

# Human Ageing, Mortality and the Role of Macroeconomics Variables in Determining Death at Older Ages

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**Keywords:** Ageing; Fatality; Macroeconomic variables; Public health; Transience; Jamaica

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**Received** November 10, 2013; **Accepted** January 23, 2014; **Published** January 25, 2014

**Citation:** Bourne PA, Solan I, Sharpe-Pryce C, Campbell-Smith J, Francis C (2014) Human Ageing, Mortality and the Role of Macroeconomics Variables in Determining Death at Older Ages. *Epidemiol* 4: 144. doi:[10.4172/2161-1165.1000144](https://doi.org/10.4172/2161-1165.1000144)

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plethora of people in developed societies a er the discoveries of the

$$\ln M_{60+} = \beta_0 + \beta_1 I + \beta_2 U + \beta_3 \text{GDP} + \beta_4 E \quad (3)$$

where  $M_{60+}$  represents mortality at older ages (60+);  $I$  being in ation;  $U$  stands for unemployment;  $\text{GDP}$  signifies gross domestic product per capita;  $E$  symbolizes annual exchange rate and  $\beta$  symbolizes ln

$$\text{Mortality}_{75+} = E \quad (4)$$

$$\ln M_{75+} = \beta_0 + \beta_4 E \quad (5)$$

Where  $M_{75+}$  represents mortality at older ages (75+),  $E$  symbolizes annual exchange rate and  $\beta$  symbolizes ln Methods and measures.

## Methods and Data .agement

The current work is a secondary data analysis. Data were collected from Jamaica Government Publications, namely Jamaica Survey of Living Conditions (JSLC) [25,26], Economic and Social Survey of Jamaica (ESSJ) [27], Bank of Jamaica [28], Demographic statistics [29] and International Monetary Fund [30]. Jamaica Survey of Living Conditions (JSLC) (Planning Institute of Jamaica and Statistical Institute of Jamaica, 1989-2010) provided data on health care utilization (or health care seeking behaviour), illness rate and poverty; Economic and Social Survey of Jamaica on poverty (Planning Institute of Jamaica, 1989-2009); Statistical Digest on in ation and annual exchange rate (Bank of Jamaica, 1981-2010) and the Demographic Statistics on mortality, crude death rate (Statistical Institute of Jamaica, 1988-2010) and gross domestic product for the publication of the International Monetary Fund. The period for this work is from 1989 to 2009.

The JSLC is jointly conducted by the Planning Institute of Jamaica (PIOJ) and the Statistical Institute of Jamaica (STATIN). The JSLC is a nationally representative cross-sectional descriptive survey which uses stratified random sampling and comprised data on households' characteristics, health, education, expenditure, social programmes, and other information. An administered questionnaire modelled from the World Bank's Living Standards Measurement Study (LSMS) household survey [31] is used to collect the data. There are some modifications to the LSMS, as JSLC is more focused on policy impacts.

The JSLC used a two-stage stratified random sampling design where there was a Primary Sampling Unit (PSU) and a selection of dwellings from the primary units. The PSU is an Enumeration District (ED) which constituted of a minimum of 100 dwellings in rural areas and 150 in urban areas. An ED is an independent geographic unit that shares a common boundary. This means that the country was grouped into strata of Equal size based on Dwellings (EDs). Based on the JSLC, the PSUs is a listing of all the dwellings and this was used as the sampling frame from which a Master Sample of dwelling was compiled. According to the JSLC, the sample was weighted to reflect the population of the nation. The households in the JSLC were interviewed during three to four years, after which a new representative sample was drawn. In this study, we used aggregate to the parish level, which means that analysis can be made across periods (or over time).

The Economic and Social Survey of Jamaica (ESSJ) is a publication of the PIOJ which collates information on social and economic indicators of Jamaica. We collected data mainly on unemployment rate in Jamaica from 1989 to 2009 (Planning Institute of Jamaica, 1988-2010).

The annual exchange rate of the Jamaican to the United States' dollar were collected from the Bank of Jamaica's (BoJ) publication (Bank of Jamaica, 1980-2009) and the Gross Domestic Product (GDP) information was had from the International Monetary Fund's World Economic Outlook (International Monetary Fund, 2009). Data on murder were obtained from Statistical Unit.

Some abbreviations will be used throughout this work. They are CDR- crude death rate; HI-health insurance coverage, HSB-health seeking behaviour (or health care utilization) and GDP (gross domestic product) per capita growth, GDP.

## Statistical Analyses

Data were entered and stored into Microsoft Excel and SPSS for Windows version 21.0 (SPSS Inc; Chicago, IL, USA) which were both used to analyze the data. Pearson's product Moment Correlation was used to assess the bivariate correlation between particular macroeconomic and other variables. Scatter diagrams and best fit models were used on the data. Ordinary Least Square (OLS) regression analyses were used to establish the model for 1) log mortality and 2) log murder. Ordinary least square regressions were utilized to analyze the

Mortality of elderly 75+ (or Elderly 75+ mortality) is the total number of annual deaths of those 75+ years old divided by total annual deaths for the population.

## Findings

Table 1 presents mortality data for people 60+ years old, by gender and total elderly mortality rates from 2000 to 2009. Over the last decade of 2000s, elderly death rates lie between 45 and 65 percentage points. In 2009 (latest data available), 59 percentage points of all mortality were accounted for people aged 60+ years old. However, between 2001 and 2009, aged people constituted more than 60 percentage points of total deaths in Jamaica. Between 3 out of every 5 and 4 out of every 5 deaths occurred among elderly were of those aged 75+ years old. Although annually more men than women die in Jamaica, at older ages (60+ years) mortality is a female phenomenon. The rate of mortality of Jamaicans 60+ years old has been relatively stable between 2001 and 2010. Furthermore, between 36 and 47 percentage points of all deaths occurring annual are people 75+ years-mortality of elderly people 75+ years in relations to total annual deaths.

Figure 1 displays the annual percentage point change in mortality at older ages disaggregating by 60+ years, 60-74 years and 75+ years. The greatest percentage point movement in mortality at older ages occurred in 2002 over 2001, with there being moderate changes between 2002 and 2009.

Figure 2 presents a diagrammatic display of intercorrelation among the macroeconomic variables, and the relationship between particular macroeconomic variables and mortality of elderly 60+ years old. Poverty does not directly influence mortality; but it interfaces with unemployment, exchange rate and these factors are associated with mortality.

Of the four (4) variables that were used to examine influence on mortality of elderly people, three emerged as statistical significant factors- 1) Unemployment ( $P=0.021$ ; 95%CI: 0.067-0.724); 2) In exchange rate ( $P<0.0001$ ; 95%CI: 0.123-0.308), 3) GDP per capita ( $P=0.028$ ; 95%CI: 0.003-0.050). These factors account for 53.1 percentage

points of the variability in mortality of aged people (Table 2). The highlighted variables indicate those that are factors of mortality. Unemployment is positively correlated with elderly mortality, which is also the case for the annual exchange rate and GDP per capita.

Results from the forward stepwise regression model revealed the contribution of each factor to the overall model (elderly mortality=f (exchange rate, unemployment, GDP per capita, ). The exchange rate contributed the most to mortality changes ( $R^2=29$  percentage points) compared to unemployment ( $R^2=17.6$  percentage points) and GDP per capita ( $R^2=13.7$  percentage points).

The moderate statistical correlation between poverty and elderly mortality ( $r_{xy}=-0.542$ ,  $P=0.006$ ) is a spurious one as it disappears with the introduction of exchange rate. A strong (R) correlation between poverty and elderly mortality is also observed.

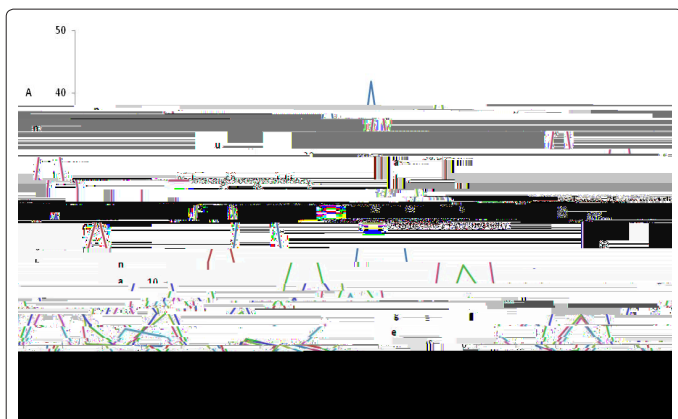


Figure 1: Annual percentage point change in mortality of elderly 60+ year, 1990-2008.

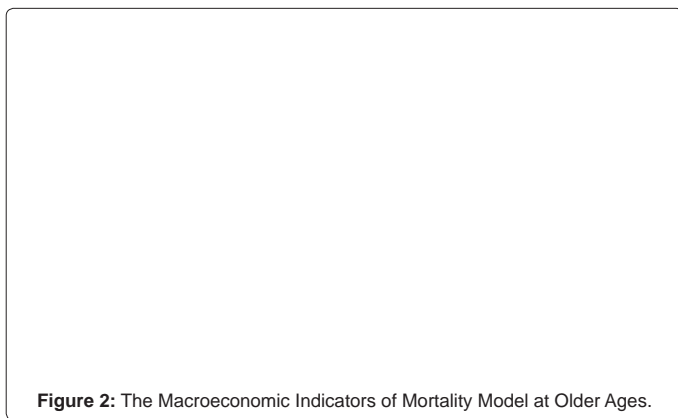


Figure 2: The Macroeconomic Indicators of Mortality Model at Older Ages.

from a low level at young-old to high intensity at oldest-old [21]. These matters suggest that mortality rises with ageing as well as economics. It is well established empirically that there is a direct correlation between gross domestic product and self-reported illness rate [44]; but the irony is the aged receive increasingly less income owing to retirement and this becomes greater in later years of the aged, which highlights the challenges of ageing on the population, social institutions and on family. Another challenge which must be brought into the health discourse is the macroeconomic environment on mortality for the aged, as evidence shows the rise in the elderly population come 2015 and beyond [45].

Overall mortality is a male phenomenon in Jamaica, with the reverse being true at older ages. Jamaicans experience it typical as according to Draper and coauthors, "In 1998-2000, life expectancy at birth for Australian males and females was 76.6 and 82.0 years respectively. Between 1990 and 2000, life expectancy increased by about 2.7 years for males at birth, and by 1.9 years for females. During the same period, the sex difference in life expectancy narrowed: in 1990 a new-born girl could expect to live 6.2 years longer than a new-born boy, and by 2000 this difference had reduced to 5.4 years" [46]. Unlike Draper et al.'s work, this study was primarily concerned with elderly mortality and what are some of the factors which influence this phenomenon. Although Sommers' used 65+ years to examine elderly compared to 60+ years for this study, both works can be compared and contrasted to provide an understanding of mortality at older ages. Sommers found that "Individuals age 65 and older have experienced remarkable declines in mortality during the past 20 years. In 1980, 14.2% of newborns could expect to live to age 90; by 2003, this percentage increased nearly 50% to

20.9. Average life expectancy went from 73.7 years in 1980 to 77.8 years in 2004 - about 30.5 years longer than the anticipated life expectancy for a baby born at the beginning of the 20th century" [47], which was not the case for this work. The mortality rates for elderly (60+ or 75+ years) in Jamaica for the last 15 years have been relatively stable, with between 60 to 80 percentage points of deaths being among the older elderly (75+ years old). Enveloped in this finding is the vulnerability and frailty of elderly 75+ years in Jamaica, which is equally the same in other geo-political areas [48]. Not only did Andrew and co-authors establish increased frailty and mortality at older ages [48], they argued about the social vulnerability.

The current work identified that positive correlation between 1) poverty and unemployment and 2) poverty and inflation. With increased job separation likely at older ages, this results in a lowering of income and a rise in the likelihood of poverty at older ages in periods of higher inflation, recession and increased health care cost owing to greater demand of health care services. Although inflation is not directly correlated with elderly mortality and there exists a spurious relationship between poverty and mortality at older ages, there are clear indications that particular macroeconomic conditions are interrelating with mortality at older ages in Jamaica. Using data from some countries in Central America and South-East Asia, Zheng et al. [25] negative correlations between mortality at older ages and 1) employment, 2) population structure, 3) technology (including GDP per capita) and 4) water pollution. While in Central America and some South-East Asian nations GDP is good for lowering mortality, increased GDP per capita in Jamaica is associated with a rise in mortality at older ages. Job separation which is captured in unemployment is a bad for the health of those 60+ years old as unemployment is directly associated with mortality, suggesting that social isolation, job separation, lowered income and psychological issues related to unemployment are affecting the quality of life of elderly people. Because at older ages, particularly 75+ years, are associated with job separation (unemployment), increased frailty, greater risk of health conditions and higher health care utilization, ageing has a greater probability of increased social and societal care for the elderly.

The positive correlation which exists between the annual exchange rate and mortality at older ages has some justifications. An increase in the value of the United States Dollar (USD) - a deterioration of the Jamaican dollar - translates into higher cost of living, medication and economic challenge for those 60+ years, particularly among those 1) unemployment, 2) physically incapable of movement, 3) high demand for health care service and medication and 4) 75+ years old. With the greater likelihood of health conditions at older ages, especially at 75+ years [21], high cost of living will increase the vulnerability of the aged, and result in mortality (pre-mature death). In the same token, the elderly demand greater social amenities and services and therefore with increased unemployment, people are less likely to aid the aged and this accounts for a rise in mortality as the higher cost of living coupled with the unemployment will deplete the resource base of the elderly as well as the society's ability to respond to their demands. The exchange rate which affects the cost of living in Jamaica, especially medication and health care resources translate into economic bad for elderly people.

This finding is applicable to all developing nations and provides a rationale for an argument of social intervention and programmes for the elderly in periods of high cost of living.

It is a paradox which arises in the current work as 1) high cost of living is associated with increased mortality at older ages, yet 2) GDP per capita is positively correlated with mortality. In Zheng and co-

authors' work, GDP per capita was inversely related with mortality at older ages which would indicate that increased income will rise in less mortality and vice versa. Unlike what obtains in Central America and South-East Asian nations [25], increased income is an economic bad for health and result in a rise in mortality among the elderly. Health is a complex phenomenon in Jamaica, especially for the elderly, as the exchange rate is inversely related to unemployment; unemployment is positively associated with mortality among people 60+ years; the exchange rate is negatively correlated with GDP per capita; GDP per capita is directly influencing mortality, and exchange rate positively relate to mortality at older ages. There is a clear difficulty for policy makers to wholly change one macroeconomic variable in wanting to lower mortality among the elderly.

A critical finding which emerged in this paper is at older ages (75+ years), of the macroeconomic variables used only the exchange rate influenced mortality. The economics of death, therefore, changes with ageing. The mortality of people 75+ years is not affected by GDP per capita, job separation (or unemployment), and inflation.

The health phenomenon of aged people cannot be examined across the cohort (60+ years) to provide a comprehensive understanding of these people health status as the macroeconomic climate in the society affects those 75+ years somewhat differently from those 60+ years. As unemployment (job separation) is not a factor in influencing the health status of elderly 75+ years compared to those at younger ages (60-74 years old). On the other hand, the extent with which the exchange rate affects those at older (60-74 years) and older ages (75+) is different; and the deterioration in the Jamaican dollar compared to the USD is more intense on the health status (mortality) of those at older compared to those 60-74 years old. The rationale for this is simple cost of health care, survivability and insufficient money owing to retirement.

Although the government of Jamaica introduced the 'Jamaica

Drug for the Elderly Programme (JADEP)' in 1996 to lower the cost

**Citation:** Bourne PA, Solan I

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