable is outside the credible range (between OLS and fixed effect). The other estimator that is more efficient and consistent is system GMM. One of the advantages of system GMM than difference GMM is that not only the lagged value but also the lag of the first difference of endogenous variable is used as an additional instrument, improving the efficiency of the estimator. The estimation result of our growth equation is presented in the fourth column of Table 2.6. As shown in the table, the coefficient of the lagged dependent variable also lies

in the acceptable range, therefore, the interpretation of the growth equation is based on system GMM results (column 4).[15]

Two specification tests are important to check the validity of the GMM estimation method: Hansen test and Arellano–Bond test. Hansen test is crucial for testing the validity of the instruments so that they are not correlated with the error term. On the other side, the Arellano–Bond test tests for the existence of second-order serial correlation in the error term. Both of these tests were conducted and the results are presented in the lower section of Table 2.6. According to Roodman (2009), no second-order serial correlation is expected. As shown in the table below, the p-value of Arellano–Bond (AR (2)) is 0.429, which indicates that the null hypothesis of no second-order serial correlation is not rejected. The result of the Hansen test with p-value 0.298 also indicates the validity of instruments. Finally, since the strategy suggested by Roodman (2009) was followed, the estimation result is not weakened by instrumental proliferation. As shown in the lower section of the table, the number of cross-sections (countries) is greater than the number of instruments. Overall, the estimation results of the system GMM passes all of the diagnostic tests, indicating that the estimation result is satisfactory and robust.

[15] For all estimators, period dummies are used to account for time-related shocks from the error and two-step GMM estimator with orthogonal deviation and the Windmeijer (2005) correction was employed for both difference and system GMM.

Table 2.6: Estimation results of the growth equation

Independent Variables	(1) Pooled OLS	(2) Fixed Effect	(3) Difference GMM	(4) System GMM
GDP per capita (t-1)	0.969***	0.708***	0.564***	0.884***
	(0.0219)	(0.0938)	(0.0373)	(0.0391)
Investment-promoting	0.00122	0.0232*	0.0185***	0.0317***
	(0.00981)	(0.0124)	(0.00298)	(0.00876)
Democ &regulatory	0.00864	0.0260**	0.0135	0.0151*
	(0.00844)	(0.0127)	(0.0105)	(0.00843)
Conflict-preventing	0.00675	-0.00214	0.00161	0.0123
	(0.0107)	(0.0107)	(0.00551)	(0.0131)
Human capital	-0.0418	-0.0181	-0.000543	-0.00578
	(0.0299)	(0.0493)	(0.0218)	(0.0380)
Population growth	-0.0347	-0.00602	0.00587	-0.0385*
	(0.0265)	(0.0450)	(0.0238)	(0.0207)
Domestic saving	0.0279**	0.0728***	0.0778***	0.0710***
	(0.0128)	(0.0218)	(0.0122)	(0.0173)
Constant term	0.532***	2.057***		0.773***
	(0.177)	(0.636)		(0.179)
R-squared	0.989	0.870		
Period dummies	yes	yes	yes	yes
AR (2) test (p-value)			-1.23 (0.219)	-0.79 (0.429)
Hansen J-test (p-value)			14.40 (0.496)	10.68 (0.298)
Number of Instruments			27	22
Number of countries		29	27	29

Notes: Standard errors are presented in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All variables are expressed as natural logarithms except for population growth and institutional indicators.

The above estimation result shows that the estimated coefficient of the explanatory variables have the correct sign, although some of the variables are insignificant. It shows that out of the three institutional indicators, only conflict-preventing institution is insignificant. But investment-promoting and democratic & regulatory institution indicators are positive and significant at a conventional significance level, implying that improvement in these institutional dimensions significantly affects the growth performance of the region. More specifically, conditional on all other regressors and initial level of GDP per capita, a 10-percentage point increase in the quality of investment-promoting institutions leads to a 0.3 percentage point increase in the growth rate of GDP per capita. Similarly, a 10-percentage point increase in the quality of democratic & regulatory institutions improves economic growth by 0.2 percent. The third institutional dimension, conflict-preventing, is found to be insignificant. This finding indicates that once investment-promoting and democratic & regulatory institutions are controlled, conflict-preventing institutions do not affect economic growth. This result is similar to the result of previous studies like Hashim et al. (2011) in the case of SSA countries, and (Acemoglu et al., 2001; Knack & Keefer, 1995; K. Lee & Kim, 2009; Rodrik et al., 2004), in case of global sample, who argued that institutions affect economic growth.

Another control variable included in the growth equation is human capital (secondary school enrolment) and surprisingly it is found to be insignificant. It seems to suggest that human capital doesn't affect economic growth once institutions and other determinants of growth are included. This result corroborates to the study of Minier (2007) that found a significant positive effect of Barro and Lee (2001) human capital measure in baseline regressions but insignificant when policy and executive constraints are included in the model. Similarly, Durlauf, Kourtellos, and Tan (2008) found little evidence that human capital is a significant and robust determinant of growth. Using five different schooling databases, Delgado, Henderson, and Parmeter (2014) conclude that all the five measures of human capital are insignificant. Although our result is supported with the above studies, it is not only counter-intuitive but also appeared to contradict a bulk of theoretical and empirical studies that found the significant positive impact of human capital on economic growth. Therefore, our result must be interpreted with caution because of many reasons. First, any conclusion must be proceeded by a caveat on whether the relationship between human capital and economic growth is linear or non-linear. For instance, using a semi-parametric smooth model, Durlauf, Kourtellos, and Minkin (2001) found that secondary school enrolment is significant but it has a nonlinear effect on economic growth conditional upon initial income estimates. It indicates

that the functional form of the growth model must be taken into consideration before any conclusion on the insignificance of the human capital coefficient. Second, school enrolment may not adequately represent human capital in a growth regression, therefore, there is a need to check if the indicator of human capital is significant or not when an alternative measure of human capital is used (for instance, secondary Vs tertiary, vocational training Vs formal training).

As expected the coefficient of population growth is negative and significant, implying that population growth significantly retards the economic growth of the region. Likewise, the parameter of domestic saving is positive and significant at 1% level. It indicates that domestic saving strongly affects the economic growth of the region. To be more specific, a 10 percentage points increase in domestic saving leads to a 0.7 percentage point increase in the growth rate of GDP per capita, c*eteris paribus*. This significant and positive impact of domestic saving is supported by both theoretical growth models and empirical studies such as Aghion et al. (2016).

2.4.3 Robustness check via additional control variables

Although our empirical estimate is valid and reliable as it passes all the diagnostic test, we conducted a robustness check by including other determinants of growth in order to account for potential omitted variable bias. If the relationship between institutional indicators and growth still exist and similar after the inclusion of other determinants of growth, we can conclude that our empirical result is robust. We have included the widely discussed determinates growth: government expenditure, openness to trade, inflation, and financial development.

One important determinant of economic growth widely discussed in the literature is government expenditure measured by government expenditure as a percentage of GDP. There are two opposing views regarding the effect of government expenditure on economic growth. The first is the Keynesian hypothesis which describes public expenditure, any kind, as an accelerator of growth (Loizides & Vamvoukas, 2005). On the contrary, the Neo-classical growth model argued that there is no positive relationship between government expenditure and growth because it may crowd out private spending. The regression result of our extended growth model with government expenditure is presented in the second column of Table 2.7. The institutional indicators, both investment-promoting and democratic & regulatory institutions, have similar sign and significance level to our baseline regression result reported

in Table 2.6. Not only the coefficient of institutions but the significance of the remaining variables also unchanged, indicating the robustness of our estimation result. The coefficient of government expenditure is negative but insignificant, implying that government expenditure is an insignificant predictor of economic growth in the presence of institutional variables in the growth equation.

For further check, we included trade openness as another explanatory variable, and it is measured by the sum of exports and imports as a percentage of GDP. The liberal theory of international trade postulate that openness promotes growth. However, empirical studies have found mixed results: positive, negative, and insignificant. The estimation result is presented in column 3 of Table 2.7, and without slight change on the coefficients, the sign and significance level of the remaining explanatory variables are the same with both models (model 1&2). In this model, openness to trade is positive but insignificant. Once again, it indicates that when institutional variables are included in the model, the effect of openness to trade on economic growth is negligible. Similar to ours, Barro (2003) argued that "…there is only weak statistical evidence that greater international openness stimulates economic growth."

The other determinant of growth included in the extended regression is inflation measured by the consumer price index. Previous studies on the impact of inflation on economic growth have indicated that it has a neutral, positive or negative impact on growth. Our estimation with the inclusion of inflation variable is presented in column 4 of Table 2.7. What is interesting in this estimation result is that still, the sign and significance level of the three intuitional indicators remain the same with our baseline and other models (see column 1, 2 &3). This consistency of the significance and sign of institutional indicators, even though other growth determinants are included in the baseline model, indicates the robustness of the relationship between institutional quality and economic growth. Column 3 of Table 2.7 further shows that inflation has the expected sign but insignificant.

Previous growth literature also has shown that growth is linked to the level of financial development of the country. Thus, in order to check whether including financial development level of the country might alter the significance of institutional indicator, the growth equation is extended using credit to the private sector as a percentage of GDP and the estimation result is presented in column 5 of Table 2.7. As shown in the table, financial development has a negative sign but insignificant. While the two institutional indicators are positive and

significant. Similarly, the coefficient and the sign of all other control variables are very similar to the baseline model.

Finally, we included the above variables simultaneously in the growth equation to investigate whether the significance of institutional variable indictors might change with inclusion additional variables, and the result is presented in column 6 of Table 2.7. Again, the regression estimate of the growth model indicates that the coefficients of the two institutional variables are significant and positive. Besides, no significant change was found in the estimation coefficient of other variables than the baseline model estimate. To sum up, we found a robust relationship between quality of institutions and economic growth, and our empirical results strongly support that investment-promoting and democratic & regulatory institutions affect economic growth, but conflict-preventing institutions do not have a significant impact.

Table 2.7: System GMM estimation with additional control variables

Independent Variables	(1) System GMM Basic	(2) _gov	(3) openness	(4) inf	(5) Finance	(6) all
GDP per capita (t-1)	0.884***	0.887***	0.869***	0.880***	0.927***	0.903***
	(0.0391)	(0.0416)	(0.0311)	(0.0393)	(0.0456)	(0.0374)
Investment-promoting	0.0317***	0.0331***	0.0291***	0.0319***	0.0268***	0.0307**
	(0.00876)	(0.0118)	(0.00796)	(0.00970)	(0.00932)	(0.0133)
Democ &regulatory	0.0151*	0.0178*	0.0173**	0.0155*	0.0212**	0.0205*
	(0.00843)	(0.00916)	(0.00743)	(0.00852)	(0.00883)	(0.0109)
Conflict-preventing	0.0123	0.0124	0.00730	0.0103	0.0255*	0.0171
	(0.0131)	(0.0117)	(0.0126)	(0.0117)	(0.0146)	(0.0107)
Human capital	-0.00578	0.00334	0.0118	-0.00459	-0.0304	0.00372
	(0.0380)	(0.0399)	(0.0240)	(0.0377)	(0.0380)	(0.0308)
Population growth	-0.0385*	-0.0319	-0.0440**	-0.0396*	-0.0283	-0.0338
	(0.0207)	(0.0236)	(0.0193)	(0.0232)	(0.0229)	(0.0287)
Domestic saving	0.0710***	0.0674***	0.0746***	0.0732***	0.0564***	0.0637***
	(0.0173)	(0.0180)	(0.0150)	(0.0168)	(0.0185)	(0.0201)
Government expend		-0.0529				-0.0458
		(0.0596)				(0.0547)
Openness			0.0144			-0.0194
			(0.0471)			(0.0345)

Inflation				-5.57e-06		5.95e-05
				(4.55e-05)		(8.69e-05)
Credit to private					-0.0212	-0.00903
					(0.0136)	(0.0134)
Constant	0.773***		0.767***	0.797***	0.734***	
	(0.179)		(0.166)	(0.185)	(0.211)	
AR (2) test (p-value)	-0.79 (0.429)	-0.61(0.539)	-0.72(0.473)	-0.79 (0.431)	-0.97(0.334)	-1.13 (0.259)
Hansen test (p-value)	10.68 (0.298)	9.01(0.436)	10.11(0.341)	10.36 (0.322)	9.07 (0.431)	7.90 (0.545)
Number of Instruments	22	23	23	23	23	26
Number of countries	29	29	29	29	28	28

Notes: Standard errors are presented in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All variables are expressed as natural logarithms population growth and institutional indicators. For all estimation, two step estimator, orthogonal deviation, and period dummy was used.

2.5 Conclusion and policy recommendations

Although there is now a growing consensus that institutions are important for economic growth and development, disagreement persists on to what extent this is the case and which institutional arrangements affect economic growth. The disagreement is pronounced when sampled countries are reduced at a regional level. Thus, studies at a regional level provide an interesting insight concerning the nexus between institutions and economic growth. It is against this backdrop that this study aims to investigate the effect of institutions on the economic growth of 31 SSA countries over the period 1991–2015. System GMM with a strategy suggested by Roodman (2009) was used to estimate the growth equation. In order to make sure that our estimation is not driven by misspecification and omitted variable bias, a robustness check was conducted by including additional control variables.

Three important conclusions have been drawn from our empirical investigation on the nexus between institutional quality and economic growth in SSA. First, as in earlier studies, we found a significant positive effect of institutional quality on economic growth. More explicitly, institutions related to investment-promoting and democratic & regulatory quality affect the economic performance of the region significantly. The effect of conflict-preventing institutions, however, is negligible. Second, domestic saving and population growth are found to be a significant determinant of economic growth for the countries considered. While population growth retards growth, domestic saving enhances the economic performance of the region. Third, once institutional quality is considered in the growth model, growth determinants such as openness, inflation, and human capital do not have a significant impact on growth. Thus, institutional quality appeared to matter most in improving the economy of the region.

In light of the empirical findings of this study, we recommend that policy-makers in the region should promote institutional reforms so as to accelerate the economic growth of the region. Specifically, institutions related to investment-promoting and democratic institutions is crucial. This requires drafting new or revisiting existing laws and regulations which is related to the investment profile of the country, bureaucracy, and democratic accountability.

Whilst the empirical findings of the present study provide a new understanding regarding the nexus between institutions and economic growth in SSA, several limitations need to be noted. First, our findings are subject to data limitation, especially institutional data. Ideally, it would have been better if institutional data from various sources be used and

analyzed using PCA approach. However, institutional indicators for most countries in our sample are not available. Therefore, the direction of future research would be to include institutional indicator from various sources and apply PCA approach to extract institutional variables and analyze the impact of each institutional indices on economic growth. Second, the study did not evaluate the nature and the direction of causality between institutions and growth. If the debate on institutions and growth to move forward, it is recommended that the causal relationship, especially heterogeneous causality, between institutions and economic performance is investigated in future studies.

CHAPTER 3

3. THE INSTITUTION-GROWTH NEXUS IN SUB-SAHARAN AFRICA: NEW EVIDENCE FROM HETEROGENEOUS PANEL CAUSALITY APPROACH

Abstract

Whether economic growth is the cause or the consequence of improved institutional quality has been a controversial issue. To throw light on this debate, this chapter aims to investigate the nature and the direction of the causal relationship between institutions and economic growth. To this end, a panel data of 30 SSA countries for the 1990-2015 period is used and analyzed by using a heterogeneous panel non-causality approach recently developed by Dumitrescu and Hurlin (2012). Our empirical findings indicate a significant heterogeneity across the countries with regard to the relationship between growth and institutional quality, based on the income level. In low-income countries, we found a unidirectional causality that runs from institutional quality to growth. For lower-middle-income countries, however, the direction of causality is reversed. The evidence from this study also suggests a bidirectional causality in upper-middle-income countries. The policy implication of these findings is that policymakers in low-income countries should focus on institutional reform. Good quality institutions will promote economic growth that will ultimately turn into a cyclical process between economic growth and institutional development in later stages.

***Keywords*:** Institutional quality, economic growth, SSA, Heterogonous panel causality.

JEL classification: O43, O55, C33

3.1.Introduction

Over the past three decades, there has been a proliferation of empirical studies that investigated the link between institutions and growth. With few exceptions, most of these studies have documented a significant positive relationship between institutions and growth (Acemoglu et al., 2001; Dawson, 1998; Knack & Keefer, 1995; Rodrik et al., 2004; Siddiqui & Ahmed, 2013; Slesman et al., 2015). It has been argued that institutions, which are defined as the 'rules of the game', matter most for the development of countries as they influence the incentive structure of the economy. In countries with good quality institutions, the return of investment is secured, the reward of innovation is acknowledged, and resources are efficiently allocated. Therefore, investment raises, innovation triumphs, efficient allocation of resources abounds; consequently, the country prospers. Therefore, according to institutional economists such as Easterly (2001, p. 252), the path to success must begin by setting up "quality institutions."

However, this concept has been challenged by other studies because good quality institutions may have been the result of successful growth experiences. Thus, it is unclear whether sustained growth is the cause or the consequence of improved institutional quality. In this regard, H.-J. Chang (2011) argued that because it creates new agents of change who demand a new institutional framework, economic growth causes improvement in institutional quality. In addition, poor countries cannot afford to install high-quality institutions because setting up and building high-quality institutions requires resources. The author, therefore, claims that not only does bidirectional causality exist but also that the causality from economic growth to institutions may even be stronger than the other way round. In fact, empirical studies have acknowledged the possibility of reverse causality and employed various statistical solutions to address the problem. One of the statistical solutions is to use an Instrumental Variable (IV) estimation method so that the institutional variable is replaced by variables that are correlated with it but not with the error term. Another way of addressing the problem of reverse causality is to use the Generalized Methods of Moments (GMM) estimation method if the dataset in use is a panel dataset.

Despite increasing awareness of the existence of reversal causality and employing advanced econometrics techniques to resolve the problem, little attention has been given to the empirical examination of the nature and the direction of causality. The empirical findings of the existing few studies are rather controversial. While one strand of literature has found bi-

directional Granger causality (Chong & Calderon, 2000; K. Lee & Kim, 2009), others have revealed one-directional causality. Studies such as (Asghar, Qureshi, & Nadeem, 2015; Justesen, 2008) documented only one-way causality from institutions to growth, supporting the institutions-led-growth hypothesis. On the contrary, Glaeser et al. (2004) found evidence of growth-led-institutional quality hypothesis, i.e. growth Granger causes institutional quality, but not vice versa.

The aforementioned studies have employed a VAR based panel causality approach developed by Holtz-Eakin, Newey, and Rosen (1988), which assumes slope homogeneity of individual countries. This assumption, however, is misleading because it may be possible that for some countries institutions might Granger cause growth, and that for others they might not. Therefore, the heterogeneous characteristics of the sample were not taken into consideration by the aforementioned studies. A recent study by Law et al. (2013) addresses this problem by employing a Hurlin and Venet (2001) heterogeneous panel causality test. Recently, however, Dumitrescu and Hurlin (2012) proposed a new version of non-causality testing in heterogeneous panel data, which provides a procedure for analyzing the character of the causal procedures (heterogeneous or homogeneous).

The present study, thus, aims to examine the causal relationship between institutions and growth using this new version of heterogeneous panel causality test for Sub-Saharan Africa (SSA) countries. We argue that analyzing the direction of causality using a sample of SSA countries offers better insight into the nexus between institutions and growth for two reasons. First, there has been economic growth resurgence and improvement in institutional quality in the region since the mid-1990s. Thus, it is worth investigating if the recent economic growth of the region has been driven by improvement in the institutional arrangement as the institutions-led-growth hypothesis suggested, or vice versa as the proponent of the growth-led-institutions hypothesis has argued. Moreover, the experience of individual countries both in economic growth performance and improvement in institutional quality has not been even during this period. This enduring presence of both successful and failed countries within the region necessitates an in-depth analysis of whether the alleged causality between economic growth and institutions is homogenous or heterogeneous. Second, the most recent World Bank country opinion survey in developing countries, including SSA, indicates that governance and institutional quality were regarded as the most important development priority, surpassing

education and job creation.[16] But a compelling argument, that while high-quality institutions may foster growth, wealth makes it possible for countries to own high-quality institutions, is out of the current discourse. Thus, the present study brings these two compelling arguments together and empirically evaluates the panel dataset from the region.

To this end, we used a sample of 30 SSA countries for the period 1990-2015 and a Dumitrescu and Hurlin (2012) panel causality test. This causality test addresses the problem of heterogeneity in the panel and thus informs the nature and direction of causality between institutions and growth for the sub-set of countries within SSA. The results of the study show that the direction of causality differs depending on the income level of countries. While institutional-led-growth hypothesis has been confirmed in low-income countries, causality in lower-middle-income countries runs in the reverse direction. The evidence from this study also suggests a bidirectional causality in upper-middle-income countries. These results propose that policymakers in low-income countries should focus on institutional reform. Good quality institutions will promote economic growth that will ultimately turn into a cyclical process between economic growth and institutional development in later stages.

The present study thus contributes to the existing institutions-growth literature by presenting evidence on the nature and direction of causality between institutions and growth, arguably the first of its kind that uses heterogeneous panel causality testing of institutions and economic growth in the context of SSA countries. To the best of our knowledge, no attempt so far has been made to investigate the causal relationship between institutional and economic growth using the above-mentioned approach in the context of SSA.

This chapter is organized into five sections, including this introductory section. Section 3.2 discusses related literature while section 3.3 presents data source and methodology. Section 3.4 discusses the empirical results. Finally, section 3.5 concludes and provides policy recommendations.

3.2.Literature review

The question of why some countries are poor while others are rich has been the main conundrum for economists since the period of Adam Smith. Since then, several theories have been developed and diverse factors that make countries poorer or richer have been suggested.

[16] https://blogs.worldbank.org/publicsphere/comment/13161#comment-13161

Since the 1950s, growth econometrics has taken the center stage of growth research and growth models have been generated, and the debate continued from empirical perspectives. Growth models can be broadly classified into two main strands: i) neoclassical models of Solow (1956), and ii) endogenous growth models Romer (1990). Neoclassical growth models emphasize the importance of physical capital accumulation, whereas the endogenous growth model underlines the prominence of human capital, innovations, and technology in determining the growth performance of countries (Söderbom, Teal, Eberhardt, Quinn, & Zeitlin, 2014, p. 117). Recently, however, a strand of literature has argued that both growth models have failed to explain cross-country growth and income gap mainly because the focus of the two strands of growth models is on the proximate rather than the fundamental causes of growth (Acemoglu et al., 2005).

Unsatisfied with hitherto growth models, institutional economists including (Alchian & Demsetz, 1972; North, 1990; O. Williamson, 1985) accentuated that the reason why some countries are poor while others are rich is because of the divergent path of institutional arrangements. According to the New Institutional Economics (NIE), institutions are defined as "the rules of the game" which set "constraints" on human behavior (North, 1990, p. 3). Institutions, as a fundamental determinant of growth, influence proximate determinants such as investment, innovation, and education; hence, they affect growth (Acemoglu, Gallego, & Robinson, 2014). Thus, countries that installed good quality institutions have achieved sustained growth for a long period of time and lifted a greater portion of their society out of poverty. On the contrary, countries with low-quality institutions haven't shown any significant improvement in income level for decades. Based on the abovementioned theoretical ground, empirical studies that examine the impact of institutions on growth have flourished in the last three decades. Although these studies differ in terms of the institutional variable used, size of the sampled countries, and the estimation method employed, the overwhelming majority have documented the positive impact of institutions on growth (Acemoglu et al., 2001; Dawson, 1998; Knack & Keefer, 1995; Rodrik et al., 2004; Siddiqui & Ahmed, 2013; Slesman et al., 2015).[17]

It is often said that many of the macroeconomic variables are mutually correlated, indicating two-way causation. Like other growth empirics, institutions-growth literature was

[17] As a counter study see Brinkerhoff and Goldsmith (2005), who argued that high-quality institutions may produce poorer economic results.

also confronted with reverse causality and recently a number of studies have suggested that good quality institutions themselves may have been the result of successful growth experiences. In this regard, Glaeser et al. (2004) argued that the demand for better institutions is higher in a society where income is higher. Therefore, the author showed that economic growth is not the consequence of high-quality institutions but it is the cause for an improved institutional arrangement. Similarly, H.-J. Chang (2011) indicated that good institutions would have been the consequence of previous economic growth. Thus, the author argued, the causality that runs from growth to institutional quality is even stronger than the other way around. This is because as the economic situation of the country improves, new economic agents will emerge, and these economic agents ask for better institutional infrastructure.

The increasing recognition of the existence of reverse causality leads to a proliferation of studies that explore the direction and nature of causality. These studies have examined not only the one-way causation between institutions and growth but also the bi-directional relationship. In this regard, Chong and Calderon (2000) conducted one of the pioneering studies on the causal relationship between institutions and growth using an institutional dataset from the Business Environment Risk Index (BERI) and International Country Risk Guide (ICRG). The result of their empirical investigation confirms bidirectional causality, i.e. institutional quality causes growth, and growth causes institutional quality. Kaufmann and Kraay (2002), on the other hand, found empirical evidence that improvement in the governance structure of Latin American and Caribbean countries causes economic growth, as opposed to economic growth improving governance. The authors find a weak but negative feedback effect of growth on the quality of institutions.

Dawson (2003) conducted an empirical investigation of the causal relationship between institutions and economic growth using the Granger causality approach. The author used the overall freedom index and its components and found that the overall economic freedom index Granger causes economic growth. Among the components of the composite index of economic freedom, the author argued, indicators related to markets and property rights seem to be pushing the causal relationship. After exploiting the causal link between institutions and economic growth, Glaeser et al. (2004) concluded that it is not the improvement in institutional quality that leads to growth, rather it is an accumulation of human capital that brings growth, and growth, in turn, improves institutional quality. Thus, their study is in support of unidirectional causality that runs from growth to improvement of institutional quality.

In sharp contrast to Glaeser et al. (2004), the empirical study of Justesen (2008) suggests that institutional quality measured by economic freedom does cause economic growth, but the author found no evidence of causality from economic growth to the institutional indicator for 77 developed and developing countries. A recent study by Asghar et al. (2015) using 13 developing countries of Asia for the period 1990-2013 indicate that the direction of causality runs from institutional quality to economic growth, not vice versa.

To sum up, although studies differ in terms of institutional variables used, the sample analyzed, and methodology employed, their empirical findings can be broadly classified into three divisions: a) unidirectional causality, i.e. either institutions cause growth or vice versa, b) bi-directional causality, i.e. two-way causality between intuitions and economic growth, sometimes called feedback effect, and c) no causality, i.e. institutional quality and economic growth are independent of each other. Although the literature reviewed so far provides the first step in understanding the direction causality, it has failed to consider the heterogeneous characteristic of the sample, meaning all these studies assumed that sampled countries show the same pattern and the causality which is valid for one country is also valid for the others. However, it may be possible that for some countries, institutions Granger cause growth, whereas in others they do not. Thus, causality studies that consider the heterogeneous aspect of sampled countries are of utmost importance.

In a recent study, Law et al. (2013) addressed this heterogeneity issue by employing a Hurlin and Venet (2001) heterogeneous panel causality test, which provides a procedure for analyzing the character of the causal procedures (heterogeneous or homogeneous) within a panel framework. The authors used a sample dataset of 60 countries and conducted heterogeneous causality tests after dividing sample countries into four income groups, namely, low income, lower-middle-income, upper-middle-income, and high-income countries. The rationale for dividing the sample countries into four groups was the expectation that the relationship between institutional quality and growth in the countries with different levels of development would show a non-uniform character. The empirical results of their study confirm that the casual relationship between institutions and growth varies based on the income level of the country. For high-income countries, institutional quality Granger causes economic growth, while for low-income countries it was economic growth that drives improvement in institutional quality.

The heterogeneity issue is addressed in Ang (2016) by using a different methodology. In her book in which how China surged from deep poverty to a middle-income country in three decades is investigated, she begins with the usual debate about whether good governance or economic growth should come first in escaping from poverty. Surveying Chinese experience, she concludes that escaping from poverty is a coevolutionary process starting with harnessing normatively "weak" institutions to kick-start markets. Then, markets with weak institutions (characterized by corruption, weak property rights, etc.) will generate problems that require officials to build stronger institutions, which in turn strengthen market institutions further. The extension of her three-step approach to late medieval Europe, 19th century America, and contemporary Nigeria show that the coevolutionary development process is not particular to China, but also applicable to other national and temporal settings.

In conclusion, the empirical literature has produced mixed results as to whether improvement in institution quality causes growth or growth causes institutional quality. The substantial contradictory results of previous studies seem to be caused by differences in the quantification of institutional quality, the causality test employed, and the characteristics of the sample countries used in the study. Therefore, the present paper seeks to contribute to the existing debate by employing the recently developed heterogeneous panel causality approach for a set of SSA countries. In doing so, it will serve as a guide for policymakers in the region.

Table 3.1: Selected papers on causality between institution and growth

Authors	**Study period/sample**	**Institutional quality measure &data source**	**Econometric technique**	**Major findings**	**Limitation**
(Glaeser et al., 2004)	1982-1997/1960-2000/1998-2000 54/71 developed and developing	ICRG, WGI, Polity IV	OLS	No-causality/ Independence	-heterogeneity not considered - issue of estimation technique
(Vega-Gordillo & Alvarez-Arce, 2003)	1975-1995/ a sample of 45 countries	Fraser Institute & freedom House	Panel LSDV	-both economic & political freedom Granger cause economic growth -economic growth only Granger cause political freedom	-heterogeneity not considered - issue of estimation technique and measure of institutions
(Dawson, 2003)	1970-2000	Fraser Institute	Pooled Granger causality	-economic freedom causes growth	-heterogeneity not considered
(K. Lee & Kim, 2009)	1965-2002/63 developed & developing countries	Polity IV projects	Panel GMM Causality	Bi-directional Causality/feedback	-heterogeneity not considered -economic institutions not considered
(Law et al., 2013)	1990–2008/ 60 countries	ICRG & WGI	Panel Granger causality	-two way causality -causality pattern vary -institutions causes growth in HIC - growth causes growth in LIC	-heterogeneity not considered

3.3.Data and Empirical Methodology

3.3.1. Source of Data

To analyze the causal relationship between economic growth and institutional quality, we used a panel data of 30 SSA countries and 25 years (1990-2015). The variables used are GDP per capita (constant 2010 US$), which is taken from the World Development Indicators (WDI) of the World Bank and over-all institutional quality index. Institutional variables are extracted from the database of the International Country Risk Guide (ICRG) and Polity IV Project. We follow recent approaches in the literature, see Law et al. (2013) and Ndjokou, Mwa, and Tsopmo (2017), to measure institutional quality. In line with these studies, the institutional quality variable is measured by averaging five indicators: four variables from ICRG (Government Stability, Corruption, Law & Order, and Bureaucracy) and one indicator from Polity IV Project-polity2. Since each of the indicators is scaled differently, we rescale each of them to have a minimum of 0 and a maximum value of 10. Once rescaled, the average value is calculated and used as an indicator of the institutional quality of the country.

3.3.2. Panel Granger Non-Causality Tests

Testing the direction of causality is straightforward for time-series models. As developed by Granger (1969), the first step in detecting the direction of causality of two variables, say x and y, is to regress y on the lagged values of itself and x. If the lagged values of x are significant, the null hypothesis of 'x does not Granger cause y' is rejected. Similarly, if the lagged value of y is significant after regressing x on lagged value of itself and y, the null hypothesis 'y does not Granger cause x' will be rejected. In general, three possibilities can emerge from causality analysis: a) unidirectional causality i.e. one-directional causality either from y to x or from x to y; b) bidirectional causality i.e. x causes y, and y causes x; c) no causality i.e. x and y are independent.

Holtz-Eakin et al. (1988) modified the time series Granger causality test and developed a panel VAR based Granger non-causality test. Previous studies on the nexus between institutions and economic growth have applied this causality test in order to detect the direction of causality. However, applying this classical Granger test in the panel data framework is not without limitations. One of the main drawbacks is its assumption of slope homogeneity across cross-sections (countries). This assumption is misleading because it may be possible that, for

some individual cross-sections (countries), x might Granger cause y, and for others it might not Granger cause y.

Hurlin and Venet (2001) proposed a Granger causality test that addresses the aforementioned problems by considering the heterogeneity of the regression model. Thus, the author suggested four types of panel causality hypothesis: a) Homogenous Non-Causality (HNC) i.e., no causal relationship between two variables in any individual; b) Homogenous Causality (HC) i.e. causal relation between the two variables in every individual; c) Heterogeneous Non-Causality (HENC) i.e. no causal relationship between the two variables in individuals of a subgroup; and d) Heterogeneous Causality (HEC) i.e. causality between the two variables in individuals of a subgroup. Recently, Dumitrescu and Hurlin (2012) proposed a new version of non-causality testing in heterogeneous panel data, and this causality testing approach is used in the present paper.

The Dumitrescu and Hurlin (2012) panel Granger non-causality analysis considers two stationary variables, x and y, for period t and individual (countries) N and based on the following model:

$$y_{i,t} = \alpha_i + \sum_{k=1}^{k} \beta_{ik} y_{i,t-k} + \sum_{k=1}^{k} \gamma_{ik} x_{i,t-k} + \varepsilon_{i,t} \quad \text{---------- 3.1}$$

where α_i = individual fixed effect across i,

β_{ik}= different coefficients of $y_{i,t-k}$ for individual i

γ_{ik} = different coefficients of $x_{i,t-k}$ for individual i

The data is assumed to be balanced panel data and the lags of k are similar for all cross-section of the panel. In addition, it is assumed that the autoregressive slope coefficients are identical for all individual cross sections but the regression coefficients vary. Thus, $x_{i,t}$ Granger cause $y_{i,t}$ if the lag values of $x_{i,t}$ are significant along with the lagged values of $y_{i,t}$. The null hypothesis of Dumitrescu and Hurlin (2012) panel causality test is defined as Homogeneous Non-Causality (HNC) and is expressed as:

$$H_0: \gamma_{i1} = \cdots = \gamma_{ik} = 0 \quad \forall i = 1, \ldots, N$$

The null hypothesis indicates that there is no causality for all individuals in the panel, i.e. x is not causing y in all N countries of the sample. The alternative hypothesis, on the other hand, is that x causes y for at least one of the cross-sections (countries) and is therefore defined as:

$$H_1: \gamma_{i1} = \cdots = \gamma_{ik} = 0 \quad \forall i = 1, \ldots., N_1$$

$$: \gamma_{i1} \neq 0 \; or \ldots or \; \gamma_{ik} \neq 0 \quad \forall i = 1, \ldots., N_1 + 1, \ldots, N$$

where N_1 is unknown but it fulfills the condition $N_1 \in [0, N-1]$. The value of N_1/N do not exceed one because there is no causality for any of the individuals in the panel if $N_1=N$. Conversely, if $N_1=0$, there is homogenous causality i.e. causality for all the cross-sections in the sample. Accepting and rejecting the null hypothesis is dependent on the Wald statistics. First, Wald statistics ($W_{i,T}$) are calculated for each cross-section (country) and then the panel Wald statistic is computed by averaging the Wald statistics of each individual that is:

$$\overline{W} = \frac{1}{N}\sum_{i=1}^{N} W_i$$

The testing procedure is finally based on $\bar{Z}$ if $T \to \infty$ where

$$\bar{Z} = \sqrt{\frac{N}{2k}}.\overline{W} - K$$

and for a fixed T dimension, the testing procedure is based on $\tilde{Z}$ where

$$\tilde{Z} = \sqrt{\frac{N}{2k}.\frac{T-3K-5}{T-2K-3}.\frac{T-3K-3}{T-3K-1}}.\overline{W} - K$$

If the value of $\bar{Z}$, in case of larger T, and $\tilde{Z}$, in case of fixed, is larger than the corresponding normal critical values, null hypothesis of no Granger causality is rejected.

Before continuing to test the direction of causality between institutional quality and economic growth, we have to make sure that both variables of the panel data set are stationary (do not contain a unit root). In this study, we employ the Im, Pesaran and Shin (IPS) unit root test. The IPS starts by specifying a separate ADF regression for each cross-section with individual effects and no time trend:

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t-1} + \sum_{j=1}^{\rho_i} \beta_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \quad \text{---------- 3.2}$$

where $i = 1, \ldots, N$ and $t = 1, \ldots, T$

Then, a separate unit root test for the N cross-section units is estimated. First, a separate ADF regression is estimated for each country, then the average of the t-statistics for ρ_i from the individual ADF regressions is calculated and given by:

$$\overline{t_{NT}} = \frac{1}{N} \sum_{i=1}^{N} t_{iT}(\rho_i \beta_i)$$

The t-bar is then standardized and converges to the standard normal distribution as N and T approach infinity. It is a robust unit root test in the presence of cross-sectional dependence.[18]

3.4.Empirical results of the study

3.4.1. Descriptive statistics

The following table provides the mean standard deviation and minimum and maximum of the variable used in the study.

Table 3.2: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
lnGDPPC	780	6.849438	0.974446	5.08657	9.386458
Inst	780	4.96062	1.160252	1.326115	8.712729

3.4.2. Stationarity test

Before proceeding with the panel Granger tests, the stationarity of the panel series must be tested in order to ensure that none of the series contain a unit root. There are many panel unit root testing methods which are broadly classified as the first and second generation. The main difference between them is that the first generation unit root tests assume cross-sectional independence while the second generation rejects the assumption of cross-sectional independence (Barbieri, 2009). We used an H. Pesaran (2004) test of cross-sectional

[18] A detailed explanation is available at H. Pesaran (2007)

independence test in order to examine the existence of cross-sectional dependence. The estimated value of Pesaran's test of cross sectional-independence is 15.255 and significant at 1% level; hence, we reject the null hypothesis of cross-sectional independence. Thus, second generation unit root tests should be used to test the stationarity of the variable. In this study, an IPS panel unit root test is employed because of the fact that it is based on the Dickey-Fuller procedure and a small time period is needed for the test. Moreover, the performance of an IPS test is better than that of LLC (Levin, Lin, and Chu Test) (Baltagi, 2005, p. 243). The test result is reported in Table 3.3.

Table 3.3: Result of Panel stationarity test

Variable	Level	First order difference
GDPPC	-0.0154 (0.4938)	-5.0306*** (0.0000)
Institutional quality	-2.4789*** (0.0066)	

Note: The superscript *, ** and *** denotes significance at 10%, 5%, and 1% levels respectively.

The above table reports the IPS based stationarity test results both at level and first difference. The first column presents the test result at level while the second column reports the test result at first difference. As can be seen in the first column of the above table, the stationary test result for GDP per capita is not significant at the conventional significance level; thus, the null hypothesis of a panel unit root in the level for real per capita GDP cannot be rejected, indicating that this variable is non-stationary at level. But the null hypothesis of unit root test is rejected at 1 percent significance level when the real GDP per capita is differenced (see the second column of Table 3.3). The test result for the institutional quality indicator, on the other hand, is significant at level; hence, institutional indicator is stationary at level. Therefore, for further analysis, real GDP per capita will be used in difference while institutional quality indicator will be used in level.[19]

3.4.3. Panel Granger non-causality test Results

This section presents the Dumitrescu and Hurlin (2012) panel Granger non-causality test results. First, a causality test for the full sample of 30 SSA countries was conducted. Following recent advancement in the literature Law et al. (2013), we assume that the causal

[19] Dumitrescu and Hurlin (2012) Granger non-causality test requires variables to be stationary.

effect of institutional quality is not uniform for different income groups. To see if this is true, we divided the sample countries into three income groups and causality analysis was conducted using these sub-samples. The results are presented in the following Table 3.4, where Panel A reports the Granger causality test while panel B presents the number of countries with significant P-value provided that the null hypothesis is rejected. This causality test is sensitive to the number of lags used in the analysis, and Lopez and Weber (2018) recommended using Akaike Information Criteria (AIC) to choose the optimal lag length. Therefore, we conducted the causality test up to three lags and chose the optimal number of lags based on AIC. The Z-bar statistics with optimal lag are written in bold in the following table. The left side of the table reports the test results for 'institutional quality Granger causes growth' while the right side reports the test results for 'growth Granger causes institutional quality'.

Table 3.4: Dumitrescu & Hurlin (2012) Granger non-causality test Results

Panel A: Homogenous Non-Causality test						
	Inst ⇒ ΔlnGDPPC H0: inst does not cause growth. H1: inst does cause growth for at least one country			**ΔlnGDPPC ⇒ Inst** H0: growth does not cause inst H1: growth does cause inst for at least one country		
	Lags:1	Lags:2	Lags:3	Lags:1	Lags:2	Lags:3
All countries (30)	**3.3055*** (0.0009)**	2.7347*** (0.0062)	2.6424*** (0.0082)	0.0094 (0.9925)	**4.0290*** (0.0001)**	2.9364*** (0.0033)
Lower income countries	**2.4524*** (0.0142)**	1.1794 (0.2382)	2.0674*** (0.0387)	-0.9071 (0.3643)	**1.0156 (0.3098)**	1.6733* (0.0943)
Lower middle income	**1.6198 (0.1053)**	0.7261 (0.4678)	0.7005 (0.4836)	1.1932 (0.2328)	**4.5331*** (0.0000)**	2.2297*** (0.0258)
Upper middle income	1.5669 (0.1171)	**3.9689*** (0.0001)**	1.9237** (0.0544)	0.1062 (0.9154)	**2.1407** (0.0323)**	1.2475 (0.2122)
Panel B: Number of countries with p-value <0.10						
All countries (30)	**6**	4	5		6	5
Lower income (17)	3		2			
Lower middle income (9)					2	2
Upper middle income (4)		1	1		2	

Notes: The reported values are Z-bar statistics and the P value is given in parenthesis. *, **, *** indicates rejection of the null hypothesis at 10%, 5%, and 1% levels of significance. Z-bar statistics written in bold indicates the optimal number of lags based on Akaki Information Criteria (AIC).

Result with full sample

As shown in the first panel of Table 3.4, the null hypothesis of the homogenous non-causality, i.e. institutional quality does not cause growth for all cross-sections (countries), is rejected with 1% significance level at all number of lags, although the optimal lag based on AIC is 1. It indicates that for at least one country institutional quality does cause economic growth. Similarly, the second panel of Table 3.4 reports the panel causality test results that run from growth to institutional quality. Since the Z-bar statistics are significant at optimal lag (lag

2), the null hypothesis that economic growth does not cause institutional quality for all countries is rejected. Thus, for at least one country, economic growth improves institutional quality.

To sum up, the above homogenous non-causality test is rejected for both variables, i.e. growth and institutional quality indicator. Furthermore, because the Wald statistic and Z-bar statistics of this causality test depend on individual countries, we count the number of countries with significant P-value. As reported in the lower panel of Table 3.4, for 6 out of the total sample of 30 countries, there is strong evidence of two-way causality, i.e. institutional quality causes growth and growth Granger causes institutional quality.

Result with income-level sub-samples

Once homogenous no-causality is rejected, the next procedure is to investigate for which group of countries or individual country there exists bi-directional and/or unidirectional causality. Since the causal relationship between economic growth and institutional quality might be affected by the income level of the country, we conducted a Dumitrescu and Hurlin (2012) Granger non-causality test with a reduced sample which we classified based on the income level of the country. The World Bank classifies countries into three major categories based on their income level: low-income, middle-income, and high-income countries. Middle-income countries are further classified into lower-middle-income and upper-middle-income countries. In our sample, none of the countries are in the high-income category, so we divide our sample countries into three sub-samples, namely, low-income, lower-middle-income, and upper-middle income countries. The causality analysis is then conducted for each group. The following table reports the classification of our sample countries into three income groups based on World Bank criteria.

Table 3.5: classification of countries by income

Low income countries **(GNI per capita $995 or less in 2017)**		Lower Middle-income countries **(GNI per capita $996–$3,895)**	Upper middle income **(GNI per capita $3,896–12,055)**
Burkina Faso	Malawi	Angola	Botswana
Congo, Dem. Rep.	Niger	Côte d'Ivoire	Gabon
Ethiopia	Senegal	Congo, Rep.	Namibia
Guinea	Sierra Leone	Ghana	South Africa
Gambia, The	Togo	Kenya	
Guinea-Bissau	Tanzania	Nigeria	
Madagascar	Uganda	Sudan	
Mali	Zimbabwe	Zambia	
Mozambique		Cameroon	

Source: World Bank list of economies (June 2018)[20]

The results of homogenous no-causality test for low income countries are presented in the second row of Table 3.4. Similarly, the Z bar statistics with their corresponding significance level for testing the hypothesis 'growth does not cause intuitional quality' are presented up to 3 lags in the right portion while the test for 'intuitional quality does not cause growth' is presented in the left portion.

As reported in Table 3.4, the null hypothesis of institutions does not Granger cause growth is rejected for the sub-sample of low-income countries at 1 percent significance level, based on the optimal lag length. However, the null hypothesis of growth does not cause institutions cannot be rejected at optimal lag length. This indicates that there is at least one directional causality that runs from institutional quality to economic growth in low income countries. For lower-middle-income countries, however, the causality tests indicate that causality runs in the opposite direction, i.e. economic growth causes improvement in institutional quality but not vice versa. For upper-middle-income countries, the causality test indicates that there exists bidirectional causality between growth and institutional quality.

[20] See https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

In short, it appears from the results of the causality analysis that there exists a significant heterogeneity in the relationship between growth and institutional quality. As in Law et al. (2013), our analysis confirms that causal relationship varies depending on the income level of the country. Thus, country specific factors, such as income level, need to be considered to determine whether countries should focus on policies that promote growth or institutional reform. However, given institutional deficiencies in most SSA countries, it might be said that countries can promote sustained growth by improving the institutional quality.

3.5.Conclusion and policy recommendation

One of the most significant current discussions in economics is the relative importance of institutional quality in explaining cross-country differences in growth. The role of institutional quality in economic growth has been documented well in the literature. A substantial number of studies have found evidence for the causality between these two variables in reverse direction, while others have indicated a bi-directional one. These studies generally employed VAR based panel causality analysis developed by Holtz-Eakin et al. (1988). This approach, however, is based on a strict assumption that causality operates either from institutions to growth or growth to institutions for all sample countries (slope homogeneity).

The present study aims to examine the nature and direction of causality between institutions and economic growth by employing a Dumitrescu and Hurlin (2012) non-causality test, which relaxes the slope homogeneity assumption. This causality test addresses the problem of heterogeneity in the panel; thus, it informs the nature and direction of causality between institutions and economic growth for the sub-set and individual countries within the sample. To this end, we used a sample of 30 SSA countries for the period 1990-2015. Since we assume the causal effect of institutional quality is not uniform for different income groups, we divided the sample countries into three sub-samples, namely, low-income, lower-middle-income, and upper-middle income countries, and causality analysis was conducted using these sub-samples.

Our empirical findings indicate that there exists a significant heterogeneity in the relationship between economic growth and institutional quality indicators depending on the level of economic development of the country. For low-income countries we found a unidirectional causality from institutional quality to economic growth, which implies that it all begins with good quality institutions. Then, when the country reaches lower-middle-income

status, causality is reversed. In the following income bracket (upper-middle-income status) the relationship between institutional quality and economic growth becomes a self-feeding phenomenon. Even though the methodology and the definition of institutional quality are different, these findings are very similar to Ang (2016)'s three step development approach.

These findings provide additional support for studies that demonstrate the importance of institutions. More importantly, this study shows that the answer to the question of whether policymakers should focus on good governance or economic growth for development depends on what stage of development the country is in. Countries at lower levels of development should fix their institutions first. Good quality institutions will promote economic growth that will ultimately turn into a cyclical process between economic growth and institutional development in later stages.

CHAPTER 4

4. THE IMPACT OF REGIONAL INSTITUTIONAL QUALITY ON FIRM INNOVATION: A MULTILEVEL ANALYSIS[21]

Abstract

The main aim of this chapter is to empirically examine the role of regional institutional quality, and compare the relative importance of three different institutional arrangements, namely regulatory quality, rule of law, and corruption, on the propensity of firm innovation in African countries. To this end, we used the most recent World Bank Enterprise Survey (WBES) of firms from 19 African countries. Our empirical investigation using multilevel logistic regression has drawn three important conclusions. First, there is no significant relationship between firm-specific factors, such as age, ownership, and exporting, and firm innovation. Nonetheless, firms' propensity to innovate is significantly determined by the size of the firm, R&D expenditure, on-the-job training (OJT), and the capability of managers/owners to adopt new technologies. Second, the innovation performance of firms is significantly affected by regional institutional quality. Third, among different regional institutional arrangements, reducing corruption and maintaining rule of law appeared to matter the most for firm innovation.

Keywords: innovation, regional institutions, multilevel logistic regression, Africa

JEL classification: O43, O55, L26, M53

[21] This chapter is published and it can be accessed by the following doi number https://doi.org/10.1080/2157930X.2020.1750143

4.1.Introduction

Although the role of institutions, which are defined as "the rules of the game in a society", on economic growth has long been acknowledged to be that of promotion of innovation (North & Thomas, 1973, p. 157), empirical studies that examine the nexus between firm innovation and regional institutional quality have lagged behind and been limited to the developed world because of data deficiencies. However, the development of standardized innovation surveys and institutional quality indicators by international organizations in the last two decades has led to renewed interest in this realm. Accordingly, not only has the number of empirical studies flourished but also their geographical scope has extended to the developing world.[22]

The present study thus expands the emerging debate on the role of regional institutions on firms' propensity to innovate and aims to answer following questions: (1) To what extent variations in regional institutional quality affect firms' innovation performance? (2) Which of the institutional arrangements have more influence on innovativeness of firms than the others? To this end, a sample of more than 11,000 firms from 19 African countries, obtained from World Bank Enterprise Survey (WBES), is used, and the innovation equation is estimated using a multilevel logistic regression approach. In the survey, firms were asked about their experience and perception of the business environment in which they operate; we used these variables to construct regional institutional quality indices for each region of our sampled countries. We argue that well-developed regional institutions that maintain rule of law, reduce regulatory uncertainty, and lessen corruption provide necessary incentives for firms to spend in long-term investments such as R&D and worker training, thereby enabling firms' ability to engage in innovative activities. Thus, even within the same country, firms in the regions with high institutional quality perform better in terms of innovation compared to their counterparts located in regions with low-quality institutions.

Africa is an interesting case study to analyze this strand of research because there seems to be a significant variation in local/regional institutions within each particular country. In fact, regions in African countries are more heterogeneous than any other part of the world (Elbadawi & Sambanis, 2000). For instance, Ethiopia and Nigeria follow a federal political structure where each region or locality has its own administrative and local rules. Therefore, the level of

[22] See for instance Barasa, Knoben, Vermeulen, Kimuyu, and Kinyanjui (2017) and Chadee and Roxas (2013).

institutional quality within each region of these countries shows substantial variation. Even if the political structure is not a federal system and similar institutions are installed for other countries in our sample, national laws and regulations could be interpreted and enforced differently in various regions within a country depending on local experience. In this regard, de facto institutions, which, as opposed to de jure institutions, are identified as key for understanding the role of institutions, appeared to be dissimilar across various regions in a particular country.[23] Consequently, it seems reasonable to assume that institutional quality differs across different regions and localities within each country.

The contribution of this paper is threefold. First, by analyzing the nexus between regional institutional quality and firm innovation, it provides further empirical evidence supporting the hypothesis that institutional quality matters not only at a national but also at a local level. Second, this study went further and provided empirical evidence on the relative importance of the three institutional arrangements. In doing so, we were able to identify which of the institutional arrangements have a greater impact on the dynamics of firm innovation in Africa. Third, in most innovation studies, much emphasis has been placed on developed and emerging countries, with relatively little emphasis on African countries. Thus, this study provides further empirical evidence on the topic by concentrating on otherwise overlooked regions, using a larger sample size and rich data set.

The remainder of this chapter is structured as follows. Section 4.2 discusses related literature on the topic while section 4.3 is concerned with the data and methodology used for this study. Section 4.4 presents the empirical results of the study. Section 4.5 concludes and provides policy recommendations.

4.2.Literature review

Since the influential book of Joseph Schumpeter (1934), there have been increasing theoretical and empirical studies that assert innovation as one of the main sources of economic growth and development (Acemoglu, Aghion, & Zilibotti, 2006; Kremer, 1993). In fact, the main suggestion of the endogenous growth model is that innovation (technological progress) is the driver of modern economic growth and development (Cohen & Levinthal, 2000; Romer, 1990). Innovation is reported to contribute 85% to economic growth by the Solow growth

[23] For instance, Lu, Png, and Tao (2013) argued that although the de jure property right is the same at the national level, de facto property right varies across Chinese cities. These differences, according to them, affect the performances of firms. See Acemoglu and Johnson (2005) for detailed information regarding de facto and de Jure institutions.

model, while the remaining 15% is explained by factor inputs (Oluwatobi, Efobi, Olurinola, & Alege, 2015). Country-level case studies also show the importance of innovation for growth and development. For instance, explaining the observed variation in economic success and failure between Ghana and South Korea, the World_Bank (2010, p. 6) claimed that two-thirds of the variation in the growth performance of South Korea and Ghana is ascribed to innovation.

Considering the importance of innovation to economic growth, it is imperative to investigate the enabling factors thereof. Previous studies that have examined the determinants of firm innovation can be grouped into three strands: those which focus on firm-specific characteristics, studies that concentrate on characteristics of the environment in which the firm is operating (external factors), and those considering both. Early studies tend to focus on firm-specific characteristics. These studies examined the impact of firm-specific characteristics such as size (Cohen & Klepper, 1996; Hansen, 1992; Lööf & Heshmati, 2006; Luo, 2005; Tsai, 2005; Zemplinerová & Hromádková, 2012), age (Balasubramanian & Lee, 2008; Becheikh, Landry, & Amara, 2006), foreign ownership (V. Chen, Li, Shapiro, & Zhang, 2014; Love & Roper, 1999, 2001; Michie & Sheehan, 2003; Un & Cuervo-Cazurra, 2008), public ownership (Ayyagari, Demirgüç-Kunt, & Maksimovic, 2011; V. Chen et al., 2014; Dewenter & Malatesta, 2001), exporting (Abdelmoula & Etienne, 2010; Ayyagari et al., 2011; C.-L. Chang, Chen, & McAleer, 2013) education and/or experience of the top-level manager (Ayyagari et al., 2011; Balsmeier & Czarnitzki, 2014; Barker & Mueller, 2002), on-the-job training (OJT) (Dostie, 2018; González, Miles-Touya, & Pazó, 2016), employees' educational achievement (Capozza & Divella, 2018; van Uden, Knoben, & Vermeulen, 2017), expenditures on R&D (Baumann & Kritikos, 2016; Goedhuys, 2007; Shefer & Frenkel, 2005) on the innovativeness of firms.

The more recent innovation studies emphasized the role of external factors like access to finance and level of competition (Hussen & Çokgezen, 2019; Pavitt, 2002; Yang, 2017), collaboration with other firms and linkages with knowledge centers like universities and technology centers (Keizer, Dijkstra, & Halman, 2002), government policies on R&D (Carboni, 2011; González & Pazó, 2008; Mansfield, 1986), intellectual property rights (Y. Chen & Puttitanun, 2005) on the propensity of a firm's innovativeness.

In recent decades there is growing concern about the role of institutions in innovation. Institutions are defined as the "rules of the game" which can be either formal, like written laws, policies, rights and regulations, or informal, like social norms, customs or traditions. They shape incentive structure and accordingly peoples' behavior and, in turn, determine how

opportunities and resources will be allocated in an economy. It is a widely held view that better institutions affect long-run growth through their effect on the provision of incentives, which creates better resource allocation, and reduction of uncertainty and transaction costs for economic actors to engage in innovative and productive activities. Such an approach *is supported with empirical research* results indicating that well-designed institutions create improved economic performance (Acemoglu et al., 2001, 2002; Dawson, 1998; Knack & Keefer, 1995; K. Lee & Kim, 2009; Rodrik et al., 2004)

Part of the contribution of institutions on economic performance is realized through innovation. That innovation is an important driver of economic performance is a well-known phenomenon (Cohen & Levinthal, 2000; Romer, 1990). Innovation is, on the other hand, a process that is influenced by the institutional structure of an economy. Institutional structure influences the internal and external factors affecting innovation and these factors, in turn, influence firms' decision to engage in innovative activity in the economy. For instance, the firms located in an economy where regulatory quality is good, the rule of law is respected, and the level of corruption is lower are more likely to invest in R&D, have easier access to finance, provide more OJT for their workers. On the other hand, those who are operating in an economy that has low-quality institutions waste their time and financial resources dealing with cumbersome regulatory rigidities, corrupt officials, and ineffective legal processes distracting them from engaging with innovation. Therefore, well-functioning instiutions that favor work, investment and entrepreneurship were identified as prerequisite for nurturing innovative activities (Elert, Henrekson, & Stenkula, 2017, p. 25).

Empirical research in this realm also supported the hypothesis that institutional quality has a positive influence on innovativeness of firms (Barasa et al., 2017; Blind, 2012; Boudreaux, 2017; Chadee & Roxas, 2013; Fuentelsaz, Maicas, & Montero, 2018; Lu et al., 2013; Oluwatobi et al., 2015; Wu, Wu, & Zhuo, 2015). In these studies, researchers are usually focused on the formal institutions, like regulatory quality, rule of law, corruption, protection of property, economic freedom probably because of the availability of data provided by surveys and/or indicators developed by international organizations that allow us to quantify quality of formal institutions. Studies (Geng & Huang, 2017; Khan, Hussain, & Iqbal, 2017; Pattit, Raj, & Wilemon, 2012) also confirmed the positive relationship between informal institutions and innovativeness, particularly for developing countries.

Most of the empirical evidence on the impact of institutional quality on firm innovation has concentrated on country-level institutional arrangement.[24] In country level or cross-country studies a country is considered as an institutionally homogenous unit. However, studies have shown that quality of institutions and accordingly innovation performance may vary – sometimes considerably- within the same country. In this regard, (Cooke, 1992, 2001) introduced the concept of regional innovation systems (RIS) and indicated that regional level organizational and institutional environment affects the innovation capability of firms.[25] In the same line, Asheim and Isaksen (2002) pointed out the importance of regional context-such as institutions and resources- in enhancing the innovative performance of firms and regions. In their empirical study on the probability of firm innovation across different regions of Sweden, Johansson and Lööf (2008) found, even after controlling for other variables, that firms located in the Stockholm region were more innovative than elsewhere. Donges, Meier, and Silva (2017) showed that territories of the Imperial Germany occupied by France in the late 18th century had more than twice as many patents per capita around 1900 as unoccupied counties. The number of per capita patents in the counties with the longest period of occupation was nearly four times higher than the unoccupied regions. They explain the difference with the imposition of substantial reforms, like establishment of commercial freedom through the dissolution of guilds, the introduction of a general civil code, the abolition of serfdom and the implementation of agrarian reforms, by the French.

The variation is especially pronounced in developing countries where regions tend to be more heterogeneous economically, socially and culturally. For instance, Lu et al. (2013) investigated the impact of property rights protection on the productivity of Chinese enterprises by using a World Bank survey of 1,566 manufacturing enterprises in 18 Chinese cities. In addition to the positive link between the two variables, results of the study showed that enterprises perform better in the cities where institutional quality is higher. The most recent study that focused on the case of African countries, and the one closest to the subject of this research, is Barasa et al. (2017). The study used WBES for three East African countries, Kenya, Uganda, and Tanzania, to construct a regional level institutional index based on the perception of firms regarding regulatory quality, rule of law, and corruption. The empirical result, after employing multilevel logistic regression, indicates that regional institutional quality not only

[24] See, for instance, Pattit et al. (2012) for USA, Wu et al. (2015) for China, Blind (2012) for 21 OECD countries, Oluwatobi et al. (2015) for 40 African countries.
[25] According to Cooke (2001) a region is defined as a sub-national entity that has some cultural or historical homogeneity but had some power to intervene and support economic development, particularly innovation.

influences the propensity of firms' innovation but also reinforces the effect of internal determinants such as R&D on innovation.

Whilst these few studies confirm the importance of quality of regional institutions on firm innovation, they rely on a small sample or one country dataset. Therefore, it is unclear if the relationship between innovativeness of firms and regional institutions could change when a large sample of firms and more control variables are taken into account. In addition, the relative importance of different regional institutional arrangements on firm innovation performance has not been examined empirically. Therefore, further work using cross-country dataset and examining relative importance of different regional institutional arrangements will improve our understanding of the nexus between regional institutional quality and innovation.

4.3.Data and methodology

4.3.1. Data Source

To examine the nexus between regional institutions and innovation, we employed WBES data of 19 African countries. WBES collects data from nationally representative firms across the developing world using a harmonized core questionnaire and similar sampling method. Typically, in each country, the survey is conducted on a 3 to 4-year rotation from firms stratified based on size (small, medium, and large), sector (manufacturing and service) and geographical region (differs depending on the country). The data is collected through face-to-face interviews with top-level managers or firm owners concerning firm performance, finance, ownership, employees, export, business environment etc. We intended to use the most recent survey data (2014 through 2016) available for African counties. Thus, our sample countries include 19 countries of Africa where the survey was conducted during this period (see Table 4.1 for the list of countries). All countries in our sample were surveyed only once between 2014 and 2016, therefore, the data is considered as a cross-section of firms. Overall, the dataset covers more than 11,000 firms drawn from 19 countries.[26]

[26] Detailed information on the data is available on WBES website http://www.enterprisesurveys.org/.

Table 4.1: List of sample countries and survey year

Country	Survey year	Number of firms	Country	Survey year	Number of firms
Benin	2016	150	Mauritania	2014	150
Burundi	2014	157	Namibia	2014	580
Cameroon	2016	361	Nigeria	2014	2,676
Côte d'Ivoire	2016	361	Senegal	2014	601
Egypt	2016	1,814	South Sudan	2014	738
Ethiopia	2015	848	Sudan	2014	662
Guinea	2016	150	Swaziland	2016	150
Lesotho	2016	150	Togo	2016	150
Malawi	2014	523	Zimbabwe	2016	600
Mali	2016	185			
Total					11,006

4.3.2. Empirical methodology and Estimation strategy

Since our data has a hierarchical structure with firms nested in geographical regions, which possess institutions with different qualities and the dependent variable is of a binary nature, we used the following two-level random intercept fixed slope regression model:[27]

$$logit(INV_{ij}) = \beta_0 + \beta_1 Z_{ij} + \beta_2 Inst_j + u_j \quad \text{----------} \quad 4.1$$

Where $u_j \sim N(0, \sigma_u^2)$, u_j is a normally distributed random variable representing random effect of region j. INV_{ij} denotes the probability of firm i in region j to engage in

[27] Since the regions are also nested in countries, three-level model could be an alternative. However, we preferred two-level model for two reasons: First, country characteristics, which may influence innovativeness of the studied countries are more or less the same. For instance, economically they all belong to either low or lower-middle income categories. All of them are also characterized with poor political and judicial institutions etc. Second, some of these countries are too small to divide in regions, like Swaziland, Lesotho, and Namibia. Therefore, in these countries all surveyed firms are in the same region which is the country itself.

innovation activities while $Inst_j$ represents the regional level institutional quality indicator. Z_{ij}, on the other hand, indicates explanatory variables of firm i in region j.

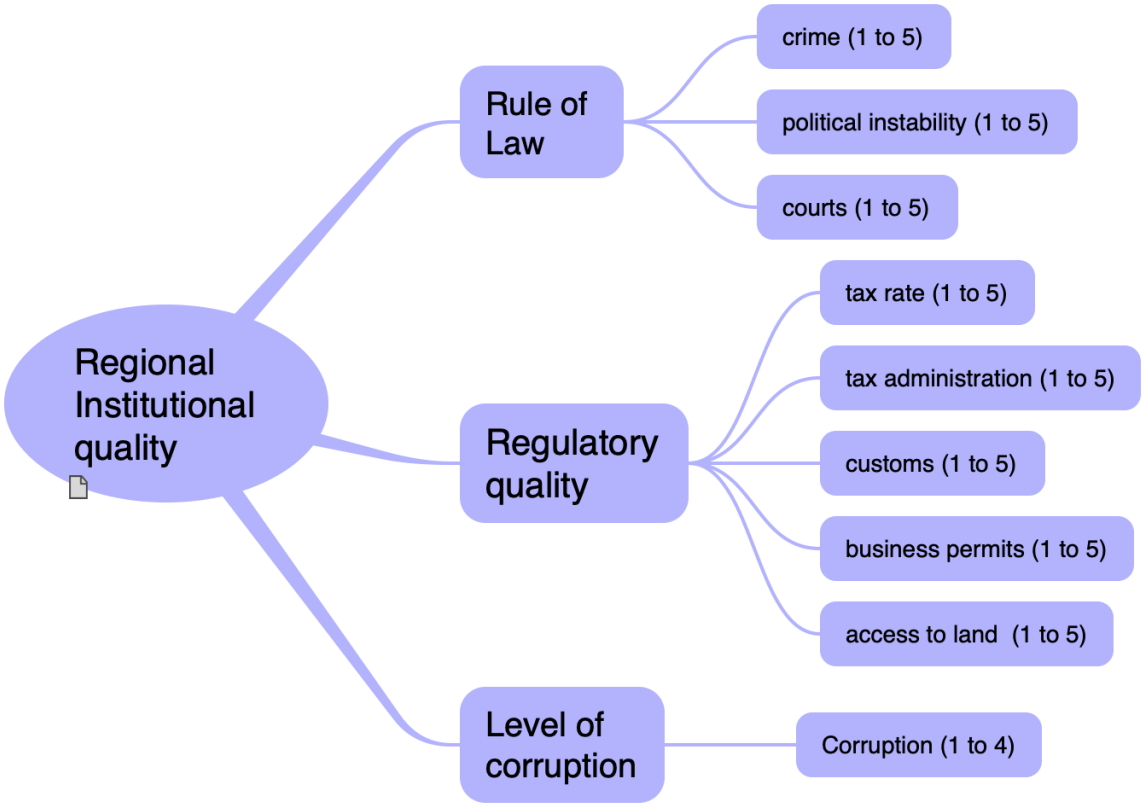
The definition of innovation used in this study resembles the OECD definition. Therefore, a firm is considered to be innovative if it introduces a new or significantly improved product or service. Enterprise Survey asks if the firm had introduced 'new' or 'significantly improved' products/services in the last three years prior to the survey year. If the answer was yes, the dependent variable innovation (***INV***) takes the value 1, 0 otherwise. Thus, the dependent variable is binary.

Finding a good measure for institutional quality (***Inst***) has been one of the most daunting tasks for researchers. This, in fact, is because institutions are multifaceted and often not easily quantifiable. Despite all the difficulties, economists conduct empirical analyses at macro level using institutional indicators that were made available by think tanks, multilateral agencies, and nongovernment organizations, like Corruption Perception Index, Index of Economic Freedom, and Democracy Index.

In this regard, some recent studies make use of the WBES to measure the local institutional infrastructure that represents the underlying institutional dimension (Barasa et al., 2017; Chadee & Roxas, 2013). Given the nature of the survey data, these studies identified three institutional indicators, namely regulatory quality, rule of law, and corruption, as the proxy of the different dimension of institutions. Our study follows the lead of Barasa et al. (2017) and Chadee and Roxas (2013) to compute regional institutional index using WBES. Three components from WBES were used to calculate a comprehensive measure of the rule of law. In the survey, firms were asked to indicate on five-point scales (1=not an obstacle, to 5=very severe obstacle) the extent to which crime, political instability, and the courts posed as obstacles to their business operation. First, we reversed the scale of each of the three indicators of rule of law, so that the higher the value represents the better perception of the respondent. Second, the variables were standardized to have mean zero and standard deviation 1 in order to make it comparable to other regions in the sample. Then the average value of the above three indicators was calculated to gauge the perception of each respondent. Finally, to estimate regional rule of law, the average perception of rule of law of firms located in the same region was calculated.

To calculate the comprehensive measure of regulatory quality, five components from WBES were used. In the survey, firms were asked to indicate on five-point scales (1=not an obstacle, to 5=very severe obstacle) the extent to which tax rate, tax administration, customs, business permits, and access to land posed as obstacles to their business operation. Similar to the rule of law indicator, we reversed the scale and then standardized all variables. To get firms' perception of regulatory quality, the mean value of the above five indicators was calculated. The mean perception of firms located in the same region was calculated to construct regional regulatory quality indicator. The last component of institution used to measure regional institutional quality is the level of corruption, and the survey question "How Much of an Obstacle: Corruption" was used to quantify it. Because firms were asked to indicate on four-point scales (1=not an obstacle, to 4=very severe obstacle), we reversed the scale first and then standardized. Once again, the mean perception of corruption of firms operating in the same region is calculated so as to measure the regional level of corruption indicator. A composite indicator of overall regional intuitional quality is thus the average of the above three regional indicators (regional rule of law, regional regulatory quality, and regional corruption). The indicators used to calculate regional institutional quality is given in the following figure (Figure 4.1).

Figure 4.1: Measure of regional institutional quality



One advantage of using this indicator, as opposed to experts' perception, is that it reflects firms' perception of investment risks, which happens to be one of the most relevant factors that shape firms' operation and investment decisions.

Our prior expectation is that regional institutional quality indicator would have a significant positive impact on firm innovation. Firms in regions with high regional institutional quality, where the regulatory quality is good, the rule of law is maintained, and the level of corruption is lower, tend to be more innovative than their counterparts. This is because well established and efficient institutions provide incentives for firms to spend in long-term risky investments such as R&D and worker training, thereby enabling firms to engage in innovative activities. On the contrary, regions with low quality institutions create an uncertain business environment. Therefore, rather than engaging in innovative activities, firm owners/managers waste their time and financial resources dealing with regulatory rigidities or corrupt officials. Accordingly, even within the same country, differences in regional institutional quality affect the innovative performance of firms.

Institutional quality is a second level variable (regional level) while the other variables, which explain the firm characteristics, are first level variables, indicating the hierarchical structure of the data. In this case, the use of single-level statistical models does not provide valid standard errors and confidence intervals. Therefore, the appropriate empirical strategy to explore the impact of institutional quality (higher level variable) on firm innovation (lower level) is to employ multilevel modelling. The multilevel models allow inclusion of both the fixed, which correspond to the observed firm and regional characteristics, and random effects, which correspond to intra-region correlation.

Following previous empirical studies on the topic, the following firm level control variables were used.

Email is a dummy variable that takes the value 1 if the firm uses email to communicate with customers and suppliers, 0 otherwise. Enterprise survey asks whether firms communicate with clients and suppliers by email. We used this variable as a proxy for technology adoption capability of the owner/manager. Communication is at the heart of all business transactions. Owners/managers are permanently in contact with their suppliers and customers through various channels. There are various communication channels including face to face meetings, phone calls, sms messaging and internet communication such as email. We argue that using internet communication, in our case email, indicates managers' flexibility and ability to adapt to new technologies. Given that most firms from our sample are located in urban areas, it is likely that firms would have access to broadband internet. In fact, mobiles phones are the most common tools in the construction and/or maintenance of business relations in Africa, a continent which has more mobile phone users than fixed-line subscribers because of poor landline infrastructure. [28] Therefore, we assumed that those who use email to communicate with customers and suppliers are more technology friendly and have a higher capability of adopting technologies. Hence, we expect a positive relationship between the variable ***Email*** and innovativeness of a firm.

Training is a dummy variable that takes the value 1 if the firm offers OJT for employees, 0 otherwise. In line of this empirical evidence, we assume firms that do provide

[28] https://www.africa-business.com/features/mobile_phones_africa.html and https://qz.com/africa/1206935/whatsapp-is-the-most-popular-messaging-app-in-africa/

OJT to be more innovative than non-providers; hence a significant positive coefficient is expected.

R&D is a dummy variable that takes the value 1 if the firm made an expenditure on R&D, 0 otherwise. Like previous studies, we expect that R&D have a significant positive impact on the propensity of firm innovation.

School represents the human capital stock of the firm and is approximated by the (logarithm of) percentage of employees with a high school diploma. It has been argued that firms with highly educated personnel tend to be more innovative because highly educated and skilled employees can develop and/or imitate new technologies. The findings of earlier studies are consistent with this hypothesis. Thus, our expectation is that education level of employees positively affects the innovation performance of the firm.

Size was measured by the (logarithms of) total number of workers in the firm. Based on the previous literature, our prior expectation is a significant positive association between firm size and propensity to innovate.

Age was measured by the (logarithm of) difference between the survey year and the year in which the firm started operation. Again, depending on the previous discussions, our initial expectation about the relationship between the age of a firm and innovativeness is inconclusive.

Manage represents the experience of the top manager of the firm in that particular industry and is approximated by the (logarithm of) number of years of his or her experience in the same sector. Our prior expectation is a positive and significant coefficient for this variable.

Export is a dummy variable that takes the value 1 if a firm's direct export is more than 10 percent of total sales, 0 otherwise. It is expected that exporters be more innovative than non-exporters.

Gove is a dummy variable that takes the value 1 if the government has at least 20 percent share in the firm, 0 otherwise. Here, our prior expectation about the sign of the variable ***Gove*** is negative.

Foreign is a dummy variable that takes the value 1 if foreigners have at least 20 percent share in the firm, 0 otherwise. We do not have any initial expectation about the sign of this variable.

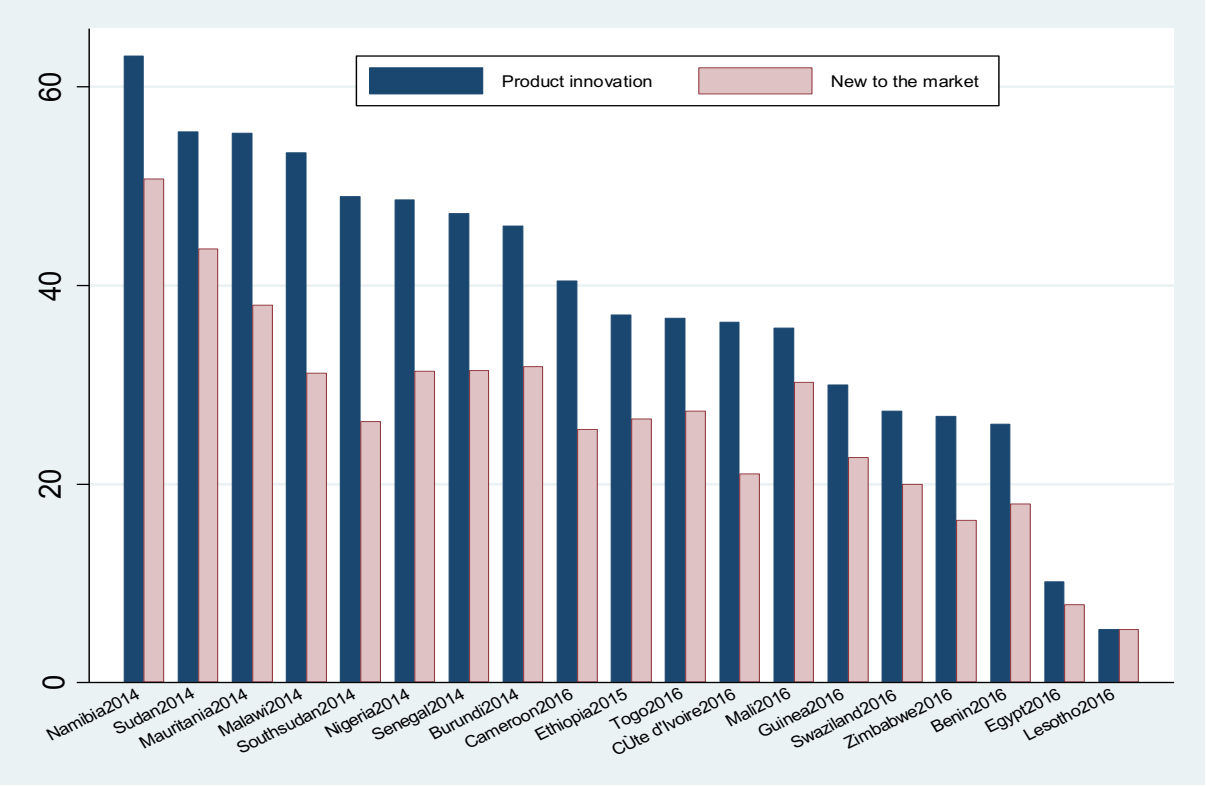
Industry is a dummy variable to control for industry fixed effect. Some industries by nature tend to be more innovative than others (for instance, chemicals & chemical products); thus, firms operating in different industrial sectors may show dissimilar innovation performance. In order to account for this industry-specific difference, industry dummy was used as another control variable.

4.4.Discussion and Empirical Results

4.4.1. Overview of the innovation landscape in Africa

Figure 4.1 presents the percentage of firms that introduced new or significantly improved products and services for each of the 19 African countries included in our sample.

Figure 4.2: Rate of Innovation in selected African countries.



Source: Authors' own elaboration from the World Bank Enterprise Survey

In general, a large percentage of firms (around 39 percent, without weighting) in the sampled countries is innovative. The rate of innovation in individual countries ranges from 6 percent in Lesotho to 63 percent in Namibia. These levels of innovation rates are relatively high as compared to international standards. These relatively high rates of innovation can be explained in part by the subjective nature of innovation measure. WBES uses the OECD definition of 'implementation of a new or significantly improved product (good or service)' as innovation. In the survey, firms were asked if they have implemented "new" or "significant" improvements in the last three years. Since "significant" is a highly subjective term, i.e. what one firm regards as significant may not be the same as what other firms regard as significant, it is likely that firms in Africa may overstate and reply as if they are innovators. Another possible explanation for this is that firms in developing countries in general, and Africa in particular, engaged in incremental innovation as opposed to radical innovation, which is less expensive. Thus, although innovation rate is high in Africa (39 percent of firms engaged in innovation), the intensity of innovation is lower (only 26 percent of the new products or services introduced by firms were new to the firm's main market) (see Figure 4.1). In addition, innovation at firm level may not depend on the current level of economic development. For instance, Malawi, whose per capita income is 12 times lower than that of Egypt, is 5 times more innovative (see Figure 4.1).

4.4.2. Innovators and firm characteristics

Table 4.2 compares the general characteristics of innovators and non-innovators. It classifies the sample based on some characteristics of the firm such as size, ownership, exporting, and spending on R&D, and compares the corresponding percentage of innovators and non-innovators.

Table 4.2: Firm characteristics and innovation

	Non-innovator	Innovator		Non-innovator	innovator
Size of the firm (based on number of employees)					
Small (<20)	61.77	38.23	R&D expenditure		
Medium (20-99)	58.99	41.01	Spenders	30.22	69.78
Large (100 +)	58.32	41.68	Non-spenders	66.18	33.52
Ownership of the firm (Foreign vs Domestic)			Training		
Foreign owned	51.76	48.24	Training provider	46.24	53.76
Domestic owned	61.82	38.18	Non-provider	65.05	34.95
Ownership of the firm (Private vs Government)			Email		
Government owned	49.43	50.57	Email user	56.62	43.37
Private owned	60.85	39.15	Non-user	65.62	34.38
Exporting			Institutions		
Exporter	53.56	46.44	institutions >0	54.66	45.34
Non-exporter	61.75	38.25	institutions <=0	66.04	33.96

Source: Authors' own elaboration from the World Bank Enterprise Survey

First, we observe that firm size does matter for innovation. Similar to the Schumpeterian hypothesis, smaller firms appear to be less innovative compared to large and medium-size firms. However, there is no difference between medium and large firms in terms of innovation (41 percent of both medium and large firms engaged in innovative activities). The innovation performance of firms is also varied depending on ownership, with a larger percentage of foreign-owned firms (as compared with domestic owned) engaging in innovative activities. Surprisingly, innovation appeared to be more prevalent in government-owned firms than privately owned firms. As expected, firms that participate in direct exports showed a higher rate of innovation than firms that do not. Needless to say, innovation rate is higher in firms that spend in R&D, provide OJT, and are owned/managed by people with a high capacity to adopt new technology. Raw data also suggests that there are significant differences in innovation rates based on the regional institutional quality index. As illustrated in Table 4.2, the share of

firms that introduced new products/services is higher in regions where the institutional quality is above average. While 45 percent of firms are engaged in innovative activities in regions where the institutional quality is above average, only 34 percent of those located in regions where the institutional quality is below average do the same. In a nutshell, the innovation performance of firms in Africa seems to be affected by a wide range of factors, including regional institutions. However, these relationships may change if other factors are taken into consideration. Therefore, in what follows, we empirically examined the determinants of firm-level innovation by using a multilevel logit regression model.

4.4.3. Descriptive Statistics

Table 4.3 reports the summary statistic of the variables used in the regression analysis, while table 4.4 displays the correlation matrix. The correlation matrix shows that there is a significant positive relationship between firm-level innovation and regional institutions indicator. This confirms our hypothesis that quality of regional institutions enhances the performance of firm innovation. With regard to other control variables, except for age, the experience of manager, and education level of the employees, the correlation matrix indicates a positive relationship.

Table 4.3: Summary statistics

Variables	Observation	Mean	SD	Min	Max
Product innovation	10,902	0.395	0.489	0	1
Government owned	10,632	0.0180	0.133	0	1
Foreign owned	10,612	0.118	0.323	0	1
Size of the firm (log)	10,783	2.921	1.308	0	10.31
Age of the firm (log)	10,578	2.546	0.855	0	7.578
Exporting firms	10,460	0.128	0.335	0	1
Manager's experience (log)	10,628	2.514	0.813	0	4.220
Email	10,932	0.563	0.496	0	1
Research expenditure	10,823	0.158	0.364	0	1
% high school graduate (log)	9,316	3.747	1.125	0	4.605
Training	10,824	0.243	0.429	0	1
Regional institutional quality	11,005	0.00363	0.353	-0.764	0.917

Source: Authors' own elaboration from the World Bank Enterprise Survey

Table 4.4: Correlation matrix

	Innov	Gov	For	size	Age	Expo	Manag	R&D	School	Train	Email	Inst
Innov	1											
Gov	0.02*	1										
For	0.0705***	0.0723***	1									
Size	0.0093	0.101***	0.145***	1								
Age	-0.055***	0.0558***	-0.070***	0.334***	1							
Expo	0.0459***	0.123***	0.106***	0.244***	0.0954***	1						
Mang	-0.063***	-0.0067	-0.038***	0.223***	0.494***	0.0445***	1					
R&D	0.262***	0.062***	0.0513***	0.130***	0.005	0.100***	0.0029	1				
School	-0.0352**	-0.025*	-0.0003	0.176***	0.074***	-0.048***	0.0495***	0.022*	1			
Train	0.161***	0.067***	0.0820***	0.233***	0.109***	0.131***	0.0802***	0.227***	0.048***	1		
Email	0.0549***	0.0214	0.120***	0.373***	0.152***	0.0965***	0.181***	0.145***	0.179***	0.190***	1	
Inst	0.139***	-0.004	-0.069***	-0.05***	-0.034**	-0.052***	-0.085***	0.037***	0.016	-0.027*	-0.038***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Authors' own elaboration from the World Bank Enterprise Survey

Conclusions regarding the impact of regional institutional quality and other determinants on the propensity of firm innovation based on a correlation matrix are erroneous. This is due to the fact that a correlation matrix doesn't consider the existence of other determinants that may change the relationship between variables. Therefore, a regression analysis that includes other determinants needs to be conducted.

4.4.4. Estimation results

Estimation was conducted on firm-level factors first, as presented in column 1 of Table 5 using a single-level logit model. Later, the regional-level variable, regional institutional quality, is included in the innovation equation and both single-level and two-level estimation results are reported in columns 2 and 3 of Table 5 respectively. We reported the single-level result only for comparison purpose but our preferred estimation results are the one reported in column 3 of Table 5. As indicated in the previous section, institutional quality is a regional-level variable while the other variables are firm-level variables. This implies the hierarchical structure of the data; thus, two-level modeling is the appropriate empirical strategy. In fact, the estimated intra-class correlation (ICC) of the innovation equation is 0.23 implying that 23 percent of the variation in product innovation is explained by between-region differences.[29] In addition, as can be seen in the lower section of the table, the LR test is significant for the multilevel model implying the appropriateness of two logit estimation. The value of the Akaike Information Criterion (AIC), which measures the goodness of fit, is also smaller for our preferred two-level logit estimation result.

[29] ICC is computed by first fitting the empty multilevel logistic model

$$log\left(\frac{p}{1-p}\right) = \beta_0 + u_j$$

and then calculating

$$ICC = \frac{var(u_j)}{var(u_j) + (\pi^2/3)}$$

ICC value ranges from 0 to 1 and indicates whether multilevel modelling is appropriate. ICC closer to 0 indicates that individuals within countries are no more similar than individuals from other countries. Therefore, there is no variance to explain at the country level and multilevel modelling is of no use. Conversely, if the ICC is close to 1, it indicates that there is no variance to explain at the individual level.

Table 4.5: Estimation result of product innovation

	(1)	(2)	(3)
	Dependent variable: Product innovation		
	Single-level logit model	Single-level logit model	Two-level logit model
Firm-level			
Gov	0.0138	0.00498	-0.296
	(0.189)	(0.191)	(0.203)
For	0.311***	0.381***	0.176*
	(0.0735)	(0.0743)	(0.0838)
Size	-0.0690**	-0.0667**	0.0873***
	(0.0214)	(0.0216)	(0.0250)
Age	-0.0758*	-0.0837*	0.0766
	(0.0326)	(0.0329)	(0.0396)
Expo	0.0846	0.122	0.157
	(0.0734)	(0.0739)	(0.0834)
Mang	-0.144***	-0.113**	-0.0269
	(0.0347)	(0.0351)	(0.0406)
R&D	1.356***	1.343***	1.100***
	(0.0680)	(0.0687)	(0.0760)
School	-0.0766***	-0.0853***	0.00542
	(0.0217)	(0.0218)	(0.0257)
Train	0.583***	0.609***	0.552***
	(0.0567)	(0.0574)	(0.0642)
Email	0.124*	0.138**	0.311***
	(0.0531)	(0.0536)	(0.0641)
Regional-level			
Inst		0.864***	1.128**
		(0.0685)	(0.343)
Constant	0.119	0.0602	-1.385***
	(0.116)	(0.117)	(0.189)
Random Parameter			
$\sigma^2{}_{intercept}$			0.999***

			(0.189)
N	8310	8310	8310
AIC	10384.0	10223.5	9176.1
χ^2	759.8	922.3	507.2
LR test			1049.69***

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Contrary to expectations, this study did not find any significant relationship between firm innovation and its firm specific associates such as ownership structure (government and foreign)[30], age of the firm, exporting, and managerial experience. Although some of these results are contradictory to our expectations, it is not surprising for the reason that previous empirical studies have not been conclusive. Earlier studies indicate both a positive and negative impact of these variables on innovativeness of firms. However, the signs and statistical significances of the other variables -namely, size, R&D expenditures, firm-sponsored OJT and technology adopting capability of owners/managers (*Email*)- are in line with our expectations and the conclusions of earlier studies in this realm.

Most importantly, the estimated coefficient of regional institutional quality, our variable of interest, is positive and significant. This supports our hypothesis that innovation is not only determined by firm characteristics, as previous innovation studies claim, but also by the business environment of the region in which the firm is operating. In this regard, firms operating in regions where regional institutional quality is better (worse) are more (less) innovative. A possible explanation for this is that all three components of regional institutional quality taken together affect the incentive to engage in innovative activities. For instance, regulatory rigidities would put an extra burden on firms to spend unnecessary time and financial resources which could have been used for undertaking risky innovative activities. In addition, disrespect of the rule of law in a specific region would threaten business owners and entrepreneurs. Finally, corruption increases transaction cost and creates uncertainty so that it weakens firms' ability to introduce new products and services or imitate existing ones. Hence, it could be argued that difference in regional institutional quality in Africa influences the variation of firm innovativeness across the continent. Given the institutional deficiencies in many African countries, our empirical investigation suggests that African countries can improve the innovative performance of firms by enhancing regional institutional quality, in

[30] Foreign ownership is only significant at 10 percent significance level.

addition to national institutions. This finding corroborates the findings of recent studies in the field of innovation such as (Anokhin & Schulze, 2009; Barasa et al., 2017; Blind, 2012; Chadee & Roxas, 2013; Lu et al., 2013).

In summary, the empirical analysis thus far conducted strongly supports the claim that regional institutional quality is one of the main determinants of firm innovation. It confirms that enhancing regional institutions in developing countries in general, and African countries in particular, is imperative in order to improve the innovation capacity of firms and the country at large. From policy perspectives, however, it would be worthwhile if we had a better idea of which regional institutional framework is crucial and has a greater impact on innovation for two reasons. First, different types of regional institutions may influence innovation in various ways. For instance, there are two opposing views as to whether corruption enhances or harms firm performance and productivity. As mentioned in literature review section, a large number of studies demonstrated that corruption hampers innovativeness of firms. However, some researchers claim that corruption enhances the efficiency of an economy by lubricating the 'squeaky wheels' of bureaucracy and/or by giving firms and individuals a means to avoid burdensome regulations and ineffective legal systems and this alternative hypothesis is supported by limited number of empirical studies (Mahagaonkar, 2010; Williams & Kedir, 2016). However, most studies found that regulatory quality affects firms' productivity and innovation positively (Blind, 2012). Second, institutions are generally believed to be persistent over time, therefore, it would take time to change. In addition, setting up and building high-quality institutions requires resources which makes it difficult for developing countries, like African countries, to change all three institutional infrastructures simultaneously. Thus, identifying which institutional arrangement has a greater impact on the dynamics of innovation is vital for allocating limited resources efficiently. For this purpose, we included the three institutional arrangements, i.e. corruption, rule of law and regulatory quality, in a separate innovation model and estimated the impact of each arrangement on innovativeness separately by using the same multilevel logit model. The results are reported in Table 4.6.

Table 4.6: Different institutional indicator

	(1)	(2)	(3)
	Dependent variable: Product innovation		
Firm level			
Gov	-0.292	-0.298	-0.297
	(0.203)	(0.203)	(0.203)
For	0.172*	0.175*	0.178*
	(0.0838)	(0.0838)	(0.0838)
Size	0.0877***	0.0874***	0.0872***
	(0.0250)	(0.0250)	(0.0250)
Age	0.0791*	0.0759	0.0769
	(0.0395)	(0.0396)	(0.0396)
Expo	0.162	0.154	0.156
	(0.0835)	(0.0835)	(0.0834)
Mang	-0.0263	-0.0281	-0.0273
	(0.0406)	(0.0406)	(0.0406)
R&D	1.100***	1.100***	1.099***
	(0.0759)	(0.0760)	(0.0760)
School	0.00656	0.00646	0.00451
	(0.0257)	(0.0257)	(0.0257)
Train	0.552***	0.551***	0.554***
	(0.0642)	(0.0642)	(0.0642)
Email	0.307***	0.311***	0.313***
	(0.0641)	(0.0642)	(0.0641)
Regional level			
Corruption	0.994***		
	(0.256)		
Regulatory Quality		0.655	
		(0.388)	
Rule of Law			0.964**
			(0.324)

Constant	-1.425***	-1.357***	-1.369***
	(0.188)	(0.193)	(0.190)
Random Parameter			
$\sigma^2{}_{intercept}$	0.945***	1.114***	1.019***
	(0.180)	(0.209)	(0.193)
N	8310	8310	8310
AIC	9172.4	9183.5	9177.9
χ^2	510.9	500.6	505.6
LR test	963.33***	1189.19***	1039.31***

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

As shown in the table above, the signs of all three institutional indicators are positive but the significance level varies (see Table 4.6). While the coefficients of control of corruption and regional rule of law are significant, the coefficient of regulatory quality is insignificant at conventional significance level. This result indicates that firms located in regions where corruption is lower and rule of law is maintained are more innovative than their counterparts and, accordingly, improvement in rule of law, which includes, but not limited to, minimizing regional crime, reducing regional political instability, and promoting regional impartial courts, and controlling corruption can positively influence firms' propensity of innovation.

4.4.5. Robustness check

In order to conclude that the relationship between local institutional quality and firms' propensity to innovate was indeed valid, we conducted two different robustness checks. First, drawing from previous studies, we thought that some industries may tend to be more innovative by nature than others. Therefore, firms operating in different industrial sectors may show dissimilar innovation performance even though they are similar in all other characteristics. In order to account for this industry-specific difference, we estimated the innovation model by adding an industry fixed effect and the result is presented in the second column of Table 4.7.[31] As shown in the table, not only the coefficient of local institutional quality but also the coefficient of other determinants of firm innovation remain nearly unchanged, indicating the

[31] 31 industrial sectors were included in the survey.

robustness of our empirical results with the inclusion of industry fixed effect as additional control variables.

Table 4.7: Robustness check

	(1)[a] Product Innovation	(2) Product Innovation	(3) Product Innovation	(4) Technological Innovation
Firm level				
Gov	-0.296	-0.268		-0.210
	(0.203)	(0.208)		(0.233)
For	0.176*	0.172*	0.201*	0.202*
	(0.0838)	(0.0839)	(0.0833)	(0.0907)
Size	0.0873***	0.0958***		0.135***
	(0.0250)	(0.0261)		(0.0277)
Age	0.0766	0.0725	0.0838*	0.0946*
	(0.0396)	(0.0399)	(0.0393)	(0.0422)
Expo	0.157	0.145		0.152
	(0.0835)	(0.0847)		(0.0921)
Mang	-0.0269	-0.0388	-0.0379	-0.0349
	(0.0406)	(0.0409)	(0.0408)	(0.0437)
R&D	1.100***	1.092***	1.102***	1.410***
	(0.0760)	(0.0765)	(0.0761)	(0.0929)
School	0.00542	0.0139	0.0149	-0.0134
	(0.0257)	(0.0260)	(0.0259)	(0.0278)
Train	0.552***	0.543***	0.568***	0.578***
	(0.0642)	(0.0649)	(0.0644)	(0.0716)
Email	0.311***	0.327***	0.364***	0.367***
	(0.0641)	(0.0652)	(0.0640)	(0.0689)
Gov1			-0.278	
			(0.164)	
Size1			0.218*	
			(0.0872)	

Expo1			0.179*	
			(0.0914)	
Regional level				
Inst	1.128**	1.009**	0.992**	1.577***
	(0.343)	(0.331)	(0.329)	(0.450)
Constant	-1.385***	-1.376***	-1.177**	-0.499
	(0.189)	(0.386)	(0.382)	(0.391)
Random parameter				
$\sigma^2{}_{intercept}$	0.999***	0.885***	0.873***	1.721***
	(0.189)	(0.179)	(0.176)	(0.329)
N	8310	8310	8351	8250
AIC	9176.1	9166.3	9217.7	8461.4
χ^2	507.2	564.7	562.6	618.5
LR test	1049.69***	484.00***	482.94***	931.55***
Sector fixed effect	NO	YES	YES	YES

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The second robustness check conducted was to use alternative measures for control variables and dependent variables. Initially, we changed the dummy variables of government ownership, which took the value 1 if government ownership was 20 percent, to 10 percent. Similarly, a dummy variable for export took the value 1 if a firm directly exported at least 10 percent of its products and service. For the purpose of the robustness check, the percentage of direct export was changed to 20 percent, so the dummy variable for export now took the value 1 if the firm exports at least 20 percent. Size of the firm was measured by the number of employees in previous estimation, now size was specified by a dummy variable that took the value 1 if the firm is considered 'large', 0 otherwise. The regression result is presented in column 3 of Table 4.7. The coefficient of the institutional quality variable is positive and significant, confirming the robustness of our result to alternative measures of control variables.

As a further check, the measure of the dependent variable, innovation, is defined as technological innovation so as to include process innovation. In our baseline innovation model, a firm is understood to have engaged in innovative activities if it introduced a new or significantly improved product or service prior to the survey, i.e. product innovation. According to OECD definition, there are four types of innovation: product, process,

organization, and marketing innovation. The first two are classified as technological innovation, the latter as non-technological innovation. Our last robustness check considers a firm to be innovative if the firm engaged in either of the first two types of innovations, product and/or process. Thus, the last column of Table 4.7 demonstrates logistic regression estimates for the determinants of the technological innovation model. The estimated coefficient of the regional institutional quality indicator is nearly similar to those presented in all specifications presented in the previous section. In a nutshell, all estimated regression so far supports our hypothesis that regional institutions determine the performance of firm innovation. [32]

4.5. Conclusions and policy recommendations

In this chapter, we examined the role of regional institutional quality on firms' propensity to innovate and compared the relative importance of three institutional arrangements on firms' innovation. To this end, we used a sample of more than 11,000 firms from 19 African countries operating in various sectors. After taking into consideration the sample design of the survey, we estimated the innovation model by using multilevel logistic regression.

Our empirical investigation has drawn three important conclusions. First, there is no significant relationship between firm-specific factors such as age, ownership, and exporting, and firm innovation. Nonetheless, firms' propensity to innovate is significantly determined by R&D expenditure, employee OJT, and the capability of managers/owners of adopting new technologies. Second, the innovation performance of firms is significantly affected by regional institutional quality. This is true even after controlling for a wide range of determinants of innovation and industry fixed effect. Third, among different regional institutions' arrangements, controlling corruption and maintaining rule of law appeared to matter the most for firm innovation.

These findings have important policy implications for accelerating economic growth and promoting innovation in Africa. First, it is highly essential to enhance the capacity of African firms to spend more on R&D, provide OJT for their employees, and for owners/managers to enhance their familiarity with technology. Second, given the institutional deficiencies in many African countries, policymakers in the region should focus not only on improving national institutions but also regional institutions, so that the rate of innovation

[32] Note that similar robustness check also conducted for disaggregated regional institution indicators-corruption, rule of law, and regulatory quality- and the estimation results are similar to Table 5.7.

increases. Third, since improving institutional quality at the regional level would take time and might not be accomplished swiftly, policymakers could start by improving regional rule of law and controlling regional corruption in order to build better regional institutions in Africa which would have a greater impact on innovation.

This study is not without its limitations relative to the proxy of innovation. Since only binary data is available for most of our sample, we couldn't use a different proxy of innovation such as patent. It will be interesting in future research, to examine whether employing a different measure of innovation will give different conclusions. Thus, the direction of future research would be to further examine determinants of innovation using other measures of innovation and comparing it with the current study.

CHAPTER 5

5. RELATIONSHIP BETWEEN INNOVATION, REGIONAL INSTITUTIONS AND FIRM PERFORMANCE: MICRO-EVIDENCE FROM AFRICA

Abstract

Although African countries have registered rapid economic growth in the last two decades, their populations are still food insecure and firms are less productive than their counterparts in other parts of the world. Considering the relevance of productivity in sustaining long-term growth, job creation and alleviating poverty, analyzing the factors that influence productivity of African firms has the utmost importance. The aim of this chapter is to examine empirically the extent to which innovation and the quality of regional institution affect firms' productivity. To this end, a firm-level dataset from 15 African countries was used and the three-step CDM approach was employed. The empirical results of the study highlight that innovation has a significant positive impact on firms' productivity. Furthermore, we find that regional institutional quality is an important determinant of productivity, particularly for firms at low productivity distribution.

Keywords: Productivity, regional institutions, CDM model, Africa

JEL classification: L26, O31, D24

5.1. Introduction

Following a prolonged period of economic stagnation, African countries have registered rapid economic growth in the last two decades. However, this economic resurgence is negligible when considered on a per-capita basis. An average individual in Africa still gets a per capita GDP of 6 times lower than the world average in 2018.[33] Human development indicators also reflect a similar picture. According to FAO (2017) report, a third of African population is still extremely food insecure, which is four times higher than other parts of the world, and seven out of ten countries with largest extreme poverty population are in Africa. It is with this reality that African countries set out an ambitious goal of poverty-free Africa in 2030 and Agenda 2063.[34] The question of how these goals can be achieved and lift millions of Africans out of poverty has been the main concern of international organizations, policymakers, and research community.

Policy-makers and researchers widely acknowledge that productivity growth at firm level is not only crucial for long-term growth but also for job creation and poverty reduction. For instance, UNCTAD (2015) suggested that enhancing the productivity of firms is one of the mechanisms through which developing countries achieve sustainable industrial development and growth. Likewise, numerous theoretical and empirical studies have indicated that the contribution of total factor productivity (TFP) to economic growth is higher than the combined effect of factors of production (Mohnen & Hall, 2013). It is probably for this reason that recent growth theories mainly concentrated on the question of what explains productivity growth than the growth itself. Productivity growth can also contribute to poverty reduction. When goods are produced with more efficient technologies, prices of goods and services decline, the purchasing power of the poor increases; accordingly, the well-being of the people improves (Cirera & Cusolito, 2019). Therefore, it can be stated that Africa's quest to meet abovementioned goals necessitates sustained improvement in the productive capacities of its firms.

Over the past three decades, several attempts have been made to search for factors that influence firms' productivity. Traditionally, it has been suggested that productivity growth originates from firms' specific action, innovation. In this regard, the endogenous growth theory

[33] https://www.imf.org/external/datamapper/datasets/WEO/1

[34] In 2015, countries adopted the Sustainable Development Goal (SDG) i.e. Agenda 2030 as a successor of Millennium Development Goal. One of the first goal of SDG is to end poverty by 2030. In the same year, African leaders plead for Agenda 2060. It is Africa's long-term vision to transform the continent into the global powerhouse by 2060. .

of Romer (1990) suggested that economic system in which a firm is operating determines incentives for involving in innovative activities and innovations in turn promote TFP. Ample number of studies has provided empirical support to the Romer's work by confirming the critical role of innovation in enhancing productivity (Baumann & Kritikos, 2016; F. Crespi & Pianta, 2008; G. Crespi & Zuniga, 2012; Crowley & McCann, 2018; Geroski, 1991; Bronwyn. Hall & Sena, 2017; Van Leeuwen & Klomp, 2006). This line of work also demonstrated the importance of policies that promote innovation like R&D expenditures or well protected property rights.[35]

Besides innovation, recent studies have revealed that higher level of productivity is also associated with higher level institutional quality (Goedhuys & Srholec, 2015; LiPuma, Newbert, & Doh, 2013). In these studies, institutions are defined as the "rules of the game" which shape incentive structure and accordingly peoples' behavior and, in turn, determine how opportunities and resources will be allocated in an economy. It is a widely held view that better institutions affect long-run growth through their effect on the provision of incentives, which creates better resource allocation, and reduction of uncertainty and transaction costs for economic actors to engage in innovative and productive activities. These studies distinctly focus on institutions at national level than at sub-national level, assuming that institutional quality is the same in various regions within a country. However, as evidenced by (Bennett, 2019; Lasagni, Nifo, & Vecchione, 2015; H. Lee & Lee, 2018), each regional government formulate rules and regulation of transactions that exert influence on firms' performance. Compared to the importance given to institution in the literature, there has been little empirical evidence as to whether and to what degree regional institutional quality affects firms' productivity.

Our objective in the present study is to shed light whether and to what extent innovativeness of a firm and the quality of regional/local institutions enhances firm productivity in Africa. More specifically, the main questions addressed in this study are: i) Are innovative firms more productive than non-innovators? If so, which type of innovation is more important? ii) Does the quality of regional institutions impact firms' productivity? iii) Does the return of innovation and regional institutions vary at different level of productivity distribution? For this purpose, we used a firm-level data from the World Bank Enterprise Survey (WBES) of 15 African countries and the three-step CDM model to estimate the relationship. A regional

[35] For instance, the Europe 2020 strategy, which was adopted by the European Council in 2010, sets R&D spending target of 3 percent of GDP for EU members to achieve its goal of smart, sustainable and inclusive growth (Andersson, Johansson, Karlsson, & Lööf, 2012, p. 2).

institutional indicator is constructed for each region in our sample based on the perception of firms regarding corruption, regulatory quality, and rule of law. The results of our empirical investigation support the hypothesis that firms that invest in R&D are more innovative and innovative firms are more productive. Furthermore, in addition to innovation and other conventional factors, regional institutional quality significantly affects firms' performance, particularly for firms at low productivity distribution. Therefore, our empirical findings suggest that improving the quality of regional institutions, in addition to promoting R&D and innovation, is essential to enhance the productivity of firms in Africa.

The present paper contributes to the existing literature in several ways. First, although plenty of works have been carried out on the impact of innovation and institutions in recent decades, number studies on Africa, the region which needs the productivity enhancement the most, are still very limited. This paper aims at filling this gap by providing evidence for a larger set of African countries. Second, the present study contributes to the existing literature by providing new empirical evidence on the role of regional/local institutions on firm productivity. Vast majority of the previous studies *treat countries as homogeneous units* and assume that quality of institutions is the same all over a country. However, most recent studies show that quality of institutions and accordingly productivity of the firms vary across a country (Bennett, 2019; Lasagni et al., 2015). Therefore, this paper helps us to improve our understanding of this rarely examined issue. Third, by applying quantile regression for the productivity equation at the last stage of the analysis, we provide empirical evidence that the effect of innovation and regional institutions varies across different productivity distribution.

The remainder of this chapter organized as follows: Section 5.2 provides a review of literature in the topic while section 5.3 discusses the empirical methodology and data. Section 5.4 presents and discusses the empirical result of the study and the final section concludes the study and provide policy recommendations.

5.2.Literature review

5.2.1. Innovation and firm productivity

The determinants of economic growth can be identified from either the demand-side or supply-side of the economy. Following the demand-side, determinants of economic growth are those variables that create GDP. Mathematically the components of GDP are given as $GDP = C + I + G + NX$, where C, I, G, and NX denote consumption, investment, government

expenditures and net export, respectively. Thus, economic growth can be achieved by increasing these variables. Based on the supply-side of the economy, determinants of economic growth are derived from production function, and those that determine production (output) also determine growth. For instance, the Cobb-Douglas production function is given as $Y = f(K, L, A)$, where Y denotes output, K represents capital, L represents labor, and A denotes TFP. It would mean that the main factors that generate growth are production factors (L and K) and TFP. Needless to say, production function was augmented to include other variables, such as human capital, over the years.

The seminal work of Solow (1956) popularized the supply-side determinants of economic growth, and empirical analysis of the source of long-term growth became one of the widely studied topics in economics. In general — following Cobb-Douglas production function— growth can be achieved in either/both of the two ways: increase factor input, or increase output using the same level of input (Caselli, 2005). The first alternative requires adding more resources, such as capital, labor, into production while the second is to improve the productive efficiency of the economy so that more goods and services can be produced without the need for extra inputs. Empirical studies, however, have found that output growth predominantly is explained by productivity growth or commonly known as 'Solow residual' or "the economists' measure of ignorance" (Abramovitz, 1993; Bronwyn Hall, 2011). However, it was not until the rise of endogenous growth theory that this residual accounted in the analytical framework of growth theories, and mainly considered to be 'endogenous'. Recognizing the importance of productivity, the main focus of growth economists has been changed into investigating what determines productivity growth. Romer (1990) indicated that innovation, by rising productivity, is one of the major sources of economic growth for countries and competitiveness for firms.

Of course, the discussion on the economic contribution of innovation on productivity, hence growth, dates back to Adam Smith. Smith argued that productivity increases through the division of labor (Huggins & Izushi, 2007). Joseph Schumpeter (1942, pp. 82-83) also pointed out that it is "the new consumers' goods, the new methods of production or transportation, the new markets, the new forms of industrial organization" that contributed for the success of the capitalist economic system. The effect of innovation is not only to innovative firms but also for the economy as a whole. Initially, innovative firms hold a monopoly power for a short period of time in which they accumulate monopoly profit. But because of the spillover effect in the

market, innovation not only benefits the innovator but eventually to the entire industry as well (Stojčić & Hashi, 2014).[36] It is also likely that less innovative firms will exit from the market, and firms that can innovate enter into the market. At a country level, entry of efficient firms and exit of less efficient firms enhance the efficiency of the country's economy as a whole (Mohnen & Hall, 2013; Rajapathirana & Hui, 2018).

Successful innovation requires considerable efforts and expenditures on R&D, tangible products, such as machinery or equipment, and non-tangible activities, such as on-the-job training (OJT). Firms spend in these innovative activities expecting to get a return in the future, in terms of productivity/profitability. Thus, innovative firms are expected to be more productive than non-innovator. In fact, successful innovation leads to a rise in the value of firms' product (particularly product innovation), reduction of cost (specifically processes and organizational innovation), and differentiate firms' product from competitors (marketing innovation). Integrating these relationships between innovation input (R&D), innovation outcome, and productivity, Crépon, Duguet, and Mairessec (1998) develop an empirical model that comprises a recursive system of three equations, commonly referred as CDM model. The first equation in the model analyzes factors that determine the propensity of firms to conduct R&D and the intensity of the expenditure. The second equation describes the impact of R&D on the probability of innovation while the last equation explains the impact of innovation on firms' productivity. Using the French Community Innovation Survey (CIS) and estimating the model using Asymptotic Least Squares, the authors conclude that firms that spend more in R&D are more innovative, and innovative firms are more productive.

Following this pioneering paper, many empirical studies have been conducted using firm-level datasets such as CIS and WBES to investigate the nexus between innovation input, innovation output, and productivity. The empirical results of these studies seem to confirm the hypothesis that firms engaged in R&D are more innovative and innovative firms are more productive than their counterparts, especially in developed countries. For instance, Griffith, Huergo, Mairesse, and Peters (2006) employed the CDM model using the CIS dataset for France, Germany, Spain the United Kingdom. Their empirical investigation indicates that spending on R&D has a significant positive impact on both product and process innovation. However, the effect of innovation on productivity varies depending on the types of innovation

[36] The introduction of the Oslo manual in 1992 paved a way for a comprehensive survey around the world and a standard measure of innovation outcome. OECD (2018) defines innovation as the introduction of new or significantly improved products, processes, organizational, and marketing methods.

considered: product innovation has a significant and profound effect on firm productivity than process innovation.[37] In contrast, Lööf & Heshmati (2006) conducted a sensitivity analysis on the relationship between innovation and productivity using the CDM model and conclude that innovation significantly affects firms' productivity regardless of estimation methods, measures of productivity and types of innovation.

Parisi, Schiantarelli, and Sembenelli (2006), on the other hand, examine the effect of innovation on productivity employing the CDM model for Italian firms. The authors found that spending on R&D is more strongly related to process innovation, and process innovation has a larger effect on firms' productivity. Martin and Nguyen-Thi (2015) employed the CDM approach to analyze the effect of R&D and ICT on innovation and productivity using firm-level data of Luxemburg and found a significant positive relationship between innovation and firm productivity. Baumann and Kritikos (2016) also employed the CDM approach to examine whether the relationship between R&D, innovation, and productivity of micro firms differ from their counterparts using data of German firms. Their empirical results indicate that micro firms do exhibit similar patterns as far as the relationship between R&D, innovation and productivity is concerned, albeit the effect of R&D larger for product innovation than process innovation. An empirical study by Stojčić and Hashi (2014) using firm-level data from 12 European countries also indicate that innovation, especially process and technological, significantly improves productivity. Using the micro-moments database for European countries, the empirical study of Bartelsman, van Leeuwen, and Polder (2017) indicate that innovation enhances the aggregate productivity of firms even though its impact at the firm level is insignificant.

In a nutshell, most of the previous studies that employed the CDM model to analyze the effect of innovation on productivity for the case of developed countries have produced similar results: innovation significantly and measurably affects productivity.

Contrary to the results of developed countries, existing studies on the case of developing countries have produced mixed findings. In this regard, three conclusions emerge from the empirical investigation on the impact of innovation on productivity. The first group of studies argued that although firms in developing countries do innovate, they encounter obstacles to

[37] Crépon et al. (1998) estimated the four equations jointly using asymptotic least square, but later studies used an instrumental variable method by using the predicted values. According to Mohnen and Hall (2013), the estimation results using either of the estimation methods produce similar results provided that endogeneity and selection bias is taken into account.

translate the innovation output into productivity. For instance, in their empirical analysis on the effect of innovation on productivity using a firm-level data from Tanzania, Goedhuys, Janz, and Mohnen (2008) found that innovation, both product and process, is not a significant predictor of firm productivity. The author suggested that Tanzanian firms were engaged in incremental innovation that did not have any significant impact on productivity and recommended that the government should improve the business environment so as to enhance the effect of innovation on productivity. The empirical results of Benavente (2006) also indicate that the productivity of Chilean firms is not determined by innovation and R&D. Similarly, Raffo, Lhuillery, and Miotti (2008) compare the effect of innovation on the productivity of selected developed countries, namely France, Spain, Switzerland, and developing countries including Brazil, Mexico, and Argentina. Their empirical results indicate that innovation positively and significantly affects firm productivity in all countries except Argentina.

The second group of studies has found empirical evidence consistent with the results of developed countries i.e. innovation significantly affects productivity. For instance, G. Crespi, Tacsir, and Vargas (2016) conducted an empirical analysis using WBES and employing the CDM model for developing Latin American countries. Their empirical analysis indicates that innovation-both process and product- have a significant and positive impact on firm productivity. The third group of studies, on the other hand, revealed mixed results about the effect of different types of innovation on productivity. It has been argued that some types of innovation have a significant impact while others do not. For instance, in a recent study of Bangladesh firms, Waheed (2017) found that only process innovation affects labor productivity, not product innovation. In short, most of the empirical evidence on the nexus between innovation and firm-level productivity indicate a positive relationship between the two. On this basis, we hypothesize:

H1: All types of innovations i.e. product, process, and technological are positively related to firm productivity.

5.2.2. Institutions and firm productivity

The abovementioned studies have tended to focus on the nexus between internal factors, R&D and innovation, on productivity only. The influence of external factors, such as quality of institutions, has not been treated in much detail. However, macroeconomic studies indicated that institutions, which are defined as the rule of the game, are one of the fundamental determinants of growth (Acemoglu et al., 2001, 2002; Dawson, 1998; Égert, 2016; Hall &

Jones, 1999; K. Lee & Kim, 2009; Rodrik et al., 2004). It has been argued that institutional quality has both direct effects on growth through improving human capital and investment and indirectly through improving TFP (Dawson, 1998). Recently micro-level studies have also acknowledged the importance of institutional quality on firm productivity. For instance, Borghi, Del Bo, and Florio (2016) indicated that the higher quality of the institutional environment is associated with a higher level of firms' productivity in Europe. In another study, Goedhuys and Srholec (2015) examined the effect of national-level institutional quality on firm-level productivity using a multilevel modeling approach and found little effect of governance index on productivity. This study, however, distinctly focuses on institutions at the national level.

Other strands of studies relied on individual firm response to reveal the effect of institutions on productivity. For instance, Faruq, Webb, and Yi (2013), used an individual firm's perception of institutional quality and examined its relationship with firm-level productivity. Using a sample of firms from three African countries, namely Ghana, Kenya and Tanzania, the author concluded that poor bureaucratic quality and corruption reduce firm productivity. Similarly, Bah and Fang (2015) examined the impact of the business environment such as crime, regulation corruption on TFP of firms in selected Sub-Saharan African countries and found that poor business environment negatively affects the TFP of firms.

In addition to national governments, sub-national or regional governments also formulate rules and regulations of transactions; thus, institutional quality varies from one region to the other even within a single country (H. Lee & Lee, 2018; Tran, Huong, Doan, & Tran, 2016). Since firms interact with other firms, households, and government officials during their operation, and most of these interactions occur at the regional level, it is argued that regional institutional quality also influences firms' performance. A recent study by Lasagni et al. (2015), which is closer to the spirit of the present study, offers empirical evidence for this hypothesis using a panel data of Italian firms. Their empirical findings, employing various estimation techniques, indicate that the quality of local institutions is, in fact, one of the principal sources of firms' productivity. In the same vein, Tran et al. (2016) found that a higher level of provincial corruption level is associated with a lower level of firm-level productivity, affirming the significance of the quality of sub-national institutions. A longitudinal study of Chinese firms by H. Lee and Lee (2018) also reports that "private firms cannot prosper without sound

[regional] institutions." This view is supported by Bennett (2019) who indicates the importance of local economic freedom for the growth of firms in the USA.

Regions within a single country in Africa are more heterogeneous than other continents, and this heterogeneity creates differences in the quality of regional institutions. This leads to the second hypothesis of the research:

H2: The quality of regional institutions is positively related to firm productivity.

In a nutshell, numerous studies have investigated the nexus between innovation and firm productivity using the CDM approach but they overlook what we consider an important external determinant of productivity i.e. quality of institutions. Although few studies examine the effect of both innovation and regional institutional quality, their empirical evidence is based on a sample of one country, and most importantly based on the experience of economically/technologically developed countries. A better study would examine the effect of both innovation and regional institutional quality using a larger dataset by pooling data from various countries, employing an empirical methodology that controls for recursive nature of productivity equation, and a set of developing countries in which regions/localities are heterogeneous as a case study. Since all these are taken into consideration in the present study, we believe that this study would provide new insights into this realm.

5.3.Empirical methodology and data

5.3.1. Data Source

In order to investigate the impact of innovation and regional institutional quality on firm-level productivity, we used a firm-level dataset of 15 African countries from WBES. The World Bank collects firm-level data through surveys across the developing world once in three/four years rotation. The data collected through these surveys include information about the surveyed firms, such as age, size and ownership structure, as well as the perception of firms regarding access to finance, corruption, political instability, tax system, and business permit. This study used a sample of African countries for which most recent survey data, especially R&D expenditure data, is available. Thus, our sample includes data form 15 African countries as shown in the following table.

Table 5.1: Sample country and year surveyed

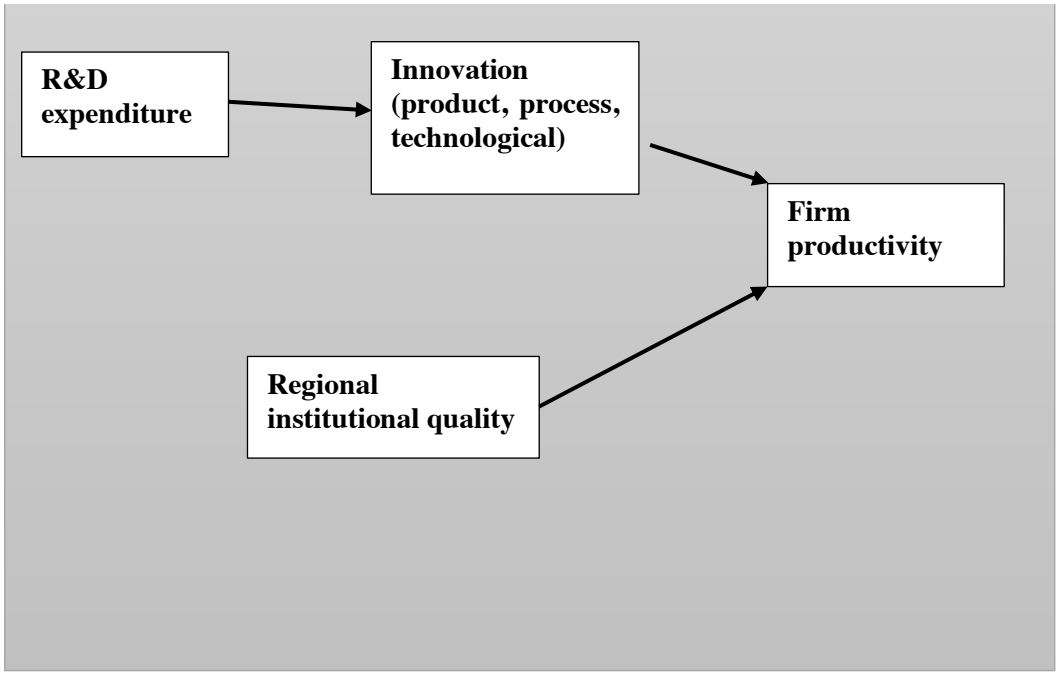
Country	Survey year	Number of firms
Benin	2016	150
Cameroon	2016	361
Chad	2018	153
Côte d'Ivoire	2016	361
Egypt	2016	1,814
Eswatini	2016	150
Ethiopia	2015	848
Gambia	2018	151
Guinea	2016	150
Lesotho	2016	150
Liberia	2017	151
Mali	2016	185
Niger	2017	151
Sierra Leone	2017	152
Togo	2016	150

5.3.2. Empirical Methodology

To estimate the impact of innovativeness and institutional quality on productivity, we used an empirical model in which the first two are explanatory variables that influence dependent variable productivity. However, rather than adopting this model directly, considering the endogeneity problem between productivity and innovation, we preferred to adopt the CDM approach. Since this model controls for causality and endogeneity, it is regarded as a robust method of analyzing the link between innovation and productivity (Lööf, Mairesse, & Mohnen, 2017) and over the past decade, several studies have employed this model to investigate the linkage both in developed (Griffith et al., 2006) and developing countries (Mohan, Watson, & Strobl, 2016; Raffo et al., 2008).

The conceptual framework of the CDM model is that innovation is a process, which is conducted by firms with a particular set of innovative activities, mostly, but not limited to, R&D. These innovative activities produce certain outputs in terms of new or modified products and/or processes (for the firm or the market). Finally, the innovation outputs are not the end of the process but reflected in the performance of firms. Thus, firms that have undertaken innovation are expected to perform better than non-innovators. Accordingly, the nexus between R&D, innovation and productivity is modelled sequentially and estimated in three stages (see the upper panel of Figure 5.1). The CDM approach, however, overlooks an important external determinant of productivity i.e. regional institutional quality. Thus, we included institutional quality variable in the last stage of the model. The theoretical framework of the present study, which is the modified version of the CDM approach, is presented in the following figure.

Figure 5.1: Conceptual Framework



The CDM model comprises a recursive system of three equations and estimated in the three stages. Detail explanation of the three stages of the CDM model is discussed below.

- **First stage: innovation decision and intensity**

In this stage, firms' decision to engage in innovative activities, more specifically on R&D, and the amount of the investment (intensity of innovation) is analyzed. In WBES firms

were asked how much they had spent for R&D in the previous three years. We use this variable as a dependent variable to model innovation-decision and intensity equation as follows:

$$R\&D_i^* = X_i\beta + u_i \quad \text{----------} \quad 5.1$$

Where $R\&D_i^*$ represents the latent unobserved variable (firms' innovative effort), X_i is the vector of determinants of the innovation effort, and u_i is the error term. Consistent with previous studies, the latent variable $R\&D_i^*$ is proxied by the log of R&D expenditure per worker.[38] Because some firms reported that they didn't spend on R&D, the dependent variable contains many zero observations. In such circumstances, the appropriate method of estimation is the generalized Tobit model.[39] Therefore, the generalized Tobit estimation was employed in this study to estimate the probability of spending in R&D and the intensity of the investment. As suggested by (Griffith et al., 2006; Lööf & Heshmati, 2006; Stojčić & Hashi, 2014), the predicted value of R&D is calculated for all firms, not only for those which report R&D expenditure.

In this respect, it can be said that a firm decides to conduct R&D if its latent variable is greater than the industry threshold c. Hence, the firm first decides to conduct innovation investment as given below:

$$R\&D_i = \begin{cases} 1 \ if \ R\&D_i^* = X_i\beta + u_i > c, \\ 0 \ if \ R\&D_i^* = X_i\beta + u_i \leq c \end{cases} \quad \text{----------} \quad 5.2$$

Where $R\&D_i$ is a dichotomous variable that takes the value 1 if the firm had conducted R&D investment and 0 otherwise. The intensity of innovation activities (R&DE) can be expressed as follows provided that the firm had spent on R&D:

$$R\&DE_i = \begin{cases} R\&DE_i^* = X_i\beta + e_i \ if \ R\&D_i = 1 \\ 0 \ if \ R\&D_i = 0 \end{cases} \quad \text{----------} \quad 5.3$$

Over the past decades, several studies have examined this topic and identified various determinants of R&D decision and intensity. Although restricted by data availability, like most studies in this area, our choice independent variables is informed by previous literature (Cirera, Lage, & Sabetti, 2016; G. Crespi et al., 2016; Hall, Lotti, & Mairesse, 2009; Mairesse, Mohnen,

[38] Since R&D expenditure is reported by local currency in the WBES, this variable is converted to the US dollar using annual average exchange rates obtained from the IMF.
[39] The generalized Tobit model has been used by a large number of empirical studies for innovation input equation including G. Crespi and Zuniga (2012), G. Crespi et al. (2016) and Raffo et al. (2008).

& Kremp, 2005; Stojčić & Hashi, 2014). Hence, the following four major determinants are considered in the innovation input equation. First, the commonly discussed factors of innovation input in the literature are firm characteristics. To account for this, we use the following variables: Government ownership (**Gov**), foreign ownership (**For**), managerial experience (**Mang**), the age of the firm **(Age)** and a dummy variable (**Group**). The second factor that determines firms' engagement in innovative activities is demand-pull factors (Cirera et al., 2016). The demand for innovative products in the market motivates firms to spend more in R&D (innovation inputs). In this regard, firms that are integrated into the international market (by exporting or importing) tend to spend more money than their counterparts. Like previous studies, we used two-way trader (**impoexpo**) as a measure of demand-pull factors in innovation input equation. Third, we added a technology push factor, which put pressure on firms to spend more on R&D in order to catch up to the ongoing technological improvement, to the innovation input equation. This factor is captured by the dummy variable **inter_quality**. Fourth, another factor identified in the literature to affect innovation input is access to external knowledge (G. Crespi et al., 2016). To account for this, we use a dummy variable (**large_city**); hence, we assume that firms that are operating in big cities have easier access to knowledge than their counterparts in smaller settlements.

- **Second stage: innovation output equation (innovation production function)**

It has been assumed that R&D, together with other inputs, produces innovation outcomes. Therefore, in this stage, the impact of R&D on innovation outcomes is analyzed. Following recent studies on the topic, we consider three types of innovation: product innovation, process innovation, and technological innovation. Hence, the innovation output equation of the ith firm is given as:

$$In_i = \delta R\&DE_i^* + \gamma z_i + \varepsilon_i \quad \text{----------} \quad 5.4$$

Where In_i is a dummy variable for innovation (product, process, technological innovation) being one for the firm that introduced an innovation, zero, if not; $R\&DE_i^*$ is the latent innovation effort variable predicted from equation 3, z_i is control variables and ε_i is the error term. As discussed by Bronwyn Hall (2011) and Hall et al. (2009) the benefit of including the $R\&DE_i^*$ (the latent R&D intensity variable) than the observed R&D expenditure is twofold. First, it will account for informal R&D effort that is often not reported. Second, it also addresses

simultaneity problems that may arise between innovation and R&D.[40] Similar to the innovation input equation, the choice of control variables for the innovation output equation is also informed by previous studies in this realm (Ayyagari et al., 2011; Cohen, 2010; Hussen & Çokgezen, 2019). They include government ownership (**Gov_owned**), foreign ownership (**For**), the age of the firms (**Age**), internationalization of the firm (**expo**), managerial experience (**Mang**). technological capability of the firm's owner/manager (**email),** human capital of the firms (**highschool)** and (**training)**. Following Ayyagari et al. (2011), we use two dummies i.e. **medium** which takes the value 1 if the firm is medium size and **large** if the firm is considered a large firm to measure the size of the firm. Taking into consideration the dichotomous nature of the dependent variable, the probit estimation method is employed to estimate the parameters.

- **Third stage: productivity equation (output production function)**

In this stage, the impact of all three types of innovation on labor productivity is analyzed. The most widely used approach to conducting such kind of analysis is Cobb–Douglas production function, augmented with innovation. We further argue that quality of regional/local institutions also affects the productivity of the firm; therefore, we introduce regional institutional quality as one of the potential inputs for firm's productivity, and labor productivity equation of the CDM models is given below:

$$y_i = \varphi_1 k_i + \varphi_2 l_i + \varphi_3 In_i + \varphi_4 reg_i + Z_i\pi + u_i \quad \text{----------} \quad 5.5$$

Where y_i is the labor productivity of the i[th] firm proxied by the log of annual sales per worker in US dollar.[41] k_i is the log of physical capital per worker, reg_i is the measure of institutional quality of the region the firm i is operating. Following Barasa et al. (2017) and Chadee and Roxas (2013), regional institutional quality is measured by averaging firm's perception regarding rule of law, regulatory quality and corruption level of the region where the firm is operating.[42] l_i is the log of the total number of workers and In_i is the proxy of innovation which indicates product, process or technological innovation. Since there is simultaneity between innovation and productivity, the predicted value of innovation from the

[40] Cirera et al. (2016) maintain that even though some firms did not report spending on R&D, they may carry out innovation output. Mohan et al. (2016) also argue that innovation is a multidimensional and complex process, and R&D expenditure alone underestimates the true cost of innovation.
[41] Since WBES collects monetary data using local currency, the total value of sales is converted to the US dollar using annual average exchange rates obtained from the IMF to ensure the comparability of sales data for the sampled countries.
[42] See chapter 4 for detail discussion on the calculation of regional-level institutional quality.

innovation equation was used as an instrument. Moreover, following Griffith et al. (2006) and Musolesi and Huiban (2010), product, process and technological innovation indicators are included separately because of the substantial multicollinearity among these variables. To control for unobserved sectoral characteristics and cross-country heterogeneity in the sample, both sector dummies and country fixed effects are included, and the productivity equation was estimated using OLS and later quantile regression analysis.

As argued in many studies (Griffith et al., 2006), the CDM model has two main advantages. First, since it takes not only firms that invest in R&D but also non-spender, it can handle selection bias. Second, it also tackles the problem of endogeneity by adopting a three stages analysis of the link among decision to invest, innovation, and productivity. As discussed above, there exists simultaneity between some of the independent and the dependent variables. For instance, the log of R&D per capita (second equation) may not only affect but also affected by innovation. Therefore, some explanatory variables, like the log of R&D per capita and innovation, are endogenous. The CDM model handles this problem using the predicted value of the R&D per capita, rather than actual value, in the innovation equation and predicted values of innovation in the productivity equation. While it has the aforementioned advantages, it has been also criticized as being static, and its assumption of unidirectional causality from R&D effort to innovation output only, not vice versa (Mairesse et al., 2005; Mohnen & Hall, 2013).

The variables used in this chapter are defined in the following table (Table 5.2).

Table 5.2: List of variables

	Innovation variables	1st stage	2nd stage	3rd stage
tech	A binary variable which takes the value 1 if the firm introduced new/significant product or process		*(dependent)	*(predicted)
product	A binary variable which takes the value 1 if the firm introduced a product innovation		*(dependent)	*(predicted)
process	A binary variable which takes the value 1 if the firm introduced a process innovation		*(dependent)	*(predicted)
	Performance variable			
Product_log	Logarithm of sales per worker			*(dependent)
	Knowledge intensity			
R&D intensity	R&D expenditure per worker	*(dependent)	*(predicted)	
	Firms characteristics			
Gov_owned	A binary variable which takes the value 1 if the government has at least 10% ownership	*	*	
Age	Survey year minus year of firm's establishment	*	*	
Highschool	% of workers with high school degree		*	*
training	A binary variable which takes the value 1 if the firm provides on-job training		*	
group	A binary variable which takes the value 1 if the firm is part of large group	*		
For1	A binary variable which takes the value 1 the firm is at least 10% owned by foreigner	*	*	
Mang	Log of (years) experience of the manager in the sector of the firm	*	*	

lncapital	$ Net book value of machinery vehicles, and equipment in last fiscal year per no of employee.			*
size_numlog	Log of full-time employee			*
Large	A binary variable which takes the value 1 if the firm is large		*	
Medium	A binary variable which takes the value 1 if the firm is medium		*	
exporter	A binary variable which takes the value 1 if the firm is exporting firm		*	
	Access to external knowledge			
large_city	A binary variable which takes the value 1 if the firm is operating in a large city (>1 million)	*		
email	A binary variable which takes the value 1 if firm interact with customers and supplier via email		*	
	Demand Pull (market condition)			
impoexpo	A binary variable which takes the value 1 if the firm is both importer and exporter	*		
	Technology push factor			
inter_quality	A binary variable which takes the value 1 if the firm has internationally recognized quality certificate	*		
	Enabling environments			
regional_instiution	Average of rule of law (crime, political instability, and the courts), regulatory quality (tax rate, tax administration, custom, business permit, and access to land), and corruption of each region			*

5.4.Empirical Results

As noted above, the empirical model of the study encompasses three different, but related, equations. Namely, a) R&D and its determinants, b) R&D and innovation, and c) innovation, regional institution, and productivity. Thus, we discussed the estimation results of each equation in the subsequent sections.

5.4.1. R&D and its determinants

In the first stage of the CDM model, the firm's decision to spend on R&D and the intensity of its expenditure is estimated using the generalized Tobit model. The empirical results are reported in the following table (Table 5.3).

Table 5.3: Empirical results of innovation input equation

	(1) Innovation decision	(2) Intensity of innovation
Gov_owned	0.268***	0.659***
	(0.0926)	(0.226)
For	-0.0293	-0.0719
	(0.0460)	(0.113)
Age	0.0319	0.0782
	(0.0232)	(0.0570)
impoexpo	0.254***	0.624***
	(0.0404)	(0.0971)
Mang	0.0464*	0.114*
	(0.0255)	(0.0627)
group	0.114***	0.280***
	(0.0351)	(0.0862)
large_city	0.0576	0.142
	(0.0422)	(0.104)
inter_quality	0.206***	0.506***
	(0.0415)	(0.101)
N	3960	3960
Pseudo R2	0.06	-
Country dummy	yes	yes
Sector dummy	yes	yes

Standard errors are presented in parentheses
* $p < .1$, ** $p < .05$, *** $p < .01$

The first column presents the marginal coefficients of the probability of R&D expenditure (occurrence of R&D) while the second column reports the estimated coefficients of the intensity of R&D expenditure provided that the firms had decided to invest. In general, the empirical results indicate that government ownership, being both importer and exporter, the experience of firms' manager, belonging to a group, and having an international quality certificate significantly and positively affect both firms' propensity of spending in R&D and the intensity of R&D expenditure. More specifically, firms owned by the government are 26.8% more likely to spend on R&D compared to privately owned firms. This might be due to the fact that R&D is a costly activity that requires financial and human resources, and in Africa, where

capital accumulation in the private sector is very low, only government companies can afford to spend on such resources than the private sector. Similarly, importing and exporting firms are 25.4% more likely to spend on R&D than their counterpart, indicating that demand-pull factors also determine the firm's decision. The empirical result also indicates that firms belonged to a group are 11% more likely to spend on R&D, indicating that belongingness to the group provides an opportunity for the firms to have additional financial and human resources for innovation input expenditure. A one percent increase in years of firms' manager experience also increases the probability to spend on R&D by 4.6%. Likewise, firms with international quality are 20.6% more likely to spend on R&D than their counterpart.

5.4.2. R&D and innovation

In the second stage, the impact R&D on innovation is estimated using the probit estimation method, and the empirical results are reported in Table 5.4 below.[43] Since we consider three types of innovations, the estimation results of each innovation equation are presented in a separate column. In order to address the problem of endogeneity related to R&D variable, the predicted value of R&D in the previous stage is used.

[43] The reported coefficients in the table are marginal coefficients.

Table 5.4: Estimation results for innovation output with predicted R&D

	(1) Product innovation	(2) Process innovation	(3) Technological innovation
R&D (hat)	0.0113***	0.00407	0.0123***
	(0.00408)	(0.00299)	(0.00447)
Gov_owned	-0.147**	-0.00240	-0.0860
	(0.0596)	(0.0389)	(0.0627)
For1	0.0341	0.0223	0.0397*
	(0.0211)	(0.0153)	(0.0235)
Age	0.00394	0.0115	0.00883
	(0.0109)	(0.00815)	(0.0120)
exporter	0.0126	0.0248	0.0193
	(0.0252)	(0.0185)	(0.0276)
Mang	-0.0208*	-0.0171**	-0.0209
	(0.0118)	(0.00850)	(0.0131)
email	0.0572***	0.0515***	0.0704***
	(0.0181)	(0.0139)	(0.0198)
highschool	-0.0000606	-0.00182	0.0000881
	(0.00637)	(0.00486)	(0.00705)
training	0.152***	0.0947***	0.162***
	(0.0159)	(0.0117)	(0.0177)
Medium firms	-0.0110	0.0205	-0.00678
	(0.0178)	(0.0135)	(0.0195)
Large firms	0.0253	0.0280	0.0366
	(0.0247)	(0.0182)	(0.0270)
N	3378	3369	3364
Pseudo R2	0.184	0.214	0.202
Country dummy	yes	yes	yes
Sector dummy	yes	yes	yes

Standard errors are presented in parentheses
* $p < .1$, ** $p < .05$, *** $p < .01$

The first column of Table 5.4 presents the empirical results of product innovation. It indicates that spending on R&D significantly and measurably affects the propensity of product

innovation. It indicates that the propensity of innovation is higher for firms that spend on R&D than non-spender, leading to the conclusion that firms have to spend more on R&D in order to be product innovator. It is worthwhile noting that government-owned (*Gov_owned*) firms are less innovative even though they tend to spend more in R&D, implying that such types of firms inefficiently spent the budget allocated for R&D. Counterintuitively, the coefficient of ***highschool***, which represents the percentage of workers with a high school diploma, is insignificant. It was expected that more educated employees would contribute to the innovation effort of the firms. Nonetheless, the insignificance, and surprisingly negative sign, of this variable may be due to the nature of innovation in developing countries. Firms in developing countries, particularly in Africa, are engaged in incremental innovation, not radical such as a new brand of computer or telephone etc. that may not need an educated employee. As argued by recent empirical studies, such as van Uden et al. (2017), employee schooling may not be a significant determinant of firm innovation in developing countries but other forms, such as OJT, might be important for the innovativeness of firms.

Our empirical investigation also shows that foreign ownership, the age of the firms, exporting, and the size of the firms (proxied by dummy variable as Large firms and Medium firms) are insignificant. This result is in line with previous studies as these studies reported both in favor and against these variables with regard to the probability of innovation. Consistent with the literature, the estimated results show that OJT and the use of email to interact with buyers and customers significantly predict the probability of firm's innovation. It indicates that firms that provide OJT for their workers are 15% more likely to be product innovator while firms whose managers/owners are technological friendly i.e communicate with customers and buyers through email are 6 percent more likely to be product innovator.

The second column of Table 5.4 reports the marginal coefficients of the process innovation equation. It indicates that R&D expenditure, unlike in the product innovation equation, do not have a significant impact on the probability of firms to engage in process innovation. This result, thus, suggests that process innovation does not depend on the amount of finance on R&D, probably because, as argued by (Mohan et al., 2016), replicating technologies already existed in developed countries might be more important for process innovation. Except for government ownership and medium firms, the sign and the significance of other control variables are similar to the product innovation equation. More specifically, OJT

and email have a significant positive effect on the probability of process innovation while the impact of the experience of firms' manager is negative.

Types of innovations are divided broadly into two categories: technological and non-technological. While product and process innovation are considered as technological innovation, organization and marketing innovation is called non-technological innovation. In view of the potential benefits of technological innovation, we investigated the effect of R&D on the propensity of firms to engage in technological innovation (either product or process). The third column of Table 5.4 reports the empirical estimation result of the technological innovation equation and it strongly suggests that R&D expenditure significantly predicts the probability of firms to engage in technological innovation, supporting the hypothesis that spending on R&D has a significant impact on firm innovation performance. Except for foreign ownership, which indicates the positive relationship between foreign ownership and technological innovation, the significance and the sign of other control variables remain similar to our previous results.

In a nutshell, the empirical results of the innovation equation suggest three points. First, R&D is a significant predictor of the propensity of firms' innovation in product and technological innovation but not process innovation. Second, once the endogeneity of the R&D variable is accounted for, firms' specific factors such as ownership, age, size, exporting, and even education level of employees are not a significant predictor of any type of innovation. Third, internal factors such as OJT and the use of email profoundly affect the innovativeness of firms in the sampled countries. This is good news for African firms that are small, young, and staffed with low educated employees. Our empirical investigation demonstrated that firm in Africa can improve their innovative capacity by training their employees, spending on R&D, and adopting information technology.

5.4.3. Innovation, regional institutions and firm-level productivity

In the third stage of the CDM model, the effect of firm innovativeness and regional institutional quality on labor productivity of firms is estimated using the OLS estimation technique. Each of the innovation types is included separately in the productivity equation in order to tackle the multicollinearity problem. In addition, to address the possible endogeneity of innovation variables, the predicted values of each innovation type in the previous stage are used and the labor productivity equation is estimated. The empirical results are presented in the

following Table 5.5 where the first column presents when product innovation enters into productivity estimation, the second process innovation, and the third column technological innovation.

Table 5.5: Estimation results of labor productivity (OLS regression)

	(1)	(2)	(3)
	Dependent variable: Labor productivity		
product_hat	1.346***		
	(0.360)		
process_hat		1.537***	
		(0.408)	
tech_hat			1.682***
			(0.364)
regional_institution	0.356*	0.386*	0.359*
	(0.213)	(0.214)	(0.212)
lncapital	0.222***	0.222***	0.218***
	(0.0167)	(0.0167)	(0.0167)
highschool	0.112***	0.116***	0.109***
	(0.0347)	(0.0347)	(0.0347)
size_numlog	0.108***	0.110***	0.0856***
	(0.0263)	(0.0260)	(0.0275)
_cons	6.447***	6.561***	6.343***
	(0.247)	(0.244)	(0.250)
N	1299	1299	1299
adj. R^2	0.559	0.559	0.561
Country dummy	yes	yes	yes
Sector dummy	yes	yes	yes

Standard errors are presented in parentheses
* $p < .1$, ** $p < .05$, *** $p < .01$

As shown in the table above, all types of innovation, namely product, process, and technological innovation significantly affect the productivity of firms. Our empirical investigation indicates that product innovators are 1.4 times more productive than non-innovator while process and technological innovators are approximately 1.5 times more productive than non-innovator. This result corroborates to previous studies, such as (Cirera & Cusolito, 2019; G. Crespi et al., 2016; Hall et al., 2009; Stojčić & Hashi, 2014) to name a few,

and suggest that there is a need to enhance the innovative capacity of firms in order to improve their productivity.

Regarding our variable of interest regional institutional quality, the empirical investigation confirms our initial hypothesis that firms located in a region where institutional quality is better are more productive than firms located in regions where institutional quality is poor. As can be seen from the table above, the coefficients of regional institutional quality are positive and significant in all of the three models. These results would seem to suggest that better regional institutions enable firms to improve their productivity. On the contrary, firms located in a region where institutions are poor face risk and uncertainty, which in turn affect their productivity negatively.

Like previous studies in this realm, our empirical results further indicate that control variables which include labor (***siz_numlog***), human capital (***highschool***), and capital intensity (***lncapital***) significantly affect the productivity of firms in Africa.

5.4.4. Differences in returns to innovation and regional institutions

It is likely that the effect of innovation and regional institutions might differ on various productivity distributions. For instance, regional institutional quality might be more important for firms at a lower level of productivity distribution than those at higher productivity distribution. Similarly, the impact of innovation on productivity could be heterogeneous for firms. Therefore, to analyze the effect of innovation and regional institutions on firm productivity at different levels of productivity distributions, we conducted a quantile regression at 25%, 50% and 75% levels and the empirical results for different types of innovations are reported in Table 5.6, 5.7 and 5.8.

The following Table 5.6 reports the estimated coefficients of quantile regression when product innovation is included as an independent variable in the productivity equation. The first column reports the estimation with 0.25 quintiles, the second column with 0.5 quintiles and the third column with 0.75 quintiles. As shown in the table, the significance and the sign of all variables, except the regional intuitional quality indicator, remain the same for different quintiles. These results indicate that the quality of regional institutional quality is crucial for firms at the lower and upper levels of the productivity distribution.

Table 5.6: Estimation results of labor productivity (quintile regression)

	(1)	(2)	(3)
	Dependent variable: Labor productivity		
	0.25	0.5	0.75
product_hat	1.190**	1.163**	1.867***
	(0.560)	(0.549)	(0.414)
regional_institution	0.464**	0.345	0.491**
	(0.204)	(0.284)	(0.213)
lncapital	0.253***	0.252***	0.215***
	(0.0295)	(0.0287)	(0.0285)
highschool	0.152***	0.126***	0.0457
	(0.0588)	(0.0429)	(0.0451)
size_numlog	0.101***	0.127***	0.126***
	(0.0299)	(0.0337)	(0.0325)
_cons	5.439***	6.260***	7.399***
	(0.307)	(0.459)	(0.308)
N	1299	1299	1299
Country dummy	yes	yes	yes
Sector dummy	yes	yes	yes

Standard errors are presented in parentheses
* $p < .1$, ** $p < .05$, *** $p < .01$

Likewise, the following table reports the quantile regression result of the productivity equation when process innovation is considered as an independent variable. As shown below, all the independent variables are significant at all quintile level, except regional institutions. Regional institutional quality has a significant positive effect on productivity at a lower distribution of the productivity level only.

Table 5.7: Estimation results of labor productivity (quintile regression)

	(1)	(2)	(3)
	Dependent variable: Labor productivity		
	0.25	0.5	0.75
process_hat	1.599***	1.250***	2.176***
	(0.497)	(0.304)	(0.588)
regional_institution	0.616***	0.358	0.415
	(0.220)	(0.227)	(0.285)
lncapital	0.257***	0.251***	0.222***
	(0.0264)	(0.0274)	(0.0230)
highschool	0.148*	0.129***	0.0556*
	(0.0759)	(0.0375)	(0.0293)
size_numlog	0.0975***	0.120***	0.126***
	(0.0341)	(0.0340)	(0.0268)
_cons	5.489***	6.449***	7.488***
	(0.196)	(0.507)	(0.298)
N	1299	1299	1299
Country dummy	yes	yes	yes
Sector dummy	yes	yes	yes

Standard errors are presented in parentheses
* $p < .1$, ** $p < .05$, *** $p < .01$

Finally, the productivity equation is estimated using quantile regression and technological innovation is used as an independent variable. The empirical results are presented in the following table (Table 5.8). The first column reports at 0.25 quintile, the second for 0.50 and the last column reports 0.75 quintiles. These results are similar to previous estimation results in that all control variables are significant at all quantile, albeit the magnitude varies. The variable of our interest, regional institutions, however, is significant only at 0.25 quantile, indicating that firms at lower productivity distribution benefit more from improving the regional institutional quality in terms of increased productivity.

Table 5.8: Estimation results of labor productivity (quintile regression)

	(1)	(2)	(3)
	Dependent variable: Labor Productivity		
	0.25	0.5	0.75
tech_hat	1.386***	1.508**	1.975***
	(0.399)	(0.653)	(0.510)
regional_institution	0.544***	0.321	0.442
	(0.204)	(0.207)	(0.332)
lncapital	0.253***	0.251***	0.213***
	(0.0255)	(0.0259)	(0.0223)
highschool	0.146**	0.109*	0.0452
	(0.0591)	(0.0565)	(0.0302)
size_numlog	0.0903***	0.100**	0.106**
	(0.0230)	(0.0428)	(0.0445)
_cons	5.315***	6.345***	7.355***
	(0.487)	(0.338)	(0.327)
N	1299	1299	1299
Country dummy	yes	yes	yes
Sector dummy	yes	yes	yes

Standard errors are reported in parentheses
* $p < .1$, ** $p < .05$, *** $p < .01$

To summarize, comparing the empirical results of the quintile regression models at different levels of productivity distribution, two inferences can be made. First, all types of innovation i.e. product, process, and technological innovation are significant determinants of firms' productivity at different productivity distribution. Second, the effect of regional institutions, however, varies depending on the productivity distribution. The quality of regional institutions is crucial especially for firms at lower productivity levels. As most African firms are low productive, it is necessary therefore to focus on improving the quality of institutions not only at the country level but also at the regional level, in addition to efforts to improve the innovative capacity of firms.

5.5. Conclusion and recommendation

Although African countries have registered remarkable economic growth in the last two decades, the growth of firm-productivity is very low in comparison with the rest of the world. In order to meet the goal of poverty-free Africa by 2030 and Agenda 2060[44], African countries need to concentrate on accelerating their growth pace. As evidenced by many theories and countless empirical studies, the major source of long-term growth is productivity growth. Spending can realize this more on R&D activities and improving the innovative capability of firms and the country in general. Innovation is given much emphasize by economists and policymakers alike, but the nexus between innovation and productivity seems to be not established in developing countries. Moreover, although the institutional setting of the country is acknowledged to affect productivity, previous empirical studies have remained silent on the effect of regional/local institutional quality on firm productivity. It is against this backdrop that this chapter examines the impact of innovation and regional institutional quality on African firms. To this end, we used WBES of firms from 15 African countries and the standard CDM model.

We draw three important conclusions from our empirical investigation. First, R&D intensity significantly affects product and technological innovation, but not process innovation, indicating that firms that spend more on R&D tend to introduce new or significantly improved products. Process innovation, however, seems to be independent of R&D expenditure. Second, innovative firms are more productive. All types of innovation—product, process and technological—increases the productivity of firms. Third, in addition to innovation and other conventional factors, regional institutional quality also affects firms' productivity, but its effect is profound for the firms at the lower productivity distribution.

Our empirical investigation suggests the following policy recommendations so as to enhance the innovative capacity and productivity of African firms. First, it is necessary to support firms to spend more on R&D. Second, it is also essential to improve the regional/local institutional environment in order for firms to translate innovation into productivity. This could

[44] https://au.int/en/agenda2063/overview

be realized by drafting and improving strong legal and regulatory framework that includes maintaining the rule of law, lowering corruption, and removing regulatory rigidities.

Although the present study makes several noteworthy contributions, several limitations need to be acknowledged. First, the study is constrained by unavailability of data. For instance, prior literature measure firm productivity in two ways: total sales per person and value-added. In the present study, only the former was used because of unavailability of value-added data. Second, as indicated by G. Crespi et al. (2016) a better measure of an innovation effort is total innovation investment, which includes not only investment in R&D but on training, know-how, and technology transfer. However, the WBES doesn't provide information regarding investment on training and other innovation investment. Therefore, the direction of future studies is to use value-added to measure productivity and total innovation investment to measure innovation effort so as to provide a clearer picture on the impact of innovation and regional/local institutions on firms' productivity.

CHAPTER 6

6. CONCLUDING REMARK

Although the impact of institutional quality on the economy has extensively been studied in recent years, much emphasis has been given to global samples and macroeconomic variables. It is, however, equally important to explore its impact using reduced samples, such as Africa, and identify which institutional arrangement is more important than others. In addition, it worth exploring whether local institutional quality, in addition to country-level, affects micro-economic variables such as firm innovation and productivity. This dissertation was designed to explore these issues; thus, its objectives are multifold. Accordingly, the dissertation was organized in six chapters, all of which are an independent research article, except the first and the last.

The first chapter provides an overview on the theory of economic growth and economic growth performance of SSA countries. A simple descriptive analysis in this chapter indicated a seemingly positive relationship between institutional reform and economic growth in SSA, but rigorous empirical investigation was needed to make sure this is the case. This chapter leaves us with a question that becomes the motivation for the next chapter: a) to what extent institutional quality matters for the economic growth of SSA? b) if so, which of the institutional arrangement matter most to stimulate growth in the region? Using a panel dataset of SSA countries and a two-step system-GMM estimation, we concentrated on answering the above research questions in the second chapter. Our empirical results indicated that while investment-promoting and democratic & regulatory institutions affect the economic growth of the region significantly, the effect of conflict-preventing institutions is negligible.

Although the second chapter showed the significance of institutional quality on economic growth, still the causality between the variables remained unanswered. Therefore, chapter three aimed to investigate the direction of causality between institutional quality and economic growth using a heterogeneous panel non-causality approach. It is found that the causal relationship between the two varies depending on the income level of countries. In low-income countries, there is a unidirectional causality that runs from institutional quality to growth, but in lower-middle-income countries, the direction of causality is vice versa. For upper-middle-income countries, the evidence suggests a bidirectional causality.

In chapter four and five, it was attempted to examine the importance of local-level institutional quality on micro variables – firm innovation and productivity. More specifically, chapter four explores the role of regional institutional quality and compare the relative importance of three different institutional arrangements, namely regulatory quality, rule of law, and corruption, on the propensity of firm innovation. Results using multilevel logistic regression indicated the significance regional institutional quality on firm innovation performance. Among different regional institutional arrangements, reducing corruption and maintaining rule of law appeared to matter the most for firm innovation. Chapter five examined the extent to which innovation and the quality of regional institution, affect firms' productivity using a firm-level dataset from African countries. Employing the three-step CDM approach, we found that both innovation and regional institutions has a significant positive impact on firms' productivity. Furthermore, we found that regional institutional quality is particularly important for firms at low productivity distribution.

In a nutshell, three important conclusions have been drawn from this dissertation. First, institutional quality has a significant positive effect on firm innovation, productivity and economic growth. Second, the causal relationship between economic growth and institutions depends on the level of economic development of the country. Third, the effect of different types of institutions is not the same. For instance, investment-promoting and democratic institutions matter the most for accelerating economic growth while controlling corruption and maintaining rule of law appeared to matter the most for firm innovation.

Therefore, this dissertation suggests the following policy recommendations.[45] First, given the institutional deficiencies in many African countries, improving the quality of institutions—both at the country and regional level— is imperative to enhance firms' innovative and productive capability and countries' economic performance as a result. Therefore, policymakers in Africa should focus on improving both national and regional/local institutional quality. This can be achieved by drafting and improving strong rules, legal and regulatory frameworks. Second, in the light of the fact that different types of institutions may have different impact and improving institutional quality would take time and resources, policymaker should give priority to institutions that have a greater impact on the economy. For

[45] It should be noted that each independent article (chapter) in this dissertation has policy recommendations based on the findings of each study. Therefore, we recommend seeing the comprehensive policy recommendation of each article for further details.

instance, policymakers could start by improving institutions related to maintaining of the rule of law, lowering corruption, and improving investment.

Although this dissertation makes several noteworthy contributions to the literature, a number of limitations need to be noted. First, as it is always the case for studies focusing on Africa, this dissertation is constrained by data limitation. On the one hand, the dissertation could not cover all African countries mainly because of unavailability of data. On the other hand, some indicators such as institutional indicators, value-added and patent data are not available for most of our sampled countries. The direction of future studies on this realm is thus to further examine i) the nexus between institution and growth using institutional data from various sources, ii) the impact of regional institution on innovation using patent, rather than binary indicators, and iii) the relationship between regional institutions and productivity using value-added as a dependent variable, and compare the result with the current study. Second, the dissertation did not explore the effect of national-level institutions on firm performance—innovation and productivity. It would be interesting, in future studies, to investigate how both national and regional institutional quality affects the dynamics of firm innovation and productivity.

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Appendix

Appendix 1: ICRG Political Risk Components and polity2

Political risk component	Component point (max)		Political risk component	Component point	
	min	max		min	max
Government stability	0	12	Military in politics	0	6
Socioeconomic condition	0	12	Religious tension	0	6
Investment profile	0	12	Law and order	0	6
Internal conflict	0	12	Ethnic tension	0	6
External conflict	0	12	Democratic Accountability	0	6
corruption	0	6	Bureaucracy quality	0	4
Polity2	-10	10			

Source: ICRG methodology by the PRS group and Center for Systemic Peace (CSP), Polity IV dataset

Appendix 2: Countries List

Angola	Ghana	Niger
Botswana	Guinea	Nigeria
Burkina Faso	Guinea-Bissau	Senegal
Cameroon	Kenya	Sierra Leone
Congo, Dem. Rep.	Liberia	South Africa
Congo, Rep.	Madagascar	Sudan
Cote d'Ivoire	Malawi	Tanzania
Ethiopia	Mali	Togo
Gabon	Mozambique	Uganda
Gambia, The	Namibia	Zambia

		Zimbabwe

Appendix 3: Data and Sources

Variable	Measure	Source	Indicator
Institution	Quality of institutions	ICRG & Polity IV	Pc1, pc2, pc3
Economic Growth	GDP per capita growth	WDI	Growth
Initial income	Per capita GDP (at 2010 Int'l $)	WDI	INCOME
Human Capital	secondary school enrollment ratio	WDI	TER
Investment	Share of gross capital formation	WDI	INV
Inflation	Average inflation rate	WDI	INF
Trade Openness	Export+ Import / GDP	WDI	OPN
Government expenditure	General government consumption expenditure/ GDP	WDI	GOV