TELECOMMUNICATION INFRASTRUCTURE AND ECONOMIC GROWTH: A CASE OF SUB-SAHARAN AFRICA (1988-2010)

Martin Chege Wainaina

A Thesis submitted to the School of Economics in partial fulfillment of the requirement for the award of the Degree of Doctor of Philosophy in Economics of Kenyatta University

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DECLARATION

This Thesis is my original work and has not been presented for any other any other award in any University.

Signature _____ Date _____

Martin Chege Wainaina B.ED (Arts), MA (Econ)

Reg.No. K96/10033/2008

This thesis has been submitted to the School of Economics, Kenyatta University with our approval as university supervisors.

Signature _____ Date _____

Almadi Obere (Ph.D)

Department of Econometrics & Statistics

Kenyatta University

Signature _____ Date _____

Nelson H.W. Wawire (Ph.D)

Department of Applied economics

Kenyatta University

Signature _____ Date _____

Julius Korir (Ph.D)

Department of Economic Theory

Kenyatta University

DEDICATION

To my wife, Dorcas, and my children Simon, Evans and Evelyn for their support and understanding.

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ABBREVIATIONS AND ACRONYMS

GDP	Gross Domestic Product
GSM	Global System for Mobile Communication
ITU	International Telecommunication Union
PSTN	Public Switch Telephone Network
BTS	Base Transmitter Station
ICT	Information and Communication Technology
FDI	Foreign Direct Investment
OECD	Organization of Economic Cooperation and Development
ATU	Africa Telecommunication Union
GMM	Generalized Method of Moments
IFS	International Financial Statistics
WDI	World Development Indicators

OPERATIONAL DEFINITION OF TERMS

Penetration: Refers to the number of telephones per 100 inhabitants (people)

Mobile Telephone (cellular) subscribers: Users of portable telephones subscribing to an automatic public telephone service which provides access to the Public Switch Telephone Network (PSTN) using cellular technology.

Digital Divide: The lack of access to Information and Communication Technology.

Teledensity: Index of numbers of telephone lines, indicating a measure of telephone availability expressed as the number of main lines per 100 inhabitants in a country.

Telecommunication Device: These are devices and systems that transmit electronic or optical signals across long distances thereby enabling people around the world to contact one another, to access information and to communicate.

Fixed line Telephone Services: This is a telecommunication service provided mainly by means of copper wires that run from a customer's home or office/business premises up to a telephone exchange or switch. This service can also be provided by means of a wireless terminal connected to an ordinary telephone set between the home /office and the exchange instead of using copper wires all the way to the exchange.

Mobile (cellular) Telephone service: Service provided by means of portable hand held radio communication devices that are linked to telephone exchange through

other fixed radio-communication apparatus called Base Transmitter Stations (BTSs).

3rd Generation (3G): is a generation of standards for mobile phones and mobile telecommunication services fulfilling specifications by International Telecommunication Union (ITU)

Global System for Mobile Communications (GSM): is a second generation (2G) mobile phone system originally from *Groupe Spe'cial Mobile* whose signaling and speech channels are digital.

Telecommunication infrastructure: Is the index of teledensity, index of numbers of telephone lines, indicating a measure of telephone availability expressed as the number of main lines per 100 inhabitants in a country.

ABSTRACT

The need for an efficient, modern telecommunication sector is now regarded as crucial to economic growth in transition countries. Various studies have given conflicting findings on the relationship between economic growth and telecommunication. In addition, studies of different regions of the world have had different findings, with Africa recording least of these studies. Sub-Saharan Africa had registered the lowest levels of GDP growth across the world despite having registered the fastest growth rate in terms of telecommunication growth. This calls for a thorough investigation on the role, relationship and, direction of causality between telecommunication growth and economic growth. The objectives of the study were to; determine the relationship between mobile teledensity and economic growth; investigate the relationship between landline teledensity and economic growth and; analyze the effects of interaction between mobile teledensity and landline teledensity and how teledensity affect on economic growth. To achieve the objectives, the study adopted the neoclassical growth model developed by Solow and Swan (1956).Using relevant diagnostic tests, Generalized Method of Moment (GMM) method of estimation was used on the panel data from 44 of Sub-Saharan Africa countries (1988 to 2010), the study found out a two-way causality for mobile teledensity and economic growth. On the other hand landline teledensity growth was found to influence economic growth and not vice versa. In addition telecommunication investment was found to be subject to diminishing returns, suggesting that countries at an early stage of development are likely to benefit most by investing in telecommunications infrastructure. Other factors found to influence growth included; population growth, investment, and trade openness. The study proposes that the respective governments of sub-Saharan countries should implement policies that enhance the development of the telecommunications sectors in their respective countries, increase attention to measures that would increase mobile telephone penetration. The respective government should focus on measures that would attract more foreign direct investment, allow more reforms in the telecommunication sector to allow more investment and eliminate or reduce barriers to trade. This is because the result shows that removal of trade barriers increases trade amongst countries. In addition increased trade will see further usage of mobile telephone to transact business.

CHAPTER ONE

INTRODUCTION

1.1. Telecommunication Infrastructure in Sub-Saharan Africa.

Basic conventional telecommunications was first used in Africa during the pre-independence era by trading firms in West Africa. It is also believed that similar communication was available in Eastern Africa at around the same period. In Eastern Africa, a legal creation of a postal and telecommunication entity was made in 1893. Major development activities in this field, though, started in Africa in the 1960s (Aloo, 1988). The changes in telecommunication infrastructure could not have been realized without technical and financial assistance from international and regional organizations. These include Organization of African Unity (OAU), International Telecommunication Union (ITU), World Bank, United Nations Development Programme (UNDP), Economic Commission for Africa (ECA), and African Development Bank (ADB).

African telecommunications sector changed significantly from late 1990s, the continent experienced a considerable development in the mobile telecommunication sector compared to the fixed line system where countries such as Nigeria, Uganda and Cote d'lvoire had more mobile telephony than fixed line (ITU, 2006). The development was as a result of technological revolution,

development of wireless mobile telecommunication and economic reforms in Africa as from the early 1990s.

Over the years, the number of fixed line service monopolies grew tremendously. Africa had the largest growth in the world. It accounted for about 37 percent of the fixed line service monopolies, compared to 23 percent in Asia, 19 percent in America, 14 percent in Oceania and 7 percent in Europe (ITU, 2007). In most African countries, respective governments went on to liberalize the telecommunication sector in order to attract investments from high-income countries which had already participated in the process of privatization.

In Africa, fixed line telephone services were often in the hands of government owned monopolies whereas the mobile telephone market was generally in private hands. In 93.3 percent of the economies in Africa, there were partial or full competitive systems and 83 percent had established a regulatory authority for telecommunications (ITU, 2007). By 2010 many African countries were approaching full universal access to all inhabited rural areas with a mobile signal. Countries with mobile rural coverage of over 90 percent include Comoros, Kenya, Malawi, Mauritius, Seychelles, South Africa, and Uganda. By the end of the year 2015 other countries in the process of increasing rural mobile coverage should have reached their goals (Enowbi, 2008). These countries include; Burundi, Cape

Verde, Guinea, Namibia, Rwanda, Senegal, Swaziland and Togo, all of which have rural mobile population coverage rates above 50 percent.

By the end of the year 2006 more than 36 countries had created a separate regulatory sector (ITU, 2007). Over the same period about 45 countries had licensed private cellular operators and effective cellular competition had sprung up in many countries in the region. As a result of the market structure, fixed line telephony became the less competitive service in Africa.

In order to create a competitive market between the different operators and allow customers benefit from the competition, it was important to institute an independent and regulatory authority which would oversee the smooth functioning of the telecommunication sector. About 83 percent of the African economies had established such an authority by the end of the year 2006. This was intended to regulate the telecommunications market and to create competition through lower prices, better quality of services and openness to innovation in a regulated telecommunications market. However, according to ITU (2008), the continent still lagged behind compared to other developing regions such as Asia and Latin America. Worldwide fixed line telephones were 1,270 million. Africa had less than 2 percent of these compared to 48 percent in Asian countries and Brazil alone (ITU, 2007). In general, the fixed line penetration was 3.1 per 100 inhabitants in Africa compared to 32.4 fixed line penetration per 100 inhabitants

in America, 39.7 per 100 inhabitants in Europe and with a world average penetration rate of 19.5 per 100 inhabitants, which is six times higher than the penetration rate in Africa (ITU, 2008).

Within Africa, the fixed lines are concentrated in just 6 of the 54 countries, that is, Algeria, Egypt, Morocco, Nigeria, South Africa and Tunisia (Enowbi, 2008). These accounted for almost 80 percent of all fixed lines in Africa mostly located within the urban towns. Figure 1.1 shows the distribution and the trend of telephone subscriptions across Africa for the period 2000-2007.

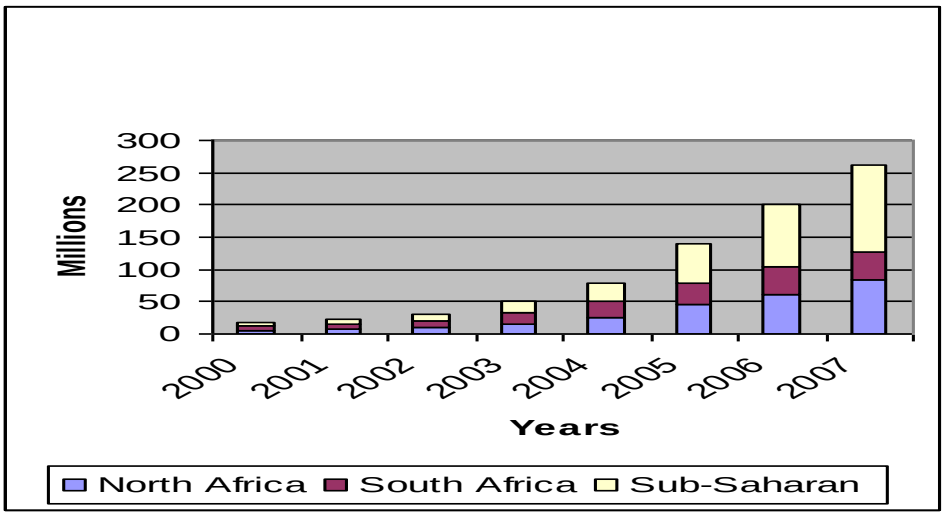


Figure 1.1 Mobile telephone subscriptions in Africa, 2000-2007

Source: World Telecommunication/ICT indicators database (2008).

Figure 1.1 shows that by the year 2007, Africa had 280 million total subscribers. Of these subscribers, 260 million (over 85 percent) were mobile telephone subscribers. This meant that Africa was the continent with the highest ratio of

total mobile telephone subscription in the world. Africa had the highest growth rate worldwide. In 2000, the total subscribers in Africa were 21 million. This number grew to 50 million in 2003, 200 million in 2006 and 280 million in 2007. Regionally, sub-Saharan Africa had taken a larger share of subscriptions, especially from the year 2003 to 2007 (ITU, 2008). The growth in mobile telecommunication subscription is an indication of the vast investment in the telecommunication sector by various key players including the government and the private sector.

1.2 Economic Growth in Sub-Saharan Africa

The first decade of the 21st century saw the world's developing economies produce their strongest period of sustained growth in decades (World Bank, 2009). sub-Saharan Africa was no exception in this trend – this was until the 2008 global financial crisis. Gross Domestic Product growth across the region's economies increased from an average of 3.5 percent in 2000 to 5.7 percent by 2005. Non-oil producing countries which relied on agriculture such as Burkina Faso, Ethiopia, Mali, Mozambique, Uganda and Tanzania were able to post growth rates of over 5 percent (World Bank, 2008). Technological revolution, development of wireless mobile telecommunication and economic reforms were among the key contributors to this growth.

The evidence from sub-Saharan Africa suggests that the economic recovery in the early years of 21st century was attributed to positive economic environment. This

was influenced either directly or indirectly by improvements in macroeconomic policies and structural reforms (World Bank, 2008). In the period 2002 to 2007 sub-Saharan Africa's output grew annually by 6.5 percent, the highest rate in more than 30 years. However, with the onset of the global financial crisis in 2008, economic growth has faltered in many economies in the region. Table 1.1 presented below gives the details on some of the contributors of the GDP growth in the region.

Table 1.1 GDP growth in Sub-Saharan Africa: Selected Indicators (2005-2010)

	GDP growth in Percentages					
	2005	**2006**	**2007**	**2008**	**2009**	**2010**
Export of Goods and Services	36.6	37.6	38.9	41.0	31.2	33.5
Import of Goods and Services	33.6	33.1	36.2	38.2	34.2	34.6
Gross Domestic Savings	22.8	25.5	24.5	25.0	19.3	21.5
Gross Domestic Investment	19.9	21.1	22.0	22.2	22.4	22.7
Fiscal Balance	1.8	4.8	1.2	1.3	-4.8	-2.4
Current Account	-0.4	4.1	1.1	1.0	-3.1	-2.1
Terms of Trade	7.5	7.3	3.1	8.6	9.1	6.6
Reserves (months of Import)	4.7	5.9	6.0	5.3	1.3	4.1
GDP growth in Sub-Saharan	6.2	6.6	7.0	5.5	5.5	1.3

Source: African Department database (2009); IMF (2010), and World Economic Outlook (2010)

In every sector for example, the gross domestic savings were on the rise during the same period from 22.8 percent to 25 percent in the year 2008, Gross domestic investment rose consistently over the years from 19.9 in 2005 to 22.4 in 2008 and contrary to increased gross domestic investment, the GDP growth declined to 5.5 percent in 2008. Sub-Saharan Africa's growth takeoff seems to have been built on

major improvements in factors fundamentally important for economic growth; better political governance, reduced macroeconomic imbalances, infrastructural development, and openness to trade.

The World Bank (2009) explained how inadequate spending on maintenance of telecommunication infrastructure has contributed to sub-Saharan Africa's infrastructure deficit and undermined the effectiveness of capital investments. In most countries revenue constraints limit the scope for spending more on priority areas by reallocating budget resources.

With continued global trade recovery, the future of economic development in sub-Saharan Africa looks promising (World Bank, 2009). The majority of sub-Saharan African states have recovered rapidly from the global financial crisis.

Table 1.2 shows the growth rate of GDP over the years categorized into different groups. Further, projections for the year 2011 and 2012 are given.

Table 1.2 Economic Growth by Country groups

	GDP Growth in Percentage				
	2008	**2009**	**2010**	**2011**	**2012**
Sub-Saharan	5.5	2.8	5.0	5.5	5.8
Oil exporters	6.2	5.2	6.5	6.3	6.7
Middle income	3.8	-1.6	3.1	3.5	4.0
Low income Countries	5.1	4.8	5.3	6.5	6.7

Source: IMF, World Economic Outlook Databases 2008- 2010

As shown in table 1.2 and in consistence with table 1.1, sub-Saharan African growth continues to accelerate. Many African states, especially the low-income ones, posted the largest GDP growth as compared to middle income and oil exporting countries. Middle-income states had the most difficult time during the 2009 economic downturn, perhaps signaling greater reliance and interdependency on the global market place (Saliha, 2010).

In 2010, GDP in sub-Saharan Africa was estimated to have increased by 2.2 percent; up from 2.8 percent in 2009. Tourism services, a critical industry for many developing countries, registered growth in the region. Hosting the FIFA World Cup helped sub-Saharan Africa become the only world region to have experienced an increase in tourist arrivals in 2009. Tourism revenues were also up in the region's major tourist destinations such as Cape Verde, Kenya, Mauritius, Seychelles, and Tanzania (Saliha, 2010).

The forecasts for 2011 and 2012 look even brighter especially for the oil exporters and low income countries. According to the IMF (2010), sub-Saharan Africa's accelerating economic growth is expected to be broad-based in 2010 and 2011, with a strong domestic demand and resurgent exports. These are expected to boost average growth rates in the region to 5.5 percent, a value almost the same as the levels recorded before the global economic slowdown. The advancement of telecommunication technology has seen productivity increase. This is largely due

to efficiency brought about by use of modern telecommunication devices that are turning the world into a global village (Saliha, 2010).

1.3 Telecommunication and Economic Growth

Introduction of new and advanced technology and new innovations in technology is making it possible for the world to turn into a global village. The widely spread economic activities, both in real estate and commodities as well as in credit facilities, has been enhanced with the use of modern technology to communicate. This is a fact: that the world is rapidly moving towards an economic system based on the continuous and ubiquitous availability of information. (Waverman *et al*.,2001)

Development in telecommunication technology has been an important tool in the exchange of information used to develop a sharp and valuable commodity market (Zahra *et al.*, 2008). In the 21st century, there has been a move into post-industrial information based economic growth where countries and sectors try to equip themselves with the necessary telecommunication infrastructure. A modern telecommunication infrastructure is not only important for domestic economic growth but also in connecting domestic market of commodities as well as credit with international commodity and financial markets. This develops a smooth flow

of foreign investment, positive value of exports and increase in the value addition in GDP of an economy (Cronin *et al*., 1991).

The world has experienced a rapid growth in communication due to advancement in telecommunication technology. The need for an efficient, modern telecommunication sector is now regarded as crucial to economic development in transition countries. The basic telecommunication industry comprises a vast portion of the world's economy. The development of new technologies has increased the need to stay competitive due to the growth of new telecommunication technologies in domestic spheres (Aschauer, 1989).

There has been a sustained growth in telecommunications sector as well as rapid progress in policy and technology development. The factors contributing to this include privatization, opening of markets to competition, and the establishment of telecommunication regulatory authorities at both regional and national levels. Globally, mobile telephony has continued to grow surpassing fixed telephony (ITU, 2006).The importance of mobile telephone services from both an economic and a sociological perspective cannot be understated. Consumers have benefited enormously from mobile communication, and the industry has generated considerable wealth for shareholders in a relatively brief period of time (Zahra *et al*., 2008). Many consumers now view mobile telephone services as essential to their daily lives, particularly as a growing number of innovative services that go

well beyond voice communication become available. Moreover, rapid growth of mobile telephony has non-trivial positive spillover effects on the economy. For example, mobile telephony expands communication possibilities between consumers and businesses and lowers transactions costs and other costs of doing business (ITU, 2007). In addition, there are technological changes embodied in the newer, third-generation (3G) mobile services which can transmit broadband data and internet services. These promise to alter, profoundly, the way in which people live and work. From a sociological perspective, mobile communication plays an indispensable role in helping to connect different populations, especially those located in isolated areas, and in increasing citizens' access to health care and emergency services.

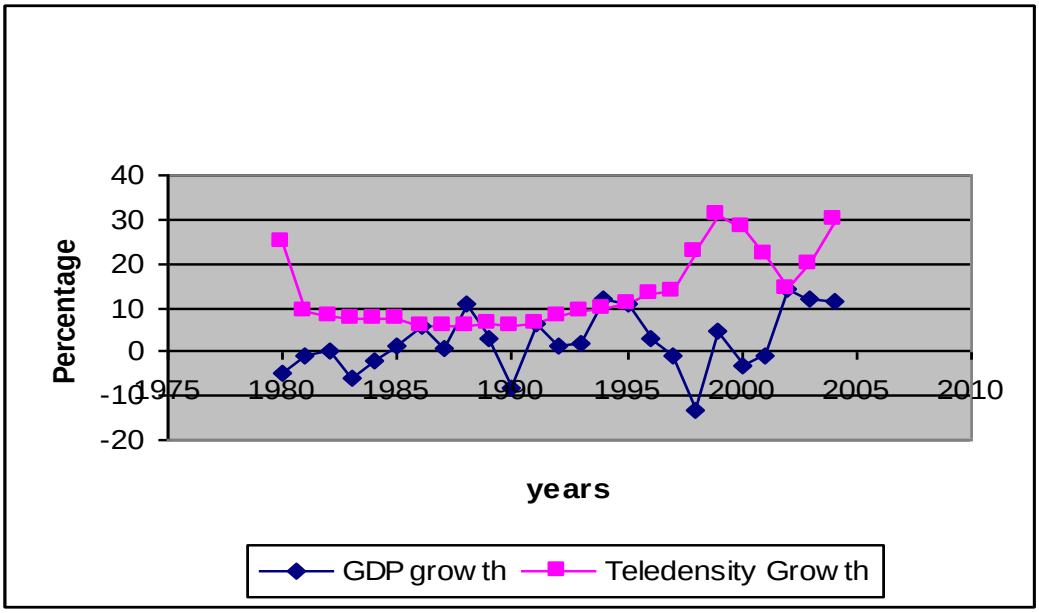
Competition has pushed traditional telecommunication operators to new areas such as internet and broadcasting. New technologies and service innovations have changed economics of network roll-out especially in developing countries. The new telecommunication players are global in nature with interests cut out across different sectors (Aschauer, 1989).

An adequate supply of infrastructure services has long been viewed as a key ingredient for economic development, both in academic literature as noted by Aschauer (1989), as well as in the policy debate by World Bank (1994). Increasing attention has also been paid to the impact of infrastructure on poverty

and inequality (Estache, Foster and Wodon, 2002; World Bank, 2003; 2006). While the empirical literature on these two topics is far from unanimous, on the whole, a consensus has emerged that under the right conditions, infrastructure development can play a major role in promoting growth and equality and, through both channels, reduce poverty (World Bank, 2003).

In most dimensions of infrastructure performance, sub-Saharan Africa ranks at the bottom of all developing regions (World Bank, 2006). So the emphasis on infrastructure is hardly surprising. Some intrinsic features of Africa's economies make the potential role of infrastructure for the region's economic development more critical than elsewhere in the world. Evidence from sub-Saharan Africa suggests that economic recovery over time has been influenced by positive economic environment, either directly or indirectly by improvements in macroeconomic policies and structural reforms (Enowbi, 2008). Figure 1.2 shows the trend of economic growth and teledensity for Africa over the period between 1975 and 2005.

Figure 1.2 GDP and Teledensity Growth in Africa (1980-2004)



Source: International Telecommunication Union (ITU) Databases(2007) and World bank (2008).

From figure 1.2, in the years between 1983 and 1988, there was increased growth in GDP while the rate of teledensity growth was on the decline. Between 1982 and 1995, both GDP growth and Teledensity growth rate changed but at different rates. The GDP growth dropped while teledensity continued to rise between year 2000 and 2005. This inconsistent trend as observed by Enowbi (2008) cast doubt on whether telecommunication infrastructure growth aids economic growth.

The situation in sub-Saharan Africa is at variance with countries such as the Seychelles, Bostwana, Cameroon and Gabon, which are performing better in telecommunication growth than other sub-Saharan African countries (ITU, 2008). Seychelles in the 1990s registered the highest fixed line penetration rate of 35.7 per 100 inhabitants in the region, followed by other countries, but they fell behind with differences of 10 points. The slow rate of penetration of the fixed line service was due to inefficient investment, insufficient private sector involvement, poor management incentives and the scarcity of foreign exchange (Gebreab, 2000), not forgetting the low level of GDP that many sub-Saharan African countries have had during first decade of 21st century.

1.4 Statement of the problem

The major contributor to economic growth in the World has been the agricultural sector, followed by the manufacturing and services sectors (World Bank, 2004). Globally, all these sectors have become competitive and a need arises for different countries to produce goods and services efficiently. The advent of telecommunication has led to ease in the flow of information from producers through different stages of production to the point where the goods or services reach the final consumer. Further, the advancement of telecommunication services has led to a new market mechanism with low cost structure and expanded

value chain of firms. This means that the telecommunication sector is indispensable for economic growth.

A number of studies have hypothesized that ICT (including telecommunication) infrastructure lowers both the fixed costs of acquiring information and the variable costs of participating in markets (Norton, 1992). As the ICT infrastructure improves, transactions costs reduce and output increases for firms in various sectors of the economy (Röller and Waverman, 2001). Thus, investment in ICT, including telecommunications infrastructure and their derived services, provides significant benefits to the economy.

Parker (2005) highlighted how the expansion of wireless telecommunication in sub-Saharan Africa is bridging the technological divide between sub-Saharan Africa and the industrialized world. By the year 2004 in sub-Saharan Africa, there were more new mobile telephone subscribers than in the whole of North America. This notwithstanding the private sector invested USD 230 billion in telecommunication infrastructure in the developing world between 1993 and 2003, and countries with well-regulated competitive markets have seen the greatest extent of investment (World Bank, 2003). Apparently most of this investment was in sub-Saharan Africa.

There are empirical investigations that have focused on how telecommunication infrastructure affects economic growth in the developed OECD economies, taking into account the two-way causation between them. Röller and Waverman (2001) and Waverman, Meschi and Fuss (2005), found that mobile telephony had a positive and significant impact on economic growth. Lei and Kingsley (2004) found a one-way causality between telecommunication and economic growth. Karner and Onyeji (2007) examined the contribution to economic growth by telecommunications investment and found it to be positive but not significant. From the trends indicated in figure 1.2 and from the work of Enowbi (2008), there is doubt as to whether growth in telecommunication causes economic growth.

While these studies attested to the fact that telecommunications infrastructure investment has correlation with economic, few studies have investigated the role that telecommunication specifically has played in economic growth in Africa and in particular sub- Saharan Africa, especially where a disproportionate rate of growth of mobile telecommunication is juxtaposed to the level of landline telephony. There is therefore need to investigate the role played by telecommunication in economic growth. The purpose of this study was to investigate the relationship between telecommunication infrastructure and economic growth in sub-Saharan Africa.

1.5 Research Questions

i. What is the relationship between mobile teledensity and economic growth in sub-Saharan Africa?

ii. What is the relationship between landline teledensity and economic growth in sub- Saharan Africa?

iii. How does the interaction between mobile teledensity and landline teledensity affect economic growth in sub-Saharan Africa?

iv. What are the policy implications of the findings of (i) to (iii)?

1.6 Objectives of the study

The general objective of this study was to analyze the relationship between telecommunication infrastructure and economic growth in sub-Saharan Africa.

Specific objectives were to:

i. Determine the relationship between mobile teledensity and economic growth in sub-Saharan Africa.

ii. Investigate the relationship between landline teledensity and economic growth in sub-Saharan Africa.

iii. Analyze the effects of the interaction between mobile and landline teledensity on economic growth in sub-Saharan Africa.

iv. Draw policy recommendations based on the answers in (i), (ii) and (iii).

1.7 Significance of the Study

The understanding of the impact of telecommunication infrastructure on economic growth is critical in designing policies that will help the service providers to deliver services that will make them more attractive to potential subscribers. Telecommunication services and especially telephone services are increasingly being recognized as key components in the infrastructure of economic development; hence policy formulated would also guide the concerned governments in instituting reforms in various sectors of the economy to bring efficiency and raise further revenue.

1.8 Scope and organization of the study

The scope of this study was limited to data between 1988 and 2010. The rationale for the choice of this time horizon was to enable the study to capture effects of both mobile and landline telephones. First decade (1988-1998) is more consistent with landline telephony while the other decade (1999-2010) has seen a tremendous increase in mobile telephony. The choice of sub-Saharan Africa is due to the fact that most of the studies conducted concentrated on South Africa, Egypt and Nigeria. Countries in sub-Saharan Africa have witnessed the largest mobile telephone subscription in the entire continent despite the region having received little attention in terms of the empirical research.

This thesis is organized as follows: Chapter one discusses the background of the study, the statement of the problem, research questions, objectives of the study significance of the study and scope and organization of the study. Chapter two discusses the theoretical and empirical literature review. Chapter three discusses the methodology, data type and the procedure for data analysis. Chapter four discusses the empirical findings and chapter five discusses the summary, conclusion and policy implications.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this chapter, both theoretical and empirical literature are reviewed. The first section reviews the theory and exposes the theoretical foundations that underlie the effects of telecommunication infrastructure on economic growth. The second section reviews the empirical literature and the final section deals with the overview of the literature.

2.2 Theoretical Literature

2.2.1 Neo-Classical Theory of Growth

The Neo-Classical growth model was developed by Solow (1956) and Swan (1956). The model according to Romer (2006) focuses on four variables; output (Y), capital (K), labour (L), and knowledge or the effectiveness of labour (A). At any time the economy has some amounts of capital, labour and knowledge, and these are combined to produce output. The production function takes the form

$$Y(t) = F(K(t), A(t), L(t)) \quad \text{.....(2.1)}$$

Where t denotes time

The central assumptions of the model are based on the properties of the production function and include the following; constant returns to scale, the

production function combines labour and capital with diminishing returns, savings are a fixed fraction of output, and technology improves at an exogenous rate.

According to the Neo-Classical theory, if land is held fixed, growth takes place in three ways: increase in labour supply, increase in capital stock and increase in productivity (Romer, 2006). If more people take part in a country's production, either through migration or joining of a labour force by people who were not initially part of it, there is increase in labour supply. Capital increase can be divided into two parts, that is, increase in physical and human capital. Physical capital increases output because it enhances the production of labour and provides valuable services directly. A productive increase can be said to take place when there is investment in equipment like computers and machinery which may reduce labour hours.

Human capital promotes economic growth because people with skills are more productive than those without them. Investment in human capital is made through education and job training. Productivity increment is the rise in output that can be explained by increase in inputs of labour and capital. Productivity of input can be affected through a number of factors. These include first, financing or supplying directly to those investments that the private sector would not supply in adequate quantities. Second, efficiently supplying certain basic public services that are necessary for entrepreneur activity and third, long-term investment and financing

its own activities in the manner that minimizes distortions to private sector savings and investment decision and to economic activities more generally (Burda and Wyplosza, 2001). Within this framework, government expenditure in principle could impact growth by affecting capital and/or labor, as well as by the generation and/or assimilation of technological progress reflected in total factor productivity (TFP).

Following Age'nor (2005), the model is extended to account for other externalities associated with telecommunication infrastructure; Output (Y) is produced with private physical capital (K_p) and public infrastructure services (GI), consisting of spending on roads, power plants and telecommunication infrastructure among others. This extension of the neo-classical model and introduction of telecommunication infrastructure has been supported by Levine and Renelt (1992), Mankiw *et al*., (1992), Barro and Sala-i-Martin (2003) and Waverman, Meschi and Fuss (2005).

2.2.2 Endogenous Growth Theory

The theory explains the factors that determine the long-term economic growth. According to the theory the model endogenizes the rate of technical progress and the savings rate, particularly investments. These models assume long-term effects on production function revenues. Technological progress is understood as

accumulation of human capital and scientific and technological knowledge and the authors assume it arises from an intentional investment.

Romer (2006) noted that the theory highlighted the fact that if productivity is to increase, the labour force must continuously be provided with resources such as physical capital and knowledge capital (technology). Therefore, growth is driven by accumulation of the factors of production while accumulation is in turn the result of investment in the private sector. This implies that the only way a government can effect economic growth, at least in the long-run, is via its impact on investment in capital, education, research and development. Reduction of growth in this model occurs when government expenditure deters investment by creating tax wedges beyond what is necessary to finance investments, or by taking away the incentive to save and accumulate (Folster and Henrokson, 1997).

The theories of endogenous growth involve a large variety of advanced models which go into different directions. The main directions of the endogenous growth models are those which deal with more than one production sector and models which explicitly model microeconomic decisions.

The theory does not form a new theoretical background but is only a further elaboration of neoclassical theory where some assumptions have been changed. The theory itself widened the number of formalized descriptions and how the

changes of some economic variables can influence growth. However the fundamental and influencing factors stay behind. As a result, the endogenous growth theory and empirical testing did not widen the existing concept of growth, nor did it prove more successful than the neoclassical theory (Nedomlelova, 2007). The realized economic and political recommendations on behalf of empirical research did not always lead to an unambiguous support of economic growth. The mathematical and econometric methods of modeling endogenous growth represent a certain deficiency. They do not allow implementing complex quantifiable variables such as political or institutional features.

These reasons lead to a conclusion that the models of endogenous growth do not describe the economic reality satisfactorily and they do not provide an adequate solution. However, to fully internalize the long run effects of telecommunication infrastructure on economic growth, the theory is important. The endogenous growth theory elaborates the Neo-classical theory which forms the basis of the study.

2.3 Empirical Literature

Roller and Waverman (2001) examined the impact of investment in telecommunication infrastructure on the GDP of 21 OECD countries and 14 developing or newly-industrialized non-OECD countries between 1970 and 1990. They found that the impact may not have been linear. The impact was greater in

OECD countries than it was in non-OECD countries and in countries that had reached critical mass (the number of main telephone lines exceeds 40 per 100 persons). The study highlighted various shortcomings. These included lack of data and statistical knowledge. The study further suggested the use of panel data to observe the specific country effects.

Chakraborty and Nandi (2003), in their study on privatization, telecommunication and economic growth in 12 developing countries in Asia found a bidirectional relationship. The study divided these countries into two groups, those with a high degree and those with low degree of privatization. There was a bidirectional relationship between teledensity and GDP both in the short run and long run. The causality was bidirectional for those countries with high degree of privatization. In the countries with a low degree of privatization, the causality ran from teledensity to GDP.

Cieslik and Kaniewsk (2004) in their study on impact of telecommunication infrastructure and income at the regional level in Poland found that there was a positive and statistically significant causal relationship between telecommunication and income at regional level. Further, the causality ran from the former to the latter.

Ding and Haynes (2004) conducted a study on the role of infrastructure in regional economic growth in China. The study empirically investigated the role of telecommunication infrastructure on the long run regional economic growth in China for a sample size of 29 regions in a 17 years' period from1986-2002. They used panel data set and a dynamic fixed effects model for estimation. The study objectives were to establish whether there was a positive and significant impact of telecommunication investments on economic growth, the nature of the relationship if any and whether the relationship was linear or non-linear.

The study estimated the growth equation using growth frame work of Barro (1996). The growth equation was then extended to include the effects of telecommunication growth; the equation took the following form:

$$GRTH_{it} = \alpha_t + \eta_t + \beta_1 GRTH_{i,t-1} + \beta_2 Ln(GDP)_{\mathrm{i,t-1}} + \beta_3 POP_{it} + \beta_4 INV_{it} + \beta_5 TEL_{it} + \mu_{it} \quad (2.2)$$

$$GRTH_{it} = \alpha_t + \eta_t + \beta_1 GRTH_{i,t-1} + \beta_2 Ln(GDP)_{\mathrm{i,t-1}} + \beta_3 POP_{it} + \beta_4 INV_{it} + \beta_5 TEL_{it} + \beta_6 TELSQ_{it} + \mu_{it} \quad (2.3)$$

Where *i* indexes provinces in china; *t* indexes time; $\alpha_t$and $\eta_t$are province and time specific parameters respectively. GRTH represents the annual growth rate of real GDP per capita, $GRTH_{t-1}$represents the lagged growth rate of real GDP per capita. The lagged GDP variable was included to test for convergence in a panel data framework. INV measures the share of fixed investment in GDP. POP

represents population growth rate and it is introduced to show the effects of population growth.

TEL contained measure of telecommunication infrastructure; the number of telephones (fixed line and mobile) per 100 inhabitants. TELSQ is the square of the telecommunication variable. It was introduced to check whether the relationship between economic growth and telecommunication was linear or not.

The empirical findings of the study confirmed conditional convergence hypothesis, which suggested that regions with higher levels of GDP per capita tended to grow at a slower rate. The study further showed that telecommunication was both statistically and positively correlated to regional economic growth in real GDP per capita growth in China. The finding further indicated that telecommunications investment was subject to diminishing returns, suggesting that regions or countries at an earlier stage of development were more likely to gain from investing in telecommunication infrastructure.

Ding and Haynes (2004) made the following contributions; the confirmation of the conditional convergence hypothesis in the studies conducted by Barro (1991) and Waverman (2005), diminishing returns to scale for regions that are at earlier stages of development and one-way causality between telecommunication infrastructure and economic growth. The study had weakness in that it failed to

confirm linearity or non-linearity between telecommunication and economic growth, and did not separate the behavioral characteristics of population in different regions.

Lei and Kingsley (2004) empirically investigated the role of telecommunication infrastructure on regional economic growth in China, for a sample of 29 regions in a 17 years' period from 1986-2002. The results of the study revealed that telecommunication was both statistically significant and positively correlated to regional economic growth in real GDP per capita in China. The results were strong even after controlling investment, population growth, past levels of GDP per capita and lagged growth. The study further revealed that the telecommunication investment is subject to diminishing returns. However the study failed to establish a dual causality and could probably have given better results had the time period been extended.

Waverman, Meschi and Fuss (2005) conducted a study of mobile telecommunication impact on developing countries' growth. The study considered the average growth rate of per capita GDP from 1980-2003 as the dependent variable. This was regressed on the average ratio of investment to GDP, the stock of telecoms in 1980, the proportion of the 15 years and above population that had completed primary schooling in 1980 and the average level of mobile penetration for the period (1996-2003). The initial level of telephone

(fixed line) penetration was found to be insignificant. However, the average level of mobile telephone penetration was significant, implying that an increase in mobile penetration will increase economic growth.

Having tested for endogeneity, the study divided the sample into four income quartiles according to their level of GDP per capita, the classification were; low income (or potentially fast-growth) if they were in quartiles 1, 2 or 3, and high income if in 4^{th} quartile. The average mobile penetration from 1996-2003 was positive and significant for both cases (low and high-income countries), but the impact was twice as large as for the low income countries.

The study however, failed to indicate whether expansion of the sample would improve or change the findings. Whilst the study tested for endogeneity of mobile telephone penetration variables, there is need to examine some more subtle issues such as the potential endogeneity of some of the other regressors. There is need to also test for the possibility of another factor, institutional quality, that has not been captured yet it influences growth and the level of mobile penetration.

Karner and Onyenji (2007) examined the contribution to economic growth of private telecommunications investment in African countries, Central and Eastern Europe (CEE) for the period 1999 to 2005. Their regression results indicated that the contribution was positive but insignificant. The study attributed the

insignificance to the relatively low levels of telecommunication infrastructure in the countries selected for the study. The findings are also attributed to lack of data from some of the countries. The study recommended use of panel data from countries with similar economic characteristic. One such recommendation was countries in Africa, specifically Sub-Saharan Africa.

Zahra *et al.* (2008) conducted a study on telecommunication infrastructure development and economic growth, using data from twenty four low income, middle income and high income countries from 1985-2003 globally. The study used dynamic fixed effect and random effect model for estimation. The study's main objective was to establish whether there existed a significant relationship between telecommunication infrastructure development and economic growth. The study focused on both fixed and random effects to analyze the telecommunication development effect on economic growth. After analyzing the fixed and random effects, the study analyzed the causal relationship between telecommunication infrastructure and economic growth. The study used the work of Barro (1991), Levine and Renelt (1992) and others to examine the determinants of economic growth. The growth equation was extended to include the effects of telecommunications infrastructure on economic growth. The modified equation took the following form;

$$GRTH_{it} = \alpha_i + \eta_t + \beta_1 GRTH_{i,t-1} + \beta_2 (GDP)_{i,t-1} + \beta_3 INV_{i,t-1} + \beta_4 \frac{G^c}{Y}_{it} +$$

$$\beta_5 POP(1)_{it} + \beta_6 POP(2)_{it} + \beta_7 POP(3)_{it} + \beta_8 TEL_{it} + \mu_{it} \ldots\ldots (2.4)$$

$$GRTH_{it} = \alpha_i + \eta_t + \beta_1 GRTH_{i,t-1} + \beta_2 (GDP)_{i,t-1} + \beta_3 INV_{i,t-1} + \beta_4 \frac{G^c}{Y}_{it} +$$

$$\beta_5 POP(1)_{it} + \beta_6 POP(2)_{it} + \beta_7 POP(3)_{it} + \beta_8 TEL_{it} SQ_{IT} + \mu_{it} \ldots\ldots (2.5)$$

Where i represent the countries in low income, middle income or high income panels; t stands for time; α_i and η_t are country specific and time–specific parameters, respectively. GRTH represents the annual growth rate of real GDP per capita. It is basically the dependent variable that stands to measure economic growth.

$GRTH_{i,t-1}$ represent the lagged growth rate of real GDP per capita. It was included to check the autoregressive behaviour of the dependent variable. GDP_{t-1} represents lagged real GDP per capita measured in purchasing power parity (PPP). INV_{t-1} measures the share of fixed investment of previous year to current GDP. The G^c / Y represent the share of government consumption, population growth rate and panel dummy variable was used to check the optimal growth theory of population. POP (1) represent the growth rate of population of lower income countries, POP (2) represent the population growth rate of the countries included in middle income panel. POP (3) to represent the effect of population growth rate of the countries included in the high income panel.

The TEL_{it} variable contains a measure of telecommunication infrastructure. It is an index of two basic infrastructure of telecom teledensity (the number of telephones per 100 inhabitants, including only fixed line and mobile phone subscribers) and the number of internet users (per 100 people). TELSQ is the square of telecom variable included to establish the linearity of the relationship.

The study used the Granger causality test to check causality between the two variables; general likelihood test was carried out to determine the best model to use among several models given. Most importantly, neither test for stationality nor test for co-integration was carried out. The granger test revealed a one way causality that telecommunication leads to GDP per capita growth.

The study found the relationship between telecommunication development and per capita GDP growth to be highly positively correlated at one percent level of significance. A clear implication from both theoretical and empirical literature has been that telecommunication can actively participate in the growth of an economy. The strength of the study was that it measured individual effects and the causality test conducted revealed one way causality from telecommunication to GDP per capita growth. The weakness of the study was the use of a relatively small sample. A large sample could probably have given more insights especially on dual causality.

Shiu and Lam (2009) conducted a study, whose main objective was to study the relationship between telecommunication infrastructure development and economic growth in 105 countries across the world. In addition the study was to establish the importance of telecommunication development to economic growth. A dynamic panel data model was applied to measure the causal relationship between telecommunication development and economic growth in different regions and at different income levels for the period 1980–2006. According to the study, previous studies have used relatively small sample sizes, or have often been restricted to countries in certain regions or at similar stages of development. The study used larger sample of 105 countries.

A dynamic panel data model was applied to investigate the causal relationship between telecommunication infrastructure and economic growth based on panel data. Panel data was used because it allows the researcher to have more degrees of freedom unlike time series or cross sectional data. It also takes into account heterogeneity in the responses from countries and their groups, and also reduces the problem of multicollinearity among the explanatory variables.

The study used the following equations:

$$GDP_{it} = \alpha_1 + \sum_{m=1}^{M} a_m TEL_{i,t-m} + \sum_{m=1}^{m} c_m GDP_{i,t-m} + \mu_i + \eta_t + \upsilon_{it} \quad \ldots (2.5)$$

$$TEL_{it} = \alpha_2 + \sum_{n=1}^{N} b_n GDP_{i,t-n} + \sum_{n=1}^{N} d_n TEL_{i,t-n} + \omega_i + \tau_t + e_{it} \ldots\ldots\ldots (2.6)$$

$GDP_{i,t-m}$ and $TEL_{i,t-n}$ refer to lagged real GDP and lagged teledensity, respectively while m and n indicated the level of lags for these two variables. i

represents the countries and t represents time periods. μ_i and ω_i are the unobserved country specific effects and η_t and τ_t are time period dummies, the error terms were represented by v_{it} and $e_{it.}$

Having conducted various tests the researcher found that neither of the two hypotheses H_1 and H_2 could be rejected based on Wald tests, thus there was no causal relationship between teledensity and real GDP.

The study further subdivided the panel data into four groups based on per capita GDP (high income. upper-middle income, lower-middle income and low income). The results indicated a bidirectional relationship between teledensity and real GDP for countries in the high–income group. For other income groups, the relationship was unidirectional, running from real GDP to teledensity. The implication was that increased income led to increased demand for telecommunication services, but a higher level of telecommunication development does not stimulate growth.

The results of the causality tests on different regions and different income levels were quite consistent. Of the high –income countries covered in the study, 20 were in Europe. In general, these results indicated the mutual precedence of telecommunications of development and economic growth.

The general findings of the study suggested that an increase in teledensity caused economic growth for high income countries while in less developed countries or regions; telecommunication development was caused by an increase in real GDP. However, despite using data from different countries under different levels of development, the study concentrated on the part of less-developed countries. It would also have been important to have established whether the relationship that exists is linear or non linear thus the use of Generalized Methods of Moments (GMM).

2.4 Overview of the Literature

In the literature review, it is evident that most of the empirical studies used panel data. This could be attributed to short periods, heterogeneity and lack of adequate data in specific countries. Dynamic fixed effect model which allows testing the relationship between regional economic growth with initial economic conditions, fixed investment and population growth was used in a number of studies (Lei and Kingsley, 2004; Zhu, 1996)

Various studies conducted have pulled in different directions; (Ding and Haynes 2004; Zahra *et al.,* 2008; Cieslik and Kaniewsk, 2004; Chakraborty and Nandi, 2003) showed one-way causality between the telecommunication and economic growth while (Zhu 1996; Lei and Kingsley 2004; Shiu and Lam (2009) found

two-way causality (mutual causality). Other studies for example; Karner and Onyenji (2007) have found the relations to be non-significant. Linearity of the models has been raised and most of the studies have not indicated whether the relationship is linear or not. Different studies have used different methods to establish causality and that is probably the reasons why there are different findings.

Generalised Method of Moment (GMM) has been used in some studies specifically Zahra *et al.* (2008) and Shiu and Lam (2009). The method offers some advantages (in terms of efficient estimation and ability to correct for serial correlation) over other methods available for estimating a model comprising of a system of equations.

Some of the previous studies (Ding and Haynes, 2004 and Karner and Onyenji, 2007) used Ordinary Least Squares or Distributed Lag models in their estimation. Traditionally, ordinary least squares regression analysis is not sufficient to determine the flows of causality, and it cannot be used to test the existence of non-linearity of variables. This study employed more elaborate econometric techniques that account for the complexity of the relationship between the specified variables. Dynamic panel data models for estimations were used. This helped to determine the role of telecommunication infrastructure along other variables in a country's economic growth. In addition, causality between

telecommunication infrastructure and economic growth was established. The estimation of growth equation of each country followed the cross sectional growth framework of Barro (1991), Levine and Renet (1992) and applied the Solow and Swan (1956) model.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents the methodology that was employed in the study. The sections included in the chapter are the research design, empirical model, model specification, definition and measurement of variables, data collection and analysis.

3.2 Research Design

The study utilized non-experimental panel design. 44 countries in sub-Saharan Africa were considered and annual observations on each country were obtained for the period 1988 to 2010. Panel data analysis allowed the unobserved country effects to be correlated with the explanatory variables.

3.3 Theoretical Frame work

This study used the neoclassical model developed by Solow and Swan (1956). The Solow model focuses on four variables: output (Y), capital (K), Labour (L) and Knowledge or the effectiveness of labour (A). At any time, the economy has some amounts of capital, labour, and knowledge, and these are combined to

produce output. The production function takes the form as shown in equation 3.1

$$Y(t) = F(K(t), A(t), L(t)) \quad \text{(3.1)}$$

where t denotes time.

The technology does not enter the model directly, but only through K, L, and A. That is output changes over time only if the inputs to production change. In particular, the amount of output obtained from given quantities of capital and labour rises over time. There is technological progress only if the amount of knowledge increases.

Notice also that A and L enter multiplicatively. AL is referred to as effective labour, also known as labour-augmenting or Harrod-neutral. The central assumption of the Solow model concerns the properties of the production function and the evolution of the three inputs into production over time. The model is set in continuous time and the initial levels of capital, labour, and knowledge are taken as given. Labour and knowledge grow at constant rates as shown in equation3.2.

$$\dot{L}(t) = nL(t) \quad \text{(3.2)}$$

$$\dot{A}(t) = gA(t) \quad \text{(3.3)}$$

Where n and g are exogenous parameters and where a dot over a variable denotes a derivative with respect time.

The growth rate of a variable refers to its proportional rate of change which is represented as $\frac{\dot{X}(t)}{X(t)}$, thus equation (3.2) implies that the growth rate of L is

constant and equal to n, and equation (3.3) implies that A's growth rate is constant and equal to g. Applying the result that a variable's growth rate equals the rate of change of its log to equations (3.2) and (3.3) shows that the rates of change of the logs of L and A are constant and that they are n and g, respectively. Thus

$\ln L(t) = [lnL(0)] + nt$ ..... (3.4)

$lnA(t) = [lnA(0)] + gt$ ..... (3.5)

Where L(0) and A(0) are the values of L and A at time 0. Exponentiation both sides of the equation gives:

$L(t) = L(0)e^{nt}$ ..... (3.6)

$A(t) = A(0)e^{gt}$ ..... (3.7)

Thus the assumption is that both L and A grow exponentially.

Output is divided between consumption and investment. The fraction of output devoted to investment, s, is exogenous and constant. One unit of output devoted to investment yields one unit of new capital. In addition, existing capital depreciates at rate δ thus:

$\dot{K}(t) = sY(t) - \delta K(t)$ ..... (3.8)

Because the economy may be growing over time, it turns out that it is easier to focus on the capital stock per unit of effective labour, k, than on the unadjusted capital stock, K.

Since $k = {}^{K}/_{AL}$, then using chain rule the equation becomes

$$\dot{k}(t) = \frac{\dot{K}(t)}{A(t)L(t)} - \frac{K(t)}{[A(t)L(t)]^2}\left[A(t)\dot{L}(t) + L(\dot{t})A(t)\right] \text{ ……..…… (3.9)}$$

$K/_{AL}$ is the same as k. From equation (3.2) and (3.3), $\dot{L}/L$ and, $\dot{A}/A$ are n and g, respectively. $\dot{K}$ is given by equation (3.8). Substituting these facts into equation (3.9) yields

$\dot{k}(t) = \frac{sY(t)-\delta K(t)}{A(t)L(t)} - k(t)n - k(t)g$ which simplifies to

$$\dot{k}(t) = \frac{sY(t)}{A(t)L(t)} - \delta k(t) - nk(t) - gk(t) \text{ …….…… (3.10a)}$$

Using the fact that Y/AL is given by $f(k)$, the equation thus becomes

$$\dot{k}(t) = sf(k(t)) - \delta k(t) - nk(t) - gk(t) \text{…… (3.10b)}$$

Where, s denotes the propensity to save, $n > 0$ the exogenous rate of population growth and δ the rate of depreciation of physical capital and g is the growth rate in technology. The model implies that countries with similar production technologies as well as comparable savings and the population growth rates should converge to similar steady state levels of per capita income. This convergence property means that poor countries starting with relatively low standard of living and a lower capital/labour ratio will grow faster during transition as they catch up with rich countries. Intuitively according to Agenor (2005), convergence occurs because, with diminishing marginal returns, each increment in capital stock generates large additions to output when the capital stock is initially small.

According to Romer (2006), the neoclassical growth model led to "Sources of Growth" approach, a popular empirical methodology aimed at analyzing the determinants of changes in output. Considering equation 3.1 the study assumed that production function included labour-augmenting technological progress, and that the technology term $T(t)$, grows at constant rate x. Thus the condition for the change in the capital stock is:

$\dot{K} = s.F[K, L.T(t)] - \delta K$ ……(3.11)

Dividing equation 3.11 by L an expression for the change in time in k overtime becomes:

$\dot{k} = s.F[k, T(t)] - (n + \delta).k$ ……(3.12)

To compute per capita growth rate equation (3.12) is divided by k to yield

$\dot{k}/k = s.F[k, T(t)]/k - (n + \delta)$ ……(3.13)

Since s, n and δ are constants, equation (3.13) implies that the average product of capital, $F[k, T(t)]/k$, is constant in the steady state. Because of constant returns to scale, the expression for average product equals $F[1, T(t)/k]$ and is therefore constant only if k and $T(t)$ grow at the same rate. The output per capita is given by:

$y = F[k, T(t)] = k.F[1, T(t)/k]$ …… (3.14)

The variable k is the quantity of capital per unit of effective labor and y is the quantity of output per unit of effective labour. Taking that technology T (t) grows at the rate x the dynamic equation for k becomes

$\dot{k}/k = s.f(k)/k - (x + n + \delta)$ ……..…..…..… (3.15)

The technology incorporated is assumed to be as a result of investment in telecommunication infrastructure.

3.4 The Empirical Model

This study focused on investigating the relationship between telecommunication infrastructure and economic growth using panel data. Roller and Waverman (2001), indicated that when fixed effects are ignored in the model the importance of telecommunications in explaining productivity was too large to be true. Two step GMM dynamic panel model developed by Arellano and Bover (1995) and Blundell and Bond (1998) was used to analyze the telecommunication development effect on economic growth.

The study estimated the growth equation for each country by following the cross section growth framework of Barro (1991) and Levine and Renelt (1992) to examine the determinants of growth. To test conditional convergence hypothesis given by Solow and Swan (1956) and then endogenous growth theory, a Solow-equation was used to show a set of variables reflecting differences in the steady–state equilibrium. The growth analysis was based on a pooled data set of cross country and time series observation of sub-Saharan countries over the period

1988-2010. The study further investigated the role of telecommunication infrastructure on economic growth and other variables stated in literature review.

3.4.1 Model Specification

To investigate the relationship between mobile, landline teledensity and economic growth, the study considered equation 3.14 and extended the equation to account for other externalities associated with output growth. Output growth is contributed by effective amount of labour($L.T(t)$). The study assumes that telecommunication infrastructure services contribute to the efficiency in labour. The telecommunication infrastructure was further decomposed into landline teledensity and mobile teledensity.

Using equation 3.14 where the growth rate is a function of capital growth $(\dot{k})$ and technological progress $T(t)$, the externalities stated in literature review and specifically by Barro (1991), Mankind *et al.* (1992) and Norton (1992) were incorporated and thus the equation was `generally stated as:

$\dot{g} = f(I, G_c T, L_T, M_T, F_D, O_F)$……..…… (3.16)

Where $\dot{g} = \frac{dY}{Y}$ is the economic growth rate, I gross domestic investment as a share of GDP, G_c government consumption of goods and services as a share of GDP, T measure of telecommunication infrastructure (interaction between landline and mobile telephones), L_T is the landline telephone lines per 100 people,

M_T number of mobile subscribers per 100 people, O_F country's volume of trade (measured degree of openness) and F_D is the amount of investment from abroad.

To capture the effects of mobile and telecommunications over time, a dummy variable D_y , was added to the above specification so that:

$$\dot{g} = f(\alpha_i, \eta_t, n, I, G_c T, L_T, M_T, F_D, O_F, D_y) \quad \text{(3.17)}$$

Where α_i represents a country's specific parameters, η_t a country's specific time parameters, and n represent population growth rate of specific countries.

To determine how the interaction between mobile teledensity and landline teledensity affect the economic growth, the study used equation 3.14 and 3.15. The two equations showed that there was more than one way causality. Traditionally, equation 3.14 and 3.15 would have required structural model and identification, but instead the study followed Sims (1972) who argued that the model can be specified as follows:

$$g_{it} = \alpha_1 + \sum_{m=1}^{M} a_m T_{i,t-m} + \sum_{m=1}^{M} c_m g_{i,t-m} + \upsilon_{it} \quad \text{(3.18)}$$

$$T_{it} = \alpha_2 + \sum_{z=1}^{N} b_z g_{i,t-z} + \sum_{z=1}^{N} d_z T_{i,t-z} + e_{it} \quad \text{(3.19)}$$

g_{it} and T_{it} refer to lagged real GDP and lagged teledensity, while m and z indicate the levels of lags for these two variables. i represents the countries in the sample and t represents the time periods. The error terms are represented by $\upsilon_{it} and \quad e_{it}$

3.4.2 Estimation Techniques

It was not possible to directly estimate this equation using Ordinary Least Squares (OLS) technique, thus this prompted the use of dynamic panel data model following Islam (1995). The model is more appropriate in taking into account the correlation between subsequent values of growth, besides accounting for separate country effects. A panel data regression in general known as dynamic panel data model, has the function stated as:

$$\dot{g}_{it} = \alpha_i + X'_{it}\beta + \mu_{it} \quad \text{..... (3.20)}$$

i=1, 2… N; t =1, 2…T

With i denoting individual, countries and t denoting time. The subscript i, therefore, denotes the cross section dimension where t denotes the time series dimension, α is a scalar, β is a K×1 and X_{it} is the i^{th} observation on K explanatory variables.

According to Pasha, Aslam and Abdullah (2007) in different economic relationships, the regressand depends not only on the pure exogenous variables as stated in the literature review, but also on its own lag values. The dynamic panel data model allows observing these dynamics of adjustment. The functional form for dynamic panel data model is expressed as:

$$\dot{g}_{it} = \alpha + \delta y_{i,t-1} + X'_{it}\beta + \mu_{it} \quad \text{..... (3.21)}$$

Where α and δ are scalars, β is a K×1 and $X_{it}^{'}$ is the i^{th} observation on K explanatory variables. The $X_{it}^{'}$ is expressed as

$$X_{it}' = \left[I, G_c, T, L_T, M_T, n, F_{D,} O, D_y\right] \quad \text{.....(3.22)}$$

Where I is the investment, G_c is the share of government consumption, T is the telecommunication infrastructure, L_T is the landline teledensity, M_T is the mobile teledensity, F_D is the foreign direct investment, n is the population growth rate , O is the openness of the economy and D_y is the dummy.

Estimating equation (3.18) and (3.19) with OLS could be problematic due to inclusion of the lagged dependent variable as a regressor, because g_{it} and T_{it} are a function of the unobserved country specific effects. The correlation of a regressor with individual effects, may lead to biased and inconsistent OLS estimates. To deal with this problem Generalised Method of Moments (GMM) was used as suggested in Arellano and Bond (1991). The general idea was to use lags of the dependent and independent variables in each of the equations as instruments for lagged dependent variables.

The study applied the dynamic panel data model to the complete data set based on the country's per capita GDP.

3.5 Definition and Measurement of Variables

Economic growth (g) was the average annual growth rate of real GDP per capita. It was measured by change in GDP at constant prices and presented in percentage form.

Investment (I) measures the share of fixed investment of the previous year in current GDP. It was measured in percentage.

Share of Government Consumption (G_C) was measured as the ratio of government purchases to GDP. It was expressed as a percentage.

Population Growth rate (n) refers to the change in population over a time period. It was expressed as a percentage of the number of individuals in the population of a given country at the beginning of that period.

Telecommunication infrastructure (T) was represented by teledensity which is the number of telephone per 100 inhabitants, including both fixed line and mobile subscribers. It is an interaction term between landline teledensity and mobile teledensity.

Landline Teledensity (L_T) was the number of landline (main telephone) telephone lines per 100 people.

Mobile Teledensity (M_T) was the number of mobile telephone subscribers per 100 people.

Openness (O) was the share of trade in GDP (trade/GDP). It is used as a proxy for the level of openness of the economy.

Foreign Direct Investment (F_D) was the amount of investment from abroad as a share of GDP.

Dummy (Dy) was the dummy variable that represented the two periods; 1988-2000 and 2001-2010, 1 if the period was 1988-2000, and zero otherwise. The dummy captured the impact of mobile teledensity in the period 1988-2000 and 2001 -2010 on economic growth.

3.6 Data Type and Sources

This study used balanced panel data to address the study objectives (i) to (iii). According to Cameron and Trivendi (2005), the panel data approach has the advantage as it makes the sample size large, which provides a good basis for obtaining more precise estimates. It can also facilitate analysis of common dynamic trends; help solve omitted variable and measure individual heterogeneity. The study used published data for the sub-Saharan countries over the period 1988 to 2010. The countries included were; Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Democratic Republic of Congo, Cote d'Ivoire, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia and Zimbabwe.

The sources of data were from government official documents, statistical abstracts and Central Banks of the respective countries. Other sources included International Financial Statistics (IFS), World Development Indicators (WDI), World Bank's African Database (CD-ROM), International Telecommunication Union (ITU) Databases, Africa Development Indicators and International Monetary Fund Statistics (CD-ROMs). This was preceded by identification of the data sources and designing of suitable data template (see appendix for the guide). Caution was taken to ensure consistency in the data for all variables.

3.7 Data Entry and Cleaning

All the data collected from various sources were entered in the data sheet and cleaned appropriately. Descriptive statistics for all the variables were generated to provide a preliminary view of the data. The data were collected in fiscal years for accuracy purposes and where the data were given in calendar years, adjustment was done to convert them to fiscal years.

3.8 Stationarity Analysis

Panel unit root test was conducted to investigate whether there were any variables in the model that were non-stationary. The Im-Pesaran-Shin (IPS) panel unit root was performed. The IPS estimates the *t*-test for unit roots in heterogeneous panels

(Wicks-Lim, 2005). The test allows for individual effects, time trends and common time effects. It is based on the mean of the individual Dickey Fuller (DF) t- statistics of each unit in the panel, and assumes that all series are non stationary (have unit roots) under the null hypothesis that all panel contain unit roots.

All variables were stationary at levels, except population growth rate and foreign direct investment which were only stationary at first difference (see appendixA.2). Population growth rate which was non-stationary at level became stationary at first difference for constant and constant plus time trend. The presence of trend showed that all the variables involved changed naturally with time.

For all series, the null hypothesis of unit root test was rejected at either 1percent or 5 percent level of significance. Hence, based on IPS test, there was strong evidence that all the series were in fact integrated of order zero with the exception of foreign direct investment which became integrated at order one. Considering the various statistical tests that have been conducted, the model satisfies the key assumptions of GMM estimation and is therefore an appropriate statistical generating mechanism. Moreover, the study applied the two-step estimator required to obtain the robust *Sargan test*, i.e., the (robust) *Hansen J-test*, which are not available in one-step estimation.

3.9 Diagnostic tests

The validity of the obtained results in two step GMM depends on the statistical diagnostics. Compared to the OLS model, two-step GMM does not assume normality and it allows for heteroskedasticity in the data. Dynamic panel models are known for having a common problem with the heteroskedasticity of data, which can be controlled (Baltagi, 2008). Accordingly, robust standard errors consistent in the presence of heteroskedasticity and autocorrelation within the panel were reported (see tables 4.2 to 4.7).

The study reported two-step estimates that yield theoretically robust results. The GMM approach assumes linearity and that the disturbance terms were not auto-correlated, or in other words the applied instruments in the model were exogenous. Consequently, an important procedure in testing the statistical properties of this model was testing for the validity of instruments, which required testing for the presence of first and, in particular, second-order autocorrelation in the error term.

The AR (1) and AR (2) tests of first and second-order serial correlation in the first differenced residuals reported their p-values statistics. The p-values as shown in the tables 4.2 to 4.7 gave the probability of correctly rejecting the null hypothesis of no autocorrelation. It is required that the AR (1) tests of first-order

autocorrelation rejects the null while the test for second-order autocorrelation fails to reject the null hypothesis of no autocorrelation (Arellano and Bond, 1991; 1998). Therefore, the system GMM estimator is consistent only when second-order correlation is not significant although first-order correlation need not be zero.

The Hansen J-statistic tested the null hypothesis of correct model specification and valid over the identifying restrictions, i.e. validity of instruments (Baum, 2006). The rejection of the null hypothesis means that assumptions are questionable. Baum (2006) argued that the *Hansen J- test* is the most commonly used diagnostic test in GMM estimation for assessment of the suitability of the model. *The Hansen test* of over identifying restrictions does not reject the null at any conventional level of significance (see Table 4.2 to 4.7). Hence, it is an indication that the models estimated have valid instrumentations.

3.10 Data Analysis

The study addressed the four objectives. The first two objectives which sought to determine the relationship between teledensity (landline and Mobile teledensity) and economic growth were achieved by estimating equation 3.18 and 3.19, and interpreting the coefficient of the variables. The third objective sought to determine how interaction between mobile teledensity and landline teledensity

affect economic growth. This was achieved by estimating adjusted equations 3.18 and 3.19 to include the interaction variable. The fourth objective was based on the findings of the three objectives. The study used Generalized Method Moments (GMM) to analyze the first three objectives.

This study proposed to use dynamic panel data model to analyze the relationship between economic growth and telecommunication infrastructure. Gujarati (2004) and Cameron and Trivedi (2005) asserted that in many econometric applications, the whole reason of using panel data is to allow the unobserved to be correlated with the explanatory variables. Horowitz and Lee (2002), however, argued that standard methods of estimating empirical models in economics rely on strong assumptions about functional forms and distribution of unobserved random variables. Aslam, Pasha and Abdulla (2007) noted that in different economic relationships, the regressand depends not only on the pure exogenous variables, but also on its own lags. The next chapter present the empirical findings

CHAPTER FOUR

EMPIRICAL FINDINGS

4.1 Introduction

This chapter presents the findings of the study. First, the relationship between mobile teledensity and economic growth in sub-Saharan Africa is investigated. Second, the relationship between landline teledensity and economic growth in sub-Saharan Africa is examined. Finally, the chapter presents the effects of the interaction between mobile and landline teledensity on economic growth in sub-Saharan Africa.

4.2 Descriptive Statistics

Table 4.1 reports the descriptive statistics of the main variables for the sample of 44 countries between 1988 and 2010.

Table 4.1 Descriptive statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Economic growth	1.374	6.184	-9.485	10.655
Foreign Direct investment	2.37e+08	7.35e+08	-1.30e+09	9.94e+09
Share of Government Spending	26.654	11.301	5.82	82.081
Investment	21.202	11.764	2.06	64.308
Trade openness	20.100	13.709	1.7	62.412
Population growth rate	2.474	1.113	-7.533	9.770
Mobile Teledensity	2.396	5.136	0	29.7
Landline teledensity	7.295	16.183	0	107.498
Mobile. Landline Teledensity	25.839	134.229	0	1920.49

Source: Constructed from the study data.

From the results shown in table 4.1 it is noted that the average growth rate for all sample countries over the study period is 1.374percent, ranging from a minimum of -9.485 percent to a maximum of 10.655 percent. It can also be noted that, on average, the population growth rate was 2.47 percent over the study period. The total trade amounted to an average of 20.100 percent of GDP over the study period ranging from a minimum of 1.7 percent of GDP to a maximum of 62.412 percent. Further, there was a wide variation in the government spending, investment and landline teledensity of the sample countries. From 1988 to late 1990's, the share of government spending and investment as a share of GDP were relatively high and specifically for the small countries. Examples include Lesotho, Equatorial Guinea and Seychelles. These countries had an average of 57.6 percent and 67.78 percent of government spending and investment respectively. The rest of the countries had an average of 26.65 percent and 21.20 percent. It's important to note that the relative share of government spending and investment declined for

all countries in the year 2000-2010. A similar observation had been made by Lee (2007).

The large variation in the landline teledensity can be attributed to a few countries whose landline telephone penetration was high, such as Botswana, Senegal, Mauritania and Cameroon. The rest of the countries had an average landline penetration of below 3. The low landline teledensity in the rest of the countries could be attributed to the high cost of installation and the inefficiency of the monopolies that exist (ITU, 2006).

Average mobile teledensity for the sample countries over the study period was 5.1 percent, ranging from a minimum of 0 percent to a maximum of 29.7 percent. The mobile teledensity in the late 1980s and the 1990s was below 1 mobile telephone per one hundred inhabitants. This was attributed to the fact that it was around this time that policies were being put in place in many of the sub Saharan countries to make mobile telephones affordable. Over the years, there has been tremendous mobile teledensity growth in many countries (Datta and Agarwal, 2004). It was apparent that there had been some notable growth in the telecommunication sector. Equally, there has been some progression in terms of other macroeconomic variables considered in this study.

4.3 Mobile Teledensity and Economic Growth

4.3.1 Introduction

The first objective of this study was to investigate the relationship between mobile teledensity and economic growth. The study employed two step GMM dynamic panel developed by Arellano and Bover (1995) and Blundell and Bond (1998). The estimated model was for the period 1988-2010 and covered the full set of all countries in sub-Saharan Africa.

The estimation was done by regressing economic growth rate against its lag, foreign direct investment, investment, openness to trade, population growth, share of government consumption, mobile teledensity and a dummy. The dummy was introduced to represent the two periods; 1988 - 2000 and 2001 - 2010. The first period 1988 - 2000 was synonymous with landline telephones. During this period mobile telephony penetration was quite low (below 1 mobile telephone out of every 100 inhabitants). The later period showed a robust mobile teledensity growth. For notation the dummy variable was equal to one (1) if 1988-2000 and zero (0) otherwise.

Table 4.2 shows the results of a two step difference GMM estimation results

Table 4.2 Two Step Difference GMM Estimation Results

Dependent variable :Economic Growth			
Independent variable	**Coefficient**	**Standard Error**	**P>‖z‖**
Lagged economic growth	-0.1050	0.1176	0.372
Foreign direct investment	-4.10e-10	1.42e-09	0.773
Share of government expenditure	0.0165	0.1316	0.900
First lag of share of the government expenditure	-0.2016	0.2368	0.141
Population growth rate	1.7957**	0.7772	0.021
Mobile Teledensity	0.0449**	0.0193	0.020
First lag of mobile teledensity	-0.0301**	0.0166	0.041
Investment	0.0340	0.0485	0.484
First lag of Investment	0.3001**	0.1559	0.044
Dummy capturing theimpact of mobile teledensity	-3.2978***	1.2707	0.009
Trade Openness	0.1298 **	0.0605	0.019
Constant	-0.4154	1.8542	0.823
No. of observations			1012
No. of groups(countries)			44
Arellano-Bond test for AR(1) in first differences *Ho :There is no first-order serial correlation in residuals*			z = -2.7667 Pr>z = 0.0057
Arellano-Bond test for AR(2) in first differences *Ho: There is no second-order serial correlation in residuals*			z = 1.0877 Pr>z = 0.2767
Hansen J-test of Over identification *Ho: Model specification is correct and all over identifying restrictions are correct.*			$Chi^2(14)$ = 122.59 Prob> Chi^2= 0.234

, * denotes rejection of the hypothesis at 5%, and 1% significant level

Source: Constructed from the estimation results.

4.3.2 Economic Growth equation

Table 4.2 shows the results when the economic growth is the dependent variable. The independent variables include mobile teledensity, foreign direct investment, investment, population growth rate trade openness and a dummy.

The coefficient of mobile teledensity was found to be positively correlated with the economic growth rate and the estimated coefficient was statistically different from zero at 5 percent. The significance of the coefficient for mobile teledensity shows that economic growth is enhanced where mobile teledensity is increased. However, the impact of mobile telecommunication was much less as compared with the lagged investment. The positive relationship of the coefficient with economic growth was consistent with the fact that the mobile telephone technology became easier and cheap to roll out from the year 2000. These made it easier for majority of people in sub-Saharan Africa to afford the handsets. In addition, the competitive mobile telephone markets in the region made it easier to access mobile phones this finding was however confirmed by ITU, (2007).

The population growth rate coefficient was positive and significant at the 5 percent level. This shows that population growth rate registered a significant contribution to economic growth, An increase in population creates demand for goods and services, leading to increased output.

Though the coefficient of investment in the same period was not significantly different from zero, that of the lag of the investment was positive and significant at 5 percent. This implies that the growth of the economy depends on the investment made in the previous period as opposed to the current period. Therefore, past investment enhances increased economic growth in future.

The coefficient of the current share of government expenditure was not an important determinant of the current economic growth. This was true when lagged by one period though contrary to the expectations. These findings imply that government expenditure was no longer a significant factor in promoting country's economic growth in sub-Saharan Africa. These findings were consistent with the study conducted by Lee (2007).

The coefficient of the lagged economic growth was not significantly different from zero. This finding is consistent with the study done by Levie and Renelt (1992). In the case of foreign direct investment the null hypothesis was not rejected. This showed that foreign direct investment was no longer a significant factor in increasing economic growth. This finding was consistent with the study conducted by Shiu and Lei (2008) across the world involving 105 countries.

The coefficient of the share of trade in GDP was positive and significant. Since the variable was used as proxy, the results show that countries with greater global

interaction achieve a higher economic growth. Hence increased trade was a key component to economic growth.

The dummy capturing the effect of mobile teledensity in the period 1988-2000 and 2001-2010 in the regression had a negative coefficient which was significant at 1 percent level. The results imply that the contribution to economic growth by mobile teledensity was stronger in the second period. This period was characterized by a high level of mobile telephone penetration in sub-Saharan African countries compared to landline telephone penetration. This finding was consistent with the fact that cellular telephone technology was relatively easy to fund. As a result mobile telephone penetrations had increased due to affordable handsets and competitive mobile telecommunications markets in the region. The impact on economic growth by mobile telephone penetration was more pronounced when landline telephone expansion was low. These findings were consistent with those of Yilmaz *et al*. (2001) and Cronin *et al*. (1991).

4.3.3 Mobile Teledensity Equation

Table 4.3 presents the results of estimation of mobile teledensity against its lag, economic growth rate, foreign direct investment, investment, openness to trade, population growth, share of government consumption and a dummy capturing the

impact of economic growth in the period 1988-2000 and 2001-2010 on mobile telecommunication infrastructure.

Table 4.3 Two-Step Difference GMM Estimation Results

Dependent variable: Mobile teledensity			
Independent variable	**Coefficient**	**Standard Error**	**P>‖z‖**
Lagged mobileTeledensity	0.7703***	0.0804	0.000
Foreign direct investment	2.78e-09**	2.44e-09	0.011
Share of government expenditure	0.0456	0.0934	0.625
First lag(Share of government expenditure)	0.0741	0.0828	0.371
Population growth rate	2.0660**	1.3137	0.016
Economic growth	0.1714**	0.0935	0.047
First lag of economic growth	0.0364	0.0628	0.562
Investment	-0.1484	0.1518	0.328
First lag of investment	0.2293	0.1548	0.139
Dummy capturing the impact of economic growth on mobile telecommunication infrastructure	-7.7461***	2.0230	0.000
Trade Openness	0.2511**	0.1459	0.035
Constant	0.1224	2.1786	0.955
No. of observations	1012		
No. of groups (countries)	44		
Arellano-Bond test for AR(1) in first differences *Ho :There is no first-order serial correlation in residuals*	z = -1.1412 Pr> z = 0.2538		
Arellano-Bond test for AR(2) in first differences *Ho: There is no second-order serial correlation in residuals*	z = -0.09714 Pr> z = 0.9226		
Hansen J-test of Over identification *Ho: Model specification is correct and all over identifying restrictions are correct.*	$Chi^2(14)$ = 2771.60 Prob> Chi^2= 0.456		

, * denotes rejection of the hypothesis at 5%, and 1% significant level

Source: Constructed from the estimation results.

In the regression the coefficient of economic growth was found to be positive and significant at 5 percent level. The results show that increased economic growth leads to increased mobile teledensity. These findings were consistent with the studies of Shiu and Lam (2008).

The coefficient of the lagged mobile teledensity was positive and significant. The positive sign of the coefficient implies that a growth in teledensity depends on the teledensity growth from the previous period. This implied that people build on their past experience to participate more in the future. This finding was consistent with the study done by Dings and Haynes (2004).

Foreign direct investment coefficient was positive and significant. This implies that increased foreign investments made in the sub-Saharan African countries contribute to growth of mobile teledensity. The teledensity had been dominated by foreign investors. It may also imply that capital requirement was huge hence only major investors could compete.

Population growth rate coefficient was positive and significant at the 5 percent level. This implied that an increase in population means an increase in demand for mobile telephone services. The need for the services had created the need for expanded mobile telecommunication infrastructure. Thus, growth in population contributed positively to mobile telephony growth. The findings were contrary to

the findings of Ding and Haynes (2004), who found out the coefficient of population growth rate coefficient to be negative and significant. The study's argument was explained by the large population in the country side and insufficient employment.

Investment which was represented as a share of GDP had a negative coefficient that was not significantly different from zero. The investment during the same period was not an important determinant of mobile teledensity growth. The first lag of investment coefficient was positive and insignificant. These results were contrary to expectations. Ding and Haynes (2004) found that there existed a positive relationship between investment and mobile teledensity in China. The insignificance of the coefficient showed that investment plays no role in the determination of growth of mobile teledensity in sub-Saharan Africa.

The coefficient of trade openness was positive and significant. The results showed that the trade acted as a major contributor to growth in mobile teledensity. The study by Lee (2007) which was conducted on sub Saharan Africa using special linear GMM for 44 countries over the period 1975-2006 found similar findings.

The coefficient of government expenditure and its lag were positive but insignificant. Government spending did not play any significant role in the growth

of mobile teledensity. Similar observations were made by Lee (2007) and Shiu and Lam (2008).

The coefficient of the dummy capturing the impact of economic growth in the period 1988-2000 and 2001-2010 on mobile telecommunication infrastructure was negative and significant at 1 percent level. This implied that the impact of economic growth on mobile teledensity was stronger in the period 2001-2010. This finding could be attributed to the fact that mobile telephone penetration was higher in the second period of the study (2001-2000). According to ITU (2007) similar observations were made that the growth of mobile subscriptions increased at a higher rate in most of the sub Saharan countries from the year 2000.

4.4 Landline Teledensity and Economic Growth

4.4.1 Introduction

The second objective of this study was to investigate the relationship between landline teledensity and economic growth. The study also employed the two-step GMM dynamic panel developed by Arellano and Bover (1995) and Blundell and Bond (1998). The estimated model is for the period 1988-2010 and covers the full set of all countries in sub-Saharan Africa.

4.4.2 Growth Equation

The results were obtained by estimating economic growth against its lag, foreign direct investment, openness to trade, investment, population growth, share of government consumption, landline teledensity and a dummy capturing the effect of mobile teledensity in the period 1988 -2000. The dummy was introduced to represent the two periods; 1988-2000 and 2001-2010, 1 if the period was 1988-2000, and zero otherwise.

The expectation was that the first period 1988-2000 was synonymous with landline telephones. During this period, mobile telephony penetration was very low i.e at below 1 mobile telephone out of every 100 inhabitants. However, it is important to note that landline telephony continued to grow but its growth rate was surpassed by mobile telephone growth (ITU, 2007). The later period (2000-2010) showed a robust mobile teledensity growth. A positive coefficient of the dummy capturing the effect of mobile teledensity in the period 1988 -2000 shows that landline teledensity should have a positive impact of on economic growth as shown in table 4.4. A negative coefficient of the dummy capturing the effect of mobile teledensity in the period 1988-2000 shows that mobile teledensity should have a positive impact of on economic growth.

Table 4.4 presents the results of estimation of economic growth rate against the rest of the variables.

Table 4.4 Two Step difference GMM Estimation Results

Dependent variable: Economic growth			
Independent variable	**Coefficient**	**Standard Error**	**P>‖z‖**
Lagged economic growth	-0.0902	0.1145	0.431
Foreign direct investment	-5.84e-10	1.35e-09	0.665
Share of government expenditure	-0.0219	0.1616	0.892
Share of government expenditure (First lag)	-0.1512***	0.1507	0.010
Population growth rate	1.8180**	0.7780	0.020
Landline teledensity	0.07227**	0.3545	0.042
First lag of landline teledensity	0.0007	0.0351	0.983
Investment	0.0401	0.0457	0.379
First lag of investment	0.2885**	0.1578	0.068
Dummy capturing the effect of mobile teledensity in the period 1988-2000 and 2001-2010	-2.1267**	1.4619	0.016
Trade Openness	0.1246**	0.1596	0.035
Constant	-1.3430	1.8076	0.457
No. of observations	1012		
No. of groups	44		
Arellano-Bond test for AR(1) in first differences *Ho :There is no first-order serial correlation in residuals*	z = 2.7221 Pr> z = 0.0065		
Arellano-Bond test for AR(2) in first differences *Ho: There is no second-order serial correlation in residuals*	z = 1.2526 Pr> z = 0.2104		
Hansen J-test of Over identification *Ho: Model specification is correct and all over identifying restrictions are correct*	$Chi^2(13) = 122.60$ Prob> $Chi^2 = 0.621$		

, * denotes rejection of the hypothesis at 5%, and 1% significant level

Source: Constructed from the estimation results

From the regression, the coefficient of landline teledensity was positive and significant at 5 percent. This implied that an increase in landline teledensity leads to an increase in economic growth. The results supported those of previous studies by Lee (2007). Landline teledensity was quite low with most of the sub-Sahara African countries recording a teledensity of between 4 and 15 landline connections per 100 inhabitants. These findings were consistent with the fact that mobile telephones technology was less capital intensive than landline telecommunications (ITU, 2007). This low penetration probably had led to almost negligible contribution to economic growth.

The population growth rate coefficient was positive and significant at 5 percent level. This implied that an increase in population leads to an increase in demand for goods and services leading to increased output hence growth in output. These findings were consistent with the findings of Lee (2007).

The coefficient of the first lag of investment was positive and significant implying that the growth of the economy depended on the investment made in the previous period as opposed to the current period. Increased investment in a country leads to more contribution to economic growth. Other than the lagged investment, the investment in the current period was found not to be important in explaining economic growth. This implied that the effect of investment carried out in a given year had no immediate effect on economic growth.

The coefficient of government expenditure was negative and insignificant at the current period but significant when lagged. This implies that reduced government spending overtime will lead to increased economic growth. This leads to the suggestion that when the government reduces its spending, the private sector gets an opportunity do more business thereby contributing to more growth in the economy. The results support those of previous studies by Lee (2007) and Lei and Haynes (2004).

The coefficient of lagged economic growth was negative and insignificant. This was contrary to the findings of Lei and Haynes (2004). The insignificance of the variable implied that results from the study didn't support the convergence hypothesis that economic growth tend to grow at slow rate in countries with higher level of GDP per capita growth (ITU, 2007).

The coefficient for trade openness had a positive and significant coefficient. The results showed that increased trade acts as a major contributor to economic growth. The study by Lee (2007) which was conducted on sub-Saharan Africa using special linear GMM for 44 countries over the period 1975 - 2006 had similar findings. The results indicated that countries with greater global interaction achieve a higher economic growth. Therefore, increased imports and export are key components to economic growth.

The coefficient of foreign direct investment was not significantly different from zero. This implied that the contribution of foreign investment no longer played a major role in economic growth.

The dummy capturing the effect of mobile teledensity in the period 1988 - 2000 and 2001 - 2010 in the regression had a negative coefficient which was significant at the 5 percent level. The results implied that the contribution to economic growth was stronger in the second period than in the first period. This period was characterized by a high level of mobile telephone penetration in sub-Saharan African countries compared to landline telephone penetration. These finding were consistent with those of Yilmaz *et al*. (2001) and Cronin *et al*. (1991).

4.4.3 Landline Teledensity Equation

Table 4.5 presents the results of estimation of landline teledensity against its lag, economic growth rate, foreign direct investment, investment, openness to trade, population growth, share of government consumption and a dummy capturing the impact of economic growth in the period 1988 - 2000 and 2001 - 2010 on mobile telecommunication infrastructure.

Table 4.5 Two Step Difference GMM Estimation Results

Dependent Variable : Landline Teledensity			
Independent Variable	**Coefficient**	**Standard Error**	**P>‖z‖**
Lagged landline Teledensity	0.4642***	0.1045	0.000
Foreign direct investment	1.13e-10	3.02e-10	0.709
Share of government expenditure	-0.0020	0.0417	0.961
First lag(Share of government expenditure)	0.0233	0.0349	0.506
Population growth rate	0.0978	0.1220	0.423
Economic growth	0.0144	0.0178	0.224
First of lag of economic growth	0.0131	0.0168	0.436
Investment (It)	0.0179	0.0213	0.401
First of lag investment	-0.0101	0.0188	0.590
Dummy capturing the impact of economic growth in the period 1988-2000 and 2001-2010 on mobile teledensity.	0.1210	0.5942	0.839
Trade Openness	0.0077	0.0252	0.761
Constant	0.5852	1.0657	0.583
No. of observations	1012		
No.of groups	44		
Arellano-Bond test for AR(1) in first differences *Ho :There is no first-order serial correlation in residuals*	z = -2.3021 Pr> z = 0.0213		
Arellano-Bond test for AR(2) in first differences *Ho: There is no second-order serial correlation in residuals*	z = 1.7534 Pr> z = 0.7950		
Hansen J-test of Over identification *Ho: Model specification is correct and all over identifying restrictions are correct*	$Chi^2(13) = 149.87$ Prob> $Chi^2 = 0.1954$		

*** denotes rejection of the hypothesis at 1% significant level

Source: Constructed from the estimation results

The coefficient of landline teledensity is positively related to economic growth, but not significant. This implied that an increase in economic growth did not lead to increase in landline teledensity. The lack of change in landline penetration was

attributed to the increased penetration of mobile telephone in sub-Saharan Africa. Mobile telephones were easy to acquire and are more convenient to use (ITU, 2005).

The coefficient of the first lag of the landline teledensity was positive and significant at 1 percent level. This implied that growth of landline teledensity depend on the growth of teledensity from the previous period. The rest of the variables were found not to be important in determining the landline teledensity.

Foreign direct investment coefficient was not significantly different from zero. The statistical insignificance of the coefficient implies that foreign investment to landline telephone industry was probably low compared to foreign investment directed to other sectors of the economy.

The coefficient of the share of government was not significantly different from zero; this was also true when lagged by one. This implies that government expenditure was not an important determinant of the current economic growth. Further, according to the variable both in the current and previous period, the proportion of government spending to landline telephone industry was small compared to other sectors of the economy.

The coefficient of investment was positive while its first lag is negative. However, both coefficients were insignificant. The statistical insignificance can be attributed to the fact that most of investment in sub-Saharan countries for telecommunication sector was directed towards other sectors such as internet and mobile telephone (ITU, 2008).

The coefficient of trade openness was positive but insignificant. This was an indication that global interaction had no effect on landline telephone industry. The signs of the coefficients observed were consistent with other empirical findings such as Lee (2007) and Lei and Haynes (2004).

The coefficient of the dummy capturing impact of economic growth in the period 1988 – 2000 and 2001 – 2010 on mobile teledensity was not significant. This implies that none of the two periods had any impact on expansion of landline teledensity in sub-Saharan Africa. In general, it's apparent that little attention was given to the development of landline telephones and probably this was caused by the ease in deployment of the mobile telecommunications infrastructure. Furthermore, the indirect benefits of mobile telephones penetration to economic growth were substantial as it had emerged as a practical means of communication in the countries partly due to affordable handsets and competitive mobile telecommunications markets (ITU, 2008).

4.5 Interaction between Mobile and Landline Teledensity and Economic Growth

4.5.1 Introduction

The third objective of this study was to analyze the effects of the interaction between mobile and landline teledensity and economic growth. The study was expected to establish whether the interaction of both mobile and landline teledensity relates to economic growth. To establish the effects of the interaction between mobile and landline teledensity on economic growth, estimation was done through the two-step GMM dynamic panel developed by Arellano and Bover (1995) and Blundell and Bond (1998).

The results were obtained by estimating economic growth rate against its lag, foreign direct investment, and investment, trade openness, population growth, and share of government consumption, the interaction between landline and mobile teledensity and a dummy capturing the impact of economic growth in the period 1988 - 2000 and 2001 - 2010 on mobile telecommunication infrastructure.

The dummy was introduced to represent the two periods; 1988-2000 and 2001-2010, 1 if the period was 1988 - 2000, and 0 otherwise. The expectation was that the first period 1988 - 2000 was synonymous with landline telephones. During this period mobile telephony penetration was very low at below 1 mobile telephone out of every 100 inhabitants. However, it is important to note that

landline telephony continued to grow but its growth rate was surpassed by mobile telephone growth (ITU, 2007).

The later period showed a robust mobile teledensity growth. A positive coefficient of the dummy variable shows the impact of landline teledensity on economic growth while a negative coefficient shows the impact of mobile teledensity growth on the economic growth. Table 4.6 presents the results of the estimation of economic growth rate against the rest of the variables.

Table 4.6 Two Step Difference GMM Estimation Results

Dependent variable :Economic Growth			
Independent variable	**Coefficient**	**Standard Error**	**P>‖z‖**
Lagged economic growth	-0.1038	0.1130	0.358
Foreign direct investment	-7.36e-10	1.34e-09	0.583
Share of government expenditure	0.0097	0.1387	0.944
Lag of share of the government expenditure	-0.1853***	0.1379	0.007
Population growth rate	1.8054**	0.7732	0.020
Mobile.Landline Teledensity	-0.0040***	0.00157	0.01
First lag of Mobile.Landline Teledensity	0.0009**	0.0009	0.037
Investment	0.0375	0 .0456	0.411
First lag of investment	0.3107**	0.1590	0.041
Dummy capturing the impact of mobile teledensity in the period 1988-2000 and 2001-2010	-2.4880**	1.3553	0.046
Trade Openness	0 .1125**	0.1562	0.016
Constant	-1.0869	2.0089	0.588
No. of observations	1012		
No. of groups	44		
Arellano-Bond test for AR(1) in first differences *Ho :There is no first-order serial correlation in residuals*		z = -2.7371 Pr> z = 0.0062	
Arellano-Bond test for AR(2) in first differences *Ho: There is no second-order serial correlation in residuals*		z = 1.0481 Pr> z = 0.2946	
Hansen J-test of Over identification *Ho: Model specification is correct and all over identifying restrictions are correct*		$Chi^2(13) = 97.86$ Prob> $Chi^2 = 0.911$	

, and * denotes rejection of the hypothesis at 5%, and 1% significant level.

Source: Constructed from the estimation results

4.5.2 Growth Equation

Table 4.6 shows the results where economic growth is the dependent variable. The results supported the findings of previous studies such as Cronin *et al*.(1991). Lei and Haynes (2004), Enowbi (2004) and Yilmaz *et al*. (2001). that that telecommunication was both statistically significant and positively correlated to regional economic growth in real GDP per capita. The results also indicated that lagged share of government spending, population growth and lagged investment contributed to economic growth.

The population growth rate coefficient was positive and significant at 5 percent. This implied that an increase in population led to an increase in economic growth. The growth of population leads to increased demand for goods and services. This increase will lead to increased return from firms producing goods and services hence growth of the economy will be registered.

The coefficient of investment was not significantly different from zero. The coefficient of the lag of investment was positive and significant. This implied that the growth of the economy depended on the investment made in the previous period as opposed to the current period.

The coefficient of government expenditure was negative and insignificant at the current period, but was not an important determinant of economic growth in the

previous period. The results supported the previous studies by Lee (2007) and Lei and Haynes (2004).

The coefficient of economic growth from the previous period was not an important determinant of current growth. This implies that the lagged economic growth is not a driver of current economic growth.

The coefficient of share of trade in GDP as a proxy of level of trade openness of a country's economy was positively correlated and significant at 5 percent level with economic growth rate. The results indicated that countries with greater global interaction achieved a higher economic growth. Hence increased imports and exports were key variables that affected economic growth, a position supported by the findings of Lei and Haynes (2004).

The foreign direct investment coefficient was not significantly different from zero. The statistical insignificance implied that foreign investment contribution to economic growth did not play any role in the economic growth.

The dummy variable capturing the impact of economic growth in the period 1988 - 2000 and 2001 - 2010 on mobile telecommunication infrastructure had a negative coefficient which was significant at 1 percent level. The results suggested that the contribution to economic growth by mobile teledensity was

stronger in the second period. This period was characterized by a high level of mobile telephone penetration in sub-Saharan African economies as opposed to landline telephone penetration.

The coefficient of the interaction between mobile and landline teledensity was negatively related to economic growth and was significant at 1 percent. The significance of the negative coefficient supported the fact that the impact on economic growth of mobile telecommunication was more pronounced when the penetration of landlines was relatively low (ITU, 2007). The negative coefficient of the interaction term supports the "diminishing returns" hypothesis (Roeller and Waverman, 2001). A unit increase of teledensity for countries with higher level of telecommunication infrastructure had an effect on economic growth. This implied that countries at an earlier stage of development are likely to benefit most by establishing a telecommunications infrastructure, which seemed to be the case for sub Saharan countries.

4.5.3 Mobile Landline equation

Table 4.7 presents the results of the estimation of the variable denoting the interaction between mobile and landline teledensity against its lag, economic growth rate, foreign direct investment, openness to trade, investment, population growth, share of government consumption and a dummy variable capturing the impact of economic growth in the period 1988 - 2000 and 2001 - 2010 on mobile

telecommunication infrastructure.

Table 4.7 Two-Step Difference GMM Estimation Results

Dependent Variable: Mobile. Landline teledensity			
Independent Variable	**Coefficient**	**Standard Error**	**P>‖z‖**
Lagged Mobile.Landline Teledensity	0.8319***	0.2380	0.000
Foreign direct investment	7.71e-09	9.87e-09	0.435
Share of government expenditure	0.4956	0.8032	0.537
Lag of Share of government expenditure	-0.5175	0.8934	0.562
Population growth rate	4.3087	3.0143	0.153
Economic growth	-0.8557**	0.8611	0.049
First lag of economic growth	0.7908	0.5818	0.174
Investment	0.5089	0.5225	0.330
First lag of Investment	0.2407	0.6312	0.703
Dummy capturing the impact of economic growth in the period 1988-2000 and 2001-2010 on mobile teledensity	-22.5732	17.2990	0.192
Trade Openness	0.6183	0.6929	0.372
Constant	9.7501	15.5980	0.532
No. of observations	1012		
No.of groups(countries)	44		
Arellano-Bond test for AR(1) in first differences *Ho :There is no first-order serial correlation in residuals*		z = -1.4556 Pr> z = 0991	
Arellano-Bond test for AR(2) in first differences *Ho: There is no second-order serial correlation in residuals*		z = 1.6493 Pr> z = 0.1455	
Hansen J-test of Over identification *Ho: Model specification is correct and all over identifying restrictions are correct*		$Chi^2(14) = 508.32$ Prob> $Chi^2 = 0.746$	

, * denotes rejection of the hypothesis at 5% and 1% significant level Source:

Constructed from the estimation results

The results showed that the coefficient of economic growth is significantly different from zero. The coefficient was negative and significant at 5 percent level. This implies that economic growth is an important determinant in the increase of the penetration of both landline and mobile telephones. In addition the negative coefficient implied that marginal impact of mobile telephones vary with the number of landlines that were already in place. This finding was consistent with the result of Lee (2007) and it was the case in sub Saharan countries. In addition, the results provided some evidence for the argument of diminishing returns of telecommunication investment as indicated by Lei and Haynes (2004).

The coefficient of the lagged dependent variable which was the interaction between mobile and landline teledensity was significantly different from zero. This implied that the growth of both the mobile and landline teledensity was largely determined by the previous growth of the two. This was so probably because expansion of telecommunication relies heavily on the subscribers' base.

Population growth rate coefficient was not an important determinant in the growth of the interaction between mobile and landline teledensity. This implies that increase in population growth rate could no longer explain change in the variable that shows the interaction of mobile and teledensity. These findings were consistent with those of Enowbi (2004).

The coefficient of investment was not significantly different from zero for both the current and lagged. This implies that investments in either period were not important in determining the interaction of mobile and landline teledensity. The statistical insignificance can be attributed to the fact that most of the investment in sub Saharan countries for telecommunication sector was directed towards other sectors such as internet and mobile telephone ignoring the landline sector (ITU, 2008).

The coefficient of government expenditure was not an important determinant of the interaction between mobile and landline teledensity. The results supported those of previous studies by Lee (2007) and Lei and Haynes (2004).

The coefficient of share of trade in GDP which was measured using a proxy was not important. This implied that the growth in trade amongst countries was not an important engine to the growth of landline and mobile teledensity when interacted.

Foreign direct investment coefficient is not significantly different from zero. The statistical insignificance implied that foreign investment does not contribute to the growth in both landline and mobile telephone.

The dummy variable capturing the impact of economic growth in the period 1988 - 2000 and 2001 - 2010 on mobile telecommunication infrastructure has a

coefficient which was not significantly different from zero. The results implied that the model could not explain whether growth in the economy was caused by the first period or the second period under study.

CHAPTER FIVE

SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

5.1 Introduction

This chapter presents a summary of the study, findings and the policy implications. Section 5.2 summarizes the study's purpose and findings, section 5.3 draws conclusions from the findings, section 5.4 provides a set of policy implications and section 5.5 present areas for further research.

5.2 Summary

There are empirical investigations that focused on how telecommunications infrastructure affects economic growth in the developed OECD economies, taking into account the two-way causation between them. Röller and Waverman (2001) and Waverman, Meschi and Fuss (2005), found that mobile telephony had a positive and significant impact on economic growth. Lei and Kingsley (2004) found a one-way causality between telecommunication and economic growth. Karner and Onyeji (2007) examined the contribution to economic growth by telecommunications investment and found it to be positive but not significant.

While these studies attested to the fact that telecommunications infrastructure investment has correlation with economic, few studies have investigated how telecommunication specifically has played a role in economic growth in Africa and in particular sub- Saharan Africa, especially where a disproportionate rate of growth of mobile telecommunication is juxtaposed to the level of landline

telephony. There is, therefore, need to investigate the role played by telecommunication in economic growth.

The specific objectives of the study were; to determine the relationship between mobile teledensity and economic growth; to investigate the relationship between landline teledensity and economic growth and; to analyze the effects of the interaction between mobile teledensity and landline and teledensity on economic growth. In addition, the study sheds light on the effects of various macroeconomic components on growth of telecommunication infrastructure.

To achieve the objectives, the study used panel data from 44 sub-Saharan Africa countries for a 20 year period from 1988 to 2010. The diagnostic tests and Generalized Method of Moment (GMM) method of estimation was used to achieve the objectives.

The first objective of this study was to investigate the relationship between mobile teledensity and economic growth. To achieve the objective, two regression equations were estimated whereby economic growth was taken as the dependent variable for the first case, while mobile teledensity was taken as the dependent variable in the second case.

The results from the first equation as presented in table 4.2 showed that coefficient of mobile teledensity was positive and significant. The coefficients of population growth rate, trade openness, share of government spending and lagged investment were positive and significant. Foreign direct investment, lagged economic growth and lagged share of government spending had negative but insignificant. The coefficient of the dummy capturing the impact of mobile teledensity on economic growth was negative and significant.

The second equation had mobile teledensity as the dependent variable against the other variables. The study findings showed that the coefficients of economic growth, foreign direct investment, population growth rate, lagged mobile teledensity and trade openness were positive and significant. The coefficient of share of government expenditure, its first lag, first lag of economic growth and the first lag of investment were found to be positive but insignificant, while the coefficient of investment was negative but insignificant. The coefficient of the dummy variable capturing the impact of economic growth on mobile telecommunication infrastructure was negative and significant.

The second objective of this study was to investigate the relationship between landline teledensity and economic growth. To achieve the objective, two regression equations were estimated whereby economic growth was taken as the

dependent variable for the first case, while landline teledensity was taken as the dependent variable in the second case.

In the first equation the coefficient of mobile landline teledensity was positive and significant. The coefficients of population growth rate, first lag of investment were positive and significant. Coefficients of the first lag of the share of government spending and the dummy capturing the impact of mobile teledensity were negative and significant. Foreign direct investment, lagged economic growth and the share of government spending coefficients were all positive and insignificant.

The second equation took landline teledensity to be the dependent variable. Only the coefficient of lagged landline teledensity was positive while the rest of the variables did not have significant coefficients. Foreign direct investment, first lag of the share of government spending, population growth rate, economic growth and its first lag, investment and the dummy capturing the impact of mobile teledensity coefficients were positive. The coefficients of the share of government spending and the first lag of investment were negative and significant.

The third objective of this study was to analyze the effects of the interaction between mobile and landline teledensity on economic growth. The first equation had the economic growth as the dependent variable against other variables that

included interaction between mobile and landline teledensity, population growth rate, trade openness, share of government spending, investment and foreign direct investment. The coefficients of population growth rate, share of trade in GDP as a proxy to trade openness of a country's economy and the first lag of investment were found to be positive and significant. However, the coefficient of the first lag of share of government spending and the interaction of mobile and landline were negative and significant.

The second equation took the interaction between mobile and landline teledensity to be the dependent variable. The coefficient of the first lag of interaction between mobile and Landline teledensity was positive and significant. The coefficient of economic growth rate was negative and significant. The rest of the variables which included population growth rate, trade openness, share of government spending, investment and foreign direct investment had insignificant coefficients.

5.3 Conclusions

The study concluded that there exists a two way positive relationship between mobile teledensity and economic growth. An improvement in mobile teledensity leads to an increase in the growth of the economy. Increased economic growth leads to growth in mobile telephone penetration. The study also concludes that, other than economic growth, population increase has led to the increase in

demand for mobile telephones, while foreign direct investment has impacted positively on mobile telephone penetration.

The study showed that the contribution of mobile teledensity to economic growth was stronger in the period 2001-2010. This period was characterized by a high level mobile telephone penetration in sub-Saharan African economies compared to landline telephone penetration. The benefits of mobile telephone penetration to economic growth were quite substantial in the region partly due to affordable handsets and competitive mobile telecommunications markets in the region. The impact of economic growth on mobile telephone penetration is more pronounced when landline telephone expansion is low.

The relationship between landline teledensity and economic growth is uni-directional i.e. a change in landline teledensity causes a change in economic growth. An increase in landline teledensity contributes to growth in the economy. However, the effect is lower as compared to the effect of mobile teledensity. The low level landline teledensity in sub-Saharan Africa is attributed the high cost of maintenance in landline telecommunication infrastructure and the popularity of mobile telecommunication which has embraced the most recent technology.

The interaction between mobile and landline teledensity and economic growth was negative. The study found the importance of the landline telephones to

economic growth to be negligible in the sub-Saharan Africa. In addition, the study found that the marginal impact of mobile telephones is greater, whenever the landline teledensity is low. The study further indicated that the telecommunication investment is subject to diminishing returns, suggesting that countries at an earlier stage of development are likely to benefit most by investing in telecommunications infrastructure.

5.4 Policy Implications

The respective governments of sub-Saharan African countries should implement policies that enhance the development of the telecommunications sectors in their respective countries. This is because the results show that telecommunication is found to be a positive and significant determinant of economic growth in sub-Saharan Africa. The development of complementary factors such as electrification specifically in rural areas and political stability may also lead to further increase in both economic and telecommunication growth.

The governments of respective countries should pay more attention to measures that would increase mobile telephone penetration. These include; reduce tariffs on telecommunication components, allow more mobile telephone operators to bring competition to cover wider areas and restructure education and manpower training

to include telecommunication. This is because results show that an increase in mobile teledensity has a direct impact on economic growth.

The government in sub-Saharan Africa should therefore focus on measures that would attract more foreign direct investment, specifically to the telecommunication sector. This is because the results show that foreign direct investment in the telecommunication sector has a potential to grow the economies of sub-Saharan Africa.

The governments of respective countries in sub-Saharan Africa countries should allow more reforms in the telecommunication sector to allow more investment. This is because investment is found to be an important in determinant in mobile teledensity growth in sub-Saharan Africa.

The governments of the sub-Saharan countries should eliminate or reduce barriers to trade. This is because the result shows that removal of trade barriers increases trade amongst countries. In addition increased trade will see further usage of mobile telephone to transact business.

The government needs to focus on further development of landline telephone infrastructure. This is because a further growth of landline teledensity was found to spur economic growth in sub-Saharan Africa.

The various governments of sub-Saharan African economies that are in the early stages of development should increase their investment in the telecommunication sector. This is because they are guaranteed more contribution to economic growth as the results suggest.

5.5 Areas for Further Research

This study sought to estimate the relationship between telecommunication and economic growth in sub-Saharan Africa. Future research may be undertaken in the following areas:

(i) Internet connectivity and determine its relationship with economic growth.

(ii) The causality tests in individual countries.

(iii) The effects of ICT on the productivity of firms in developing countries.

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APPENDICES
Appendix I: Raw data

Country Name	Time	G	FDI	Gc	It	Ot	n	Lt	Mt	Tt
Angola	1988	3.04737	1.3E+08		12.846	15.824	2.44696	0.52	0	0.00
Benin	1988	0.58046	-2E-09		16.23	14.8686	2.76977	0.87	0	0.00
Botswana	1988	15.786	4E+07	31.888	27.935	13.2024	3.1154	6.75	0	0.00
Burkina Faso	1988	3.03385	3709943	14.925	16.244	11.3819	2.64513	0.47	0	0.00
Burundi	1988	1.97737	1196624		14.173	11.7146	2.95049	0.33	0	0.00
Cameroon	1988	-10.512	9.2E+07		21.634	10.8882	2.95946	14.65	0	0.00
Cape Verde	1988	5.09255	597912		39.121	15.0784	0.85682	0.23	0	0.00
Central African Republic	1988	-0.3931	-4E+06	23.153	39.121	16.6312	2.08973	0.13	0	0.00
Chad	1988	11.8926	1289247		14.632	20.0097	3.15784	2.04	0	0.00
Comoros	1988	0.15675	3767051	31.375	11.114	28.5052	2.49541	0.02	0	0.00
Congo, Dem. Rep.	1988	-2.6005	-4E+06				3.10417	0.20	0	0.00
Congo, Rep.	1988	-0.9951	9095237		43.625	29.4861	2.75097	1.28	0	0.00
Cote d'Ivoire	1988	-2.3188	5.2E+07		12.725	14.0837	3.47614	1.58	0	0.00
Djibouti	1988					18.5071	7.60388	1.23	0	0.00
Equatorial Guinea	1988	-0.5173	500000	53.646	37.3		3.13923	0.86	0	0.00
Eritrea	1988					42.8881	2.6483	0.54	0	0.00
Ethiopia	1988	-2.6908		21.097	22.855		3.22984	2.74	0	0.00
Gabon	1988	9.36293	1.3E+08		37.979	5.55921	3.13463	2.78	0	0.00
Gambia, The	1988	-0.4197	1170486		4.033	26.7033	4.80014	1.33	0	0.00
Ghana	1988	2.82184	5000000	14.097	11.175	41.6466	2.69273	0.28	0	0.00
Guinea	1988	3.40675	1.6E+07		18.387	6.63517	2.76714	0.75	0	0.00
Guinea-Bissau	1988	2.55319	680000		21.965	11.8857	1.97619	0.91	0	0.00
Kenya	1988	2.51842	394431	21.313	24.663	10.3978	3.53116	1.63	0	0.00
Lesotho	1988	6.77848	2.1E+07	53.077	44.087	15.9053	1.90137	0.33	0	0.00
Madagascar	1988	0.48722	2910000	16.761	13.294	23.8883	2.86074	0.66	0	0.00
Malawi	1988	-2.6693	1.7E+07		18.74	15.0877	5.83341	0.46	0	0.00
Mali	1988	0.02736	7050571		13.495	17.126	1.44327	1.25	0	0.00
Mauritania	1988	-0.9123	1926633		17.54	19.5812	2.62222	26.77	0	0.00
Mauritius	1988	5.96226	2.4E+07		27.055	26.3528	0.77939	0.37	0	0.00
Mozambique	1988	8.43515	4500000	27.047	42.425	13.1796	-0.2171	5.96	0	0.00
Namibia	1988	-3.4994	-2E+06				4.42402	0.18	0	0.00
Niger	1988	3.89254	6906202		19.052	10.9057	2.85285	0.63	0	0.00
Nigeria	1988	7.09381	3.8E+08		19.882	5.11097	2.5861	0.27	0	0.00
Rwanda	1988	0.18237	2.1E+07		14.975	7.61781	4.21836	2.09	0	0.00
Senegal	1988	-3.5461	1.5E+07		12.747	18.403	3.01635	24.06	0	0.00
Seychelles	1988	4.63871	2.3E+07	51.793	30.262	86.686	0.72182	0.50	0	0.00
Sierra Leone	1988	-9.5653	-2E+07		6.502	7.8793	2.71105	2.40	0	0.00

Sudan	1988	-2.5439	2020000		7.754	2.61976	2.24517	3.99	0	0.00
Swaziland	1988	2.05449	5.1E+07	16.316	17.682	24.6897	4.32935	0.38	0	0.00
Tanzania	1988		3760000		14.731	7.46678	3.02756	0.28	0	0.00
Togo	1988	3.47	1.3E+07		14.595	22.1435	3.01992	1.11	0	0.00
Uganda	1988	4.38354	4700000		10.13	3.6135	3.65291	0.22	0	0.00
Zambia	1988	3.17384	9.3E+07		11.641	9.31108	2.96689	0.76	0	0.00
Zimbabwe	1988	3.96228	-2E+07		16.55	7.68525	3.39498	2.24	0	0.00
Angola	1989	-2.1257	2E+08		12.778	14.2733	2.54783	3.04	0	0.00
Benin	1989	-5.6454	6.2E+07		11.471	14.6129	2.91536	0.31	0	0.00
Botswana	1989	9.65517	4.2E+07	33.868	35.748	10.975	3.05728	1.98	0	0.00
Burkina Faso	1989	-0.5391	5673834	12.013	18.318	9.06283	2.66803	0.17	0	0.00
Burundi	1989	-1.3626	567227		16.353	9.68923	2.7124	0.14	0	0.00
Cameroon	1989	-4.6527	-9E+07		17.719	13.538	2.92852	0.34	0	0.00
Cape Verde	1989	4.53011	174023		37.647	18.0639	1.11197	2.31	0	0.00
Central African Republic	1989	-0.1823	1285233	19.651	37.647	16.5538	2.14046	0.16	0	0.00
Chad	1989	1.62197	1.9E+07		11.819	17.5953	3.16022	0.07	0	0.00
Comoros	1989	-5.5174	3266400	31.587	11.204	28.7586	2.44308	0.72	0	0.00
Congo, Dem. Rep.	1989	-4.5058	-6E+06		37.22		3.33631	0.09	0	0.00
Congo, Rep.	1989	-0.1602	-7E+06		29.344	24.6621	2.72696	0.68	0	0.00
Cote d'Ivoire	1989	-0.5097	1.8E+07		8.905	14.4748	3.41636	0.59	0	0.00
Djibouti	1989					17.5892	6.56502	1.05	0	0.00
Equatorial Guinea	1989	-4.1272	890259	58.254	37.579		2.97801	0.35	0	0.00
Eritrea	1989					33.0917	2.14252	0.00	0	0.00
Ethiopia	1989	-3.5736		23.49	15.739		3.27744	0.25	0	0.00
Gabon	1989	5.15964	-3E+07		26.304	5.3784	3.16881	2.08	0	0.00
Gambia, The	1989	1.24957	1.5E+07		4.565	28.4185	4.48664	0.64	0	0.00
Ghana	1989	2.29917	1.5E+07	13.738	11.656	37.977	2.68763	0.28	0	0.00
Guinea	1989	0.39114	1.2E+07		18.489	6.79756	3.53503	0.19	0	0.00
Guinea-Bissau	1989	4.00061	470000		20.614	14.9435	1.99852	0.59	0	0.00
Kenya	1989	1.1272	6.2E+07	21.818	18.983	15.8724	3.46278	0.73	0	0.00
Lesotho	1989	4.84511	1.3E+07	53.143	50.332	18.4304	1.84912	0.69	0	0.00
Madagascar	1989	1.09669	1.3E+07	22.087	13.39	23.1271	2.90719	0.24	0	0.00
Malawi	1989	-3.5217	9290000		21.161	14.475	4.92093	0.30	0	0.00
Mali	1989	9.99583	6363471		15.609	16.4623	1.59444	0.12	0	0.00
Mauritania	1989	2.05032	3467749		16.052	17.2942	2.63739	0.28	0	0.00
Mauritius	1989	3.6604	3.6E+07		29.623	23.3963	0.77333	5.03	0	0.00
Mozambique	1989	6.16658	3400000	27.049	41.222	12.5707	0.31356	0.33	0	0.00
Namibia	1989	-2.4073	-480000				4.25663	3.77	0	0.00
Niger	1989	-1.9849	761736		13.678	10.7329	2.9345	0.12	0	0.00
Nigeria	1989	4.49343	1.9E+09		20.732	8.07911	2.5575	0.29	0	0.00
Rwanda	1989	-2.3553	1.6E+07		13.871	6.6898	2.34696	0.16	0	0.00

Senegal	1989	0.88803	2.7E+07		11.15	18.5663	3.01666	0.58	0	0.00
Seychelles	1989	10.3334	2.2E+07	58.123	29.635	68.0252	0.78133	11.89	0	0.00
Sierra Leone	1989	-1.3683	2.2E+07		7.874	8.63651	2.10506	0.31	0	0.00
Sudan	1989	6.49678	3488889		2.534	4.25495	2.26035	0.24	0	0.00
Swaziland	1989	8.51729	6.7E+07	16.537	17.955	26.0512	3.96913	1.65	0	0.00
Tanzania	1989		5840000		24.84	8.81752	3.09327	0.29	0	0.00
Togo	1989	1.2018	9169040	26.176	22.322	23.9377	2.78513	0.29	0	0.00
Uganda	1989	2.58969	-2E+06		10.443	4.49542	3.61104	0.16	0	0.00
Zambia	1989	-3.8152	1.6E+08		12.314	13.2479	2.86106	0.84	0	0.00
Zimbabwe	1989	1.921	-1E+07		17.99	8.42528	3.16631	1.20	0	0.00
Angola	1990	-3.0251	-3E+08		7.35	18.6722	2.77132	3.10	0	0.00
Benin	1990	0.05735	6.2E+07	22.059	15.044	13.9266	3.10531	0.31	0	0.00
Botswana	1990	3.61908	9.6E+07	38.72	34.425	15.4406	2.99819	2.02	0	0.00
Burkina Faso	1990	-3.2399	460000	9.422	18.247	9.1709	2.68882	0.18	0	0.00
Burundi	1990	1.01831	1255435		9.876	12.8878	2.42681	0.15	0	0.00
Cameroon	1990	-8.7687	-1E+08		18.431	12.799	2.87722	0.34	0	0.00
Cape Verde	1990	-0.8924	252601		40.435	18.5461	1.59787	2.36	0	0.00
Central African Republic	1990	-4.357	697850	21.178	40.435	15.9747	2.2837	0.17	0	0.00
Chad	1990	-7.1155	9400000		11.45	15.4786	3.11306	0.07	0	0.00
Comoros	1990	2.57521	393003	31.458	11.424	24.3116	2.42341	0.73	0	0.00
Congo, Dem. Rep.	1990	-9.8749	-1E+07		33.898		3.6032	0.09	0	0.00
Congo, Rep.	1990	-1.7002	2.3E+07	31.637	15.906	31.0235	2.70988	0.69	0	0.00
Cote d'Ivoire	1990	-4.3906	4.8E+07		6.688	15.6508	3.38793	0.61	0	0.00
Djibouti	1990				22.07	20.5281	5.0009	1.08	0	0.00
Equatorial Guinea	1990	0.06792	1.1E+07	56.293	54.355		3.1412	0.36	0	0.00
Eritrea	1990					30.4758	1.45566	0.00	0	0.00
Ethiopia	1990	-0.6437		20.401	13.853		3.33568	0.25	0	0.00
Gabon	1990	1.87414	7.3E+07		21.677	5.4912	3.20514	2.12	0	0.00
Gambia, The	1990	-0.5372	1.4E+07		5.303	20.97	4.03563	0.66	0	0.00
Ghana	1990	0.52934	1.5E+07	12.133	24.772	35.5785	2.74666	0.28	0	0.00
Guinea	1990	-0.2576	1.8E+07	26.042	26.27	6.57322	4.49112	0.20	0	0.00
Guinea-Bissau	1990	3.99458	2020000		14.899	19.6766	2.00432	0.61	0	0.00
Kenya	1990	0.71828	5.7E+07	22.982	23.719	11.0435	3.39085	0.74	0	0.00
Lesotho	1990	4.5392	1.7E+07	49.063	54.205	21.3954	1.83415	0.70	0	0.00
Madagascar	1990	0.14087	2.2E+07	19.12	14.818	22.5701	2.94127	0.24	0	0.00
Malawi	1990	1.97801	2.3E+07		20.555	12.8256	3.57747	0.30	0	0.00
Mali	1990	-3.658	5729716		23.064	16.2204	1.85655	0.13	0	0.00
Mauritania	1990	-4.3628	6736221		15.66	18.9578	2.6737	0.28	0	0.00
Mauritius	1990	6.36747	4.1E+07		29.353	16.0472	0.76727	5.13	0.20814	1.07
Mozambique	1990	-0.2598	9200000	20.965	43.538	12.5445	1.25517	0.33	0	0.00
Namibia	1990	-1.4261	3E+07	27.254	27.874	20.6759	3.90028	3.84	0	0.00

Niger	1990	-4.2349	4.1E+07		11.019	10.933	3.03449	0.12	0	0.00
Nigeria	1990	5.51356	5.9E+08		21.89	10.3309	2.5105	0.29	0	0.00
Rwanda	1990	-2.1888	7562354		13.062	6.61883	-0.2154	0.17	0	0.00
Senegal	1990	-3.6143	5.7E+07		11.069	20.8221	3.0033	0.59	0	0.00
Seychelles	1990	6.0594	2E+07	49.377	30.467	68.441	0.87878	12.13	0	0.00
Sierra Leone	1990	2.05863	3.2E+07		7.893	20.864	1.25738	0.31	0	0.00
Sudan	1990	-7.6771	-3E+07		7.273	3.22759	2.36244	0.24	0	0.00
Swaziland	1990	6.07061	3E+07	18.347	14.496	25.6689	3.41271	1.68	0	0.00
Tanzania	1990		10000		23.342	9.82349	3.18442	0.30	0	0.00
Togo	1990	-2.7304	1.8E+07	26.105	15.708	24.1442	2.5244	0.29	0	0.00
Uganda	1990	2.79687	-6E+06		11.911	4.53722	3.51473	0.17	0	0.00
Zambia	1990	-3.1729	2E+08		16.304	14.9891	2.74211	0.86	0	0.00
Zimbabwe	1990	3.9226	-1E+07		18.23	8.63974	2.90754	1.22	0	0.00
Angola	1991	-4.1534	6.6E+08		16.364	16.4871	3.03487	3.17	0	0.00
Benin	1991	1.30666	1.2E+08	20.968	15.844	17.8703	3.31619	0.32	0	0.00
Botswana	1991	4.34879	-8E+06	40.889	29.597	15.0282	2.93677	2.07	0	0.00
Burkina Faso	1991	6.15495	570000	15.795	18.314	10.2564	2.709	0.18	0	0.00
Burundi	1991	2.75328	892500		9.345	14.3026	2.15994	0.15	0	0.00
Cameroon	1991	-6.4885	-1E+07		17.248	12.2908	2.82556	0.35	0	0.00
Cape Verde	1991	-0.723	1744334		38.399	15.4919	2.12847	2.41	0	0.00
Central African Republic	1991	-2.9522	-5E+06	21.302	38.399	13.3266	2.44268	0.17	0	0.00
Chad	1991	5.26842	4239528		10.657	12.7303	3.05605	0.07	0	0.00
Comoros	1991	-7.6522	2506163	31.373	11.297	28.5315	2.41424	0.75	0	0.00
Congo, Dem. Rep.	1991	-11.929	1.2E+07		15.829		3.90553	0.09	0	0.00
Congo, Rep.	1991	-0.3139	3.3E+07	37.962	20.528	32.5093	2.68602	0.71	0	0.00
Cote d'Ivoire	1991	-3.2677	1.6E+07		7.358	17.1196	3.36316	0.62	0	0.00
Djibouti	1991	-7.4623	2290106	40.626	18.516	19.1382	3.38357	1.1	0	0.00
Equatorial Guinea	1991	-4.372	4.1E+07	54.001	46.192	51.9347	3.32714	0.37	0	0.00
Eritrea	1991					36.2088	0.69841		0	0.00
Ethiopia	1991	-10.231		16.941	11.552		3.38799	0.26	0	0.00
Gabon	1991	2.7303	-5E+07	26.712	27.254	4.13584	3.23927	2.17	0	0.00
Gambia, The	1991	-0.5076	9197230		4.87	22.3133	3.56864	0.67	0	0.00
Ghana	1991	2.357	2E+07	11.646	18.701	43.5021	2.81741	0.29	0	0.00
Guinea	1991	-2.8585	3.9E+07	22.667	22.384	6.65424	5.47999	0.2	0	0.00
Guinea-Bissau	1991	2.99928	2090000		16.573	16.3336	2.01903	0.62	0	0.00
Kenya	1991	-1.8799	1.9E+07	21.985	20.992	15.7367	3.32585	0.76	0	0.00
Lesotho	1991	0.5115	7467682	47.321	69.621	20.2052	1.81442	0.72	0	0.00
Madagascar	1991	-9.0515	1.4E+07	18.406	10.56	20.8345	2.97029	0.25	0	0.00
Malawi	1991	6.42935	-3E+07		20.236	14.3735	2.13885	0.31	0	0.00
Mali	1991	-0.5455	1205217		22.85	17.9256	2.15009	0.13	0	0.00
Mauritania	1991	-0.9376	2269792		17.9	16.7403	2.71435	0.29	0	0.00

Mauritius	1991	3.49005	1.7E+07		27.666	16.1166	0.90937	5.25	0.23438	1.23
Mozambique	1991	2.47674	2.3E+07	24.305	18.937	14.2461	2.33716	0.34	0	0.00
Namibia	1991	4.4542	1.2E+08	32.604	16.37	24.3534	3.49831	3.93	0	0.00
Niger	1991	-0.6609	1.5E+07		7.476	10.8584	3.13644	0.12	0	0.00
Nigeria	1991	2.20541	7.1E+08		22.998	12.2088	2.46454	0.3	0	0.00
Rwanda	1991	0.86717	4577985		13.598	8.08323	-3.41	0.17	0	0.00
Senegal	1991	-0.4679	-8E+06		12.666	19.0712	2.9927	0.6	0	0.00
Seychelles	1991	1.66393	2E+07	50.644	17.829	62.7426	1.07278	12.4	0	0.00
Sierra Leone	1991	1.99845	7504465		7.047	16.8543	0.34407	0.32	0	0.00
Sudan	1991	4.87568	-620000		13.437	2.41053	2.48167	0.25	0	0.00
Swaziland	1991	-0.2244	8.2E+07	20.231	15.015	23.5663	2.80181	1.72	0	0.00
Tanzania	1991	-1.265	10000	16.335	23.541	8.92564	3.29126	0.29	0	0.00
Togo	1991	-2.879	6479813	22.617	12.433	25.1322	2.21885	0.3	0	0.00
Uganda	1991	2.00973	1000000		15.417	7.90552	3.41554	0.17	0	0.00
Zambia	1991	-2.6123	3.4E+07		9.985	13.1989	2.61088	0.88	0	0.00
Zimbabwe	1991	2.79228	2790486		20.59	10.4134	2.63019	1.25	0	0.00
Angola	1992	-9.8564	2.9E+08		28.083	37.8109	3.22699	4.38	0	0.00
Benin	1992	0.46194	7.8E+07	22.399	14.126	21.0683	3.47079	0.59	0	0.00
Botswana	1992	0.01178	-2E+06	42.094	30.16	13.2495	2.86356	4.83	0	0.00
Burkina Faso	1992	-2.4642	3113052	15.305	18.765	12.1471	2.72755	0.32	0	0.00
Burundi	1992	-0.9122	600088	25.824	10.631	14.2939	1.92133	0.25	0	0.00
Cameroon	1992	-5.7522	2.9E+07		13.94	11.5368	2.77522	0.52	0	0.00
Cape Verde	1992	0.69274	450472		36.772	16.4158	2.5188	6.37	0	0.00
Central African Republic	1992	-8.7783	-1E+07	19.573	36.772	13.7942	2.54797	0.29	0	0.00
Chad	1992	4.78753	1960771		9.098	13.3312	3.02098	0.09	0	0.00
Comoros	1992	5.94729	-1E+06	32.487	17.602	29.8903	2.40935	0.79	0	0.00
Congo, Dem. Rep.	1992	-14.102	-730000		25.682		4.10823	0.08		0.00
Congo, Rep.	1992	-0.0974	2739033	36.645	21.6	27.3956	2.66426	0.82	0	0.00
Cote d'Ivoire	1992	-3.4941	-2E+08		5.664	18.1009	3.31179	0.88	0	0.00
Djibouti	1992	-2.1702	2290106	51.8	19.667	19.0657	2.17613	1.32	0	0.00
Equatorial Guinea	1992	7.01145	6018320	45.839	35.155	51.2682	3.3847	0.89	0	0.00
Eritrea	1992			25.244	7.742	28.0952	0.11278	0.51	0	0.00
Ethiopia	1992	-11.73	170000	13.923	10.627		3.40435	0.25	0	0.00
Gabon	1992	-6.1851	1.3E+08	28.26	22.602	4.51029	3.24573	3.16	0.02825	0.09
Gambia, The	1992	0.12897	6329114		5.061	22.7527	3.19398	1.89	0.01973	0.04
Ghana	1992	0.96184	2.3E+07	14.911	16.74	43.7245	2.84882	0.44	0.00255	0.00
Guinea	1992	-2.8399	2E+07	19.291	21.22	9.03998	6.09963	0.22	0	0.00
Guinea-Bissau	1992	-0.9441	5830000		25.824	14.6839	2.04256	0.73	0	0.00
Kenya	1992	-3.9773	6363133	23.542	15.07	17.2871	3.2559	0.82	0.00439	0.00
Lesotho	1992	5.46157	2667302	44.381	70.179	19.5352	1.78685	0.77	0	0.00
Madagascar	1992	-1.8052	2.1E+07	22.499	11.296	17.5179	3.00086	0.26	0	0.00

Malawi	1992	-8.2713	-7E+06		19.935	14.3599	1.01771	0.35	0	0.00
Mali	1992	5.76825	-2E+07		19.774	20.4127	2.39618	0.19	0	0.00
Mauritania	1992	-0.8875	7549403		20.672	17.8077	2.74829	0.43	0	0.00
Mauritius	1992	5.09935	1.5E+07		27.239	13.6047	1.33582	16.22	0.26938	4.37
Mozambique	1992	-8.0921	2.5E+07	29.352	23.068	20.8746	3.19868	0.34	0	0.00
Namibia	1992	3.83692	1.2E+08	35.514	20.583	23.975	3.17873	5.43	0	0.00
Niger	1992	-9.4846	5.6E+07		6.926	11.034	3.22657	0.16	0	0.00
Nigeria	1992	0.44823	9E+08		23.785	8.75083	2.42923	0.36	0	0.00
Rwanda	1992	12.7393	2187570	27.967	16.266	7.13243	-6.2841	0.28	0	0.00
Senegal	1992	-1.7247	2.1E+07		12.78	18.9109	2.97477	1.11	0	0.00
Seychelles	1992	5.81254	9014031	51.562	21.538	62.4122	1.26677	19.56	0	0.00
Sierra Leone	1992	-18.69	-6E+06		8.548	16.1628	-0.3947	0.4	0	0.00
Sudan	1992	3.87732	90000	46.314	22.215	5.11382	2.56652	0.36	0	0.00
Swaziland	1992	-0.6658	8.7E+07	24.471	18.909	23.8589	2.3047	2.41	0	0.00
Tanzania	1992	-2.7729	1.2E+07	20.288	24.338	11.1101	3.35714	0.3	0	0.00
Togo	1992	-5.8606	-1E+07	19.603	11.481	19.6379	1.97728	0.57	0	0.00
Uganda	1992	0.0266	3000000		16.173	9.87591	3.33463	0.24	0	0.00
Zambia	1992	-4.1605	4.5E+07		11.282		2.50344	0.94	0	0.00
Zimbabwe	1992	-11.144	1.5E+07		22.36	14.292	2.36727	1.47	0	0.00
Angola	1993	-27.142	3E+08		28.813	31.5518	3.29724	4.75	0.00967	0.05
Benin	1993	-0.0463	1403787	19.936	16.233	15.2714	3.5051	0.64	0	0.00
Botswana	1993	-0.8661	-3E+08	41.754	26.451	12.4257	2.76783	5.5	0	0.00
Burkina Faso	1993	0.66282	3178381	20.092	19.187	11.735	2.7422	0.33	0	0.00
Burundi	1993	-7.7921	473680	26.805	11.57	13.794	1.66929	0.25	0.00595	0.00
Cameroon	1993	-5.7893	5120733		17.121	8.36552	2.71134	0.52	0	0.00
Cape Verde	1993	4.17528	3644068		39.762	19.1286	2.72968	8.19	0	0.00
Central African Republic	1993	-2.2291	-1E+07	10.594	39.762	13.9481	2.58895	0.29	0	0.00
Chad	1993	-18.209	1.5E+07		2.972	19.2851	3.01039	0.11	0	0.00
Comoros	1993	0.54438	190705	28.56	14.985	30.7031	2.41874	0.84	0	0.00
Congo, Dem. Rep.	1993	-16.919	6870000		16.461		4.06872	0.08		0.00
Congo, Rep.	1993	-3.6038	2.9E+08	36.75	29.496	46.9836	2.6653	0.82	0	0.00
Cote d'Ivoire	1993	-3.3588	8.8E+07		4.895	19.2534	3.22379	0.88	0	0.00
Djibouti	1993	-8.0284	1423580	52.622	18.985	18.1771	1.51876	1.32	0	0.00
Equatorial Guinea	1993	2.72834	2.2E+07	46.09	39.654	55.8746	3.41416	0.89	0	0.00
Eritrea	1993	13.5788		52.022	16.745	31.239	-0.1093	0.51	0	0.00
Ethiopia	1993	9.39569	3500000	13.472	16.44	23.2326	3.36795	0.26	0	0.00
Gabon	1993	0.67216	-1E+08	28.624	22.073	6.57564	3.20076	3.27	0.11724	0.38
Gambia, The	1993	0.03415	1.1E+07		5.278	30.4629	2.93348	1.89	0.04293	0.08
Ghana	1993	1.92266	1.3E+08	20.296	15.315	40.7703	2.83165	0.44	0.01082	0.00
Guinea	1993	-1.1484	2720000	18.499	21.696	9.88986	6.07611	0.26	0.00061	0.00
Guinea-Bissau	1993	0.02846	3300000		15.542	15.9042	2.04979	0.69	0	0.00

Kenya	1993	-2.7689	1.5E+08	25.309	16.688	13.0441	3.16051	0.81	0.0045	0.00
Lesotho	1993	1.46626	1.5E+07	44.243	63.268	39.0929	1.78543	0.96	0	0.00
Madagascar	1993	-0.9537	1.5E+07	23.114	11.448	15.228	3.03312	0.27	0	0.00
Malawi	1993	9.24173	8000000		15.171	14.515	0.41119	0.35	0	0.00
Mali	1993	-4.6275	4061271		22.371	14.0063	2.57535	0.2	0	0.00
Mauritania	1993	2.9735	1.6E+07		14.327	16.2678	2.77746	0.55	0	0.00
Mauritius	1993	3.54942	1.5E+07		27.292	16.5066	1.46926	19.52	0.368	7.18
Mozambique	1993	4.73099	3.2E+07	28.799	23.796	22.2326	3.67798	0.36	0	0.00
Namibia	1993	-4.8722	5.5E+07	34.047	16.21	25.0645	2.96585	6.25	0	0.00
Niger	1993	-1.8461	-3E+07		6.401	13.8223	3.30244	0.17	0	0.00
Nigeria	1993	-0.2226	1.3E+09		30.598	18.2107	2.39845	0.36	0.00862	0.00
Rwanda	1993	-0.9189	5851480	24.094	17.554	8.66458	-7.5333	0.28	0	0.00
Senegal	1993	-1.62	-812254		11.564	17.5244	2.92566	1.32	0	0.00
Seychelles	1993	4.65665	1.9E+07	59.965	26.208	73.6398	1.46076	19.56	0	0.00
Sierra Leone	1993	2.22041	-7E+06		4.067	15.615	-0.8256	0.39	0	0.00
Sudan	1993	1.86481	-160000	21.756	20.656	2.0179	2.61982	0.54	0	0.00
Swaziland	1993	0.77354	7.2E+07	24.206	17.317	25.6963	1.99093	2.41	0	0.00
Tanzania	1993	-2.1473	2E+07	18.348	22.454	24.3064	3.32915	0.3	0	0.00
Togo	1993	-16.728	-1E+07	22.909	3.504	17.2568	1.94094	0.58	0	0.00
Uganda	1993	4.85842	5.5E+07		15.584	12.0086	3.25368	0.25	0	0.00
Zambia	1993	4.20278	3.1E+08		14.12		2.45936	0.94	0	0.00
Zimbabwe	1993	-1.0951	2.8E+07		23.59	14.2419	2.14713	1.72	0	0.00
Angola	1994	0.22823	1.7E+08		28.009	42.199	3.21217	5.318	0.01553	0.08
Benin	1994	0.88928	1.4E+07	22.557	17.769	21.617	3.39421	0.663	0	0.00
Botswana	1994	0.92218	-1E+07	37.431	26.025	11.4781	2.6457	5.638	0	0.00
Burkina Faso	1994	-1.4357	1.8E+07	20.053	19.984	10.2722	2.75257	0.364	0	0.00
Burundi	1994	-5.1699	3957.85	23.673	6.933	11.767	1.40305	0.286	0.00628	0.00
Cameroon	1994	-5.0335	-9E+06		15.878	8.93647	2.63284	0.539	0.01177	0.01
Cape Verde	1994	4.07511	2128443		43.651	19.8476	2.70597	9.8	0	0.00
Central African Republic	1994	2.26456	3602275	21.505	43.651	17.2301	2.54443	0.274	0	0.00
Chad	1994	6.84596	2.7E+07		20.775	21.5453	3.03358	0.118	0	0.00
Comoros	1994	-7.5615	177714	36.666	18.681	40.0684	2.44167	0.946	0	0.00
Congo, Dem. Rep.	1994	-7.4341	-2E+06		7.276		3.74685	0.04		0.00
Congo, Rep.	1994	-8.0119	2990000	35.895	54.486	60.0691	2.69409	0.789	0	0.00
Cote d'Ivoire	1994	-2.2563	7.8E+07		8.644	19.4657	3.09008	1.189	0	0.00
Djibouti	1994	-2.5019	1423580	47.568	15.382	18.2689	1.59198	1.273	0	0.00
Equatorial Guinea	1994	1.60976	1.7E+07	28.472	53.542	48.928	3.39213	1.252	0	0.00
Eritrea	1994	21.0113		38.969	25.217	21.6173	0.17347	0.67	0	0.00
Ethiopia	1994	-0.1303	1.7E+07	17.239	17.524	18.3566	3.27073	0.275	0	0.00
Gabon	1994	0.55178	-1E+08	25.461	21.561	8.80005	3.09523	3.273	0.24448	0.80
Gambia, The	1994	-2.631	9722679		4.685	24.9658	2.82047	2.083	0.07416	0.15

Ghana	1994	0.4961	2.3E+08	22.163	16.944	43.0143	2.75185	0.752	0.02015	0.02
Guinea	1994	-1.4515	210000	17.57	20.993	10.4457	5.35544	0.477	0.0112	0.01
Guinea-Bissau	1994	1.11954	430000		14.622	15.3366	2.03655	0.712	0	0.00
Kenya	1994	-0.4353	7432413	25.141	14.898	13.8867	3.03495	0.921	0.00747	0.01
Lesotho	1994	3.77263	1.9E+07	44.591	64.308	37.8516	1.81374	0.974	0	0.00
Madagascar	1994	-3.0913	5728098	22.179	10.903	13.8145	3.06842	0.288	0.00236	0.00
Malawi	1994	-10.704	2.5E+07		28.66	17.9383	0.51857	0.347	0	0.00
Mali	1994	-1.7381	1.7E+07		32.037	14.7058	2.66144	0.25	0	0.00
Mauritania	1994	-5.7362	2079709		49.099	21.8991	2.79879	0.583	0	0.00
Mauritius	1994	2.63913	2E+07		28.434	15.7364	1.44799	21.365	0.51267	10.95
Mozambique	1994	2.92156	3.5E+07	30.764	24.816	23.7843	3.66676	0.399	0	0.00
Namibia	1994	4.25102	9.8E+07	30.891	21.708	22.3677	2.89781	6.86	0	0.00
Niger	1994	0.5686	-1E+07		10.393	11.4851	3.35947	0.179	0	0.00
Nigeria	1994	-2.2486	2E+09		25.005	14.2734	2.37418	0.395	0.01191	0.00
Rwanda	1994	-47.287	1000	15.832	9.84	0	-5.7809	0.163	0	0.00
Senegal	1994	-2.8175	6.7E+07		12.519	23.3428	2.84061	1.55	0.0012	0.00
Seychelles	1994	-2.4267	3.1E+07	56.624	35.487	67.8695	1.65475	24.354	0	0.00
Sierra Leone	1994	-1.1544	-3E+06		6.781	22.7811	-0.8082	0.345	0	0.00
Sudan	1994	-1.6126	9.9E+07	17.959	22.688	2.34411	2.62694	0.573	0	0.00
Swaziland	1994	1.82532	6.3E+07	24.788	16.646	22.1627	1.92263	3.046	0	0.00
Tanzania	1994	-1.6587	5E+07	18.881	22.028	20.4297	3.18787	0.379	0.00128	0.00
Togo	1994	12.52	1.5E+07	20.441	12.018	19.9678	2.16482	0.714	0	0.00
Uganda	1994	3.07631	8.8E+07		15.229	12.54	3.17702	0.276	0	0.00
Zambia	1994	-10.876	4E+07		5.915		2.49418	0.884	0	0.00
Zimbabwe	1994	7.08933	3.5E+07		21.37	15.8719	1.984	1.724	0	0.00
Angola	1995	7.09719	4.7E+08		30.421	42.9496	3.03734	5.2	0.01647	0.09
Benin	1995	1.31084	1.3E+07	24.583	22.173	23.2214	3.19909	0.66	0.01858	0.01
Botswana	1995	1.82127	7E+07	36.168	27.073	14.76	2.50475	7.51	0	0.00
Burkina Faso	1995	2.83805	9816728	21.859	20.757		2.76043	0.41	0	0.00
Burundi	1995	-8.9733	1981922	24.194	6.348	9.97421	1.15045	0.29	0.00927	0.00
Cameroon	1995	0.70172	7292420		15.014	9.19509	2.54745	0.66	0.02009	0.01
Cape Verde	1995	4.81586	2.6E+07		38.802	25.967	2.52434	11.21	0	0.00
Central African Republic	1995	4.61467	6200566	16.872	38.802		2.44125	0.28	0.00132	0.00
Chad	1995	-1.8341	3.3E+07	16.712	13.178		3.08014	0.12	0	0.00
Comoros	1995	1.07795	889525	30.506	14.86	36.3801	2.47431	0.95	0	0.00
Congo, Dem. Rep.	1995	-2.5383	-2E+07		10.6		3.26865	0.04	0.01929	0.00
Congo, Rep.	1995	1.19295	1.3E+08	32.027	36.573	36.8201	2.73618	0.79	0	0.00
Cote d'Ivoire	1995	4.03655	2.1E+08		15.598	16.056	2.92611	1.51	0	0.00
Djibouti	1995	-5.5398	3218528	39.222	8.438	17.333	2.14857	1.27	0	0.00
Equatorial Guinea	1995	10.5129	1.3E+08	21.424	78.15	47.7718	3.33666	1.29	0	0.00
Eritrea	1995	2.01182		62.837	22.283	48.6155	0.82644	0.74	0	0.00

Ethiopia	1995	2.85089	1.4E+07	17.008	12.39	16.1406	3.1361	0.32	0	0.00
Gabon	1995	1.92116	-3E+08	26.701	23.313	9.16926	2.95117	3.17	0.36787	1.17
Gambia, The	1995	-1.9138	7727642		6.904	21.3507	2.81034	2.3	0.12804	0.29
Ghana	1995	1.40472	1.1E+08	24.718	15.721	31.9655	2.63516	0.81	0.03648	0.03
Guinea	1995	0.24268	769000	17.666	21.394	9.0175	4.26229	0.59	0.01256	0.01
Guinea-Bissau	1995	2.32302	40000		11.633	13.7206	2.0095	0.7	0	0.00
Kenya	1995	1.42607	4.2E+07	23.177	14.708	14.0179	2.8959	0.99	0.00831	0.01
Lesotho	1995	-0.0925	2.8E+08	46.025	73.849	29.8251	1.85451	0.97	0	0.00
Madagascar	1995	-1.3952	9710168	19.77	11.252	12.284	3.10273	0.32	0.0099	0.00
Malawi	1995	15.4156	5643046		17.392	19.0284	1.13136	0.35	0.00387	0.00
Mali	1995	3.39523	1.1E+08		32.567	12.5642	2.68501	0.25	0	0.00
Mauritania	1995	6.77252	6989379		20.377	21.171	2.81403	0.67	0	0.00
Mauritius	1995	3.40908	1.9E+07		26.176	17.3015	0.8461	22.36	1.04547	23.38
Mozambique	1995	-0.6772	4.5E+07	25.06	30.629	26.3665	3.34443	0.4	0	0.00
Namibia	1995	1.11947	1.5E+08	32.413	21.691	24.7419	2.9178	6.38	0.21195	1.35
Niger	1995	-0.8255	7188243	16.961	7.831	9.83855	3.40133	0.18	0	0.00
Nigeria	1995	0.11294	1.1E+09		15.794	18.595	2.35638	0.38	0.01182	0.00
Rwanda	1995	37.1201	2212202	21.392	13.997	13.3425	-1.3924	0.16	0	0.00
Senegal	1995	2.51842	3.2E+07		14.384	22.3545	2.73735	1.8	0.00146	0.00
Seychelles	1995	-2.6423	4.6E+07	53.635	30.325	75.1946	1.84874	24.79	0.0664	1.65
Sierra Leone	1995	-7.6038	7287056		4.651	20.5196	-0.4275	0.38	0	0.00
Sudan	1995	3.27492	1.2E+07	11.829	20.369	2.15177	2.60171	0.87	0	0.00
Swaziland	1995	0.89114	5.2E+07	21.906	15.368	21.2669	2.01129	3.12	0	0.00
Tanzania	1995	0.48891	1.2E+08	18.074	17.688	26.297	2.98121	0.38	0.01169	0.00
Togo	1995	5.13515	2.6E+07	19.673	13.827	19.2134	2.54561	0.85	0	0.00
Uganda	1995	8.1095	1.2E+08		12.492	11.5832	3.10885	0.27	0.00839	0.00
Zambia	1995	-5.2929	9.7E+07		16.635		2.5763	0.88	0.01734	0.02
Zimbabwe	1995	-1.6834	1.2E+08		24.58		1.85559	1.89	0	0.00
Angola	1996	8.09583	1.8E+08		37.807	35.7532	2.83122	0.53	0.02648	0.01
Benin	1996	2.45015	3.6E+07	22.093	17.396	14.2629	2.97838	0.88	0.0465	0.04
Botswana	1996	3.07754	7.1E+07	35.493	23.281	10.5539	2.37237	8.30	0	0.00
Burkina Faso	1996	7.98459	1.6E+07	22.215	23.245		2.76745	0.46	0.00478	0.00
Burundi	1996	-8.8017	100	26.847	8.203	5.62568	0.87523	0.32	0.00914	0.00
Cameroon	1996	2.44885	1E+08		15.9	15.8089	2.45967	14.41	0.0245	0.35
Cape Verde	1996	1.63029	2.9E+07		37.605	29.3819	2.30766	0.24	0	0.00
Central African Republic	1996	-6.2191	1.1E+07	17.153	37.605		2.33866	0.13	0.03144	0.00
Chad	1996	-0.9143	3.9E+07	16.292	14.899		3.10878	1.54	0	0.00
Comoros	1996	-3.7398	510000	25.609	7.512		2.51144	0.02	0	0.00
Congo, Dem. Rep.	1996	-3.7058	2.5E+07	9.635	23.457		2.74779	0.68	0.0159	0.01
Congo, Rep.	1996	1.42679	7.3E+07	17.573	32.79	40.4568	2.79341	1.74	0.03559	0.06
Cote d'Ivoire	1996	4.78291	2.7E+08		12.112	17.6204	2.77312	1.28	0.08979	0.12

Djibouti	1996	-6.7784	3263542	34.66	9.072	16.5253	2.81646	1.32	0.01707	0.02
Equatorial Guinea	1996	24.9642	3.8E+08	19.693	115.102	48.1736	3.28841	0.82	0.01334	0.01
Eritrea	1996	7.56746	3.7E+07	53.125	26.893	73.1284	1.56015	0.42	0	0.00
Ethiopia	1996	9.11253	2.2E+07	18.377	17.57	22.8695	2.99147	2.95	0	0.00
Gabon	1996	0.76266	-5E+08	23.671	19.953	8.56937	2.80113	2.62	0.60811	1.59
Gambia, The	1996	-0.6116	1.1E+07		6.779	20.2271	2.81263	1.25	0.26729	0.33
Ghana	1996	2.00794	1.2E+08	23.102	15.78	44.9356	2.51164	0.30	0.07324	0.02
Guinea	1996	1.98043	2.4E+07	16.459	20.783	8.39791	3.12953	0.78	0.01217	0.01
Guinea-Bissau	1996	9.41099	1030000		10.13	14.1198	1.98097	0.96	0	0.00
Kenya	1996	1.3175	1.1E+08	22.923	12.53	13.3903	2.75427	1.08	0.01002	0.01
Lesotho	1996	2.68744	2.9E+08	48.625	74.167	20.8411	1.9147	0.37	0.06899	0.03
Madagascar	1996	-1.0032	1E+07	19.949	12.24	12.3789	3.13443	0.47	0.01698	0.01
Malawi	1996	5.32121	1.6E+07		12.327	16.6882	1.87693	0.44	0.03674	0.02
Mali	1996	0.47509	4.5E+07		22.354	9.74956	2.69374	0.91	0.01176	0.01
Mauritania	1996	2.8734	-435540		17.625	18.1467	2.82293	25.57	0	0.00
Mauritius	1996	4.51343	3.7E+07		24.262	18.2192	1.02276	0.48	1.83801	0.88
Mozambique	1996	4.26271	7.3E+07	18.499	21.827	18.0014	2.96464	6.06	0	0.00
Namibia	1996	0.1848	1.3E+08	33.962	23.116	26.3014	2.96073	0.19	0.3906	0.07
Niger	1996	-0.0789	9873866	14.115	10.209	10.3341	3.44085	0.47	0	0.00
Nigeria	1996	1.88869	1.6E+09		14.408	15.7497	2.33904	0.25	0.01243	0.00
Rwanda	1996	8.2073	2218241	23.137	14.802	12.4125	4.1086	2.43	0	0.00
Senegal	1996	-0.6324	8722469		14.406	15.29	2.6266	26.17	0.01643	0.43
Seychelles	1996	3.38942	2.9E+07	55.508	39.845	69.7977	1.46719	0.53	1.36488	0.72
Sierra Leone	1996	5.00501	663928		7.449	18.1085	-0.0048	1.28	0	0.00
Sudan	1996	3.22069	400000	8.644	12.473	2.78844	2.58065	3.14	0.00711	0.02
Swaziland	1996	1.37514	2.2E+07	23.561	16.381	21.1617	2.1601	0.51	0	0.00
Tanzania	1996	1.65663	1.5E+08	15.505	14.879	24.0368	2.76476	0.51	0.02936	0.01
Togo	1996	5.64912	1.7E+07	19.181	12.917	21.6728	2.97207	0.98	0	0.00
Uganda	1996	5.80854	1.2E+08		20.376	13.5544	3.0378	0.22	0.01863	0.00
Zambia	1996	4.11529	1.2E+08		12.755		2.6822	0.82	0.0297	0.02
Zimbabwe	1996	8.44331	8.1E+07		18.04		1.75265	2.02	0	0.00
Angola	1997	5.03628	4.1E+08		27.751	35.75	2.6899	0.54	0.05513	0.03
Benin	1997	3.20355	2.7E+07	21.118	19.889	13.3668	2.81317	0.90	0.07173	0.06
Botswana	1997	7.72588	1E+08	36.527	23.363	12.5659	2.24317	8.19	0	0.00
Burkina Faso	1997	3.40588	9765809	22.523	25.186		2.77618	0.48	0.0133	0.01
Burundi	1997	-2.2465	100	20.319	6.103	4.10632	0.66931	0.33	0.01001	0.00
Cameroon	1997	2.62596	7.8E+07		16.749	14.192	2.38213	15.50	0.0287	0.44
Cape Verde	1997	3.17242	1.2E+07		38.709	32.2283	2.13628	0.24	0.00484	0.00
Central African Republic	1997	2.95537	1497424	12.813	38.709		2.25178	0.13	0.03932	0.01
Chad	1997	2.39803	4.4E+07	16.315	15.825		3.12964	1.73	0	0.00
Comoros	1997	1.41254	20000	24.104	10.425		2.54859	0.02	0	0.00

Congo, Dem. Rep.	1997	-7.8037	-4E+07	20.184	35.192		2.34408	0.67	0.01919	0.01
Congo, Rep.	1997	-3.3756	7.9E+07	25.137	22.233	36.5153	2.8321	1.89		0.00
Cote d'Ivoire	1997	2.97432	4.2E+08	22.127	14.423	16.5013	2.63055	1.59	0.23238	0.37
Djibouti	1997	-3.9245	3100365	35.427	9.572	17.558	3.25493	1.32	0.03049	0.04
Equatorial Guinea	1997	65.6935	5.3E+07	14.678	73.121	47.9426	3.26226	0.90	0.06349	0.06
Eritrea	1997	5.57457	4.1E+07	46.549	30.475		2.18678	0.51	0	0.00
Ethiopia	1997	0.22265	2.9E+08	17.433	13.435	37.7988	2.86355	2.49	0	0.00
Gabon	1997	2.95766	-3E+08	31.624	31.472	8.82879	2.66499	2.79	0.82723	2.31
Gambia, The	1997	2.0073	1.2E+07		5.175	22.2558	2.79631	1.37	0.39743	0.54
Ghana	1997	1.71015	8.2E+07	19.672	15.926	43.76	2.41501	0.30	0.12246	0.04
Guinea	1997	2.33777	1.7E+07	17.527	21.009	9.20398	2.23497	0.87	0.03593	0.03
Guinea-Bissau	1997	4.43381	1.1E+07		13.292	11.4241	1.95915	0.98	0	0.00
Kenya	1997	-2.1396	6.2E+07	23.397	13.459	12.7164	2.63659	1.42	0.02338	0.03
Lesotho	1997	1.44108	2.7E+08	50.427	60.446	25.6477	1.94872	0.36	0.18765	0.07
Madagascar	1997	0.47185	1.4E+07	19.509	12.813	18.4437	3.15618	0.62	0.02932	0.02
Malawi	1997	1.29274	1.5E+07		11.599	18.546	2.43782	0.47	0.06784	0.03
Mali	1997	3.89338	6.3E+07		24.473	9.68734	2.72284	1.13	0.0274	0.03
Mauritania	1997	-6.723	-3E+06		15.14	17.4206	2.83085	26.26	0	0.00
Mauritius	1997	4.37242	5.5E+07		26.976	16.7528	1.2521	0.44	3.70248	1.61
Mozambique	1997	7.29999	6.4E+07	21.165	20.579	16.1868	2.70182	6.15	0.01483	0.09
Namibia	1997	1.18969	9.1E+07	34.422	20.184	25.1376	2.94833	0.19	0.71352	0.14
Niger	1997	-0.7567	1.8E+07	17.304	11.579	10.4173	3.47631	0.54	0.001	0.00
Nigeria	1997	0.33859	1.5E+09		17.188	15.1762	2.32618	0.29	0.01301	0.00
Rwanda	1997	4.92103	2598560	20.143	14.095	13.4843	8.16717	2.24	0	0.00
Senegal	1997	0.53989	1.8E+08		15.704	16.3386	2.53779	25.39	0.07877	2.00
Seychelles	1997	10.6554	5.3E+07	56.409	28.053	68.1174	1.17345	0.53	2.90614	1.55
Sierra Leone	1997	-17.07	1800032		4.136	9.36711	0.39694	1.88	0	0.00
Sudan	1997	7.7632	9.8E+07	6.471	15.771	1.74896	2.56831	3.24	0.01197	0.04
Swaziland	1997	1.49527	-2E+07	22.691	16.515	19.5992	2.22881	0.45	0	0.00
Tanzania	1997	0.8386	1.6E+08	14.33	13.303	16.8077	2.59505	0.45	0.06394	0.03
Togo	1997	10.6796	2.1E+07	16.418	11.476	17.1017	3.28633	1.01	0.06886	0.07
Uganda	1997	2.014	1.8E+08	18.755	18.24	13.2947	2.98023	0.21	0.0226	0.00
Zambia	1997	0.48891	2.1E+08		14.297	10.0655	2.75785	0.82	0.04831	0.04
Zimbabwe	1997	1.02203	1.4E+08		18.05		1.62845	2.28	0.04744	0.11
Angola	1998	3.9918	1.1E+09		38.354	42.7762	2.66905	0.55	0.07474	0.04
Benin	1998	1.71071	3.8E+07	18.117	18.946	14.2966	2.74443	0.93	0.10213	0.09
Botswana	1998	8.28768	9.5E+07	37.102	33.669	14.9756	2.08873	7.18	0.89585	6.43
Burkina Faso	1998	4.35704	4407138	22.202	25.181		2.78825	0.50	0.02349	0.01
Burundi	1998	4.04271	2000000	22.422	6.769	5.12444	0.6775	0.35	0.00996	0.00
Cameroon	1998	2.62448	2.2E+08		18.129	13.9786	2.32577	15.59	0.03339	0.52
Cape Verde	1998	5.28108	9039816		31.414	32.8141	1.99264	0.24	0.24216	0.06
Central African	1998	2.47702	7602313	17.259	31.414		2.14605	0.14	0.04588	0.01

Republic										
Chad	1998	3.59622	2.2E+07	13.787	15.283		3.18754	2.17	0	0.00
Comoros	1998	-1.2986	384216	23.48	11.03		2.58159	0.02	0	0.00
Congo, Dem. Rep.	1998	-3.7096	6.1E+07	12.347	17.062		2.14265	0.21	0.02111	0.00
Congo, Rep.	1998	0.82309	3.3E+07	29.6	26.684	50.0157	2.81347	1.36	0.11401	0.16
Cote d'Ivoire	1998	2.20317	3.8E+08	21.214	13.34	17.404	2.46375	1.68	0.57444	0.96
Djibouti	1998	-3.2693	3173514	33.724	12.19	16.7305	3.42324	1.30	0.03193	0.04
Equatorial Guinea	1998	18.0258	2.7E+08	29.706	107.981	50.4354	3.23872	0.92	0.06086	0.06
Eritrea	1998	-0.9914	1.5E+08	68.097	30.379		2.75343	0.57	0	0.00
Ethiopia	1998	-6.0861	2.6E+08	20.5	15.242	36.0556	2.75982	2.92	0	0.00
Gabon	1998	0.8846	1.5E+08	48.45	39.089	10.4977	2.53802	2.96	0.82296	2.44
Gambia, The	1998	0.63683			4.884	27	2.80533	1.41	0.41207	0.58
Ghana	1998	2.26137	1.7E+08	18.642	14.286		2.35709	0.30	0.22839	0.07
Guinea	1998	3.1467	1.8E+07	14.771	19.208	14.7221	1.62161	0.80	0.26584	0.21
Guinea-Bissau	1998	-29.483	4407138		6.106	13.7538	1.94287	0.97	0	0.00
Kenya	1998	0.67589	2.7E+07	22.557	12.788		2.56363	1.73	0.03622	0.06
Lesotho	1998	3.50572	2.6E+08	49.228	47.328	26.7989	1.89821	0.35	0.51716	0.18
Madagascar	1998	0.69805	1.7E+07	22.384	15.082	13.2166	3.16137	0.70	0.08859	0.06
Malawi	1998	1.02454	1.2E+07		13.465	19.432	2.80197	0.49	0.09894	0.05
Mali	1998	3.13749	8868522		22.042	11.029	2.76885	1.32	0.04195	0.06
Mauritania	1998	-0.1029	132643		19.02	16.8193	2.84296	28.48	0	0.00
Mauritius	1998	4.96122	1.2E+07		26.637	15.257	1.05142	0.39	5.20914	2.05
Mozambique	1998	8.0078	2.1E+08	19.184	24.216	16.0931	2.53622	6.34	0.03888	0.25
Namibia	1998	0.38742	9.6E+07	34.902	25.76	23.0646	2.85335	0.19	1.08178	0.21
Niger	1998	6.62943	-1E+06	18.199	11.924	9.03958	3.49522	0.67	0.01324	0.01
Nigeria	1998	-0.4647	1.1E+09		26.529	15.7092	2.32776	0.29	0.01695	0.00
Rwanda	1998	-1.2743	7089194	19.413	15.191	11.9614	9.7705	2.22	0.072	0.16
Senegal	1998	3.28885	7.1E+07		17.035	17.1616	2.49532	25.59	0.30422	7.79
Seychelles	1998	6.30396	5.3E+07	58.021	33.996	62.4056	1.95569	0.53	6.58245	3.52
Sierra Leone	1998	-1.8413	104885		4.653	8.67019	1.01748	2.56	0	0.00
Sudan	1998	1.69488	3.7E+08	7.564	17.949	1.95374	2.53759	4.24	0.02642	0.11
Swaziland	1998	0.56765	1.5E+08	23.72	18.466	22.9861	2.15028	0.40	0.45688	0.18
Tanzania	1998	1.12448	1.7E+08	13.796	14.479	16.5116	2.48905	0.40	0.11714	0.05
Togo	1998	-5.5743	3E+07	19.784	14.701	14.193	3.40897	1.18	0.16666	0.20
Uganda	1998	1.841	2.1E+08	18.133	16.198	13.7343	2.96449	0.23	0.13164	0.03
Zambia	1998	-4.5341	2E+08		16.02	11.8621	2.7639	0.81	0.08531	0.07
Zimbabwe	1998	1.41496	4.4E+08		20.60		1.43933	2.39	0.15495	0.37
Angola	1999	0.3874	2.5E+09		31.377	44.6429	2.80178	0.59	0.17763	0.10
Benin	1999	1.80635	3.9E+07	19.319	19.164	16.4272	2.80001	0.98	0.11484	0.11
Botswana	1999	3.08414	3.7E+07	37.541	23.957	14.4749	1.90393	7.11	5.32352	37.87
Burkina Faso	1999	4.43376	7925951	24.309	24.2		2.80461	0.62	0.04214	0.03
Burundi	1999	-1.9575	238660	24.924	5.882	3.62803	0.96181	0.39	0.01273	0.01

Cameroon	1999	2.02411	-2E+07		19.35	10.9578	2.29613	15.36	0.03915	0.60
Cape Verde	1999	6.55716	5.3E+07		34.397	37.8571	1.89898	0.25	1.87943	0.48
Central African Republic	1999	1.52694	3777820	16.623	34.397		2.02132	0.14	0.11458	0.02
Chad	1999	-3.8965	2.5E+07	17.514	16.332		3.28928	2.41	0	0.00
Comoros	1999	-0.7009	271000	18.557	8.506		2.6092	0.02	0	0.00
Congo, Dem. Rep.	1999	-6.3581	1.1E+07	9.521	15.79		2.2052	0.40	0.02478	0.01
Congo, Rep.	1999	-5.2174	5.4E+08	32.28	27.772	43.1041	2.72404	1.45	0.16364	0.24
Cote d'Ivoire	1999	-0.6922	3.2E+08	19.79	13.117	18.1126	2.26858	1.78	1.58306	2.82
Djibouti	1999	-1.071	3212901	33.042	8.545	16.2902	3.23238	1.40	0.03935	0.06
Equatorial Guinea	1999	36.9668	1.5E+08	18.686	75.978	44.4031	3.21829	0.91	0.11905	0.11
Eritrea	1999	-3.1402	8.3E+07	82.081	40.098		3.20402	0.67	0	0.00
Ethiopia	1999	2.37212	7E+07	26.028	15.25	22.0871	2.68914	2.88	0.01055	0.03
Gabon	1999	-11.115	-2E+08	27.152	23.939	12.0088	2.42598	2.94	0.7367	2.17
Gambia, The	1999	3.42493			4.755	24.6163	2.83595	1.48	0.4211	0.62
Ghana	1999	1.97591	2.4E+08	17.086	2.508		2.3493	0.29	0.37416	0.11
Guinea	1999	3.22814	6.3E+07	16.11	19.847	14.4465	1.38921	0.72	0.30612	0.22
Guinea-Bissau	1999	5.73445	730877		8.986	13.7974	1.93469	0.86	0	0.00
Kenya	1999	-0.2663	5.2E+07	20.209	10.877		2.54589	1.82	0.07799	0.14
Lesotho	1999	-1.3555	1.6E+08	58.564	45.121	30.9458	1.74046	0.34	0.62037	0.21
Madagascar	1999	1.41626	5.8E+07	19.975	14.903	11.9754	3.14751	0.75	0.24007	0.18
Malawi	1999	0.11852	5.9E+07		14.65	21.0436	2.87847	0.52	0.206	0.11
Mali	1999	3.7457	2178012		16.114	13.1737	2.84047	1.32	0.05822	0.08
Mauritania	1999	3.66166	1.5E+07		12.542	18.7511	2.86111	28.69	0	0.00
Mauritius	1999	1.3146	4.9E+07		24.857		1.27125	0.34	8.689	2.99
Mozambique	1999	5.43268	3.8E+08	21.626	36.678	15.7576	2.51485	6.26	0.06903	0.43
Namibia	1999	0.6663	1592530	33.861	23.289	20.9035	2.6526	0.19	1.62072	0.31
Niger	1999	-3.9849	276109	19.898	11.847	8.60801	3.49613	0.75	0.02078	0.02
Nigeria	1999	-1.2442	1E+09		28.886	12.812	2.34635	0.25	0.0207	0.01
Rwanda	1999	-1.481	1725717	20.897	18.308	12.6334	8.79959	2.31	0.14506	0.34
Senegal	1999	3.70979	1.5E+08		19.538	16.4345	2.51119	25.78	0.94849	24.45
Seychelles	1999	-0.1094	5.5E+07	54.895	30.772	69.5502	1.9642	0.54	20.291	10.86
Sierra Leone	1999	-9.8223	533202		3.619	18.4128	1.86814	2.74	0	0.00
Sudan	1999	0.57242	3.7E+08	8.421	16.811	3.33738	2.48611	4.06	0.03896	0.16
Swaziland	1999	1.5523	9.8E+07	27.199	16.105	14.2204	1.8746	0.39	1.33566	0.52
Tanzania	1999	2.24982	5.2E+08	15.632	13.888	14.3878	2.466	0.39	0.15348	0.06
Togo	1999	-0.8364	4.3E+07	18.456	9.456	12.6265	3.29135	1.25	0.36553	0.46
Uganda	1999	4.86196	1.4E+08	20.044	19.437	10.2558	2.99858	0.26	0.24	0.06
Zambia	1999	-0.4795	1.6E+08		17.095	13.1701	2.6807	0.82	0.28346	0.23
Zimbabwe	1999	-4.7151	5.9E+07		2.55		1.16346	2.52	1.40263	3.53
Angola	2000	-0.0561	8.8E+08	49.619	13.849	32.4974	3.02377	0.59	0.1853	0.11
Benin	2000	2.74288	6E+07	23.279	19.255	14.5345	2.9321	1.00	0.85114	0.85

Botswana	2000	4.09388	5.7E+07	37.994	31.759	15.4865	1.70659	7.28	12.6393	91.96
Burkina Faso	2000	-0.9888	2.3E+07	22.3	16.616	6.55855	2.82387	0.64	0.20534	0.13
Burundi	2000	-2.2673	1.2E+07	24.168	6.141	6.57255	1.43287	0.43	0.25603	0.11
Cameroon	2000	1.84581	1.6E+08	16.543	17.028	16.8669	2.28521	15.14	0.65874	9.97
Cape Verde	2000	4.65933	3.3E+07		30.481	39.1097	1.83729	0.25	4.51219	1.12
Central African Republic	2000	0.38423	842725	16.241	30.481		1.89046	0.13	0.13418	0.02
Chad	2000	-4.199	1.2E+08	19.074	20.43		3.4061	2.63	0.06689	0.18
Comoros	2000	-1.2156	93636.1	15.875	9.659		2.63089	0.02	0	0.00
Congo, Dem. Rep.	2000	-9.1444	7.2E+07	11.105	3.358		2.4402	0.45	0.03023	0.01
Congo, Rep.	2000	4.84337	1.7E+08	25.453	22.626	27.17	2.59531	1.43	2.2323	3.20
Cote d'Ivoire	2000	-5.6676	2.3E+08	18.434	10.786	20.1282	2.06416	1.65	2.85226	4.69
Djibouti	2000	-2.3766	3286049	32.597	8.763	16.4084	2.82069	1.31	0.03142	0.04
Equatorial Guinea	2000	9.91054	1.5E+08	21.058	60.995	42.2323	3.19811	0.84	0.96084	0.81
Eritrea	2000	-16.145	2.8E+07	74.158	21.997		3.54367	0.82	0	0.00
Ethiopia	2000	3.30839	1.3E+08	25.783	20.28	14.0916	2.64076	2.85	0.02708	0.08
Gabon	2000	-4.1397	-4E+07	21.615	20.31	12.1743	2.32692	2.93	9.71444	28.43
Gambia, The	2000	2.50674		15.851	4.562	20.4314	2.87824	1.49	0.43174	0.64
Ghana	2000	1.26616	1.7E+08	20.437	17.005		2.37498	0.28	0.67854	0.19
Guinea	2000	0.43727	9942000	16.425	19.703	21.8564	1.42843	0.70	0.50467	0.35
Guinea-Bissau	2000	5.44186	702271	26.461	6.134	11.3378	1.93312	0.81	0	0.00
Kenya	2000	-1.9481	1.1E+08	20.566	14.679		2.56527	2.32	0.40764	0.95
Lesotho	2000	4.07106	3.2E+07	50.241	42.703	13.4902	1.51565	0.52	1.09986	0.57
Madagascar	2000	1.54109	8.3E+07	20.327	15.045	36.583	3.12091	0.80	0.41065	0.33
Malawi	2000	-1.1965	2.6E+07		13.565	22.8533	2.76746	0.58	0.43638	0.25
Mali	2000	0.22516	8.2E+07	21.573	21.905	11.552	2.92496	1.35	0.09206	0.12
Mauritania	2000	-1.0402	4E+07		19.375	17.9121	2.87909	28.75	0.57894	16.65
Mauritius	2000	7.96048	2.7E+08	23.464	26.085		0.98268	0.34	15.1659	5.09
Mozambique	2000	-1.4899	1.4E+08	23.659	33.544	18.1512	2.58616	6.68	0.28057	1.87
Namibia	2000	1.04267	1.2E+08	29.858	17.098	12.6362	2.39171	0.18	4.32526	0.80
Niger	2000	-4.7872	8437079	18.328	12.341	9.42023	3.48606	0.87	0.01882	0.02
Nigeria	2000	2.92528	1.1E+09	36.176	20.189	11.1628	2.37594	0.26	0.02425	0.01
Rwanda	2000	1.21912	8319040	19.412	18.301	14.9549	6.5769	2.45	0.48158	1.18
Senegal	2000	0.58557	6.3E+07	17.921	21.545	16.8802	2.56502	25.82	2.6326	67.97
Seychelles	2000	3.32671	2.4E+07	54.531	27.565	77.6024	0.89266	0.54	31.9989	17.26
Sierra Leone	2000	0.92955	3.9E+07	27.865	6.608	24.3907	2.81134	1.48	0.28819	0.43
Sudan	2000	5.7827	3.9E+08	11.005	18.343	5.45845	2.4249	3.17	0.06728	0.21
Swaziland	2000	8.45303	9.1E+07	27.262	17.52	39.1702	1.48279	0.40	3.10199	1.23
Tanzania	2000	2.30199	4.6E+08	15.187	16.072	12.8591	2.50136	0.40	0.32469	0.13
Togo	2000	-3.7381	4.2E+07	18.459	15.18	13.4887	3.02323	1.16	1.04308	1.21
Uganda	2000	0.02979	1.6E+08	21.983	19.484	10.8505	3.06378	0.31	0.52415	0.16
Zambia	2000	0.97498	1.2E+08	22.592	17.357	13.8875	2.54594	0.83	0.969	0.80

Zimbabwe	2000	-3.5185	2.3E+07		11.80		0.83679	2.61	2.12991	5.56
Angola	2001	-0.169	2.1E+09	41.937	14.604	41.6363	3.26271	0.58	0.52126	0.30
Benin	2001	1.82052	4.4E+07	22.639	19.183	14.2943	3.07487	0.98	1.85975	1.83
Botswana	2001	1.95758	-7E+07	37.901	25.774	14.1454	1.49755	6.95	18.62	129.33
Burkina Faso	2001	3.65982	8831732	22.111	13.675	6.318	2.84243	0.68	0.60233	0.41
Burundi	2001	0.08829	9152.73	27.239	6.222	6.56037	1.94671	0.37	0.51412	0.19
Cameroon	2001	2.15896	7.3E+07	16.836	20.7	21.4443	2.27936	14.97	2.60163	38.94
Cape Verde	2001	1.96745	9112802		31.711	45.201	1.78123	0.29	7.0787	2.08
Central African Republic	2001	-1.4813	5183899	13.653	31.711		1.75299	0.13	0.292	0.04
Chad	2001	7.78302	4.6E+08	16.417	35.459		3.53217	2.89	0.25828	0.75
Comoros	2001	0.62776	1145915	21.352	9.62		2.64919	0.02	0	0.00
Congo, Dem. Rep.	2001	-4.7173	8E+07	8.166	5.218		2.70993	0.50	0.29418	0.15
Congo, Rep.	2001	1.29468	7.7E+07	24.49	26.357	35.645	2.44321	1.48	4.66805	6.89
Cote d'Ivoire	2001	-1.8631	2.7E+08	16.907	11.162	18.9311	1.85944	1.60	4.31274	6.89
Djibouti	2001	-0.3583	3392959	29.44	7.85	17.5347	2.38602	1.37	0.40021	0.55
Equatorial Guinea	2001	56.8298	9.4E+08	12.982	71.889	43.3645	3.18018	0.81	2.79228	2.26
Eritrea	2001	4.73946	1.2E+07	69.047	35.261		3.87471	0.95	0	0.00
Ethiopia	2001	5.52432	3.5E+08	22.612	21.528		2.5977	2.61	0.04086	0.11
Gabon	2001	-0.1234	-9E+07	29.64	27.5	12.8241	2.23277	2.99	11.8749	35.54
Gambia, The	2001	2.74325		16.09	11.173	18.632	2.93174	1.61	4.12414	6.63
Ghana	2001	1.52731	8.9E+07	23.453	17.048		2.40631	0.25	1.24182	0.31
Guinea	2001	1.3314	1677000	18.816	15.362	21.4309	1.52057	0.49	0.65708	0.32
Guinea-Bissau	2001	-1.7171	395614	22.281	6.149	14.5823	1.9318	0.80	0	0.00
Kenya	2001	1.11882	5302623	22.367	16.761	17.449	2.59761	2.55	1.87055	4.77
Lesotho	2001	2.85036	3E+07	46.249	36.701	14.8643	1.27024	0.70	2.86579	2.02
Madagascar	2001	2.79215	9.3E+07	19.129	18.5	35.7952	3.08983	0.99	0.93081	0.92
Malawi	2001	-7.4524	1.9E+07		13.799	19.0209	2.64168	0.61	0.48338	0.29
Mali	2001	8.78246	1.2E+08	21.064	27.755	12.5284	3.00413	1.11	0.20616	0.23
Mauritania	2001	-0.0436	7.7E+07		24.581	21.7719	2.89494	28.52	4.06059	115.80
Mauritius	2001	1.46156	-3E+07	23.666	20.807		1.09003		22.7036	0.00
Mozambique	2001	8.96066	2.6E+08	28.795	25.891	21.301	2.66092	6.43	0.81669	5.25
Namibia	2001	-0.939	3.6E+07	30.955	22.317	15.5631	2.11686	0.18	5.50506	0.98
Niger	2001	3.45108	2.3E+07	18.532	13	10.4812	3.47046	1.18	0.0188	0.02
Nigeria	2001	0.64572	1.2E+09	51.124	24.035	13.1104	2.40928		0.2103	0.00
Rwanda	2001	3.89898	4634138	21.222	19.031	15.2322	4.33311	2.53	0.7686	1.94
Senegal	2001	1.86986	3.2E+07	20.945	19.835	16.6402	2.6265	24.44	3.09269	75.60
Seychelles	2001	-2.3566	6.5E+07	48.106	21.454	81.9117	0.08747	0.54	45.175	24.59
Sierra Leone	2001	13.7567	9835742	29.483	6.887	20.2152	3.80621	1.27	0.62491	0.79
Sudan	2001	3.69496	5.7E+08	11.605	17.589	5.05077	2.35451	3.93	0.29668	1.17
Swaziland	2001	-0.0569	2.9E+07	28.367	21.825	24.9653	1.05204	0.39	5.11588	2.02
Tanzania	2001	3.29003	3.9E+08	14.755	16.672	15.0694	2.54936	0.39	0.78918	0.31

Togo	2001	-2.8672	6.4E+07	16.275	15.613	15.1839	2.72945	1.48	1.92849	2.86
Uganda	2001	1.93749	1.5E+08	21.434	19.302	11.9208	3.13482	0.37	1.1348	0.42
Zambia	2001	2.40783	7.2E+07	31.334	18.914	14.0411	2.40444	0.80	1.15983	0.92
Zimbabwe	2001	2.12345	3800000		12.12		0.52254	2.68	2.49703	6.69
Angola	2002	10.629	1.7E+09	38.189	13.696	30.8684	3.43102	0.54	0.9402	0.51
Benin	2002	1.23685	1.4E+07	22.728	17.995	12.859	3.17243	1.37	3.15322	4.31
Botswana	2002	7.54275	7.3E+08	40.368	26.959	16.546	1.31685	7.10	18.3764	130.56
Burkina Faso	2002	1.74759	1.6E+07	21.894	16.432	6.06513	2.85994	0.81	0.85293	0.69
Burundi	2002	1.99202	10.744	25.916	6.44	7.99244	2.37806	0.37	0.78124	0.29
Cameroon	2002	1.67413	6E+08	15.702	20.169	21.2057	2.2705	14.86	4.27537	63.52
Cape Verde	2002	2.83395	1.5E+07	39.85	35.82	47.8602	1.7028	0.29	9.48646	2.74
Central African Republic	2002	-2.1967	5600230	16.49	35.82		1.63688	0.13	0.32905	0.04
Chad	2002	4.64287	9.2E+08	17.995	60.153		3.61158	3.14	0.38726	1.22
Comoros	2002	1.41017	430423	23.46	10.537		2.66531	0.01	0	0.00
Congo, Dem. Rep.	2002	0.5079	1.4E+08	7.791	8.54		2.90298	0.54	1.06684	0.57
Congo, Rep.	2002	2.19586	3.3E+08	27.824	23.408	36.1485	2.32524	1.33	6.74385	8.95
Cote d'Ivoire	2002	-3.0819	2.1E+08	19.621	10.066	18.1139	1.68924	1.55	5.97799	9.28
Djibouti	2002	0.51613	3432346	32.861	10.007	18.5432	2.07006	1.68	1.96006	3.30
Equatorial Guinea	2002	15.7494	3.2E+08	10.807	31.675	42.9576	3.15776	0.78	5.7717	4.50
Eritrea	2002	-1.1807	2E+07	62.558	29.549		4.14883	1.13	0	0.00
Ethiopia	2002	-1.0392	2.6E+08	25.06	24.118		2.54801	1.86	0.07296	0.14
Gabon	2002	-2.3821	3.9E+07	27.699	30.552	14.9661	2.14341	3.06	21.6414	66.23
Gambia, The	2002	-6.0878		17.75	7.278	17.1267	2.97701	1.66	7.26726	12.05
Ghana	2002	1.99537	5.9E+07	17.367	15.011		2.42597	0.23	1.92288	0.45
Guinea	2002	2.16995	3E+07	18.254	13.366	18.8929	1.55294	0.32	1.05488	0.34
Guinea-Bissau	2002	-8.8773	3561036	16.373	8.461	13.7917	1.93172	1.24	0	0.00
Kenya	2002	-2.0538	2.8E+07	23.467	12.003	16.6873	2.62053	2.26	3.60522	8.14
Lesotho	2002	-0.0002	2.8E+07	51.029	32.033	13.4005	1.06411	0.71	6.86244	4.84
Madagascar	2002	-15.306	1.5E+07	15.638	14.263	38.1511	3.06098	1.29	0.99768	1.29
Malawi	2002	-0.9107	5899999	28.829	16.137	25.0335	2.6006	0.57	0.72717	0.41
Mali	2002	1.01108	2.4E+08	24.32	14.682	10.1798	3.06338	1.25	0.38306	0.48
Mauritania	2002	-1.7899	6.7E+07		30.377	16.6458	2.89715	28.62	8.82888	252.65
Mauritius	2002	1.24296	3.2E+07	24.638	22.164		0.85599	0.36	28.717	10.27
Mozambique	2002	5.93467	3.5E+08	26.369	29.589	21.8111	2.68446	6.40	1.32687	8.49
Namibia	2002	2.82192	5.1E+07	31.329	18.521		1.89319	0.17	7.60106	1.31
Niger	2002	-0.5032	2404632	19.334	14.903	9.3442	3.45948	1.07	0.49154	0.53
Nigeria	2002	-0.8974	1.9E+09	30.812	30.467	12.5942	2.43854	0.24	1.20852	0.29
Rwanda	2002	7.94419	2610000	21.828	17.595	15.6487	2.79159	2.35	0.94742	2.22
Senegal	2002	-1.9999	7.8E+07	20.284	18.94	17.4462	2.67282	26.72	5.52168	147.55
Seychelles	2002	-1.8078	4.8E+07	57.73	27.62	75.9938	3.02991	0.55	53.4421	29.56
Sierra Leone	2002	21.7566	1E+07	28.557	8.922	12.7266	4.57922	0.85	1.48707	1.27

Sudan	2002	2.96636	7.1E+08	12.766	19.456	6.34598	2.29859	3.88	0.53266	2.07
Swaziland	2002	1.10766	9.2E+07	29.906	19.897	25.8082	0.71312	0.40	6.28015	2.50
Tanzania	2002	4.38779	4E+08	14.968	16.425	14.3691	2.58792	0.40	1.6936	0.67
Togo	2002	1.56268	5.3E+07	13.086	16.119	16.1296	2.50141	1.76	3.26946	5.75
Uganda	2002	5.31733	1.8E+08	23.001	20.095	11.6545	3.19144	0.55	1.52479	0.83
Zambia	2002	0.94636	3E+08	31.156	21.928	13.1891	2.30481	0.76	1.30072	0.99
Zimbabwe	2002	-10.007	2.6E+07		10.17		0.2603	2.76	2.68706	7.43
Angola	2003	-0.239	3.5E+09	43.185	13.799	25.2375	3.494	0.63	2.26979	1.44
Benin	2003	0.60838	4.5E+07	20.53	19.131	11.9801	3.21933	1.23	3.29624	4.07
Botswana	2003	4.99627	7.7E+08	38.927	29.997	16.022	1.21071	7.28	24.3141	176.97
Burkina Faso	2003	4.97814	3E+07	19.793	17.713	6.53857	2.87903	0.93	1.7774	1.65
Burundi	2003	-3.8625	4618.43	34.892	10.612	8.83684	2.70776	0.38	0.93584	0.36
Cameroon	2003	1.70483	3.4E+08	15.399	17.277	13.7067	2.26141	14.74	6.41707	94.62
Cape Verde	2003	4.51684	3.9E+07	31.801	31.023	49.0355	1.59759	0.28	11.5953	3.28
Central African Republic	2003	-9.045	2.2E+07	12.806	31.023		1.57626	0.12	1.02826	0.13
Chad	2003	10.6775	7.1E+08	20.39	52.13		3.58885	3.34	0.71008	2.37
Comoros	2003	-0.2334	793760	20.848	9.862		2.67821	0.06	0.32826	0.02
Congo, Dem. Rep.	2003	2.64903	3.9E+08	14.932	12.232		3.01538	0.58	2.30363	1.33
Congo, Rep.	2003	-1.4839	3.2E+08	29.87	26.09	30.5935	2.29186	1.88	9.80634	18.41
Cote d'Ivoire	2003	-3.1055	1.7E+08	19.635	10.116	18.6424	1.58712	1.51	7.33692	11.08
Djibouti	2003	1.29954	1.4E+07	36.305	18.785	17.7919	1.85866	1.74	2.95008	5.14
Equatorial Guinea	2003	10.4549	6.9E+08	15.665	59.679	45.4553	3.11985	0.82	7.25526	5.93
Eritrea	2003	-6.6833	2.2E+07	67.009	26.544		4.22571	1.13	0	0.00
Ethiopia	2003	-4.5708	4.7E+08	27.018	22.204		2.49374	1.83	0.07251	0.13
Gabon	2003	0.37884	1.6E+08	22.803	27.101	17.1853	2.06693	2.99	22.7707	68.01
Gambia, The	2003	3.72055	1.9E+07	16.001	10.039	16.7146	2.99129	0.62	10.5303	6.51
Ghana	2003	2.66563	1.4E+08	20.645	16.158	28.5113	2.43859	0.22	3.85975	0.85
Guinea	2003	3.74205	7.9E+07	20.396	21.617	20.2358	1.60265	0.32	1.27517	0.41
Guinea-Bissau	2003	-1.8603	4005504	19.212	9.828	12.7954	1.94061	1.68	0.09697	0.16
Kenya	2003	0.2608	8.2E+07	23.322	13.125	8.88055	2.62984	1.94	4.70573	9.11
Lesotho	2003	3.3835	4.4E+07	48.817	31.655	12.6698	0.92667	0.84	6.20756	5.24
Madagascar	2003	6.50282	1.3E+07	19.655	16.846	37.4057	3.03515	1.25	1.68423	2.10
Malawi	2003	2.7911	6.6E+07	31.549	17.103	17.1805	2.60122	0.56	1.11251	0.62
Mali	2003	4.15902	1.3E+08	23.19	17.146		3.10268	2.32	1.99694	4.63
Mauritania	2003	2.60187	1E+08		34.349	16.1947	2.87472	28.73	12.1774	349.85
Mauritius	2003	2.58749	6.3E+07	24.806	23.477		1.037	0.35	37.8149	13.26
Mozambique	2003	3.2228	3.4E+08	26.253	22.48	18.8127	2.67731	6.36	2.20961	14.06
Namibia	2003	2.42615	3.3E+07	31.425	19.37	13.9998	1.75475	0.45	11.1371	4.99
Niger	2003	1.71878	1.5E+07	17.947	16.333	9.36617	3.46014	0.87	0.67967	0.59
Nigeria	2003	7.61878	2E+09	35.307	25.404	13.5804	2.46087	0.17	2.36683	0.40
Rwanda	2003	0.33687	4655623	21.357	18.437	15.177	1.83985	2.02	1.47575	2.98

Senegal	2003	3.81541	5.2E+07	21.774	25.875	16.8874	2.70436	25.67	7.59785	195.04
Seychelles	2003	-4.8642	5.8E+07	48.198	10.902	78.0246	-1.0811	0.56	59.4553	33.37
Sierra Leone	2003	4.10082	8615050	26.793	14.086	16.1287	4.86272	0.88	2.39352	2.12
Sudan	2003	4.72575	1.3E+09	15.066	19.956	4.87489	2.28364	3.82	1.43882	5.50
Swaziland	2003	3.31817	-6E+07	29.869	18.805	30.8407	0.54773	0.29	7.8073	2.29
Tanzania	2003	4.02258	3.6E+08	17.644	18.3	14.3532	2.63242	0.29	5.27885	1.55
Togo	2003	0.32961	3.4E+07	15.115	14.428	17.0001	2.33512	2.44	4.71182	11.49
Uganda	2003	3.0873	2E+08	21.904	20.993	10.1087	3.23176	0.54	2.91337	1.57
Zambia	2003	2.74794	3.5E+08	30.836	25.489	12.9954	2.26335	0.73	2.20328	1.61
Zimbabwe	2003	-17.197	3800000		13.81		0.04096	2.79	2.88315	8.06
Angola	2004	7.43768	1.4E+09	35.738	9.93	25.9188	3.42648	1.63	4.63733	7.58
Benin	2004	-0.1473	6.4E+07	20.396	18.541	12.4218	3.2003	1.48	6.20874	9.18
Botswana	2004	4.80057	7.5E+08	35.856	33.152	15.393	1.2012	7.28	28.2274	205.40
Burkina Faso	2004	1.64405	1.8E+07	22.783	16.2	7.15762	2.89983	1.04	2.87126	3.00
Burundi	2004	1.84376	44690.7	39.805	13.3	15.4105	2.8935	0.39	1.4285	0.55
Cameroon	2004	1.39465	8.6E+07	15.973	20.391	16.4793	2.24997	14.69	8.9184	130.98
Cape Verde	2004	-2.1489	6.8E+07	35.876	39.466	48.1771	1.45727	0.28	14.0922	3.92
Central African Republic	2004	-0.5897	2.9E+07	13.819	39.466		1.58644	0.12	1.51811	0.18
Chad	2004	29.1035	4.7E+08	13.065	24.284		3.44555	3.55	1.29818	4.61
Comoros	2004	-2.8866	671354	19.52	8.956		2.68891	0.06	1.3386	0.08
Congo, Dem. Rep.	2004	3.47131	4.1E+08	15.771	12.77		3.01633	0.62	3.57049	2.20
Congo, Rep.	2004	1.07921	-9E+06	26.725	22.52	26.0933	2.36672	1.46	11.134	16.23
Cote d'Ivoire	2004	0.20747	2.8E+08	20.096	10.802	19.5	1.57071	1.47	9.44252	13.86
Djibouti	2004	1.98236	3.9E+07	37.5	21.12	18.0568	1.79212	1.93	4.34425	8.39
Equatorial Guinea	2004	33.8351	3.4E+08	17.487	43.734	43.5362	3.06361	0.95	10.4952	9.98
Eritrea	2004	-2.6041	-8E+06	54.841	20.263		4.08484	1.13	0.46314	0.52
Ethiopia	2004	10.8435	5.5E+08	23.351	26.516		2.43205	1.79	0.21445	0.38
Gabon	2004	-0.6661	3.2E+08	22.555	24.393	19.5321	2.00536	2.91	36.4066	106.08
Gambia, The	2004	3.92204	5.6E+07	21.687	24.217	15.2603	2.9655	1.12	11.9823	13.45
Ghana	2004	3.05492	1.4E+08	20.809	18.022	29.0148	2.43963	0.23	8.0256	1.81
Guinea	2004	0.66529	9.8E+07	17.948	20.727	20.1097	1.64882	0.33	1.74254	0.57
Guinea-Bissau	2004	-1.2585	1679019	25.285	7.62	9.83515	1.95961	1.68	2.94232	4.95
Kenya	2004	2.38789	4.6E+07	22.743	14.432	9.95363	2.61848	1.86	7.33717	13.66
Lesotho	2004	1.35352	5.6E+07	46.583	24.39	15.5049	0.8847	0.90	9.58537	8.63
Madagascar	2004	2.13147	5.3E+07	25.294	25.836	32.9673	3.01441	1.21	1.92355	2.33
Malawi	2004	2.72692	1.1E+08	36.326	18.215	24.3407	2.66368	0.54	1.78096	0.97
Mali	2004	-0.952	1E+08	23.777	16.474		3.11853	2.20	3.1855	7.02
Mauritania	2004	2.25077	3.9E+08		51.722	15.8582	2.82316	29.72	17.6217	523.80
Mauritius	2004	4.83911	1.4E+07	23.866	24.376		0.86109	0.36	44.4099	16.02
Mozambique	2004	5.08477	2.4E+08	24.75	18.345	13.8108	2.62869	6.34	3.49694	22.16
Namibia	2004	10.3489	8.8E+07	28.847	19.068	13.5569	1.72757	0.43	14.0013	6.08

Niger	2004	-3.3196	2.6E+07	20.694	14.593	11.6485	3.47587	0.92	1.37421	1.26
Nigeria	2004	7.89796	1.9E+09	27.212	23.289	10.5972	2.47341	0.32	6.70619	2.18
Rwanda	2004	5.59051	7660000	21.345	19.908	16.3943	1.69917	2.30	1.5236	3.51
Senegal	2004	3.06459	7.7E+07	22.725	25.988	17.1223	2.71444	25.28	10.5971	267.91
Seychelles	2004	-2.4972	3.8E+07	41.426	20.464	77.5126	-0.363	0.57	65.9018	37.66
Sierra Leone	2004	2.69171	6.1E+07	24.772	10.773	14.0335	4.58892	0.87	3.35093	2.92
Sudan	2004	-0.5294	1.5E+09	20.29	22.495	5.11262	2.3204	3.77	2.79588	10.53
Swaziland	2004	1.8783	7E+07	34.708	9.041	27.492	0.61926	0.40	13.2361	5.26
Tanzania	2004	4.95222	2.3E+08	19.389	21.548	16.4383	2.67844	0.40	5.13934	2.04
Togo	2004	0.70129	5.9E+07	16.589	14.515	18.8854	2.25703	3.03	6.28873	19.04
Uganda	2004	3.39207	3E+08	19.837	20.176	10.8655	3.24974	0.72	4.23316	3.05
Zambia	2004	2.98753	3.6E+08	26.618	24.908	12.4853	2.29701	0.71	4.14882	2.95
Zimbabwe	2004	-6.7689	8700000		5.11		-0.1196	3.09	3.3795	10.43
Angola	2005	16.725	-1E+09	34.736	8.797	22.7466	3.27683	2.11	9.77085	20.62
Benin	2005	-0.2781	5.3E+07	21.15	18.62	11.0285	3.13725	2.01	7.81092	15.70
Botswana	2005	0.37263	4.9E+08	31.621	26.271	16.5523	1.25702	7.91	30.0576	237.76
Burkina Faso	2005	3.29134	5.2E+07	22.738	20.321	7.87509	2.92092	1.06	4.46213	4.73
Burundi	2005	-2.0483	584702	36.752	10.773	21.2184	2.96559	0.39	2.10993	0.83
Cameroon	2005	0.03364	2.3E+08	14.61	16.769	14.6177	2.23704	14.98	12.8322	192.22
Cape Verde	2005	10.4466	8E+07	37.636	36.033	47.8354	1.29814	0.28	17.2814	4.90
Central African Republic	2005	0.72814	3.2E+07	16.881	36.033		1.64615	0.12	2.48887	0.30
Chad	2005	13.6023	-1E+08	11.73	20.237		3.2308	3.62	2.14594	7.77
Comoros	2005	1.4582	558644	19.308	8.909		2.6952	0.06	2.41425	0.15
Congo, Dem. Rep.	2005	3.37512		20.472	13.842		2.94367	0.63	4.78243	3.01
Congo, Rep.	2005	5.13299	5.1E+08	24.162	20.19	26.9038	2.50515	1.49	15.7986	23.49
Cote d'Ivoire	2005	-0.3685	3.1E+08	19.858	9.736	20.6721	1.61729	1.50	13.0373	19.52
Djibouti	2005	1.30254	2.2E+07	36.819	23.174	18.0644	1.82627	1.97	5.44963	10.73
Equatorial Guinea	2005	6.50812	7.7E+08	14.057	39.86	46.8588	2.99722	0.97	15.9443	15.46
Eritrea	2005	-1.2708	-1E+06	57.487	20.339		3.81242	1.15	0.9014	1.04
Ethiopia	2005	9.20309	2.7E+08	23.078	23.755		2.36708	1.83	0.55293	1.01
Gabon	2005	1.02554	2.4E+08	22.668	21.31	17.925	1.95652	2.97	53.7444	159.72
Gambia, The	2005	-3.7269	5.4E+07	21.293	21.569	13.7068	2.91401	1.14	16.4582	18.84
Ghana	2005	3.35576	1.4E+08	19.747	19.087	28.0008	2.43182	0.23	13.2837	3.05
Guinea	2005	1.26515	1.1E+08	16.89	19.535	22.1969	1.69687	0.33	2.09037	0.70
Guinea-Bissau	2005	2.25031	8692468	22.108	6.59	12.298	1.98499	1.72	7.22566	12.40
Kenya	2005	3.19347	2.1E+07	24.284	16.912	8.18769	2.59526	1.90	12.9497	24.58
Lesotho	2005	1.51549	6.9E+07	48.377	23.609	16.1023	0.91161	0.92	12.0918	11.10
Madagascar	2005	1.51465	8.5E+07	21.427	23.776	29.8965	2.9968	1.24	2.8529	3.53
Malawi	2005	-0.1989	5.2E+07	34.529	22.685	22.0928	2.76584	0.55	3.28454	1.82
Mali	2005	2.82431	1.9E+08	24.627	15.482		3.11698	2.25	5.78285	13.00
Mauritania	2005	2.58251	8.1E+08		61.543	16.2539	2.75221	30.32	24.4685	741.87

Mauritius	2005	0.43789	4.2E+07	24.364	22.668		0.79681	0.37	52.8314	19.44
Mozambique	2005	5.65469	1.1E+08	22.895	17.677	15.0558	2.55388	6.46	7.24093	46.81
Namibia	2005	0.72344	1.7E+08	27.254	19.69	10.7604	1.77591	0.44	21.5802	9.56
Niger	2005	0.90561	4.4E+07	20.19	23.094	10.7738	3.50016	0.94	2.49235	2.33
Nigeria	2005	2.81903	5E+09	28.682	22.835	7.4977	2.47921	0.33	13.2932	4.40
Rwanda	2005	7.01853	8030000	23.358	20.933	16.7862	2.10944	2.35	2.42322	5.69
Senegal	2005	2.80381	4.5E+07	23.593	28.495	18.1935	2.70924	25.79	15.9135	410.36
Seychelles	2005	6.95196	8.6E+07	38.466	35.398	68.2772	0.48368	0.58	70.9361	41.35
Sierra Leone	2005	2.99174	8.3E+07	24.507	17.37	13.6775	3.98449	0.89	4.6913	4.17
Sudan	2005	3.81595	2.3E+09	25.372	24.048	7.15044	2.3888	3.84	4.75898	18.28
Swaziland	2005	1.33707	-5E+07	34.777	23.782	27.1551	0.8564	0.41	18.101	7.34
Tanzania	2005	4.4564	9.4E+08	21.701	23.898	17.5117	2.72558	0.41	8.72958	3.54
Togo	2005	-1.0604	7.7E+07	19.272	16.292	20.2168	2.23957	3.09	8.01833	24.77
Uganda	2005	2.93077	3.8E+08	20.22	22.389	12.2753	3.2515	0.74	4.62626	3.40
Zambia	2005	2.86055	3.6E+08	26.059	23.673	10.3656	2.38321	0.72	8.28415	6.00
Zimbabwe	2005	-5.9159	1E+08	24.975	2.06		-0.2161	3.15	5.14777	16.21
Angola	2006	14.9295	-4E+07	34.142	11.953	19.9176	3.11282	0.58	17.9574	10.36
Benin	2006	0.95321	5.3E+07	19.305	17.179	12.0238	3.06948	0.98	13.4117	13.18
Botswana	2006	3.74037	7.5E+08	28.912	24.018	14.2669	1.33626	6.95	43.2988	300.75
Burkina Faso	2006	2.4474	7.6E+07	23.583	16.396	8.06896	2.94073	0.68	6.95248	4.71
Burundi	2006	1.98942	31593.8	38.141	16.269	25.7631	3.0281	0.37	2.67581	1.00
Cameroon	2006	0.9516	1.6E+07	14.548	14.298	13.8747	2.22423	14.97	17.472	261.49
Cape Verde	2006	8.90158	1.3E+08	37.226	38.046	57.0605	1.13212	0.29	22.7609	6.68
Central African Republic	2006	2.03119	3.5E+07	13.913	38.046		1.71875	0.13	2.69111	0.35
Chad	2006	-2.7629	-3E+08	11.427	32.585		3.00159	2.89	4.62201	13.34
Comoros	2006	-1.4531	576284	20.647	9.212		2.69822	0.02	5.5827	0.09
Congo, Dem. Rep.	2006	2.118	2.6E+08	20.082	13.244		2.86331	0.50	7.47265	3.71
Congo, Rep.	2006	3.34742	1.5E+09	28.003	21.632	34.8192	2.66387	1.48	25.2855	37.33
Cote d'Ivoire	2006	-0.9919	3.2E+08	20.81	9.334	20.3861	1.67849	1.60	22.1839	35.45
Djibouti	2006	2.85129	1.1E+08	37.395	35.032	17.7207	1.87684	1.37	5.44106	7.47
Equatorial Guinea	2006	-1.6591	4.7E+08	17.268	32.476	44.3148	2.92486	0.81	22.3722	18.08
Eritrea	2006	-4.3633	450000	41.156	13.681		3.49756	0.95	1.33444	1.27
Ethiopia	2006	8.31213	5.5E+08	22.239	25.202		2.30221	2.61	1.14049	2.98
Gabon	2006	-0.7352	2.7E+08	22.481	25.092	15.4615	1.91218	2.99	64.2708	192.33
Gambia, The	2006	-1.35	8.2E+07	22.155	23.839		2.85709	1.61	26.133	42.00
Ghana	2006	3.85285	6.4E+08	21.771	21.636	36.6229	2.42306	0.25	23.4872	5.87
Guinea	2006	0.70856	1.3E+08	19.023	17.23	14.2346	1.75951	0.49	15.1234	7.35
Guinea-Bissau	2006	0.1019	1.8E+07	21.251	6.39	12.8832	2.01202	0.80	11.2742	9.05
Kenya	2006	3.62345	5.1E+07	24.719	17.947	7.43336	2.56785	2.55	20.0879	51.18
Lesotho	2006	3.72991	5.9E+07	49.34	24.76	17.0253	0.95436	0.70	17.1615	12.09
Madagascar	2006	1.93976	2.9E+08	21.507	24.976	27.8104	2.97935	0.99	5.67589	5.59

Malawi	2006	4.65769	7.2E+07	36.152	25.671		2.86547	0.61	4.69987	2.85
Mali	2006	2.07616	4.8E+07	24.873	16.932		3.10942	1.11	11.1305	12.40
Mauritania	2006	16.2446	1.1E+08		25.02	16.8404	2.67807	28.52	33.8702	965.94
Mauritius	2006	3.14012	1.1E+08	23.451	26.702		0.7799		61.6443	0.00
Mozambique	2006	6.02344	1.5E+08	26.991	16.995	16.1277	2.47719	6.43	10.9874	70.61
Namibia	2006	5.11706	-3E+07	26.417	22.263	11.9711	1.84362	0.18	28.7374	5.12
Niger	2006	2.13513	5.1E+07	19.753	23.589	11.4971	3.52538	1.18	3.58837	4.23
Nigeria	2006	3.59529	4.9E+09	23.23	22.583	11.0457	2.48323		22.5495	0.00
Rwanda	2006	6.42785	1.1E+07	21.725	19.718	12.0109	2.57137	2.53	3.3279	8.42
Senegal	2006	-0.2041	2.2E+08	26.581	28.166	17.5811	2.7009	24.44	26.7032	652.71
Seychelles	2006	6.1243	1.5E+08	47.264	30.5	72.7863	2.02992	0.54	83.1442	45.26
Sierra Leone	2006	3.77837	5.9E+07	22.664	15.246	9.02805	3.31931	1.27	7.50608	9.51
Sudan	2006	8.58495	3.5E+09	25.227	25.111	8.37253	2.46456	3.93	11.8956	46.80
Swaziland	2006	1.7031	1.2E+08	32.233	13.921	24.5968	1.14241	0.39	22.3693	8.81
Tanzania	2006	3.79242	4E+08	22.847	26.422	19.3801	2.77483	0.39	14.444	5.69
Togo	2006	1.75938	7.7E+07	21.194	16.775	21.1035	2.22837	1.48	12.8031	19.00
Uganda	2006	7.24265	6.4E+08	18.749	21.174	12.9926	3.2495	0.37	6.83964	2.52
Zambia	2006	3.62392	6.2E+08	23.472	22.11	7.62927	2.47931	0.80	14.1559	11.26
Zimbabwe	2006	-3.0159	4E+07	12.818	2.33		-0.3269	2.68	6.77709	18.15
Angola	2007	19.0943	-9E+08	34.496	13.509	21.4286	2.98265	0.54	28.3106	15.23
Benin	2007	1.49438	2.6E+08	23.255	20.505	14.4604	3.01401	1.37	25.2913	34.53
Botswana	2007	3.34935	6.5E+08	31.064	25.811	15.1594	1.39145	7.10	59.7529	424.53
Burkina Faso	2007	0.57808	3.7E+08	25.634	18.886	7.28742	2.9576	0.81	10.6964	8.65
Burundi	2007	0.46293	500245	53.9	17.521	21.3979	3.07514	0.37	3.50295	1.30
Cameroon	2007	1.2347	1.9E+08	15.745	15.039	15.1517	2.21301	14.86	24.7193	367.26
Cape Verde	2007	7.57981	1.9E+08	33.553	46.978	58.9874	0.98951	0.29	31.5124	9.09
Central African Republic	2007	1.87056	5.7E+07	13.225	46.978		1.77992	0.13	3.12429	0.39
Chad	2007	-2.5799	-7E+07	21.12	26.629		2.81357	3.14	8.85432	27.78
Comoros	2007	-2.1809	7522604	21.694	10.69		2.69484	0.01	9.72588	0.06
Congo, Dem. Rep.	2007	3.31266	1.8E+09	20.41	18.24		2.80972	0.54	10.8471	5.84
Congo, Rep.	2007	-4.282	2.6E+09	30.039	21.941	46.1092	2.77361	1.33	34.5153	45.83
Cote d'Ivoire	2007	-0.0351	4.3E+08	20.5	8.685	20.4448	1.73524	1.55	40.0483	62.19
Djibouti	2007	3.12552	2E+08	37.749	42.968	17.2597	1.8966	1.68	8.28385	13.93
Equatorial Guinea	2007	18.0178	1.2E+09	18.966	35.276	42.0112	2.86053	0.78	34.1649	26.64
Eritrea	2007	-1.8016	-110000	39.94	12.674		3.23445	1.13	1.75778	1.99
Ethiopia	2007	8.98215	2.2E+08	20.677	22.12		2.2446	1.86	1.55497	2.89
Gabon	2007	3.59263	2.7E+08	20.847	24.663	15.9572	1.87504	3.06	82.1136	251.29
Gambia, The	2007	2.26048	7.8E+07	17.178	18.289		2.81021	1.66	50.2949	83.38
Ghana	2007	3.91994	8.6E+08	23.085	22.927	32.9804	2.41461	0.23	33.4797	7.86
Guinea	2007	-0.106	3.9E+08	14.788	14.243	15.5316	1.84848	0.32	21.3365	6.85
Guinea-Bissau	2007	1.12252	1.9E+07	22.133	11.705	8.16852	2.03569	1.24	20.7994	25.73

Kenya	2007	4.31155	7.3E+08	26.224	19.075	14.7115	2.55139	2.26	30.277	68.40
Lesotho	2007	3.433	1E+08	49.646	26.866	16.9334	0.98133	0.71	21.6511	15.27
Madagascar	2007	3.14243	7.7E+08	18.673	28.305	26.7397	2.95965	1.29	11.366	14.65
Malawi	2007	2.73194	9.2E+07	39.75	26.957		2.94275	0.57	7.73288	4.41
Mali	2007	1.1162	5.4E+07	24.498	16.884		3.1001	1.25	18.051	22.62
Mauritania	2007	-8.1355	1.4E+08	29.625	22.35	16.1376	2.60831	28.62	44.0122	1259.46
Mauritius	2007	5.22815	3.4E+08	22.82	26.924		0.61305	0.36	73.6597	26.34
Mozambique	2007	4.72216	4.3E+08	28.148	15.307	16.3672	2.41472	6.40	14.1201	90.33
Namibia	2007	3.40581	1.7E+08	26.103	23.724	12.6304	1.88572	0.17	37.067	6.38
Niger	2007	-0.1999	1.3E+08	23.148	22.839	10.5817	3.54359	1.07	6.45362	6.94
Nigeria	2007	3.83295	6E+09	28.746	22.773	11.9262	2.48904	0.24	27.4891	6.55
Rwanda	2007	2.57609	6.7E+07	23.06	20.204	12.0593	2.81061	2.35	6.5407	15.34
Senegal	2007	2.06825	3E+08	27.46	33.976	21.5211	2.695	26.72	31.6419	845.52
Seychelles	2007	9.13991	2.5E+08	42.108	29.457	76.0344	0.51051	0.55	90.88	50.27
Sierra Leone	2007	3.50958	9.7E+07	17.591	13.199	8.61296	2.79363	0.85	14.165	12.11
Sudan	2007	7.4205	2.4E+09	25.967	26.537	7.14131	2.52052	3.88	20.3551	79.05
Swaziland	2007	2.10341	3.7E+07	31.299	19.246	32.5967	1.36881	0.40	33.5391	13.33
Tanzania	2007	4.14669	5.8E+08	23.015	28.716	19.5501	2.82659	0.40	20.2659	8.06
Togo	2007	0.06649	4.9E+07	20.377	14.643	21.4575	2.19818	1.76	21.0571	37.06
Uganda	2007	4.94763	7.9E+08	18.384	23.659	13.1746	3.24812	0.55	13.8276	7.56
Zambia	2007	3.50436	1.3E+09	24.265	21.976	10.2945	2.56492	0.76	21.8908	16.67
Zimbabwe	2007	0.59236	6.9E+07	7.696	5.36		-0.3871	2.76	9.81997	27.14
Angola	2008	10.5661	1.7E+09	42.017	16.223	26.6918	2.88293	0.63	37.5506	23.79
Benin	2008	2.03847	1.7E+08	21.223	19.99	12.8399	2.95624	1.23	43.3865	53.57
Botswana	2008	1.43191	9E+08	39.257	32.427	15.1418	1.40546	7.28	76.0065	553.21
Burkina Faso	2008	1.92665	1.5E+08	21.244	20.186	8.70514	2.97069	0.93	16.4548	15.27
Burundi	2008	1.40041	3833208	56.693	22.339	29.2668	3.01092	0.38	6.05012	2.32
Cameroon	2008	0.6578	-2E+07	18.497	17.523	17.4926	2.2031	14.74	32.8427	484.25
Cape Verde	2008	5.2502	2.1E+08	34.882	46.567	61.9078	0.89614	0.28	56.973	16.13
Central African Republic	2008	0.14624	1.2E+08	16.174	46.567		1.83412	0.12	3.63382	0.44
Chad	2008	-3.0356	2.3E+08	23.382	24.839		2.68187	3.34	16.9799	56.76
Comoros	2008	-1.6952	7521125	25.288	13.667		2.67994	0.06	14.121	0.84
Congo, Dem. Rep.	2008	3.30298	1.7E+09	24.352	22.393		2.76329	0.58	14.8265	8.58
Congo, Rep.	2008	2.66056	2.5E+09	23.784	18.411		2.79462	1.88	47.1022	88.44
Cote d'Ivoire	2008	0.49621	4.5E+08	21.146	10.141	20.5449	1.80828	1.51	55.0326	83.09
Djibouti	2008	3.79892	2.3E+08	40.605	46.693	15.7359	1.90946	1.74	13.1888	22.98
Equatorial Guinea	2008	7.60407	-8E+08	21.618	25.871	43.3973	2.816	0.82	52.2401	42.67
Eritrea	2008	-12.509	-233333	42.132	12.714		3.05706	1.13	2.19567	2.48
Ethiopia	2008	8.37887	1.1E+08	18.894	22.356		2.19903	1.83	2.46018	4.50
Gabon	2008	0.4416	2.1E+08	20.206	21.771	16.401	1.85625	2.99	89.636	267.73
Gambia, The	2008	2.55828	7.9E+07	17.569	13.982		2.77325	0.62	71.275	44.09

Ghana	2008	5.85878	1.2E+09	24.511	22.958	24.7258	2.40035	0.22	49.735	10.93
Guinea	2008	2.9007	3.8E+08	17.458	17.515	14.3691	1.95954	0.32	40.1752	12.84
Guinea-Bissau	2008	1.12229	5142861	21.122	8.717	14.4837	2.05473	1.68	34.4044	57.83
Kenya	2008	-1.0087	9.6E+07	27.556	20.343	15.2292	2.55522	1.94	42.396	82.09
Lesotho	2008	3.61885	1.1E+08	58.333	29.492	17.0521	1.0055	0.84	27.8844	23.52
Madagascar	2008	4.02683	1.2E+09	18.624	40.913	25.8871	2.93787	1.25	24.7374	30.91
Malawi	2008	5.37646	1.7E+08	41.14	26.276		3.01321	0.56	12.7168	7.13
Mali	2008	1.81076	1.3E+08	21.168	19.036		3.08446	2.32	23.7829	55.11
Mauritania	2008	0.92278	3.4E+08	30.678	23.983	16.9208	2.53803	28.73	63.485	1823.90
Mauritius	2008	4.84025	3.8E+08	23.837	27.297		0.64534	0.35	81.4325	28.56
Mozambique	2008	4.33602	5.9E+08	27.814	17.595	15.3701	2.36316	6.36	19.7243	125.49
Namibia	2008	2.33584	4.1E+08	27.649	28.934	12.7507	1.90114	0.45	47.809	21.42
Niger	2008	4.90607	3.4E+08	22.783	32.291	13.6273	3.55264	0.87	13.1324	11.40
Nigeria	2008	3.38686	8.2E+09	28.242	24.041	12.8625	2.49612	0.17	41.8068	7.01
Rwanda	2008	7.93694	1E+08	24.803	23.538	19.7287	2.97832	2.02	13.221	26.67
Senegal	2008	0.5882	4E+08	26.452	34.131	20.5041	2.68665	25.67	45.7205	1173.67
Seychelles	2008	-3.4827	2.4E+08	30.842	40.103	87.3828	2.23628	0.56	107.498	60.34
Sierra Leone	2008	3.01725	5.8E+07	20.725	14.759	9.55725	2.41373	0.88	17.9754	15.89
Sudan	2008	4.15087	2.6E+09	23.224	22.738	5.36321	2.54698	3.82	28.9543	110.75
Swaziland	2008	0.85671	1.1E+08	38.061	13.895	30.8559	1.51859	0.29	46.216	13.54
Tanzania	2008	4.38876	4E+08	22.817	29.72	17.6086	2.87887	0.29	30.7724	9.01
Togo	2008	0.18123	2.4E+07	17.863	17.321	20.3028	2.17034	2.44	26.8234	65.43
Uganda	2008	5.24184	7.3E+08	18.56	22.978	14.2348	3.24123	0.54	27.2975	14.68
Zambia	2008	2.91376	9.4E+08	23.781	20.93	8.23753	2.65396	0.73	28.5873	20.92
Zimbabwe	2008	-17.504	5.2E+07	5.82	3.65		-0.2383	2.79	13.2893	37.14
Angola	2009	-0.454	2.2E+09	39.464	15.233	26.2177	2.82668	1.63	43.7045	71.41
Benin	2009	0.83397	1.3E+08	24.836	23.257		2.89907	1.48	58.5153	86.50
Botswana	2009	-6.2168	2.5E+08	45.804	23.996	16.4001	1.35933	7.28	94.5763	688.21
Burkina Faso	2009	0.46175	1.7E+08	23.997	16.438		2.97943	1.04	20.6388	21.56
Burundi	2009	0.61867	348405	50.682	22.133	17.0249	2.82338	0.39	10.261	3.96
Cameroon	2009	-0.2142	6.7E+08	18.435	16.616	13.652	2.1947	14.69	38.577	566.55
Cape Verde	2009	2.67099	1.2E+08	35.321	39.409	50.6944	0.86825	0.28	79.7362	22.16
Central African Republic	2009	-0.1881	4.2E+07	16.056	39.409		1.87397	0.12	3.89057	0.46
Chad	2009	-4.1491	4.6E+08	30.131	31.481		2.62466	3.55	24.5586	87.15
Comoros	2009	-0.8552	9089626	22.36	11.864		2.65303	0.06	13.9709	0.87
Congo, Dem. Rep.	2009	0.06445	6.6E+08	28.504	19.383		2.73054	0.62	15.8298	9.76
Congo, Rep.	2009	4.60278	2.1E+09	24.722	22.545		2.70312	1.46	55.0812	80.29
Cote d'Ivoire	2009	1.80358	3.8E+08	21.065	10.171	17.5574	1.89389	1.47	68.9709	101.26
Djibouti	2009	3.01844	9.7E+07	41.558	35.5	15.0166	1.90476	1.93	14.7664	28.52
Equatorial Guinea	2009	2.42022	1.6E+09	48.952	48.132	42.8601	2.79718	0.95	65.334	62.12
Eritrea	2009	0.8103	35555.6	30.635	9.264		2.99613	1.13	2.76834	3.12

Ethiopia	2009	6.4586	2.2E+08	17.227	22.716		2.16816	1.79	4.99053	8.95
Gabon	2009	-3.2274	3.3E+07	25.079	26.174	12.896	1.85836	2.91	92.9264	270.76
Gambia, The	2009	3.27642	3.9E+07	21.18	17.974		2.75058	1.12	85.2097	95.63
Ghana	2009	2.1967	1.7E+09	22.183	24.363	25.4626	2.37957	0.23	63.4178	14.29
Guinea	2009	-2.3449	5E+07	24.067	11.42	18.009	2.09225	0.33	57.4416	18.75
Guinea-Bissau	2009	0.8886	1.4E+07	21.946	10.06	9.67548	2.06708	1.68	37.756	63.54
Kenya	2009	-0.0252	1.4E+08	29.05	20.886		2.58434	1.86	49.0712	91.33
Lesotho	2009	2.0127	1E+08	65.517	34.878	16.1133	1.01899	0.90	30.7556	27.69
Madagascar	2009	-7.3183	1.1E+09	15.012	32.198	24.9008	2.91355	1.21	29.8022	36.11
Malawi	2009	4.34288	6E+07	39.868	24.896		3.07382	0.54	16.6179	9.03
Mali	2009	1.34728	7.2E+08	25.808	20.257		3.06341	2.20	25.0976	55.33
Mauritania	2009	-3.6293	-4E+07	30.582	24.601	13.1621	2.4691	29.72	64.6089	1920.49
Mauritius	2009	2.51179	2.6E+08	26.247	21.512		0.50853	0.36	85.2135	30.74
Mozambique	2009	3.99824	8.8E+08	32.189	14.816	17.0989	2.32668	6.34	26.1205	165.55
Namibia	2009	-2.5449	4.9E+08	30.672	28.652	12.3119	1.8754	0.43	54.28	23.56
Niger	2009	-4.6463	7.4E+08	24.445	32.953		3.55041	0.92	17.3588	15.94
Nigeria	2009	4.35261	8.6E+09	30.352	27.587	12.4073	2.50532	0.32	47.3171	15.35
Rwanda	2009	0.99876	1.2E+08	25.854	22.363	16.3399	3.02437	2.30	23.5592	54.25
Senegal	2009	-0.4778	2.1E+08	26.624	27.853		2.6765	25.28	57.0048	1441.15
Seychelles	2009	0.3055	2.7E+08	36.723	29.299	86.2558	0.39253	0.57	105.734	60.43
Sierra Leone	2009	0.91342	7.4E+07	22.937	14.938	9.73204	2.24059	0.87	20.2115	17.63
Sudan	2009	1.36107	2.7E+09	19.968	21.725	5.43349	2.53468	3.77	36.1123	136.00
Swaziland	2009	-1.1469	6.6E+07	43.071	14.376	25.9643	1.55272	0.40	56.1478	22.31
Tanzania	2009	2.98444	4.1E+08	26.068	29.351	16.6776	2.9307	0.40	40.1369	15.95
Togo	2009	1.03968	4.9E+07	21.289	18.021	21.1704	2.14111	3.03	37.0618	112.23
Uganda	2009	3.83958	7.9E+08	17.481	23.451	15.1241	3.22916	0.72	28.9909	20.92
Zambia	2009	3.52519	6.9E+08	21.43	21.628	7.38975	2.74191	0.71	34.6335	24.59
Zimbabwe	2009	5.80924	1.1E+08	19.62	2.44		0.18013	3.09	23.9779	74.03
Angola	2010	-0.5242	9.9E+09	34.306	10.399		2.79954	2.11	52.4454	110.66
Benin	2010	0.11223	1.1E+08	20.215	18.739		2.84371	2.01	70.2183	141.14
Botswana	2010	5.83907	5.3E+08	40.948	27.402		1.27212	7.91	113.492	897.72
Burkina Faso	2010	6.0301	3.7E+07	26.334	20.251		2.98443	1.06	24.7665	26.25
Burundi	2010	1.27245	1.4E+07	51.041	20.64		2.56145	0.39	12.3132	4.84
Cameroon	2010	0.38109	-551207	18.309	16.438	12.9719	2.18641	14.98	46.2925	693.45
Cape Verde	2010	4.47951	1.1E+08	38.891	47.126		0.88658	0.28	95.6835	27.12
Central African Republic	2010	1.35366	7.2E+07	17.125	47.126		1.90214	0.12	4.66869	0.57
Chad	2010	1.60481	7.8E+08	33.497	39.689		2.61804	3.62	29.4704	106.67
Comoros	2010	-0.5369	9391766	23.346	16.494		2.61658	0.06	16.7651	1.07
Congo, Dem. Rep.	2010	4.38087	2.9E+09	30.64	27.026		2.70661	0.63	18.9957	11.95
Congo, Rep.	2010	6.02255	2.8E+09	21.109	20.764		2.54123	1.49	66.0974	98.28
Cote d'Ivoire	2010	0.98624	4.2E+08	22.196	9.575	17.9389	1.98418	1.50	82.7651	123.94

Djibouti	2010		2.7E+07	35.807	25.043		1.88851	1.97	17.7196	34.90
Equatorial Guinea	2010	-1.8343	7E+08	34.645	48.253		2.79219	0.97	78.4009	76.04
Eritrea	2010	-0.8253	5.6E+07	34.655	9.299		3.00801	1.15	3.32201	3.82
Ethiopia	2010	7.79771	1.8E+08	18.608	22.349		2.14681	1.83	5.98864	10.96
Gabon	2010	3.70142	1.7E+08	24.719	25.678		1.87395	2.97	111.512	331.41
Gambia, The	2010	2.17769	3.7E+07	22.156	17.433		2.73672	1.14	102.252	117.06
Ghana	2010	4.13981	2.5E+09	25.071	21.815	19.8211	2.35376	0.23	76.1014	17.49
Guinea	2010	-0.3178	1E+08	30.188	10.469	14.3121	2.23253	0.33	68.9299	22.95
Guinea-Bissau	2010	1.34848	8848736	20.602	9.817	10.1526	2.07413	1.72	45.3073	77.77
Kenya	2010	2.56957	1.3E+08	31.423	22.586		2.62721	1.90	58.8854	111.79
Lesotho	2010	2.24779	1.2E+08	65.049	37.49		1.02382	0.92	36.9067	33.89
Madagascar	2010	-1.3256	8.6E+08	12.851	25.798	26.4575	2.88805	1.24	35.7626	44.20
Malawi	2010	3.80416	1.4E+08	40.572	30.103		3.12569	0.55	19.9414	11.05
Mali	2010	1.37247	1.5E+08	23.5	19.206		3.03855	2.25	30.1171	67.72
Mauritania	2010	2.51357	1.4E+07	25.795	26.487		2.40287	30.32	77.5307	2350.68
Mauritius	2010	3.55689	4.3E+08	25.064	25.067		0.46086	0.37	102.256	37.62
Mozambique	2010	4.76118	7.9E+08	31.858	21.937	18.6114	2.30136	6.46	31.3446	202.63
Namibia	2010	2.90847	8.6E+08	32.488	27.626		1.82138	0.44	65.136	28.84
Niger	2010	5.02007	9.5E+08	23.254	47		3.54119	0.94	20.8305	19.52
Nigeria	2010	5.17109	6E+09	32.642	24.663	13.1065	2.51529	0.33	56.7805	18.79
Rwanda	2010	4.33561	4.2E+07	25.35	23.423		2.98781	2.35	28.271	66.40
Senegal	2010	1.42913	2.4E+08	27.118	29.813		2.66401	25.79	68.4057	1763.97
Seychelles	2010	7.14877	3.7E+08	37.083	53.955	81.3379	-0.8894	0.58	126.881	73.96
Sierra Leone	2010	2.65471	8.7E+07	27.296	18.263	10.6877	2.20988	0.89	24.2539	21.57
Sudan	2010	1.8757	2.9E+09	17.647	20.864	5.11184	2.49607	3.84	43.3348	166.46
Swaziland	2010	-0.4097	9.3E+07	39.156	12.474		1.50453	0.41	67.3774	27.30
Tanzania	2010	3.91989	4.3E+08	27.412	28.842	17.0932	2.97985	0.41	48.1643	19.52
Togo	2010	1.20861	4.1E+07	22.135	16.866		2.11144	3.09	44.4741	137.36
Uganda	2010	1.85603	8.2E+08	19.903	24.319	18.4892	3.21272	0.74	34.789	25.60
Zambia	2010	5.92304	1E+09	22.703	23.849	7.7273	1.58024	0.72	41.5602	30.10
Zimbabwe	2010	8.15496	1.1E+08	31.737	5.65		0.77829	3.15	28.7735	90.61

Appendix II: Diagonistic Tests

Appendix A.2: Panel Unit Root Test –Im, Pesaran and Shin (IPS)

Variable		Constant	Constant +Trend
Economic G	Level	-12.8931*** (0.000)	-14.6801*** (0.000)
Foreign Direct investment (FDi)	Level	1.5336 (0.9374)	-5.1786*** (0.000)
Share of Government Spending (Gc)	Level	2.0665** (0.0194)	7.8633*** (0.000)
Investment (It)	Level	-3.9522*** (0.000)	-8.6184*** (0.000)
Trade openness (Ot)	Level	4.5739*** (0.000)	8.5372*** (0.000)
Population (n)	Level	1.0496 (0.1368)	1.9412 (0.9739)
	First difference	-23.2657*** (0.000)	-37.9172*** (0.000
Mobile Teledensity (Mt)	Level	42.8088*** (0.000)	24.3008*** (0.000)
Landline teledensity (Lt)	Level	10.1656*** (0.001)	10.1656*** (0.000)
Mobile. Landline Teledensity (Tt)	Level	5.6308*** (0.000)	2.6657*** (0.000)

Note: *, ** indicates rejection of the null hypothesis that all panels contains unit roots at 1% and 5%, levels of significance

Source: Constructed from the study data