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The Relationship Between Conflict And Longevity: A Panel Data Analysis

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THE RELATIONSHIP BETWEEN CONFLICT AND LONGEVITY: A PANEL DATA ANALYSIS

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DEDICATION

To God Almighty, I owe it all to Him. To my loving, wonderful and supportive husband Dr. Francis Antwi-Boateng, my two beautiful daughters Meaghan-Jana Antwi-Boateng and Macie-Janell Antwi-Boateng. I appreciate your immense support and sacrifices throughout my years of schooling. I wouldn't have come this far without you. I love you all.

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CHAPTER 1 INTRODUCTION

1.1 Conflict

In situations where interests, goals and or values of people or countries are not compatible, and they block each other's efforts to achieve their goals, conflicts arise. In other words, conflicts occur when there is a clash of interests among individuals, groups, parties, or states as they pursue their incompatible and opposing goals. Throughout history, conflict has been a way of expressing disputes or disagreements between political and other groups within society, (Oyeniyi, 2011). "Conflict is an inevitable outcome of human diversity and a world without conflict is not desirable, because it would mean a world without diversity" (Onyeniyi, 2011).

Conflict, whether severe or minor, is common in most countries worldwide. Its effects on society cannot be underestimated. Not only does conflict exploit humans, it can also have effects on social and economic development and can erode the social capital of communities and countries. In Africa and Latin America, armed conflict is the ninth and seventh leading cause of death, respectively (Peden, McGee and Krug, 2002). In times of violent conflict, thousands of people may be injured, and some may suffer permanent disabilities. These events can have lingering effects on people throughout their lives.

The effects of conflict on longevity cannot be underrated. Wars and conflicts not only lead to death and casualties among soldiers and military officers, but among civilians as well. According to the World Bank (2000) report, more than 4 million people lost their lives from violent conflicts between 1989 and 2000, whereas over 37 million people became displaced and refugees. The World Bank also reports that conflict remains a challenge to achieving the sustainable development goals as well as the World Bank group goal of ending poverty by the year 2030 (World Bank, 2017).

Conflict kills, results in physical disabilities, creates fear and mental health problems, and damages infrastructure, including hospitals and clinics, and over the years, terrorist groups have become more daring, sophisticated and damaging. These effects may shorten lives and limit the ability to treat medical problems.

Stewart (2002) has identified four root causes of conflict in developing countries. The first she calls the "group motivation hypothesis." According to this hypothesis, groups may be divided by class, geography, religion or along cultural lines. Differences among the groups can become worth fighting over if there is an unequal distribution in the exercise of economic and political powers. In situations where political redress for the deprived group(s) is not possible, resentments may begin to boil, and this leads to conflict. Stewart describes a second cause of conflict as the "private motivation hypothesis." It describes a situation in which rational individual weigh the benefits and costs of involving themselves in some sort of conflict. When the benefits outweigh the costs, the rational decision maker will choose to fight. Her third hypothesis, which she refers to as the "failure of the social contract," posits that social stability is based on an implicit contract between the government and its people. People accept authority if they enjoy better economic conditions and services provided by the state. But if the social contract breaks down, then conflict may result. For example, high and rising levels of poverty, unemployment, or a decline in state services may lead to conflict (Nafizger and Auvinen, 2000). The last hypothesis Stewart offers is the "green war hypothesis." According to this theory, the degradation of the environment may be a source of poverty and the root cause of conflict. For example, as the population expands, people cut down trees to build houses and this may lead to land disputes. These and other sorts of problems associated with changing the environment can eventually lead to conflict.

1.2 Longevity

One of the greatest social achievements of the last few decades has been an improvement in life expectancy and infant mortality. People are now living longer than in the past (Crimmins, 2015). This pattern is evident across most developed and developing countries. Over the decades, adverse events in most countries have waned and life expectancy continues to increase. Data from the Organization for Economic Co-operation and Development (OECD) reveal that average life expectancy in the 1940s was about 40 years among OECD member nations (OECD, 2000). This increased to 65.4 years in the 1990s (OECD, 2000). Among European countries average life expectancy for females rose from 72.5 to 80 years between 1960 and 1995, and that of men rose from 67.6 to73.6 years over the same period.

In the United States, life expectancy in 1960 for females was 73.1 years, whereas for males, it was 66.6 years. By 1980, these figures had risen to 77.4 and 70.0 years respectively. By 2000, they had climbed to 79.7 and 74.3 years, and by 2010, they had increased to 81.1 and 76.2 years respectively (Infoplease, 2000-2017). Thus, between 1960 and 1980, longevity increased by 8.76% for males and 10.81% for females. Currently in Africa, the average life expectancy for males is 61years and for females, 64years. In Asia, the average life expectancy is 75 for males and 79 for females. Worldwide, according to the World Health Organization (WHO), between 2010 and 2015 life expectancy at birth for an individual was about 70.5 years, for males it was 68.4 years and for females it was 72.8 years (WHO, 2015). This improvement is attributable to improvement in technology, medicine, education, urbanization, nutrition and other factors (WHO, 2015).

According to the WHO, infant mortality, which is another facet of longevity, has been falling worldwide. The infant mortality rate, defined as the number of deaths under one year of

age that occur per 1000 livebirths in a given year, declined from 18.2% in 1960 to 4.3% in 2015 worldwide (WHO, 2016). Infant mortality was highest in the African region where 55 deaths occurred per 1000 live births in 2015. This was five times higher than in the European region where 10 deaths occurred per 1000 live births. Universally, the infant mortality rate has declined from 63 deaths per 1000 live births in 1990 to about 32 deaths per 1000 live births as of 2015 (WHO, 2016).

The dissertation is organized into four sections. Following this introduction of the topic (section 1), Section 2 discusses the effects of conflict and non-conflict factors on longevity in OECD and emerging countries. Section 3 examines the association of various types of conflict in African countries with different facets of longevity, and further examines the effect of other non-conflict factors on longevity in Africa. Section 4 concludes this study with a summary of its major findings and policy recommendations.

1.3 Research Objectives and Questions

The purpose of this study is to empirically examine the effects of conflict on longevity, and whether any other variable influence longevity more in OECD, emerging and African countries. Examining the association between conflict and longevity may help illuminate the real costs of war and conflicts, and thereby help in promoting peace. This dissertation is the first to introduce conflict into the health production function as no one has looked at the longevity effects.

More specifically, Section 2 seeks to address the question of how factors such as conflict, the state of the environment, and the state of a country's economy affect longevity. It also seeks to establish whether and how the health production function of longevity differs between OECD countries and emerging countries.

Specifically, Section 3 addresses the following questions: what relationship do particular characteristics of conflict, such as violence against civilians, riots, remote violence, and battles where government regains territory, have with longevity in Africa; how do non-conflict factors such as HIV, gross national income per capita, tuberculosis, and fertility influence longevity; and whether variables describing conflict influence longevity more than the non-conflict variables.

CHAPTER 2 LONGEVITY IN RETROSPECT, DOES CONFLICT MATTER? A PANEL DATA ANALYSIS OF DIFFERENT COUNTRIES' EXPERIENCES

In this section, I investigate the predictors of longevity and how they differ between emerging and OECD countries. The study seeks to empirically examine how increasing health expenditures lead to increased longevity, and whether any other variable influence longevity more than health expenditures. More specifically, this paper differs from prior studies by considering how factors such as conflict, the state of the environment, and the state of a country's economy, affect longevity, and it examines whether and how the health production function of longevity differs between OECD countries and emerging countries.

The section discusses the background of the study; the data sources used for the study; variables in the analysis; and the specification of the health production function. Following this, I report the estimation results and then discuss them.

2.1 Background

Few authors have studied the relationship between some aspects of conflict and mortality. Li and Wen (2005) examined the immediate and lingering effects of armed conflict on adult mortality by employing a pooled time-series cross-sectional design. They examined the effects of different kinds of conflict across 84 countries from 1961 to 1998 on the age-standardized and gender-specific mortality rates of the working age population, ages 15 to 64. They modelled mortality rates as a function of the five indicators of conflict. To test the immediate effect of conflict, they created five different dummy variables. One of their conflict indicators was coded 1 if a country was engaged in any type of conflict that year, 0 otherwise. Two other indicators measured the presence or absence of interstate and intrastate conflict, respectively. Each was coded 1 if the country was involved in that type of conflict that year, 0 otherwise. They also created

indicators for whether minor or severe conflict occurred in a country. Minor conflict was defined as the occurrence of 1,000 conflicts or less, whereas severe conflict was defined as the occurrence of more than 1,000 conflict in a country. They lagged the conflict dummy variables one year behind the dependent variable to control for possible reverse causality. To test the lingering effects of conflict on mortality, they created five continuous variables where they used the percentage of years a country has been in a conflict type from 1946 to year (t-2). Using a Heckman-type selection model, they found that armed conflict had both lingering and immediate effects on adult mortality with lingering effect being robust than immediate effect. They also found that the immediate effect for intrastate conflict was very large and the reverse applied to the lingering effect. The lingering effect for interstate conflict however was very robust but the immediate effect was not too strong. In addition, both the immediate and lingering effects of severe conflict were much stronger than the effects of minor conflicts. In terms of intrastate conflicts, the immediate effects on men were more pronounced than the effects on women, although women experience much mortality in the long run owing to the lingering effects.

As some researchers find positive relationship between conflict and mortality, Lawrence et al., (2015) have also conducted a study on the relationship between happiness and longevity. In their study that examined the relationship between happiness and longevity among a nationally representative sample of adults in the United States, data from 1978-2002 was obtained from the General Social Survey-National Death Index (GSS-NDI). Using a sample size of 32,830 individuals of which 9,271 died over the follow-up period, the authors estimated Cox proportional hazards models to determine how happiness relates to longevity. They found that happy people live longer and further explained that happiness may be related to other risk factors such as social relations, census division, socioeconomic status, as well as religious attendance, and its effect on

life expectancy may operate partially through stronger social relationship and increased socioeconomic status. A corollary may be that in countries where there is conflict, happiness is short-lived and therefore longevity is reduced.

Shaw et al. (2005) analyzed the determinants of longevity in OECD countries, Cremieux et al. (1999) studied longevity among residents of Canada, and Case and Deaton (2015) studied longevity in the United States. Some researchers have also undertaken the study of longevity by considering both developed and developing countries (Jaba et al., 2014, Kabir, 2008). This dissertation, however, will consider whether and how the determinants of longevity differ between OECD countries and emerging countries.

Jaba et al. (2014) used panel data to analyze the relationship between life expectancy at birth and health expenditures from 1995 to 2010. According to the authors, some causes of increasing health expenditures include population aging, medical technology and improvement in living standards. Data were collected from World Bank Indicators for 175 countries, and the countries were grouped according to geographical regions and income groups. That is, the countries were grouped into low income, lower middle income, upper middle income and high-income categories. Fixed-effects models were estimated separately for each group of countries. Their results suggest that, for developed countries, health expenditure per capita increase significantly along with an increase in longevity, and the European countries enjoy the highest longevity. They also found that variation in health expenditures per capita is more relevant in the developed and developing or less developed countries with the difference growing in time.

Kabir (2008) examined the socio-economic determinants of life expectancy for 91 developing countries using data from the United Nations Development Program (UNDP, 2004, 1994), the United Nations Conference on Trade and Development (UNCTAD, 2004) and World

Bank (2003). Multiple regression and probit frameworks were used in drawing conclusions about significance of the variables he incorporated in the analysis. Disaggregated probit regression was applied for three groups of countries with low, medium and high life expectancy. Most of explanatory variables turned out to be statistically insignificant, which implied that relevant socio-economic factors like per capita income, education, health expenditure, access to safe water, and urbanization cannot always be influential in determining life expectancy in developing countries. Based on the analysis it was suggested that the countries should formulate and implement appropriate social sector policies and programs to increase physicians' availability and reduce adult illiteracy and undernourishment to improve their life expectancies.

Shaw et al. (2005) conducted a panel data analysis of the determinants of life expectancy for 19 developed countries using data from the OECD Health 2000 database from 1960 to 1999. Life Expectancy at ages 40, 60 and 65 for men and women in 1997 were used as their dependent variables. Their explanatory variables included the gender distribution, gross domestic product (GDP), the age distribution, pharmaceutical consumption, health expenditures, health behaviors of the population such as overall tobacco use, and butter and vegetable consumption. They found that pharmaceutical consumption has a positive effect on life expectancy at middle and advanced ages. They also found that doubling annual pharmaceutical expenditures adds about one year of life expectancy for males at age 40 and slightly less than a year of life expectancy for females at age 65. According to the authors, decreasing tobacco consumption by about two cigarettes per day, or increasing fruit and vegetable consumption by 30%, increases life expectancy by about one year for 40-year-old females. Per capita GDP is also a relevant predictor of life expectancy at ages 60 and 65.

Studies of longevity have also been undertaken at the individual level. Thus, linking data on medical care expenditures to estimates of life expectancy for persons 70 years of age in various health states, Lubitz et al (2003) assessed the relations among health, longevity and the expected health care spending. Their data were obtained from the 1992-1998 Medicare Current Beneficiary Survey. They classified each person's health according to functional status, whether they were institutionalized or not, and self-rated health. They then used multistate life-table methods and microsimulation to estimate life expectancy for persons in various states of health. Annual health care expenditures were then linked with transitions between health states. Their results revealed that persons in good health at age 70 can expect to live longer than those in poor health at the same age. But their total expected medical care expenses appear to be no greater than those for less healthy persons even though healthier persons live longer.

2.2 Methods

To test what makes for longevity, the five facets of longevity; infant mortality (infmort), male life expectancy at birth (lebm), female life expectancy at birth (lebf), male life expectancy at age 65 (le65m), and female life expectancy at age 65 (le65f) are modeled as functions of conflict, economic factors, healthcare consumption, environmental factors, demographic factors, lifestyle choices and country-specific fixed effects.

Data Sources and Variable Measurement

The main sources of data for the 35 OECD and 25 emerging countries from 1990 to 2014 are the OECD health database, the World Development Indicators data set from the World Bank, the Uppsala Conflict Data Program and the Global Health Expenditure Database of the WHO. The

period selected for this study is limited by the availability of data. The list of the countries is shown in Appendices A and B.

Health production functions for each of these aspects of longevity are estimated for the panel data set. The dataset includes various measures of healthcare consumption such as total health expenditure, immunization, pharmaceutical expenditures and the number of hospital beds; environmental factors which constitute sanitation and the level of greenhouse gas; the level of poverty which is used as proxy for economic factors; demographic factors which include fertility and education; and lifestyle choices which include tobacco and alcohol consumption.

Measures of longevity and healthcare consumption may be influenced by the population age structure which is measured in previous years or simultaneously. Therefore, to account for this effect and to guarantee the reliability of the regression results, I use both life expectancies at birth and at age 65 or older, (Shaw, et al. 2005). Since I am using data on both OECD and emerging countries, inferences drawn from this study are valid for both developed and emerging countries. I concentrated on these two categories of countries because of data availability and reliability.

The empirical analysis for males and females is separated for women and men as women tend to have higher longevity than men and this is also a standard practice in the public health literature. In addition, in terms of physiological dynamics and gender roles, men and women are different, (Li and Wen, 2005). Since I am studying the determinants of longevity over time across countries, I need data covering enough years to make a valid generalization and to also know what is currently happening in the countries in terms of longevity studies, hence the selection of the period from 1990 to 2014.

Description of Variables

There are five outcome variables, each measured at the country level: life expectancy for males at birth, life expectancy for females at birth, life expectancy for males at 65 years, life expectancy for females at age 65, and the infant mortality rate.

Summary statistics and variable definitions for OECD and emerging countries are presented in Tables 1a and 1b respectively.

Table 1a: Variable Definitions, Means, and Standard Deviations for OECD Countries from 1990-2014

Code	Variable	Definition	Source	Mean	Standard deviation
conflict	conflict	Involves government and/or territory, armed and unarmed that result in 25 deaths and above.	Uppsala Conflict Data Program	0.130	0.337
thexp	Total health expenditure	It measures the final consumption of health care goods and services. It sums both private and public consumption.	OECD data	2161.7	1534.631
immuz	Immunization	% of children that receive the respective vaccination in the recommended timeframe. This indicator is presented for Diphtheria, Tetanus and Pertussis.	OECD data	93.177	6.521
pharm	Pharmaceutical expenditure	This covers expenditure on prescription medicines and self-medication	OECD data	296.925	223.066

ledu	Lower education	Education below post-secondary. That is high school and below	World Development Indicators of the World Bank (WDI)	23.517	21.336
tedu	Tertiary education	All post-secondary education including private and public universities, technical and vocational institutes and colleges	WDI	19.363	14.367
fer	Fertility	Number of children that will be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with current age-specific fertility rates.	OECD	1.713	0.414
san	Sanitation	% of the population using safely managed sanitation facilities and % of rural population with access	WDI	91.080	20.693
ghg	Greenhouse gas	Greenhouse gases which include the total emission of CO2, methane, nitrous oxide, hydrofluorocarbon, perfluorocarbon, Sulphur hexafluoride and nitrogen trifluoride in tons	WDI	12.199	5.608
alcho	Alcohol	Sales of pure alcohol in litres per person aged 15 years and older	OECD	9.462	2.954
tobcons	Tobacco consumption	Population aged 15 years and above	Global Health Expenditure	1155.744	1053.502

		who consume tobacco everyday			
poverty	Poverty	The poverty rate is defined as the percentage of a country's population working at $1.90 a day or less (measured in 2011 PPP)	WDI	12.199	5.608
infmort	Infant mortality	Number of death of children under one year per 1000 live births	OECD	6.331	4.881
lebf	Female life expectancy at birth	The number of years a female newborn is expected to live on average if current death rates do not change	OECD	80.676	2.829
lebm	Male life expectancy at birth	The number of years a male newborn is expected to live on average if current death rates do not change	OECD	74.516	3.808
le65f	Female life expectancy at age 65	Average number of years that a female at age 65 is expected to live if mortality remains constant	OECD	19.487	1.821
le65m	Male life expectancy at age 65	Average number of years that a male at age 65 is expected to live if mortality remains constant	OECD	15.940	1.846

Variables measured annually

Table 1b: Variable Definitions, Means, and Standard Deviations for Emerging Countries from 1990-2014

Code	Variable	Definition	Source	Mean	Standard deviation
conflict	Conflict	Involves government and /or territory, armed and unarmed that result in 25 deaths and above.	Uppsala Conflict Data Program	0.532	0.499
thexp	Total health expenditure	It measures the final consumption of health care goods and services. It sums both private and public consumption.	World Development Indicators of the World Bank (WDI)	236.045	340.814
immuz	Immunization	Percentage of children aged 12-23 months. This indicator is presented for Diphtheria, Tetanus and Pertussis.	WDI	85.215	14.703
fer	Fertility	Total birth per woman	WDI	2.999	1.274
alcoh	Alcohol	Sales of pure alcohol in liters per person aged 15 years and older	WDI	3.608	3.683
san	Sanitation	% of the population using safely managed sanitation facilities and % of rural population with access	WDI	58.710	27.698
ghg	Greenhouse gas	Greenhouse gases which include the total emission of CO2, methane, nitrous oxide, hydrofluorocarbon, perfluorocarbon, Sulphur hexafluoride and nitrogen trifluoride in tons	WDI	2.720	6.798
poverty	Poverty	% of a country's population working at $1.90 a day or less (measured in 2011 PPP)	WDI	5.014	11.695

hbeds	Number of hospital beds	The number of hospital beds per 1000 people	WDI		
infmort	Infant mortality	Number of death of children under one year per 1000 live births	Global Health Expenditure	34.826	26.944
lebf`	Female life expectancy	The number of years a female newborn is expected to live on average if current death rates do not change	WDI	70.045	8.075
lebm	Male life expectancy	The number of years a male newborn is expected to live on average if current death rates do not change	WDI	65.088	7.539

Variables measured annually

A country interested in the healthy life of its citizens spends more on their health, hence the importance of healthcare consumption in determining longevity. Mack (2016) mentions that some of the causes of high healthcare expenditure include wasteful spending, prescription drugs, advances in medical technology, unhealthy lifestyle, ageing workforce, high administrative costs and service provider consolidation. Total health expenditures (measured in PPP 2011 US dollars) is used as one of the explanatory variables in this study (OECD 2016, World Development Indicators (WDI) 2014).

Immunizations against infectious diseases, pharmaceutical expenditures, and hospital beds per capita are other facets of healthcare consumption included in the models. In communities where most children are vaccinated against infectious diseases, both those who are vaccinated and those who are not benefit. Immunizations reduce the number of deaths and disabilities from diseases such as whopping cough. I expect a positive relationship between longevity and immunization.

Pharmaceutical expenditures include not only the cost incurred in purchasing drugs but also the cost of developing new and effective drugs. Pharmaceutical spending across OECD countries reached around USD 800 billion in 2013, accounting for about 20% of total health spending on average when pharmaceutical consumption in hospitals is added to the purchase of pharmaceutical drugs in the retail sector. Retail pharmaceutical spending growth has slowed down in most OECD countries in the last decade, while spending on pharmaceuticals used in hospital has increased in most countries. Current market developments, such as the multiplication of high-cost medicines targeting small populations and/or complex conditions, have prompted new debates on the sustainability and efficiency of pharmaceutical spending (*Health at a glance*, 2015, OECD). It is expected that if a country spends more on needed pharmaceuticals, longevity would be increased.

It is expected that if the number of hospital beds per capita increases, more people can be admitted when sick. People are better taken care off when on admission than at home depending on the type of the sickness, and they will live longer. I expect a positive relationship between number of hospital beds per capita and longevity.

Another variable of interest is conflict. Most economic studies on longevity have not included conflict in the health production function to know its correlation with longevity. It is believed that understanding the effects of conflict on longevity has some important policy implications. Conflict theorists Marx and Weber understood the social order involved in the regulation of opposing interests, and because of that, conflict among groups and between individuals was a vital part of every society. In the presence of conflict, resources meant for other sectors in the economy to improve lives may be diverted to the military. This may lead to economic insecurity and hardship and that can lead to suicide, starvation and other death-threatening

diseases. (Peden, McGee and Krug, 2002; WHO, 2008b). In times of conflicts, thousands of people are injured whereas some suffer permanent disabilities, and this can have a lingering effect on them throughout their lives.

To test the effect of conflict on longevity, I created a dummy variable. Conflict dummy is coded 1 if a country is engaged in any type of conflict in a year and 0 otherwise, and it was regressed on longevity.

Environmental factors may also affect longevity. The level of greenhouse gases is used to measure the health of the country's environment. As more countries become industrialized, there is increased employment, increased GDP and improved livelihood of people. Although industries emit these gases into the atmosphere, the good aspect of this allows people to take care of themselves well and enables countries to put measures in place that will reduce the harmful effect of these emissions. This translates to increased longevity since people can now take care of themselves well and live longer. I expect a positive correlation between longevity and environmental factors.

Will a nation advance if its main resource, the people, are so diminished from the beginning of their lives – diminished by preventable diseases like diarrhea and cholera? Sanitation is therefore another important environmental factor that affects longevity. In this 21st century, half of the world's population are enduring a medieval level of sanitation. Most people in developing countries do not have access to decent toilet as many queue-up to pay for the use of filthy latrine. In some developing countries, the plagues of the earlier times are revisiting. The recent cholera epidemic in Peru and the outbreaks of bubonic and pneumonic plagues in India are examples of this. Sanitation's influence on longevity is therefore assessed in this study (Khan, 2018). I expect a positive correlation between sanitation and longevity.

The economic characteristics of a country is another potential predictor of longevity in this study, and differences across countries may significantly influence longevity. According to the United Kingdom Prime Minister Theresa May, "If you were born poor, you will die on average nine years earlier than others" (Milne, 2016). The poverty rate measures the percentage of families living with an income below a given percentage. This is a good economic indicator of the relative size of the poorest segment of the population. It is expected that poor people are not able to afford certain necessities of life such as food and better health care. As a result, they tend to have lower levels of longevity. I expect a negative correlation between poverty and longevity.

Lifestyle variables included in the models are tobacco consumption, and alcohol intake. Alcohol intake and or smoking by an expectant mother or even the father can have a negative impact on an unborn child. Smoking and alcohol intake can also affect the liver of the smoker and can lead to cancer as well as other liver-related sicknesses, which can affect longevity. It is suggested that moderate drinking is not cardioprotective and that higher mortality among abstainers results from people who no longer drink due to poor health (Shaw, et al. 2005).

Demographically, fertility and education may also impact longevity. Joshua Mittledorf (2010) found that women who give birth to a lot of children tend to have shorter lives, compared to those who do not give birth. Fertility worldwide has been decreasing over the years and with the continuous decline in fertility, this study expects to find a negative association with longevity.

Lastly, education is another potential determinant of longevity. People of higher education generally take better care of themselves. People who attain higher education are mindful of their eating habits, exercising, avoid certain behaviors like drinking and smoking excessively. Furthermore, they can change their risky health behaviors quicker in response to new evidence. As a result, they tend to live longer. Research from Harvard Medical School indicates that

individuals with more than 12 years of education live longer than those who never went beyond high school (Harvard Medical School, 2008). In this study, I expect a positive relationship between higher education and longevity and a negative relationship between low levels of education and longevity.

A relevant econometric problem encountered during this study was the issue of missing data. This problem was resolved by using the modified zero-order regression method. With this method, the missing values were filled with zeros, and a dummy variable was created to take the values of one for the missing values and zero for the complete ones.

Model specification and estimation

I estimate the determinants of longevity using a random-effects model. In panel data analysis, a Hausman test can be used to help decide between a fixed-effects or random-effects model. The null hypothesis is that the preferred model is a random-effects model, and the alternative hypothesis is that it is not. The test assumes that the unique errors, u_i , are not correlated with the regressors. The null hypothesis posits that there is no correlation between the two. Therefore, if the test statistics is sufficiently different from zero with prob>0.05, it is significant hence use fixed effect. If it is sufficiently closer to zero with P<0.05, use random effect (Greene, 1993).

The Hausman test was conducted for each of the models estimated for both OECD and emerging countries, and in some instances, it identified a random-effects model as the better model since the p-values were less than 0.05. The estimates underlying these tests are reported in Appendices D and E. Among emerging countries for instance, the variables change little among themselves within countries but there is a great level of variability across countries and it is the relationship among various countries which are being explored making random effect a better

model to use. In addition, if the factors that affect the dependent variables are different across countries, then irrespective of the Hausman test, Random effects model is to be used.

In this framework, Y_{it} measures the population longevity for country *i* at time *t* and it depends on a vector of inputs, *X.* Therefore, the random-effects health production function is given as:

- $Y_{it} = \beta X_{it} + \alpha + u_i + \varepsilon_{it}$

Where the vector, X, includes measures of conflict, total health expenditures, immunizations, pharmaceutical expenditures, number of hospital beds, education, fertility, sanitation, greenhouse gas, poverty, tobacco use, and alcohol consumption. My interest centers on β, the vector of coefficients on the explanatory variables. Country-specific random-effects are captured by u , and ε reflects an error term assumed to be independently and identically distributed across time and countries, and which is independent from u .

I explicitly test for the possibility that the underlying function for longevity may vary between OECD and emerging countries, in other words, that the vector, β, varies between these two sets of countries. I use a Chow test to formally test for this (Wooldridge, 2013 p.453), and if there is evidence of differential functions, I proceed with estimating separate functions for each set of countries. All statistical analyses are performed using Stata 14.1® (Stata Corporation, College Station, Texas).

2.3 Results

I begin with the assessment of whether or not the health production functions for longevity differ between OECD and emerging countries. I use the Chow test to determine whether the estimated coefficients are different for the two sets of countries. If they are not, I should estimate one set of models for all countries, whereas if they are, I should estimate separate models for each

set of countries. Three Chow tests are conducted, one for each of the three outcome measures common to both sets. For life expectancy at birth for females, the corresponding F-statistic for the Chow test is F(9, 1451) = 27.03, which is significant (p-value < 0.001). For life expectancy at birth for males, F(9, 1,451) = 25.90 (p-value < 0.001), and for the infant mortality rate, F(9, 1451) = 57.06 (p-value < 0.001). Thus, for all three outcome measures, I reject the null that the coefficients of the production functions are the same between OECD and emerging countries. Therefore, separate models are estimated for each group of countries. The estimation results for OECD countries are reported in Table 2.

Table 2: Estimated Health Production Functions for Five Facets of Population Longevity in OECD Countries, 1990-2014

variables	LEBF Coefficient (se)	LEBM Coefficient (se)	LE65F Coefficient (se)	LE65M Coefficient (se)	Infant Mortality Coefficient (se)
Intercept	76.806 (0.910)	70.662 (1.105)	16.921 (0.597)	13.715 (0.524)	17.645 (2.796)
conflict	-0.509*** (0.123)	-0.509*** (0.146)	-0.283*** (0.082)	-0.287*** (0.071)	0.740* (0.431)
thexp	0.066*** (0.006)	0.109*** (0.007)	0.037*** (0.004)	0.069*** (0.004)	-0.034* (0.020)
immuz	0.039*** (0.006)	0.032*** (0.007)	0.018*** (0.004)	0.011*** (0.003)	-0.048** (0.021)
pharm	0.076*** (0.030)	0.091*** (0.035)	0.075*** (0.020)	0.002 (0.017)	-0.343*** (0.102)
ledu	-0.016*** (0.002)	-0.015*** (0.003)	-0.013*** (0.002)	-0.011*** (0.001)	-0.006 (0.008)
tedu	0.055*** (0.004)	0.062*** (0.005)	0.044*** (0.003)	0.037*** (0.002)	-0.036** (0.015)
fer	-1.941*** (0.190)	-2.042*** (0.226)	-0.481*** (0.126)	-0.259** (0.109)	1.611*** (0.597)
san	0.006** (0.003)	0.001 (0.39)	0.004** (0.002)	0.000 (0.002)	-0.053*** (0.009)
ghg	0.113*** (0.021)	0.151*** (0.025)	0.048*** (0.139)	0.048*** (0.012)	-0.082* (0.057)
alcoh	-0.075***	-0.102***	-0.081***	-0. 081***	-0.152*

	(0.030)	(0.036)	(0.020)	(0.018)	(0.921)
tobcons	-0.009 (1.47)	-0.018** (0.008)	-0.005 (0.004)	-0.019*** (0.004)	0.016 (0.021)
Poverty	1.930*** (0.390)	1.721*** (0.463)	1.449*** (0.259)	1.088*** (0.224)	-2.208* (1.366)
R^2 overall	0.480	0.415	0.471	0.486	0.439
R^2 within	0.792	0.826	0.796	0.872	0.279
R^2between	0.326	0.233	0.295	0.246	0.541
Observations	847	847	847	847	847
Wald chi^2	3065.33***	3767.60***	3132.25***	5385.26***	346.16***

1% = *** 5% = ** 10% = *

Table 3: Estimated Health Production Functions for Five Facets of Population Longevity in Emerging Countries, 1990-2014

variable	Lebf Coefficient(se)	Lebm Coefficient(se)	Infant mortality Coefficient(se)
Intercept	63.203 (1.965)	58.641 (1.869)	62.181 (6.462)
conflict	-0.409* (0.259)	0.259 (0.242)	1.522* (0.893)
thexp	0.053 (0.039)	0.10*** (0.036)	0.212* (0.132)
immuz	0.064*** (0.014)	0.059*** (0.013)	-0.360*** (0.049)
fer	-1.54*** (0.239)	-1.383*** (0.225)	8.787*** (0.800)
alcoh	-0.261*** (0.064)	-0.288*** (0.060)	0.390* (0.214)
san	0.118*** (0.015)	0.112*** (0.014)	-0.440*** (0.048)
ghg	0.031* (0.020)	0.026 (0.018)	-0.068 (0.068)
poverty	-0.019*** (0.008)	-0.017** (0.007)	0.066*** (0.026)
hbeds	-0.275*** (0.082)	-0.291*** (0.077)	0.244 (0.277)
R^2 overall	0.67	0.686	0.797
R^2 within	0.486	0.502	0.621
R^2 between	0.693	0.706	0.828
Observations	609	609	609
Wald chi^2	600.06***	635.06***	1059.40***

1% = *** 5% = ** 10% = *

Depending on the outcome measure, the estimated models explain between 42% and 49% of the variation observed across OECD countries. Specifically, the R-squares were 48% for female life expectancy at birth, 42% for male life expectancy at birth, 47% for female life expectancy at age 65 years, 49% for male life expectancy at age 65, and 44% for the infant mortality rate.

The estimated models for emerging countries are reported in Table 3. They explain 67% to 80% of the variation in longevity across countries, again, depending on the outcome measure. The R-squares were 67% for female life expectancy at birth, 69% for male life expectancy at birth, and 80% for the infant mortality rate

Effects of environmental factors on longevity

In all instances where I find a significant effect of environmental measures, the coefficients have the expected sign. Among OECD countries, a unit increase in greenhouse gas produced an increase in female life expectancy at birth (lebf) and at age 65 (le65f) of 0.113 years and 0.048 years, respectively. Likewise, it raised male life expectancy at birth (lebm) and at age 65 (le65m) of 0.151 years and 0.479 years, respectively. Among emerging countries, a unit increase in greenhouse gas significantly raised lebf by 0.031 years. This is obviously because most of the emerging countries were not industrialized.

The effects of sanitation on longevity are more pronounced in emerging countries, as one might expect, since access to safe sanitation is generally not an issue in developed OECD countries. Among OECD countries, sanitation is a significant predictor of female life expectancies at birth and at age 60, and infant mortality. A unit increase in sanitation raised female life expectancies at birth and at 65 years by 0.006 and 0.004 years, respectively. It also lowered infant mortality in these countries by 0.053 years.

In emerging countries, a unit increase in sanitation raised female life expectancy by 0.118 years, male life expectancy by 0.112 years, and lowered the infant mortality rate by 0.440 years. Notice these effects are far larger than in OECD countries. Sanitation's effect on longevity is also much greater than the effect of health expenditures on longevity. This suggests that the fundamental access to improved sanitation is enormously valuable as far as longevity is concerned. During late pregnancies and delivery times, a lack of convenient sanitary facilities has a negative impact on mothers and their babies. The positive impact of improved sanitation on longevity is consistent with the works of Hertz et al. (1994), who found that sanitation plays an important role in reducing the infections of early childhood and facilitating good hygiene before, during, and after childbirth.

Effect of conflict on longevity

Among all countries, the presence of conflict shortens lives dramatically. Among OECD countries it reduced life expectancy at birth among females by 0.509 years, life expectancy at birth among males by 0.509 years, life expectancy at age 65 among females by 0.283 years, life expectancy at age 65 among males by 0.287 years and increases the infant mortality rate by 0.740. Among emerging countries, conflict's effects are most pronounced among females and infants. The presence of conflict reduces life expectancy at birth among females by 0.409 years and raises the infant mortality rate by 1.522.

In both OECD and emerging countries, the correlation between conflict on longevity are highest for the infant mortality rate. Conflict is costly, and its effects can be very damaging to the national economy. When a country is faced with constant conflicts, be it armed or unarmed, a lot of private and public properties are destroyed. Conflict discourages investors from investing in the country, which may also contribute to a slowdown in economic growth, unemployment and low

GDP. A slowdown in growth, in turn, weakens public services such as health and education. Low GDP creates a poverty trap whereby the poor people in the country become vulnerable to diseases. Unemployment causes psychological, emotional and physical stress and may lead to increased rates of alcoholism, smoking and suicide. In addition, many people become homeless because of wars and conflicts whereas others are forced to migrate.

Effects of Economic Measures on Longevity

Poverty remains one of the greatest challenges of most developing countries. In the developing world, poverty means not having enough to eat, not having a place to sleep, and not having access to good medical care, among other things. Hence, any increase in the poverty rate tends to raise mortality rates. The situation in OECD countries, on the other hand, is different in the sense that poverty is not equated to starvation and absolute deprivation.

Poverty significantly correlates with longevity among the two groups of countries. In OECD countries, a unit increase in poverty level predicts an increase in life expectancy at birth among females by 1.93 years, life expectancy at birth among males by 1.721 years, life expectancy at age 65 among females by 1.449 years and life expectancy at age 65 among males by 1.088 years and predicts a decrease in the infant mortality rate by 2.208 years. This is consistent with the works of Bezruchka (2009) and, Gerdthamand and Ruhm (2006). Gerdthamand and Ruhm (2006) found that mortality increases during good times or economic booms and reduces during economic downturns among OECD countries. In other words, longevity increases during economic downturns. They attributed this to the wide range of social insurance systems as well as strong safety nets. According to Bezruchka (2009), mortality declines faster during recessions in rich countries than periods of economic growth.

Among emerging countries on the other hand, a unit increase in the poverty level predicts a reduction in life expectancy at birth among females and males by 0.019 years and 0.017 years, respectively, and predicts an increase in the infant mortality rate of 0.066.

Pressures from poverty such as financial struggles, poor and unsafe living conditions, lack of good and effective social support, bad neighborhood, among others create the kind of environment that bring stress not only to adults but also to children. Poverty in general increases stress which affect the happiness of people by creating despair and hopelessness. People who are poor are not able to pay their bills, not able to eat healthy foods, not able to go to hospitals when they are sick, and all these reduce longevity in emerging countries. Poverty affects not only the physical health of people but also their mental health. Some countries like India and China have instituted some economic growth-oriented policies aimed at reducing poverty although it has come with environmental costs, such as increased air pollution. In a nut shell, for poor and emerging countries, improved economic growth appears to improve health by providing the means to meet essential needs such as food, shelter and clean water, as well as assess to good health care. This leads to long life. Lack of these basic things due to poverty reduces longevity.

Effects of Healthcare Consumption on Longevity

The effect of total health expenditures on longevity is direct for OECD countries and this is consistent with what Jaba et al (2014) found. A hundred units increase in total health expenditures predict an increase in life expectancy at birth among females by 0.066 years, life expectancy at birth among males by 0.109 years, life expectancy at age 65 among females by 0.037 years, and life expectancy at age 65 among males by 0.069 years and predicts a reduction in the infant mortality rate of 0.034 years. Among emerging countries, a hundred units increase in total health expenditure predicts an increase in life expectancy at birth among males by 0.099 years and

an increase in the infant mortality rate of 0.212 years. Notice that the effect of health expenditure on infant mortality among emerging countries is positive, unlike in OECD countries. In most OECD countries, health expenditures are heavily subsidized by the government. Hence, more can be spent in the health sector to improve life thereby expanding lifespan. Most emerging countries which in this dataset are basically developing countries do not experience infrastructural development in the health sector. Health expenses are usually borne by individuals of which most of the people are poor, making healthcare unaffordable to the vulnerable. This explains the negative relationship. Kabir (2008) did not find any significant relationship between health expenditure and life expectancy among developing countries.

The effects of immunization on longevity cannot be underestimated. Immunization is associated with a decreased infant mortality and increased life expectancies for both OECD and emerging countries with significant effects. Among OECD countries, a unit increase in immunizations raises life expectancy at birth among females by 0.039 years, life expectancy at birth among males by 0.032 years, life expectancy at age 65 among females by 0.175 years, life expectancy at age 65 among males by 0.011 years and decreases the infant mortality rate by 0.048. Among emerging countries on the other hand, a unit increase in immunization raises life expectancy at birth among females by 0.064 years, life expectancy at birth among males by 0.595, and lowers the infant mortality rate by 0.36. Thus, in both groups of countries, immunizations reduce infant mortality and raise life expectancy. Interestingly, the effect of immunizations on longevity was stronger than the effect of total health expenditures.

Increased pharmaceutical expenditures raise life expectancy and lower the infant mortality rate. A hundred unit increase in pharmaceutical expenditure predicts an increase in life expectancy at birth among females by 0.076 years, life expectancy at birth among males by 0.914 years, life

expectancy at age 65 among females by 0.075 years, and a decrease in the infant mortality rate by 0.343 years. Individuals who spend more on drugs tend to live longer. Patients who are not able to afford medications get sicker and when such occurrences happen it is the family, the government and the insurance companies that suffer more. To avoid this instance, insurance companies, government and individuals spend on drugs irrespective of the cost to prevent additional cost when the sicknesses escalates. This is consistent with the works of Shaw et al, (2005). In addition, more financial resources are spent in developing new and effective drugs which prolongs life. However, government must ensure pharmaceutical expenses are not too high so that patients will be able to afford prescription drugs.

The number of hospital beds per capita also affects longevity among emerging countries. A unit increase in the number of hospital beds per capita lowers female and male life expectancy at birth by 0.275 and 0.291 years, respectively. This is contrary to what was expected. One explanation is that hospital beds per capita are likely correlated with the level of illness in the population, and thus the negative effect of beds per capita is likely picking up the effects of the level of illness in the population.

Effects of Demographic Factors on Longevity

Different researchers have found negative (Penn and Smith, 2007), positive (Le Bourg, 2007) and no relationship (Helle et al. (2004)) between fertility and longevity. On average, the number of children born to each woman has declined over the years in both OECD and emerging countries. This may be due to several factors such as financial, contraceptive use, education, population control, and even social. For instance, highly educated women mostly end up becoming career women. Most of the women who have high education postpone marriage and hence childbirth. They also tend to have fewer children since they tend to focus on their career.

Financially, couples who earn more usually have fewer children because most of such couples, place quality above quantity. They focus on their careers to earn more rather than parenting. Unlike some decades ago when most women did not work but stayed home to care for their children, women today are often career oriented, so there are competing demands between a woman's career development and raising children. Moreover, the increased availability of effective contraceptives has given couples the flexibility to decide on the number of children they would like to have and when. In terms of policies, the one child policy in China also limits the number of children born per woman.

Evolutionary theories suggest that, an inverse relationship exist between longevity and fertility and the results of this study confirms it. In OECD countries, a unit increased in fertility predicts a decrease in life expectancy at birth among females by 1.941 years, in life expectancy at birth among males by 2.042 years, in life expectancy at age 65 among females by 0.481 years, in life expectancy at age 65 among males by 0.259 years, and an increase in the infant mortality rate by 1.611 years. In emerging countries, a unit increase in fertility predicts a decrease in female life expectancy by 1.54 years, male life expectancy by 1.383 years, and an increase in the infant mortality rate by 8.787 years. In both set of countries, fertility strongly correlates with longevity. Not surprisingly, the impact of fertility is smaller for life expectancies at age 65, since that is usually a menopausal age and very few people give birth around such age. This suggests that bearing and raising a large number of children is physically taxing and depleting on a woman's health and hence reduces her expected longevity.

Longevity on average, differs across educational groups. This study considered people with tertiary education and people with high school education and less. Among OECD countries, people with high level of education tend to have higher longevity. A unit increase in high education

predicts an increase in life expectancy at birth among females by 0.055 years, life expectancy at birth among males by 0.062 years, life expectancy at age 65 among females by 0.044 years, life expectancy at age 65 among males by 0.037 years and lowers the infant mortality rate by 0.036 years. In contrast, a unit increase in lower level of education predicts a reduction in life expectancy at birth among females by 0.016 years, life expectancy at birth among males by 0.015 years, life expectancy at age 65 among females by 0.013 years, and life expectancy at age 65 among males by 0.011 years. It had no impact on the infant mortality rate.

Individuals who come from impoverished families are more likely to have poor physical health early in life. Such individuals usually have negative peer influence and most of them end up with low levels of education. These individuals tend to have higher risk of mortality than their counterparts who do not face such hardships. Hence the factors pertaining to early life hardships might cause differences in education which affect longevity.

Education often increases awareness, which helps people make more informed decisions that ultimately improve their health. Higher education often leads to a better occupational status as it enhances labor market productivity which in turn can lead to increased income. With higher income, better educated individuals can afford better housing in safer neighborhoods and increased access to quality foods. They are also able to purchase more comprehensive health insurance if there is the need for it. This too increases longevity. Women who are well educated can make decisions that affect their family's health positively.

Those with low levels of education usually involve themselves in certain lifestyles that reduce their longevity. Such include smoking which lead to all kinds of cancer and heart diseases and eating unhealthy foods that leads to obesity. In a nutshell, healthy behaviors such as the use of home safety devices like the fire alarm, exercising, nutrition, preventive healthcare, among others

are all related to educational attainment and may account for the decreased longevity among those with low levels of education.

In addition, highly educated people tend to marry highly educated spouses, and make friends who are also highly educated. In times of need, these people will be there to help. For instance, a physician friend can give free medical advice when there is the need for it. Differences in educational attainment bring about the differences in social ties and that leads to differences in terms of longevity between those with high educational attainment and those with low educational attainment.

Effects of Lifestyle on Longevity

Aspects of lifestyle such as alcohol consumption and tobacco smoking are generally known to be some of the factors that affect lifespan. Increased smoking leads not only to cancer but also to cardiovascular and lung diseases. Similarly, to the findings of Shaw et al. (2005), tobacco consumption significantly correlates with male life expectancy at birth and at age 65 in OECD countries. A hundred unit increase in smoking predicts a decrease in life expectancy at birth among males and life expectancy at age 65 among males by 0.018 years and 0.019 years, respectively.

Alcohol consumption also affect life expectancy in both OECD and emerging countries. The results for the infant mortality rate in OECD countries, however, are not as expected. For OECD countries, a unit increase in alcohol consumption lowers life expectancy at birth among females by 0.747 years, life expectancy at birth among males by 0.102 years, life expectancy at age 65 among females by 0.081 years, and life expectancy at age 65 among males by 0.081 years. However, it lowers the infant mortality rate by 0.152 years. For emerging countries, a unit increase in alcohol consumption predicts a decrease in life expectancy at birth among females by 0.261

years, life expectancy at birth among males by 0.288 years, and predicts an increase in the infant mortality rate of 0.39 years.

CHAPTER 3 CONFLICT AND ITS EFFECT ON LONGEVITY IN AFRICA

Africa is a diverse continent and hence, some level of conflict is to be expected. However, too much of it may cause governments to spend more time and resources in resolving conflicts. Most African countries have recently suffered or continue to suffer some kind of conflict. These conflicts carry immense human, economic and social costs and have led to ill-health, underdevelopment and poverty (Stewart, 2002). Most of these conflicts occur within the countries. Conflicts usually occur in the presence of high unemployment, poor government services, social and economic inequalities, the incentive to fight by some people, extreme poverty, among others, (Stewart, 2002).

This section examines the relationship between conflict and longevity in African countries, while controlling for other (non-conflict) factors that also affect longevity. It differs from other studies by considering various characteristics of conflict, and their relationship to population longevity.

The section discusses the background of the study; the data sources used for the study; variables in the analysis; and the specification of the health production function. Following this, I report the estimation results and then discuss them.

3.1 Background

Ascherio et al. (1992) studied the effects of the gulf war on infant and child mortality in Iraq between January 1, 1985 and August 31, 1991. The researchers surveyed households in Iraqi and found that among 16,076 children in the households surveyed, 768 died during the period examined under survey. The international team of public health professionals, independent of the Iraqi authorities, selected the households in the survey and conducted the actual interviews. In the selected households, women aged 15-49 were interviewed and the dates of birth and death of all

children born on or after January1, 1985, were recorded. They found that the increase in mortality after the onset of the war was higher among children. They also found a strong negative relationship between war and mortality in the northern and southern Iraq than in the central parts or in Baghdad. They concluded there was strong evidence that the gulf war and trade sanctions caused a threefold increase in mortality among Iraqi children under age five.

Li and Wen (2005) examined the immediate and lingering effects of armed conflict on adult mortality across 84 countries observed between 1961 and 1998 by employing a pooled time-series cross-sectional design. They explored the effects of different kinds of conflicts across countries in their sample on the age-standardized, sex-specific mortality rate among working age adults (ages 15 to 64 years old). To test the immediate effects of conflict, they created five different dummy variables. A conflict dummy was coded 1 if a country was engaged in any type of conflict in that year and 0 otherwise. In assessing different types of conflict, interstate or intrastate conflict dummy was coded 1 if the country was involved in it and 0 otherwise. Minor or severe conflict dummy was also coded 1 if a country was involved in conflict fewer or more than 1,000 and 0 otherwise. They lagged the conflict dummy variables one year behind the dependent variable to address the possibility of reverse causality. Using a Heckman-type selection model, they found that the immediate effects of civil conflict were stronger than interstate conflict, and the reverse applied to the lingering effects of conflict. They also found that both the immediate and lingering effects of severe conflict were much stronger than those of minor conflicts. In terms of intrastate conflicts, the effect on men's mortality were more pronounced than on women's mortality, although women experience much mortality in the long run owing to the lingering effects.

Grimard and Laszlo (2014) studied the long-term effects of civil war on women's health outcomes in Peru. They analyzed the long-term health effects of early life exposure to civil conflict

using data from the Demographic and Health Survey (DHS) of Peru and district-level conflict data. Using the conceptual framework of a health production function, also used by Gimard et al. (2010) (and inspired by Grossman (1972) and Maccini and Yang (2009)), the authors estimated their models by ordinary least squares (OLS), allowing for district-level fixed effects. They found that district exposure to conflict deaths and disappearances in the year prior to birth had a negative effect on the women's stature. Thus, there was a long-lasting impact on conflict women's height. Specifically, they found that the effects of the shock right before birth were long-lived, especially for height even when adult socioeconomic conditions such as education and wealth were controlled for in the model.

3.2 Methods

Using country-level data spanning 1997 through 2016 from 50 African nations, a set of production functions are estimated for four aspects of longevity including infant mortality (among children under age one), mortality among children ages 1-4years, male life expectancy at birth, and female life expectancy at birth. Each is modeled as a function of four characteristics of conflict: battles where government regains territory, violence against civilians, remote violence, and riots; and non-conflict factors including the incidence of tuberculosis, the immunization rates, the fertility rate, the prevalence of HIV, and gross national income per capita.

Data Sources and Variable Measurement

Because I am interested in assessing the effects of some conflict types on longevity across 50 African countries, I need enough data covering enough countries and years to reach a valid generalization. Hence data for life expectancies at birth for male and female, infant mortality at less than one year, age 1-4 mortality, and fertility from 1997-2016 were obtained from the 2017

International Data Base (IDB). This database is very reliable and has no missing observations. Data from the IDB are based on careful evaluation of census and survey results and they are accurately dated. Data for HIV, incidence of tuberculosis, immunization, and GNI per capita from 1997-2016 were obtained from the 2019 World Bank Data. Data for battles where government regains territory, riots, violence against civilians, and remote violence were obtained from the 2017 ACLED data. The period selected for this study is limited by the availability of data for conflict. Four countries including Cape Verde, Comoros, Sao Tome and Principe, and Seychelles, were excluded due to too many missing data. Appendix C lists the 50 countries represented in the data set analyzed in this study.

Description of Longevity Variables

There are four outcome variables, each measured at the country level: male life expectancy at birth, female life expectancy at birth, the age 1-4 years child mortality, and the infant mortality. Infant mortality is defined as the number of deaths among children from 0 to 11months old per 1000 live births (IDB, 2017). Age 1-4 years child mortality is defined as the number of deaths among children from 12 months to four years per 1000 live births (IDB, 2017).

Female life expectancy at birth is defined as the number of years a female newborn is expected to live, on average, if current death rates at the time of birth do not change throughout her life. Male life expectancy at birth, on the other hand, refers to the number of years a male newborn is expected to live, on average, if current death rates do not change throughout his life. Life expectancy at birth reflects the total mortality level of a population (IDB, 2017, PopulationPyramid.net, 2015).

Explanatory Variables

Conflict Variables

Riots are a type of conflict, and one of the variables included in the models. In this study riots are defined as spontaneous acts of violence by disorganized groups which may target properties, businesses, other disorganized groups or security institutions, but they do not target civilians (ACLED codebook, 2017). It is on rare occasions that rioters harm civilians. If this happens, then this type of conflict is no longer a riot but rather it is violence against civilians. Since it does not involve the death of people, I do not expect an inverse relationship between riots and longevity. However, the paper seeks to find out the relationship between riots and longevity.

Violence against civilians is another type of conflict included in the models to be estimated. Violence against civilians are deliberate acts violently executed by armed grouped against unarmed groups or civilians to either harm or kill them. Examples of such armed groups include rebels, government, militia, among others. According to ACCLED (2017), if an individual is harmed or killed while unarmed and is unable to defend himself or counter-attack, the act is also referred to as violence against civilians. Examples of such violence include shooting, rape, torture, mutilations, kidnaping, and many others. If an incident or action does not result in physical injury or death, it is not classified as violence against civilians (ACCLED codebook, 2017). I expect an inverse relationship between longevity and violence against civilians.

Remote violence is another aspect of conflict included as an explanatory variable in this study. Remote violence is a form of targeted violence but in a broader category. It is an event where a conflict actor engages another group while remaining spatially removed from the area of attack. This is the case where perpetrators indulge in actions such as bombings, drone activities, missile attacks, air attacks, among others. In Africa, this type of conflict constituted about 8.93%

of recorded conflict events in 2014 with more political militias and less of heavily armed rebel groups. Remote violence attacks increased in countries such as Libya, Algeria, and Egypt, and this usually happened at a time prior to their elections. Sudanese and Somalians used remote violence to attack their rebels with minimal menaces to their own troops. The target of remote violence could be civilians or armed agents (ACLED, 2014, 2017). However, participation of governments with regards to remote violence against civilians and rebel groups has decreased year by year. Accordingly, I expect an inverse relationship between remote violence and longevity.

Finally, battles where government regains territory is also included in the estimated models. These are battles between two violent groups where the government or its associates regains control of a place. This type of conflict is for government reacquisition of control only. For instance, with this kind of conflict, an armed group work on behalf of the government to regain territory that is outside the control of the government. This occurs only for the re-establishment of government control and not dual non-state violence (ACLED codebook, 2017).

Each of these four conflict variables are measured by a dummy variable, which equals 1 if a country exhibited that type of conflict in that year and 0 otherwise.

Non-Conflict Variables

One of the non-conflict variables is the immunization rate against Diphtheria, Tetanus and Pertussis. The immunization rate refers to the percentage of children who receive the respective vaccination in the recommended timeframe. In communities where most children are vaccinated against infectious diseases, both those who get vaccinated and those who do not benefit. Since immunizations reduce the number of deaths and disabilities from diseases (World Bank, 2019), I expect a positive effect on longevity.

An African country's fertility rate may also affect longevity. It is defined as the total number of children born to the female population of childbearing age estimated per year. Each cohort of children born is also followed through time and survivors are calculated after exposure to mortality (IDB, 2013). Joshua Mittledorf (2010) found that women who give birth to a lot of children tend to have shorter lives, compared to those who do not give birth. Fertility worldwide has been decreasing over the years and with the continuous decline in fertility, this study expects to find a negative association with longevity.

Gross National Income (GNI) per capita (measured in US dollars) is another explanatory variable. This measures the well-being of a country although it does not entirely summarize the level of development and measure of welfare of a country. However, it is usually used because of its usefulness and availability as an indicator that closely correlates with other nonmonetary measures of quality of life such as life expectancy at birth and mortality rates. It is measured as the dollar value of a country's final income for the year divided by its mid-year population. The World Bank uses the Atlas method in the calculation of the GNI to reduce any changes to the exchange rate caused by inflation (World Bank, 2018). I expect a positive relationship between GNI per capita and longevity.

Longevity for people living with HIV has increased over time especially with the introduction of the antiretroviral treatment. Human Immunodeficiency Virus (HIV), is a virus that can results in acquired immunodeficiency syndrome (AIDS) if it is not treated. Once a person gets HIV, it is incurable. The virus attacks the immune system in the body of an individual, particularly the T Cells rendering it useless in fighting against infections. Without treatment it can lead to certain kinds of cancers. 37 million people were infected with the virus in 2014 (Malani, 2016). It has been found that access to the current drugs helps HIV patients to live longer just as non-HIV

patients (Nakagawa, et al. 2013). This paper seeks to find the correlation between longevity and HIV in African countries.

Finally, the incidence of Tuberculosis (TB) measured in terms of per 100,000 people is used as an explanatory variable in this study. Incidence in this regard refers to the number of people who are newly diagnosed with TB within a year (Basic Statistics, 2017). TB is a disease that basically affect young adults living in poverty in their most productive years. However, TB cases over the years have been declining globally although it continues to be the cause of death for many young women aged 15-44 years in poor countries (The World Bank, 2013). This paper seeks to find the correlation between TB and longevity. Summary statistics for all variables are presented in Table 4.

Table 4: Summary Statistics for African Countries from 1997-2016

Code	Variable	Definition	Std. Deviation	Mean	Min	Max	No of obs.
infmort	Infant Mortality	Per 1,000 live births	28.20	69.39	10	117	978
age14 mort	Age 1-4 Mortality	Per 1,000 live births	26.81	42.81	1.30	124.80	978
lef	Female Life Expectancy	Total per female measured in years	8.32	58.62	42.10	80.10	978
lem	Male Life Expectancy	Total per male measured in years	7.71	55.63	37.30	75.50	978
riots	Riots	Assigned a dummy of 1 if the country is engaged in it and 0 otherwise	0.38	0.83	0	1	960
vioaciv	Violence against Civilians	Assigned a dummy of 1 if the country is engaged in it and 0 otherwise	0.48	0.82	0	1	1000
rviolence	Remote Violence	Assigned a dummy of 1 if	0.48	0.37	0	1	1000

		the country is engaged in it and 0 otherwise					
bagovrter	Battle where Government Regains Territory	Assigned a dummy of 1 if the country is engaged in it and 0 otherwise	0.38	0.17	0	1	980
fer	Fertility Rate	Number of children per woman	1.39	4.97	1.36	7.71	980
immuz	Immunization	% of children that receive it	21.23	73.32	3	99	982
hiv	Human Immunodeficiency Virus	% of population aged 15-49	6.82	5.24	0	30	1000
gnipc	Gross National Income	Per capita	3336.63	1649.4	0	77580	954
tb	Incidence of Tuberculosis	Per 100,000 people	246.45	231.09	0	1280	1000

Model specification and estimation

I estimate the impact of some conflict types and other non-conflict factors on longevity using a random-effects model, with country-level random-effects. There are several reasons for this. First, the Hausman test conducted as shown in Appendix F indicated that, random effect is a better estimator of female life expectancy and male life expectancy, and fixed effect model is a better estimator of infant mortality and age 1-4 mortality. However, the choice of an estimator is not guided by only the Hausman test. When the between effects are larger than within effects, it would be incorrect to go for fixed effect model.

Therefore, by calculating the between and within variation of this panel data set, between variations of all the variables happened to be more than the within variation. That is within a country, the variables change little among themselves but there is great level of variability across countries. As per (Cameron and Trivedi Chap 18, P.no 607) therefore, random effect model is appropriate for this data. Random effect model allows for modelling heterogeneity across units. This model requires that the group-level effects and the explanatory variables must be uncorrelated; in such cases, random effect estimation is unbiased, consistent and efficient as it uses both within and between group variation whereas fixed effect uses only within-group variation. In addition, the R-squares for the random effect model are higher than that of the fixed effect model.

In this framework, Y_{it} measures the population longevity for country at time *t* and it depends on a vector of inputs, *X.* Therefore, the health production function is given as:

- $Y_t = \beta X_{it} + \alpha + u_i + \varepsilon_{it}$

where the vector, X, includes the four conflict-type variables, HIV, the fertility rate, the immunization rate, Gross National Income (GNI) per capita, and tuberculosis. My interest centers on β, the vector of coefficients on the explanatory variables. Country-specific random effects are captured by u , and ε reflects an error term assumed to be independently and identically distributed across time, and which is independent from u .

I lagged the conflict dummy variables in the panel data one year behind the dependent variable to control for any possible reverse causality since unnatural mortality diminishes a country's manpower (Li and Wen 2005). Reverse causality violates the assumption of strict exogeneity which forbids the current values of ε_{is} to be correlated with past, present and future values of X_{it} . When this core assumption of random effect is violated, the presence of reverse causality will bias the estimates. The set up including lagged values becomes

- $Y_t = \beta_1 X_{it-1} + \beta_2 X_{it} + \alpha + u_i + \varepsilon_{it}$

where X_{it-1} is a vector of the lagged conflict variables, and X_{it} is a vector of the non-conflict explanatory variables.

All statistical analyses are performed using Stata 14.1® (Stata Corporation, College Station, Texas).

3.3 Results

Recent Trends in Conflict in 50 African Countries

Since our interest centers on the effects of conflict, it is useful to understand trends in conflict within this sample over the study period. Although riots have been increasing in Africa, they have become less deadly in nature over time, according to ACLED data, and this is positively affecting longevity. According to the data, countries that experienced a high incidence of riots include Nigeria, South Africa, Egypt, Tunisia, Algeria, Kenya, and Somalia. In Egypt, for instance, riots peaked in 2013 following the one-year anniversary of Mohamed Morsi's inauguration as president as millions of people demanded for his resignation. Nigeria also experienced same in 2015 during the election between President Muhammadu Buhari and the ex-president Goodluck Jonathan.

As shown in Figures 1a and 1b, although there is an increase in rioting events there has been a steady decline in fatalities over the period under review. The fatalities, however, are not deadly according to ACLED data.

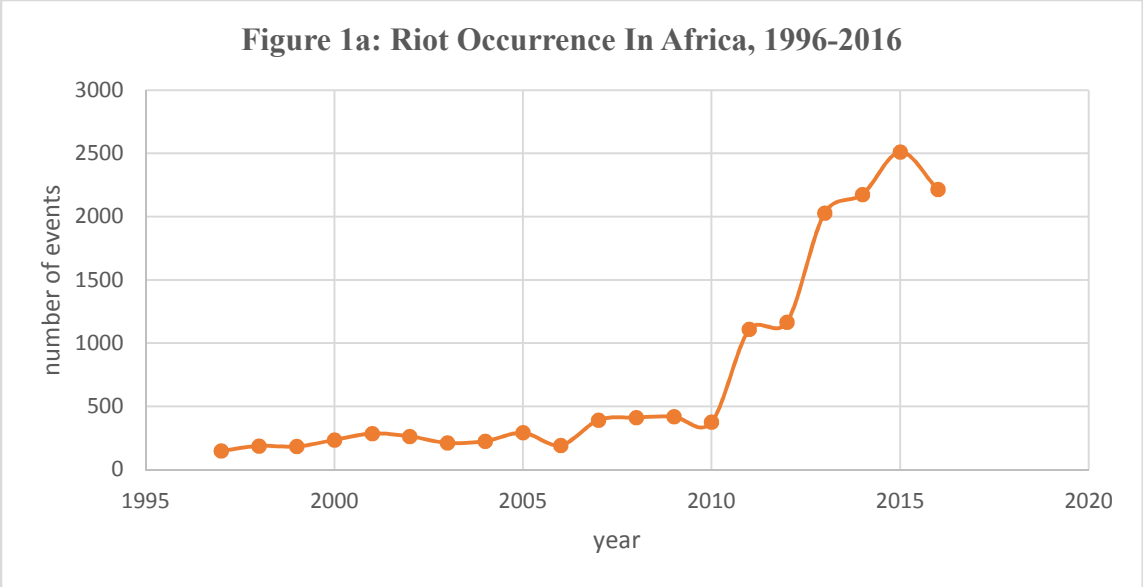
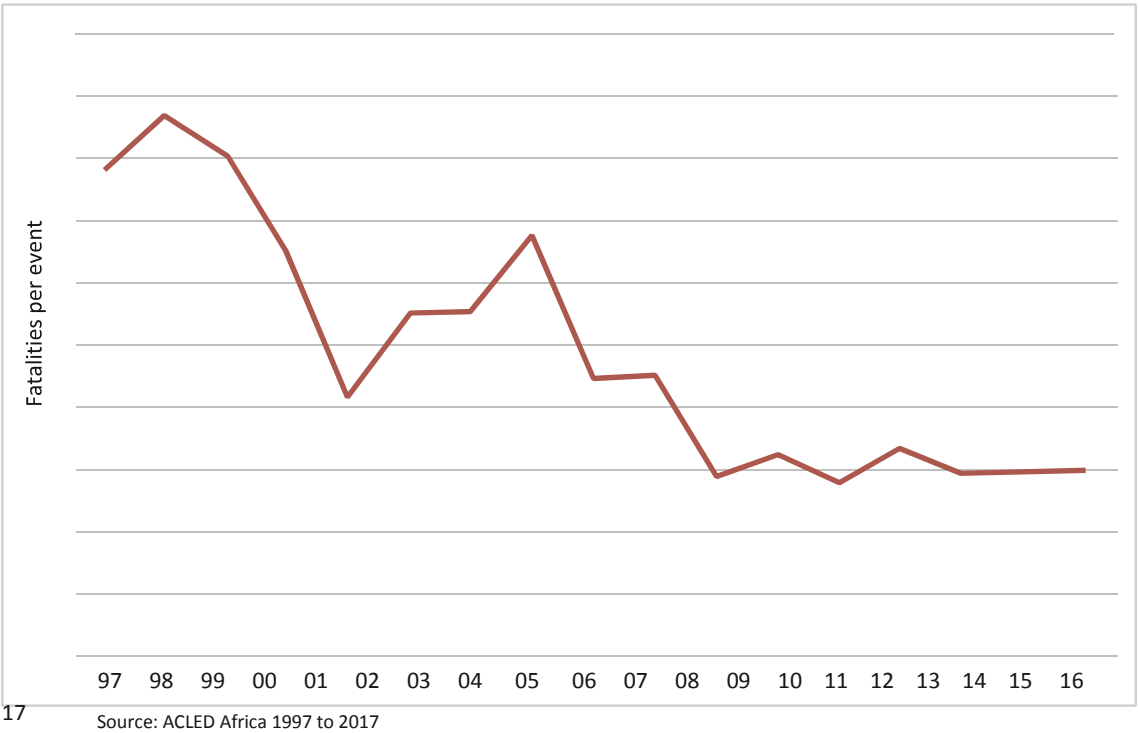


Figure 1b: Average number of fatalities per riot in Africa



Source: ACLED Africa 1997 to 2017

The occurrences of remote violence have also been increasing during the period under review whereas fatalities have been decreasing as indicated by Figures 2a and 2b. The diagram shows an increase between 2012 and 2016. These fatalities, however, are deadly.

Figure 2a: Remote Violence Occurrence in Africa, 1996-2016

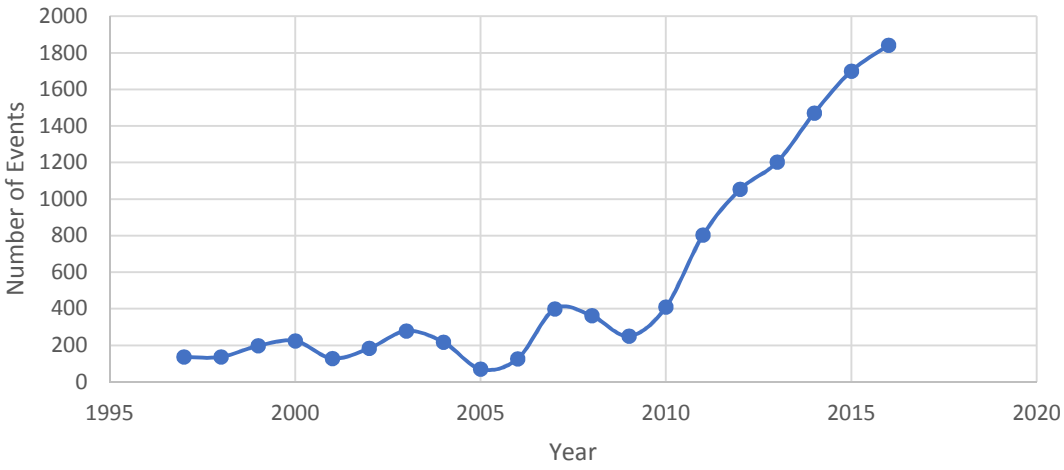
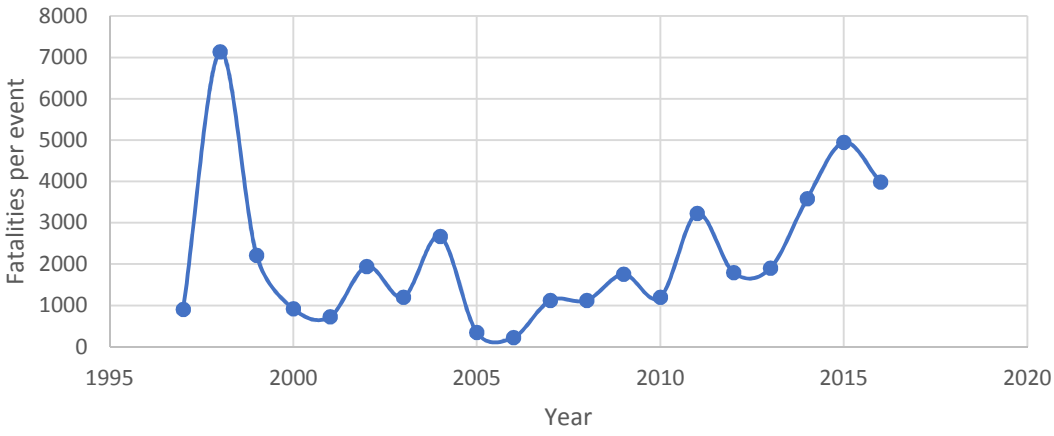
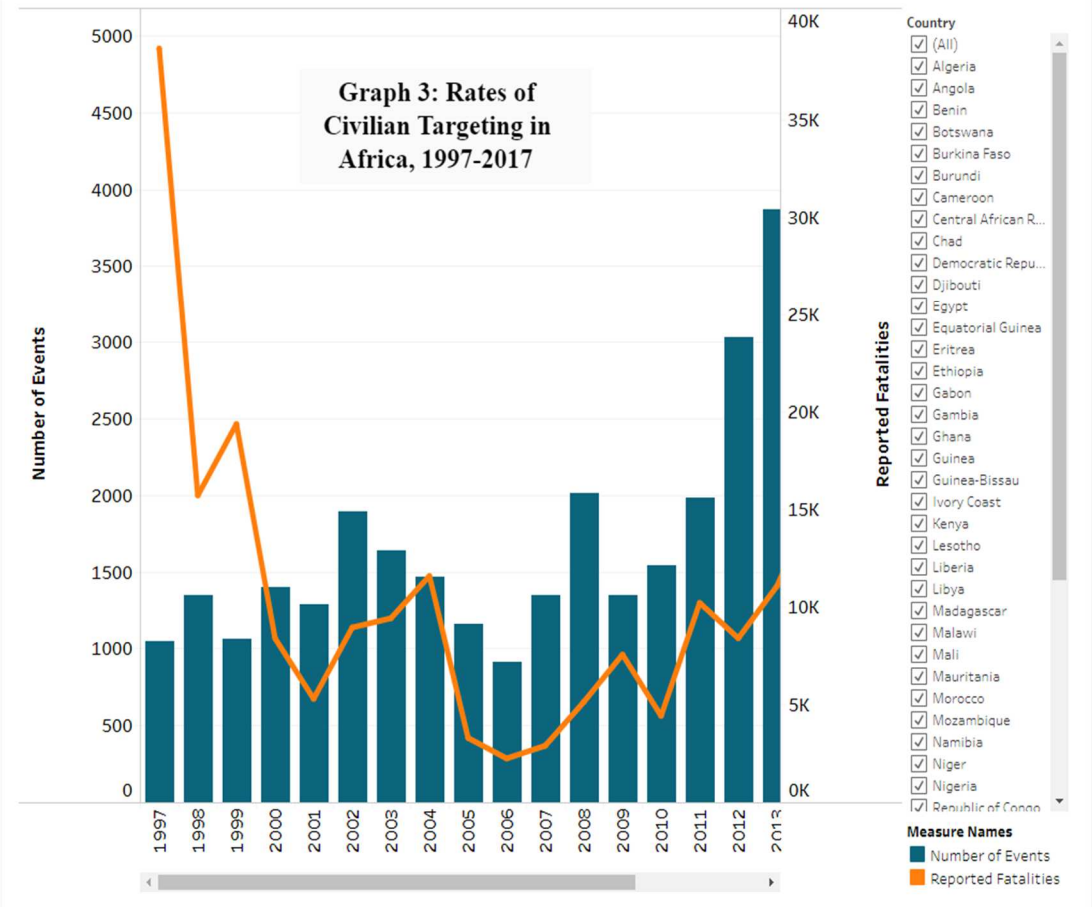


Figure 2b: Fatalities Associated with Remote Violence, 1996-2016

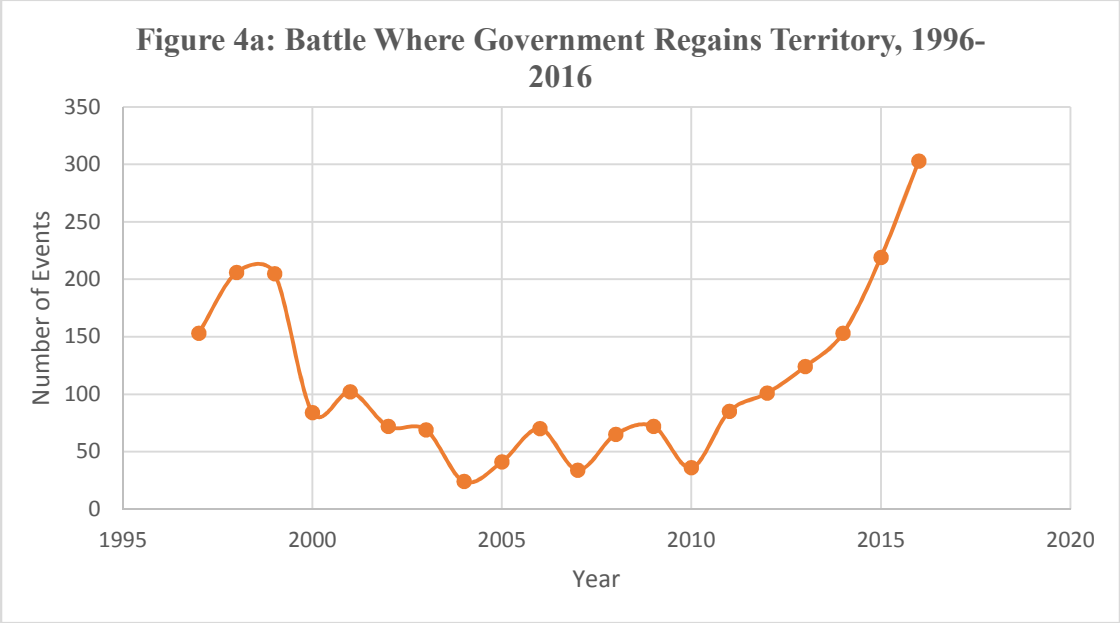


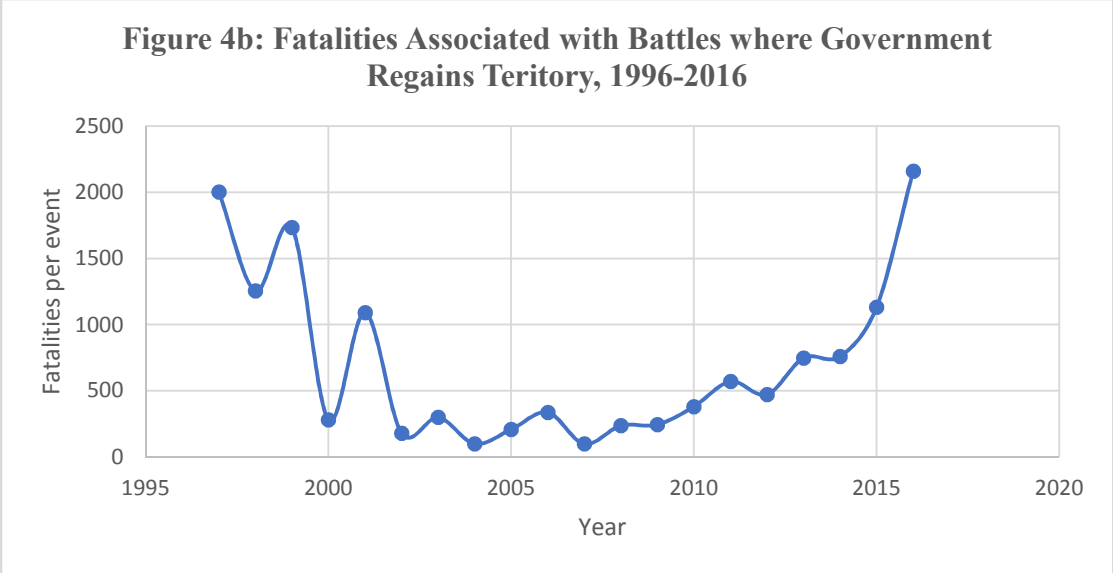
Events through violence against civilians have also been increasing during the period under review but fatalities decreased overtime as indicated by Figure 3.

Figure 3: Violence Against Civilians in African Countries from 1997-2016



Fatalities and events through battles where government regains territories are generally low although there was a sharp increase in 2015/2016 as indicated by Figures 4a and 4b.





I now turn to assessing the relationship between the selected conflict types and longevity. I further examine the relationship between the non-conflict factors and longevity. The estimated models are found in Table 5. The estimated models explain most of the variation in longevity

measures observed across the countries. Specifically, the R-squares were 74% for the infant mortality rate, 72% for age 1-4 years mortality, 81% for female life expectancy, and 80% for male life expectancy.

Table 5: Estimated Health Production Functions for Four Facets of Population Longevity Among African Countries, 1997-2016

Variables	Infant Mortality Coefficient (se)	Age 1-4 Mortality Coefficient (se)	Female Life Expectancy Coefficient (se)	Male Life Expectancy Coefficient (se)
intercept	-18.595*** (5.285)	-39.411*** (5.389)	84.704*** (1.412)	79.608*** (1.264)
riotslag_1	-3.348*** (0.833)	-1.463* (0.792)	0.691*** (0.215)	0.624*** (0.182)
vioacivlag_1	0.345 (0.813)	0.959 (0.772)	0.055 (0.210)	-0.017 (0.178)
rviolag_1	2.215*** (0.682)	1.933*** (0.649)	-0.467*** (0.176)	-0.368*** (0.149)
bagovlag_1	3.163*** (0.873)	1.050 (0.830)	-0.343* ((0.225)	-0.297* (0.191)
fer	21.070*** (0.733)	19.612*** (0.751)	-5.019*** (0.197)	-4.719*** (0.175)
immuz	-0.229*** (0.025)	-0.231*** (0.242)	0.035*** (0.007)	0.034*** (0.006)
hiv	0.902*** (0.176)	0.694*** (0.189)	-0.756*** (0.048)	-0.634*** (0.044)
gnipc	-0.029*** (0.010)	-0.017* (0.009)	0.011*** (0.003)	0.009*** (0.002)
Tb	-0.004 (0.002)	-0.001 (0.002)	-0.003*** (0.001)	-0.002*** (0.000)
R^2 overall	0.741	0.725	0.807	0.796
R^2 within	0.715	0.671	0.666	0.697
R^2 between	0.793	0.758	0.856	0.812
Observations	897	897	897	897
Wald chi^2	2137.25***	1790.68***	1926.11***	2121.39***

1% = *** 5% = ** 10% = *

Relationship between the different types of conflict and longevity

Riots

I find a significant positive relationship between riots and longevity. A unit increase in riots reduces infant mortality by 3.35 years per 1000 lives, reduces age 1-4years mortality by 1.46 years per 1000 lives, increases female life expectancy by 0.69 years, and increases male life expectancy by 0.62 years. Although riots as per definition by ACLED do not involve death, I find a positive relationship between riots and longevity.

Riots draw a variety of people for a variety of reasons. Different people participate in different ways at different times, (Miller, 1999). Riots are dependent on factors real time, dynamics of interpersonal encounters due to the absence of a structured framework. Riots are not devoid of meaning, and when rioters are asked the reason for their participation, they refer to identity frame as a part of the reason for their inclusion. For instance, Hacker and Harmetz demonstrated in their study that the frames rioters use to justify their involvement in riots are usually referred to identity affirmation as an individual or a group (Hacker and Harmetz, 1969). Rioting is economically efficient with the right measure. Rioting can impose costs in the society, however, it can theoretically and practically result in huge benefits by dissuading bad governance or poor performance. In situations where government and institutions do not meet the needs of the people, rioting makes them responsible. Schelling refers to this as commitment which explores the circumstances under which an institution or a person can be made credible. That is during rioting, there is the threat of pain and the assurance of its absence if there is compliance. Hence, both the threats and assurances require actors to be able to commit to certain courses of action (Schelling, 1966). If they end up providing the needs of the people to end the rioting, standard of living increases and that can lead to increased longevity. This does not however mean that rioting should

be a continuous thing in any economy since it comes with its negative effect too such as discouraging investors from investing in such economies.

Violence Against Civilians

A unit increase in violence against civilians increases the infant mortality rate by 0.35 years per 1000 lives, age 1-4 years mortality rate by 0.96 years per 1000 lives and reduces male life expectancy by 0.02 years. However, increase in violence against civilians increases female life expectancy by 0.06 years. However, the relationship is not statistically significant.

Remote Violence

I also find a negative relationship between remote violence and longevity. A unit increase in remote violence increases infant mortality by 2.21 years per 1000 lives, age 1-4 years mortality by 1.93 years and reduces female life expectancy by 0.47 years and male life expectancy by 0.37 years. Remote violence involves bombings, drone activities, missile attacks, air attacks, among others that can lead to death of people, However, most these African countries have not experienced much of this kind of conflict during the years represented in this data set.

Battles where Government Regains Territory

Battles where government regains territory exert a toll on infant mortality, as well as on female and male life expectancy. I find an inverse relationship between longevity and battle where government regains territory. This kind of battle involves the combat of two violent armed groups, and it is a type of armed conflict. A unit increase in this battle increases infant mortality by 3.16 lives per 1000 births, reduces female life expectancy by 0.34 years and reduces male life expectancy by 0.30 years. It can be inferred from the results that the impact of this conflict type on infants exceeds the impact on adult, and this is consistent with a study by Stanford University

Researchers who found that more children die from indirect impact of armed conflicts in Africa. According to the study, between 3.1 million and 3.5million infants born within 30 miles of armed conflict died from indirect consequences of battles from 1995 to 2015 (Duff-Brown, 2018).

Non-conflict variables and longevity.

Effect of fertility on longevity

One important influence of population longevity in Africa is the fertility rate. I find an inverse relationship between the fertility rate and longevity. A unit increase in the fertility rate increases infant mortality rate by 21.07 years per 1000 lives, increases age 1-4 mortality by 19.61 years, reduces female life expectancy by 5.02 years and reduces male life expectancy by 4.72 years. This notion of lower fertility higher longevity has been a relevant rationale for the national and international support of family planning programs in African countries. It is generally believed that when the fertility rate falls, it steadily modifies patterns of family-building in terms of birth spacing, mother's age at child birth and parity, to an extent that are beneficial to the mothers' and children's health (Legrand and Philips, 1996). Hence it can be inferred from the result that the impact is stronger for infants and children, followed by women, and then men.

Effect of immunization on longevity

According to the World Health Organization (WHO, 2002), the global coverage for DPT was 70% in the 1990s, and the developing countries remain vulnerable to vaccine-preventable illnesses. Three million people die from vaccine-preventable diseases each year (Center for Global Development, 2005). I find a positive relationship between longevity and immunization. A unit increase in immunization reduces infant mortality and age 1-4 years mortality by 0.23 years per 1000 live births, increases female and male life expectancy by 0.03 years. In this 20th century,

prevention of suffering and death through childhood immunization is presumed to be one of the greatest public health achievements. Breiman et al. (2004) found a substantially reduced mortality among children who received DTP vaccine. Despite the importance of immunizations, it continues to be underused and undervalued in most countries. In some countries in Sub-Saharan Africa for example, about 70% of children do not receive the full dose of vaccines. As a result, many lives are lost from preventable diseases. The use of vaccines could prevent more deaths of children under the age of five years (Ehreth, 2003). Immunization reduces the spread of infection. Immunization of an individual can lead to the protection of an entire group. Good health stimulates economic growth as bad health suppresses it. If children are immunized, they become healthy. Healthy children perform better at school, grow into healthy adults who become more productive at work and such are better able to tend to the health and education needs of their children. Healthy families can improve their life prospects. Healthier societies can be a stronger force that attract foreign direct investment and tourism than in areas where diseases pose constant threat.

Effects of HIV on longevity

HIV contributes considerably to both child and adult mortality. The estimated model reveals that a unit increase in HIV increases infant and child mortality by 0.90 years and 0.69 years per 1000 live births. It reduces female life expectancy by 0.76 years and male life expectancy by 0.63 years. Most children with HIV get it from their HIV-infected mothers and most of these children die before their fifth birthday if they do not receive any antiretroviral treatment. On the average based on this result, children are harder hit by death resulting from HIV than adults. According to Marinda et al. (2007), nearly about 700,000 children are newly infected by HIV and 500,000 die of AIDS every year. Most of these children acquire this virus from their mothers through, breastfeeding, during pregnancy or childbirth and most of these incidences are found in

Sub-Saharan Africa. With the availability of antiretroviral treatment, only a handful of infected children receive the treatment leaving majority to die before age five. Among adults, the age group heavily hit by HIV is between 20 and 49 years. This group of adults, accounts for 60% of all deaths in Africa as compared to 20% between 1985 and 1990 when HIV was not common (UNAIDS, 2006). It can be inferred that HIV usually hit people in their most productive lives and reproductive ages and this negatively impact the community, social systems and the entire economy. The results also show that HIV related deaths affect females more than males. This is in line with what Muhwava et al. (2013) who found in their studies that HIV-related deaths increased among females and the effect of HIV has been higher for females than males.

Effects of gross national income (gni) per capita on longevity

The effect of gni per capita on longevity is positive but has a smaller impact or magnitude. A hundred unit increase in a country's gni per capita reduces infant and child mortality by 0.03 years and 0.02 years per 1000 live births respectively. A hundred unit increase in gni per capita increases female life expectancy by 0.01 years and increases male life expectancy by 0.01 years. Higher income usually implies better access to education, health, housing, among others that lead to improved health and higher longevity. The income in most of these African countries are low and that explains the low impact on longevity.

Effect of tuberculosis on longevity

Tuberculosis is considered as a curable disease that affect mostly adults in their most productive and reproductive stages in life. Although I find an inverse relationship between the incidence of Tuberculosis and life expectancy for male and female, the impact is not strong. A unit

increase in the incidence of tuberculosis reduces female life expectancy by 0.003 years and reduces male life expectancy by 0.002 years.

CHAPTER 4 CONCLUSION AND SUMMARY

4.1 Summary for OECD and Emerging Countries

From the analysis of the determinants of longevity in OECD and emerging countries, I draw several conclusions. First, influential predictors of longevity in both OECD and emerging countries include conflict, health care consumption, demographic factors, alcohol consumption, the environmental factors, and rates of poverty.

Second, there are some variables that affect longevity only in OECD countries or only in emerging countries. For example, factors such as education, tobacco consumption, and pharmaceutical expenditures strongly correlate with longevity only in OECD countries, whereas the number of hospital beds correlates with longevity only in emerging countries.

Third, even when variables are important in both sets of countries, their effects often differed between them. Access to safely managed sanitation facilities, for example, was found to have a major effect on longevity in emerging countries, but only a small effect in OECD countries.

Fourth, this paper demonstrates the importance of acknowledging conflict as an important determinant of longevity. I found strong evidence that conflicts shorten lives in both OECD and emerging countries, regardless of how longevity is measured. Conflict, whether armed or unarmed, causes tension in the social fabric, leading to unhappiness, thereby reducing lifespan. Health facilities and infrastructure can be destroyed during conflicts. For instance, bombings destroy not only hospitals but kill doctors and nurses. Roads and highways are often damaged, making it difficult for the sick and wounded as well as hospital equipment to be transported to the hospitals. Coupled with a weakened healthcare sector, mortality increases. Considering the detrimental effects of conflict, the onus is on government to institute measures that facilitate peace in and among nations.

Fifth, to measure environmental factors, most previous studies have used carbon dioxide levels and sanitation, among others. I, however, included greenhouse gas as a determinant of longevity, and found that its effects were more pronounced in OECD countries. One might argue that the emission of gasses should be detrimental to health and as a result, its effect on longevity should be negative rather than positive. The positive relationship I found, however, is in the right direction as it represents an economy where the historical economic growth is driven by unsustainable utilization of energy. In general, industrialization thrives on the availability of energy. As an economy expands and depends on energy intensive sectors, Gross Domestic Product (GDP) increases as emission increases. An increase in a country's GDP confirms the well-established relationship between a country's overall wealth and the citizen's lifespan. This is called high GDP emission intensity measured as GDP/Total Emission. Mostly, developed and industrialized countries depend on energy from industrialization where both GDP and emission are high. Although this leads to increased longevity, it is not desirable. Perhaps a more desirable measure would be to pursue a decarbonized economic development pathway where GDP grows and emissions declines. This would lead to a more efficient economy. Some of the policies that lead to growth in GDP and decline in emissions are green policies or investment in technologies like renewable energy such as solar power and removing subsidies on fossil fuels. In addition, one of the problems leading to poor sanitation especially among emerging countries is lack of proper urban planning. As more people migrate to the urban areas, there should be proper city planning at the regional and municipal levels. Instead of people living in slums as they migrate to the cities, government can build affordable houses for such migrants with at least one toilet facility per ten people. Again, most cities and villages also lack toilet facilities and investors can be encouraged to invest in it in addition to what the government can build, and ensure it is maintained effectively.

There should also be increased awareness of diseases associated with poor sanitation in order to facilitate better hygiene practices.

With regards to alcohol and tobacco consumption, the government can increase taxes on alcohol and tobacco production causing the prices to increase to discourage people from buying. Tariffs on their importations can also be increased. Furthermore, the government can enforce laws such as increasing the alcohol and tobacco consumption legal age to 25 years, banning public smoking and instituting measures that ensure no sale of alcohol during weekends.

Finally, I find that although increasing health expenditure impact positively on longevity, the coefficients are smaller, and the effects of conflict, poverty, immunization and low fertility rates outweigh health expenditure's impact on longevity. Education is very key in explaining longevity among OECD countries.

4.2 Summary for African Countries

In the analysis of determinants of longevity in Africa, I draw the following conclusions. First, riots, a form of conflict that does not harm humans, have a strong positive relationship with longevity. Battles where government regains territory have a strong negative relationship with longevity, and remote violence also has a strong negative relationship with longevity. Hence, although conflict in general is not good for any society, riots are apparently beneficial to longevity in the right measure. Considering these detrimental effects of battles where government regains territory and of remote violence, African governments should focus on stimulating job creation and fostering better working conditions, stop misappropriation of funds, and provide better security that will facilitate peace in and among nations.

Second, the strongest predictor of longevity in Africa, without a doubt, is the fertility rate. According to Flegg (1982), high fertility infers high parity and closely spaced births, and a high

proportion of births to young and old mothers. These in-turn leads to birth complications and abnormalities, maternal malnourishment, earlier weaning, and low birth weights. Therefore, high fertility has adverse consequences on infant and child mortality as well as life expectancy in many developing countries (Husain, 2002). Governments can make education more affordable and provide more jobs for the people. Highly educated people tend to have fewer children because they are more occupied by work. They give birth to fewer number of children, so they can adequately cater for their needs. More jobs in the economy will keep people busy rather than just staying at home and giving birth even in poor conditions.

Third, HIV and tuberculosis also have a strong inverse relationship with longevity. The marginal effect of HIV is strong whiles that of tuberculosis is very small. Of the three variables however, the fertility rate has the highest marginal effect.

Fourth, the immunization rate and gross national income per capita have positive effects on longevity. However, although gross national income per capita has a strong positive relationship with longevity, the marginal effect is very small.

Finally, of all the determinants of longevity in Africa used in this study, the fertility rate is the strongest predictor of longevity, followed by the different types of conflict and HIV. The effects of tuberculosis, gnip, and immunization are minimal. Policies should therefore be targeted at reducing fertility, conflict and the spread of HIV. The antiretroviral drugs should be subsidized by government to make it more accessible to everyone. Family planning education should be intensified especially in the remote rural areas.

4.3 Conclusion

There is a strong evidence that conflicts shorten lives of people in OECD, emerging and African countries regardless of how longevity is measured. People suffer in times of conflict in the

areas of death, displacement, impoverishment, and lack of access to basic services. Conflict thus matters for population longevity. Whether it's measured using an overall index of conflict or measured using disaggregated indicators for the various types of conflict that were present, conflict tends to lower longevity. The one exception appears to be non-violent riots which dissuades bad governance or poor performance. Too much of it however can discourage investors, cause tension and unhappiness.

Governments should therefore make it a point to generate resources to address early warning signs. They should also avoid and or settle conflicts through the implementation of good governance. There should be job creation, that is individuals should be motivated to establish their own business thereby creating employment. Banks should be made to give low interest rate facilities to people who want to borrow to establish their own businesses. In addition, tax holidays can be granted to foreigners who would want to invest in home countries. But that should be granted with regulations such as employing about 90% of indigenous people to reduce poverty. More vocational, technical and other non-conventional institutions should be established to absorb those who are not academically good, or who cannot attain high education. Such institutions can be used to train and sharpen the skills and talents of people so they can come out of the poverty trap. When poverty is reduced and institutions are working, there will be less conflicts and hence increased longevity.

The results are broadly in line with other studies that have contributed to this area of research. Further research can however be conducted on the impact of extraordinary events such as oil shocks, Asian currency crisis, and the 2008 financial crisis, etc. that happened within a period on longevity.

APPENDIX

Appendix A: List of OECD Countries

1	Australia
2	Austria
3	Belgium
4	Canada
5	Chile
6	Czech Republic
7	Denmark
8	Estonia
9	Finland
10	France
11	Germany
12	Greece
13	Hungary
14	Iceland
15	Ireland
16	Israel
17	Italy
18	Japan
19	Korea
20	Latvia
21	Luxembourg
22	Mexico
23	Netherlands
24	New Zealand
25	Norway
26	Poland
27	Portugal
28	Slovak Republic
29	Slovenia
30	Spain
31	Sweden
32	Switzerland
33	Turkey
34	United Kingdom
35	United States

Source: OECD.org

Appendix B: List of Emerging Countries

1	Argentina
2	Brazil
3	Bangladesh
4	China
5	Colombia
6	Egypt
7	India
8	Indonesia
9	Iran
10	Kuwait
11	Lithuania
12	Malaysia
13	Morocco
14	Namibia
15	Nigeria
16	Pakistan
17	Peru
18	Philippines
19	Qatar
20	Russia
21	Saudi Arabia
22	South Africa
23	Mauritius
24	Thailand
25	Zambia

Appendix C: List of 50 African Countries

Number	Name of Country
1	Algeria
2	Angola
3	Benin
4	Botswana
5	Burkina Faso
6	Burundi
7	Cameroon
8	Central African Republic
8	Chad
10	DR Congo
11	Republic of Congo
12	Cote d'Ivoire
13	Djibouti
14	Egypt
15	Equatorial Guinea
16	Eritrea
17	Ethiopia
18	Gabon
19	Gambia
20	Ghana
21	Guinea
22	Guinea Bissau
23	Kenya
24	Lesotho
25	Liberia
26	Libya
27	Madagascar
28	Malawi
29	Mali
30	Mauritania

Number	Country
31	Mauritius
32	Morocco
33	Mozambique
34	Namibia
35	Niger
36	Nigeria
37	Rwanda
38	Senegal
39	Sierra Leone
40	Somalia
41	South Africa
42	South Sudan
43	Sudan
44	Swaziland
45	Tanzania
46	Togo
47	Tunisia
48	Uganda
49	Zambia
50	Zimbabwe

Source: COUNTRIES-ofthe-WORLD.COM

Appendix D: Hausman Test for OECD Countries from 1990-2014

	Infant Mortality		female life expectancy		Male life expectancy		le65f		le65m	
Variable	Fixed (F)	Random (R)	F	R	F	R	F	R	F	R
conflict	0.59	0.74	-0.51	-0.51	-0.52	-0.51	-0.28	-0.28	-0.29	-0.29
thexp	-0.02	-0.03	0.07	0.07	0.11	0.11	0.04	0.04	0.07	0.07
ledu	-0.01	-0.01	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01
tedu	-0.03	-0.04	0.06	0.06	0.06	0.06	0.45	0.44	0.04	0.04
immuz	-0.05	-0.05	0.04	0.04	0.03	0.03	0.07	0.08	0.01	0.01
pharm	-0.40	-0.34	0.07	0.08	0.09	0.09	0.04	0.04	0.02	0.02
alcoh	-0.14	-0.15	-0.07	-0.08	-0.09	-0.10	-0.08	-0.08	-0.08	-0.08
san	-0.05	-0.05	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
tobcons	0.04	0.02	-0.01	-0.01	-0.02	-0.02	-0.01	-0.01	-0.02	-0.02
ghg	-0.03	-0.08	1.13	1.11	0.16	0.15	0.06	0.48	0.06	0.05
poverty	-2.43	-2.21	1.92	1.93	1.74	1.72	1.43	1.45	1.08	1.09
fer	1.44	1.61	-1.99	-1.94	-2.16	-2.04	-0.49	-0.48	-0.31	-0.26
R^2 overall	0.40	0.44	0.47	0.48	0.40	0.42	0.46	0.47	0.47	0.49
R^2 within	0.28	0.28	0.79	0.79	0.83	0.83	0.80	0.80	0.87	0.87
R^2 between	0.48	0.54	0.32	0.33	0.22	0.23	0.29	0.30	0.23	0.25
Prob>chi^2	0.016		0.045		0.025		0.578		0.101	

Appendix E: Hausman Test for Emerging Countries from 1990 to 2014

	Infant mortality		Female life expectancy		Male life expectancy	
variable	Fixed	Random	Fixed	Random	Fixed	Random
conflict	1.394	1.522	-0.413	-0.409	0.248	0.259
thexp	0.192	0.212	0.073	0.053	0.108	0.100
fer	8.116	8.787	-1.249	-1.540	-1.229	-1.383
immuz	-0.353	-0.360	0.063	0.064	0.058	0.059
alcoh	0.541	0.390	-0.300	-0.261	-0.267	-0.288
san	-0.488	-0.440	0.126	0.118	0.118	0.112
ghg	-0.069	-0.069	0.028	0.031	0.026	0.026
poverty	0.065	0.066	-0.019	-0.019	-0.-17	-0.017
hbeds	0.380	0.244	-0.334	-0.275	-0,281	-0.291
R^2 overall	0.776	0.797	0.615	0.670	0.670	0.686
R^2 within	0.622	0.621	0.488	0.486	0.503	0.502
R^2 between	0.803	0.828	0.628	0.693	0.686	0.706
Prob>chi^2	0.036		0.0210		0.042	

Appendix F: Hausman Test for African Countries

	Infant mortality		Age 1-4 mortality		Female life expectancy		Male life expectancy	
Variable	Fixed	Random	Fixed	Random	Fixed	Random	Fixed	Random
riotslag1	-2.648	-3.348	-1.215	-1.463	0.654	0.691	0.603	0.624
vioacivlag1	0.712	0.345	1.167	0.959	0.017	0.551	-0.041	-0.017
rviolag1	1.957	2.215	1.788	1.932	-0.461	-0.467	-0.349	-0.368
bagovlag1	2.881	3.163	0.914	1.050	-0.333	-0.343	-0.286	-0.297
fer	25.214	21.070	21.504	19.612	-5.314	-5.019	-4.946	-4.719
immuz	-0.189	-0.229	-0.218	-0.231	0.029	0.035	0.030	0.034
hiv	0.468	0.902	0.513	0.694	-0.777	-0.756	-0.622	-0.634
gnipc	-0.026	-0.029	-0.016	-0.017	0.011	0.011	0.009	0.009
tb	-0.003	-0.004	0.001	0.001	-0.003	-0.003	-0.002	-0.002
R^2 overall	0.725	0.741	0.722	0.725	0.803	0.807	0.792	0.796
R^2 within	0.720	0.715	0.672	0.671	0.667	0.666	0.697	0.697
R^2 between	0.782	0.793	0.758	0.758	0.853	0.856	0.807	0.812
Prob>chi^2	0.000		0.001		0.106		0.809	

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ABSTRACT

THE RELATIONSHIP BETWEEN CONFLICT AND LONGEVITY: A PANEL DATA ANALYSIS

by

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December 2019

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With a series of multivariate regression models this study investigates the association of conflict, health and non-health inputs with different facets of longevity in OECD, emerging and African countries. Using a country-level panel data set covering the period 1990 through 2014, five facets of longevity are examined: infant mortality, life expectancy for males at birth, life expectancy for females at birth, life expectancy for males at age 65, and life expectancy for females at age 65 among OECD and emerging countries. With country-level data spanning 1997 through 2016 from 50 African nations, production functions are also estimated for four distinct aspects of longevity: life expectancy at birth for males, life expectancy at birth for females, the infant mortality rate, and the mortality rate among children ages 1-4. The analysis of the determinants of longevity among OECD and emerging countries reveals that conflict shorten lives of people in both OECD and emerging countries. It was also found that greenhouse gas and health expenditures positively affect longevity although health expenditure's impact is minimal. In the analysis of the determinants of longevity specific to African nations I find that although conflict in general is not good for any society, non-violent riots are beneficial to longevity in the right measure. With an

inverse relationship between HIV, tuberculosis and longevity, HIV's effect is stronger than tuberculosis' effect. Immunization rate and gross national income per capita have positive effect on longevity. However, the marginal effect of GNI per capita is very small. In all countries under study however, the fertility rate remains the strongest predictor of longevity.

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