

**DETERMINANTS OF MATERNAL MORTALITY OF SOMALIA IN THE PERIOD
1990 To 2012.**

BY:

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DECLARATION

"This Thesis is my original work and has not been presented for a Degree or any other academic award in any University or Institution of Higher Learning".

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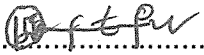
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Approval

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DEDICATION

This thesis is dedicated to my Mother Halima Duhulow Jim'ale, my Father Ali Aser Adawe, my brothers and sisters.

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ABSTRACT

This study investigated the influence of gross domestic product per capita, total fertility rate and HIV/AIDS prevalence rate (termed as determinants) on maternal mortality of Somalia in the period 1990-2012. This model is dedicated from demographic transition theory-derived from modernization theory. Secondary data between 1990 and 2012 inclusive collected from the publications of United Nations Statistics Division (UNSD) and World Health Organization (WHO) was used for this study. The trend of each of the above mentioned variables have also been examined in this study to show their movements and changes with the time. In order to determine the relationship between GDP per capita, total fertility rate, and HIV/AIDS prevalence rate as explanatory and maternal mortality ratio as dependent variable and the influence of independent variables on maternal mortality, the researcher used Pearson correlation coefficient and ordinary least square (OLS) regression analysis with the help of STATA, version12. Line graphs were also used to examine the trends of the four research variables.

The findings of this study showed that the trend of GDP per capita of Somalia in the study period is not predictable and there were fluctuations from time to time. GDP per capita of Somalia has experienced decreasing trend in three periods; from 1991 to 1992, 1999 to 2005 and from 2009-2012 while it has showed increasing trend in the periods; 1993-1998 and 2006-2008. The trend of the total fertility rate of Somalia in the period under, there were two equal and opposite trends. In the first decade (from 1990 up to 2000) an increasing trend while in the last decade (from 2001 to 2012) the trend was declining. In HIV/AIDs prevalence rate, there was generally rising trend of HIV/AIDs prevalence rate in Somalia in study period. The maternal mortality ratio of Somalia in the period 1990-2012 exposed increasing trend in the period covered by the study under consideration. Consequently the extent of maternal mortality ratio is as high as 978 deaths per 100000 live births. The study also showed that the explanatory variables (GDP per capita, TFR and HIV/AIDS

prevalence rate) have strong relationship to the maternal mortality ratio as R^2 coefficient of determination was found 81%.

The study concluded that GDP per capita, TFR and HIV/AIDS prevalence rate have high influence on the maternal mortality and therefore, it is in line with the demographic transition theory.

Based on the findings of this study, it is therefore, recommended that incomes of the population among them vulnerable groups should be elevated by giving microfinance to poor families, put forward policies to reduce fertility rate such as education and employment opportunities given to the women, and Community awareness campaign to be taken to warn people the ways that HIV/AIDS spreads.

CHAPTER ONE

THE PROBLEM AND ITS SCOPE

1.0 Introduction

This chapter deals with the background of the study which comprises of historical perspectives, theoretical perspectives, conceptual perspectives and contextual perspectives. It presents the statement of the problem, purposes and objectives of the study, research questions, hypothesis, scope of the study and significance of the study.

1.1 Background of the Study

1.1.1 Historical Perspectives

Maternal mortality is unacceptably high with About 800 women die from pregnancy- or childbirth-related complications around the world every day. In 2013, 289 000 women died during and following pregnancy and childbirth. Almost all of these deaths occurred in low-resource settings, and most could have been prevented (WHO, 2013).

Improving maternal health is 1 of the 8 Millennium Development Goals (MDGs) adopted by the international community in 2000. Under MDG5, countries committed to reducing maternal mortality by three quarters between 1990 and 2015. Since 1990, maternal deaths worldwide have dropped by 45%. In sub-Saharan Africa, a number of countries have halved their levels of maternal mortality since 1990. In other regions, including Asia and North Africa, even greater headway has been made. However, between 1990 and 2013, the global maternal mortality ratio (i.e. the number of maternal deaths per 100 000 live births) declined by only 2.6% per year. This is far from the annual decline of 5.5% required to achieve MDG5 (WHO, 2013).

The high number of maternal deaths in some areas of the world reflects inequities in access to health services, and highlights the gap between rich and poor. Almost

all maternal deaths (99%) occur in developing countries. More than half of these deaths occur in sub-Saharan Africa and almost one third occur in South Asia. The maternal mortality ratio in developing countries in 2013 is 230 per 100 000 live births versus 16 per 100 000 live births in developed countries. There are large disparities between countries, with few countries having extremely high maternal mortality ratios around 1000 per 100 000 live births. There are also large disparities within countries, between women with high and low income and between women living in rural and urban areas. The risk of maternal mortality is highest for adolescent girls under 15 years old and complications in pregnancy and childbirth are the leading cause of death among adolescent girls in developing countries. Women in developing countries have on average many more pregnancies than women in developed countries, and their lifetime risk of death due to pregnancy is higher. A woman's lifetime risk of maternal death – the probability that a 15 year old woman will eventually die from a maternal cause – is 1 in 3700 in developed countries, versus 1 in 160 in developing countries (WHO, 2013).

Reproductive health is a major problem in Somalia, with a maternal mortality ratio of 1,044 per 100,000 live births placing Somali women among the most high-risk groups in the world. The child and maternal mortality rates for Somalia are amongst the highest in the world; one out of every ten Somali children dies before seeing their first birthday. While comprehensive information is not available, it is believed that leading causes of infant and child mortality are poverty, diseases such as pneumonia, diarrhoea, and measles, HIV/AIDS neonatal disorders as well as higher fertility rate (UNICEF, 2013).

1.1.2 Theoretical Perspectives

This study is based on demographic transition theory which is derived modernization theory. Modernization theory is closely linked to neoclassical economic theory. Both view economic development as a bridging of the gap between developed and under developed nations through an imitative process. According to demographic transition theory-derived from modernization theory –fertility and mortality go hand in hand. In societies where fertility is high, maternal mortality tends to be high. Economic development leads to higher standards of living and advanced medical technology which in turn contribute to lower mortality. Maternal mortality, an indicator of health status of the population, should decrease as the level of economic development increases. This process allegedly requires greater levels of industrialization, education, and urbanization (Inkeles and Smith, 1974; Kelly and Cutright, 1980; Van de Walle and Knodel, 1980). Modernization theorists have also emphasized the importance of capital for the development in LDCs (Rostow, 1971). Capital scarcity is viewed as a major inhibitor to development in LDCs (International Monetary Fund, 1985; Grieco, 1986). They believe that investment from the core industrialized countries and world trade promote development in LDCs by providing external capital, new technology and management experience, which are crucial to the economic and social development of LDCs. Indicators commonly used by researchers working this tradition include gross national (domestic) products, economic growth rate, urbanization, education, fertility rate and health care service.

1.1.3 Conceptual Perspective

Maternal mortality is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes (WHO, 2012). In this study we mean maternal deaths, based on their causes, as either direct or indirect. Direct maternal deaths are those resulting from obstetric complications of the pregnant state (pregnancy,

delivery and postpartum), interventions, omissions, incorrect treatment, or a chain of events resulting from any of the above. Deaths due to, for example, obstetric haemorrhage or hypertensive disorders in pregnancy, or those due to complications of anaesthesia or caesarean section are classified as direct maternal deaths. Indirect maternal deaths are those resulting from previously existing diseases, or from diseases that developed during pregnancy and that were not due to direct obstetric causes but aggravated by physiological effects of pregnancy. For example, deaths due to aggravation of an existing cardiac or renal disease are considered indirect maternal deaths.

According to the above mentioned theory (demographic transition theory), among major factors which are determining maternal mortality include gross domestic product, urbanization, education, fertility rate and health care service. In this study, researcher concentrated on the factors of gross domestic product, fertility rate and HIV/AIDS prevalence rate as health care service indicator and these factors were termed as determinants of maternal mortality.

Gross domestic product (GDP) was first developed by Simon Kuznets for a US Congress report in 1934. In this report, Kuznets warned against its use as a measure of welfare. After the Bretton Woods conference in 1944, GDP became the main tool for measuring a country's economy.

From 5.5% of annual GDP growth between 2005 and 2008, Africa's economies grew only 2.4% in 2009. However, the UN projects a healthier growth rate of 4.7% in 2010, signaling a relatively rapid recovery from the crisis. On a country level, Africa boasts of some of the world's biggest growth success stories. Over the last ten years, no fewer than six of the world's ten fastest-growing economies were in Sub-Saharan Africa.

According to the central intelligence agency (CIA) and the Central Bank of Somalia, despite experiencing civil unrest, Somalia has maintained a healthy informal economy, based mainly on livestock, remittance/money transfer companies and telecommunications. Due to a less efficiency of formal government statistics and the recent civil war, it is difficult to gauge the size or growth of the economy. For

1994, the CIA estimated the GDP at \$3.3 billion. In 2001, it was estimated to be \$4.1 billion. By 2009, the CIA estimated that the GDP had grown to \$5.731 billion, with a projected real growth rate of 2.6%. According to a 2007 British Chambers of Commerce report, the private sector also grew, particularly in the service sector. Unlike the pre-civil war period when most services and the industrial sector were government-run, there has been substantial, albeit unmeasured, private investment in commercial activities; this has been largely financed by the Somali diaspora, and includes trade and marketing, money transfer services, transportation, communications, fishery equipment, airlines, telecommunications, education, health, construction and hotels.

Gross domestic product is the monetary value of all the finished goods and services produced within a country's borders in a specific time period, though GDP is usually calculated on an annual basis. It includes all of private and public consumption, government outlays, investments and exports less imports that occur within a defined territory.

GDP per capita is a measure of the total output of a country that takes the gross domestic product (GDP) and divides it by the number of people in the country. The per capita GDP is especially useful when comparing one country to another because it shows the relative performance of the countries. A rise in per capita GDP signals growth in the economy and tends to translate as an increase in productivity.

Based on the theoretical perspective above, economic development leads to higher standards of living and advanced medical technology which in turn contribute to lower mortality. Regarding to that argument, a relationship can be established between GDP per capita which is indicator of economic growth level and maternal mortality.

In demographic contexts, fertility refers to the actual production of offspring, rather than the physical capability to produce which is termed fecundity. Demographers measure the fertility rate in a variety of ways, which can be broadly broken into "period" measures and "cohort" measures. "Period" measures refer to a cross-section

of the population in one year. "Cohort" data on the other hand, follows the same people over a period of decades. Among other measures of fertility rate, the total fertility rate (TFR) is a more direct measure of the level of fertility than the crude birth rate, since it refers to births per woman. This indicator shows the potential for population change in the country.

Total fertility rate is the average number of children that would be born per woman if all women lived to the end of their childbearing years and bore children according to a given fertility rate at each age. A rate of two children per woman is considered the replacement rate for a population, resulting in relative stability in terms of total numbers. Rates above two children indicate populations growing in size and whose median age is declining. Rates below two children indicate populations decreasing in size and growing older. Global fertility rates are in general decline and this trend is most pronounced in industrialized countries, especially Western Europe, where populations are projected to decline dramatically over the next 50 years.

As can be deduced from the theoretical perspective, fertility rate is one of the factors affecting maternal mortality and therefore, it is worth to investigate the relationship between fertility rate and maternal mortality.

Somalia is one of the highest countries in the world when it comes to fertility rate. In 2014 estimates by CIA world factbook showed that Somalia is the 4th country in terms of total fertility rate after Niger, Mali and Burundi. Since fertility rate is one of the factors affecting maternal mortality as can be understood from demographic transition theory discussed above, it is worthy to examine whether the high maternal mortality in Somalia is affected by the total fertility rate.

The new analysis of maternal mortality data is showing greater progress in reducing maternal deaths than previous examinations. They also highlight the role of HIV in preventing even more significant gains in saving mother's lives. It has been estimated that there were 342,900 maternal deaths globally in 2008, down from about 526,300 in 1980. Subtracting HIV from the equation there would have been 281,500 maternal deaths in 2008 (Lancet Today, 2012).

In the absence of HIV, progress in sub-Saharan Africa in reducing the MMR would have been much more extensive than how it is now. The counterfactual analysis of the MMR without HIV-related deaths has important implications for intervention policy. The set of interventions for dealing with HIV infection in pregnant or post-partum women would include access to antiretroviral drugs, which is not part of the set of maternal health interventions targeting women who are HIV negative (Dr. Murray, 2012). This motivated the researcher to take HIV/AIDS prevalence rate as factor affecting maternal mortality and it is also supported by the demographic transition theory as it suggested that maternal mortality is influenced by health care services.

HIV prevalence rate of adults is an estimate of the percentage of adults (aged 15-49) living with HIV/AIDS. The adult prevalence rate is calculated by dividing the estimated number of adults living with HIV/AIDS at yearend by the total adult population at yearend (UNICEF, 2001).

Although maternal mortality is a significant global health issue, achievements in mortality decline to date have been inadequate. A review of the interventions targeted at maternal mortality reduction demonstrates that most developing countries face tremendous challenges in the implementation of these interventions, including the availability of unreliable data and the shortage in human and financial resources, as well as limited political commitment. Examples from developing countries, such as Sri Lanka, Malaysia and Honduras, demonstrate that maternal mortality will decline when appropriate strategies are in place. Such achievable strategies need to include redoubled commitments on the part of local, national and global political bodies, concrete investments in high-yield and cost-effective interventions and the delegation of some clinical tasks from higher-level healthcare providers to mid- or lower-level healthcare providers, as well as improved health-management information systems.

In Somalia although The situation is improving in the first half of 2013 and the population in food security crisis is reducing, healthcare is now largely concentrated in the private sector and the country's public healthcare system is in the process of

being rebuilt, and is overseen by the Ministry of Health, the maternal mortality ratio of Somalia is the second or third highest in the world after South Sudan and Chad according to CIA World Factbook (2013).

1.1.4 Contextual Perspectives

This study was conducted in Somalia. Federal Republic of Somalia is a country located in the Horn of Africa. It is bordered by Ethiopia to the west, Djibouti to the northwest, the Gulf of Aden to the north, the Indian Ocean to the east, and Kenya to the southwest. Somalia has the long coastline and its terrain consists mainly of plateaus, plains and highlands. Climatically, hot conditions prevail year-round, with periodic monsoon winds and irregular rainfall.

Somalia has a population of around 10-15 million with a land area of 637,657 square kilometers. Around 85% of residents are ethnic Somalis, who have historically inhabited the northern part of the country. Ethnic minorities make up the remainder and are largely concentrated in the southern regions. The official languages of Somalia are Somali and Arabic, both of which belong to the Afro-Asiatic family. Most people in the country are Muslim, with the majority being Sunni.

1.2 Statement of the problem

Maternal mortality is unacceptably high with About 800 women die from pregnancy- or childbirth-related complications around the world every day. In 2013, 289 000 women died during and following pregnancy and childbirth. Almost all of these deaths occurred in low-resource settings, and most could have been prevented and between 1990 and 2013, the global maternal mortality ratio (i.e. the number of maternal deaths per 100 000 live births) declined by only 2.6% per year. This is far from the annual decline of 5.5% required to achieve MDG5 (WHO, 2013).

In Somalia, maternal mortality is among the highest in the world; one out of every 12 women dies due to pregnancy related causes. Access to maternal services is low with only 9% of births being attended by a skilled birth attendant. Modern contraceptive rate is around 1% only. The maternal mortality rate of Somalia is 1,000 deaths/100,000 live births (2010) placing Somali women among the most high-risk groups in the world. Poverty, hemorrhage, prolonged and obstructed labour, infections and eclampsia (toxemia that may occur in late pregnancy) are the major causes of death at childbirth. Anaemia and female genital mutilation (infibulation) have a direct impact on, and aggravate these conditions (UNICEF, 2013).

Poverty, high fertility rate, poor health care services i.e. poor antenatal, delivery and postnatal care, with an almost complete lack of emergency obstetric referral care for birth complications, poor nutrition, and illiteracy in Somalia puts the women at a high risk of mortality and morbidities around child birth especially with the low access to basic health services. Somalia is also drought prone and faces extreme food insecurity, which is exacerbated by poor healthcare, lack of access to safe drinking water and safe sanitation facilities (UNICEF, 2013).

While there are several causes of the high mortality of Somalia the researcher investigated the extent to which the poverty proxied by low income, higher fertility rate and HIV/AIDS prevalence rate can determine the maternal mortality of Somalia because there is no substantial evidence for the extent that GDP per capita, total fertility rate and HIV/AIDS prevalence rate can affect maternal mortality.

1.3 Purposes of the study

The overall objective of the study was to investigate the influence of GDP per capita, total fertility rate and HIV/AIDS prevalence rate on the maternal mortality of Somalia in the period from 1990 to 2012.

1.3.1 Specific Objectives

1. To determine the trend of the following variables: GDP per capita, total fertility rate and HIV/AIDS prevalence rate of Somalia in the period from 1990 to 2012.
2. To determine the trend of maternal mortality of Somalia in the period from 1990 to 2012.
3. To establish the significant influence of GDP per capita, total fertility rate and HIV/AIDS prevalence rate on maternal mortality of Somalia in the period from 1990 to 2012.

1.5 Research questions

1. What is the trend and of determinants of mortality (GDP per capita, total fertility rate and HIV/AIDS prevalence rate) of Somalia from 1990 to 2012?
2. What is the trend of maternal mortality of Somalia from 1990 to 2012?
3. Is there a significant influence of GDP per capita, total fertility rate and HIV/AIDS prevalence rate on maternal mortality of Somalia?

1.6 Research hypotheses

1. There is significant negative impact of GDP per capita on maternal mortality of Somalia.
2. There is significant positive influence of total fertility rate on maternal mortality of Somalia
3. There is significant positive effect of HIV/AIDS prevalence rate on maternal mortality of Somalia.

1.7 Scope of the Study

Geographical Scope

This study covers Somalia as a whole but the researcher used secondary data on mortality determinants and maternal mortality ratio. The data were collected from the publications of United Nations Statistics Division (UNSD) and World Health Organization (WHO).

Theoretical Scope

This study is based on demographic transition theory which was proposed in 1929 by the American demographer Warren Thompson (1887–1973). According this theory, fertility and mortality go hand in hand. In societies where fertility is high, maternal mortality tends to be high. Economic development leads to higher standards of living and advanced medical technology which in turn contribute to both lower mortality and fertility. Maternal mortality, an indicator of health status of the population, should decrease as the level of economic development increases.

Content scope

The variables have been investigated upon in this study include gross domestic product which can be broken into Private consumption, government spending, sum of all the country's business spending on capital and nation's total net exports, total fertility rate and HIV/AIDS prevalence rate. The other variable is maternal mortality ratio which will be broken into direct and indirect maternal mortality.

Time Scope

This study used secondary data collected and acknowledged from United Nations Statistics Division (UNSD) and World Health Organization (WHO) and it covered a period of 23 years from 1990 to 2012.

1.8 Significance of the Study

This study is significant to all public health stakeholders including Ministry of Health of Somalia, local authorities, international and local organizations who work on public health issues in general and maternal mortality reduction in specific way. It will give level and trend of maternal mortality in the last two and half decades and it will assist them to develop effective strategies and policies to reduce maternal mortality of Somalia as the research exhibited some of the factors that can affect maternal death. This study will also be beneficial to the maternity hospitals in that it gives them potential causes of maternal deaths.

This study will also be beneficial to the students and instructors in public health and statistics when they employ research on maternal mortality. It will give information of maternal mortality of Somalia in the last 23 and some factors affecting maternal death. It will also serve as a future reference for researchers on the subject of maternal mortality and the different stakeholders of this area. Moreover, this research provided recommendations on how to reduce maternal mortality based on the findings of this study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter reviews the available literature for the variables under study. It demonstrates review of the concepts and ideas of the authors and experts as conceptual framework, theoretical framework and related studies.

Maternal Mortality

Maternal mortality is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management (WHO–ICD 10).

Globally, the lifetime risk for women of maternal death is 1 in 74. In industrialized countries this risk is 1 in 2,800. In the least developed countries, they face a 1 in 16 chance of dying in childbirth in their lifetime (DFID, 2004). The fifth Millennium Development Goal is to improve maternal health, with a target to reduce the maternal mortality ratio by three quarters, between 1990 and 2015. Yet maternal mortality in developing countries has barely decreased over the past decade, and in parts of Africa it has increased. The national target was to reduce the 1990 maternal mortality rate of 740 per 100,000 live births by 3/4 to 185 per 100,000 live births by 2015.

Hogan and Foreman (2010) assessed levels and trends in maternal mortality for 181 countries in their report titled —Maternal mortality for 181 countries, 1980—2008: a systematic analysis of progress towards Millennium Development Goal 5. They constructed a database of 2651 observations of maternal mortality for 181 countries for 1980—2008, from vital registration data, censuses, surveys, and verbal autopsy studies. They used robust analytical methods to generate estimates of maternal deaths and the MMR for each year

between 1980 and 2008. They explored the sensitivity of the data to model specification and show the out-of sample predictive validity of the methods. As a result, they estimated that there were 342 900 maternal deaths worldwide in 2008, down from 526 300 in 1980. The global MMR decreased from 422 in 1980 to 320 in 1990, and was 251 per 100 000 live births in 2008. The yearly rate of decline of the global MMR since 1990 was 1.3%. They found out that in the absence of HIV, there would have been 281 500 maternal deaths worldwide in 2008. The report concluded that, although substantial progress has been made towards MDG 5, only 23 countries are on track to achieving a 75% decrease in MMR by 2015 and that countries such as Egypt, China, Ecuador, and Bolivia have been achieving accelerated progress.

Worawan *et al.* (2010) undertook a study aimed at using multiple sources of data to calculate the maternal mortality ratio (MMR) in 2004–09, and to illustrate the difference between the official causes of death with the research findings. In their research titled —Thailand's approach to measuring maternal mortality ratio|| individual data from civil registration and inpatient records from all public hospitals were used. The civil registration contains data about individual's personal identification (PID) etc. Their result shown that, the number of maternal deaths declined from 362 in 2004 to 269 in 2009. The country's MMR declined from 44.5 to 35.2, a 21% reduction. Their conclusion was that, using matching technique together with individual data, policy makers can get reliable information about the causes of maternal death.

In their study titled —Maternal mortality in the former East Germany before and after reunification: changes in risk by marital status||, Razum *et al.* (1998) examined the impact of marital status on maternal mortality in the period before and the period after German reunification in the area covered by the former East Germany. They calculated the maternal mortality ratio by relating the number of maternal deaths among women resident in eastern Germany in 1980-96 to the respective number of live births, using national register data. They then investigated the effect of marital status, controlling for maternal age

and year of death, in a Poisson regression model. Altogether, 413 maternal deaths and 2.99 million live births were reported. The overall maternal mortality ratio was stable before, and declined after, reunification. Before reunification, unmarried women had a risk of maternal death equal to that of married women; after reunification, they had 2.6 times the age adjusted risk of married women. Unmarried status thus became a significant risk factor for maternal mortality in eastern Germany after reunification.

Measures of maternal mortality

The extent of maternal mortality in a population is essentially the combination of two factors:

(i) the risk of death in a single pregnancy or a single live birth; and (ii) the fertility level, that is, the number of pregnancies or births that are experienced by women of reproductive age. The MMR is defined as the number of maternal deaths in a population divided by the number of live births. It depicts the risk of maternal death relative to the number of live births and essentially captures (i) above. By contrast, the maternal mortality rate (MMRate) is defined as the number of maternal deaths in a population divided by the number of women aged 15–49 years (or woman years lived at ages 15–49 years). The MMRate captures both the risk of maternal death per pregnancy or per birth (live birth or stillbirth) and the level of fertility in the population. In addition to the MMR and the MMRate, it is possible to calculate the adult lifetime risk of maternal mortality for women in the population. An alternate measure of maternal mortality, the proportion of maternal deaths among deaths of women of reproductive age (PM), is calculated as the number of maternal deaths divided by the total deaths among women aged 15–49 years.

Maternal mortality rate

Maternal mortality rate is the number of maternal deaths in a given period per 100 000 women of reproductive age during the same time period from any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes). The maternal mortality ratio includes deaths during pregnancy,

childbirth, or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, for a specified year (CIA world factbook)

According to Partner Medical Dictionary, the number of pregnancy-related deaths/100,000 of reproductive age; the number of maternal deaths related to childbearing divided by number of live births—or number of live births + fetal deaths in a year (Farlex, 2012).

Maternal mortality Ratio

Maternal Mortality Ratio (MMR) is the ratio of the number of maternal deaths per 100,000 live births from any cause related to or aggravated by pregnancy or its management, excluding accidental or incidental causes. According to the CIA World Factbook, the MMR includes deaths during pregnancy, childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, for a specified year. The MMR is used as a measure of the quality of a health care system.

In 2010, countries with highest maternal mortality were Chad (1,100), Somalia (1,000), Central African Republic, (890), Sierra Leone (890) and Burundi (800). Lowest rates included Estonia at 2 per 100,000 and Singapore at 3 per 100,000. In the United States, the maternal death rate averaged 9.1 maternal deaths per 100,000 live births during the years 1979-1986. "Lifetime risk of maternal death" accounts for number of pregnancies and risk. In sub-Saharan Africa the lifetime risk of maternal death is 1 in 16, for developed nations only 1 in 2,800.

Calculating maternal mortality ratio

Maternal mortality ratio can be calculated using the formula below:

$$\text{Maternal mortality ratio} = \frac{\text{deaths of women due to causes relating to pregnancy and child birth}}{\text{Live births}} \times 100000$$

2.1 Conceptual Framework

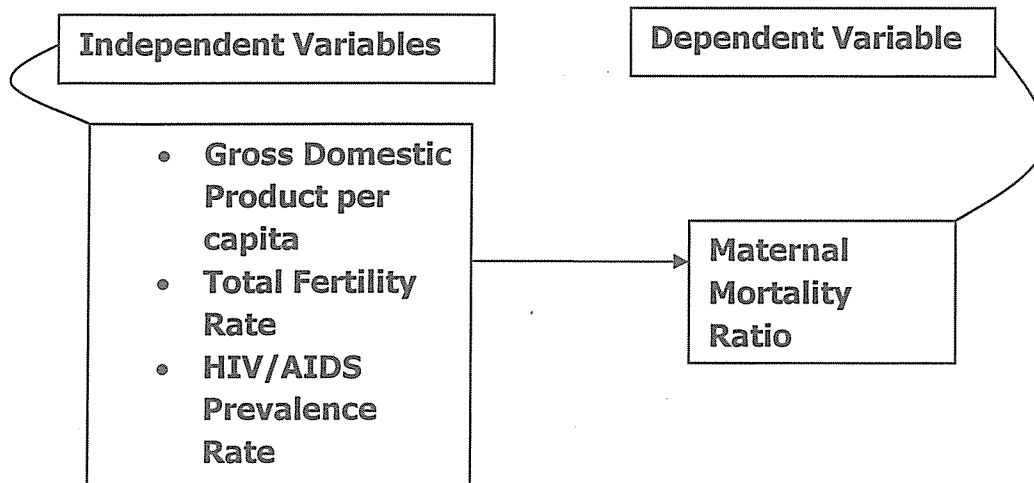


Figure 2.1: Diagrammatical Representation of Conceptual Framework

Source: Demographic transition theory which was derived from modernization theory

As the diagram above shows, there are three independent variables namely: Gross domestic product per capita, total fertility rate, and HIV/AIDS prevalence rate and one dependent variable; maternal mortality and below is their full explanation one by one.

Determinants of maternal mortality ratio

Gross domestic product (GDP) is one of the main national output measures. GDP is the sum of total value of consumption expenditure; total value of investment expenditure; government purchases of goods and services; and net exports i.e. exports minus imports of goods and services. Alternatively, it can be viewed as the total value of consumption expenditure; gross private saving (business saving + personal saving + depreciation); net tax revenues (tax revenue minus domestic transfer payments, net interest paid, and net subsidies); and total private transfer payments to foreigners (African Journal of Health Sciences, Volume 13, Number 1-2, January-June 2006).

According to central intelligence agency (CIA) World Fact book, the gross domestic product (GDP) is the value of all final goods and services produced within a nation in a given year. A nation's GDP at purchasing power parity (PPP) exchange

rates is the sum value of all goods and services produced in the country valued at prices prevailing in the United States in the year noted. This is the measure most economists prefer when looking at per-capita welfare and when comparing living conditions or use of resources across countries.

The measure is difficult to compute, as a US dollar value has to be assigned to all goods and services in the country regardless of whether these goods and services have a direct equivalent in the United States (for example, the value of an ox-cart or non-US military equipment); as a result, PPP estimates for some countries are based on a small and sometimes different set of goods and services. In addition, many countries do not formally participate in the World Bank's PPP project that calculates these measures, so the resulting GDP estimates for these countries may lack precision. For many developing countries, PPP-based GDP measures are multiples of the official exchange rate (OER) measure. The differences between the OER- and PPP-denominated GDP values for most of the wealthy industrialized countries are generally much smaller.

Nominal GDP vs Real GDP: Nominal GDP is the market value (money-value) of all final goods and services produced in a geographical region, usually a country. While real GDP is a macroeconomic measure of the value of output economy, adjusted for price changes. The adjustment transforms the nominal GDP into an index for quantity of total output. Real GDP offers a better perspective than nominal GDP when tracking economic output over a period of time. When people use GDP numbers, they are often talking about nominal GDP, which can be defined as the total economic output of a country. This output is measured at current price levels and currency values, without factoring in inflation.

Calculating real vs nominal GDP

$$\text{Nominal GDP} = \sum_{t=1}^n p_t q_t$$

where p refers to price, q is quantity, and t indicates the year in question (usually the current year).

However, it can be misleading to do an apples-to-apples comparison of a GDP of \$1 trillion in 2008 with a GDP of \$200 billion in 1990. This is because of inflation. The value of one dollar in 1990 was far greater than the value of a dollar in 2008. In other words, prices in 1990 were different from prices in 2008. So if you want to really compare economic output (quantities), you can calculate GDP by using prices from a base year.

When you adjust nominal GDP for price changes (inflation or deflation), you get what is known as the real GDP. It can be calculated using the following formula:

$$\text{Real GDP} = \sum_{t=1}^n p_t q_t$$

where b denotes the base year.

To effectively compare the real GDP of two years, one can construct an index using a base year. A base year is usually an arbitrary figure (here, a particular year) which is used as a yardstick for comparison of the GDP numbers.

Usage and Applications

When should we use real GDP numbers and when is nominal GDP used?

One uses the nominal GDP figures to determine the total value of the products and services manufactured in a country during a particular year. However, when one wants to compare GDP in one year with past years to study trends in economic growth, real GDP is used.

By definition (since real GDP is calculated using prices of a given "base year"), real GDP has no meaning by itself unless it is compared to GDP of a different year.

If a set of real GDPs from various years are calculated, each calculation uses the quantities from its own year, but all use the prices from the same base year. The differences in those real GDPs will, therefore, reflect merely differences in volume.

An index called the **GDP deflator** can be obtained by dividing, for each year, the nominal GDP by the real GDP. It gives an indication of the overall level of inflation or deflation in the economy.

GDP deflator for year $t = \text{GDP}_t / \text{Real GDP}_t$

According to Colander (2004), gross domestic product is the total market value of all final goods and services produced in an economy in one year period. GDP is probably the single most-used economic measure. When economists, journalists and other analysts talk about the economy, they continually discuss GDP, how much it has increased or decreased and what it's likely to do.

Fertility is the ability of an individual or couple to reproduce through normal sexual activity. About 90% of healthy, fertile women are able to conceive within one year if they have intercourse regularly without contraception. Normal fertility requires the production of enough healthy sperm by the male and viable egg by the female, successful passage of the sperm through open ducts from the male testes to the female fallopian tubes, penetration of a healthy egg, and implantation of the fertilized egg in the lining of the uterus. A problem with any of these steps can cause infertility (Macmillan Dictionary 2013).

Total fertility rate is the Average number of children a woman would bear during her lifetime, assuming her childbearing conforms to her age-specific fertility rate every year of her childbearing years age 15 to 49 (Smith, 2008).

According to central intelligence agency (CIA) world factbook, total Fertility Rate (TFR) of a population is the average number of children that would be born to a woman over her lifetime if (1) she were to experience the exact current age-specific fertility rates (ASFRs) through her lifetime, and (2) she were to survive from birth through the end of her reproductive life. It is calculated by summing the single-year age-specific rates at a given time. TFR is a synthetic (not real) rate, not based on the fertility of any real group of women since this would involve waiting until they had completed childbearing. It's not based on counting the total number of children actually born over their lifetime. Instead, the TFR is based on the age-specific fertility rates of women in their "child-bearing years," which is age 15-49 internationally. The TFR is therefore, a measure of the fertility of an imaginary woman who passes

through her reproductive life subject to all the age-specific fertility rates for ages 15-49 that were recorded for a given population in a given year.

Calculating total fertility rate

Total fertility rate (TFR) is calculated from age specific fertility rate. Actually, the sum of age specific fertility rate is the total fertility rate. It is the most common and refined form of fertility rate. It is calculated by taking the sum of ASFR and multiplying by 5 and finally dividing the product by 1000 only if the ASFR is calculated in per thousand bases. It is measured per woman. Generally global fertility rates are in decline.

The following formula can be used to calculate TFR.

$$TFR = \frac{\sum 5 \times ASFR}{1000}$$

Where,

$\sum ASFR$ = total sum of age specific fertility rate

TFR = total fertility rate

Prevalence rate or prevalence proportion is the proportion of a population found to have a condition (typically a disease or a risk factor such as smoking or seat-belt use). It is arrived at by comparing the number of people found to have the condition with the total number of people studied, and is usually expressed as a fraction, as a percentage or as the number of cases per 10,000 or 100,000 people. "Point prevalence" is the proportion of a population that has the condition at a specific point in time. "Period prevalence" is the proportion of a population that has the condition at some time during a given period ("12-month prevalence", etc.), and includes people who already have the condition at the start of the study period as well as those who acquire it during that period. "Lifetime prevalence" (LTP) is the proportion of a population that at some point in their life (up to the time of assessment) have experienced the condition.

Prevalence estimates are used by epidemiologists, health care providers, government agencies, and insurers.

Prevalence is contrasted with incidence, which is a measure of *new* cases arising in a population over a given period (month, year, etc.). For mnemonic purposes, the difference between prevalence and incidence can be summarized thus: prevalence is "how many people have this disease right now" and incidence is "how many people per year newly acquire this disease"?(UNSD, 2012).

Calculating prevalence rate

Prevalence rate is the proportion of people who have a particular disease at a specified point in time or over a specified period of time.

The numerator includes not only new cases, but also old cases (people who remained ill during the specified point or period in time). A case is counted in prevalence until death or recovery occurs. This makes prevalence different from incidence, which includes only new cases in the numerator. Prevalence is most useful for measuring the burden of chronic diseases such as tuberculosis, malaria and HIV in population.

The formula for calculating prevalence rate is:

$$\text{Prevalence rate} = \frac{\text{all new cases and pre-existing cases during a time period}}{\text{population during the same time period}} \times 10^5$$

HIV prevalence rate is the proportion of people who have HIV/AIDS at a specified point in time or over a specified period of time.

$$\text{HIV prevalence rate} = \frac{\text{all new HIV cases and pre-existing cases during a time period}}{\text{population during the same time period}} \times 10^5$$

2.2 Theoretical Perspective

This study is based on demographic transition theory which has been derived from modernization theory which proposed by economic historian Rostow in 1950 and cited by Inkeles and Smith (1974). According to demographic transition theory-derived from modernization theory, fertility and mortality go hand in hand. In societies where fertility is high, maternal mortality tends to be high. Economic development leads to higher standards of living and advanced medical technology which in turn contribute to both lower mortality and fertility. Maternal mortality, an

indicator of health status of the population, should decrease as the level of economic development increases.

This process allegedly requires greater levels of industrialization, education, and urbanization (Inkeles and Smith, 1974; Kelly and Cutright, 1980; Van de Walle and Knodel, 1980). Modernization theorists have also emphasized the importance of capital for the development in LDCs (Rostow, 1971). Capital scarcity is viewed as a major inhibitor to development in LDCs (International Monetary Fund, 1985; Grieco, 1986). They believe that investment from the core industrialized countries and world trade promote development in LDCs by providing external capital, new technology and management experience, which are crucial to the economic and social development of LDCs. Indicators commonly used by researchers working in this tradition include gross national (or domestic) products, economic growth rate, urbanization, education, and health care service.

According to the underlying theory, a nation's industrialization and modernization will enhance women's status in general by providing more labor participation opportunities, and increase women's access to, and control over, any resources including health services, and maternal mortality rate should decrease automatically in step with the decline of general mortality, that is the maternal mortality rate decreases as the economics of the country increases.

2.3 Related Studies

Williamson (1999) conducted a study on women's economic status in less developed countries. That research was conducted in 79 less developed countries, and it focused on the impact of predictors linked modernization theory. The findings of that research revealed that women's status, as measured by indicators such as level of education relative to men, age at first marriage, and reproductive autonomy, is a strong predictor of maternal mortality. We find that economic dependency, especially multinational corporate investment, has a detrimental effect on maternal

mortality that is mediated by its harmful impacts on economic growth and the status of women. The findings of this research imply that women's socio-economic status affects the maternal survivorship.

The World Health Organization, UNICEF and World Bank (2012), conducted a study on trends in maternal mortality from 1990 to 2010. The findings of that study revealed that globally, maternal mortality has fallen by 47% between 1990 and 2010. This means that the overall aim of MDG 5 (a 75% reduction) is very unlikely to be achieved by 2015, unless there are remarkable further reductions from 2011 to 2015. Nevertheless, apart from Southern Africa, substantial reductions in maternal deaths have been achieved in all regions of the world, there were an estimated 287 000 maternal deaths in 2010, yielding a MMR of 210 maternal deaths per 100 000 live births among the 180 countries that were covered in this study. The range of uncertainty indicates that the true total number of maternal deaths could plausibly be as low as 230 000 and as high as 398 000. Similarly, the global MMR plausibly ranges from 170 to 300 maternal deaths per 100 000 live births. Further, the global adult lifetime risk of maternal mortality (i.e. the probability that a 15-year-old woman will die eventually from a maternal cause) is 1 in 180. The findings in their study implied that maternal mortality rate of the African region is still high and the fifth MDG is not achieved.

Lee, Peterson and Chu (2012) conducted a study on the health issues of women and children in Pennsylvania USA. the findings that their study showed include that maternal mortality is much higher in developing than in developed countries and that maternal mortality is a function of a number of factors, including the greater risk inherent in pregnancy and delivery owing to lack of adequate medical care, the greater prevalence of infectious diseases, which are cofactors in some deaths; and the higher incidence of pregnancy. Provision of family planning services has been proposed as one way to reduce maternal mortality. The findings of this research revealed that economic status of the mother, greater prevalence of infectious diseases and higher fertility rate are factors affecting the maternal mortality.

Cham (2003) wrote a thesis about maternal mortality in the Gambia as masters degree thesis in the University of Oslo Norway and the contributing factors he had were socio-cultural, economic and health service factors contributing to maternal deaths. According to his findings, health service factors were the most frequently identified contributing factors to maternal deaths in this study, therefore he recommended that improving the quality of and accessibility to emergency obstetrical care services will significantly contribute to the reduction of maternal deaths in the area.

2.4 Summary of Gaps

From the reviewed literature and related studies, maternal mortality are in other countries other than Somalia or it is done in regional level and this research is focusing on Somalia solely examining the extent that GDP per capita, total fertility rate and HIV/AIDS prevalence rate influence on maternal mortality conducted in Somalia; therefore this study is going to fill that contextual gap.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter deals with research design and methods used in this study. It consists of research design, source of data used, data analysis, ethical considerations, and limitations of the study

3.1 Research Design

This study followed a descriptive design, retrospective, and time series designs. It is descriptive in that determined the trend of gross domestic product per capita, total fertility rate, HIV/AIDS prevalence rate and maternal mortality ratio. It is time series in that data of 23 years have been used. Ordinary least squares (OLS) regression analysis was used to estimate the relationships among variables, modeling and analyzing of the variables. More specifically, OLS regression analysis was used to help us understand how the typical value of the dependent variable changes when any one of the independent variables is varied, while the other independent variables are held fixed and overall significance of the explanatory variables.

3.3 Sources of Data Used

This study used secondary data on GDP per capita, total fertility rate, HIV prevalence rate and maternal mortality ratio. This data were collected from United Nations Statistics Division (UNSD) and World Health Organization (WHO). The Economic Statistics Branch of the United Nations Statistics Division (UNSD) maintains and annually updates the National Accounts Main Aggregates database. It consists of a complete and consistent set of time series, from 1970 onwards, of the main National Accounts aggregates of all UN Members States and other territories in the world for which National Accounts information is available. Its contents are based on the official data reported to UNSD through the annual National Accounts. Questionnaire, supplemented with data estimates for any years and countries with incomplete or inconsistent information.

3.4 Techniques Employed in Data Analysis

3.4.1 Ordinary Least Squares (OLS)

Ordinary least squares (OLS) is a method for estimating the unknown parameters in a linear regression model, with the goal of minimizing the differences between the observed responses in some arbitrary dataset and the responses predicted by the linear approximation of the data. The resulting estimator can be expressed by a simple formula, especially in the case of a single regressor on the right-hand side.

The Ordinary Least Squares method of estimation can easily be extended to models involving two or more explanatory variables, though the algebra becomes progressively more complex. In fact, when dealing with the general regression problem with a large number of variables, matrix algebra was used (see Appendix I).

The OLS estimator is consistent when the regressors are exogenous and there is no perfect multicollinearity, and optimal in the class of linear unbiased estimators when the errors are homoscedastic and serially uncorrelated. Under these conditions, the method of OLS provides minimum-variance mean-unbiased estimation when the errors have finite variances. Under the additional assumption that the errors be normally distributed, OLS is the maximum likelihood estimator. OLS is used in economics (econometrics), political science and electrical engineering among many areas of application.

Ordinary least squares (OLS) regression analysis was used to determine the relationship between explanatory variables and the variable to be explained. This was done to estimate the parameters and to see effect of each independent variable to the maternal mortality and joint influence of GDP per capita, total fertility rate and HIV/AIDS prevalence rate on maternal mortality by computing coefficient of determination R-squared and adjusted R-squared.

Based on the research variables under study the following model was developed:

$$\text{MMR} = \beta_0 + \beta_1 \text{GDPPC} + \beta_2 \text{TFR} + \beta_3 \text{HIVPR} + \varepsilon_t$$

Where **MMR** is maternal mortality ratio

GDPPC is gross domestic product per capita

TFR is the total fertility rate

HIVPR is human immune deficiency virus prevalence rate

ε_t is error term

3.4.5 Pearson Correlation Coefficient

Correlation between sets of data is a measure of how well they are related. The most common measure of correlation in stats is the Pearson Correlation. The full name is the Pearson Product Moment Correlation or PPMC. Two letters are used to represent the Pearson correlation: Greek letter rho (ρ) for a population and the letter "r" for a sample.

Pearson correlation coefficient measures the relationship between two variables X and Y , giving a value between +1 and -1 inclusive, where 1 is total positive correlation, 0 is no correlation, and -1 is total negative correlation. It is widely used in the sciences as a measure of the degree of linear dependence between two variables.

In samples, the value of correlation coefficient r is calculated as

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Where n is number of the data set, x and y are the variables to be related.

Pearson correlation coefficient was used to determine the relationship between each of the explanatory variables i.e. GDP per capita, total fertility rate and HIV prevalence rate with the maternal mortality ratio then the significance of each relationship was checked by comparing the P-value and the level of significance.

3.4.6 Line Graphs and Linear Trend Model

Line graphs were used to visualize the trend of each of the four research variables. In addition to line graphs, linear trend models have been developed to estimate the rate of change of each variable with the time.

Below are the models being applied to assess the trends:

$$GDPPC_t = \beta_0 + \beta_1 t + e_t \dots\dots\dots(1)$$

$$TFR_t = \beta_0 + \beta_1 t + e_t \dots\dots\dots(2)$$

$$HIVPR_t = \beta_0 + \beta_1 t + e_t \dots\dots\dots(3)$$

$$MMR_t = \beta_0 + \beta_1 t + e_t \dots\dots\dots(4)$$

Where β_0 is constant, β_1 is the rate of change of the dependent variable (GDPPC, TFR, HIVPR, and MMR) with the change of time in one year. t is time and e_t is the error term.

If β_1 is significantly different from zero we say that the variable at hand is changing with the time change and there is trend. If β_1 is not significantly different from zero that means there is no trend as the variable at hand is not changing with time.

These calculations have been made with the help of STATA 12 and Minitab 16 statistical softwares.

3.4.7 F-test and t-test

In hypothesis testing the researcher carried out two types of tests: the first one was entire set test which will be used to test the overall ability of the three independent variables (GDP per capita, total fertility rate and HIV prevalence rate) to explain variations in the dependent variable (maternal mortality ratio).

The null hypothesis was that none of the explanatory variables (GDP per capita, total fertility rate and HIV prevalence rate) has significant effect on the dependent variable (maternal mortality ratio). If accepted, it would imply that the set of the coefficients is of no value in explaining variations in the dependent variable. The alternate hypothesis was that at least one of the independent variables (GDP per capita, total fertility rate and HIV prevalence rate) has significant effect jointly on the dependent variable (maternal mortality ratio). This test can be written in symbolic form as:

$$H_0: \beta_1 = \beta_2 = \beta_3 = 0$$

$$H_1: \text{Not all the } \beta\text{'s are 0}$$

Rejecting H_0 and accepting H_1 implies that one or more of the independent variables is useful in explaining variations in the dependent variable. However it does not identify which regression coefficients is not zero.

The test statistic used in this case was the F distribution which has been computed as

$$f = \frac{MSR}{MSE}$$

Where MSR is the mean square of the regression and MSE is the mean square of the error.

This F has been compared with $F_{n-(k+1)}^k$ which is F from the table of F distribution.

Where K is the degree of freedom of the numerator and is equal to the number of independent variables and $n-(k+1)$ is the degree of freedom of the denominator.

The second test of hypothesis is called individual test and it identifies which of the set of independent variables are significant predictors of dependent variable. That is, it tests the independent variables individually rather than as a unit.

The test statistic is the Student t distribution with $n - (k + 1)$ degrees of freedom. The null and alternate hypotheses would be written as follows:

Null hypotheses:

GDP per capita has no inverse significant influence in maternal mortality of Somalia (i.e. $\beta_1=0$)

Total fertility rate has no positive significant effect on maternal mortality ratio of Somalia (i.e. $\beta_2=0$)

HIV prevalence rate has no direct significant effect on maternal mortality ratio of Somalia (i.e. $\beta_3=0$)

Alternative hypotheses:

GDP per capita has inverse significant influence on maternal mortality ratio of Somalia (i.e. $\beta_1 \neq 0$)

Total fertility rate has positive significant effect on maternal mortality ratio of Somalia (i.e. $\beta_2 \neq 0$)

HIV prevalence rate has direct significant effect on maternal mortality ratio of Somalia (i.e. $\beta_3 \neq 0$).

The significance levels of 99%, 95% and 90% were used through the testing of the hypotheses.

3.5 Ethical considerations

The principles underlying research ethics regarding confidentiality, honesty and respect for individual rights has been observed. Ethical standards in this study have been assured. The institutions and organizations whose data is used have been

thanked for their participation. Authors of published data has been recognized and acknowledged.

3.6 Limitations of the study

Since the data used in the study was secondary data from international organizations, the research had the following limitations:

- i. Since the researcher did not collect the data, he has no control over what is contained in the data set. Often times this can limit the analysis or alter the original questions the researcher sought out to answer.
- ii. Another limitation is that the researcher does not know exactly how the data collection process was done and how well it was done. The researcher is therefore not usually privy to information about how seriously the data are affected by problems such as low response rate or respondent misunderstanding of specific survey questions.

CHAPTER FOUR

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

4.0 Introduction

This chapter deals with presentation and analysis of data with tables, graphs and interpretation of the results. Given the data collected we discussed in this chapter the trends and levels of GDP per capita, total fertility rate, HIV prevalence rate and maternal mortality ratio of Somalia in the period 1990-2012. We also discussed in this chapter the relationship between the variables (GDP per capita, total fertility rate, HIV prevalence rate) and maternal mortality ratio through regression analysis. The last part in this chapter involves testing hypotheses.

4.1 Trend of GDP per capita of Somalia in the period 1990-2012

Data in table 4.1 show the Somalia GDP per capita in the period 1990-2012.

Table 4.1: GDP per capita of Somalia in US dollars

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
151	93	89	153	174	172	190	218	276	265	172	171	156	190

2005	2006	2007	2008	2009	2010	2011	2012
190	280	284	291	221	115	112	128

Source: United Nations Statistics Division (UNSD)

To determine the trend of the GDP the following graph is plotted.

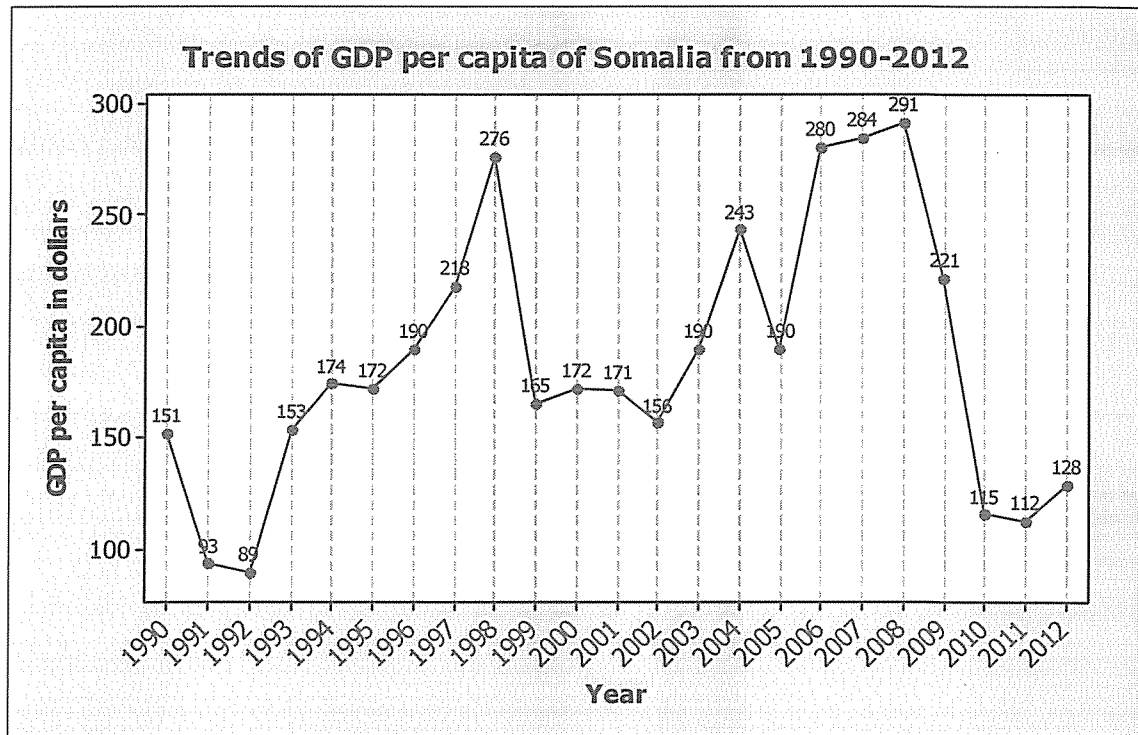


Figure 4.1: Trend of GDP per Capita

As table 4.1 and figure 4.1 show the GDP per capita of Somalia sharply declined in the years 1991 and 1992. This decline can be explained that as a result of the fall down of central government in the early 1991, almost all the economic sources such as the agriculture sector, livestock, export and import of the different seaports, airports, factories among others were stopped working. In addition to that, severe civil war broke out which caused extensive displacement and the problem was even worse in 1992. From 1993 to 1998 the GDP per capita was gradually increasing and despite experiencing civil unrest, Somalia has started an informal economy based mainly on livestock, remittance/money transfer companies and telecommunications.

Unfortunately, the GDP has again turned down because before 1999 the people had expectations of returning law and order in the country such that they will continue their activities but when it reached to 1999 and the situation is becoming worse they disappointed that may be the reason why the GDP was declining in the years 1999 to 2002. After 2002 there was a little hope of returning government which may be the cause of steady increase of GDP in the period 2003 to 2008 although there was some drop down in 2005.

As the figure above is showing there was sharp decline of the GDP in the last three years of the period under study. Although there are many factors caused this decline but the major two factors were due to renewed fighting in the southern part of the country and two consecutive missed rainy seasons precipitated the worst drought in East Africa seen in 60 years. Belated and sub-average harvests, high food, water and fuel prices, and depleted grazing and farm lands caused by an estimated 25 percent drop in rainfall led to a large severe decline in the economy of the country. In July 2011, the United Nations officially declared a famine in several regions of southern Somalia, a situation reportedly exacerbated by a temporary ban on relief supplies imposed by Islamist militants.

Table 4.2: Linear Trend Model to test the trend

gdppc	Coef.	Std. Err.	t	P> t
year	2.251976	1.940162	1.16	0.259
_cons	-4317.77	3882.286	-1.11	0.279

Source: Results of the Analysis (2015)

Results in table 4.2 revealed that regression of GDP per capita on time variable (year) to assess the trend of GDP per capita with time. From the table we develop linear trend model.

$$GDPPC_t = \beta_0 + \beta_1 t + e_t$$

Considering the estimates of β_0 and β_1 the linear trend model is

$$GDPPC_t = -4317.77 + 2.25t$$

This means that GDP per capita changes 2.25 as time changes one year but according to the table P-value (1.16) is greater than all conventional levels 0.01, 0.05 and 0.1 and therefore the trend is not significantly different from zero. That is there is no predictable trend of GDP per capita in the 23 years under study which is in line to the line graph.

4.2 Trend of total fertility rate of Somalia in the period 1990-2012

The table below shows the total fertility rate of Somalia from 1990 to 2012.

Table 4.2 Total fertility rate (children born per woman as an average)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Total fertility rate	6.40	6.46	6.52	6.50	6.48	6.48	6.79	6.73	6.82	6.96	7.18	6.11	7.05

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
6.98	6.91	6.84	6.86	6.90	6.93	6.95	6.82	6.76	6.68

Source: United Nations Statistics Division (UNSD)

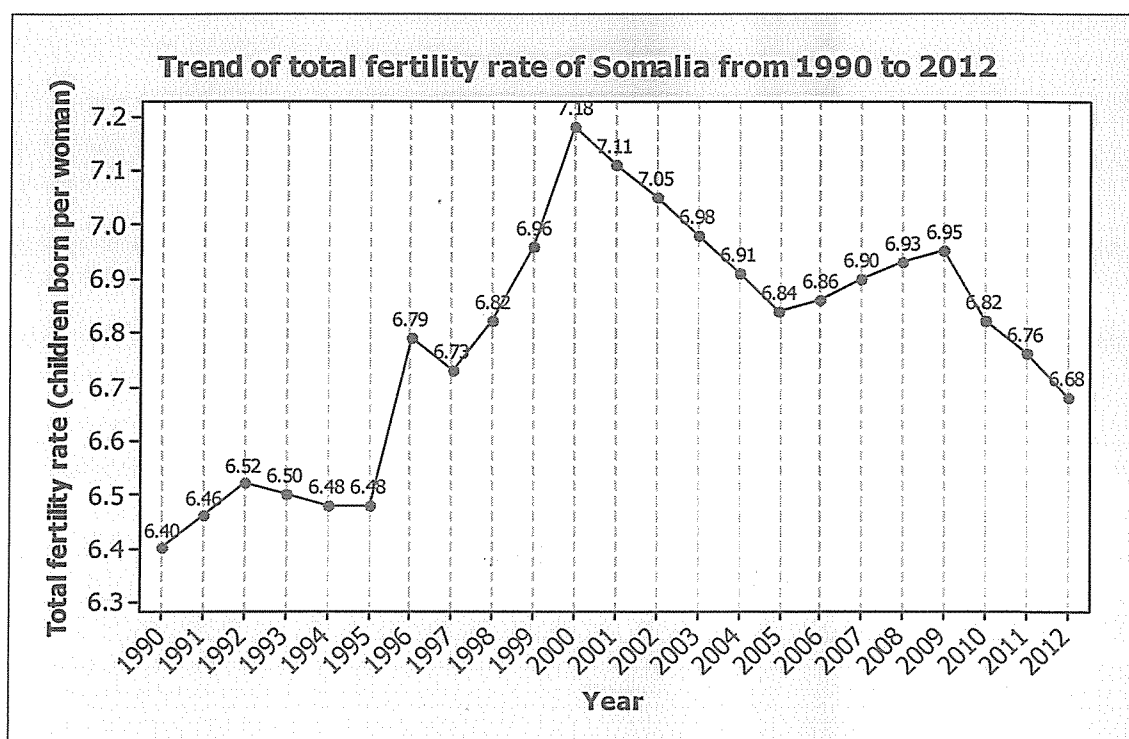


Figure 4.2 Trend of total fertility rate of Somalia from 1990-2012

Source: Results of the Analysis (2015)

The graph in figure 4.2 and the table 4.3 above show a general upward trend from 1990-2000 of total fertility rate, This portion being mainly post statehood collapse, the period immediately after the military rule has fallen. The explanation of this trend is that following the falling of the military government all of the governmental policies including family planning strategy was shattered while there was an extensive displacement of the people from main cities and they settle villages and refugee camps in the country and outside of the country mainly in the neighboring countries i.e. Kenya, Ethiopia, and Djibouti. In the refugee camps as well as villages there were wide spread jobless which caused men and women to sit in their homes all the time waiting humanitarian aid which in turn increased the chance of meeting of the couple raising the fertility.

In the period 2001-2012 although there were some fluctuations, the graph shows a general downward trend which was characterized by number of factors. In the late of 2000 the first interim government was setup after a decade of lack of government. Although it was less efficient, that government showed returning of statehood of Somalia and reformed some policies among them family planning policies. In spite of steady increase between the years of 2005 and 2009 where many regions of the country experienced wars and lawlessness, the total fertility rate of Somalia has been decreasing in the last decade. Although there is general decrease, the total fertility rate is still one of the highest in the world which may cause deaths of number of mothers.

Linear Trend Model to test the trend

tfr	Coef.	Std. Err.	t	P> t
year	.0187945	.0058896	3.19	0.004
_cons	-30.82033	11.78512	-2.62	0.016

The model developed from the parameter estimates in the table is as below.

$$TFR_t = -30.820 + 0.187t$$

As the coefficient of t reveals, total fertility rate increases 0.187 as the time which is in years changes one unit. The P-value (0.004) shows that the coefficient of t is significantly different from zero as 0.004 is less than even 0.01 that is 99% significance level. In conclusion there is an increasing trend of total fertility rate with respect to the time.

4.3. Trend of HIV prevalence rate of Somalia in the period 1990 to 2012

Table 4.3 Percentage of adults living with HIV/AIDS

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Prevalence	1.2	1.2	1.3	1.3	1.4	1.4	1.3	1.3	1.3	1.3	1.4

2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
1.4	1.5	1.5	1.4	1.4	1.5	1.4	1.4	1.5	1.5	1.6	1.6

Source: World Health Organization (WHO)

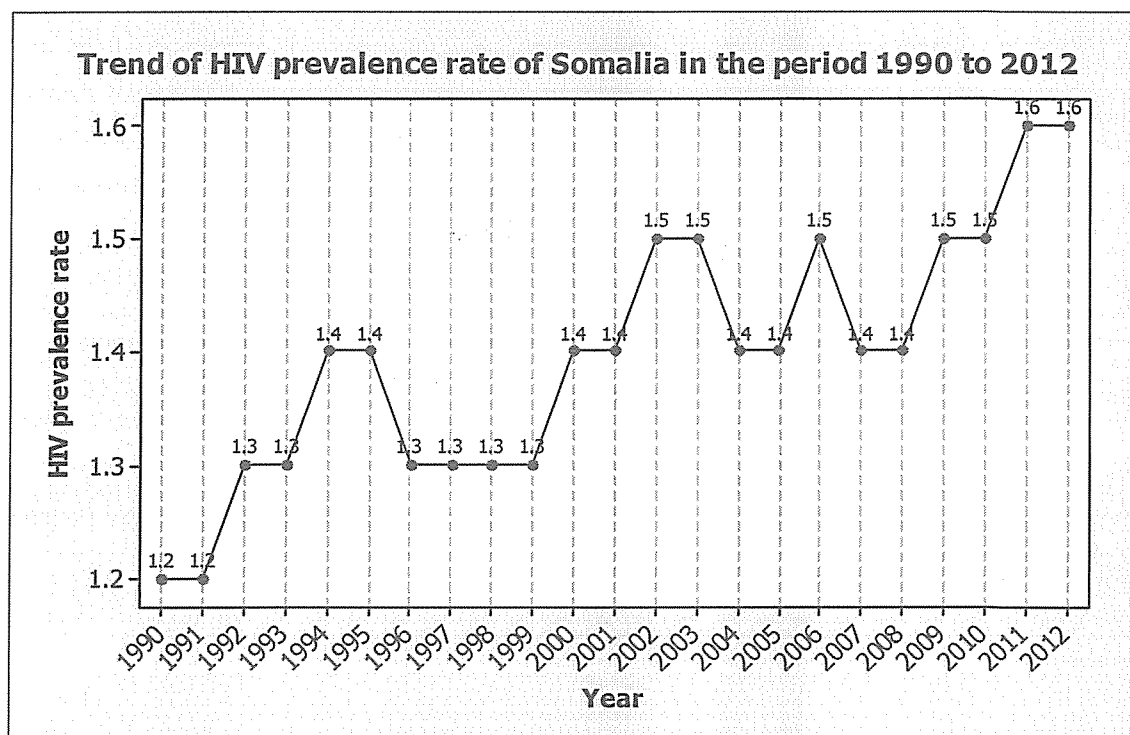


Figure 4.3 Percentage of adults living with HIV/AIDS

Source: Results of the Analysis (2015)

Figure 4.3 and table 4.5 above show general increase of HIV prevalence rate in the period under study although there were some fluctuations. After the collapse of military government, clan-based wars started in the capital city of Somalia, Mogadishu which spread all over the country. Consequently, many people displaced in the villages as many others reached to the neighboring countries. Because the lack of adequate health service many people developed diseases among them HIV AIDs. This massive displacement also led the Somali people to interact with different communities with different backgrounds some of them are carriers of communicable diseases such as HIV AIDS.

The fluctuations shown by the graph can be explained that there were some humanitarian agencies that helped the people as there were regular programs to raise community awareness.

Linear Trend Model to test the trend

hivpr	Coef.	Std. Err.	t	P> t
year	.013834	.0018897	7.32	0.000
_cons	-26.28617	3.78129	-6.95	0.000

The above output is the regression of HIV prevalence rate over time and the trend model is built based on the estimates in the table.

$$\text{HIVPR}_t = -26.286 + 0.014t$$

This model is showing that HIV prevalence rate is changing with the time with a rate of 0.014 and therefore there is an increasing trend of HIV prevalence rate as time increases with one year. The P-value of 0.000 which is very small from all conventional levels is illustrating that the trend is significantly different from zero.

4.4 Trend and level of maternal mortality ratio of Somalia in the period 1990-2012.

Table 4.4: maternal mortality ratio per 100,000 live births in the period 1990 to 2012

year	Maternal mortality ratio
1990	890
1991	952
1992	963
1993	953
1994	948
1995	941
1996	938
1997	937
1998	931
1999	925
2000	998
2001	1008
2002	1006
2003	1007
2004	975
2005	1000
2006	1012
2007	998
2008	1003
2009	1024
2010	1032
2011	1032
2012	1025

Source: World Health Organization (WHO), 2012

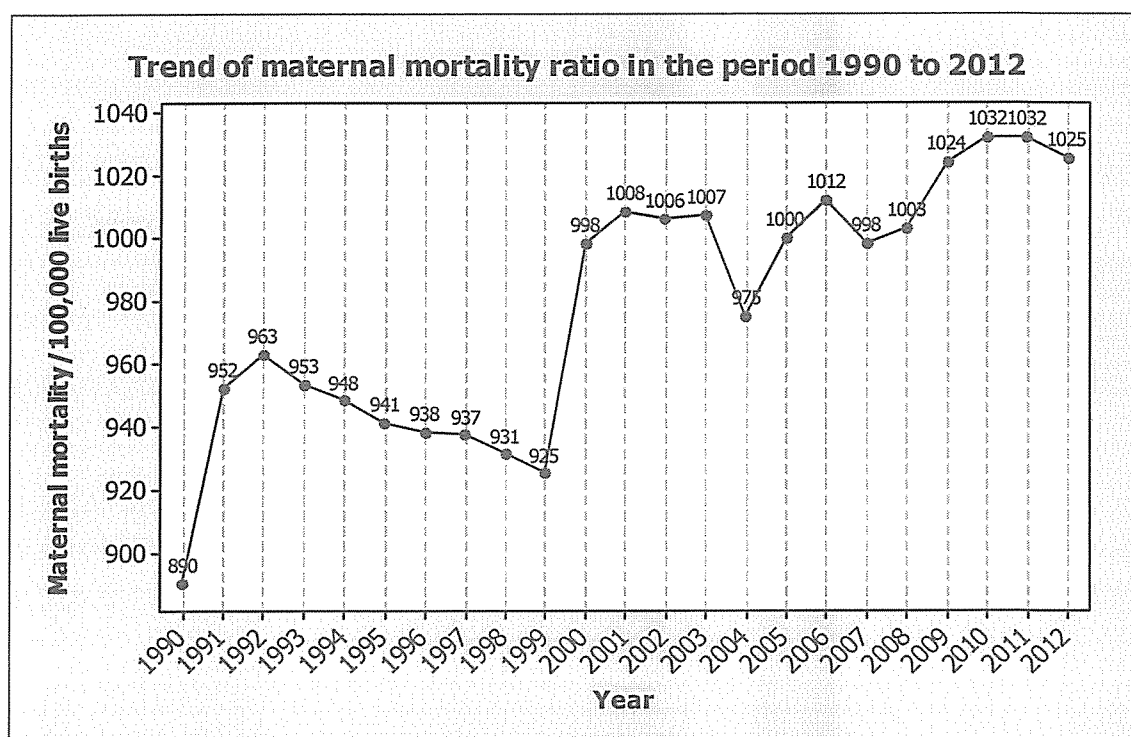


Figure 4.4. Trend of maternal mortality ratio of Somalia 1990-2012.

Source: Results of the Analysis (2015)

The table above and the following graph show general increase in maternal mortality ratio during the period under study. There are rise and fall in the graph as maternal mortality ratio increased very extensively from 1990 to 1992 where maternal death increased in those two years by 73/100,000 live births. This sudden rise can be explained that in 1991 was the fall of the government of Somalia followed by civil wars, destruction of social service infrastructure such as hospitals, schools, universities among others, massive displacement and famine in 1992-1993. As a result, mother death was very high since the mothers cannot get skilled workers during the birth or even if they get they could not pay the money that skilled worker demands.

As we can see in the figure above, although Somalia's public healthcare system was largely destroyed during the ensuing civil war, the maternal mortality ratio decreased from 1993 to 1999 because informal providers have partially filled the

vacuum and replaced former government monopoly over healthcare, with access to facilities witnessing a significant increase. Many new healthcare centers, clinics, hospitals and pharmacies have in the process been established through home-grown Somali initiatives. During these years many private schools and universities have been established consequently literacy rate has increased. During this period gross domestic product of the country has increased as private business increased.

Unfortunately, the maternal mortality ratio again increased from 1999 up to the last year of the study period although there was slight drop downs in some years such as 2004 and 2007. This increase of maternal mortality ratio can be illustrated that many parts of the country such as the capital city, Mogadishu experienced again instability as warlords divided the civilians into clan based parts. Although the period of warlords ended in 2006, the war has got new phase as Islamist groups emerged and started fighting with the successive interim governments and that war is still going on. Because of that long term instability, the production of the country, health care and education sectors were very low. In addition to the above mentioned problems, during this period the insurgent groups seized most of the country and expelled humanitarian agencies which were helping the disadvantaged people. As a consequent of these accumulated troubles maternal mortality ratio reached in one of the highest measures in the world.

In conclusion, there is general increase in the maternal mortality ratio of Somalia from 1990 to 2012 and the worst years were 2010 and 2011 which can be explained by the droughts and fierce fighting during those years

Linear Trend Model to test the trend

mmr	Coef.	Std. Err.	t	P> t
year	5.066206	.672763	7.53	0.000
_cons	-9159.303	1346.206	-6.80	0.000

$$MMR_t = 0.916 + 5.066t$$

From the model it can be seen that maternal mortality increases 5.066 units as time increases one year. Considering the significance that rate of change which is the trend of maternal mortality ratio with time, it seems that the coefficient is significantly different from zero as P-value of 0.000 is less than all significant levels been used in this study i.e. 0.01, 0.05, and 0.10 and it can be concluded regardless of the fluctuations that there is increasing trend of maternal mortality in the period under study.

4.5 Basic Assumptions Test

Multicollinearity

The first basic assumption test undertaken here is multicollinearity test. Multicollinearity means that independent variables are correlated one another. If correlation exists between independent variable, then we are in the state of multicollinearity problem. In this case, the regression model will end up with an incorrect or erroneous result and therefore, invalid conclusion will be prevailed.

The simplest multicollinearity test is conducted by testing the correlation coefficient between the independent variables. As a rule (rule of thumb), if the correlation coefficient is above 0.85, we should suspect of multicollinearity problems among

independent variables. Correlation value between independent variables can be shown as below:

Correlation Value among Independent Variable

	gdppc	tfr	hivpr
gdppc	1.0000		
tfr	0.4468	1.0000	
hivpr	-0.0321	0.4211	1.0000

The table shows that the maximal absolute correlation value among independent variables is 0.447 which exists between GDP per capita and total fertility rate. Since the maximal absolute correlation value is below the rule of thumb (in this study, it is assumed to be 0.85), we may conclude that we do not have multi-collinearity.

Normality Test

Normality test is performed to determine whether the data in the study is normally distributed or not. This study applied Shapiro Wilk test to detect normality problem in the model. Null hypothesis in Shapiro-Wilk test is that the data have not been normally distributed. If we select 5% level of significance, then we may reject the null hypothesis if prob< z for Shapiro-Wilk test is above 5%; otherwise we have no option but to accept null hypothesis and conclude that the residual data are not normally distributed.

Shapiro Wilk Test on Normality Problem

. swilk r					
Variable	Shapiro-Wilk W test for normal data				
	Obs	W	V	Z	Prob>z
r	23	0.83358	2.111	1.545	0.03116

Shapiro-Wilk test calculated in STATA version 12.0 yield value prob> z is 3.116% which is less than 5% level of significant. Therefore, we can safely conclude that the residual of this model is normally distributed. The graphical method performed by STATA version 12.0 also shows the normality of model residual.

Autocorrelation Test

Autocorrelation test is conducted by applying Durbin-Watson Test (d statistics). According to Gujarati (2005), the area in which we do not reject null hypothesis and decide that we do not have autocorrelation problem in the model is if the Durbin Watson value is located between 2 and 4-du. As the figure 4.9 shows, Durbin Watson statistics value is 2.164005 which is clearly located between 2 and 4-du. Therefore, we may consider that the model is clear from autocorrelation problem.

Durbin Watson Statistics

. dwstat					
Durbin-Watson d-statistics (7, 30) = 2.164005					

Heteroscedasticity Test

Heteroscedasticity test aims at testing whether the regression model has constant residual variance for each observation. If the residual variance of each observation is different, we conclude that there is a heteroscedasticity. This study carried out Breusch-Pagan test for heteroscedasticity. The null hypothesis of this test is heteroscedasticity or inconstant variance. With the level of significant 5%, the Breusch-Pagan Prob< Chi2 should be less than 5% for us to conclude that we have no heteroscedasticity problem.

Breusch-Pagan heteroscedasticity Test

```
. estat hettest
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant Variance
Variables: Fitted Values of MMR

Chi2 (1)      =      9.25
Prob< chi2    =      0.0024
```

According to STATA 12.0 result as shown in figure 4.10, Breusch-Pagan Prob< Chi2 is 0.24%. Therefore, we can reject null hypothesis and conclude that we have no heteroscedasticity problem in the model.

4.6 Relationship between maternal mortality and the explanatory variables

Table 4.5 Pearson Correlation Coefficient
Significance Level $\alpha = 1\%, 5\%$ or 10%

		MMR	Sig	Decision
GDPPC	Pearson Correlation Coefficient (r)	-0.372	0.083	Significant negative relationship
TFR	Pearson Correlation Coefficient (r)	0.548	0.007	Significant positive relationship
HIVPR	Pearson Correlation Coefficient (r)	0.860	0.000	Significant positive relationship

Source: Results of the Analysis (2015)

The table above shows the individual relationship of the explanatory variables with maternal mortality ratio. Starting with GDP per capita, Pearson correlation coefficient $r = -0.372$. The negative sign shows reverse relationship between GDP per capita and maternal mortality ratio which means, maternal mortality increases as GDP per capita decreases and vice versa. As the p-value (Sig=0.083) is less than 0.10 it means that the relationship between GDP per capita and maternal mortality is significant at 10%. The total fertility rate and HIV prevalence rate are significantly, positively related to maternal mortality at 99% as $r = 0.548$ and 0.860 with sig. of 0.007 and 0.000 respectively which are less than 0.01 .

Regression Analysis

In order to investigate the causal relationship between the independent variables (GDP per capita, total fertility rate and HIV prevalence rate) and the dependent variable (maternal mortality ratio), researcher compiled regression analysis and below is the output.

mmr	Coef.	Std. Err.	t	P> t
gdppc	-.1293192	.0748905	-1.73	0.100
tfr	60.99421	23.01391	2.65	0.016
hivpr	258.333	41.51149	6.22	0.000
_cons	228.0076	131.7681	1.73	0.100

Source	SS	df	MS	Number of obs =	23
Model	28867.0811	3	9622.36036	F(3, 19) =	27.18
Residual	6726.22328	19	354.011751	Prob > F =	0.0000
Total	35593.3043	22	1617.87747	R-squared =	0.8110
				Adj R-squared =	0.7812
				Root MSE =	18.815

Source: Results of the Analysis (2015)

From the first table above we can develop the model of the study:

$$MMR = \beta_0 + \beta_1 GDPPC + \beta_2 TFR + \beta_3 HIVPR + \varepsilon_t$$

Where

MMR is the maternal mortality ratio

GDPPC is the gross domestic product per capita

TFR is the total fertility rate

HIVPR is the human immunodeficiency virus prevalence rate and

ε_t is the error term

$\beta_0, \beta_1, \beta_2, \beta_3$ are the parameters

Referring to the table above the model can be developed as below

$$\text{MMR} = 228 - 0.13\text{GDPPC} + 61\text{TFR} + 258\text{HIVPR}$$

$$(1.73) \quad (-1.73) \quad (2.65) \quad (6.22)$$

$$F = 27.18 \quad R^2 = 0.811$$

According to the model above, the GDP per capita is reversely related to maternal mortality ratio as the negative sign reveals. This means that when GDPPC increased by one unit, MMR will decrease approximately 0.13 units and vice versa. Total fertility rate and HIV/AIDS prevalence rate are positively related to maternal mortality ratio as indicated by the positive signs. This can be explained as total fertility rate increases one unit, maternal mortality ratio increases 61 units so they are related positively. When it comes to HIV prevalence rate, an increase of one unit in HIV prevalence rate will cause an increase of 258 units in maternal mortality ratio. When all mentioned variables are zero, maternal mortality ratio will be approximately 228 per 100,000 live births.

The above mentioned explanation is the individual effects of the explanatory variables on the explained variable which is maternal mortality ratio and it seems that all of the three independent variables are significant in explaining the variations of maternal mortality ratio. Coming to joint effects of the three explanatory variables, we can see the second table that the coefficient of determination (R^2) is 0.811 which means that the three explanatory variables are jointly explaining 81% of the variations in the explained variable (maternal mortality ratio) while the remaining 19% are explained by other factors not included in the model. Adjusted R^2 is the R-squared regulated with degrees of freedom.

Therefore, we can reach the conclusion that these three variables (GDP Per capita, total fertility rate and HIV/AIDS prevalence rate) are very important factors

influencing maternal mortality ratio. To reduce maternal mortality ratio, the GDP per capita should be increased by increasing the incomes of the individuals as it is influencing maternal mortality ratio negatively. It should also put in place policies to decrease total fertility rate and HIV/AIDS prevalence rate which will directly reduce maternal mortality ratio.

4.6Hypothesis testing

The hypotheses which have been mentioned in chapter three were tested into two ways:

First is to test the significance and influence of all the explanatory variables as a whole on explained variable (maternal mortality ratio). To do this, a comparison was made for the P-value in the table (0.000) and for both F-computed (27.18) and R-squared (0.811). As the p-value is extremely less than both R-squared and F-computed, the researcher concluded that the independent variables (GDP per capita, total fertility rate and HIV/AIDS prevalence rate) are jointly explaining significant part of the variations in maternal mortality ratio and therefore we reject the null hypothesis of none of the explanatory variables is significant and accept the alternative hypothesis which is at least one of the explanatory variables is significantly different from zero.

Second way is to test the significant of each of the explanatory variables. This test can be achieved by comparing values of the t-computed those appears under the model with the conventional levels of α ($\alpha = 1\%$ $t=2.58$, $\alpha = 5\%$ $t=1.96$ and $\alpha = 10\%$ $t=1.65$). In comparing these values with the computed t-values above we can see that all of the three independent variables under study are significant in conventional levels those statisticians accepted that everything which is significant in one of those levels is significant. Therefore, we reject again the null hypothesis of none of the explanatory variables is significantly different from zero and accept the alternative hypothesis which is at least one of the explanatory variables is significantly different from zero.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0. Introduction

This chapter presents the discussion of the results derived from the data presented in Chapter Four. It states the major study findings on determinants of maternal mortality ratio in Somalia in the period 1990-2012. It also presents the conclusion and recommendations of the study arising from the study findings. The first section presents the summary of findings. This is followed by a presentation of the conclusion and recommendations in relation to the study research objectives.

5.1 Summary of Findings

This study was guided by three objectives which comprised of (I.) to determine the trend and level of the following variables: GDP per capita, total fertility rate and HIV/AIDS prevalence rate of Somalia in the period from 1990 to 2012 (II.) to determine the trend and the extent of maternal mortality ratio of Somalia in the period 1990 to 2012 (III.) to establish if there is a significant relationship between the levels of GDP per capita, total fertility rate and HIV/AIDS prevalence rate and maternal mortality ratio of Somalia in the period from 1990 to 2012.

Considering the first objective which is the determination of the trends of GDP per capita, total fertility rate and HIV/AIDS prevalence rate of Somalia in the period 1990 to 2012, the following findings emerged from the analysis and summarized as below:

Starting with GDP per capita, the trend of GDP per capita of Somalia in the study period was not predictable and there were fluctuations from time to time. In 1991 and 1992 there were sharp decline, followed by steady increase of GDP per capita

from 1993 to 1998. From 1999 to 2005, the GDP has fallen down again although it was fluctuating. The next three years the GDP per capita has risen as it reached its maximum point in 2008. The following four years from 2009 to 2012 the GDP per capita has once more declined.

Glancing to the trend of the total fertility rate of Somalia in the period under study of approximately two decades, there were two equal and opposite trends. In the first decade (from 1990 up to 2000) an increasing trend with number of fluctuations has been exhibited while in the last decade (from 2001 to 2012) in spite of some fluctuations, the trend was declining. Although the trend of total fertility rate was decreasing in the last decade, its level is still high and Somalia remains as one of the highest countries in the world in terms of fertility rate as it is averaging to 6.79 children per women with very small standard deviation of 0.22.

Coming to HIV/AIDS prevalence rate, there was generally rising trend of HIV/AIDS prevalence rate in Somalia in study period of the two decades with more rise and fall from year to year.

The second objective of this study was to determine the trend of maternal mortality ratio of Somalia in the period 1990-2012. As exposed in chapter four, there was an increasing trend in maternal mortality ratio of Somalia in the period covered by the study under consideration with number of fluctuations.

The third objective of study was to investigate the influence and the relationship of the explanatory variables (GDP per capita, TFR and HIV/AIDS prevalence rate) on the dependent variable (maternal mortality ratio). The relationship of each independent variable on maternal mortality was calculated using Pearson correlation coefficient and also through regression analysis. Pearson correlation coefficients between GDP per capita, total fertility rate, HIV prevalence rate with maternal mortality were found $r = -0.372$, 0.548 and 0.860 with P-values of 0.083 , 0.007 and 0.000 respectively. This showed that the three explanatory variables have significant relationship with maternal mortality ratio at conventional levels of significance. The GDP per capita is reversely related to maternal mortality ratio while total fertility rate and HIV

prevalence rate are directly related to maternal mortality ratio. The strong influence of the explanatory variables is also shown by the regression analysis where overall influence of the independent variables is found coefficient of determination of R^2 with 81% which implies that the selected explanatory variables are explaining the dependent variable with higher percentage.

The findings of this study are in agreement with other researchers' results among them John B. Williamson (1999) conducted a study on the effect of women's economic status on their mortality in less developed countries the findings of that research revealed that women's status, as measured by indicators such as level of education relative to men, age at first marriage, and reproductive autonomy, is a strong predictor of maternal mortality. John found that the better mother's economic status the better her survivorship. This is in line with this research in that economic status of the mother affects reversely her mortality.

The underlying research is in line with the work of Nancy C. Lee, Herbert B. Peterson, and Susan Y. Chu (2012) as they conducted a study on the health issues of women and children in Pennsylvania USA. The findings that their study showed include that maternal mortality is much higher in developing than in developed countries and that maternal mortality is a function of a number of factors, including the greater risk inherent in pregnancy and delivery owing to lack of adequate medical care, the greater prevalence of infectious diseases, which are cofactors in some deaths; and the higher incidence of pregnancy. Provision of family planning services has been proposed as one way to reduce maternal mortality. The findings of this research revealed that economic status of the mother, greater prevalence of infectious diseases and higher fertility rate are factors affecting the maternal mortality and that is exactly what this study found.

5.2 Conclusion

The study investigated determinants of maternal mortality ratio of Somalia in the period 1990-2012. It was intended to find out the relationship between GDP per capita, total fertility rate and HIV/AIDS prevalence rate as an explanatory variables and maternal mortality ratio as dependent variable. In the findings of the study many important observations were made and the following conclusions were drawn.

Based on the purposes of the study in relation to its findings, the conclusion is generated as follows.

Findings indicated that GDP per capita experienced instability and there were no significant trend that can be stated as it showed numerous fluctuations in the period under study. Total fertility rate showed two equal and opposite trends as it was increasing in the first decade while it was decreasing in the last decade but in general it was increasing. HIV/AIDS prevalence rate also showed general increase in the trend in the study period of 23 years. On maternal mortality ratio, the analysis showed an increasing trend of the maternal deaths with number of fluctuations. On the relationship between GDP per capita, total fertility rate and HIV/AIDS prevalence rate as independent variables and maternal mortality ratio, the study found out that there is significant relationship between them. Based on these findings, the null hypothesis was rejected and the researcher concludes that GDP per capita, total fertility rate and HIV/AIDS prevalence rate are significantly influencing the maternal mortality ratio of Somalia. The findings also revealed the validity of demographic transition theory in that as the result of the poverty and higher fertility rate, the maternal mortality ratio is high.

5.3 Recommendations

The researcher has argued in this report that there is a significant relationship between GDP per capita, total fertility rate and HIV/AIDS prevalence rate as independent variables and maternal mortality ratio as dependent variable. The study has shown that the decrease of GDP per capita results in an increase in maternal deaths. This is because less GDP per capita means poverty and poor people among them maternal women cannot afford to get needed health care. The study also showed that an increase in the fertility rate and HIV/AIDS prevalence rate also increases maternal deaths.

Based on these findings, the researcher proposed the following recommendations:

- The Central Government of Somalia and regional states should take steps to elevate the incomes of the population such that its people among them vulnerable groups such as pregnant women could able to access health facilities in order to reduce maternal mortality ratio. One of the ways that the incomes of the people can be increased is micro financing to the women, youth and other poor people in the community.
- There should be put in place national policies towards fertility rate. As this study shows that an increase in the total fertility rate causes rise in maternal mortality ratio, the government of Somalia should produce policies to reduce fertility rate such as to educate women and to offer them employment opportunities. TFRs tend to be low when women have access to education and paid employment outside the home. Family planning policies should also be introduced which in turn will decrease fertility rate. Since total fertility rate is directly related to maternal mortality ratio, the reduction of total fertility rate will bring decrease in maternal mortality ratio.
- There is a need to minimize HIV/AIDS prevalence rate which in turn contributes the reduction of maternal mortality ratio. Community awareness campaign to be taken to warn people the ways that HIV/AIDS spreads. In this campaign the community can be mobilized in order to avoid the causes of HIV/AIDS and by reducing it will result in minimization of maternal mortality ratio.

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Appendices

Appendix I

Classical Linear Regression Model, its Assumptions and Derivation of OLS Estimator

Regression analysis studies the relationship between one economic variable to be explained (the dependent variable) and one or more independent variables. When there is only one independent variable, we have *simple regression*. In the case of more than one independent variable, we have *multiple regressions*.

$$Y_i = b_0 + b_1X_1 \dots\dots\dots \text{Simple regression model} \quad (i)$$

$$Y_i = b_0 + b_1X_1 + b_2X_2 + b_3X_3 \dots\dots\dots \text{multiple regression model} \quad (ii)$$

Since the relationships among economic variables are generally inexact, a disturbance or error term must be included.

$$Y_i = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \epsilon_i \dots\dots\dots (iii)$$

The error term measures the deviation of each observed Y value from the true (but unobserved) regression line. These error terms, designated by ϵ_i , arise because of 1) numerous explanatory variables with only slight and irregular effects on Y that are omitted from the exact linear relationship given by eq (i) and (ii), 2) possible errors of

measurement in Y and 3) random human behaviour which usually leads to different values of Y for the same value of X under identical circumstances.

ASSUMPTIONS OF CLASSICAL LINEAR REGRESSION MODEL

Six assumptions of classical linear regression model with intuitive explanation of the meaning and need for each of them.

1. $Y = x\beta + \epsilon$
This assumption states that the dependent variable Y is linearly related to the independent variables X's and error term ϵ .
2. $E(\epsilon) = 0$
The expected value of the error term or its mean equals zero. Because of this assumption Eq. (i) gives the average value of Y. specifically, since X is assumed fixed, the value of Y in Eq. (ii) varies above and below its mean as ϵ exceeds or is smaller than 0.
3. $E(\epsilon \epsilon') = \delta^2 I$

This assumption ensures that the variance of the error term is constant in each period and for all values of X . It also ensures that the value which the error term assumes in one period is uncorrelated or unrelated to its value in any other period.

4. The fourth assumption is that the explanatory variable assumes fixed values that can be obtained in repeated samples, so that the explanatory variable is also uncorrelated with the error term.

5. $R(x) = (1+k) < T$

This assumption states that the rank of matrix $X = k$ where k is the number of columns in matrix X that means matrix X has full rank i.e. the X 's are uncorrelated and k is less than the number of observations T .

6. $\epsilon \sim N(0, \sigma^2 I)$

This assumption states that the random error term ϵ is normally distributed. As a result, Y and the sampling distribution of the parameters of the regression are also normally distributed, so that tests can be conducted on the significance of the parameters.

THE ORDINARY LEAST-SQUARES METHOD

- The OLS method gives the best straight line that fits the sample of XY observations in the sense that it minimizes the sum of the squared deviations of each observed point on the graph from the straight line.
- We cannot take the sum of the deviations of each of the observed points from the OLS line because the deviations that are equal in size but opposite in sign cancel out, so the sum of the deviations equals 0.
- Taking the sum of the absolute deviations avoids the problem of having the sum of the deviations equal to 0. However, the sum of the squared deviation s is preferred so as to penalize larger deviations relatively more than smaller deviations.

DERIVATION OF OLS ESTIMATOR $\hat{\beta}$

$$\varepsilon' \varepsilon = (Y - X\beta)'(Y - X\beta)$$

$$= (Y' - \beta' X')(Y - X\beta)$$

$$= Y'Y - Y'X\beta - \beta'X'Y + \beta'X'X\beta$$

$$= Y'Y - 2\beta'X'Y + \beta'X'X\beta$$

$$\frac{d(\varepsilon' \varepsilon)}{d\beta} = -2X'Y + 2X'X\beta$$

Equate to zero

$$-2X'Y + 2X'X\beta = 0$$

Divide both sides by 2

$$-X'Y + X'X\beta = 0$$

$$X'X\hat{\beta} = X'Y$$

$$(X'X)^{-1}(X'X)\hat{\beta} = (X'X)^{-1}X'Y$$

$$\hat{\beta} = (X'X)^{-1} X' Y$$

Variance-covariance matrix of $\hat{\beta}$
 $= (X' X)^{-1} X' Y$

$$\hat{\beta} = (X' X)^{-1} X'(X\beta + \varepsilon)$$

$$= (X' X)^{-1} X' X\beta + (X' X)^{-1} X'\varepsilon$$

$$= \beta + (X' X)^{-1} X'\varepsilon$$

$$\hat{\beta} - \beta = (X' X)^{-1} X'\varepsilon$$

$$E(\hat{\beta} - \beta)(\hat{\beta} - \beta)' = E[(X' X)^{-1} X'\varepsilon][(X' X)^{-1} X'\varepsilon]'$$

$$= E[(X' X)^{-1} X'\varepsilon \varepsilon' X (X' X)^{-1}]$$

$$= (X' X)^{-1} X' E(\varepsilon \varepsilon') X (X' X)^{-1}$$

$$= (X' X)^{-1} X' \sigma^2 I X (X' X)^{-1}$$

$$= \sigma^2 (X' X)^{-1} X' X (X' X)^{-1}$$

$$= \sigma^2 (X' X)^{-1}$$

Appendix II

Researcher's Curriculum Vitae

Personal Information:

Name: Da'ud Ali Aser

Sex: Male

Marital status: Married

Nationality: Somali

Address: Mogadishu, Somalia

Telephone: 0615834875

E-mail: Casey88@hotmail.com/caseyr025@gmail.com

Educational Background:

August 2012--Up to now. Pursuing Master of Science in Statistics in Kampala International University, Uganda

Sep 2008 – June 2012 Bachelor of Education in Mogadishu University, Somalia (specialized in Mathematics and Physics)

November 2012 Certificate in Research methodology and Data Analysis in Kampala international University

June- September 2013: Certificate of data capture and data analysis in Universal ICT Solutions

July 2005 – June 2008 Secondary school Certificate at Jabir Bin Hayan Primary and Secondary school, Mogadishu, Somalia

July 2004- May 2005 Primary school certificate at Jabir bin Hayan primary school, Mogadishu, Somalia.

Work Experience:

February 2014 – up to now: Administration officer and lecturer at Mogadishu University

Jan 2014 – May 2014 Mannion Daniels,- Conflict appraisal and needs assessment, participatory Community Based Approach research conducted in Kismayo, Somalia- as researcher, specifically in the roles of developing research tools, supervising of data collection team, data coding and data analysis and report writing roles.

September 2012-December 2013: Member of Uganda statistical society, Kampala Uganda.

October 2011-July 2012: Teacher of Mathematics, Physics & Chemistry at Al-mannar and Al-anwar primary and Secondary Schools.

July 2009 – MAY 2011: Teacher of Mathematics and Chemistry at Jabir Bin Hayan primary and secondary school, Mogadishu, Somalia.

Languages:

Somali language: Native.

English: Fluent in speaking, reading and writing.

Arabic: Fluent in speaking, reading and writing.

Skills:

- I am skilled at writing project and research proposals, writing reports, formulating and conducting researches, data coding and data analysis.
- I can analyze data using statistical packages such as Microsoft excel, SPSS, STATA, EPI INFO, MINITAB, MATLAB, EVIES, EPI DATA and EPI ANALYSIS strongly with SPSS, STATA and EPI info
- I'm Skilled in using and working with database management
- I am skilled at using Microsoft Word, excel, power point and Access

Courses and Trainings:

- May 20-24, 2014: Training of trainers (TOT) seminar on Local economic development by International labour organization (ILO)
- October 2012 :Seminar about how to conduct survey in Mogadishu, Somalia by SCHORE NGO
- 2nd November 2012: Seminar on Technical efficiency of Uganda's educational system by Uganda Statistical Society held in Statistical House, presenter Dr. Joseph Muvawala, African Development Bank, Chief Country Economist-Southern Sudan.
- January 2012: Seminar on Report writing and project proposal techniques held at Kampala International University.
- 7th December 2012, Seminar on Recent developments in Statistical applications (R-statistical software). Presented by Mr. Dan Kajungu project statistician for the INDEPTH Networker's INESS project, Dar es Salaam.
- January 14, 2013 :Symposium on Statistical and other Research Methods at Statistical House, Kampala
- 1st February 2013: Analysis of data using R statistical software held at Statistical House, Kampala presented by Dr. Paul Okullo Scientist - NARO

- July & August 2011 Teacher Training for secondary teachers, implemented by Mogadishu University, Mogadishu, Somalia.

References:

1. Dr. Mohamed Hussein Isse (Liban)

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2. Abdikadir Abubakar Sh. Hassan (Weaha)

Dean of faculty of economics and mgtsience in Mogadishu University

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