Impact of Food Availability on Economic Growth and Child Mortality: A Cross Country Comparative Analysis

Mary Oluwatoyin Agboola

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Prof. Dr. Elvan Yılmaz
Director

I certify that this thesis satisfies the requirements as a thesis for the degree of Doctor of Philosophy in Economics.

Prof. Dr. Mehmet Balcılar
Chair, Department of Economics

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Doctor of Philosophy in Economics.

Prof. Dr. Mehmet Balcılar
Supervisor

Examining Committee

1. Prof. Dr. Glenn Jenkins _____
2. Prof. Dr. Mehmet Balcılar _____
3. Prof. Dr. Metin Karadağ _____
4. Prof. Dr. Murat Çokgezen _____
5. Assoc. Prof. Dr. Sevin Uğural _____

ABSTRACT

The aim of this study is to examine the impact of food availability on economic growth and child mortality; especially within food insecure African countries where child mortality is high and economic growth is considered as the highest hurdle to overcome. This study made use of both empirical and statistical tools to achieve its objective. The empirical aspect consists of two parts. First, Solow growth model was used to explore the impact of food security on economic growth within 124 countries, including food insecure African countries, for the period 1970-2007; the result posits that food security has a positive impact on economic growth in all the 124 countries and it has even greater impact on economic growth within food insecure African countries.

Second, this study examined the impact of food security on child mortality (infant mortality and under-five mortality), using a dynamic panel data analysis for 114 countries for the period 1995-2009 by considering a wide range of controlled variables such as income, social indicators and policy variables. The result suggests that food security has a negative impact on child mortality for all countries and even more impact on child mortality within food insecure African countries.

Therefore, based on the findings of this study; it is recommended that an increase in food security is indeed a positive policy option, particularly within food insecure African countries, since it not only enhances economic growth but also ensures a decrease in child mortality within these countries.

Keywords: African Dummy, Economic Growth, Food Crisis, Food Availability, Africa.

ÖZ

Bu çalışma özellikle çocuk ölümlerinin yüksek olduğu ve ekonomik büyüme sorununun da yoğun olarak yaşandığı Afrika ülkelerinde, gıda güvenliğinin ekonomik büyüme ve çocuk ölüm oranı üzerindeki etkisini ölçmeyi amaçlamaktadır. Çalışma amacını gerçekleştirmek için hem ampirik hem de istatistiki methotlar kullanılmıştır. Çalışmanın ampirik cephesi iki farklı kısımdan oluşmaktadır. İlk kısımda Solow Büyüme Modeli kullanılarak gıda güvenliğinin ekonomik büyüme üzerindeki etkisi, 124 ülke (gıda güvenliği konusunda sıkıntı yaşayan Afrika ülkeleri de dahil) dikkate alınarak, 1970 ile 2007 yılları arasındaki dönem için araştırılmıştır. Bulgular, çalışmaya dahil edilen 124 ülke için gıda güvenliğinin sağlanmasının ekonomik büyüme üzerinde olumlu bir etkisi olduğunu göstermiştir. Gıda güvenliği konusunda sıkıntı yaşayan Afrika ülkelerinde ise gıda güvenliğinin sağlanmasının ekonomik büyümeye etkisi daha yüksek oranda karşımıza çıkmaktadır. İkinci olarak bu çalışma, gıda güvenliğinin çocuk ölümleri (bebek ölümleri ve beş yaş altı çocuk ölümleri) üzerindeki etkisini dinamik panel veri analizi methodunu kullanarak, 114 ülke kapsamında, 1995 ve 2009 yılları arasındaki dönem için ölçmeyi amaçlamıştır. Bağımlı değişkenler için geniş bir değişken listesi tanımlanmıştır. Bu değişkenlere örnek olarak gelir, sosyal göstergeler ve politika değişkenleri gösterilebilir.

Çalışma sonuçları gıda güvenliğinin çalışma kapsamındaki tüm ülkeler için çocuk ölümlerinde azaltıcı (negatif) bir etkisi olduğunu göstermektedir. Gıda güvenliği, çocuk ölümlerindeki azaltıcı etkisini gıda güvenliği konusunda sıkıntı yaşayan Afrika ülkelerinde daha belirgin olarak göstermektedir.

Böylelikle, çalışma bulgularından yola çıkarak, gıda güvenliğinin artırılmasının, gerek tutarlı bir ekonomik büyüme elde etmede, gerekse çocuk ölümleriyle mücadelede, özellikle de gıda güvenliği konusunda sıkıntı yaşayan Afrika ülkelerinde olumlu bir politika opsiyonu olacağını söylemek mümkündür.

Anahtar kelimeler: Afrika Kukla Değişkeni, Ekonomik Büyüme, Gıda Krizleri, Gıda Güvenliği, Afrika.

DEDICATION

To Phillips and Mark Agboola

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INTRODUCTION

1.1 Introduction

There is a growing unanimity that food security is vital to the overall wellbeing of any economy, but far less consensus on whether food security can spur economic growth and reduce child mortality in a country. Factors impeding and accelerating economic growth have been suggested by many researchers among whom are Kormendi and Meguire, (1985); Durlauf, Johnson, and Temple, (2005); Grier and Tullock, (1989); the Commission on Growth and Development (2008); Levine and Renelt, (1992); Rodrik, 2006 and Barro, (1991). Also, factors that affect child mortality rates have been identified and suggested by authors such as Rodgers (1979); Horbcraft et al, (1985); Bicego (1990); Wang (2002) among many others.

Many economic growth strategies focus on specific interventions (trade openness index, tropical climatic variables, working age population share etc.), but many factors, such as food availability, female education and health outcomes, can potentially have a profound influence on economic growth. This century has witnessed intense debates on factors that influence economic growth in developed and developing economies, especially in Africa where economic growth is not on par with the rest of the world. Aside from economic growth discussion, there is the rate of child mortality, which is also known as under-5 mortality and infant mortality. According to the World Health Organization (WHO), 6.6 million children under five

died in 2012 with half of the child deaths in Sub- Saharan African countries. Therefore, the question remains can food security spur economic growth and child mortality reduction, particularly in African countries?

Attaining economic growth in Africa is often perceived as the most difficult objective globally; therefore ample numbers of empirical studies have argued that African countries differ from the rest of the world. They surmise that Africa nations tend to grow differently and that the growth gap is due to several elements, according to Sachs and Warner (1997), such elements includes climatic conditions, working class of the inhabitants, natural resources. Another notable contribution was from the work of Block (2001) who found that trade openness influences economic growth. Also, according to the works of Easterly and Levine (1998), and Ronelle and Stan (2006), they posit that life expectancy, natural resource wealth, and institutional quality index were not as strongly important in growth determination as primary education enrolment and black market premium.

With all these findings, Food and Agriculture Organization (FAO, 2008) reports that at least one in three people is chronically hungry in Sub- Saharan Africa, with a stunning increase in the number of hungry people in Africa from 175 million to 239 million between 1990-1992 and 2010-2012, Hunger Notes (2013); it appears the long period of fracas with poverty and food insecurity is far from coming to an end. If Africa is to attain her goal of exterminating poverty and food insecurity by 2015, then the continent must determine and pursue a specific policy that can bring about a positive turn around in its economy in a short period. Attaining economic growth in Africa is a challenging hurdle to overcome; solving this problem might just be what the continent needs to lay to rest all the other defiant problems facing it.

The past decade has seen a remarkable surge of interest in food security and economic growth issues (Agboola and Balcilar, 2012). There is now ample evidence that these two issues are intertwined. The Asian success story is a display of the current link of these two areas. The word food shortage or crisis is gradually becoming a label for the African continent. The continent, specifically the Sub Saharan African countries, shows the weakest signs for food security and human welfare indicators. It is imperative to state that a number of African countries recorded tremendous economic growth in the last decade. Five African countries were among the world's ten fastest fast emerging economies between 2001-2010, with Angola (11.1%), Nigeria (8.9%) and Rwanda (7.6%) all featured on the list. Estimating and measuring economic growth is not a new field of research, although the variables for measurement are not static.

Infant mortality is circumscribed as demise in the first year of life, whereas the under-five mortality is circumscribed as death between the first and the fifth years (Charmarbagwala et al, 2004). According to the United Nations report in 2009, the ten countries with the highest infant mortality are all in Africa except Afghanistan. In 2009 about 8.1 million children under the age of five were reported to have died, 7.6 million in 2010, 6.9 million in 2011; about 50 percent of the reported child mortality took place in Sub-Saharan Africa where income is low and access to infrastructure is hardly available or accessible. A more recent world bank-UN report in 2013 states that approximately 6.6 million children died in 2012 which is almost half of the 12 million children that died in 1990; Sub-Saharan African countries have the highest incidence of child mortality; although the continent has shown a tremendous improvement in reducing child mortality, yet the continent recorded a death ratio of 98 deaths in 1000 births in 2012.

The World Health Organization report 2012 on African regions suggests that the reason for death of both infant and children under age five within Africa is due to preventable causes some of which include neonatal conditions and critical respiratory infections and AIDS.

The relationship between food security and child mortality is well established. Studies on child mortality have shown that the child mortality rates among high-income earners are low as compared to low-income earners (Campbell et al 2009). According to the findings of Campbell et al 2009, households with food insecurity score are associated with greater neonatal, infant, and under-five child mortality among rural families in Indonesia. Furthermore, the World Health Organization, 2012 report indicates that under-nutrition has both direct and indirect impact on child mortality within Africa, about 3.5 million child deaths yearly and nothing less than 35 percent of the figure occurs among children under 5 year old.

Therefore this study aims to investigate the effect of food security on economic growth and child mortality, particularly among food insecure African countries. To achieve this goal the study examines:

1. The relationship between economic growth, different measures of human capital and food supply per day (food availability, female education and health outcomes), to see whether these measures can have a profound influence on economic growth. To explore this hypothesis more systematically, this work employs a rich cross-country dataset of 124 countries to examine the impact of

food security, using food availability as a proxy on economic growth.

2. The impact of food security on child mortality within 120 countries for the period 1995-2009. Furthermore, the study explores the possibility of the impact of these variables; whether they are different within the African continent and among African countries with food insecurity.

This work further examines the impact of food shortages on economic growth rates within food insecure African countries. It does so by extending the Barro growth model to include food availability as a right-hand-side variable and by distinguishing African countries with food shortages from others. Using both cross sectional and cross panel analysis the study investigates the impact of food availability for food insecure African countries and if these countries differ from the entire African countries and the rest of the world as well.

This Thesis is structured as follows: Chapter 1 presents the introduction, describing the motivation and purpose of the study. The introduction chapter is followed by chapter 2 which presents history of food crisis and trends of child mortality in Africa. Chapter 3 presents the literature review, chapter 4 presents the methodologies and the data used to examine the relationship between food security and economic growth. Chapter 5 presents the data and methodology used to explore the determinants of child mortality using panel data. Chapter 6 presents the result and discussion of the findings from the growth model as well as the endogeneity model of the growth study, while chapter 7 presents the result and discussion of the findings from the

panel data estimate of the determinants of child mortality. Chapter 8 presents the summary and conclusion; and Chapter 9 presents the policy implications of the findings from this work. Finally, annexes provide summary of Economic growth and child mortality studies reviewed in this work.

Chapter 2

FOOD AND CHILD MORTALITY ISSUES IN AFRICA

2.1 Introduction

Africa is the second-largest and second most-populous continent in the world, after Asia. Africa is about 30.2 million km² including nearby islands, covering 6% of the Earth's total surface area and 20% of the total land area. With a billion people as of 2009 in 54 countries and territories, it accounts for about 15% of the global human population. Africa's population has rapidly increased over the last half century, and is relatively young as a result. In some Countries of Africa half or more of the population is under 25 years of age. The African population increased from 221 million in 1950 to 1 billion in 2009. Africa straddles the equator and spans numerous climates; it is also the only continent to stretch from the northern temperate to southern temperate zones. Africa as a continent has been plagued with famine or food shortage over the years. After mid 80's most countries seems to claim victory over this problem; only that it was too early to claim victory, since the problem re-surfaced in several countries within the continent in 1990's till now. Food shortage within most countries is not only caused by unfavorable weather condition; but some are as a result of war and political unrest. A country like Zimbabwe is a typical example of food shortage that is instigated by bad leadership and political unrest; the Niger food crisis in 2005 has been argued to be a normal seasonal cycle, although it is still unclear; whether the problem was due to bad policy or otherwise.

Biswas and Biswas, 1979 predicted that the future food scenario is not optimistic because the demand for food in developing countries is expected to increase at about 3.6% per year during 1972 to 1985.This increase in demand has posed an increasing challenge to combat in most developing countries particularly in Africa. Population growth has been one of the major causes of food shortage; according to Esterlina 1982, “after the world war II, the problem of hunger and malnutrition has been aggravated by unprecedented rates of population growth”. Over 1.02 billion of people do not have enough to eat FAO (2009); 907 million people are hungry in developing countries alone while about 80 million people die of lack of food and insufficient nutrient every year-24,000 every day FAO (2008).This problem is severe; food shortage has been described by several authors among who are: Wimberly (1991), Rau (1991) and George (1984) as the greatest and most brutal of all problems in the history of human race.

According to the Oxfam report on the average developing world figure for under-nourishment is 17 percent, in sub-Saharan Africa the figure is 33 percent. For Central Africa it is 55 percent. On average, the number of African food emergencies per year, since the mid-1980s has tripled.

In the mid-22nd century BC, a sudden and short-lived climatic change that caused reduced rainfall resulted in several decades of drought in Upper Egypt. The resulting food crisis and civil strife is believed to have been a major cause of the collapse of the Old Kingdom. An account from the First Intermediate Period states, "All of Upper Egypt was dying of hunger and people were eating their children." In the 1680s, a food crisis extended across the entire Sahel, and in 1738 half of the

population of Timbuktu died of food crisis. Milich (1997). Egypt suffered six food crisiss between 1687 and 1731. Quataert (2005). The food crisis that afflicted Egypt in 1784 cost it roughly one-sixth of its population, Science Daily (2006). Libya and Tunisia were hard-hit by food crisis in 1784 and 1785 respectively (Faroqhi et al (1997).

Historians of African food shortage have documented repeated food crisis in Ethiopia. Possibly the worst episode occurred in 1888 and succeeding years, as the epizootic rinderpest, introduced into Eritrea by infected cattle, spread southwards reaching ultimately as far as South Africa. In Ethiopia it was estimated that as much as 90 percent of the national herd died, rendering rich farmers and herders destitute overnight. This coincided with drought associated with an el Nino oscillation, human epidemics of smallpox, and in several countries, intense war. The Ethiopian Great food crisis that afflicted Ethiopia from 1888 to 1892 cost it roughly one-third of its population. In Sudan the year 1888 is remembered as the worst food crisis in history, on account of these factors and also the sanction imposed by the Mahdist state. Colonial "pacification" efforts often caused severe food crisis, as for example with the repression of the Maji Maji revolt in Tanganyika in 1906. The introduction of cash crops such as cotton, and forcible measures to impel farmers to grow these crops, also impoverished the peasantry in many areas, such as northern Nigeria, contributing to greater vulnerability to food crisis when severe drought struck in 1913.

However, for the middle part of the 20th century, agriculturalists, economists and geographers did not consider Africa to be food crisis prone (they were much more

concerned about Asia). There were notable counter-examples, such as the food crisis in Rwanda during World War II and the Malawi food crisis of 1949, but most food crises were localized and food shortages were brief. The specter of food crisis recurred only in the early 1970s, when Ethiopia and the west African Sahel suffered drought and food crisis. The Ethiopian food crisis of that time was closely linked to the crisis of feudalism in that country, and in due course helped to bring about the downfall of the Emperor Haile Selassie. The Sahelian food crisis was associated with the slowly growing crisis of pastoralism in Africa, which has seen livestock herding decline as a viable way of life over the last two generations.

Since then, African food problems have become more frequent, more widespread and more severe. Many African countries are not self-sufficient in food production, relying on income from cash crops to import food. Agriculture in Africa is susceptible to climatic fluctuations, especially droughts which can reduce the amount of food produced locally. Other agricultural problems include soil infertility, land degradation and erosion, swarms of desert locusts, which can destroy whole crops, and livestock diseases. The Sahara reportedly spreads at a rate of up to 30 miles a year Mclaughlin and Purefoy (2005). The most serious food crisiss have been caused by a combination of drought, misguided economic policies, and conflict. The 1983–85 food crisis in Ethiopia, for example, was the outcome of all these three factors, made worse by the Communist government's censorship of the emerging crisis. In Sudan at the same date, drought and economic crisis combined with denials of any food shortage by the then-government of President Gaafar Nimeiry, to create a crisis that killed perhaps 250,000 people—and helped bring about a popular uprising that overthrew Nimeiry.

Numerous factors make the food security situation in Africa tenuous, including political instability, armed conflict and civil war, corruption and mismanagement in handling food supplies, and trade policies that harm African agriculture. An example of food crisis created by human rights abuses is the 1998 food crisis in Sudan. AIDS is also having long-term economic effects on agriculture by reducing the available workforce, and creating new vulnerabilities to food crisis by overburdening poor households. On the other hand, in the modern history of Africa on quite a few occasions food crisis acted as a major source of acute political instability.(Korotayev and Khaltourina,2006). According to UNU's Ghana-based Institute for Natural Resources in Africa, if current trends of population growth and soil degradation continue, the continent might be able to feed just 25% of its population by 2025.

Millions in Niger and across West Africa face food shortages after erratic rains hit farming in countries in the Sahel region south of the Sahara desert, according to European Commission's aid group the erratic rains in the 2009/2010 agricultural season have resulted in an enormous deficit in food production within these countries, nations such as Niger, Chad, northern Burkina Faso and northern Nigeria were considered to be in enormous danger and actions needs to be taking so that the shortage will not lead to devastating food crisis.

2.2 Review of Food Crisis in Africa

Several scholars ranging from sociologists, archeologists, economists just to mention a few have tried to address the problem of food crisis from different perspectives. Each has a different opinion as regards this problem and various approaches have been used in the past to capture this phenomenon. It should be noted that, food shortage is a problem of countries that depend on agriculture as its main stay of

economic survival, most countries within Africa that has to depend on local or domestic food productions to cater for domestic needs. Africa in general has been affected by a prolonged development crisis, characterized by a decline in the per capita come of its population for more than two decades.

Very often food insecurity in Africa is affiliated with increase population that is not met with increase food production; agricultural production has reduced by 1.3 percent per year while population growth kept increasing at 3 percent per year. World Bank (1991). Similarly, Jallow (1992), has attributed food shortage in sub-Sahara Africa to not only population growth but also inclement weather condition, political instability among many others. On the other hand, Jericha (2009) reveals that land reform program and it's after effects, other government policies, international sanctions and intractable political posturing have all played an important role in the prolonged post 2000 food crisis in Zimbabwe. Many famines are as a result of inadequate transportation and government policy and mismanagement of food distribution. Omrah (1997).

Most sociologists argue that there are internal and external causes of food shortage or food crisis as the case may be in developing countries. The internal factors include traditions; beliefs and socioeconomic institutions have created food shortages in developing countries Weiner (1966). These groups believe that poverty, high levels of population growth, low productivity, low income, weak economies and lack of technologies are responsible for food shortages within developing countries. Shallal (1994).

The external factors have been associated with developed countries, starting from colonial era; developed countries have been exploiting developing countries Jaffee (1990). Some authors believed that developing countries have not always been poor but were made poor by the developing countries Gunder (1969).The penetration of financial institutions into the developing countries have devastating impact on their economy and this is an example of this exploitation Dos Santos (1984).

In contrast to causes of food shortage aforementioned above, countries like Ethiopia, Eritrea, Sudan, and Congo just to mention a few in Africa have been plagued with food crisis due to war. But whatever the cause of food crisis, it should be noted that the impact is devastating and at time could lead to death of thousands or even millions of lives. Often times, food shortage in itself does not lead to death but it comes along with poverty, diseases such as cholera, tuberculosis and other deadly diseases which eventually lead to death of innocent lives. Children and nursing mothers are the most affected, because they require more nutrients than others.

2.3 Famine Theories

It is important to discuss famine theories while taking a look at food crisis. Various famine theories have emerged over the years and each viewed the causes of famine or food shortage either from the supply side or from the demand side. They include:

- Malthusian theory: This theory was propounded by Malthus in 1798. According to this author famine or food crisis is as a result of population growth rate exceeding food production growth rate, leading to over grazing, soil erosion and deforestation.
- Food availability decline theory: This theory explains food crisis in terms of sudden disruptions of food supplies Devereux (2002).For instance, the case of

Niger 2005 food crisis, this approach argues that the famine in Niger was due to drought and locust infestation. Cornia and Deotti (2005)

- Entitlement Theory: The food availability theory has dominated the theory of food crisis until 1981 when Sen came up with entitlement theory of famine. The author argued that food crisis might still occur in spite of food availability. Sen showed that several major food crisis that have occurred in Africa and some part of Asia are not as a result of decrease in supply of food. Instead food crisis is due to failure of four major entitlements to food which are: failure of production-based entitlement; trade based entitlement labor based entitlement; and transfer-based entitlements.
- Food intervention decline theory: This theory as the name sounds, argues that food crisis is due to late response of donors, the theory posits that people experience starvation due to wrong food policies and services that fail to ensure food security Webb (2002).The Zambia 2002 food crisis is an example of this, the donor agencies refuse to look for non GE (Genetically modified) food which the government requested for, and they insisted that they can only supply the GE food aid. This inadequate response led to catastrophic food crisis in Zambia.
- Market intervention theory: Food crisis is due to a failed market structure, most food shortages are due to hoarding of food stuff by middlemen in order to make more gains. Often times if the market is not regulated by the government, it encourages oligopolistic market system, hence leading to outrageous profit seeking at the expense of others Sarracino (2010)

Diverse methodologies have been used to capture food shortage; some authors believe that in order to conceptualize food shortage, food calorie is the best proxy. Jean-Marc et al, 2005 found that one third of African countries average daily calorie intake availability is below the recommended level of 2100 kcal, countries like Ethiopia, Kenya, Rwanda, and Tanzania in East Africa; and Angola, Madagascar, Mozambique, and Zambia in Southern Africa; Sierra Leone in West Africa. In a few countries such as DR Congo, Burundi, Eritrea, and Somalia, the mean availability is below 1800 kcal which is considered the minimum intake level. In some countries (Botswana, Burundi, Congo DC, Gambia, Liberia, Madagascar, Senegal, Sierra Leone, Somalia, Tanzania, and Zambia), the situation has been deteriorating over the last 10 years while in others (Ghana, Nigeria, and Malawi) aggregate figures exhibit an improving trend –. Less than 50% of sub-Saharan African countries show figures under 30% for the prevalence of malnutrition and only three of them under the 10% level (Gabon, Nigeria, and Namibia). Some countries, despite economic growth and sufficient aggregate availability, display increasing malnutrition, as measured by the prevalence of stunted growth in children. Such is the case in Mali. Also, Abebaw et al, 2010, found out that integrated food security program (IFSP) has 30 % impact of food calorie intake in the northwestern part of Ethiopia. Their result also shows that IFSP has differential impact depending on family size, land ownership, and gender of head of household.

On the other hand, food production and food prices have been used as a proxy to show if a country has food crisis. Jallow (1992) looked at the relationship between food production and food aid in sub-Sahara Africa. The author argued that, most countries in Africa are not self-sufficient in terms of food because they rely on food

aid from the developed nations. Most government even include food aid into their budget, hence are not willing to take bold steps towards food sufficiency. Cudjoe et al. (2010) argued that the impact of surging food prices differs from one country to another and it depends on the macroeconomic conditions, the country's net international trade position and the food production and consumption patterns of different households at sub national level. They concluded that for Ghana the global increase in food prices 2007-2008 has a high negative impact particularly on the poorest of the poor in the urban and the northern part of the country was hit the most. They ascribe the variations in the price effect to different consumption patterns and per capita income level which is lowest in the northern region of the country.

Babatunde and Qami (2010) found out that off-farm income has a positive net effect on food security and nutrition in Nigeria. They argued that prevalence of child stunting, underweight, and wasting is lower in households with off-farm income than in households without it. Using a structural model, they concluded that off-farm income contributes to higher food production and farm income by easing capital constraints, thus improving household welfare in multiple ways. Similarly, Seck et al, (2010) argued that about one third of the all rice traded in the world market is consumed in Africa, this makes Africa highly exposed to international market shocks. The world food crisis of 2008 serves as an important lesson for Africa, Africa can turn the rising trends in world markets to a historical opportunity to realize its large potential for rice production; this can be done by lowland and irrigated farming. This will help to reduce the yield gap and leads to expansion of paddy production within the continent.

2.4 History of Food Crisis in Selected African Countries

Each of the countries discussed below have either experienced food crisis in the past or presently been plagued by food crisis. Some of these countries' food crisis has been self-inflicted; countries like Ethiopia, Eritrea, Zimbabwe, Djibouti and Niger are case in point while for others food crisis is due to natural occurrence such as drought and famine.

Angola

This is one of the countries in which the cause of food crisis is majorly due to war. According to the WFP (World Food Programme) report "Eight years after the end of the 27-years civil war, gradual progress towards a peaceful environment has been made in Angola, including the return of millions of refugees and internally displaced people. However, the reconstruction and rehabilitation of the country's extensively-destroyed physical, social and economic infrastructure remains a national challenge". Despite the efforts being made, it will take many years before recovery activities can come to an end. Angola ranks 143 out of 182 countries in the 2009 Human Development Index with 70 percent of its population living on less than US$2 per day. Many communities have little or no access to basic social services, while more than a third of children are not enrolled in school.

The country also has one of the highest infant mortality rates in the world at 116 per 1,000 live births. Though the HIV prevalence rate is considerably lower than elsewhere in the region, it is estimated to be about 2.1 percent and growing. Despite ongoing road and railway rehabilitation, logistical constraints persist, such as

damaged roads and bridges, limited functioning of railways and the presence of landmines.

These infrastructural challenges continue to obstruct the free movement of goods and people and impede socio-economic recovery. Agricultural production is gradually improving in parallel with road infrastructure rehabilitation. However, it is still going to be a long-term process for Angola to achieve its pre-independence levels of production. Meanwhile, many people remain extremely vulnerable and trapped in a cycle of poverty and malnutrition.

Niger

The most severe food crisis in Niger occurred in 2005, several authors find it difficult to identify the cause of this crisis. Cornie and Deotti (2008) posits that the food crisis was viewed as part of a normal seasonal cycle and at the same time could be viewed to be due to nutritional crisis that in some areas reached near-famine conditions. On the other hand, Aker (2008) listed four factors that lead to the food crisis in Niger and they are:

- Key production areas in Niger and Nigeria were affected by drought in 2004
- Prices were higher in northern Nigeria, making it unprofitable to import.
- Grain prices reached record levels during the hungry season

  The author associated the food crisis in Niger with higher prices of staple foods which made it difficult for poor people to have access to food. Furthermore, the author suggests that drought is a common thing in Niger; therefore it is not the cause of food crisis within this country.

Whatever the cause may be, 2005 was a year filled with difficulties for most people in Niger. Presently Niger is still weighed down by food shortage due to lack of rain, most children and mothers do not have enough food to eat. Hopefully this present food shortage will not lead to as much disaster as was recorded in 2005.

Zambia

From History, Zambia is a country that is highly dependent on its mining industry as a major source of revenue, yet there has been increased investment in agriculture. Between 1970's and 80's, agricultural production was increasing steadily; the only problem then was post-harvest losses due to inadequate storage facilities.

After the introduction of SAP (Structural Adjustment Program) in the 90's; things changed within the agricultural sector, because the program stopped the involvement of government in agricultural production. The government was no longer involved in the procurement of inputs and subsidies for farmers became a thing of the past. This decision is believed to have had adverse effect instead of leading to growth of the country.

According to Henriot (2008), Mwananyanda (2003) among many others, Zambia's 2001-2002 food crisis was due to unfavorable weather conditions, heavy rains leading to flood-this affected crop production. Furthermore, during this period there was increase in fuel prices making it difficult to transport major agricultural products within Zambia. And global costs of wheat – largely impacted by the switch from growing grains to feed people to growing bio-fuels to run automobiles – push bread prices here to higher and higher figures. In order to mitigate the crisis, the world food program (WTP) of the United Nations decided to give the country genetically

engineered corn, but they did not inform the government that the corn was GE until it has entered the country. Several debates went on for days, the government has to decide either to take the aid and save the lives of dying Zambians or not to take it and allow many to die.

In response, the government decides not to take the aid, instead told WTP to look for non GE food which was believed to be available in some countries. WTP refuse to do so, instead the organization tried to persuade the government to accept its generosity. In the process of this argument, several Zambians died of starvation and others of food related diseases; some parents had to feed their children roots of plants just to survive.

Zimbabwe

Zimbabwe is one of the countries in which its food crisis is due to bad weather condition and bad economic policy. The country experienced four major droughts (in 1982–1984, 1986–1987, 1991–1992 and 1994–1995). During these periods, the country was able to seek help from international aid agencies in order to reduce the impact of this dry weather. According to Kinsey et al. (1998) " In three of the four droughts, state and nongovernmental organization (NGO) drought-relief schemes provided substantial support to help maintain consumption levels". In 2005, Zimbabwe was hit again by food crisis; this time around the country could not turn to international aid agencies because the president has banned these organizations from his country. Just like other droughts, there was food shortage but this time around the problem was not only food shortage but increasing level of inflation.

The United Nations Children's Fund (UNICEF) estimates that half of the remaining population of 11 million people - another 3.5 million have fled the country or emigrated - face starvation unless Mugabe permits massive aid by the same international food agencies he banned before the parliamentary election.

A U.N. food survey of Zimbabwe concluded that poor weather, skyrocketing inflation and a shortage of seeds and fertilizers are conspiring to fuel one of the worst food crises in the country in more than 15 years.

Djibouti

Djibouti is one of the hottest region in the world, Most region within the country are deserts, therefore agricultural production can only support 25 percent of local demand. The country depends majorly on imports of the main staple foods. Food crisis within this country is as a result of drought in most countries in the horn of Africa ICPAC (2008). This drought led to reduction in food production in neighboring countries such as Ethiopia and Somalia leading to high food prices. High food prices are severely restricting food access, particularly among the poorer urban and rural households within the country.

Pastoralists are severely affected with this food crisis; the failure of rain for two consecutive planting seasons has reduced the availability of pasture for their animals and food for them in the face of increase food crisis.

According to Red Cross report, 2008, there is persistent levels of malnutrition (an average of 16.8 global acute malnutrition and 2.4 severe acute malnutrition) are symptomatic of other factors that affect food utilization such as childcare, weaning practices and hygiene. About 55,000 rural people and 25,000 urban people rely on

emergency food aid, and food deficits are as high as 30 to 40 percent among the worst affected groups.

Somalia

The rainfall forecast March – May 2008 released by IGAD Climate Prediction and Applications Centre (ICPAC), revealed that most countries within the Horn of Africa have higher probability of below normal rainfall. Somalia[1] is one of the countries that will be affected. Prior to this weather forecast, in 1991 Somalia has been referred to as a failed state; this is due to the war that has plagued the country for several decades. The country is also faced with the problem of inflation. For several years, there has been consistent war and unrest in the region, coupled with the fact that the country is drought prone. In Somalia, food security in most of central and southern regions is precarious as a result of a combination of factors including two successive poor rains, civil insecurity, high-inflation, and trade and market disruptions. The number of internally displaced persons (IDPs) has increased to more than one million, with 700,000 displaced by the fighting and insecurity in Mogadishu that escalated since early 2007. More than 30 percent of the IDPs are in central regions, which are already experiencing multiple problems of food access, drought, collapsing livelihoods and malnutrition. As a result, the number of people in need across the country has increased from about 1.5 million in mid-2007 to 2 million through to July 2008. This figure does not include the urban poor who are equally hard-hit by hyperinflation, high food prices, conflicts, and disruption in trade and

[1] Somalia and Nigeria was not included in the empirical aspect of this study due to inadequate data availability but it is worth mentioning the state of food insecurity and child mortality of these countries within the study as it is one of the major countries with year to year food insecurity and child mortality.

economic activities. Food crisis in the country has deepened due to food crisis in neighboring Ethiopia and this has mount more pressure than usual on refugee camps within the country.

Malawi

The early 2002 food crisis in Malawi has been attributed to a combination of two things. According to Devereux 2002, technical and political issues are the culprit of the humanitarian crisis. The crisis led to the death of several thousands, these deaths made this famine the worst famine in the history of this country, certainly worse than the drought of 1991/92, and worse than 1949 Nyasaland famine.

The Malawi food crisis has drawn important attention to failure of development policies. Market liberalization led to low returns to farmers' and service providers' investments, with high risks from natural shocks, price variations, coordination failure and opportunistic behavior (Dorward and kydd, 2004).

Eritrea and Ethiopia

It is important that the history of food crisis in both countries be written together. This is because; the cause of food crisis within these countries was as result of the conflict between them. According to history, the two years (1998–2000) of war between the two countries was due to dispute over border ownership. The dispute led to the death of about 80,000 and it displaced up to one million people. According to White (2005) "The war was not only a humanitarian disaster in itself, but it also had adverse food security consequences beyond the immediate conflict zone". During the period of the war, UN warned that up to 16 million people in the horn of Africa will

face starvation due to drought, half of these people are Ethiopians and rest are from neighboring countries such as Somalia, Kenya and Uganda.

Both countries are food deficit, famine-prone nations, with among the highest rates of chronic under-nourishment found anywhere: 44% and 58% of the population in Ethiopia and Eritrea, respectively (FAO, 2002). Per capita cereal production has been falling since 1973–74, despite some recovery during the 1990s, with an annual national cereal deficit averaging 700,000 tons (nine percent of total production) over the past 15 years. In Ethiopia, humanitarian assistance is required each year for at least five million people or around eight percent of the population (FDRE, 2001). Ethiopia has seen at least ten major drought–famine episodes in the past four decades, the famines of 1973–74 and 1984–85 being among the worst in Africa's history

The impact of these two year war on both countries is devastating, the war led to about 315,000 displaced people. This number excludes 40,000 Ethiopians who had returned from Eritrea, an estimated 24,000 people had already been displaced in the Afar Region, bringing the total to close to 380,000 (UNEUE, 1999a). On the Eritrean side, a September 1998 UN Appeal set out emergency needs for 275,000 people affected by the conflict, including 100,000 displaced from the border zone and 17,000 'Eritreans' expelled from Ethiopia. In Ethiopia, the war also led to the closure of border and its boycott of the Eritrean ports of Assab and Massawa meant that, all of its maritime trade had to be channeled through neighboring Djibouti. At this time Djibouti did not have the needed infrastructures to facilitate this trade- importantly the country does not have good road. Ethiopia had to support Djibouti with 3 million dollars so as to enhance the trade. During the period of the war, although both

countries were expected to experience good harvest, yet report shows that due to the war, several thousand Ethiopians and Eritreans suffered from starvation.

2.5 History of Child Mortality in Africa

Child mortality in Africa is an ongoing battle, despite huge effort that has been made by governments within the continent in conjunction with diverse aid group the problem of child mortality still persist in Africa. Sub-Sahara Africa's underage-five mortality is 75 percent higher than the rest of the world countries, 36 of the 42 countries with the highest child mortality are within this region SARA (2005);, furthermore, only 22 percent of the world's children are born within this region yet it accounts for 49 percent of the world's underage-five deaths (Watch World Institutes, 2013). Although, when compared to the early 1960's child mortality (both infants and under age-five mortality) has reduced greatly as represented in the Figure 1and 2 below. Yet when compared to the child mortality level of the rest of the world, the level of child mortality in Africa is precarious. The main cause of high mortality in Africa is infectious and parasitic diseases and until recently HIV/AIDS diseases as well, countries such as Zambia, Kenya, and Cameroon have high child mortality mostly due to HIV/AIDS infection Garrene and Gakusi (2006). Malaria is one of the major parasitic diseases within Africa, every year bites from mosquito results in 300 million to 500 million clinical cases and causes more than 1 million deaths, particularly in children under the age of five; the dying rate of underage-five children that results from malaria is about 3,000 per day causing approximately 20% of all child death in Sub-Sahara Africa UNICEF (2004).

Aside from disease and infection another major cause of child mortality in Africa is war and political unrest in many of these African countries, example of such

countries includes Sudan and Somalia. According to the UNICEF report on Somalia, even before the war Somalia has the highest child mortality in Sub-Sahara Africa; for every 1,000 Somali children, 180 of them die before they reach the age of 5 years.

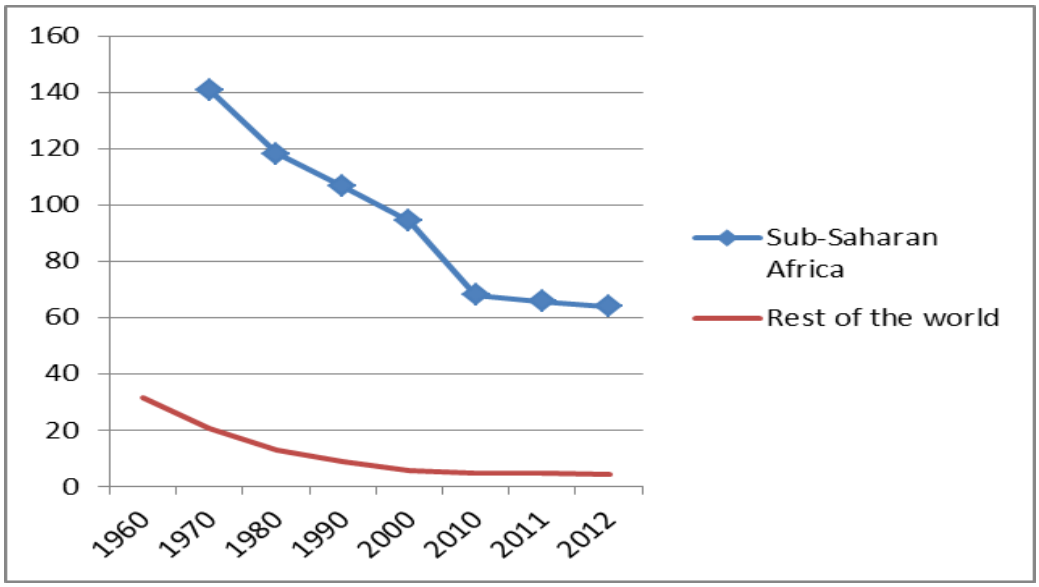

Figure 1. Comparison of infant mortality trend between Sub-Sahara Africa and rest of the world (per1,000 births)
Source: World Development indicator database

Figure 1, compared the Sub-Sahara African and rest of the world infant mortality trends from 1960-2011. The figure depicts that infant mortality in Sub-Sahara Africa is actually reducing but when compared to the rest of the world the infant mortality is still high. The 2012 Average infant mortality rate in Sub-Sahara Africa is as high as 63.5 per 1,000 as compared to the rest of the world average infant mortality rate of 4.4 per 1,000 (UNICEF, 2013)

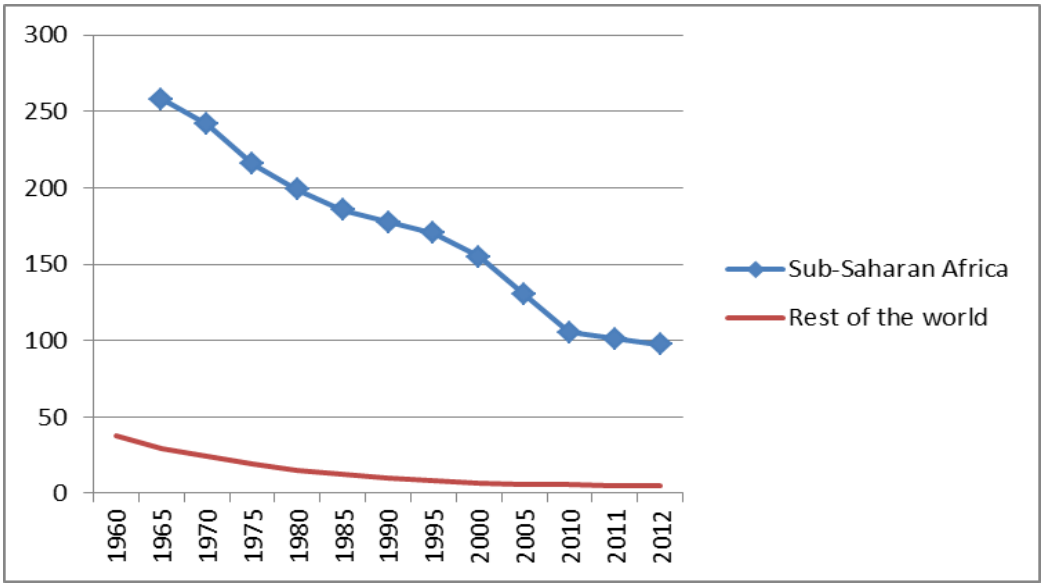

Figure 2. Comparison of underage-five mortality trend between Sub-Sahara Africa and rest of the world (per 1,000 births)
Source: World Development indicator database

Figure 2 shows the comparison of trend in the underage-five mortality between Sub-Sahara Africa and the rest of the world. The figure depicts that underage-five mortality in both Sub-Sahara Africa and rest of the world countries has been decreasing since 1960, despite this decrease the mortality rate in Africa is still much higher than the rest of the world in fact the average mortality rate in Sub-Sahara Africa is 3245 per 1,000 in 2012 while that of rest of the world is only 60 per 1,000 UNICEF (2013).

Therefore, in general the global child mortality rates (infant and child mortality rates) has decreased drastically, yet Africa as continent has a lot to do to meet up with the child mortality level in the rest of the world countries.

2.6 Child Mortality Trend within Selected African Countries

This study further explores the child mortality conditions within ten African countries with the highest child mortality rates. Child mortality within these African countries is majorly due to diseases and respiratory infections such as Pneumonia,

malaria, measles, diarrhea and neonatal disorder. Also, this high mortality is as result of AIDS/HIV infection transmitted from mother to the children WHO (2014) while for some countries the child mortality level grew worse due to war and political unrest that has displaced many people and left many hungry and food insecure, Somalia is a case in point.

Angola

Figures 3 and 4 shows the trend in infant mortality and underage-five mortality in Angola, the figures shows a reduction the trend of child mortality for Angola, yet the 2012 infant mortality rate for Angola still stands at 99.5 per 1,000 while the underage-five mortality is 163.5 per 1,000.

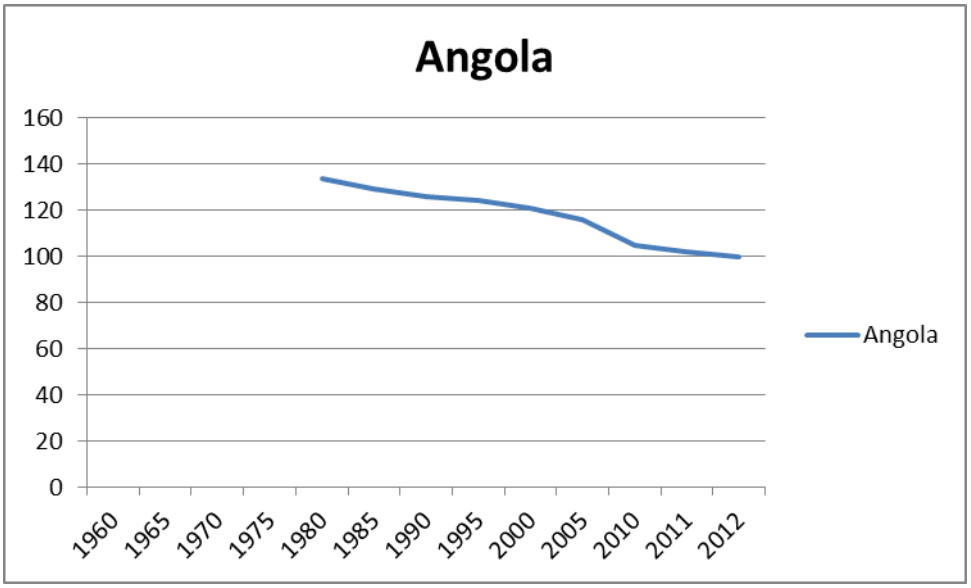

Figure 3. infant mortality trends in Angola (per 1,000 births)
Source: World Development indicator database

Angola has the highest child and maternal mortality rates in the world with a probability of at least one child in five not surviving to age five, the major causes of child mortality in Angola are malaria, diarrhoea, respiratory infections and malnutrition UNICEF (2003).

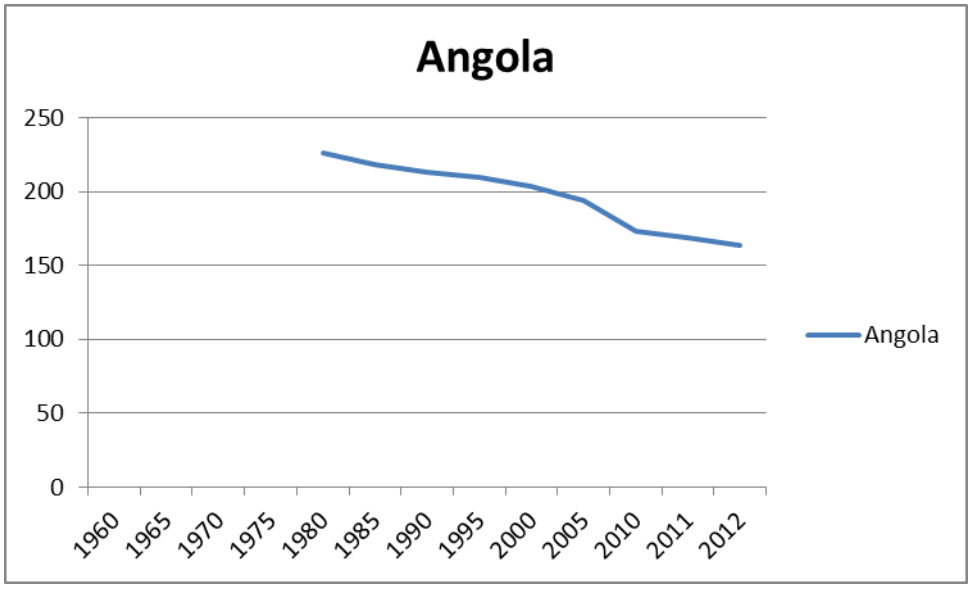

Figure 4. Underage-five mortality trend for Angola (per 1,000 births)
Source: World Development indicator database

Benin

Figures 5 and 6 shows the trend in infant mortality and underage-five mortality for Benin republic, the graph shows the infant mortality has decreased drastically within this country from 191.9 per 1,000 in 1960 to 58.5 per 1,000 in 2012 implying that the infant mortality has reduced by more than half within these periods.

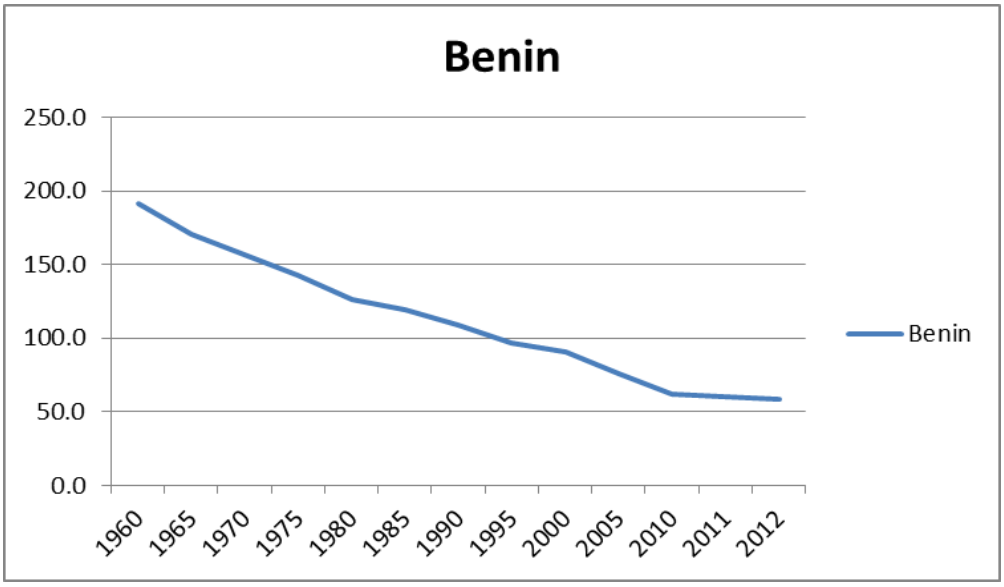

Figure 5. Infant mortality trends for Benin (per 1,000 births)
Source: World Development indicator database

Similarly, the underage-five mortality has also reduced from 321.9 per 1,000 in 1960 to 89.5 per 1,000 in 2012; this shows a success story as regards child mortality rate in Benin republic. Despite this success the child mortality rate within this country is still high when compared with rest of the world country; the cause of high child mortality rate within this country has been identified as widespread poverty which increases malnutrition, malaria and other infectious diseases UNICEF (2003).

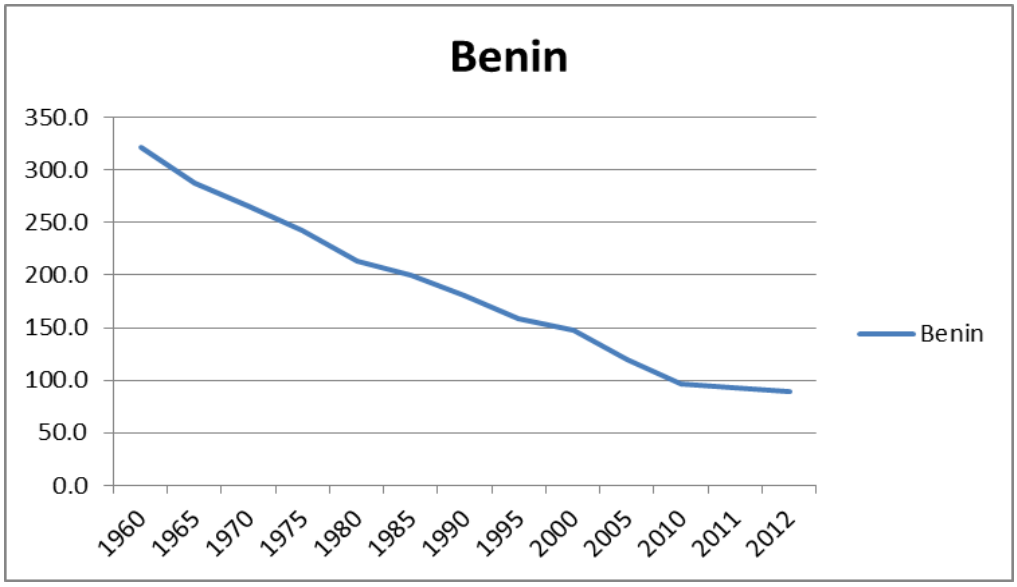

Figure 6. Underage-five mortality trend for Benin (per 1,000 births)
Source: World Development indicator database

Central African Republic

Figures 7 and 8 shows the infant and underage-five mortality rates in Central African Republic; the figures revealed that the country has not made much progress in reducing the level of child mortality. The infant mortality has only decreased from

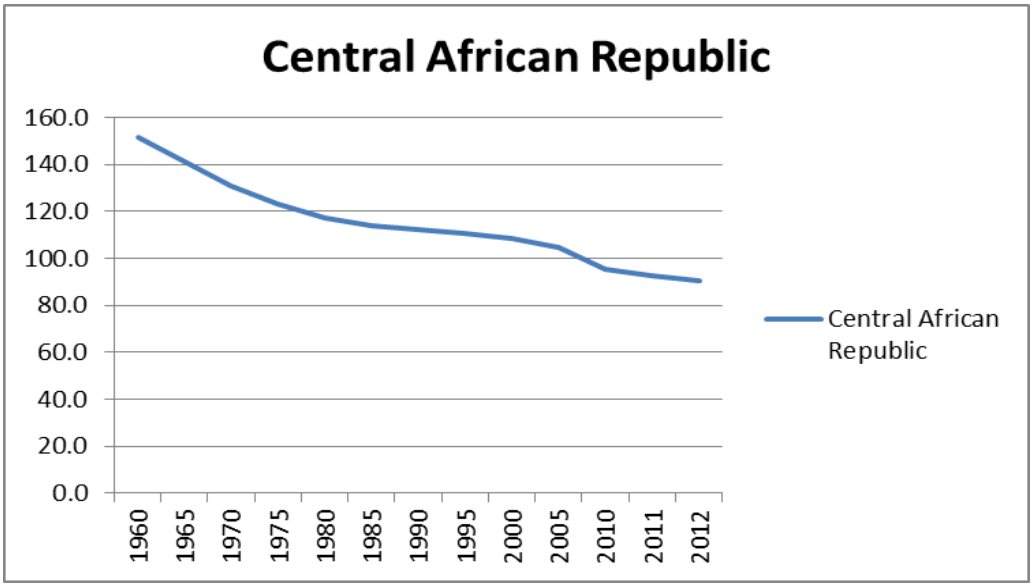

Figure 7. Infant mortality trends for Central African Republic (per 1,000 births)
Source: World Development indicator database

151.6 per 1,000 to 90.7 per 1,000 in 2012; UNCHO (2012) attributes this high child mortality to preventable and treatable diseases such as HIV/AIDS, malaria, and sleeping sickness, furthermore the continuous conflicts in the region makes access to medical care difficult within this country.

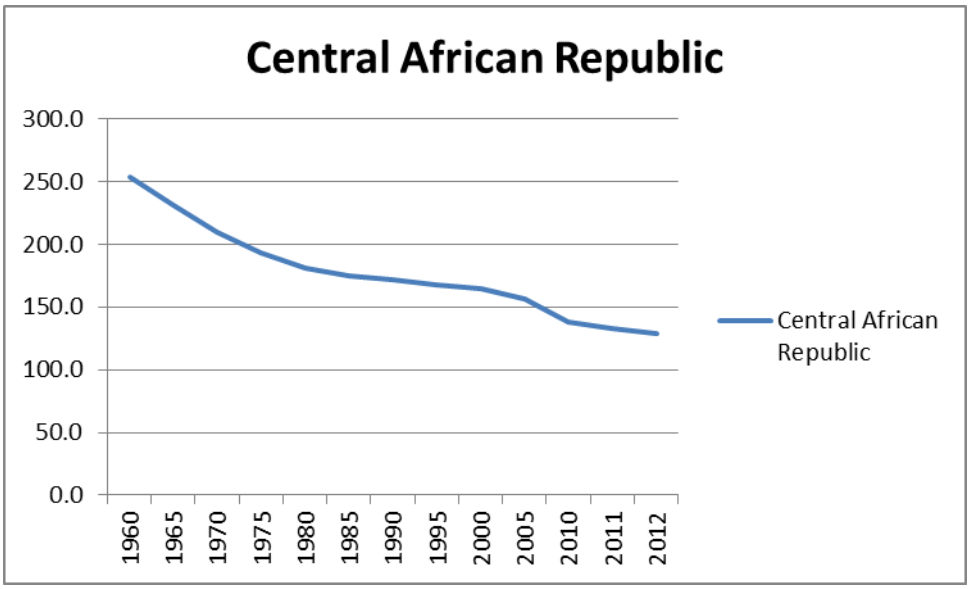

Figure 8. Underage-five mortality trend for Central African Republic (per 1,000 births)
Source: World Development indicator database

Chad Republic

Figures 9 and 10 shows the infant mortality and underage-five mortality rates in Chad republic, the figures show that both infant and child mortality rates has not reduced significantly within the country, infant mortality has only reduced from 135.9 per 1,000 in 1970 to 89.4 per 1,000 in 2012 while underage-five mortality rate has decreased from 261.9 per 1,000 in 1970 to 149.8 per 1,000 in 2012. UNICEF (2003) report has identified vaccine-preventable diseases, acute respiratory infections, malaria and diarrhoeal diseases are major killers of children within this country.

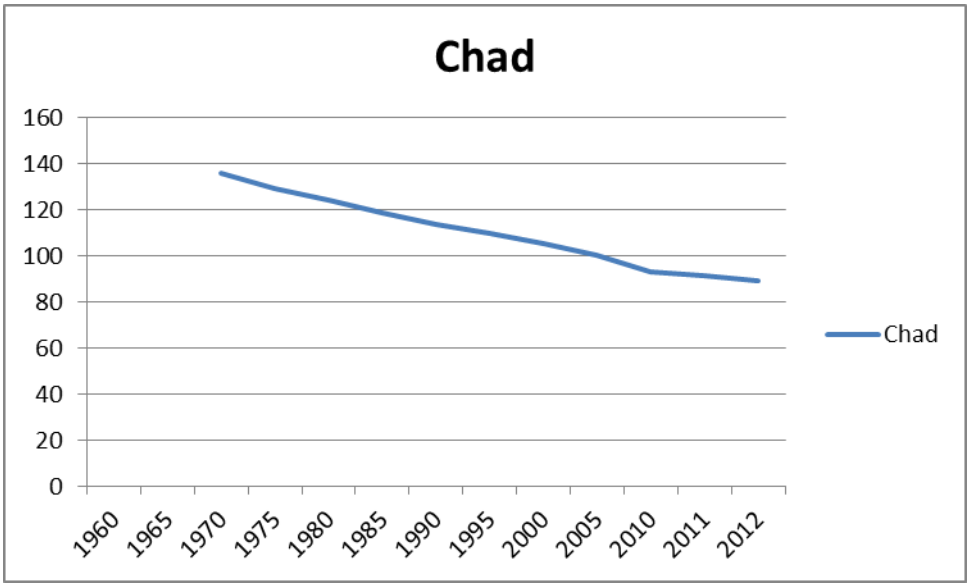

Figure 9. Infant mortality trends for Chad Republic
(per 1,000 births)
Source: World Development indicator database

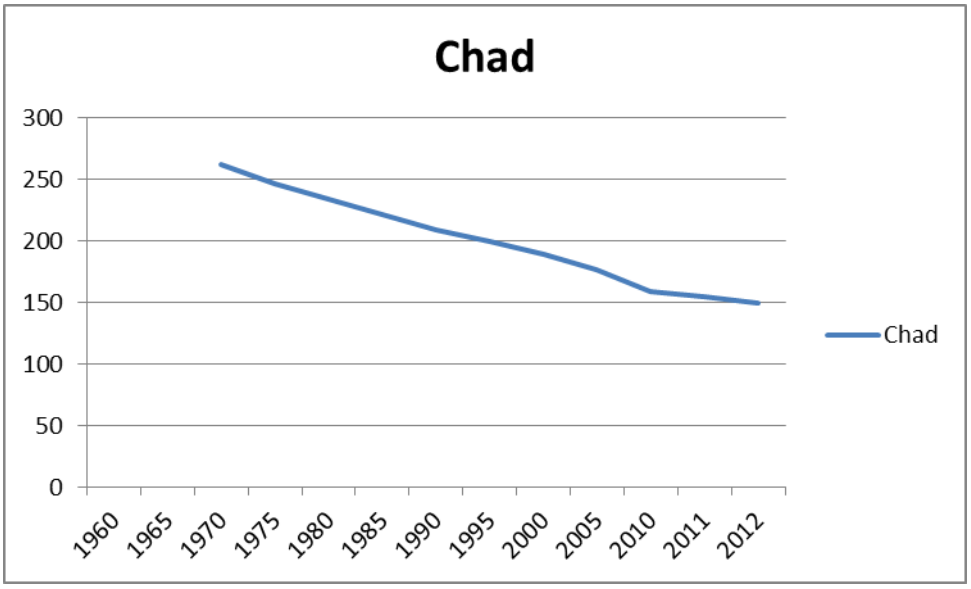

Figure 10. Underage-five mortality trend for Chad Republic
(per 1,000 births
Source: World Development indicator database

Côte d'Ivoire

Figures 11 and 12 depicts the infant mortality and underage-five mortality rates trend for Côte d'Ivoire, the figures reflects a high improvement in the reduction of child mortality within this country.

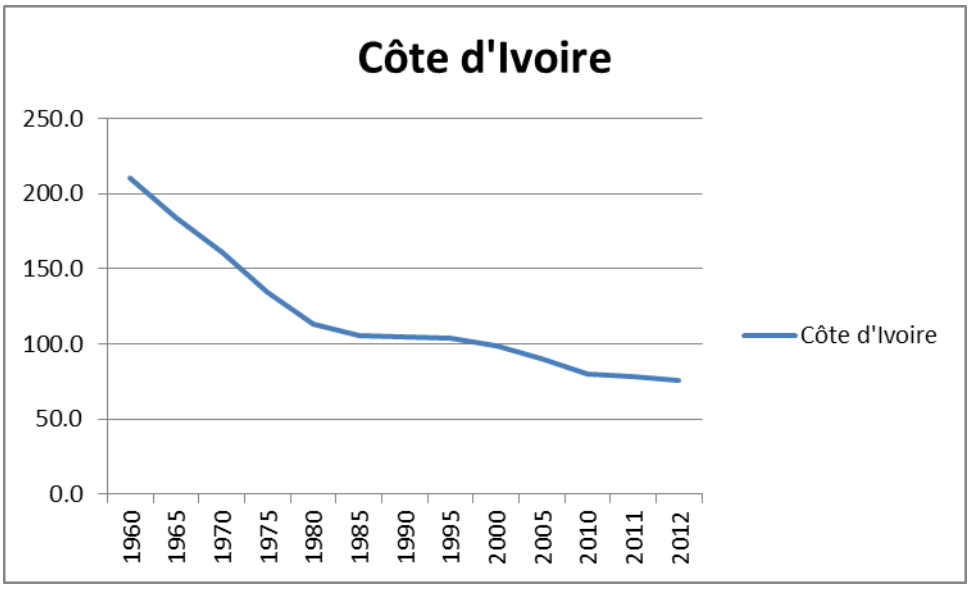

Figure 11. Infant mortality trends for Côte d'Ivoire
(per 1,000 births)
Source: World Development indicator database

Infant mortality has decreased by more than half between 1960 and 2012; similarly underage-five mortality rates have decreased by more than half as well. The Côte d'Ivoire child mortality rate is an indication of success story in policy implementation towards achieving one of the important millennium development goals. As impressive as this trend may seems, a lot still needs to be done within this country to ensure a reduction in child mortality, as the mortality rates are still far much higher than what is obtainable within the rest of the world countries. Malaria, respiratory infections, diarrhea, malnutrition and measles have been identified as the main causes for child mortality among children under five; severe malnutrition is estimated at 6.7% among children under five and approximately 3.5 million children under five are continuously exposed to malaria and other forms of diseases such pneumonia UNICEF (2007).

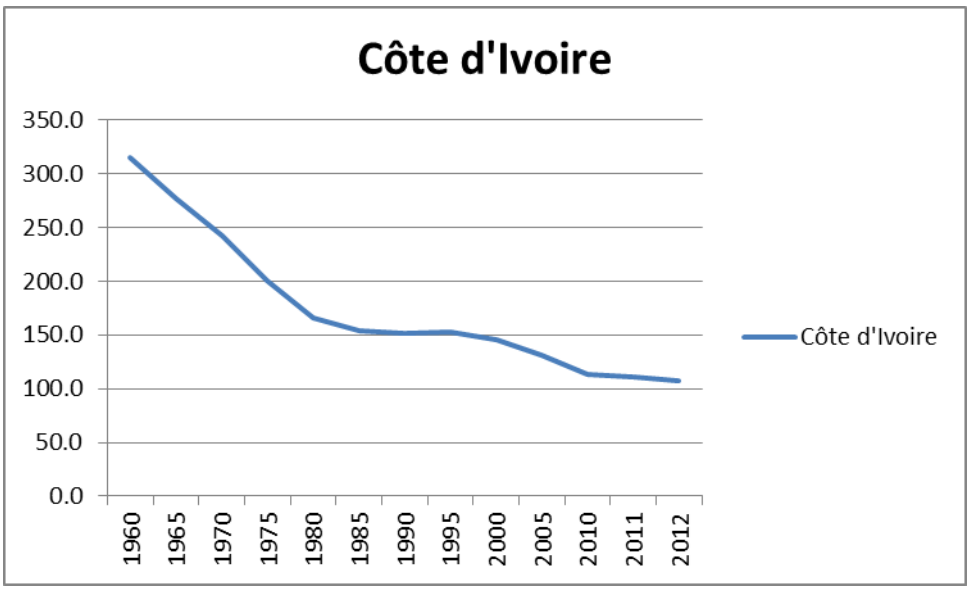

Figure 12. Underage-five mortality trend for Côte d'Ivoire (per 1,000 births)
Source: World Development indicator database

Democratic Republic of Congo

Figures 13 and14 represents the infant and child mortality trends for democratic republic of Congo; from the graph it can be observed that only little progress has been made to reduce both infant and underage-five mortality rates within this country.

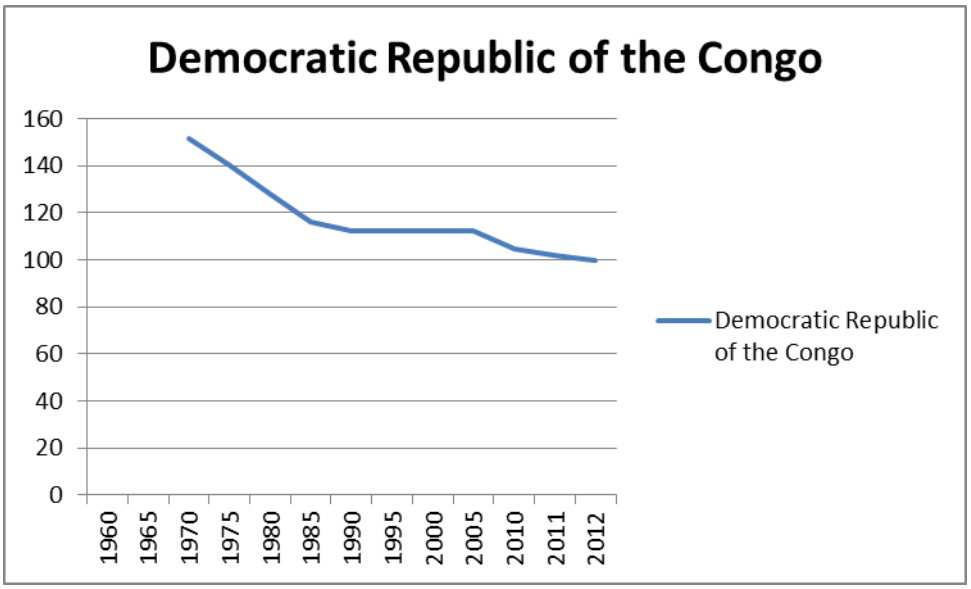

Figure 13. Infant mortality trends for democratic Republic of Congo (per 1,000 births)
Source: World Development indicator database

Infant mortality in 2012 has only reduced by less than half of what it was in 1970, while underage-five mortality rate in 2012 is more than half of what it was in 1970. Democratic Republic of Congo is one of the countries with political unrest and high number of displaced refugees, the continuous unrest within the country has made proper health care services impossible leaving young children more vulnerable to diseases and malnutrition. According to the UNICEF (2008) report one in every seven children dies before the age of five; malnutrition and micronutrients deficiencies are responsible for nearly one quarter of the underage-five deaths within the country.

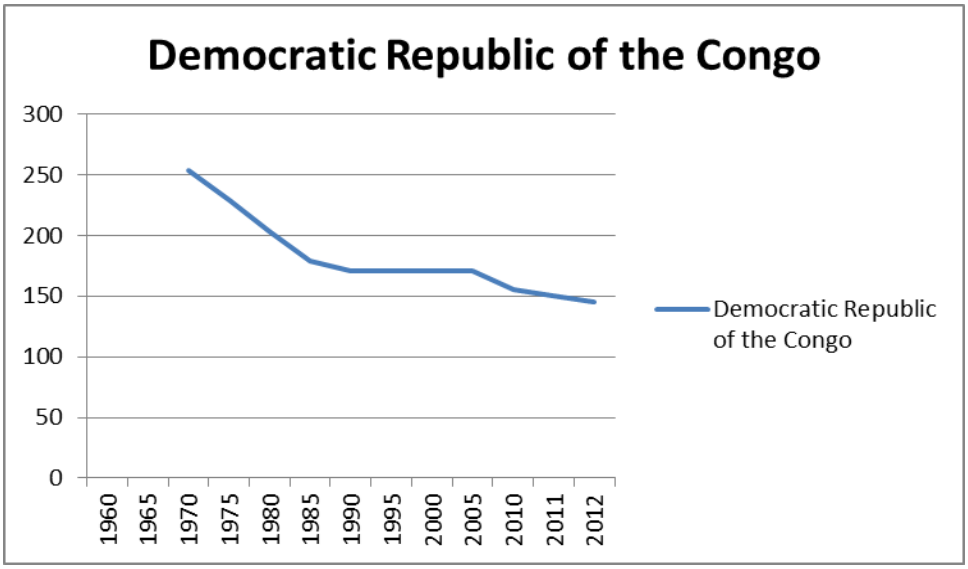

Figure 14. Underage-five mortality trend for democratic Republic of Congo (per 1,000 births)
Source: World Development indicator database

Sierra Leone

Figures 15 and 16 shows the infant and underage-five mortality trends in Sierra Leone; infant mortality rates has decreased from 219.3 per 1,000 in 1960 to 117.4 per 1,000 in 2012, while underage-five mortality rate has decreased from 388.2 per 1,000 to 181.6 per 1,000 in 2012.

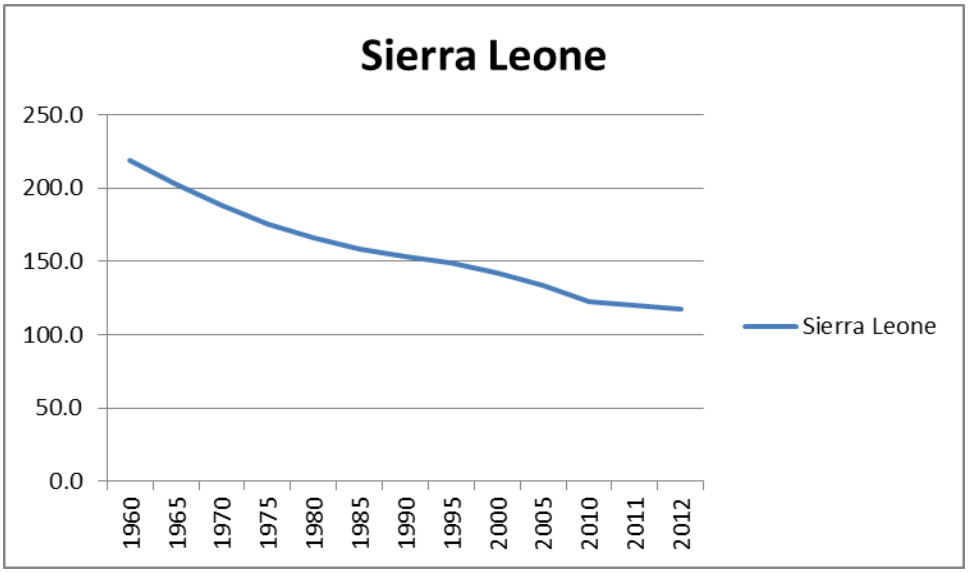

Figure 15. Infant mortality trends for Sierra Leone (per 1,000 births)
Source: World Development indicator database

Although these rates has continued to decline, yet child mortality rates remains high when compared with rest of the world countries, factors such as inadequate care, malnutrition, untimely completion of immunization and failures to prevent diseases such as malaria, diarrhea and pneumonia has been identified as the major cause of high mortality within this country UNICEF (2012)

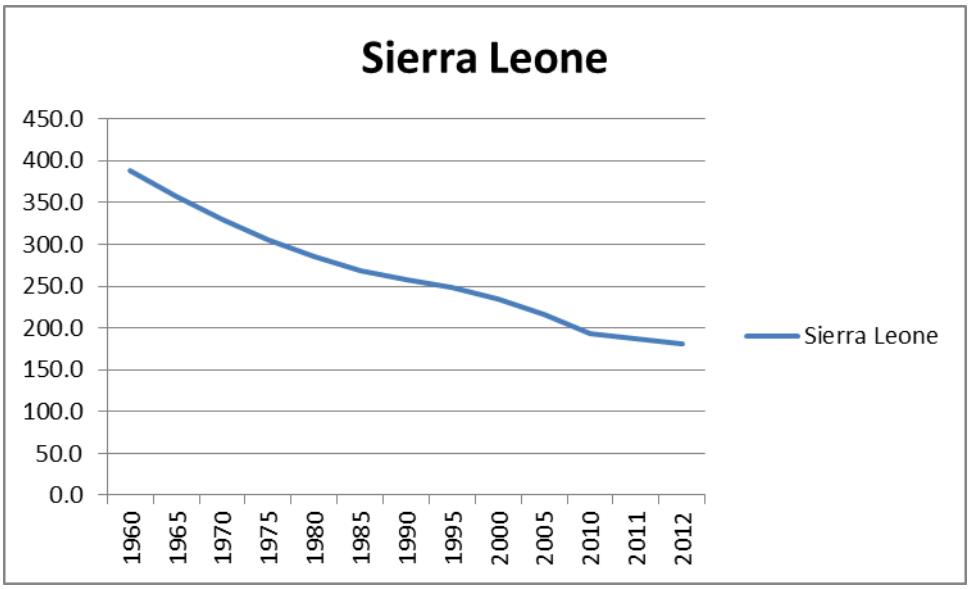

Figure 16. Underage-five mortality trend for Sierra Leone
(per 1,000 births)
Source: World Development indicator database

Somalia

Figures 17 and 18 shows the infant and underage-five mortality trends in Somalia, the figures depict a slow progress in the reduction of child mortality within this country with infant mortality decreasing from 112.5 per 1,000 in 1985 to 90.8 per 1,000 in 2012 and underage-five mortality has decreased from 187.6 per 1,000 in 1985 to 147.4 per 1,000 in 2012; due to unavailability of data prior data on child mortality within the country is not available.

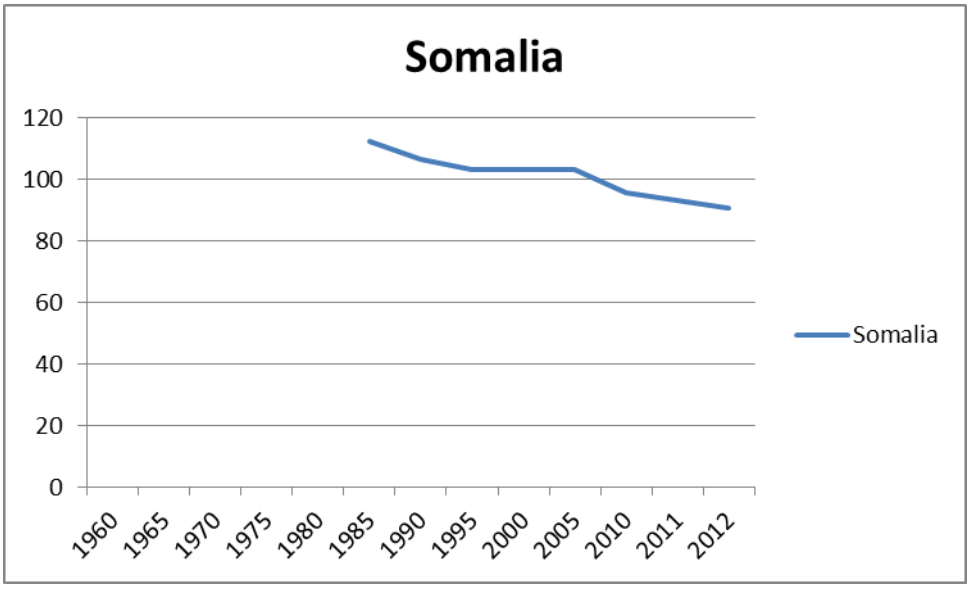

Figure 17. Infant mortality trends for Somalia (per 1,000 births)
Source: World Development indicator database

Child mortality rates in Somalia are among the highest in the world, one of every ten Somali children dies before their first birthday, although there is no adequate data but this high child mortality rates within this country is due to pneumonia (24 percent), diarrhoea (19 percent), measles (12 percent), and neonatal disorders (17 percent) UNICEF (2012). WHO (2012) reports that underage-five mortality rate in Somalia is 200 per 1,000 live births and this high child mortality is due to huge prevalence of malnutrition-deficiencies of important nutrients and inadequate breast feeding; malnutrition is responsible for up to 50 percent of the underage-five mortality within the country, other determinants of this wide spread child mortality is poverty, ill functioning health care services coupled with the ongoing conflict.

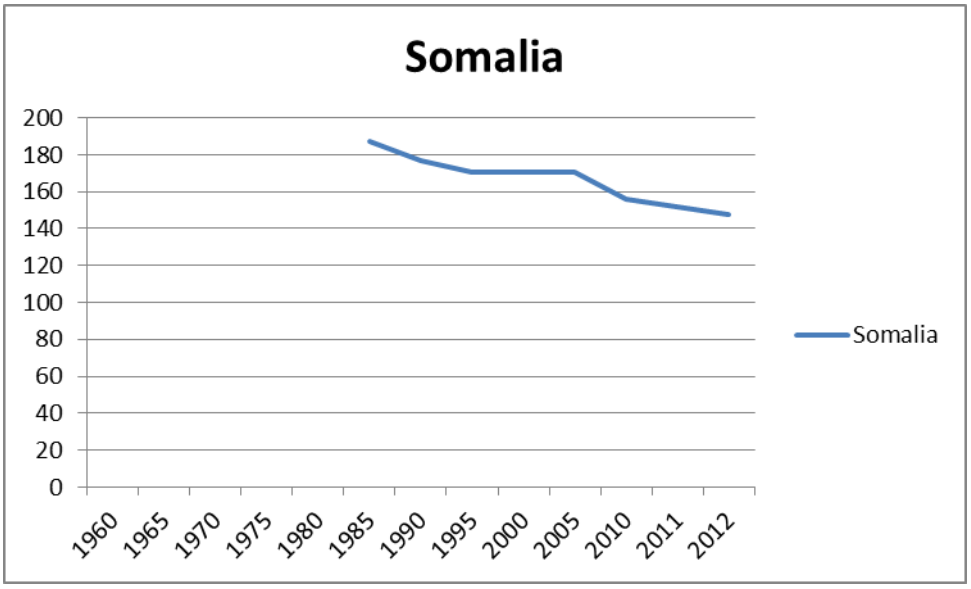

Figure 18. Underage-five mortality trend for Somalia
(per 1,000 births)
Source: World Development indicator database

Mali

Figures 19 and 20 represent the trends in infant and underage-five mortality rates for Mali; the figure shows that both infant and underage-five mortality has decreased significantly within this country between 1960 and 2012. Infant mortality rate decreased from 237.4 per 1,000 in 1960 to 79.6 per 1,000 in 2012, while underage-five mortality decreased from 486.0 per 1,000 in 1960 to 128.0 per 1,000 in 2012.

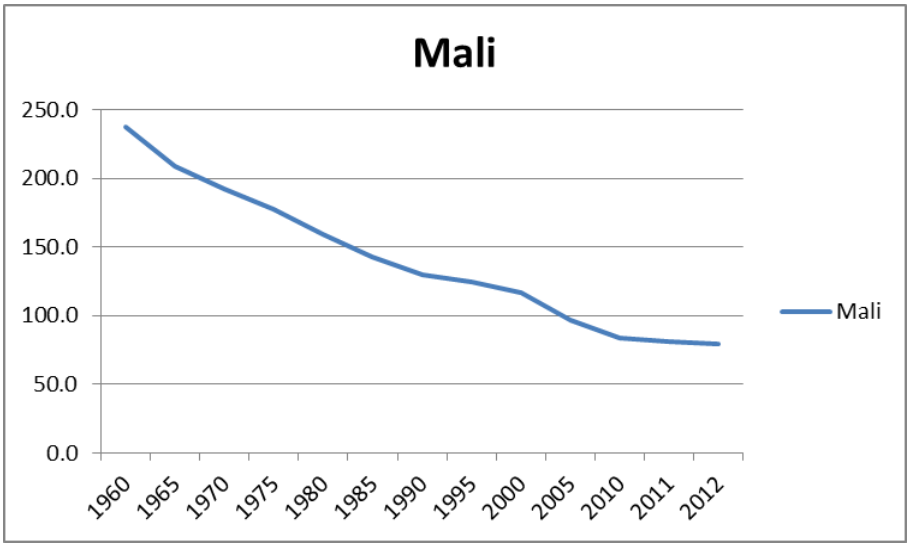

Figure 19. Infant mortality trends for Mali (per 1,000 births
Source: World Development indicator database

In spite of this decrease over the years, children in Mali is struggle to survive; with almost one child in every five dies before celebrating their fifth birthday and this is due to high poverty and lack of access to basic social services UNICEF (2009).

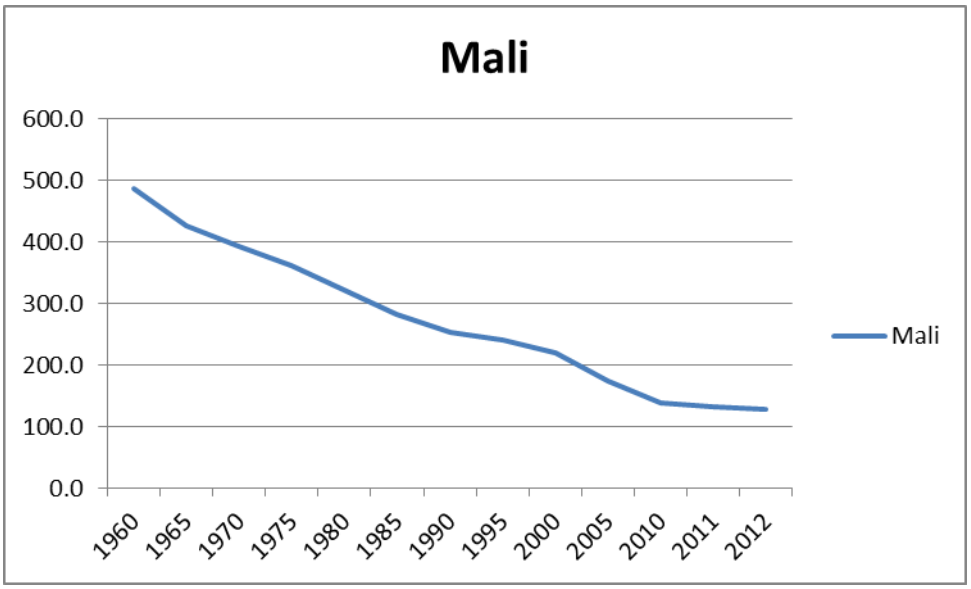

Figure 20. Underage-five mortality trend for Mali
(per 1,000 births)
Source: World Development indicator database

Nigeria

Figures 21 and 22 depict the trends in infant and underage-five mortality rates; these figures show that infant mortality has decreased from 179.3 per 1,000 in 1965 to 77.8 per 1,000 in 2012. Also, underage-five mortality rate has decreased from 301.8 per 1,000 in 1965 to 123.7 per 1,000 in 2012.

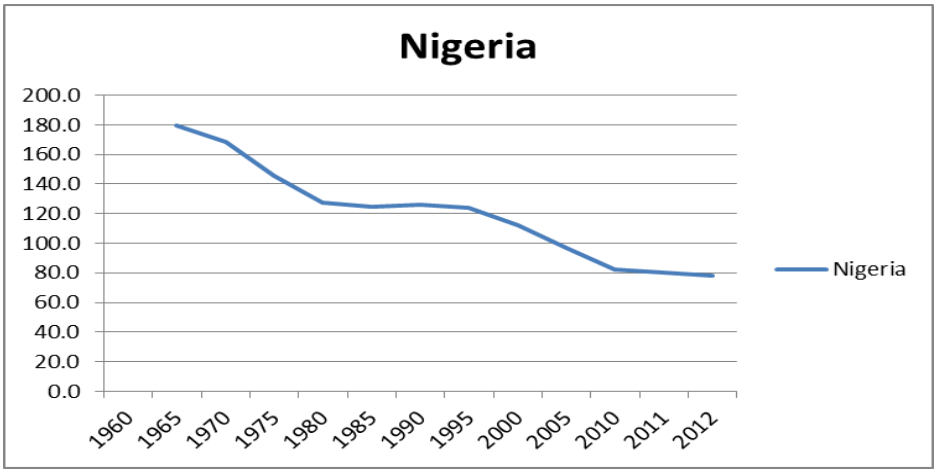

Figure 21. Infant mortality trends for Nigeria
(per 1,000 births)
Source: World Development indicator database

Although these trends show a sign of progress within the country to reduce child mortality; yet child mortality is still high within this country when compared to the rest of the world pace. Preventable diseases such as malaria, pneumonia, measles, diarrhea, and HIV/AIDS has been identified to account for more than 70 percent of one million underage-five deaths within the country while malnutrition is the underlying cause of more than 50 percent of child mortality and morbidity. UNICEF (2011).

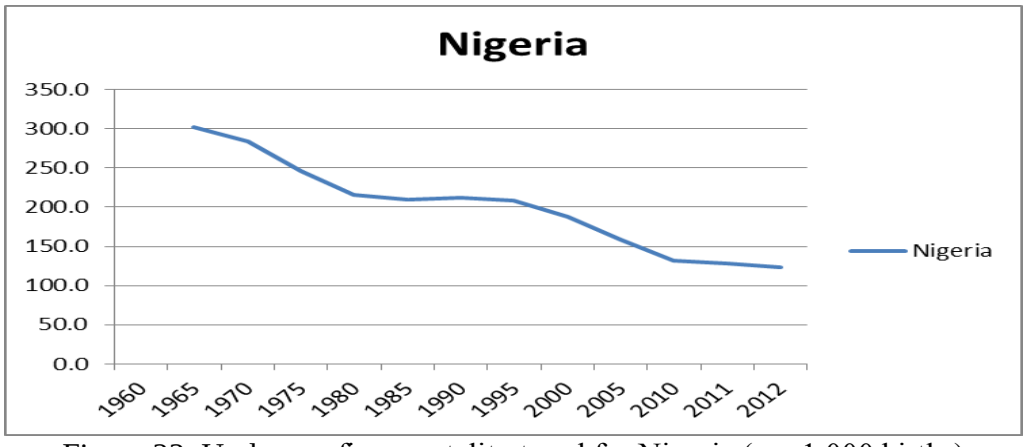

Figure 22. Underage-five mortality trend for Nigeria (per 1,000 births)
Source: World Development indicator database

Chapter 3

ECONOMIC GROWTH, FOOD SECURITY AND CHILD MORTALITY: LITERATURE REVIEW

3.1 Introduction

Food security is one of the Millennium development goals (MDG) of the United Nations in conjunction with the governments of most developing countries; the number one goal of the MDG is to halve poverty and hunger by 2015, while the fifth goal is to reduce child mortality by two-thirds. In order to achieve these goals the United Nations is encouraging the governments of these developing nations to pursue policies that will ensure food security and reduce child mortality within these developing countries. Food security is described as a situation in which people have access to sufficient quality and quantity of food at all times. The United Nations defined food security through three major concepts which are: Food Availability, Food Accessibility, and Food Utilization. These three concepts are hierarchical in nature. Food availability deals with the supply of food both at the national and domestic level, although very important, it does not guarantee food security; food access refers to the demand for food at all times, hence influenced by consumer preference and purchasing power. Food utilization, on the other hand, refers to the individual's ability to derive sufficient nutrients from the food consumed for growth. Despite the fact that these three concepts are very important in conceptualizing food security, it is still difficult to quantify food accessibility and utilization; therefore this study will focus on food availability as a proxy for food security.

Economic growth and child mortality are important objectives for most developing countries. In order to achieve these objectives it is imperative to understand the determinants of each goal so as to follow the right policy paths in achieving these goals.

3.2 Determinants of Economic Growth

Economic growth has been examined across continents, zones and nations. In line with the popular Solow growth model, population growth rate, initial level of income, depreciation and level of capital stock and technology are growth factors. Diverse studies and methods are in use to analyse economic growth determinants. Findings of Alfaro et al. (2004) suggest that foreign direct investment alone has an uncertain impact on economic growth and counties with well-developed financial markets tend to gain more from it.

Similarly, Ledyaeva (2008) found that the determinants of growth within Russia are identified as export and foreign direct investment. This study suggests that the export within the Russian regions is mainly due to oil and gas. In as much as this spurs growth in the short term, it might not sustain it in the long run with the high volatility in oil prices; policy makers in Russia should look into what else to export other than relying solely on oil exports as a source of economic growth.

Furthermore Rupasingha et al. (2002), found for different states within the United States both social and institutional factors are important factors in explaining the difference in convergence rates among the states; in particular ethnic diversity and high social capital both contribute positively to economic growth, while income inequality hampers growth among the studied states.

3.3 Determinants of Economic Growth in Africa

Despite an impressive amount of literature available on this subject, it is still imperative to establish, with some level of certainty, the factors that policy makers should focus on whilst pursuing economic growth, particularly in Africa, where a struggle in achieving economic growth has been evident.

In spite of a significant amount of available literature in this area, there are contrasting opinions with regard to factors that influences economic growth. Several models and variables have been identified. Among these authors are Barro (1991) Grier and Tullock (1989), Barro and Sala-i-Martin (1992), Quah (1993), Knowles and Owen (1997), Bills and Klenow (2000), Englebert (2000) and Webber (2002), who have used cross-country data in the study of economic growth. Their findings posit that growth across the studied countries differs even in the steady states and physical & human capital are positively significant in explaining growth while population growth has a significant negative impact on growth.

Investigation into why African nation's experienced diminutive economic growth over the decades has been understudied by many researchers. The conclusions of such many studies suggested additional causes separately from generally known determinants of economic growth contributed to retrogression in growth within the region. Researcher such as Hoeffler (2002) revealed the effects of inadequate investment and increasing population growth rates. Likewise, Easterly and Levine (1997) in their work shows that education, poor financial systems, political unpredictability, uncontrolled foreign exchange market, lack of infrastructure among other things are responsible for the stunted economic growth Africa.

Glewwe et al. (2007) finds out that since the quality of education in Africa is lower compared with other developing countries, therefore the contribution to growth is lower as well. Also, it will be more useful to focus on a country-specific microeconomic study, rather than cross-country studies, if credible evidence of the impact of education on economic growth is to be obtained. Block (2001), maintained that the wealth from natural resources is harmful to institutional expansion in Africa.

In addition, Bloom and Sachs (1998), reveal that the main hindrance to development in Africa is climate conditions which resulted into stumpy agricultural productivity. Acemoglu, et al. (2001), suggests that dysfunctional extractive institutions, by means of high settler mortality rate as a proxy, are one of the explanations for slow growth within the newly-independent Sub-Saharan African countries. Also, Emglebert (2000) posits that African nations are confronted with considerable restrictions to government power, therefore people in government make policies that will keep them in power rather than to promote developmental policies.

Tsangarides (2005) and Diop et al. (2010) both agreed that government ineptitude hampers growth among the Economic Community of West African States nations.

3.4 Determinants of Child Mortality

Reduction of child mortality is one of the United Nations (UN) Millennium development goals; the United Nations' target 5 aims to reduce under-five mortality by two-thirds between 1990 and 2015. An Inter-agency Group for the Child Mortality Estimation Report (2010) showed that great efforts have been made over the last decade to achieve this goal, in fact there has been a one third decline in global under-five mortality between 1990 and 2009, with North Africa and Asia making the

greatest efforts. Despite this improvement in the global child mortality rate, many developing countries particularly in Africa are still far from achieving this goal; the developing countries are far behind the developed world, with 66 per 1000 deaths compared to 6 per 1000 in the developed region. Kaldewei and Pitterle, (2011).

To achieve the goal of reducing child mortality globally, it is imperative to establish the determinants of child mortality, and several studies have tried to explore this area of study. The earliest of such studies were performed using a cross-country analysis; Rodgers (1979) investigates the impact of income inequality on child mortality, using life expectancy at birth, life expectancy at age five and infant mortality as the independent variables, the study posits that income strongly affects child mortality for all the countries studied.

Identifying the global determinants of child mortality has been huge debate since the early 1980, Horbcraft et al. (1985), using data from 39 world fertility surveys, found child spacing and age of mother as important risk factors in the survival of a child. Also studies of Cleland and Van Ginneken (1988) using the findings of multivariate examination of data from 16 countries presented by Hobcraft, et al. (1984), argued that changes in the reproductive pattern hide the relationship between education and child mortality; instead on average each one year increment in maternal education decreases the child mortality of under five years by 7 to 9 %.

Similarly, the findings of Bicego (1990) applying a three-step procedure using the proportional hazards model for data from Haiti, suggest that maternal education and low age at birth have significant impact on neonatal survival but negligible effects afterwards; also findings of Bicego and Boerma (1990) using the demographic health

survey (DHS) from Bolivia also shows that the maternal level of education has greater impact on child survival in the first two years in the rural areas than in the urban areas. On the other hand, Streatfield et al's (1990) findings from Indonesia suggest that educated women are more aware about appropriate immunization programs and it is this knowledge not formal education that makes such mothers ensure that their children receive the available vaccines.

King and Rosenzweig (1991), using quinquennial time-series data for 124 countries, revealed that both income growth and changes in public spending have negative significant impact on child mortality; also Bill and Gill (1991), using a different approach on annual time series data from 68 countries, suggest that public spending and income both have a negative impact on infant mortality. Similarly, Pritchett and Summers (1996) using cross country, time series data on health (infant and child mortality and life expectancy), found that over 500,000 child deaths within the developing countries were due to poor economic performance in the early 1980s. A similar study within urban areas in Ghana, Brazil and Thailand by Timaeus and Lush (1995) posits that household economic and environmental status have great impact on children's morbidity and mortality rate; in fact children from better-off families tend to have a lower diarrhoea morbidity compared to children from low-income families and this is due to differences in child care practices.

A more recent study by Wang (2002) using demographic and health survey data from 60 low-income countries also showed that determinants of child mortality differ between rural, urban and national levels; the study revealed that access to electricity, income, vaccination in the first year of birth and public health expenditure are important determinants of child mortality at the national level. Within the urban

areas, only access to electricity is an important determinant of child mortality, while in the rural areas, vaccination in the first year of birth appears to be the only significant determinant. Furthermore, using a competing risks approach, Jacoby and Wang (2003) explore the linkages in rural and urban China between child mortality and morbidity, and the quality of both household and community environment. The result of their findings suggests that access to water/sanitation, higher maternal education level; vaccination and use of unclean cooking fuel are important determinants of child mortality.

Charmarbagwala et al (2004), using a meta-analysis combining the results of 38 different empirical studies in such a way that allows for statistical hypotheses to be tested posits that income, household size, parental education, location (urban or rural), gender of the index child all explain both child mortality and nutrition. Also, the findings of Wagstaff et al. (2003) suggest that a male child dummy is significantly negative in both 1993 and 1998 for Vietnam but a similar study on Vietnam by Glewwe et al. (2002) found that this effect is insignificant. Ghosh and Bharati (2010) examined the impact of socioeconomic and demographic factors on infant and child mortality, the study compared two groups of women with similar access to health facilities in a peri-urban area of Kolkata City in India. The study posits that the two groups have different factors standing against child and infant mortality, suggesting that there is need for a more understanding of the determinants of infant and child mortality at the household or community level within culturally heterogeneous populations for more effective strategies on child development and survival.

3.5 Determinants of Child Mortality in Africa

Results from most studies on child mortality within Africa are not quite different from the results from other parts of the world; Defo (1994) found that using longitudinal data for Cameroon with a two-state parametric and nonparametric hazards model, socioeconomic factors, housing characteristics and immunization all have a deleterious effect on infant and child mortality. Similarly, Manda (1999) employed the proportional hazards model on data from the 1992 Demographic and Health Survey in Malawi, to investigate the connection between infant and child mortality and birth interval, maternal age at birth and, birth order, with and without controlling for other relevant explanatory variables. Also, the study examined the direct and indirect impact of breastfeeding on child mortality. The result from this study posits that birth interval and maternal age impacts are essentially limited to the infant year of a child and as the child grows up, the impact of social and economic variables on mortality threat tends to increase; it further revealed that breastfeeding does not meaningfully change the effects of the preceding birth interval length on child mortality, instead it partially decreases the succeeding birth interval effect.

Zerai (1996), using the Cox regression model on demographic and health survey from Zimbabwe, explored the impact of socioeconomic and demographic factors on infant survival in Zimbabwe. The finding of this study showed that women's average level of education within the community has more impact on infant survival than the actual mother's educational level. A similar study on Zimbabwe, using multivariate hazard analysis on demographic and health survey 2005-06, suggests that the infant mortality risk is associated with multiple births and socioeconomic variables do not have distinctive impact on infant mortality; therefore the study argued that health

policy makers should intensify efforts to encourage family planning methods that will help improve child spacing (Kembo and Van Ginneken, 2009).

Mutunga (2007) examined the determinants of infant and child mortality for Kenya, using survival analysis (hazard and survival functions) based on the 1998 data from Kenya demographic and health survey. The findings of the study suggests that the household's environmental and socio economic characteristics have significant influence on child mortality; therefore policies to improve both the household's environmental and socio economic status were advocated in order to ensure a reduction in child mortality in Kenya. A more recent work on the determinants of child and infant mortality in Ethiopia, using the 2011 demographic and health survey, concludes that different factors affect child and infant mortality which include mother's educational status, birth order, number of children, birth intervals, household size, breast feeding, mother's marital status and source of drinking water (Meseret et al., 2012)

A more broad work on Sub-Saharan Africa revealed that the determinants of child and infant mortality differ between the urban and rural areas. Akoto and Tambashe, (2002) found that there is a difference in the determinants of overall mortality, child and infant mortality between urban and rural areas and the factors responsible for this difference include: better education, higher income level of households, concentration of public infrastructures such as water, sanitation services and health services in the urban areas. Furthermore, Guillot et al (2012), using data from human mortality database (HMD) examined the global overview of child mortality and the findings from this study posit that Sub-Saharan African countries have the tendency to exhibit high child mortality and the reason for this is epidemiological causes.

3.6 Determinants of Food Security

Food security according to Siamwalla and Valdes (1994) is defined as the ability of countries, regions or households to meet a targeted level of food consumption on a yearly basis. Also, World Bank (1980) defines food security as the access by all people at all times to enough food for an active and healthy life. The USAID's concept of food security was accepted at the world food summit of 1996 and was reaffirmed in 2002 which described food security via three basic elements: Food availability, Food access and Food utilization. These three concepts are in hierarchy, but each is not sufficient on its own to capture food security entirely. Food availability refers to the total food stock available at the national level; it includes domestic food production, food imports and food aids, food access is influenced by the total food availability and its impact on both the market supply and price, while food utilization reflects the nutritional status of an individual and is determined by the quantity and quality of dietary intake, general child care and feeding practices, along with health status and its determinants (Omonona and Agoi, 2007)

Scanlan (2001) stress that policy action on Africa food shortage was caused by inadequacy in food supply and lack of economic growth in Africa countries; using an OLS regression on food security change, Scanlan's findings suggest that increase in population pressure coupled with rural-urban migration have a negative impact on food security, while modern agricultural techniques, land use policy, infrastructural expansion, and the internationalization of food markets assist in offsetting the negative impact. Similar findings of Yang et al, (2003) reveal that food insecurity and hunger are direct results of low income; also poor and populous countries might experience water deficit induced food insecurity, and starvation could intensify if

proper actions are not in place over the next 30 years. Timmer (2004) suggests that economic growth and food security are mutually reinforcing, using Asian markets as an example. He argued that most Asian countries have been able to escape food insecurity through economic growth and, at the same time, economic growth has been achieved within this economy via an increase in food security. Dorward (2012) has shown that short-term food security can be improved by an increase in economic growth and lower domestic price transmission.

Chapter 4

ECONOMIC GROWTH AND FOOD SECURITY: METHODOLOGY

4.1 Model and Data

In the words of Ronelle and Stan (2006) "Model choice is very difficult, particularly when dealing with growth where there is a remarkably huge number of possible regressors and inadequate theoretic direction to form a consensus on model specification". In order to make this study less complex, the traditional dynamic Solow growth model for cross-country data analysis was used with data from one hundred and twenty-four countries from the time period between 1970 to 2007. The overall impact of food supply on economic growth is the goal of this paper, food supply per day and all other variables were averaged out to net cyclical fluctuations. The countries time series data were averaged out into a single data point in order to remove variations within each of the country over the study period. Single point averaging method is common as seen in the work of Kormendi and Mequire (1985) and Barro (1991) among many others. Based on this approach, the model for the study is estimated as follows:

$$\ln y_{it} - \ln y_{io} = a_0 - a_1 \ln y_{io} + a_2 \ln s_i + a_3 \ln f_i + a_4 \ln n_i + a_5 \ln h_i + a_6 \ln \pi_i + \sum_j a_j \ln X_{ij} + \xi_i$$

…… (1)

Where **i** is an index of country, t is the final year, variable y_i is the final year's real GDP, the initial real GDP per capita (*yi0)*, is expected to have a negative effect on

growth, as a result of diminished returns on marginal investment, higher initial real GDP per capita will result in lower future growth, making any convergence conditional on the remaining explanatory variables. Investment share (*si*), food supply per day (f_i), and human capital (*hi*) are all expected to spur economic growth. Life expectancy (leb_0), primary school enrolment (P_e) and secondary school enrolment (S_e) were used as a proxy for human capital. Variable $\sum_j \ln X_{ij}$ is the sum of the African dummies and the interaction term, a_j is the coefficient for each dummy and the interaction term that will be used in the model, while ξ_i is the error term**.** The African dummy, inflation rate (π_i) and population growth (*ni)* are all expected to have a negative impact on growth. Data on investment share, the population growth rate, the inflation rate and human capital were obtained from the World Bank data base, the Real GDP Lespeyre's Index, was obtained from the Penn World Table 7.0, while daily food supply data was obtained from FAOstat[2]. To generate the African dummy (SSA) all 41 African countries under the study were assigned a value of 1 and rest of the world countries (ROW) were assigned a value of 0, while the SSA2[3] dummy was generated by assigning a value 1 to all African countries with food insecurity over the last ten years and the remaining countries were assigned a value of 0. The Stata software package was used for the regression analysis.

From the 26 of the 40 countries that have been in food crisis in the last decade in Africa, 20 of those for which data was available, characterize the nations with the SSA2 dummy, whereas other countries are considered to be non-African.

[2] FAOStat is food agriculture organization statistics and the data on food supply measured in kilo calorie per capita per day was obtained from there. To have a correct measurement of food supply, the population was excluded from the data, making the unit of measurement for food supply the food supply per day.
[3] All through this work, SSA refers to all African countries while SSA2 refers to African countries with food insecurity and ROW refers to Rest of the world countries.

Furthermore, the SSA dummy represents 41 African countries included within the study and the reasoning behind the choice for this investigation is to make known the effect of food shortage on the economic development of these nations and not to take all countries in African at face value, because those Africa nation without food.

4.2 Endogeneity and Valid Instruments

In order to test the consistency of Ordinary Least Square (OLS) in estimating the regression model and to ensure that it does not produce an unbiased coefficient for the growth regression, it is important to test whether all of the explanatory variables are exogenous. In the growth Model (1) it is expected that the food supply and the primary and secondary school enrolment rate might be endogenous, hence yielding a biased coefficient estimate. One would expect that an increase in income, measured as gross domestic income, would enhance higher purchasing power, in order to achieve sufficient food supply and demand for education. Therefore, to detect the presence of endogeneity in this study, particularly between food supply, and economic growth, both OLS and two stages least square (TSLS) approach were used in order to obtain estimates for the growth analysis coefficients. For the TSLS, it is important to get a valid set of instrumental variables[4] so as to obtain a consistent parameter estimates with meaningful inferences and to do that, a valid instrument must satisfy two important conditions: instrument's relevance and instrument's endogeneity. An instrument is considered relevant if variations in the endogenous variable are related to the variation in the instrument and an instrument is considered exogenous when part of the variations in the endogenous variable captured by the instrument variable is endogenous, Stock and Watson (2010).

[4] Richard Ashley(2007) defines an instrument as an observable regressor, which is both substantially correlated with the endogenous variable and asymptotically uncorrelated with the model error term

For this study, the instruments of choice are the lagged variables of measures for education and the determinants of food supply. If endogeneity is a problem in the OLS estimates, then the size of the regressor coefficients in the TSLS would either increase all together or decrease Webber (2002). To obtain the determinants for food supply (food availability) that can serve as valid instruments for the TSLS, this study examined the joint impact of some of the variables identified as important determinants for food security by Scanlan (2001), namely adaptive measures, such as fertilizer application, arable land size, renewable freshwater and food import ratio on food security. Following Bound, Jaeger, and Baker (1995), James L. Garrett and Marie T. Ruel (1999) suggestion the F-statistics of first-stage regression must perform well and if these variables jointly[5] determine food security, then they will be considered as relevant instruments for the growth model. The choice of these variables is to ensure that the instrument is not correlated with either the explained variable or other explanatory variables, and that these variables only affect the explained variables via the endogenous variable.

The model used in capturing the determinants of food supply is represented thus:

$$\ln f_i = \beta_0 + \beta_1 \ln \varpi_i + \beta_2 \ln \psi_i + \beta_3 \ln \ell_i + \beta_4 \ln \iota_i + \zeta_i \qquad \text{..... (2)}$$

Where f_i is the food supply, which is the suspected endogenous variable in the growth model, ϖ_i is the renewable water available, ψ_i is the fertilizer consumption, ℓ_i is the arable land size use in agricultural production ι_i is the food import ratio and

[5] F-statistics test will be used to determine the level of their joint significance

ζ_i is the error term while b_0 through to b_4 are the coefficients of each variable . All variables are in log form for each specific country over the studied period.

4.3 Reset Test

In order to avoid a linear model misspecification it is imperative to perform the general specification test called the Ramsey reset test. The Ramsey reset test has a general specification that is represented thus:

$$\hat{y} = \in \{y|x\} = \beta x \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The Ramsey reset tests whether $(\beta x)^2$, $(\beta x)^3$, $(\beta x)^4$…………….. $(Bx)^n$ are significant in explaining y; and this is tested by estimating the following model:

$$y = \alpha x + \alpha_1 \hat{y}^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + \alpha_n \hat{y}^n \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

If $\hat{y}^2$ -------$\hat{y}^n$ are jointly significant using the f-test then it implies that the linear model has been wrongly specified. From models 3 and 4, y represents the economic growth of each country; x represents the explanatory variables used in the growth model in model 1 above.

Chapter 5

CHILD MORTALITY AND FOOD SECURITY: METHODOLOGY

5.1 Data

To estimate the determinants of child mortality, this study specifies child mortality outcomes as a function of key variables. Both theory and empirical evidence from previous studies formed the basis of the choice of the explanatory variables used in this study. These explanatory variables include: 1) Income - GDP per capita measured in PPP using 2005 as the base year. 2) Social and environmental Indicators - these variables include access to potable water, proper sanitation, and female education 3) Policy variables such as share of government expenditure on health, government health expenditure per capita and 4) Food security - proxy by food availability per capita. All variables except food availability per capita were obtained from WDI data source while food availability per capita was obtained from FAO database.

5.2 Empirical Strategy

This study made use of both fixed effect model and dynamic panel model estimates System GMM to analyse the relationship between child mortality, income, social and environmental indicators, policy instruments and food availability. Both infant mortality (IMR) and under-five mortality (U5MR) were used to capture the level of child mortality in each of the 114 countries considered for the period 1995-2009.

The fixed effect model was applied on the panel data to examine the effect of the explanatory variables on child mortality.

The fixed effect model is represented thus:

$$IMR_{it} = \beta_1 X_{it} + \alpha_i + \mu_{it} \quad (5)$$

$$U5MR_{it} = \beta_1 X_{it} + \alpha_i + \mu_{it} \quad (6)$$

Where X_{it} is the matrix of the explanatory variables in both models 5 and 6, α_i is the unknown intercept for each country[6].

Due to the possibility of serial correlation and heterogeneity in the panel data, this work further made use of a dynamic specification to account for the occurrence of significant lagged effects of the dependent variable that account for serial correlation in the dependent variable. The dynamic panel model for each of the dependent variables –IMR and U5MR is represented thus:

$$IMR_{it} = \alpha + \beta_1 IMR_{it-1} + \gamma X_{it} \beta_2 IMR_{it-2} + \gamma X_{it} + \varepsilon_i + \mu_{it} \ldots\ldots\ldots\ldots (7)$$

$$U5MR_{it} = \alpha + \beta_1 U5MR_{it-1} + \beta_2 U5MR_{it-2} + \gamma X_{it} + \varepsilon_i + \mu_{it} \ldots\ldots\ldots (8)$$

Where subscript t and i represent years and countries respectively. From equation 7 the dependent variable is infant mortality rate per 1000 (IMR_{it}). The independent variables are the first and second lag values of IMR_{it}. X_{it} is a set of explanatory variables which includes: food per capita, Income-GDP per capita, social indicator -

[6]Hausman test was also performed to justify the choice of Fixed effect as against Random effect.

access to water, access to sanitation, female primary school enrolment, policy variables - share of public health in GDP expenditure and health expenditure per capita. ε_i are unobserved country-specific fixed-effects, and μit is the identical and independently distributed error term. Equation 8 represents the model for under-five mortality rate per 1000 ($U5MR_{it}$) with first and second lag values of $U5MR_{it}$ as the independent variable while X_{it} is the set of the same explanatory variables as in equation 7.

Estimating equations (7) and (8) with OLS (Ordinary Least square) regression method without a panel setting estimate can be problematic; since OLS ignores country-specific fixed effects. There is a possibility of serial correlation and endogeneity of all the regressors in the dynamic OLS regression. In order to control for the country-specific fixed effects $\varepsilon_{i,}$ equations (7) and (8) will be first differenced; first differencing removes any possible unobserved heterogeneity among the countries. The first differenced specification can be represented thus:

$$\Delta IMR_{it} = \alpha + \beta_1 \Delta IMR_{it-1} + \gamma X_{it} \beta_2 \Delta IMR_{it-2} + \gamma \Delta X_{it} + \Delta \mu_{it} \ldots\ldots\ldots\ldots (9)$$

$$\Delta U5MR_{it} = \alpha + \beta_1 \Delta U5MR_{it-1} + \beta_2 \Delta U5MR_{it-2} + \gamma \Delta X_{it} + \Delta \mu_{it} \ldots\ldots\ldots (10)$$

Where Δ represents the first difference operator.

GMM (Generalized Method of Moment) estimate will be used to control for the endogeneity problem, in which the lagged levels of the regressors will serve as instruments. These instruments might be weak or poor instruments if the cross-section variability is greater than the time variability and if there is a strong persistence in the examined panel series (Bond et al., 2001). This problem can be

solved using Arellano and Bover (1995), and Blundell and Bond (1998) augmented version of difference GMM - system GMM estimator. This system GMM estimator includes both the first-differenced and equations in levels as a system; the system GMM estimator makes use of different instruments for each estimation equation simultaneously, it also allows for the control of the dynamics of adjustment by including the lagged endogenous variable as one of the explanatory variables (Tongur et al., 2012). The system GMM is preferred to the first-difference estimator both when the time series is highly persistent and when the numbers of time periods available are small just like we have in this study (Favara, 2003). And lastly, the system of GMM corrects for both heteroscedasticity and autocorrelation (Roodman, 2009).

Chapter 6

ECONOMIC GROWTH RESULTS AND DISCUSSION

6.1 Comparison of Average Food Supply and Gross Domestic Product across Different Region

Figure 1 below shows the average food supply per capita between 1970 and 2007 across different regions. From the figure it can be inferred that Rest of the World (ROW) countries have the highest food supply, followed by SSA countries, and then SSA2 countries have the lowest average food supply. Figure 2 shows average gross domestic product across the three major classifications according to this study. ROW countries have the highest gross domestic product per capita, All Africa (SSA) countries have higher gross domestic per capita compares to African countries with food insecurity (SSA2) countries during the studied period and this is in line with expectations.

Figures 3, 4, 5 compare the trend in GDP per capita and food supply per capita for SSA2, SSA and ROW countries respectively. The three graphs show a co-movement between growth in gross domestic products and food supply; food supply and GDP growth rate within SSA2 countries with food insecurity are more closely related, unlike ROW and the SSA countries, where the food supply appears more smooth and does not fluctuate as much as the gross domestic product.

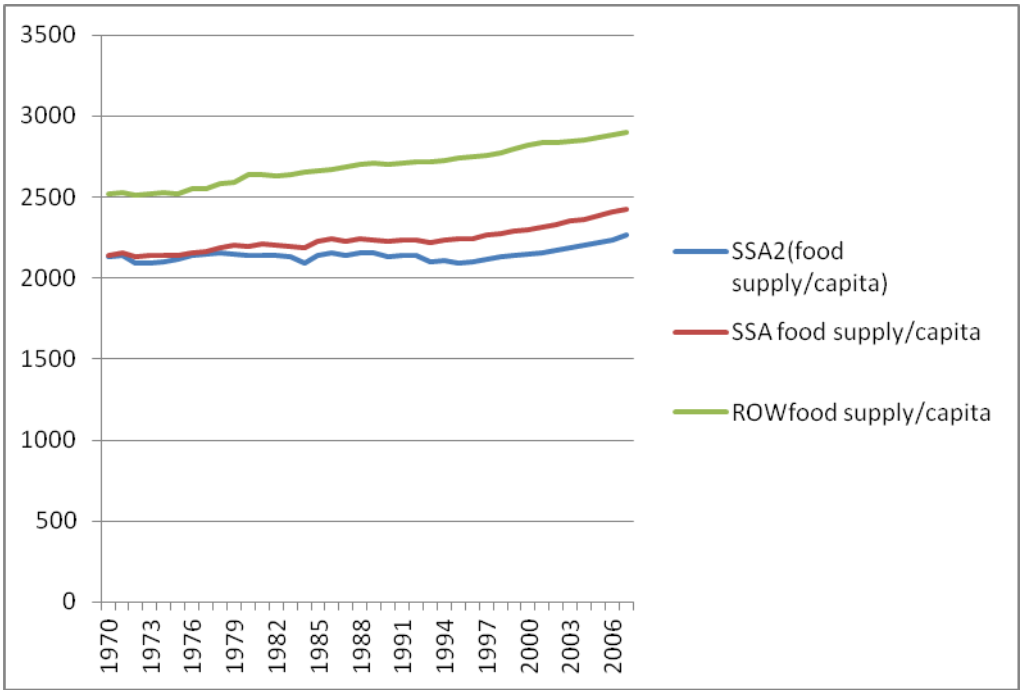

Figure 23. Average Food supply across Different Regions

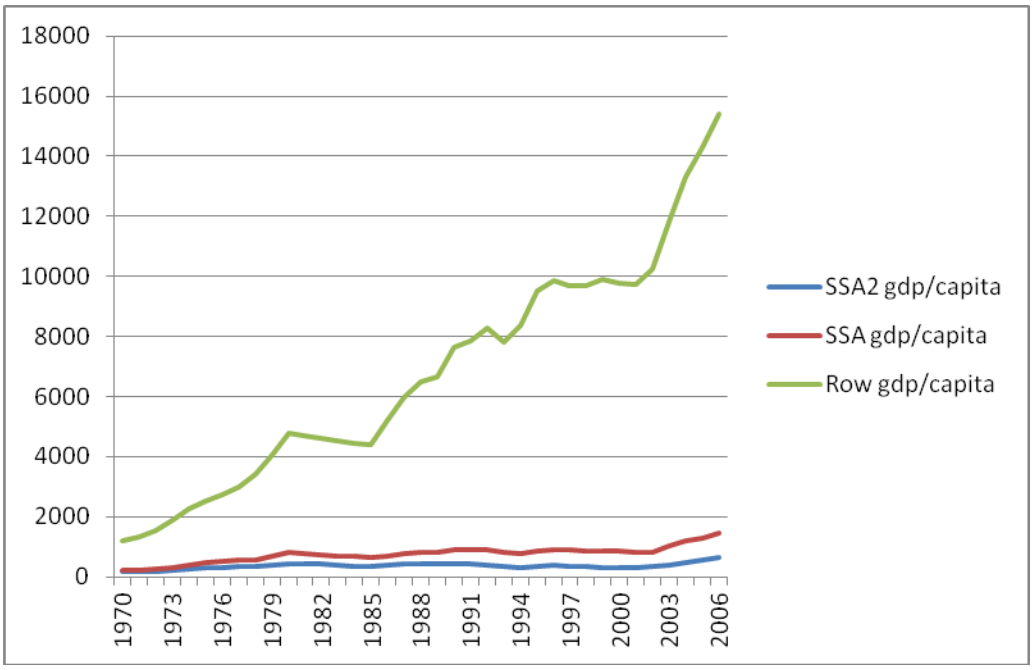

Figure 24. Average Real GDP per Capita across Different Regions

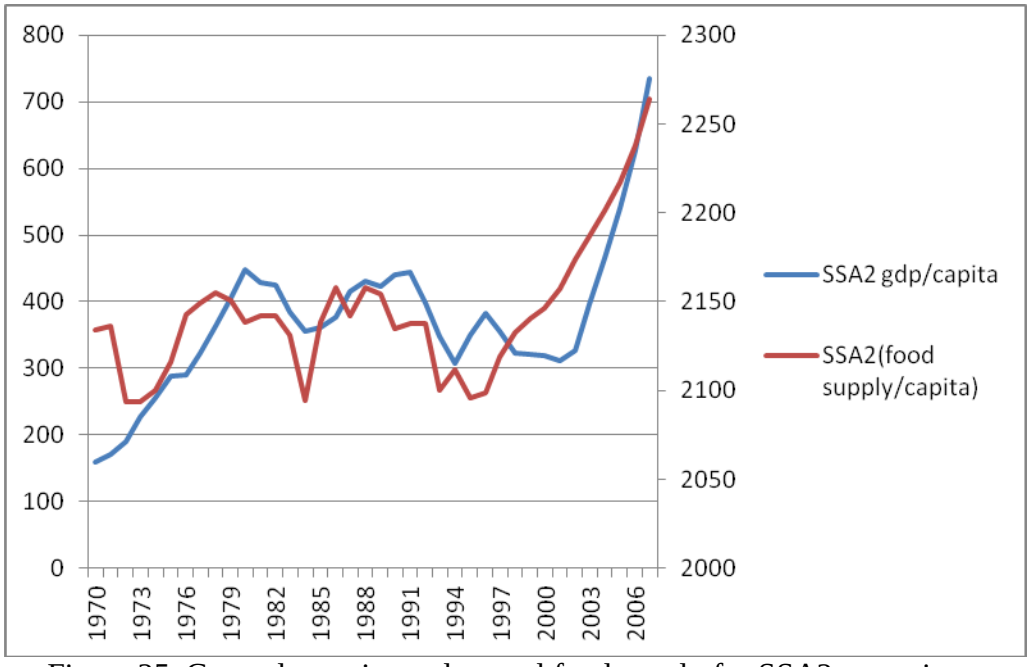

Figure 25. Gross domestic product and food supply for SSA2 countries

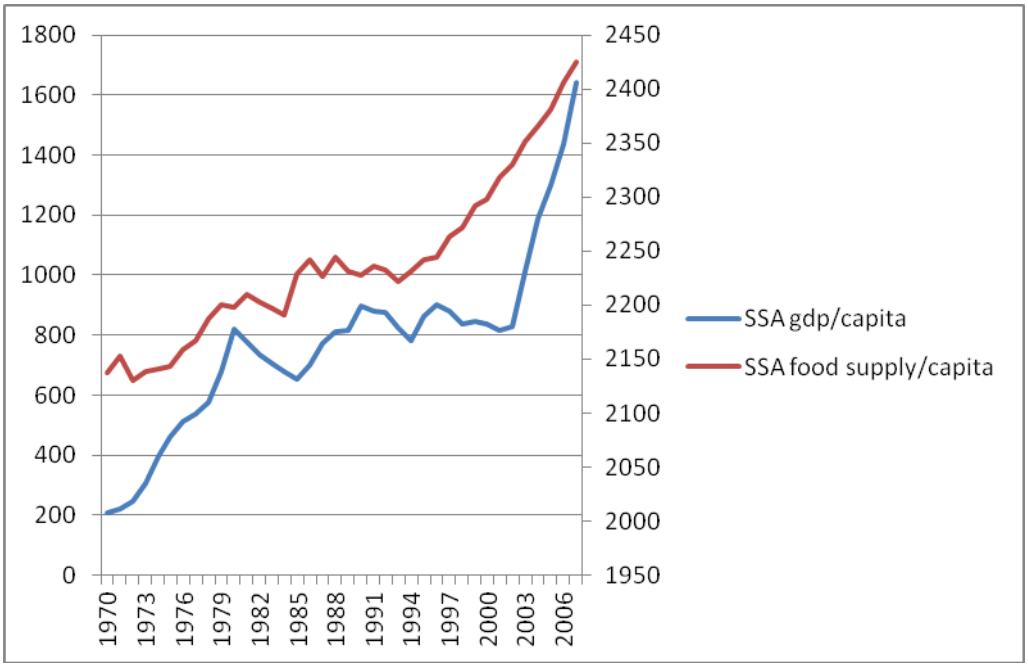

Figure 26. Gross domestic product and food supply for SSA countries

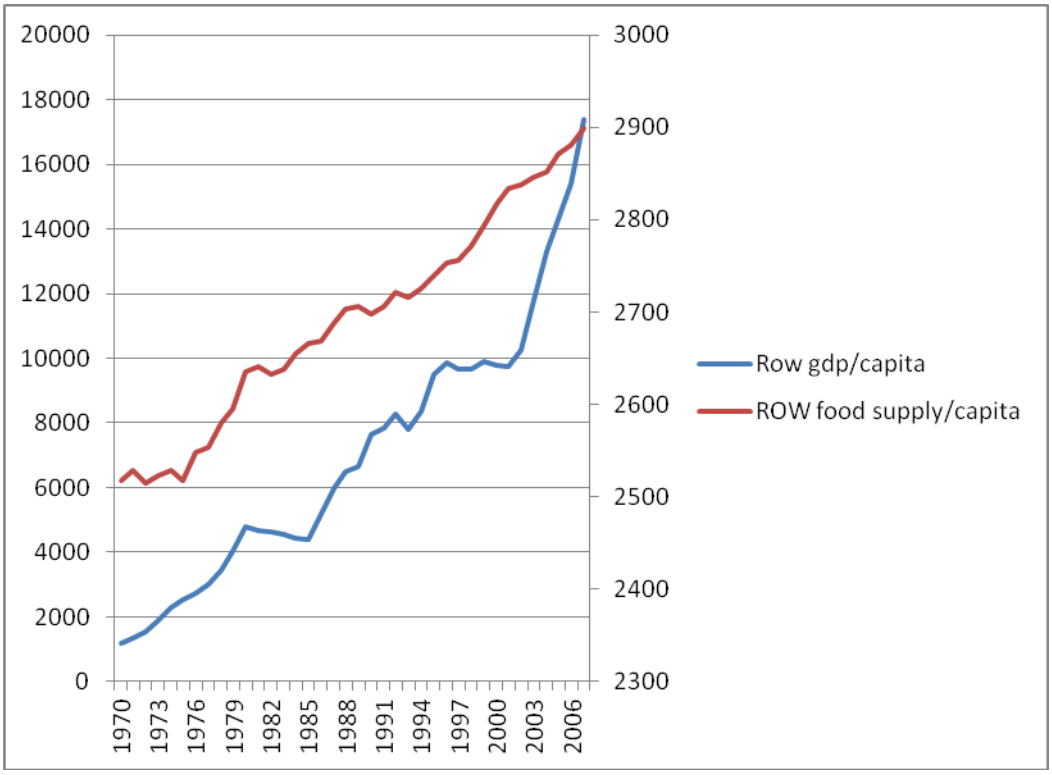

Figure 27. Gross domestic products and food supply for ROW countries

This suggests that SSA2 countries with food insecurity may tend to feel the impact of food insecurity more on their gross domestic product than other countries. Figure 28 shows the relationship between economic growth and the log of food supply for all countries. With a positive correlation of 0.29 the figure indicates that there is a possible positive relationship between food supply and economic growth.

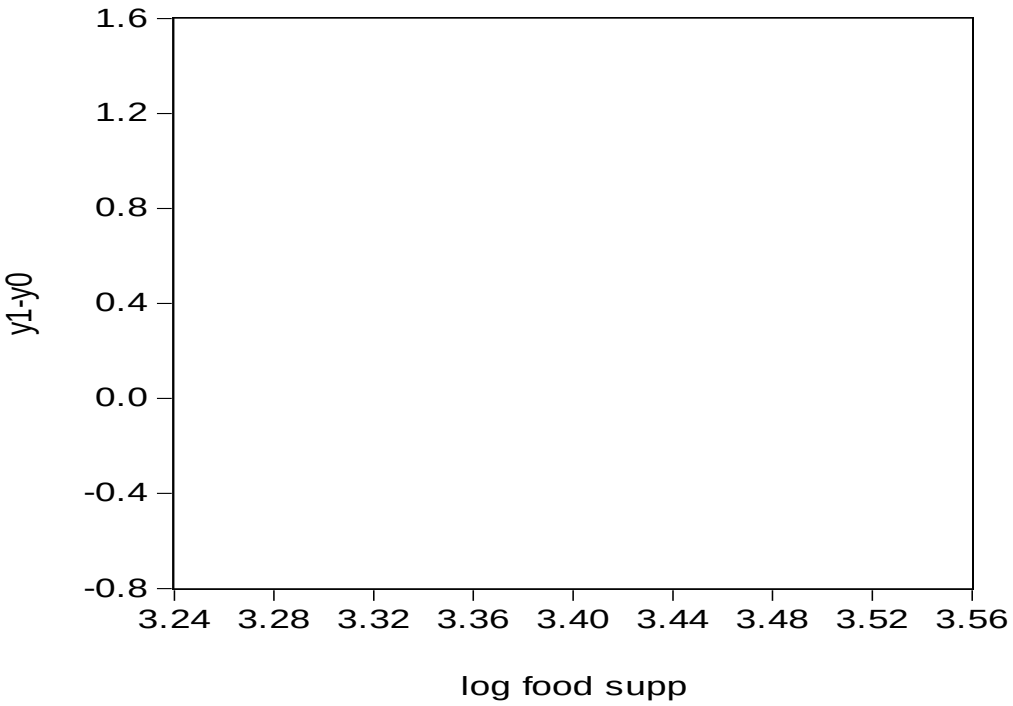

Figure 28. GDP versus log of food supply

6.2 Regression Results and Discussion

The result in Table 1 from model 2 shows the impact of the determinants of food supply proxy for food security. All of the variables except those for food import are significant in explaining food security across the countries studied. The joint p-value and f statistics signify that all the variables jointly explain food supply proxy for food security. Since the model is a log-log model, each coefficient signifies the response of food supply to a 1% change in each of the variables. In the order of importance, land availability has the largest impact on food supply proxy for food security. A 1% increase in arable land size increases food supply by 0.635%. With a 1% increase in water availability, food supply is expected to increase by 0.503%, and a 1% increase in fertilizer will increase food supply by almost 0.141%. The food import dependency ratio has a negative but insignificant long-term impact in regards to food security. This result is surprising, since previous studies found a positive and

Table 1. Determinants of Food supply a proxy for food Security, 1970 – 2007 from model 2

Basic Model: OLS Regression	
Variables	Regression Coefficients
(fertilizer)	0.140767** (0.0212)
(Water Availability)	0.502590*** (0.0000)
(Land Availability)	0.635342*** (0.0000)
(Food Import)	-0.172071 (0.1099)
Constant	3.911285*** (0.0000)
R^2	0.639350

H_o: All the included variables jointly explain food security
P-value: 0.0000
F-statistics: 44.76250
Notes: Food security using food supply as a proxy is the dependent variable, also all variables are in log form and p values in parenthesis with *** p<0.01, ** p<0.05, * p<0.1

significant relationship between food security and the food import dependency ratio[7].

The only explanation for this surprising result could be that previous studies considered this impact for a short time span, whilst in this study we have considered the impact over a long time span. Therefore in the short run, the food import dependency ratio may be helpful in ensuring food security, but in the long run this is not the case. Also countries that are highly food import dependent are likely to be more affected during periods of global food scarcity with high fluctuations in food prices.

[7] Stephen Scanlan (2001) found a positive relationship between food security and the food import dependency ratio

Since the F-statistics and P-value of the regression suggest that all the variables jointly affect food security, these variables will be considered as instruments for the TSLS to rule out the possibility of endogeneity between the GDP growth rate and food security. Furthermore Hansen's J statistics test was carried out to ensure the validity of these instruments.

Tables 2 to 4 show several results of the growth model with different measures for human capital. Table 2 below presents the regression results with different measures for human capital with the SSA2 dummy. Column 1 of the table shows that there is a positive relationship between economic growth and the three major variables, namely investment, life expectancy and food availability, while the initial gross domestic product, the population growth rate and the inflation rate all have a negative impact on the economic growth rate. This result is in line with the researcher's prior expectation. Except for the inflation rate, all coefficient estimates in the ordinary with the least square with a robust standard error model in column 1 of Table 2, are significant at the 5% level. For this study, food availability measure is the main focus and it has a positive and significant impact on economic growth within all the 124 studied countries, with a 1% increase in food availability leading to a 0.57% rise in economic growth. Column 2 of Table 2 introduces the SSA2 dummy, which attempts to identify if there is a growth difference between SSA2 and the ROW countries.

Table 2. Determinants of Cross Section Growth, 1970-2007.OLS regression using alternative measures of human capital and the SSA2 dummy from model 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
y_0	-0.290***	-0.316***	-0.414***	-0.203***	-0.246***	-0.270***	-0.316***	-0.328***	-0.442***
	(0.0710)	(0.0673)	(0.0565)	(0.0530)	(0.0529)	(0.0527)	(0.0774)	(0.0731)	(0.0605)
n_i	-0.203***	-0.224***	-0.159**	-0.280***	-0.285***	-0.277***	-0.189***	-0.213***	-0.129**
	(0.0573)	(0.0608)	(0.0658)	(0.0562)	(0.0567)	(0.0583)	(0.0559)	(0.0569)	(0.0613)
leb_0	1.301***	0.997*	1.971***						
	(0.495)	(0.535)	0.543)						
S_i	1.044***	0.897***	0.723***	1.029***	0.914***	0.722**	0.799***	0.740***	0.366
	(0.220)	(0.196)	(0.236)	(0.236)	(0.212)	(0.285)	(0.258)	(0.238)	(0.253)
f_i	0.0571***	0.0530**	0.0529**	0.0626***	0.0571***	0.0582***	0.0476**	0.0466**	0.0380*
	(0.0216)	(0.0206)	(0.0203)	(0.0221)	(0.0212)	(0.0211)	(0.0217)	(0.0210)	(0.0202)
π_i	-0.0656	-0.0679	-0.0902**	-0.107**	-0.0961**	-0.127***	-0.103*	-0.0965*	-0.135***
	(0.0490)	(0.0478)	(0.0408)	(0.0489)	(0.0471)	(0.0405)	(0.0530)	(0.0515)	(0.0344)
ssa_2		-0.192**	3.059*		-0.197***	-1.239		-0.164**	-4.173***
		(0.0741)	(1.623)		(0.0704)	(1.707)		(0.0749)	(1.373)
ssa2* f_i			0.233*			0.188			0.301**
			(0.131)			(0.151)			(0.129)
ssa2*S_i			0.711**			0.584			1.298***
			(0.336)			(0.387)			(0.384)
ssa2*n_i			-0.161			-0.439			-0.922
			(0.532)			(0.683)			(0.660)
ssa2* y_0			0.0850			0.0290			0.161*
			(0.0914)			(0.122)			(0.0888)
ssa2* leb_0			-4.284***						
			(1.014)						

Table 3. Continued. Determinants of Cross Section Growth, 1970-2007.OLS regression using alternative measures of human capital and the SSA2 dummy from model 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ssa2* π_i			0.0593			0.164			0.190**
			(0.100)			(0.122)			(0.0794)
P_e				0.465***	0.283	0.672***			
				(0.171)	(0.180)	(0.234)			
ssa2* P_e						-0.965***			
						(0.293)			
S_e							0.428***	0.326**	0.686***
							(0.129)	(0.137)	(0.116)
ssa2*S_e									-1.288***
									(0.207)
Constant	-2.872***	-1.975**	-3.098***	-1.789***	-1.052**	-1.465***	-0.744	-0.424	-0.0119
	(0.643)	(0.799)	(0.892)	(0.369)	(0.440)	(0.492)	(0.490)	(0.458)	(0.452)
R^2	0.496	0.534	0.607	0.482	0.520	0.550	0.517	0.543	0.646
No of countries	124	124	124	124	124	124	124	124	124

Notes: all variables are in log form and robust standard error in parenthesis with *** p<0.01, ** p<0.05, * p<0.1

This result suggests that the dummy is negative and significant[8] and furthermore that, all the variables except for inflation being significant at the 5% level, food availability is positive and significant. Column 3 of Table 2 shows the fully unrestricted specification with interaction between the SSA2 dummy and all the previously included dimensions. The result indicates that SSA2 slope terms differ in three dimensions, namely life expectancy, investment and food availability. The food security interaction term is positive and significant, suggesting that SSA2 countries with food insecurity over the last decade could have done better in terms of economic growth if they would have had access to sufficient food.

Columns 4 to 6 of table 2 above show the effect of adding average primary school enrolment as a measure for human capital instead of life expectancy. The result in column 4 of the table suggests that all variables have expected signs and are significant at the 5% level, with food availability having an estimated 6.2% increase impact on economic growth. Column 5 shows that all the variables except primary school enrolment are significant at the 5% level. The SSA2 dummy is negative and significant just as obtained in column 3 and a 1% increase in food availability will increase economic growth by 5.7% within all of the countries studied. Column 6 presents the fully unrestricted form of the model and the result suggests that the SSA2 slope terms differ from the rest of the world and other African countries in regards to one dimension -primary school enrolment. A 1% increase in average

[8] Different authors have different interpretations for significant African dummies. Some believe that this dummy is significant only because of omitted variables, while others believe that it is negative, because African countries are disadvantaged in terms of location. Since there is a significant amount of literature available on this issue, this study did not consider either view. Instead, it focuses on the major theme of the study.

primary school enrolment over the studied period increases economic growth by about 0.672% for all other countries, but decreases economic growth within African countries with food insufficiency by about 0.293%. This result implies that African countries with food insecurity do not benefit from primary enrolment as it occurs in the rest of world, and this may be due to the fact that a year of schooling within this region produces fewer productive skills than a year of schooling in other regions (Glewwe et al, 2007).

Columns 7 to 9 of table 2 show the effect of adding average secondary school enrolment as a measure for human capital. The result in these columns appears to suggest that the impact of average secondary school enrolment over the studied period on economic growth is not so different from the aforementioned. The only difference is that secondary school enrolment has a positive and significant impact on economic growth for all of the results reported in the three columns. This result implies that secondary school enrolment has a more significant impact on economic growth than primary school enrolment and this is similar to the findings of Webber (2002), except that Webber's result suggests an insignificant impact for all three measures of education when considered in the light of economic growth. Column 9 presents the fully unrestricted regression result and the result suggests that African countries with food insecurity differ from the rest of the world in five dimensions, namely food availability, initial real GDP levels, investment, inflation rate and secondary school enrolment. Food availability is still significant at the 5% level for all countries and it does contribute to growth differentials for African countries with food-insecurity.

Table 4. Determinants of Cross-Section Growth, 1970-2007.OLS regression using alternative measures of human capital and the SSA dummy from model 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
y_0	-0.290***	-0.300***	-0.320***	-0.203***	-0.262***	-0.258***	-0.316***	-0.321***	-0.348***
	(0.0710)	(0.0646)	(0.0608)	(0.0530)	(0.0513)	(0.0524)	(0.0774)	(0.0722)	(0.0703)
n_i	-0.203***	-0.180***	-0.120**	-0.280***	-0.214***	-0.169***	-0.189***	-0.169***	-0.0715
	(0.0573)	(0.0541)	(0.0598)	(0.0562)	(0.0544)	(0.0536)	(0.0559)	(0.0544)	(0.0618)
leb_0	1.301***	0.621	0.970						
	(0.495)	(0.578)	(0.804)						
s_i	1.044***	0.934***	0.620**	1.029***	0.920***	0.644**	0.799***	0.792***	0.413
	(0.220)	(0.192)	(0.288)	(0.236)	(0.211)	(0.318)	(0.258)	(0.240)	(0.316)
f_i	0.0571***	0.0502**	0.0452**	0.0626***	0.0524**	0.0510**	0.0476**	0.0450**	0.0418*
	(0.0216)	(0.0206)	(0.0216)	(0.0221)	(0.0209)	(0.0223)	(0.0217)	(0.0207)	(0.0216)
π_i	-0.0656	-0.0919*	-0.125***	-0.107**	-0.112**	-0.151***	-0.103*	-0.110**	-0.150***
	(0.0490)	(0.0483)	(0.0452)	(0.0489)	(0.0494)	(0.0413)	(0.0530)	(0.0520)	(0.0379)
ssa		-0.221***	-0.430		-0.232***	0.204		-0.202***	-1.104
		(0.0723)	(1.692)		(0.0626)	(1.374)		(0.0652)	(0.945)
ssa*S_i			0.543			0.602			0.799*
			(0.386)			(0.412)			(0.414)
ssa*n_i			-0.818***			-0.849***			-0.832**
			(0.292)			(0.309)			(0.338)
ssa*f_i			0.0660			0.0643			0.0645
			(0.0632)			(0.0638)			(0.0671)
ssa*y_0			0.0106			0.00996			0.00995
			(0.0147)			(0.0151)			(0.0151)
ssa*leb_o			-0.607						
			(0.898)						
ssa*π_i			0.105			0.128			0.123
			(0.116)			(0.112)			(0.114)
P_e				0.465***	0.215	0.757			
				(0.171)	(0.174)	(0.518)			
ssa*P_e						-0.892			
						(0.545)			

Table 5. Continued Determinants of Cross-Section Growth, 1970-2007.OLS regression using alternative measures of human capital and the SSA dummy from model 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
S_e							0.428***	0.246*	0.486**
							(0.129)	(0.147)	(0.196)
ssa*S_e									-0.452**
									(0.193)
Constant	-2.872***	-1.335	-1.373	-1.789***	-0.774*	-1.452	-0.744	-0.324	-0.0681
	(0.643)	(0.908)	(1.443)	(0.369)	(0.438)	(1.177)	(0.490)	(0.461)	(0.593)
R^2	0.496	0.562	0.602	0.482	0.559	0.604	0.517	0.571	0.618
No of countries	124	124	124	124	124	124	124	124	124

Notes: all variables are in log form and robust standard error in parenthesis with *** p<0.01, ** p<0.05, * p<0.1

Table 3 above presents the result for different measures for human capital with the SSA dummy. Columns 1 to 3 present the regression result with life expectancy as a measure for human capital and the results suggest that the SSA dummy is negative and significant. Similarly, all variables except life expectancy and inflation rate are significant at the 5% level and the fully unrestricted specification reveals that the SSA slope terms differ from the rest of the world only in one dimension, namely the population growth rate, and this is similar to existing findings in literature (Bloom and Sachs 1998, Block 2000, Hoeffler 2002).

Columns 4 to 6 of table 3 present the regression results in regards to primary schools as a measure for human capital and the result in column 4 suggests that all the explanatory variables are significant at the 5% level. In column 5, all variables except for the primary school are significant at 5% with the SSA dummy being negative and statistically significant with regard to explaining economic growth. Column 6 reports that the SSA dummy is no longer significant in explaining the slope differential between African countries and the rest of the world, but instead the slope differential is due to population growth as found in column 3 of table 3.

Columns 7 to 9 of table 3 report the impact of average secondary school enrolment, over the studied period, on economic growth. The result suggests that average secondary school enrolment enhances economic growth within all the studied countries and the result is not so different from the aforementioned. The only difference is that secondary school enrolment has a positive and significant impact on economic growth for all of the results reported in the three columns. This result implies that secondary school enrolment has a more significant impact on economic growth than primary school enrolment and this is similar to the findings of Webber.

Food availability is still significant at the 5% level for all countries; the only difference now is that it is not significant in explaining growth differences between SSA and ROW countries.

It is obvious from tables 2 and 3 that combing all African countries does not provide a true picture of the cause for growth differentials between Africa and the rest of the world. Instead, the cause of growth differentials between food secure and insecure African countries clearly differs. While population growth appears to be the sole growth differential between all African countries and the rest of the world, food availability and asset in physical and human capital has stood out as the reason for growth differentials between SSA2 countries and ROW countries. Investment in physical capital has more gain in SSA2 countries than ROW countries. This result clearly supports the major bedrock of the Solow model - that return to capital will be much higher within regions with a lower initial capital stock. On the other hand, investment in human capital has a negative significant differential impact on economic growth within SSA2 countries and the ROW countries. As puzzling as this may seem, the only reason this might be true may be in terms of quality of capital. Low quality of both education and health may have contributed to this negative relationship. Block (2001) reports similar findings based on the differential impact of initial life expectancy as a measure for investment in human capital. Although Block's study did not find a significant negative impact on initial life expectancy as a reason for growth differentials between Africa and the rest of the world, it suffices to mention this finding. Similarly, the negative relationship between economic growth and school enrolment, which is a proxy for human capital within these African countries, is not totally new, although there are studies that argue that education has a positive impact on economic growth. Krueger and Lindahl (2000), using cross-

country analysis and years of schooling as a proxy for human capital, argue that there is a possibility that education might not contribute to economic growth as one would expect, especially when unemployment rates are rising with an increase in education and where the return to physical capital is higher than the return to human capital. Gyimah-Brempong (2010), on the other hand, suggests that human capital using educational attainment as a proxy has a positive and significant impact on economic growth within all 52 African countries that were analysed. As different as these findings may seem, one thing that is certain is that there is a form of relationship between education and economic growth, despite the difference in methodology or approach. This study has reconfirmed this.

Another finding that stood out in this research is the positive relationship between food availability and economic growth for food insecure African countries (SSA2). Although this may appear interesting, it is possible that this result has emerged due to an endogeneity issue, which we do not intend to ignore in this study. Moreover, education might also be both a cause and a consequence of economic growth. It is therefore logical to anticipate the existence of bias in the coefficients for both food availability and education proxies.

Table 6. TSLS using alternative measures for human capital and the SSA2 dummy from model 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
y_0	-0.288***	-0.315***	-0.338***	-0.252***	-0.219***	-0.385***	-0.517***	-0.502***	-0.605***
	(0.0686)	(0.0642)	(0.0506)	(0.0835)	(0.0631)	(0.111)	(0.132)	(0.138)	(0.105)
f_i	0.0702*	0.0587*	0.0638*	0.0599	0.0733	0.0141	0.0182	0.0201	0.0103
	(0.0378)	(0.0339)	(0.0346)	(0.0441)	(0.0468)	(0.0501)	(0.0328)	(0.0329)	(0.0261)
n_i	-0.203***	-0.224***	-0.219***	-0.257***	-0.303***	-0.183***	-0.0427	-0.0633	0.00900
	(0.0560)	(0.0587)	(0.0601)	(0.0605)	(0.0747)	(0.0963)	(0.0934)	(0.112)	(0.113)
leb_0	1.282***	0.990*	1.100**						
	(0.490)	(0.522)	(0.456)						
s_i	1.043***	0.897***	0.829***	0.710	1.129**	0.348	0.192	0.229	-0.126
	(0.216)	(0.191)	(0.231)	(0.547)	(0.541)	(0.878)	(0.405)	(0.404)	(0.370)
π_i	-0.0684	-0.0692	-0.0992**	-0.139**	-0.0706	-0.2111***	-0.125*	-0.121*	-0.157***
	(0.0479)	(0.0465)	(0.0399)	(0.0674)	(0.0741)	(0.0762)	(0.0669)	(0.0662)	(0.0383)
ssa_2		-0.191***	-1.790		-0.255	2.307		-0.0487	-4.740***
		(0.0708)	(1.979)		(0.175)	(3.559)		(0.136)	(1.338)
ssa_2*s_i			0.243			1.654*			1.790***
			(0.379)			(0.905)			(0.463)
ssa_2*n_i			-0.550			-0.533			-1.060*
			(0.777)			(0.652)			(0.637)
ssa_2*y_0			0.0640			0.790			0.232**
			(0.143)			(0.125)			(0.0949)
ssa_2*f_i			0.0947			0.232			0.329***
			(0.176)			(0.151)			(0.124)
$ssa_2*\pi_i$			0.115			0.249*			0.212***
			(0.130)			(0.132)			(0.0778)
P_e			1.156	-0.321	3.652				
			(1.055)	(1.445)	(2.407)				
ssa_2*P_e					-3.945				
					(2.413)				

Table 4. Continued TSLS using alternative measures for human capital and the SSA2 dummy from model 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
S_e							1.016***	0.933**	1.251***
							(0.333)	(0.432)	(0.365)
$ssa_2 * S_e$									-1.853***
									(0.401)
Constant	-2.978***	-2.025***	-2.065***	-2.493***	-0.430	-0.928	0.102	0.125	0.555
	(0.632)	(0.765)	(0.798)	(0.909)	(1.790)	(1.744)	(0.711)	(0.585)	(0.467)
R^2	0.495	0.534	0.545	0.425	0.478	0.524	0.401	0.434	0.580
Hen- J	8.73824	6.90103	8.9564	8.94681	9.33036	3.69084	2.02919	2.12073	0.809437
No of countries	124	124	124	124	124	124	124	124	124

Notes: all variables are in log form and robust standard error in parenthesis with *** p<0.01, ** p<0.05, * p<0.1

Table 5. TSLS using alternative measures for human capital and the SSA dummy from model 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
y_0	-0.288***	-0.301***	-0.323***	-0.252***	-0.230***	-0.278***	-0.517***	-0.487***	-0.570***
	(0.0686)	(0.0620)	(0.0582)	(0.0835)	(0.0637)	(0.0501)	(0.132)	(0.137)	(0.165)
f_i	0.0702	0.0475	0.0335	0.0599	0.0561	0.0483	0.0182	0.0167	0.00727
	(0.0378)	(0.0320)	(0.0312)	(0.0441)	(0.0411)	(0.0323)	(0.0328)	(0.0301)	(0.0305)
leb_0	1.282***	0.624	0.980						
	(0.490)	(0.561)	(0.766)						
n_i	-0.203***	-0.180***	-0.120**	-0.257***	-0.219***	-0.158***	-0.0427	-0.0577	0.149
	(0.0560)	(0.0523)	(0.0565)	(0.0605)	(0.0572)	(0.0537)	(0.0934)	(0.0939)	(0.180)
S_i	1.043***	0.934***	0.618**	0.710	1.190**	0.515*	0.192	0.287	-0.253
	(0.216)	(0.186)	(0.266)	(0.547)	(0.554)	(0.310)	(0.405)	(0.427)	(0.513)
π_i	- 0.0684	-0.0914*	-0.122***	-0.139**	-0.0843	-0.171***	-0.125*	-0.124*	-0.172***
	(0.0479)	(0.0473)	(0.0442)	(0.0674)	(0.0688)	(0.0419)	(0.0669)	(0.0635)	(0.0416)
ssa		-0.221***	-0.539		-0.289*	2.498		-0.0921	-0.750
		(0.0698)	(1.570)		(0.149)	(3.976)		(0.111)	(1.059)
P_e				1.156	-0.494	2.032			
				(1.055)	(1.431)	(1.975)			
ssa*f_i			0.0776			0.0660			0.0737
			(0.0652)			(0.0666)			(0.0723)
ssa*S_i			0.546			0.744**			1.489***
			(0.360)			(0.379)			(0.574)
ssa*n_i			-0.815***			-0.842***			-0.814**
			(0.276)			(0.297)			(0.373)
ssa*y_0			0.0106			0.00977			0.0113
			(0.0139)			(0.0143)			(0.0154)
ssa*Leb_0			-0.615						
			(0.852)						

Table 5. Continued TSLS using alternative measures for human capital and the SSA dummy from model 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ssa*π_i			0.102			0.150			0.160
			(0.110)			(0.106)			(0.129)
ssa*P_e						-2.157			
						(1.955)			
S_e							1.016***	0.839*	1.529**
							(0.333)	(0.449)	(0.774)
ssa*S_e									-1.326**
									(0.658)
Constant	-2.978***	-1.309	-1.264	-2.493***	0.0975	-3.716	0.102	0.208	0.142
	(0.632)	(0.897)	(1.330)	(0.909)	(1.824)	(3.924)	(0.711)	(0.567)	(0.517)
R^2	0.495	0.562	0.601	0.425	0.504	0.571	0.401	0.473	0.491
Hen-j	8.73824	5.28702	7.05883	8.94681	6.70971	7.02965	2.02919	2.27484	2.03748
No of countries	124	124	124	124	124	124	124	124	124

Notes: all variables are in log form and robust standard error in parenthesis with *** p<0.01, ** p<0.05, * p<0.1

To tackle this issue of endogeneity, two stages least square (TSLS) was carried out and tables 4 and 5 in the above report the findings of the regression. Both tables show that the OLS coefficients do not differ significantly from the coefficients obtained from the two stage regressions. The same deduction can be made from all the results. If endogeneity was present, then the majority of the coefficients would move in the same direction (Webber 2002). In this case the majority of coefficients have an almost identical size to those obtained from the OLS regression, suggesting that endogeneity is not a problem in this study. Also, the Hansen's J statistics are not within the rejection region of the chi square in most cases, implying that the instruments are valid. Although the t-statistics were, in most cases, significantly smaller than those obtained from the OLS, this is usually the case in two-stage least square estimation, yet we can generally assume that this might be due to multicollinearity between the endogenous variables and the valid instruments.

6.3 Ramsey Reset test Result

Results of the Ramsey reset test as seen in Appendix A. It suggest that the fitted values of the explained variables are not significant in explaining economic growth; the joint f -values in each of the regression result suggest this. Therefore, there is no misspecification in the linear growth model used in the study.

Chapter 7

CHILD MORTALITY RESULTS AND DISCUSSION

7.1 Fixed Effect Regression Results

Tables 6, 7, 8, 9, 10 and 11 summarized the findings of the determinants of child mortality using fixed effect model on panel data for periods 1995-2009. The Hausman test favours the use of fixed effect over random effect; the result of the Hausman test is summarized in table 12. Since the null hypothesis cannot be rejected with a p-value of zero, the Hausman test posits that the fixed effect estimator is appropriate for the data sets[9].

Tables 6 and 7 below summarized the findings of the determinants of child mortality within 114 countries that were considered in this study. Column 1 on table 6 revealed the determinants of infant mortality for all the countries that were considered in the study; the result from this column suggests that food availability has a significant negative impact on infant mortality. Also, the result shows that sanitation, and measles vaccination also has negative impacts on infant mortality. This result implies that increasing each of these variables ensures a reduction in child mortality within all the studied countries. Column 2 on

[9] The Panel unit root test was performed on all the data set used to estimate the determinants of child mortality and the result of the unit root suggests that all the data sets are stationary. The Panel unit root result is reported in appendix B.

Table 6. Fixed Effect Estimate on the Panel data from model 3 Dependent variable: Infant Mortality Rate

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	IMR	IMR	IMR	IMR	IMR	IMR
femaleprim	3.05e-08***	2.34e-08**	2.92e-08***	2.28e-08**	2.97e-08***	2.49e-08***
	(1.04E-08)	(9.04E-09)	(9.92E-09)	(8.79E-09)	(9.85E-09)	(8.36E-09)
percapitaheal	0.000543	0.000328				
	(0.00042)	(0.00039)				
safewater	-0.149	-0.135	-0.143	-0.133	-0.111	-0.105
	(0.185)	(0.16)	(0.176)	(0.156)	(0.179)	(0.156)
sanitation	-0.961***	-0.898***	-0.684***	-0.722***	-0.937***	-0.880***
	(0.168)	(0.154)	(0.174)	(0.164)	(0.157)	(0.147)
vaccinationmeasles	-0.122*		-0.115*		-0.0756	
	(0.0719)		(0.0612)		(0.0778)	
foodpercapita	-0.0260***	-0.0210***	-0.0181***	-0.0164***	-0.0231***	-0.0191***
	(0.00533)	(0.00439)	(0.00511)	(0.00481)	(0.0047)	(0.00408)
loggdp			-33.38**	-21.13**		
			(13.25)	(8.914)		
shareofhealth					-2.482**	-1.953**
					(1.025)	(0.837)
vaccinationdpt		-0.219***		-0.213***		-0.188***
		(0.0525)		(0.0527)		(0.0547)
Constant	195.6***	184.9***	295.4***	249.3***	188.0***	180.3***
	(18.31)	(16.62)	(46.63)	(29.64)	(15.44)	(14.63)
Observations	1,603	1,599	1,603	1,599	1,588	1,584
R-squared	0.508	0.554	0.544	0.568	0.542	0.578
Number of country	114	114	114	114	113	113

Note: Robust Standard errors in parenthesis *** p<0.01, ** p<0.05, * p<0.1

This result implies that increasing each of these variables ensures a reduction in child mortality within all the studied countries. Column 2 on table 6 reports that DPT [10]Vaccines are important determinants of child mortality aside from food availability, sanitation, and measles vaccines within all the studied countries.

From column 3 of table 6 income, measured in log GDP, also has a negative significant impact on child mortality. Columns 4, 5 and 6 revealed that sanitation, both forms of vaccination, food availability per capita, share of health and log of GDP are important determinants of child mortality within all the studied countries.

Using fixed effect estimates, Table 7 below reports the determinants of under-five mortality rates within all the studied countries. The results on table 7 are quite similar to the results on Table 6 except that for under-five mortality rate, income seems not to be significant while every other variable obtained for infant mortality has negative significant impact on under-five mortality within all the studied countries. The results from Tables 6 and 7 are similar to findings from several studies such as Charmarbagwala et al, (2004). Using a meta-analysis found that income/expenditure or proxy variables have significant negative impact on infant mortality; also Wang (2002), using ordinary least square and weighted least square approach found that income, and share of health expenditure both have a significant negative impact on infant and child mortality at the national level and within the urban areas of the studied countries. Furthermore, findings of Van der Klaauw and Wang (2004), using a flexible parametric framework of hazard rate models on child and infant mortality for India were similar to this work. The authors found a strong negative relationship

[10] DPT vaccine refers to vaccines against three infectious diseases in human- diphtheria, Pertussis also known as Whooping cough and Tetanus.

between child mortality and both socio-economic and environmental characteristics; the study predicts that most under-five mortality can be prevented if there is sufficient access to sanitation facilities.

This study further explores the determinants of child mortality within all the African countries that were included in the study. Data from 37 African countries was examined and the results of the findings using fixed effect estimates are reported in tables 8 and 9 below. Table 8 reports the determinants of infant mortality while table 9 reports the determinants of the under-five mortality rate within the 37 African countries. Results in table 8 posit that for all African countries included within the study the important determinants of infant mortality are safe water, sanitation and income.

Table 9 reports the important determinants of the under-five mortality rate within Africa as a continent. The result on table 9 suggests that safe water and share of public health in GDP are the most important determinants of child mortality; ironically food security appears to be insignificant in all cases. This result suggest that for all African countries food security does not impact on under-five mortality although it does impact under-five mortality within all the 114 countries that were considered on table 7.

Table 7. Fixed Effect Estimate on the Panel data from model 4 Dependent variable: Under- Five Mortality Rate

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	u5mr	u5mr	u5mr	u5mr	u5mr	u5mr
femaleprim	1.72E-08	3.42e-08*	3.21e-08*	2.00E-08	1.65E-08	3.20E-08
	(1.75E-08)	(1.98E-08)	(1.87E-08)	(1.60E-08)	(1.73E-08)	(1.95E-08)
percapitaheal	0.00167**	0.00213**				
	(0.0008)	(0.00089)				
safewater	-0.319	-0.34	-0.267	-0.261	-0.316	-0.331
	(0.291)	(0.339)	(0.33)	(0.285)	(0.289)	(0.332)
sanitation	-1.290***	-1.427***	-1.381***	-1.254***	-1.130***	-1.091***
	(0.309)	(0.326)	(0.307)	(0.294)	(0.326)	(0.343)
vaccinationmeasles		-0.283**	-0.189			-0.267**
		(0.129)	(0.135)			(0.118)
foodpercapita	-0.0396***	-0.0497***	-0.0435***	-0.0351***	-0.0345***	-0.0392***
	(0.00976)	(0.0116)	(0.0105)	(0.00905)	(0.011)	(0.0122)
loggdp					-18.87	-40.28
					(16.88)	(24.55)
shareofhealth			-4.700**	-3.778**		
			(1.823)	(1.589)		
vaccinationdpt	-0.491***			-0.430***	-0.485***	
	(0.114)			(0.116)	(0.115)	
Constant	317.3***	337.8***	321.7***	306.7***	372.8***	456.0***
	(36.09)	(39.27)	(33.87)	(32)	(52.65)	(83.49)
Observations	1,599	1,603	1,588	1,584	1,599	1,603
R-squared	0.499	0.452	0.487	0.523	0.5	0.466
Number of country	114	114	113	113	114	114

Note: Robust Standard errors in parenthesis *** p<0.01, ** p<0.05, * p<0.

The findings on tables 8 and 9 are similar to the findings of Mutunga, (2007) - using a hazard rate framework, the study suggests that for Kenya both environmental and socio-economic variables are important determinants of infant and child mortality. Also a similar study carried out on three sub-Saharan African countries: Senegal, Uganda and Rwanda, found that a mother's level of education, and socio-economic variables are important determinants of child mortality within these three countries that were studied Kazembe et al, 2012.

Results in table 10 and 11 report the findings of the determinants of infant and under-five mortality within 17 food insecure African countries; results in table 10 revealed that important determinants of infant mortality within food insecure African countries include: access to safe water, share of health, female primary school education and food availability, each of these variables have a significant impact on infant mortality within the 17 food insecure African countries that were considered in the study. Results reported in table 10 suggest that increasing access to safe water ensures a decrease in infant mortality, likewise an increase in the share of public health in GDP and food availability ensures a decrease in infant mortality within the 17 food insecure African countries. This result differs from the determinants of infant mortality within the 37 African countries reported in table 8, in that only the environmental factors and income seems to matter for all the African countries while for African countries with food insecurity, food availability also impacts on infant mortality as well as female primary education and environmental and policy variables and the share of public health in GDP.

Table 8. Fixed Effect Estimate on the Panel data from SSA countries using model 3 Dependent variable: Infant Mortality Rate

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	IMR	IMR	IMR	IMR	IMR	IMR
percapitaheal	0.0104	0.00928				
	(-0.0141)	(-0.0137)				
femaleprim	5.64E-09	1.05E-08	2.21E-08	2.54E-08	1.01E-08	1.20E-08
	(-3.01E-08)	(2.97E-08)	(-2.48E-08)	(2.47E-08)	(2.88E-08)	(2.89E-08)
safewater	-1.417***	-1.291***	-1.267***	-1.186***	-1.339***	-1.269***
	(0.406)	(0.383)	(0.359)	(0.348)	(0.403)	(0.389)
sanitation	-1.084*	-1.047*	-0.694	-0.739	-0.625	-0.901*
	(0.582)	(0.585)	(0.43)	(0.44)	(0.5)	(0.525)
vaccinationmeasles	0.0647		0.121		0.0344	
	(0.137)		(0.127)		(0.103)	
foodpercapita	-0.0202	-0.0154	-0.0198	-0.0155	-0.014	-0.0149
	(0.0123)	(0.0124)	(0.0122)	(0.0123)	(0.0117	(0.0122)
shareofhealth			-3.734**	-2.872**		
			(1.419)	(1.227)		
loggdp					-36.78*	-5.153
					(20.64)	(19.27)
vaccinationdpt		-0.0395		-0.00286		-0.0397
		(0.0765)		(0.0707)		(0.0761)
Constant	253.8***	239.7***	234.8***	227.0***	363.8***	253.1***
	(29.2)	(27.04)	(22.22)	(21.73)	(75.56)	(66.21)
Observations	507	503	507	503	507	503
R-squared	0.646	0.664	0.688	0.692	0.667	0.663
Number of country	37	37	37	37	37	37

Note: Robust Standard errors in parenthesis *** p<0.01, ** p<0.05, * p<0.1

Table 9. Fixed Effect Estimate on the Panel data from SSA Countries using model 4 Dependent variable: Under- Five Mortality Rate

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	u5mr	u5mr	u5mr	u5mr	u5mr	u5mr
percapitaheal	0.0399	0.0425				
	(0.0287)	-0.0294				
femaleprim	-3.28E-08	-3.57E-08	8.86E-10	-1.24E-09	-2.75E-08	-2.64E-08
	(6.54E-08)	(6.50E-08)	(5.48E-08)	(5.52E-08)	(6.40E-08)	(6.30E-08)
safewater	-2.526***	-2.737***	-2.269***	-2.413***	-2.453***	-2.595***
	(0.682)	(0.709)	(0.651)	(0.664)	(0.709)	(0.725)
sanitation	-2.14	-2.220*	-1.288	-1.239	-1.838	-1.373
	(1.318)	(1.302)	(0.989)	(0.963)	(1.192)	(1.12)
vaccinationmeasles		0.0122		0.125		-0.0161
		(0.222)		(0.196)		(0.178)
foodpercapita	-0.0368	-0.0446*	-0.037	-0.0444	-0.0384	-0.0381
	(0.0264)	(0.0262)	(0.0269)	(0.0265)	(0.0278)	(0.0278)
shareofhealth			-5.906**	-7.139***		
			(2.4)	(2.55)		
loggdp					12.35	-42.47
					(41.93)	(39.16)
vaccinationdpt	-0.146		-0.0748		-0.158	
	(0.157)		(0.145)		(0.159)	
Constant	464.6***	489.2***	430.6***	445.2***	409.9***	605.9***
	(60.96)	(62.76)	(52.26)	(52.52)	(135.8)	(135.6)
Observations	503	507	503	507	503	507
R-squared	0.656	0.65	0.677	0.682	0.648	0.649
Number of country	37	37	37	37	37	37

Note: Robust Standard errors in parenthesis *** p<0.01, ** p<0.05, * p<0.1

Table 10. Fixed Effect Estimate on the Panel data from SSA2 countries using model 3 Dependent variable: Infant Mortality Rate

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	IMR	IMR	IMR	IMR	IMR	IMR
Loggdp	-30.38	21.39				
	(23.76)	(14.88)				
femaleprim	-0.113	-0.179*	-0.101	-0.155	-0.142	-0.171**
	(0.12)	(0.0903)	(0.124)	(0.0926)	(0.0943)	(0.0793)
safewater	-2.130***	-1.884***	-2.171***	-1.944***	-1.703***	-1.671***
	(0.614)	(0.582)	(0.597)	(0.586)	(0.493)	(0.503)
sanitation	0.573	0.526	0.637	0.67	0.614	0.674
	(0.605)	(0.366)	(0.526)	(0.438)	(0.445)	(0.397)
vaccinationmeasles	0.183		0.228		0.279	
	(0.151)		(0.176)		(0.166)	
foodpercapita	-0.0248	-0.0305**	-0.0316*	-0.0234	-0.0400**	-0.0291**
	(0.0198)	(0.0143)	(0.0168)	(0.0156)	(0.015)	(0.0134)
percapitaheal			-0.0615	-0.0328		
			(0.0578)	-0.0353		
shareofhealth					-3.894**	-2.465**
					(1.342)	(0.871)
vaccinationdpt		0.0125		0.0353		0.0571
		(0.0954)		(0.102)		(0.095)
Constant	361.9***	189.8***	268.3***	249.8***	265.8***	250.4***
	(90.08)	(59.1)	(35.23)	(30.08)	(30.51)	(26.89)
Observations	227	223	227	223	227	223
R-squared	0.749	0.77	0.736	0.766	0.776	0.787
Number of country	17	17	17	17	17	17

Note: Robust Standard errors in parenthesis *** p<0.01, ** p<0.05, * p<0.1

Table 11. Fixed Effect Estimate on the Panel data from SSA2 Countries using model 4 Dependent variable: Under- Five Mortality Rate

	(1)	(6)	(2)	(3)	(4)	(5)
VARIABLES	u5mr	u5mr	u5mr	u5mr	u5mr	u5mr
loggdp	58.86	-31.66				
	(36.59)	(45.3)				
femaleprim	-0.370**	-0.258	-0.326**	-0.342**	-0.300*	-0.246
	(0.139)	(0.197)	(0.15)	(0.121)	(0.15)	(0.202)
safewater	-3.594***	-4.043***	-3.706***	-3.256***	-3.346***	-4.085***
	(0.849)	(0.941)	(0.889)	(0.778)	(0.804)	(0.936)
sanitation	1.722**	1.795	1.925*	2.041*	1.922*	1.856*
	(0.741)	(1.139)	(0.965)	(0.995)	(1.011)	(1.031)
vaccinationmeasles		0.188			0.321	0.234
		(0.245)			(0.267)	(0.285)
foodpercapita	-0.0930**	-0.0828	-0.0786	-0.0857*	-0.101**	-0.0900*
	(0.0435)	(0.0539)	(0.0466)	(0.0418)	(0.041)	(0.0471)
percapitaheal			-0.0158			-0.0621
			(0.0634)			(0.09)
shareofhealth				-4.329***	-6.290***	
				(1.395)	(2.04)	
vaccinationdpt	-0.0753		-0.0358	0.0155		
	(0.159)		(0.174)	(0.155)		
Constant	340.9***	645.6***	518.4***	512.5***	537.2***	548.6***
	(97)	(153.5)	(85.73)	(74.42)	(76.92)	(91.9)
Observations	223	227	223	223	227	227
R-squared	0.817	0.784	0.804	0.822	0.812	0.78
Number of country	17	17	17	17	17	17

Note: Robust Standard errors in parenthesis *** p<0.01, ** p<0.05, * p<0.1

Table 12. Hausman Test Rest

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	u5mr	u5mr	u5mr	IMR	IMR	IMR
loggdp	0.51					0.784
	-3.92					-2.079
femaleprim	-0.295***	5.63E-08	5.11E-08	4.63E-08	4.47E-08	-0.139***
	(0.0719)	(1.21E-07)	(1.51E-07)	(7.52E-08)	(6.23E-08)	(0.0413)
safewater	-3.619***	-0.187***	-2.227***	-1.169***	-0.0725***	-1.862***
	(0.288)	(0.0379)	(0.19)	(0.0958)	(0.0201)	(0.164)
sanitation	0.988**	-1.135***	-0.522***	-0.354***	-0.770***	0.211
	(0.387)	(0.072)	(0.185)	(0.0968)	(0.038)	(0.218)
vaccinationmeasles	0.233**	-0.269***	0.105	0.112***	-0.114***	0.225***
	(0.0943)	(0.0397)	(0.0749)	(0.0374)	(0.0205)	(0.0543)
foodpercapita	-0.0858***	-0.0378***	-0.0511***	-0.0242***	-0.0210***	-0.0365***
	(0.0128)	(0.00325)	(0.00755)	(0.00384)	(0.0017)	(0.00727)
shareofhealth		-4.284***	-8.230***	-4.218***	-2.339***	
		(0.452)	(0.893)	(0.447)	(0.234)	
Constant	531.5***	287.9***	426.4***	228.3***	170.5***	269.3***
	(25.86)	(7.772)	(14.45)	(7.412)	(4.083)	(14.37)
Observations	227	1,588	507	507	1,588	227
Number of country	17	113	37	37	113	17
Hausman p-value	0.000	0.000	0.000	0.000	0.000	0.000
chi square	32.77	88.74	29.28	30.49	90.6	43.63

Table 11 reports the result of the findings of the determinants of under-five mortality within food insecure African countries; the result in the table suggests that female primary school enrolment, safe water, share of public health in GDP and food availability are important determinants of under-five mortality. This result posits that to ensure a reduction in under-five mortality rates it is imperative to increase food security, female education, access to safe water and public health expenditure. This result differs from the determinants of under-five mortality within all African countries as reported in table 9, important determinants of under-five mortality are just safe water and share of public health in GDP, therefore grouping all African countries together conceals the reality of the determinants of child mortality.

To ensure that the result of the fixed effect is not plagued by heterogeneity and autocorrelation, this study further investigates the determinants of child mortality using SYS-GMM estimate on the dynamic panel data. Tables 13 and 14 summarized the findings from the dynamic panel model for the determinants of child mortality: infant mortality and under-five mortality rates; the SYS-GMM estimator was applied to a panel with annual observations from 1995-2009. The dependent variable is child mortality, infant mortality and under-five mortality rates measures in thousands, the independent variables are per capita health expenditure, access to sanitation, access to safe water, vaccination (measles and DPT); food security proxy by food availability per capita, and female primary school enrolment rate.

Table 13 compared the determinants of infant and under-five mortality rate between all the countries considered in the study and African countries with food insecurity while table 14 compared the determinants of infant and under-five mortality rates between 37 African countries and African countries with food insecurity. Results in

columns 1, 2, 3 and 4 of table. Table 11 reports the result of the findings of the determinants of under-five mortality within food insecure African countries; the result in the table suggests that female primary school enrolment, safe water, share of public health in GDP and food availability are important determinants of under-five mortality. This result posits that to ensure a reduction in under-five mortality rates it is imperative to increase food security, female education, access to safe water and public health expenditure. This result differs from the determinants of under-five mortality within all African countries as reported in table 9, important determinants of under-five mortality are just safe water and share of public health in GDP, therefore grouping all African countries together conceals the reality of the determinants of child mortality.

From tables 13 and 14 it appears that all other variables apart from food availability, vaccinations and access to potable water - such as the policy variables - share of public health in GDP and per capita health expenditure, access to safe water and female enrolment, are not significant for all groups of countries using the SYS-GMM estimates. This could be due to correlation between the explanatory variables which are not obvious in the fixed effect estimates. The result from the SYS-GMM estimates helps confirm the importance of food security on child mortality within food insecure African countries.

Table 13. System GMM Estimate on the Panel Data: Comparing Rest of World Countries with SSA2 Countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	IMR	IMR	IMR	IMR	u5mr	u5mr	u5mr	u5mr
L.IMR	1.774***	1.762***	1.910***	1.904***				
	(0.0475)	(0.0593)	(0.0136)	(0.0148)				
L2.IMR	-0.791***	-0.781***	-0.921***	-0.918***				
	(0.0503)	(0.0605)	(0.0133)	(0.0138)				
L.u5mr					1.038***	1.045***	1.908***	1.909***
					(0.208)	(0.216)	(0.0225)	(0.0213)
L2.u5mr					-0.0857	-0.0956	-0.919***	-0.920***
					(0.201)	(0.205)	(0.0212)	(0.0202)
femaleprim	-5.57E-09	-3.60E-09	-6.82E-05	-0.00146	-1.00E-07	-7.05E-08	-0.00552	-0.00341
	(1.07E-08)	(9.88E-09)	(0.0015)	(0.00183)	(1.27E-07)	(1.05E-07)	(0.00394)	(0.00295)
percapitaheal	1.54E-05	1.81E-05	0.0002	0.000179	0.000126	0.000101	0.000869	0.00121
	(2.12E-05)	(2.13E-05)	(0.00109)	(0.0013)	(0.00011)	(0.00012)	(0.00225)	(0.00204)
safewater	-0.00114	-0.00131	0.00377	0.00557	-0.0170*	-0.0163*	0.00208	-0.00211
	(0.00089)	(0.00123)	(0.00492)	(0.0047)	(0.01)	(0.00957)	(0.00595)	(0.00728)
vaccinationmeasles	-0.00258		-0.00646***			-0.0780**		-0.00941**
	(0.00296)		(0.00202)			(0.0362)		(0.00404)
foodpercapita	-0.000273**	-0.000374**	-0.00031	-0.000324*	-0.00488**	-0.00457**	-0.000670**	-0.000685**
	(0.00012)	(0.00018)	(0.0002)	(0.0002)	(0.00232)	(0.00225)	(0.00031)	(0.00029)
sanitation	-0.00466	-0.00471	0.00157	0.00146	0.0929*	0.0840*	-0.00056	-0.00029
	(0.00568)	(0.00706)	(0.00343)	(0.00418)	(0.0555)	(0.0508)	(0.00872)	(0.00787)
vaccinationdpt		-0.00056		-0.00590***	-0.0676**		-0.00686***	
		(0.00228)		(0.00128)	(0.0311)		(0.00254)	
Constant	1.745**	1.917***	1.613***	1.779**	14.90***	15.60**	3.370***	3.566***
	(0.69)	(0.407)	(0.624)	(0.733)	(5.757)	(6.522)	(1.226)	(1.118)
Observations	1,294	1,292	198	196	1,292	1,294	196	198
Number of country	105	105	17	17	105	105	17	17

Note: Robust Standard errors in parenthesis *** p<0.01, ** p<0.05, * p<0.1

Table 14. System GMM Estimate on the Panel Data: Comparing SSA Countries with SSA2 Countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	IMR	IMR	u5mr	u5mr	IMR	IMR	u5mr	u5mr
L.IMR	1.910***	1.904***			0.975***	0.970***		
	(0.0136)	(0.0148)			(0.0143)	(0.0187)		
L2.IMR	-0.921***	-0.918***						
	(0.0133)	(0.0138)						
L.u5mr			1.908***	1.909***			0.959***	0.967***
			(0.0225)	(0.0213)			(0.0139)	(0.0113)
L2.u5mr			-0.919***	-0.920***				
			(0.0212)	(0.0202)				
femaleprim	-6.82E-05	-0.00146	-0.00552	-0.00341	-1.17E-08	-1.83E-08	-3.84E-08	-1.57E-08
	(0.0015)	(0.00183)	(0.00394)	(0.00295)	(1.36E-08)	(1.49E-08)	(3.23E-08)	(2.55E-08)
percapitaheal	0.0002	0.000179	0.000869	0.00121	0.000154	-0.00037	-0.00431	-0.00308
	(0.00109)	(0.0013)	(0.00225)	(0.00204)	(0.00248)	(0.00239)	(0.0043)	(0.00429)
safewater	0.00377	0.00557	0.00208	-0.00211	0.0259	0.0383	0.0899	0.0675
	(0.00492)	(0.0047)	(0.00595)	(0.00728)	(0.0326)	(0.0393)	(0.0885)	(0.0764)
vaccinationmeasles	-0.00646***			-0.00941**	-0.0499***			-0.119***
	(0.00202)			(0.00404)	(0.011)			(0.037)
foodpercapita	-0.00031	-0.000324*	-0.000670**	-0.000685**	-0.00061	-0.00077	-0.00196	-0.00131
	(0.0002)	(0.0002)	(0.00031)	(0.00029)	(0.0008)	(0.0008)	(0.00124)	(0.00114)
sanitation	0.00157	0.00146	-0.00056	-0.00029	0.024	0.0173	0.056	0.0689*
	(0.00343)	(0.00418)	(0.00872)	(0.00787)	(0.0225)	(0.0202)	(0.0379)	(0.041)
vaccinationdpt		-0.00590***	-0.00686***			-0.0455***	-0.111***	
		(0.00128)	(0.00254)			(0.00993)	(0.029)	
Constant	1.613***	1.779**	3.370***	3.566***	2.198	2.142	6.159	4.862
	(0.624)	(0.733)	(1.226)	(1.118)	(3.224)	(3.877)	(5.739)	(4.883)
Observations	198	196	196	198	472	469	469	472
Number of country	17	17	17	17	37	37	37	37

Note: Robust Standard errors in parenthesis *** p<0.01, ** p<0.05, * p<0.1

Results on columns 1, 2, 3, and 4 of table 14 compared the determinants of infant mortality between all African countries and food insecure African countries; the result posits that for infant mortality, vaccinations are the most important determinants for both African countries with food insecurity and all African countries. The impact of the vaccines-measles and DPT is higher within food insecure African countries than compared to all African countries, this result suggests that more infant lives will be saved by ensuring adequate vaccinations within food insecure African countries than will be saved within all African countries. On the other hand results in columns 5, 6, 7 and 8 revealed that food availability and vaccinations-measles and DPT are important determinants of under-five mortality rates within food insecure African countries but food availability is not significant in explaining under-five mortality within all African countries instead only vaccinations- measles and DPT explain under-five mortality within these African countries.

Chapter 8

CONCLUSIONS AND POLICY RECOMMENDATION

8.1 Summary

This paper examined the determinants of economic growth and the factors that cause significant growth differentials in food insecure African countries, African countries in general and the rest of the world. Furthermore, the study considered important determinants of child mortality and if there is a difference in the determinants of child mortality amidst 114 countries, 37 African countries and 17 African countries with food insecurity.

The analysis for the determinants of economic growth was performed using different measures for human capital; life expectancy, primary school enrolment and secondary school enrolment. With these different measures for human capita, food supply per day proxy for food security was positive and significant in explaining economic growth for all the 124 countries in the study. The results posit that countries in Africa that have experienced food insecurity over the last decade could have performed better if they would have had access to sufficient food.

Furthermore, the results from the SYS-GMM estimates and fixed effect estimates of the determinants of child mortality revealed that considering all African countries together concealed the true of picture of the determinants of child mortality-infant and under-five mortality rates. The findings from this study posit that food security

and vaccinations are important policy options path to follow for food insecure African countries to ensure a reduction in child mortality. For rest of the world countries, sanitation, food security and vaccinations are important determinants of child mortality, while for all African countries together only vaccinations stood out as an important determinant of child mortality.

Also, based on the findings of this study, grouping all African countries together neither gives the true picture of the determinants of growth differential between African countries and the rest of the world countries nor the important determinants of child mortality amidst this group of countries. This study shows that for African countries with food insecurity the determinants of growth differential are physical and human capital as well as food security when compared with the rest of the world. On the other hand, when all African countries are considered together, the major determinant of growth differential is the population growth rate.

Findings from this work regarding the determinants of economic growth are similar to those of Barro (1991), Sala-I Martin (1997) and Easterly and Levine (1998), who revealed that the African dummy is negative. For both SSA and SSA2 dummies that were used in this study, it was observed that the African dummies were negative and significant most of the time, but the reason for growth differentials in both cases differed. Therefore, revealing that not all African countries have the same growth pattern or characteristics and should not be treated as if they do.

Also findings from this study regarding the determinants of child mortality are similar to the findings of Wang, 2003, Charmarbagwala et al, 2004, Van der Klaauw and Wang, 2004, among many recent works on child mortality that posit that social,

economic and income factors are important determinants of child mortality. This study further extends that for food insecure African countries increasing food security is another important determining factor of child mortality. Therefore in conclusion, for food insecure African countries ensuring food security not only translates into economic growth but also guarantees a decrease in child mortality.

8.2 Policy Recommendations

The findings from this research show that it would be of countless advantage for African nations with food crises, with famine conditions or near famine conditions, to pursue economic growth and reduction in child mortality via food security. Developed countries and organizations that donate food aid should intensify aid supports to these African countries through domestic food production plans to guarantee domestic food security. Achieve food security in these countries will translate into economic development and reduction of child mortality will be much easier to attain.

Future work would analyse the contribution of the different sources of food availability by comparing domestic food production within food insecure African countries with food aid and food import and their impact on economic growth as well as child mortality, as this would help policy makers and donor countries in choosing the best policy options for these food insecure African countries.

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APPENDICES

Appendix A: Ramsey Reset test Result Table

Ramsey RESET Test
Equation: UNTITLED
Specification: LOGY1_LOGY0 LOG_Y0 LOG_POPULATIO
LOG_INVEST_AVERAGE_ LOG_INFLATION LNFOODAVAI
LOG_SECONDARY C
Omitted Variables: Powers of fitted values from 2 to 3

	Value	Df	Probability
F-statistic	0.810006	(2, 115)	0.4474
Likelihood ratio	1.734605	2	0.4201

F-test summary:

	Sum of Sq.	Df	Mean Squares
Test SSR	0.069921	2	0.034961
Restricted SSR	5.033437	117	0.043021
Unrestricted SSR	4.963516	115	0.043161
Unrestricted SSR	4.963516	115	0.043161

LR test summary:

	Value	Df
Restricted LogL	22.71069	117
Unrestricted LogL	23.57799	115

Unrestricted Test Equation:
Dependent Variable: LOGY1_LOGY0
Method: Least Squares
Date: 10/18/13 Time: 09:48
Sample: 1 124
Included observations: 124

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG_Y0	-0.320570	0.083293	-3.848716	0.0002
LOG_POPULATIO	-0.193945	0.087334	-2.220726	0.0283
LOG_INVEST_AVERAGE_	0.800691	0.250919	3.191031	0.0018
LOG_INFLATION	-0.107221	0.039584	-2.708676	0.0078
LNFOODAVAI	0.045288	0.024362	1.858953	0.0656
LOG_SECONDARY	0.453513	0.127537	3.555937	0.0005
C	-0.714144	0.394178	-1.811731	0.0726
FITTED^2	-0.704995	0.731956	-0.963166	0.3375
FITTED^3	1.002900	0.817551	1.226712	0.2224

R-squared	0.524187	Mean dependent var	0.263167
Adjusted R-squared	0.491087	S.D. dependent var	0.291222
S.E. of regression	0.207752	Akaike info criterion	-0.235129
Sum squared resid	4.963516	Schwarz criterion	-0.030431
Log likelihood	23.57799	Hannan-Quinn criter.	-0.151976
F-statistic	15.83643	Durbin-Watson stat	1.822673
Prob(F-statistic)	0.000000		

Ramsey RESET Test
Equation: UNTITLED
Specification: LOGY1_LOGY0 LOG_Y0 LOG_POPULATIO
LOG_INVEST_AVERAGE_ LOG_INFLATION LNFOODAVAI
LOG_PRIMARY_SKOO C
Omitted Variables: Powers of fitted values from 2 to 3

	Value	df	Probability
F-statistic	2.076717	(2, 115)	0.1300
Likelihood ratio	4.399508	2	0.1108

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.188309	2	0.094155
Restricted SSR	5.402199	117	0.046173
Unrestricted SSR	5.213890	115	0.045338
Unrestricted SSR	5.213890	115	0.045338

LR test summary:

	Value	df
Restricted LogL	18.32710	117
Unrestricted LogL	20.52685	115

Unrestricted Test Equation:
Dependent Variable: LOGY1_LOGY0
Method: Least Squares
Date: 10/18/13 Time: 09:46
Sample: 1 124
Included observations: 124

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG_Y0	-0.235464	0.062310	-3.778925	0.0003
LOG_POPULATIO	-0.355833	0.094805	-3.753318	0.0003
LOG_INVEST_AVERAGE_	1.242428	0.269889	4.603470	0.0000
LOG_INFLATION	-0.123202	0.041187	-2.991311	0.0034
LNFOODAVAI	0.066500	0.025082	2.651310	0.0091
LOG_PRIMARY_SKOO	0.489938	0.194095	2.524216	0.0130
C	-1.940800	0.460773	-4.212053	0.0001
FITTED^2	-1.422448	0.726242	-1.958641	0.0526
FITTED^3	1.571698	0.780726	2.013124	0.0464

R-squared	0.500185	Mean dependent var	0.263167
Adjusted R-squared	0.465416	S.D. dependent var	0.291222
S.E. of regression	0.212928	Akaike info criterion	-0.185917
Sum squared resid	5.213890	Schwarz criterion	0.018781
Log likelihood	20.52685	Hannan-Quinn criter.	-0.102764
F-statistic	14.38566	Durbin-Watson stat	1.794403
Prob(F-statistic)	0.000000		

Ramsey RESET Test
Equation: UNTITLED
Specification: LOGY1_LOGY0 LOG_Y0 LOG_POPULATIO
LOG_INVEST_AVERAGE_ LOG_LIFE_EXPE_1970_ LOG_INFLATION
LNFOODAVAI C
Omitted Variables: Powers of fitted values from 2 to 3

	Value	df	Probability
F-statistic	0.297812	(2, 115)	0.7430
Likelihood ratio	0.640582	2	0.7259

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.027078	2	0.013539
Restricted SSR	5.255135	117	0.044916
Unrestricted SSR	5.228057	115	0.045461
Unrestricted SSR	5.228057	115	0.045461

LR test summary:

	Value	df
Restricted LogL	20.03833	117
Unrestricted LogL	20.35862	115

Unrestricted Test Equation:
Dependent Variable: LOGY1_LOGY0
Method: Least Squares
Date: 10/18/13 Time: 09:22
Sample: 1 124
Included observations: 124

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG_Y0	-0.280644	0.077822	-3.606228	0.0005
LOG_POPULATIO	-0.206137	0.094276	-2.186533	0.0308
LOG_INVEST_AVERAGE_	1.036564	0.253393	4.090730	0.0001
LOG_LIFE_EXPE_1970_	1.269093	0.453059	2.801166	0.0060
LOG_INFLATION	-0.065181	0.039099	-1.667083	0.0982
LNFOODAVAI	0.054081	0.024871	2.174415	0.0317
C	-2.798947	0.712013	-3.931036	0.0001
FITTED^2	-0.296709	0.696224	-0.426170	0.6708
FITTED^3	0.458750	0.704143	0.651502	0.5160

R-squared	0.498827	Mean dependent var	0.263167
Adjusted R-squared	0.463963	S.D. dependent var	0.291222
S.E. of regression	0.213217	Akaike info criterion	-0.183204
Sum squared resid	5.228057	Schwarz criterion	0.021494
Log likelihood	20.35862	Hannan-Quinn criter.	-0.100050
F-statistic	14.30773	Durbin-Watson stat	1.683411
Prob(F-statistic)	0.000000		

Appendix B: Panel Unit Root Result Table

Levin-Lin-Chu unit-root test for u5mr		
Ho: Panels contain unit roots	Number of panels =	117
Ha: Panels are stationary	Number of periods =	15
AR parameter: Common	Asymptotics: N/T -> 0	
Panel means: Included		
Time trend: Not included		
ADF regressions: 1 lag		
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)		
Statistic	P-value	
Unadjusted t	-27.5279	
Adjusted t*	-26.7985	0.0000

. xtunitroot llc infantmortality, trend		
Levin-Lin-Chu unit-root test for infantmortality		
Ho: Panels contain unit roots	Number of panels =	117
Ha: Panels are stationary	Number of periods =	15
AR parameter: Common	Asymptotics: N/T -> 0	
Panel means: Included		
ADF regressions: 1 lag		
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)		
Statistic	p-value	
Unadjusted t	-17.6158	
Adjusted t*	-10.0068	0.0000

Levin-Lin-Chu unit-root test for per capita health expenditure		
Ho: Panels contain unit root		Number of panels = 117
Ha: Panels are stationary		Number of periods = 15
Time trend: Not included		
ADF regressions: 1 lag		
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)		
Statistic		p-value
Unadjusted t	8.4118	
Adjusted t*	14.2440	1.0000
. xtunitroot llc per capita health expenditure, trend		
Ho: Panels contain unit roots		Number of panels = 117
Ha: Panels are stationary		Number of periods = 15
AR parameter: Common		Asymptotics: N/T -> 0
Panel means: Included		
Time trend: Included		
ADF regressions: 1 lag		
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)		
Statistic		p-value
Unadjusted t	-18.9791	
Adjusted t*	-5.5061	0.0000

. xtunitroot llc share of health
Levin-Lin-Chu unit-root test for share of health
Ho: Panels contain unit roots Number of panels = 115
Ha: Panels are stationary Number of periods = 15
AR parameter: Common Asymptotics: N/T -> 0
Panel means: Included
Time trend: Not included
ADF regressions: 1 lag
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)
Statistic p-value
Unadjusted t -8.0512
Adjusted t* 2.6123 0.9955
. xtunitroot llc share of health, trend
Levin-Lin-Chu unit-root test for share of health
Ho: Panels contain unit roots Number of panels = 115
Ha: Panels are stationary Number of periods = 15
AR parameter: Common Asymptotics: N/T -> 0
Panel means: Included
Time trend: Included
ADF regressions: 1 lag
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)
Statistic p-value
Unadjusted t -24.7658
Adjusted t* -7.1189 0.0000

. xtunitroot llc loggdp
Levin-Lin-Chu unit-root test for loggdp
Ho: Panels contain unit roots Number of panels = 117
Ha: Panels are stationary Number of periods = 15
AR parameter: Common Asymptotics: N/T -> 0
Panel means: Included
Time trend: Not included
ADF regressions: 1 lag
LR variance: Bartlett kernel, 7.00 lags average (chosen by LLC)
Statistic p-value
Unadjusted t -6.5658
Adjusted t* -2.7439 0.0030

. xtunitroot fisher foodpercapita, dfuller trend lags(0)
Fisher-type unit-root test for foodpercapita
Based on augmented Dickey-Fuller tests
Ho: All panels contain unit roots Number of panels = 116
Ha: At least one panel is stationary Avg. number of periods = 14.96
AR parameter: Panel-specific Asymptotics: T -> Infinity
Panel means: Included
Time trend: Included
Drift term: Not included ADF regressions: 0 lags
Statistic p-value
Inverse chi-squared(232) P 349.8938 0.0000
Inverse normal Z -2.3910 0.0084
Inverse logit t(584) L* -2.7577 0.0030
Modified inv. chi-squared Pm 5.4731 0.0000

. xtunitroot fisher safewater, dfuller lags(0)			
Fisher-type unit-root test for safewater			
Based on augmented Dickey-Fuller tests			
Ho: All panels contain unit roots			
Ha: At least one panel is stationary			
Number of panels = 115 Avg. number of periods = 14.97			
AR parameter: Panel-specific	Asymptotics: T -> Infinity		
Panel means: Included			
Time trend: Not included			
Drift term: Not included	ADF regressions: 0 lags		
Statistic	p-value		
Inverse chi-squared(230) P	675.0503	0.0000	
Inverse normal Z	-4.9872	0.0000	
Inverse logit t(434) L*	-10.8063	0.0000	
Modified inv. chi-squared Pm	20.7506	0.0000	

. xtunitroot fisher sanitation, dfuller lags(0)			
Fisher-type unit-root test for sanitation			
Based on augmented Dickey-Fuller tests			
Ho: All panels contain unit roots Ha: At least one panel is stationary			
Number of panels = 117			
Avg. number of periods = 14.95			
AR parameter: Panel-specific		Asymptotics: T -> Infinity	
Panel means: Included			
Time trend: Not included			
Drift term: Not included		ADF regressions: 0 lags	
Statistic		p-value	
Inverse chi-squared(234)	P	529.2833	0.0000
Inverse normal	Z	-1.9634	0.0248
Inverse logit t(464)	L*	-5.3353	0.0000
Modified inv. chi-squared	Pm	13.6495	0.0000

. xtunitroot fisher vaccinationmeasles, dfuller lags(0)			
Fisher-type unit-root test for vaccinationmeasles			
Based on augmented Dickey-Fuller tests			
Ho: All panels contain unit roots Ha: At least one panel is stationary			
Number of panels = 117			
Avg. number of periods = 14.97			
AR parameter: Panel-specific		Asymptotics: T -> Infinity	
Panel means: Included			
Time trend: Not included			
Drift term: Not included		ADF regressions: 0 lags	
Statistic		p-value	
Inverse chi-squared(234)	P	461.5431	0.0000
Inverse normal	Z	-5.6504	0.0000
Inverse logit t(584)	L*	-6.8272	0.0000
Modified inv. chi-squared	Pm	10.5182	0.0000

. xtunitroot fisher vaccinationdpt, dfuller lags(0)		
Fisher-type unit-root test for vaccinationdpt		
Based on augmented Dickey-Fuller tests		
Ho: All panels contain unit roots Ha: At least one panel is stationary		
Number of panels = 117		
Avg. number of periods = 14.93		
AR parameter: Panel-specific	Asymptotics: T -> Infinity	
Panel means: Included		
Time trend: Not included		
Drift term: Not included	ADF regressions: 0 lags	
Statistic		p-value
Inverse chi-squared(234) P	494.3875	0.0000
Inverse normal Z	-5.0823	0.0000
Inverse logit t(584) L*	-7.3051	0.0000
Modified inv. chi-squared Pm	12.0364	0.0000

Appendix C: List of Countries in Growth Regression[11]

ROW Countries

Albania
Antigua &Barbados
Argentina
Australia
Austria
Bahamas
Bangladesh
Barbados
Belgium
Belize
Bermuda*
Bolivia
Brunei*
Brazil
Cambodia
Canada
Chile
China
Colombia
Comoros*
Costa Rica
Cuba*
Cyprus
Denmark
Dominican Rep
Ecuador
El Salvador
Fiji
Finland
France
Pakistan
Greece
Grenada
Guatemala
Guyana
Haiti*
Honduras
India
Indonesia
Iran
Ireland
Israel
Italy
Jamaica*
Japan
Jordan
United States
United Kingdom
Uruguay
Korea, Rep.
Laos
Lebanon
Malaysia
Maldives
Malta
Mexico
Mongolia
Nepal
Netherland
New Zealand
Nicaragua
Norway
Germany
Panama
Paraguay
Peru
Philippine
Poland
Portugal
Romania
Solomon Island
Spain
Suriname
Sweden
Switzerland
Syria
Sri Lanka
Thailand
Trinidad &Tobago
Turkey
Venezuela
Vietnam

[11] * represents countries that were not included in the child mortality regression analysis due to insufficient data.

SSA2 Countries

Angola
Burkina Faso
Burundi
Central African Rep.
Chad
Congo, Dem. Rep
Congo, Rep
Cote d`Ivoire
Guinea
Guinea-Bissau*
Kenya
Lesotho
Liberia
Madagascar
Mali
Mauritania
Niger
Sierra lone
Uganda
Zimbabwe*

SSA Countries

Algeria
Angola
Benin
Burkina Faso
Burundi
Botswana
Cameroon
Central African Rep.
Cape Verde
Chad
Congo, Dem. Rep
Congo, Rep
Cote d`Ivoire
Djibouti
Egypt
Gabon
Gambia
Mauritania
Guinea
Guinea-Bissau*
Lesotho
Liberia
Madagascar
Malawi
Mali
Mauritius
Mozambique
Morocco
Namibia
Niger
Rwanda
Senegal
Sudan
Sierra lone
South Africa
Togo
Tunisia
Ghana
Uganda
Kenya
Zambia
Zimbabwe*

Appendix D: Review of Past work

Table 7 Determinants of Economic growth from previous research

Author(s)	Panel of countries studied	Independent variables identified	Coefficients, (t statistics) or (standard errors)	R^2
R.J. Barro 98		1. Constant	0.0302	0.56
(1991)	(1960-1985)		(0.0007)	
		2. 1960 value of real per capita GDP	-0.0075	
			(0.0012)	
		3. 1960 secondary school enrolment rate	0.0305	
			(0.0079)	
		4. 1960 primary school enrolment rate	0.0250	
			(0.0056)	
		5. Average from 1970 to 1985 of the ratio of real govt. consumption (exclusive of defense and education) to real GDP	-0.1190 (0.0280)	
		6. Number of revolutions and coups per year (1960-1985)	0.0195 (0.0063)	
		7. Number of assassination per million Population per year (1960-1985)	0.0033 (0.0155)	
		8. Magnitude of the deviation of 1960 PPP value for the investment deflator (US=1.0) from the sample mean	0.0143 (0.0053)	

S. Fischer (1993)	101 (1960-1989)	1. Inflation rate	-0.0310 (-2.7200)	
		2. Budget surplus or deficit	0.2400 (3.0000)	
		3. Log difference of the terms of trade	0.0660 (3.3900)	
		4. Black market exchange rate premium	0.0150 (-1.9400)	
		5. Log of per capita GNP	-0.0210 (-2.1800)	
		6. Tariff protection	-0.0030 (-1.2700)	
		7. Barro-Lee measure of human capital	0.0050 (1.4400)	
		8. Average ratio of liquid liability to GDP for the period 1960-1989	-0.0200 (-0.3600)	
R.j Barro (1995)	Roughly 100 (1960-1990)	1. Log (GDP)	-0.0254 (0.0031)	0.58*
		2. Male secondary and higher schooling	0.0118 (0.0025)	
		3. Log (life expectancy)	0.0423 (0.0137)	
		4. Log (GDP) male schooling	-0.0062 (0.0017)	
		5. Log (fertility rate)	-0.0161 (0.0053)	

6. Government consumption ratio	-0.1360
	(0.0260)
7. Rule of law index	0.0293
	(0.0054)
8. Terms of trade change	0.1370
	(0.0300)
9. Democracy index	0.0900
	(0.0270)
10. Democracy index squared	-0.0880
	(0.0240)
11. Inflation rate	-0.0430
	(0.0080)

M. Knight, N. Loayza and D. Villanueva (1992)	81 (1960-1985)	1. Log real GDP per worker	-0.2200 (-9.4500)	n.a
		2. Log average growth rate of the working age population plus sum of rates of techno- logical progress and depreciation	(0.1470 (-12.5200)	
		3. Log average ratio of real investment (including government investment) to Real GDP	0.2013 (18.1700)	
		4. Log ratio of human capital investment to GDP, proxied by the product of gross secondary school enrolment ratio times the fraction of the working population aged 15 to 19	0.0945 (8.1800)	
		5. Log “Closedness” of the economy,proxied by the weighted average of tariff rates on imported intermediate and capital goods	0.0650 (-11.7600)	
		6. Log ratio of public infrastructure to GDP proxied by the average ratio of general govt. fixed investment (central government plus public enterprises) to GDP	0.0128	

X. sala-i- Nartin .	75 (1970-1985)	1. Constant	0.0007 (0.0099)	0.35
		2. Log 1970 GDP per capita	-0.0128 (0.0043)	
		3. Ratio of total government spending to GDP	-0.1117 (0.0370)	
		4. Savings rate is the ratio of total Investment to GDP	0.2006 (0.0357)	
		5. Average ratio of social security transfer to GDP	0.1092 (0.0509)	
		6. Ratio of total government consumption (excluding defense and education) to GDP	-0.1285 (0.0475)	
		7. Ratio of total government investment to GDP	-0.2278 (0.1728)	

Cebula& Mixon	OECD (2004-2007)	1.Net exports expressed as percentage of GDP	0.001 (0.92)
		2. Federal budget deficit as a percentage of GDP	-0.124 (-4.19)
		3. Percentage of long term nominal interest rate	-0.151 (-2.25)
		4. Fiscal freedom	0.016 (2.32)
		5. Government size freedom	0.157 (4.22)
Roberts Barro	98 (1960-1985)	1. GDP 1960 2. GDP 1970 3. Secondary school enrolment 1960 4. Primary School enrolment 1960 5. Secondary school enrolment 1950 6. Primary school enrolment 1950.	

Steven A.Block	89 (1975-1995)	1. Log GDP 2. Log Life Expectancy 3. Institutional quality 4. Openness to trade 5. Population growth rate 6. Fiscal deficit. 7. African dummy
David Bloom and Jeffrey Sachs	73 (1965-1990)	1. Log GDP per worker 1965 2. Log years of Secondary School 3. Liquid liabilities (% of GDP) 4. Openness 5. Quality of Institution 6. Budget deficit 7. Log Population Density within coast 8. Log Population Density inland 9. Average Population Growth rate 10. Average growth rate working age population
Ronelle Burge and Stan du Plessis	79 (1960-2000)	1. Initial GDP 2. Tropics 3. Primary Enrolment 4. Labour 5. Premium 6. Terms of Trade change 7. State Legitimacy 8. Openness

Ciccone Antonio and Jarocinski Marek	87 1960-1996	1. Market acess 2. Population growth 3. Climate Zones 4. Health 5.Natural Resources 6. Size of government 7.Inflation 8. War and conflicts 9. Openess to trade 10. Size of the economy 11. Rights 12. Age structure 13. Education 14. Religion.
Mark Bills and Peter J. Klenow	85 (1960-1990)	1. Number of workers 2. Level of human capital 3. Investment 4. Average years of schooling 5. Schooling (enrolment rates) 1960

Francisco L. Rivera-Batiz (1960-1990)	59	1.Average number of years of schooling of labour force 2.Average population aged 15 or older who have attended tertiary education 1960-1990 3. Democracy 4. Governance 5. Urbanization 6. Initial capital –labour ration
Ross Levine and David Renelt (1960-1989)	119	1.Population growth 2. Investment 3. Secondary School enrolment 4. Initial real GDP(1960)
Don J. Webber (1960-1990)	46	1.GDP 1960 2.Average investment in physical capital (1960-1990) 3. Health related variables -calories per head in 1990 -average calories intake per head (1960-1990) 4. Average Primary school enrolment 5. Primary school enrolment in 1960 6.Average Secondary school enrolment 7. Secondary School enrolment in 1960.
Alemayehu Geda and Befekadu Degefe	Ethiopia(1)	1.Initial GDP per capita 2. Population

Table 8 Review of Food Security Studies

Author(s)	Countries in studied	Independent variables identified	Coefficients, (t statistics) or (standard errors)
R.O Babatunde,	Nigeria	1.Farm Size	-0.498
O.A. Omotesho and			(0.558)
O.S. Sholotan		2. Access to consumption credit	-0.230
			(0.139)
		3.Educational Status of	1.334
		Household head	(4.050)
		4.Quantity of food from	0.001
		own Production	(12.801)
		5. Household size	-0.310
			(7.069)
		6. Membership of Cooperatives	3.959
			(0.759)
		7.Age of Household head	-0.44
			(1.810)
E.C. Apili Ejupu,	Uganda	1. Calorie Produced	
M.T. Makhura		2. Calorie Sold	
and J.F. Kirsten		3. Calorie bought.	

Caroline Muthoni Thuo	Kenya	1.Extent of diversification 2. Level of education of farmer 3. Gender of farmer 4. Age of farmer.
Anderson Jock, R. and Roumasette James, A.		1. Local Price of staple 2. Household consumption requirement of the staple 3. Desired Purchases or sale sales of staple food 4. An indication of whether it is possible for households to purchase its desired level of consumption staple
Hong Yang, Reichert Peter, Karim C. Abbaspour, and Alexander J.B. Zehnder	35 (1980-2000)	1. log GDP 2. Renewable water 3. Land 4. Irrigation 5. Fertilizer
Mwaniki, Angela	Africa	1. Underdeveloped Agricultural sector 2. Barriers to market Access 3. Effects of Globalization 4. Diseases and Infection 5. Good governance 6. Market Access 7. Off-farm Opportunities

Table 9 Review of Child Mortality Studies

Author(s)	Countries in studied	Independent variables identified	Coefficients, (t statistics) or (standard errors)
Joshua Kembo and Jeroen K. Van Ginneken	Zimbabwe	1.Maternal and related factors - Child's birth order - Maternal age - Preceding birth interval 2. Socioeconomic variables - Maternal education - Paternal education - Wealth index 3. Sanitation - Toilet facility - Drinking water.	
Cornelia Kaldewei and Ingo Pitterle	Jordan	1.personal and Biological factors -infant/child sex -Premature delivery -Multiple deliveries - Birth order	

		2. Behavioral factors - Mothers smokes tobacco - Use of private or public health care -Age of mother at birth -Preceding birth intervals -Breast feeding 3. Household and community factors -safe drinking water - Improved Sanitation - Region of residence - Household size.
Rodgers G.B.	56	1. Mean of income 2. Measure of income distribution
Limin Wang	60	1. GDP per capita 2. Share of health expenditure in GDP 3. Per capita health expenditure 4. Asset index
Rubiana Charmarbagwala, Martin Ranger, Hugh Waddington and Howard white		1. Income 2. Household size and composition 3. Parental education 4. Gender 5. Location (Urban/Rural) 6. Water and sanitation 7. Infant/child age

		8. Mother's age 9. Breastfeeding 10. Fate of previous child 11. Health services - Antenatal care - Place of birth - Immunization
Clive J. Mutunga	Kenya	1. Environmental services - Safe water - Sanitation - Source of cooking fuel 2. Region 3. Mother's education 4. Religion 5. Wealth quintile