China-USA Business Review, April. 2020, Vol. 19, No. 4, 123-139
doi: 10.17265/1537-1514/2020.04.003

The Effects of Unemployment on Health in Sub Saharan Africa

Yamben Michel Freddy Harry and Asaah Kangkai Zacheus
University of Maroua, Maroua, Cameroon

This research work is an empirical analysis of the relationship between unemployment and health in Sub Saharan Africa (SSA). In examining the impact of unemployment on health, we firstly made a test of interdependence of our conceptual framework. Secondly, we used the modified Generalized Methods of Moment (GMM) by Arellano and Bond (1991) from the econometric perspective to study the link between unemployment and health. We then resolved the problem of endogeneity by using a dynamic panel data relative to the study period 2006-2017. After carrying out a series of tests: test of cross-sectional dependence, stationarity tests, co-integration tests, test of endogeneity and identification of the model, the results revealed that the co-integration analysis supports a robust long-run relationship between our variables. Consequently, a 1% rise in unemployment rate at lag 1 leads to a 0.148% rise in female, 0.134% rise in male and 0.138% rise in total mortality rates, and at levels it leads to a 1.166% rise in total mortality rate in middle income countries. However, in low income countries, a 1% rise in unemployment rate leads to a 0.166% fall in total mortality rate. In terms of recommendations, to maintain a low level of unemployment rate, actions to undertake have to be based on the better functioning of the labour market, a better flexibility of markets, a health insurance cover and limiting incitements which depress economic activities.

Keywords: unemployment rate, mortality rates, middle and low income countries, GMM

Introduction

Some studies have shown a positive relationship between unemployment and mortality (Adofu & Salami, 2018; Sullivan et al., 2009). The debate concerning the association between unemployment and ill health has been the concern of researchers for many years. The two major questions that arise concerning this relationship which are firstly, does unemployment cause deterioration in health? Or, conversely, are the sick more likely to become unemployed? It is not worth mentioning that when an economy is experiencing a downturn, employers first lay off sick workers and unemployment causes material hardship which affects an individual negatively both physically and mentally (Griffin, 1993). In a study conducted by Brenner (1976), he found that for every 10% increase in the unemployment rate, suicide will also increase by 1.7% and psychiatric hospitalizations will increase by 4.2%.

In other studies, the separation of negative effects of unemployment on health has been done into individual and family effects (Hanisch, 1999). Individual effects include physical and psychological effects.

Yamben Michel Freddy Harry, Ph.D. in Economics, senior Lecturer, Faculty of Economic Sciences and Management, University of Maroua, Maroua, Cameroon.
Asaah Kangkai Zacheus, Master's Degree in Applied Economics, Faculty of Economic Sciences and Management, University of Maroua, Maroua, Cameroon.
Correspondence concerning this article should be addressed to YAMBEN Michel Freddy Harry, University of Maroua, Cameroon, Kongola Campus, P.O Box 49 Maroua.

Physical effects include: increase in stomach ache, head ache, lack of energy and sleep, heart and kidney diseases, and hypertension. Psychological effects include: increased hostility, anxiety, depression, fear, anger, stress, loneliness, loss of self-esteem, and life satisfaction. Family effects include: increase in family conflicts, abuse on spouse, child abuse, and marital friction. Some high income countries[1] have recently been severely struck by these phenomena of unemployment and ill health that developed after the 2008 financial crisis (Wanberg, 2012). The negative effects of unemployment on health is as a result of loss of income but also the deprivation of social, psychological, and non-pecuniary benefits provided by employment (Jahoda, 1982). Some researches prone a number of reasons for unemployment. The reasons for youth unemployment are fairly similar to other causes of unemployment and include: lack of qualifications, geographical unemployment, real wage unemployment, lack of graduate jobs, cyclical unemployment, frictional unemployment, cultural/social factors, underground economy, and hysteresis (past unemployment trends are likely to cause future unemployment) (Tejvan, 2017). Unemployment nowadays is caused by the economy and also by the increase in population (Jacob, 2011).

Conversely, some studies have established a negative relationship between unemployment and ill health. Some studies that were conducted in the US and Europe revealed pro-cyclical association of unemployment rates and mortality rates, depending on the economic state of the economy. These studies revealed that higher unemployment rates are associated with lower mortality (Ruhm, 2000; Granados, 2008). They found that after long-term trends, higher unemployment rates (mostly during economic recessions) lead to lower mortality rates, while lower unemployment rates (mostly during economic expansions) lead to higher mortality rates, such that mortality rates fluctuate with the business cycle. This trend of fluctuations was also found for cardiovascular and infectious disease mortality, traffic deaths, and industrial injuries (Kossoris, 1939; Miller, Page, Stevens, & Filipski, 2009).

Other studies outline the important determinant of health as a personal sense of job satisfaction. Epidemiological evidence, such as the renowned, Whitehall study of British civil servants, has shown how the hierarchy of workplace organization has significant impact on health outcomes (including mortality), with the people in the lowest-status jobs (with the least sense of control) having the worst outcomes (Marmot, Kogevinas, & Elston, 1987; Marmot & Theorell, 1988). Unemployment has been associated with low self-esteem, humiliation, and depression in the individual, and a damaged family and social life. Conversely, obtaining a job has been found to quickly lead to improvement in family and social life (Warr, 1987).

High unemployment rates are a major characteristic of developing economies most of them being found in the Middle East and Sub Saharan Africa. Unemployment is one of the greatest challenges in the development of Africa with an estimated 10.9% and 10.4% of job seekers in 2003 in Sub Saharan and North Africa, respectively, which are the second and third world's highest unemployment rates respectively after the Middle East (ERA, 2005). In the same light, Africa faces the planet's worst health issues according to the World Health Organization (WHO) report on African Regional Health of May 2019. According to the report, Africa is confronted with the world's dramatic health crisis though the region can over time redress its health challenges given sufficient international support. Amongst the prominent illnesses are human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS) which is the leading cause of deaths among adults with about 60% of the population infected. These illnesses are mostly blamed on poor hygiene and sanitation, poor

[1] High income countries include; the USA, New Zealand, Spain, and Taiwan.

drinking water, and wide spread poverty. It is estimated that only 58% of people in Sub Saharan Africa have access to safe water supplies. As a matter of fact, the study of the effects of unemployment of health in Sub Saharan Africa will provide some empirical responses to unemployment-health issues.

Empirical Literature Review

Several studies have been carried out on the cause and effect relationship between unemployment and health, in general, on unemployment and mortality in particular. The literature review shall be grouped into time series analysis and longitudinal analysis.

Time Series Analysis

In a series of aggregate studies in the 1970s, using time-series analyses, Brenner examined the relationship between the overall mortality rates and several economic variables including unemployment, for the United States, between 1909 and 1976 Brenner (1976) for England and Wales, between 1936 and 1976 Brenner (1979) and for England, Wales, and Scotland between 1954 and 1976 Brenner (1979). He found that in all these countries, national mortality rates were significantly related to earlier unemployment rates. Brenner did not suggest that all the excess deaths occur amongst the unemployed. He argued that many do occur among those who are left in unstable employment and those who lose one job and find another which may be less well paid and more hazardous. In a report of his analyses to the US Congress in 1976, Brenner predicted that a 1% rise in unemployment in the US would lead to some 6,000 excess annual deaths (Brenner, 1984). The method used by Brenner in his studies was criticized by some researchers.

In 2005, Brenner investigated the effects of real GDP per capita, unemployment rate, and the employment to population ratio on age-adjusted mortality rates over the period of 1901 to 2000, in the United States. Using Engle and Granger's co-integration method and Shiller's lag estimation model, he found that the net effect of increased unemployment leads to a substantial increase in mortality, while increases in GDP per capita leads to a significant decrease in mortality rates. He emphasized that in using the preference criterion, the occurrence of the independent variable prior to that of dependent variable is necessary to get a stable and reliable long-term effect of unemployment on mortality. In his study, he used lag of 11 years for the independent variables and found that, within short time, the results showed counter a priori expectations for both unemployment and real GDP per capital, but becomes stable over medium-to-long time phenomenon (Brenner, 2005). Adofu and Salami (2018), in a study to investigated the effect of unemployment rates on mortality rates in Nigeria, using time series data and employing the Johansen co-integration test and Fully-Modified Least Square Regression (embedded with distributed lag of unemployment) methods, found that the second lag of unemployment rates have significant and positive effect on mortality rates. A one percent increase in unemployment leads to 0.16% increase in total mortality rates, 0.17% increase in adult male mortality rates, and 0.15% increase in adult female mortality rates.

Contrary to the findings of Brenner, Gravelle, Hutchinson, and Stern (1981) were amongst the strongest critics of Brenner's method. Using Brenner's own methodology, they argued that while his studies resulted in the conclusion that there is a correlation between of unemployment rates and mortality rates in different geographical areas, some other important variables, such as income, educational levels, diet, occupational structure, and housing are also associated with mortality and that these variables are also strongly correlated with unemployment rates. Gravelle et al. (1981) suggested that if these other variables were included in the analysis the reliability of the estimates of the effects of unemployment would be reduced. Equally if these variables were omitted, the estimates would be biased in that some of the effects of omitted variables on mortality will be wrongly attributed to unemployment. Granados (2005), in an investigation of the relationship between annual national fluctuations in a number of macroeconomic indicators and mortality of US economy between 1900 and 1996, found that higher mortality rates were associated with higher unemployment rates only during recessions, and that this situation was reversed as the economy expanded. He used Stuart Mill's concomitant variation approach and Hodrick-Prescott filter to transform the variables, before regressing the percentage change in mortality on GDP growth and the rate of change of unemployment.

Longitudinal Analysis

By employing United States' state-level longitudinal data from1979 to1991 and using fixed effect method to investigate the relationship between unemployment and mortality rates, Ruhm (2000) and Ionides, Wang, and Granados (2013) found that an increase in the unemployment rate is associated with a decrease in the overall mortality rate. Ruhm also found that an increase in unemployment leads to a decrease in deaths from all preventable causes of death, except with the case of suicide and homicide that are countercyclical in nature.

Gerdtham and Ruhm (2002), using fixed effect method to investigate the relationship between mortality rates and per capita disposable income of 23 member nations of the Organisation for Economic Co-operation and Development (OECD) over the 1960-1997, found that total mortality and deaths from several common causes increased with the strengthening of the labour markets. They found that decrease in the national unemployment rate is associated with a rise in total mortality and increases in deaths from cardiovascular disease, pneumonia, liver disease, deaths associated to motor vehicle accidents, and other accidents. Similarly, Neumayer (2004), by applying fixed effect method on German state level data, equally found a pro-cyclical relationship between unemployment and mortality due to cardiovascular disease, pneumonia and influenza, motor vehicle accidents, and suicides.

Some studies carried out by researchers, like Sullivan and Wachter (2009), Crost and Friedson (2015), found countercyclical association between unemployment and mortality. Sullivan and Wachter (2009) used fixed effect method on administrative records of Pennsylvania workers of 1970s, 1980s, and death records of 1960s. They found out that job loss by high tenured male workers led to increase in their mortality rate by 50% to 100% in the first year after job loss. The trend continued, as mortality rates of displaced workers remained 10% to 15% higher after 25 years. Similarly, Crost and Friedson (2015) used fixed effect method to investigate the effect of education specific unemploymentrates on mortality to get better likelihood of being directly impacted by a recession. They found that among the working-age population, higher education-group specific unemployment rates were positively associated with mortality rates. Their findings suggest that the unemployment rate of an educated group in a given state is positively related to mortality in that group. They explained further that part of the education specific mortality effect is driven by the loss of health insurance coverage that comes with unemployment in some studies carried on health outcomes response to economic fluctuations in high income and low income countries.

Morin (2009), using fixed effects method to investigate the relationship between mortality rate and some selected macroeconomic variables of Organization for Economic Co-operation and Development countries, found that long-run economic growth (captured by GDP per capita) decreases mortality, while short-run growth is detrimental to health in rich countries. Government programs to artificially boost economic growth may negatively affect the population's health. But in poorer countries, particularly the ones with GDP per capita levels below $10,000, both long- and short- run growth lower mortality rates, so any move that boosts economic output will improve the health of citizens of the country. Similarly, Using fixed effect method, Ferreira and Schady (2009) found that, in richer countries (like United States), child health and education outcomes are countercyclical: They improve during recessions. But in poorer countries, like Africa and low-income Asia, the outcomes are pro-cyclical: infant mortality rises, school enrolment, and nutrition fall during recessions. In the middle-income countries of Latin America, health outcomes are generally pro-cyclical, and education outcomes are countercyclical.

Li, Feng, Wang, Qian, and Gu (2017) performed a periodic bivariate Pearson's analysis on the data of GDP per capita, current health expenditure (CHE) per capita, and Internet Monthly Report (IMR) in China from 1952 to 2014. They found that there was no relationship between GDP per capita and IMR from 1972 to 1970. GDP per capita and IMR were negatively correlated from 1980 to 2014. The stage from 1970 to 1975 was the turning point for the effect of GDP per capita on IMR. From 1980 to 1995, the growth rate of CHE per capita (12.80%) was slower than that of gross national product (GNP) per capita (17.26%) and the average decline rate for IMR was 2.82%. From 1995 to 2014, the average growth rate of GHE per capita (18.25%) was faster than that of GNP per capita (12.42%) and the average decline rate for IMR was significantly accelerated (7.15%).

Methodology

Nature and Source of Data

The data used in this work are a time series data that covers the period of 12 years from 2006 to 2017 collected from secondary sources and a cross-section of 10 countries in Sub Saharan Africa. The data were collected from the World Bank database, the World Health Organization database, and International Labour Office database. The 10 countries are a stratified sample of SSA with three from West Africa, three from Central Africa, two from East Africa, and two from South Africa. The selection of these countries was based on the World Bank income classification including countries of the upper middle and lower middle income groups and countries of the low income groups and also on the availability of data. This was to make sure that the sample is an actual representation of the population.

Model Specification

To attain our main objective our model, a 1 to 2 time-lag of unemployment rates and mortality rates were introduced in to the model to evaluate long-term effect of unemployment on mortality. The use of distributed lag effect of unemployment follows Neumayer (2004), Ruhm (2000), and Brenne (2005). On the basis of a dynamic panel model, our model is therefore specified as follows:

- Mortality rate, adult female

$$LogMorf_{it} = \gamma_1 LogMorf_{it-j} + \gamma_2 LogUn_{it-j} + \gamma_3 LogGNI_{it} + \gamma_4 LogCHE_{it} + \gamma_5 LogHIV_{it} + \gamma_6 Logpopg_{it} + \lambda_{it} \quad (1)$$

- Mortality rate, adult male

$$LogMorm_{it} = \beta_1 LogMorm_{it-j} + \beta_2 LogUn_{it-j} + \beta_3 LogGNI_{it} + \beta_4 LogCHE_{it} + \beta_5 LogHIV_{it} + \beta_6 Logpopg_{it} + \varepsilon_{it} \quad (2)$$

- Mortality rate, total

$$LogMort_{it} = \alpha_1 LogMort_{it-j} + \alpha_2 LogUn_{it-j} + \alpha_3 LogGNI_{it} + \alpha_4 LogCHE_{it} + \alpha_5 LogHIV_{it} + \alpha_6 Logpopg_{it} + \mu_{it} \quad (3)$$

- Mortality rate, middle income countries

$$LogMort_{it} = \delta_1 LogMort_{it-j} + \delta_2 LogUn_{it-j} + \delta_3 LogGNI_{it} + \delta_4 LogCHE_{it} + \delta_5 LogHIV_{it} + \delta_6 Logpopg_{it} + \nu_{it} \quad (4)$$

- Mortality rate, low income countries

$$LogMort_{it} = \lambda_1 LogMort_{it-j} + \lambda_2 LogUn_{it-j} + \lambda_3 LogGNI_{it} + \lambda_4 LogCHE_{it} + \lambda_5 LogHIV_{it} + \lambda_6 Logpopg_{it} + \eta_{it} \quad (5)$$

The a priori expectations between the unemployment rates and mortality rates, gross national income per capita, current health expenditure, prevalence of HIV and population growth are as follow: $\gamma_1, \beta_1, \alpha_1, \delta_1, \lambda_1 > 0$, $\gamma_2, \beta_2, \alpha_2, \delta_2, \lambda_2 > 0$, $\gamma_3, \beta_3, \alpha_3, \delta_3, \lambda_3 < 0$, $\gamma_4, \beta_4, \alpha_4, \delta_4, \lambda_4 < 0$, $\gamma_5, \beta_5, \alpha_5, \delta_5, \lambda_5 > 0$, $\gamma_6, \beta_6, \alpha_6, \delta_6, \lambda_6 < 0$.

Where $i = 1, \ldots 10$ refers to the country $t = 1, \ldots 12$ refers to the time period and $j = 1, \ldots 2$.

Morf is the mortality rate, adult female, Morm is the mortality rate, adult male, Mort is the total mortality rate, Un is the unemployment rate, GNI is the gross national income/capita, CHE is the current health expenditure/capita, HIV is the prevalence of HIV, and Popg is the population growth rate. γ, β, α, δ, and λ are coefficients to be estimated. The λ_{it}, ε_{it}, μ_{it}, ν_{it}, and η_{it} are the elements of the error terms which vary across the group of countries and time.

Unit Root Test (Test of Stationarity)

For panel data, panel unit root tests have been proposed by Im, Pesaran, and Shin (1997), Choi (1999), and Levin, Lin, and Chu (2002). The Levin-Lin-Chu unit-root test will be used to verify the stationarity of the variables. This version of unit root test includes lagged terms of the dependent variable in order to eliminate autocorrelation and statistics are suitable for finite or infinite number of panels.

Co-integration Test

Given the results of stationarity of our variables, we have to choose the form by which our model would be represented. At this stage, we have to verify if our variables are co-integrated and if our model contains a short-term and/or long-term relationship.. The Pedroni method to test co-integration is given more privilege because the model takes into account both the notion of within and between dimensions. This co-integration test is stronger than other multiple co-integration tests. The null hypothesis of this test verifies for an absence of co-integration.

Method of Data Analysis

In order to estimate the parameters of our dynamic equations, we would use the modified Generalized Methods of Moment (GMM) estimation model. This is because the GMM estimates are a more reliable and efficient models since they solve problems of serial correlation, heteroscedasticity, and endogeneity of variables Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998) and create their own instruments. In addition, it is good for small sample studies as it is our case. But the basic weakness in the system GMM estimation is that it creates too many instruments leading to the misspecification of the model (the instruments may not tie with economic theories). In this context, to get valid instruments, we follow Roodman (2009) by using the Arellano Bond (2) model which does the Sargan test, Hansen test, and difference Hansen test to verify the validity of instruments and the Arellano Bond (1 and 2) tests to check for serial correlation. In the case of a one-step estimation technique, a high *p*-value of the Sargan test if preferred to a conventional level of 0.05 and in this same light, in a two-step estimation technique, a high *p*-value of the Hansen test is preferred rather than the conventional level of 0.05. We would employ the Arellano Bond (2) two-step system robust estimation technique, create our instruments and the robust option will take care of the problem of heteroscedasticity.

Choice of Variables

Mortality rate, adult, total (Mort) in our work is merely the sum of adult female and male mortality rates. This is due to the fact that, since unemployment is concerned specifically with adults, it was not necessary to take into account infant mortality rate. We aim here at verifying the impact of unemployment rate on adult mortality rate only. The various mortality rates are employed in line with the works of Ruhm (2000) and Neumayer (2004). We have employed unemployment rate as a proxy to unemployment because the labour market is not well developed in most SSA countries and data only exist mostly on unemployment rate.

The income per capita is used because it interprets income at the macro level. More so, empirical literature suggests it has a causal effect on health outcomes summarized by Pritchett and Summers (1996, p. 863) who noted that "wealthier nations are healthier nations" and "gains from rapid economic growth flow into health gains" though some say the influence of income per capita on health outcomes has diminished over time (Preston, 2007).

We equally used current health expenditure per capita because it takes into account both private and government health expenditures. Furthermore, it in some way accounts for the quality of health care institutions (private and public). Again, HIV prevalence is employed because it greatly affects health in SSA and the rate is very high in some of these countries, like South Africa. Furthermore, the employment of population growth rate follows the Malthusian theory of population growth.

Presentation of Results

Descriptive Statistics

In this section, we would present the summary statistics for all variables in a tabular form. This is aimed at having a general observation of the variables in question as well as their relationships.

From Table 1, the mean of total mortality rate total (adult female and male) mortality rate, adult female and mortality rate, adult male are 6.443, 5.631, and 5.852, respectively. Their maximum and minimum values are 6.952, 6.153, 6.355 and 6.026, 5.096, 5.482, respectively. The standard deviation of mortality rate total, mortality rate, adult female and mortality rate, adult male are 0.208, 0.226, and 0.209, respectively. Total mortality rate and male mortality rate are skewed to the right of their mean values since their skewness values are positive, meanwhile the female mortality rate is skewed to the left of the mean. The mean value of unemployment rate is 1.921 and the maximum and minimum values are 3.35 and 0.660, respectively and the standard deviation is 0.727. Looking at the skewness, we found that unemployment rate is positively skewed implying that it mostly falls to the right of the mean value. The mean of gross national income per capita, current health expenditure per capita HIV, and population growth rate are 8.253, 5.189, 1.342, and 0.949, respectively. Their maximum values are 10.266, 6.984, 3.182, and 1.538, respectively. Also, their minimum values are 6.292, 3.103, -0.357, and 0.114 respectively. Looking at skewness, we observe that most of the values of gross national income per capita and HIV fall to the right of the distribution since they are positively skewed.

Table 1
Summary Statistics

	LogMort	LogMorf	LogMorm	LogUn	LogGNI	LogCHE	LogHIV	Logpopg
Mean	6.442631	5.631404	5.852045	1.9208	8.2532	5.18856	1.3418	0.949471
Median	6.468354	5.630369	5.866673	1.9149	8.0597	5.03385	1.2806	0.995039

Table 1 to be continued

Maximum	6.952401	6.152835	6.355429	3.3495	10.266	6.98438	3.1822	1.537923
Minimum	6.026371	5.096434	5.482367	0.6601	6.2916	3.10342	-0.35668	0.113919
Std. dev.	0.208163	0.225664	0.209112	0.7267	1.0863	1.12044	1.036	0.313953
Skewness	0.095927	-0.129693	0.196932	0.2708	0.1359	-0.03520	0.4052	-0.661870
Kurtosis	2.467436	2.523765	2.288322	2.1557	2.0469	2.05647	2.066	3.391993
Jarque-Bera	1.602164	1.470404	3.308075	5.031	4.9114	4.10299	7.6454	9.529733
Probability	0.448843	0.479409	0.191276	0.0808	0.0858	0.12854	0.0219	0.008524
Sum	773.1158	675.7685	702.2454	230.4	990.39	570.742	161.02	113.9365
Sum Sq. dev.	5.156487	6.059994	5.203596	62.834	140.42	136.837	127.72	11.72940
Observations	120	120	120	120	120	110	120	120

Note. Source: Computed by author using EViews 8.

Unit Root Test

Table 2

The Levin-Lin-Chu Unit Root Test

Variables	Statistics		*p*-value	ADF regression: lags
	Unadjusted *t*	Adjusted t^*		
Mort	-6.4858***	-4.7276	0.0000	I (0)
Morf	-3.5781**	-1.7865	0.0370	I (0)
Morm	-6.5029***	-4.3408	0.0000	I (0)
Un	-5.9068**	-2.3900	0.0084	I (0)
GNI	-7.5916***	-4.6712	0.0000	I (1)
CHE	-6.3183***	-2.7160	0.0033	I (0)
HIV	-4.0065**	-1.7060	0.0440	I (0)
Popg	-5.1759**	-3.5922	0.0002	I (1)

Notes. *** = significant at 1%, ** = significant at 5%, and * = significant at 10%. Source: Computed by the author using STATA 12. Critical values: 1.645 at 10%, 1.96 at 5%, and 2.576 at 1% level of significance.

The Levin-Lin-Chu unit-root test results show that all panels are stable at 5% level of significance at lag (0) except the gross national income per capita (GNI) and population growth rate (popg) that are stationary at first lag. Thus, we can apply the GMM model for the analysis of our data.

Co-integration Test

The results of the Pedroni's co-integration test for mortality rate, adult female show that there exist three long-run equilibrium relationships between our variables. Out of the seven statistics of the above test, four are statistically significant (rejection of the null hypothesis of absence of co-integration): two of the within effect and two of the between effects dimensions.

The results of the Pedroni's co-integration test for mortality rate, adult male show that there exist three long-run equilibrium relationships between our variables. Out of the seven statistics of the above test, four are statistically significant (rejection of the null hypothesis of absence of co-integration): two of the within effect and two of the between effects dimensions.

The results of the Pedroni's co-integration test for mortality rate, total show that there exist three long-run equilibrium relationships between our variables. Out of the seven statistics of the above test, four are statistically significant (rejection of the null hypothesis of absence of co-integration): two of the within effect and two of the between effects dimensions.

Table 3

Co-integration Test for Mortality Rate, Adult Female

Alternative hypothesis: Common AR coefficients (within-dimension)				
	Statistic	Probability	Weighted	
			Statistic	Probability
Panel v-Statistic	-0.459080	0.6769	-1.889579	0.9706
Panel rho-Statistic	3.424673	0.9997	3.510360	0.9998
Panel PP-Statistic	-8.556059***	0.0000	-4.400648***	0.0000
Panel ADF-Statistic	-2.735142***	0.0031	-1.747010**	0.0403
Alternative hypothesis: Common AR coefficients (between-dimension)				
	Statistic		Probability	
Group rho-Statistic	4.720779		1.0000	
Group PP-Statistic	-9.351880***		0.0000	
Group ADF-Statistic	-3.151724***		0.0008	

Notes. *** = significant at 1%, ** = significant at 5%, and * = significant at 10%. Source: Computed by the author using EVIEWS 8.

Table 4

Co-integration Test for Mortality Rate, Adult Male

Alternative hypothesis: Common AR coefficients (within-dimension)				
	Statistic	Probability	Weighted	
			Statistic	Probability
Panel v-Statistic	-0.313227	0.6229	-1.594998	0.9446
Panel rho-Statistic	3.418185	0.9997	2.936382	0.9983
Panel PP-Statistic	-7.527114***	0.0000	-5.697537***	0.0000
Panel ADF-Statistic	-2.625294***	0.0043	-3.350584***	0.0004
Alternative hypothesis: Common AR coefficients. (between-dimension)				
	Statistic		Probability	
Group rho-Statistic	4.304707		1.0000	
Group PP-Statistic	-9.820348***		0.0000	
Group ADF-Statistic	-4.280413***		0.0000	

Notes. *** = significant at 1%, ** = significant at 5%, and * = significant at 10%. Source: Computed by the author using EVIEWS 8.

Table 5

Co-integration Test for Total Mortality Rate

Alternative hypothesis: Common AR coefficients (within-dimension)				
	Statistic	Probability	Weighted	
			Statistic	Probability
Panel v-Statistic	-0.493105	0.6890	-1.515020	0.9351
Panel rho-Statistic	3.437282	0.9997	3.024131	0.9988
Panel PP-Statistic	-7.918482***	0.0000	-6.796309***	0.0000
Panel ADF-Statistic	-2.623698***	0.0043	-3.463372***	0.0003
Alternative hypothesis: Common AR coefficients (between-dimension)				
	Statistic		Probability	
Group rho-Statistic	4.375560		1.0000	
Group PP-Statistic	-10.64695***		0.0000	
Group ADF-Statistic	-4.623283***		0.0000	

Notes. *** = significant at 1%, ** = significant at 5%, and * = significant at 10%. Source: Computed by the author using EVIEWS 8.

Regression Results

Sub Saharan Africa.

Table 6

Results of Mortality Rate, Adult Female

Variables		Coefficient	Standard deviation	*t*	*p*-value
Dependent variable					
Mortality rate, female					
(LogMorf)	L1	1.699***	0.0364493	46.60	0.000
	L2	-0.702***	0.0375303	-18.69	0.000
Endogenous variable					
Unemployment rate		-0.050	0.050986	-0.98	0.349
(LogUn)	L1	0.148*	0.08199	1.80	0.102
	L2	-0.102**	0.044874	-2.28	0.046
Exogenous variables					
Gross national income/capita (LogGNI)		-0.011*	0.0066016	-1.72	0.116
Current health expenditure per capita (LogCHE)		0.017**	0.0072811	2.33	0.042
HIV prevalence (LogHIV)		-0.004	0.0026265	-1.60	0.142
Population growth rate (Logpopg)		0.029***	0.0074098	3.85	0.003
Test for serial autocorrelation					
AR (1)		*z* = -1.74		*p*-value = 0.083	
AR (2)		*z* = -0.93		*p*-value = 0.355	
Test for over identification of all instrument					
Sargan test		Chi2(2) = 1.42		*p*-value = 0.492	
Hansen test		Chi2(2) = 0.20		*p*-value = 0.903	
Test for linear hypothesis					
Wald test		F(5, 10) = 26.21		*p*-value = 0.0000	

Notes. *** = significant at 1%, ** = significant at 5%, and * = significant at 10%. Source: Computed by the author using STATA 12. Critical values: 1.645 at 10%, 1.96 at 5%, and 2.576 at 1% level of significance.

The result in Table 6 shows that there is autocorrelation of the first order of the Arellano-Bond test at 0.1 level of significance. However, there is absence of autocorrelation of the second order of the Arellano-Bond test given a high *p*-value of 0.355. The *p*-value associated to both the Sargan test and Hansen test are high and stand at 0.492 and 0.903, respectively, indicating that the instruments are valid. Also, the Wald statistics *F*-test is high and stands at 26.21. These show that the model estimated is globally significant and consequently the results are good for interpretation.

The result in Table 7 shows that there is autocorrelation of the first order of the Arellano-Bond test at a 0.05 significantly level. However, the test shows an absence of autocorrelation of the second order given a high *p*-value of 0.333. The *p*-value associated to both the Sargan test and Hansen test are high are 0.531 and 0.292, respectively, indicating that the instruments used are valid. Also, the Wald statistics *F*-test is high and stands at 9.48. These show that the model estimated is globally significant and consequently the results are good for interpretation.

The result contained in Table 8 shows that there is autocorrelation of the first order of the Arellano-Bond test at a 10% level. However, the test shows an absence of autocorrelation of the second order given a high *p*-value of 0.301. The *p*-value associated to both the Sargan test and Hansen test are high with *p*-value of 0.518 and 0.626 respectively indicating that the instruments are valid. Also, the Wald statistics *F*-test is as high as 10.59. These show that the model estimated is globally significant and consequently the results are good for interpretation.

Table 7

Results of Mortality Rate, Adult Male

Variables		Coefficient	Standard deviation	*t*	*p*-value
Dependent variable					
Mortality rate, male					
(LogMorm)	L1	1.788***	0.099	18.11	0.000
	L2	-0.785***	0.098	-7.98	0.000
Endogenous variable					
Unemployment rate		-0.064	0.039	-1.65	0.130
(LogUn)	L1	0.134*	0.068	1.96	0.079
	L2	-0.073*	0.036	-2.06	0.067
Exogenous variables					
Gross national income/capita (LogGNI)		-0.020**	0.008	-2.42	0.036
Current health expenditure per capita (LogCHE)		0.023**	0.01	2.32	0.043
HIV prevalence (LogHIV)		0.0003	0.001	0.31	0.761
Population growth rate (Logpopg)		0.0335***	0.011	3.17	0.010
Test for serial autocorrelation					
AR (1)		*z* = -2.09		*p*-value = 0.036	
AR (2)		*z* = -0.97		*p*-value = 0.333	
Test for over identification of all instrument					
Sargan test		Chi2 (2) = 1.26		*p*-value = 0.531	
Hansen test		Chi2 (2) = 2.46		*p*-value = 0.292	
Test for linear hypothesis					
Wald test		F(5, 10) = 9.48		*p*-value = 0.0015	

Notes. *** = significant at 1%, ** = significant at 5%, and * = significant at 10%. Source: Computed by the author using STATA 12. Critical values: 1.645 at 10%, 1.96 at 5%, and 2.576 at 1% level of significance.

Table 8

Results of Total Mortality Rate

Variables		Coefficient	Standard deviation	*t*	*p*-value
Dependent variable					
Mortality rate, male					
(LogMort)	L1	1.750***	0.0718462	24.36	0.000
	L2	-0.749***	0.0712826	-10.51	0.000
Endogenous variable					
Unemployment rate		-0.058	0.0355436	-1.64	0.133
(LogUn)	L1	0.138**	0.0536671	2.58	0.027
	L2	-0.085***	0.0256097	-3.31	0.008
Exogenous variables					
Gross national income/capita (LogGNI)		-0.016***	0.0056202	-2.81	0.019
Current health expenditure per capita (LogCHE)		0.019***	0.0063879	2.93	0.015
HIV prevalence (LogHIV)		-0.0009	0.0015089	-0.58	0.578
Population growth rate (Logpopg)		0.031***	0.0071774	4.25	0.002
Test for serial autocorrelation					
AR (1)		*z* = -1.84		*p*-value = 0.066	
AR (2)		*z* = -1.04		*p*-value = 0.301	
Test for over identification of all instrument					
Sargan test		Chi2 (2) = 1.32		*p*-value = 0.518	
Hansen test		Chi2 (2) = 0.94		*p*-value = 0.626	
Test for linear hypothesis					
Wald test		F(5, 10) = 10.59		*p*-value = 0.0010	

Notes. *** = significant at 1%, ** = significant at 5%, and * = significant at 10%. Source: Computed by the author using STATA 12. Critical values: 1.645 at 10%, 1.96 at 5%, and 2.576 at 1% level of significance.

Middle income countries of SSA. The result contained in Table 9 shows that there is autocorrelation of the first and second order of the Arellano-Bond test at 0.1 and 0.05 significance level, respectively. The *p*-value associated to the Sargan test is small indicating over identification of instrument. However, the Hansen test is high (0.775) indicating that the instruments are valid. Also, the Wald statistics *F*-test is very high (637.17). These show that the model estimated is globally significant and consequently the results are good for interpretation.

Table 9

Results of Total Mortality Rate

Variables	Coefficient	Standard deviation	*t*	*p*-value
Endogenous variable				
Unemployment rate (LogUn)	1.166*	0.651738	1.79	0.117
Exogenous variables				
Gross national income/capita (LogGNI)	1.285**	0.5287751	2.43	0.045
Current health expenditure per capita (LogCHE)	-0.79	0.6239214	-1.27	0.246
HIV prevalence (LogHIV)	-1.088*	0.6175029	-1.76	0.121
Population growth rate (Logpopg)	-0.82	1.244061	-0.66	0.531
Test for serial autocorrelation				
AR (1)	z = 1.93		*p*-value = 0.053	
AR (2)	z = 2.04		*p*-value = 0.042	
Test for over identification of all instrument				
Sargan test	Chi2 (5) = 387.10		*p*-value = 0.000	
Hansen test	Chi2 (5) = 2.51		*p*-value = 0.775	
Test for linear hypothesis				
Wald test	F(5, 7) = 637.17		*p*-value = 0.0000	

Notes. *** = significant at 1%, ** = significant at 5%, and * = significant at 10%. Source: Computed by the author using STATA 12. Critical values: 1.645 at 10%, 1.96 at 5%, and 2.576 at 1% level of significance.

Low income countries of SSA. The result contained in Table 10 shows that there is absence of autocorrelation of the first and second order of the Arellano-Bond test since both *p*-values are high (0.965 and 0.190, respectively). The *p*-value associated to the Sargan test is small indicating over identification of instrument. However, the Hansen test is high (1.000) indicating that the instruments are valid. Also, the Wald statistics *F*-test is very high (68.13). These show that the model estimated is globally significant and consequently the results are good for interpretation.

Table 10

Results of Total Mortality Rate

Variables	Coefficient	Standard deviation	*t*	*p*-value
Endogenous variable				
Unemployment rate (LogUn)	-0.166***	0.011624	-14.30	0.001
Exogenous variables				
Gross national income/capita (LogGNI)	1.002***	0.0714084	14.03	0.001
Current health expenditure per capita (LogCHE)	-0.847***	0.1080691	-7.84	0.004
HIV prevalence (LogHIV)	0.642**	0.2822785	2.28	0.107
Population growth rate (Logpopg)	2.416***	0.2075409	11.64	0.001

Table 10 to be continued

Test for serial autocorrelation		
AR (1)	z = -0.04	p-value = 0.965
AR (2)	z = -1.31	p-value = 0.190
Test for over identification of all instrument		
Sargan test	Chi2 (5) = 41.94	p-value = 0.000
Hansen test	Chi2 (5) = 0.00	p-value = 1.000
Test for linear hypothesis		
Wald test	F(2, 3) = 68.13	p-value = 0.0032

Notes. *** = significant at 1%, ** = significant at 5%, and * = significant at 10%. Source: Computed by the author using STATA 12. Critical values: 1.645 at 10%, 1.96 at 5%, and 2.576 at 1% level of significance.

Discussion of Results

Mortality rate, adult female.

$$LogMorf_{it} = 1.699LogMorf_{it-1} - 0.702LogMorf_{it-2} - 0.050LogUn_{it} + 0.148LogUn_{it-1} - 0.102LogUn_{it-2} - 0.011LogGNIPC_{it} + 0.017LogCHE_{it} - 0.004LogHIV_{it} + 0.029Logpopg_{it} \quad (1)$$

In Table 6, results show that unemployment rate is statistically significant in lags (1) and (2) at the 0.1 and 0.05 levels. Its p-values are small enough to reject the null hypothesis. But it is the elasticity of unemployment rate at lag 2 that has a good sign. Therefore, a 1% increase in unemployment rate at lag 1 will lead to a 0.148% rise in female mortality rate in SSA. The GNI per capita is statistically significant at the 0.1 level and therefore we reject the null hypothesis and its elasticity as well has a good sign. It is showing that a 1% increase in GNI per capita will lead to a 0.011% fall in female mortality rate. Also, the CHE per capita is statistically significant at the 0.5 level and, therefore, we reject the null hypothesis but its elasticity does not have a good sign. It is showing that a 1% increase in CHE per capita will lead to a 0.017% rise in female mortality rate. This may be explained by the fact that the main beneficiaries of the increase in CHE per capita for the studied period are the male folk and children.

Also, the HIV prevalence is statistically significant at the 0.1 level and therefore we reject the null hypothesis but its elasticity does not have a good sign. It is showing that a 1% increase in HIV prevalence will lead to a 0.004% fall in female mortality rate. This may be explained by the fact that HIV prevalence has been contained in women as compared to their male counterpart. Moreover, the population growth rate is statistically significant at the 0.01 level and, therefore, we reject the null hypothesis but its elasticity does not have a good sign. It is showing that a 1% increase in the population growth rate will lead to a 0.029% rise in female mortality rate. This may be explained by the fact that as population is growing, the number of women who die also increase since they form a greater proportion of the population growth and total population than their male counterpart.

Mortality rate, adult male.

$$LogMorm_{it} = 1.788LogMorm_{it-1} - 0.785LogMorm_{it-2} - 0.064LogUn_{it} + 0.134LogUn_{it-1} - 0.073LogUn_{it-2} - 0.020LogGNIPC_{it} + 0.023LogCHE_{it} + 0.0003LogHIV_{it} + 0.033Logpopg_{it} \quad (2)$$

In Table 7, results show that unemployment rate is statistically significant in lags (1) and (2) at the 0.1 and 0.05 level respectively. Its p-values are small enough to reject the null hypothesis. But it is the elasticity of unemployment rate at lag 1 that has a good sign. Therefore, a 1% increase in unemployment rate at lag 1 will lead to a 0.134% rise in male mortality rate in SSA. The GNI per capita is statistically significant at the 0.5 level and, therefore, we reject the null hypothesis and its elasticity as well has a good sign. It is showing that a 1% increase in GNI per capita will lead to a 0.020% fall in male mortality rate. The CHE per capita is statistically significant at the 0.5 level and therefore we reject the null hypothesis but its elasticity does not have a good sign. It is showing that a 1% increase in CHE per capita will lead to a 0.023% rise in male mortality rate. This may be explained by the fact that there are few qualified doctors such that the doctor-patient ratio remains low due to the fast growing population.

Conversely, HIV prevalence is insignificant and therefore we reject the null hypothesis but its elasticity has a good sign. It is showing that a 1% increase in HIV prevalence will lead to a 0.004% rise in male mortality rate. The population growth rate is statistically significant at the 0.01 level and, therefore, we reject the null hypothesis but its elasticity does not have a good sign. It is showing that a 1% increase in the population growth rate will lead to a 0.033% rise in male mortality rate. This shows that as the population is fast growing more health challenges are still faced by men.

Total mortality rate.

$$LogMort_{it} = 1.750LogMort_{it-1} - 0.749LogMort_{it-2} - 0.058LogUn_{it} + 0.138LogUn_{it-1} - 0.085LogUn_{it-2} - 0.016LogGNIPC_{it} + 0.019LogCHE_{it} - 0.0009LogHIV_{it} + 0.031Logpopg_{it} \quad (3)$$

In Table 8, results show that unemployment rate is statistically significant at the first and second lags at 0.5 and 0.01 levels, respectively. Its *p*-values are small enough to reject the null hypothesis. But it is the elasticity of unemployment rate at lag 1 that has a good sign. Therefore, a 1% increase in unemployment rate at lag 1 will lead to a 0.138% rise in mortality rate, total in SSA. The GNI per capita is statistically significant at the 0.05 level and, therefore, we reject the null hypothesis and its elasticity as well has a good sign. It is showing that a 1% increase in GNI per capita will lead to a 0.016% fall in mortality rate, total. The CHE per capita is statistically significant at the 0.05 level and therefore we reject the null hypothesis but its elasticity does not have a good sign. It is showing that a 1% increase in CHE per capita will lead to a 0.019% rise in mortality rate, total. This may be explained by the fact that there are few qualified doctors such that the doctor-patient ratio remains low due to the fast growing population.

On the other hand, HIV prevalence is insignificant and therefore we fail to reject the null hypothesis but its elasticity has a good sign. It is showing that a 1% increase in HIV prevalence will lead to a 0.0009% fall in mortality rate, total. The population growth rate is statistically significant at the 0.01 level and therefore we reject the null hypothesis but its elasticity does not have a good sign. It is showing that a 1% increase in the population growth rate will lead to a 0.031% rise in mortality rate, total. This shows that as the population is fast growing more health challenges are still faced by men.

Mortality rate, total in middle income countries.

$$LogMort_{it} = 1.166LogUn_{it} + 1.285LogGNIPC_{it} - 0.79LogCHE_{it} - 1.088LogHIV_{it} - 0.82Logpopg_{it} \quad (4)$$

In Table 9, results show that unemployment rate is statistically significant at 0.1 level. Its *p*-value is small enough to reject the null hypothesis. Its elasticity equally has a good sign. Therefore, a 1% increase in unemployment rate will lead to a 1.166% rise in mortality rate, total in the middle income countries of SSA. The GNI per capita is statistically significant at the 0.05 level and therefore we reject the null hypothesis and its elasticity does not have a good sign. It is showing that a 1% increase in GNI per capita will lead to a 1.285% rise in mortality rate, total. This may be as a result of the fact that rising GNI per capita may not improve the living standards of citizens due to rising costs of living. Also, the CHE per capita is statistically insignificant and, therefore, we fail to reject the null hypothesis but its elasticity has a good sign. It is showing that a 1% increase in CHE per capita will lead to a 0.79% fall in mortality rate, total.

HIV prevalence is statistically significant at 0.1 level and, therefore, we reject the null hypothesis but its elasticity does not have a good sign. It is showing that a 1% increase in HIV prevalence will lead to a 1.088% fall in mortality rate, total. Conversely, the population growth rate is statistically insignificant and therefore we fail to reject the null hypothesis but its elasticity has a good sign. It is showing that a 1% increase in the population growth rate will lead to a 0.82% fall in mortality rate, total. This shows that improvement in medical facilities in the middle income countries of SSA has reduced mortality rates and fostered population growth.

Mortality rate, total in low income countries.

$$LogMort_{it} = -0.166LogUn_{it} + 1.002LogGNIPC_{it} - 0.847LogCHE_{it} + 0.642LogHIV_{it} + 2.416Logpopg_{it} \quad (5)$$

In Table 10, results show that unemployment rate is statistically significant at 0.01 level. Its *p*-value is small enough to reject the null hypothesis. But its elasticity does not have a good sign. Therefore, a 1% increase in unemployment rate will lead to a 0.166% fall in mortality rate, total in the low income countries of SSA. This might be explained by the fact that when an economy is recovering, incomes are rising and people tend to prefer more leisure to work. The GNI per capita is statistically significant at the 0.01 level and, therefore, we reject the null hypothesis and its elasticity does not have a good sign. It is showing that a 1% increase in GNI per capita will lead to a 1.002% rise in mortality rate, total. This may be as a result of the fact that rising GNI per capita may not improve the living standards of citizens due to rising costs of living. The CHE per capita is statistically significant at 0.01 level and, therefore, we reject the null hypothesis and its elasticity has a good sign. It is showing that a 1% increase in CHE per capita will lead to a 0.847% fall in mortality rate, total. HIV prevalence is statistically significant at 0.1 level and, therefore, we reject the null hypothesis and its elasticity has a good sign. It is showing that a 1% increase in HIV prevalence will lead to a 0.642% rise in mortality rate, total. The population growth rate is statistically significant at a 0.01 level and therefore we reject the null hypothesis but its elasticity does not have a good sign. It is showing that a 1% increase in the population growth rate will lead to a 2.416% rise in mortality rate, total. This shows that increase in population in low income countries of SSA has increased the misery hence mortality.

Conclusion and Recommendations

Unemployment and health take the center stage of the policy decisions of governments in developed and developing countries in general and SSA in particular given the important role they play in long-term economic growth and development. This study was carried out to contribute to the ongoing debated whether job loss, or unemployment shortens people's lives in SSA. For this reason, we employed unemployment rate as indicator of job loss and mortality rate as indicator of health. The long-run co-integrating relationship between unemployment and mortality rates is estimated using system GMM regression. In other to get robust and stable results, GNI per capita, current health expenditure per capita, HIV prevalence, and population growth were used as control variables.

The unit root test results show that all panels are stable at 0.05 level of significance at lag (0), except the gross national income per capita (GNI) and population growth rate (popg) that are stationary at first lag. The co-integration results show that there is a long-run relationship between unemployment rates and mortality rates in SSA.

The estimation results showed that increase in unemployment rates lead to increase in mortality rates aggregately among female and male mortality rate as well as both joint together (total mortality rate) in SSA. In middle income countries, it is also statistically significant and positively related to total mortality rates (female and male) in SSA. This is similar to the findings of Adofu and Salami (2018), Hoynes, Douglas, Miller, and Schaller (2012), Brenne (2005) who also found, in their respective findings that unemployment rates are positively associated with mortality rates. The results also showed that GNI per capita is significant and negatively related to mortality rates across all categories except for middle income countries where it has a positive relationship. This mean GNI per capita is an important determinant of mortality rate. Policy-makers here therefore should draw policies that would reduce the skyrocketing unemployment rates. This could be done by creating a business friendly environment to encourage investment, thus a rise in employment and GNI per capita.To maintain a low level of unemployment rate, actions to undertake have to be based on the better functioning of the labour market, a better flexibility of markets, a health insurance cover and limiting incitements which depress economic activities.

Current health expenditure and population growth rates are positively related to female and male mortality rate as well as both joint together (total mortality rate) in SSA. Again, an increase in HIV prevalence leads to a fall in female mortality rate but a rise in male mortality rate. This may be because the health expenditure is mostly public expenditure and because of low incomes individuals are unable to afford for better healthcare. Policy-makers should intensify policies that aim at encouraging income yielding activities that could enable individuals raise incomes and pay for better healthcare. Also sensitization should be done on family planning to control the exponential growth in population.

Furthermore, evaluating the relationship between unemployment rates and mortality rates in low income countries, the result rather showed that an increase in unemployment rates leads to increase in mortality rates aggregately. This result is similar to that of Ionides et al. (2013) and Ruhm (2000) who also found that an increase in the unemployment rate is associated with a decrease in the overall mortality rate. Again, in the low income countries, GNI per capita is found to be negatively associated to mortality. This is because the distribution of wealth within each country can also affects mortality rates, not simply the overall wealth of countries.

Area for Further Studies

Given that no research work is perfect we wish the area of study would be enlarged by including all the countries of SSA in the study samples. Also, incomes levels and educational level can be included in the model to verify if they affect mortality positively or negatively for both female and male.

References

Adofu, I., & Salami, A. (2018). Unemployment and mortality rates in Nigeria: A co-integration approach. *Lafia Journal of Economics and Management Sciences, 3*(2). Retrieved from http://www.lajems.com/index.php/lajems/article/view/82

Brenner, M. H. (1973). *Mental illness and the economy.* Cambridge, MA: Harvard University Press.

Brenner, M. H. (1976). Estimating the social costs of national economic policy: Implications for mental and physical health and criminal aggression. *Politics & Society, 6*(4), 516-517.

Brenner, M. H. (1984). Estimating the effects of economic change on national health and social well being. Retrieved from https://www.jec.senate.gov/reports/98th%20Congress/Economic%20Change,%20Physical%20Illness,%20and%20Social%20Deviance%20(1261).pdf

Brenner, M. H. (2005). Commentary: Economic growth is the basis of mortality rate decline in the 20th century experience of the United States 1901-2000. *International Journal of Epidemiology, 34*(6), 1214-1221.

Choi, I. (1999). *Unit root tests for panel data.* Korea: Manuscript of Kookmin University.

Crost, B., & Friedson, A. (2015). Recessions and health revisited: New findings for working age adults. Retrieved from https://www.frbatlanta.org/~/media/Documents/research/seminars/2015/friedson-020515.pdf

Granados, J. A. (2005). Increasing mortality during the expansions of the US economy, 1990-1996. *International Journal of Epidemiology, 34*(6), 1194-1202.

Granados, T. J. A. (2008). Macroeconomic fluctuations and mortality in postwar Japan. *Demography, 45*(2), 323-343.

Gravelle, H. S. E., Hutchinson, G., & Stern, J. (1981). Mortality and unemployment: A critique of Brenner's time series analysis. *Lancet, 2*(8248), 675-679.

Griffin, J. (1993). Briefing the impact of unemployment on health. *Office of Health Economics*. Retrieved from https://www.ohe.org/publications/impact-unemployment-health

Hanisch, K. A. (1999). Job loss and unemployment research from 1994 to 1998: A review and recommendations for research and intervention. *Journal of Vocational Behaviour, 55*(2), 188-220.

Hoynes, H., Douglas, W., Miller, L., & Schaller, J. (2012). Who suffers during recession? *NBER Working Paper17951*. Retrieved from https://www.nber.org/system/files/working_papers/w17951/w17951.pdf

Im, K. S., Pesaran, M. H., & Shin, Y. (1997). Testing for unit roots in heterogeneous panels (Unpublished manuscript, University of Cambridge, 1997).

Ionides, E. L., Wang, Z., & Granados, J. A. (2013). Macroeconomic effects on mortality revealed by panel analysis with nonlinear trends. *Ann. Appl. Stat., 7*(3), 1362-1385.

Jacob, J. (2011). Top five reasons for high unemployment in the US. Retrieved from http://www.ibtimes.com/articles/110575/20110209/US-JOBS-unemployment-top-five-reasons.htm

Jahoda, M. (1981). Work, employment, and unemployment: Values, theories, and approaches in social research. *American Psychologist, 36*(2), 184-191.

Jahoda, M. (1982). *Employment and unemployment: A social-psychological analysis, the psychology of social issues*. Cambridge: Cambridge University Press.

Kossoris, M. D. (1939). Industrial injuries and the business cycle. *Monthly Labor Rev., 46*(3), 575-579.

Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit root tests in panel data: Asymptotic and finite sample properties. *Journal of Econometrics, 108*(1), 1-22.

Li, H. B., Feng, H. J., Wang, J., Qian, Z. J., & Gu, J. M. (2017). Relationship among gross domestic product per capita, government health expenditure per capita and infant mortality rate in China. *Biomedical Research, 28*(6), 2859-2864.

Marmot, M. G., & Theorell, T. (1988). Social class and cardiovascular disease: The contribution of work. *International Journal Health Science, 18*(4), 659-674.

Marmot, M. G., Kogevinas, M. A., & Elston, M. (1987). Social/Economic status and disease. *Ann. Rev. Public Health, 8*, 111-135.

Miller, D. L., Page, M. E., Stevens, A. H., & Filipski, M. (2009). Why are recessions good for your health? *American Economic Review, 99*(2), 122-127.

Morin, S. (2009). Business cycles and health: How the level of development of a country affects the relationship between the strength of its economy and the health of its population. Retrieved from https://www.semanticscholar.org/paper/BUSINESS-CYCLES-AND-HEALTH-HOW-THE-LEVEL-OF-OF-A-OF-Morin/db2caf7817895bd11ba34f3375f733c0f57e2e1e

Neumayer, E. (2004). Recessions lower (some) mortality rates: evidence from Germany. *Social Science & Medicine, 58*(6), 1037-1047.

Preston, S. H. (2007). The changing relation between mortality and level of economic development. *International Journal of Epidemiology, 36*(3), 484-490.

Pritchett, L., & Summers, L. H. (1996). Wealthier is healthier. *Journal of Human Resources, 31*(4), 841-868.

Ruhm, C. J. (2000). Are recessions good for your health? *Quarterly Journal of Economics, 115*(2), 617-650.

Sullivan, D., & Wachter, T. (2009). Job displacement and mortality: an analysis using administrative data. *Quarterly Journal of Economics, 124*(3), 1265-1306.

Tejvan, P. (2017). Reasons for youth unemployment. Retrieved from http//www.economicshelp.org/blog/517/economics/reasons-fot-youth-unemployment/

Wanberg, C. R. (2012). The individual experience of unemployment. *Annual Review of Psychology, 63*, 369-396.

Warr, P. B. (1987). *Work, unemployment and mental health*. Oxford: Oxford Science Publications.

Warr, P. B., & Parry, G. (1982). Paid employment and women's psychological wellbeing. *Psychological Bulletin, 91*(3), 498-516.

World Health Organization (WHO). (2019). The African regional health report: The health of the people. Retrieved from https://www.who.int/bulletin/africanhealth/en/