Department of Management Sciences

WORKING PAPER SERIES

Working Paper 2015-006

Determinants of Life Expectancy and its Prospects under the Role of Economic Misery: A Case of Pakistan

Muhammad Shahbaz
Nanthakumar Loganathan
Nooreen Mujahid
Amjad Ali
Ahmed Nawaz

Department of Management Sciences

COMSATS Institute of Information Technology, Lahore, Pakistan

Determinants of Life Expectancy and its Prospects under the Role of Economic Misery: A Case of Pakistan

Muhammad Shahbaz
COMSATS Institute of Information Technology,
Lahore Campus, Pakistan. Email: shahbazmohd@live.com

Nanthakumar Loganathan
Faculty of Economics and Management Sciences,
Universiti Sultan ZainalAbidin
21300 Kuala Terengganu, Terengganu, Malaysia
Email: n4nantha@yahoo.com

Nooreen Mujahid
Department of Economics, University of Karachi,
Pakistan. Email: Nooreenmujahid111@yahoo.com

Amjad Ali
School of Social Sciences
National College of Business Administration & Economics
40/E-1, Gulberg III, Lahore-54660, Pakistan
Email: chanamjadali@yahoo.com

Ahmed Nawaz
COMSATS Institute of Information Technology,
Lahore Campus, Pakistan.
Email: drahmadnawaz@ciitlahore.edu.pk

Abstract: The present study investigates the determinants of life expectancy in the presence of economic misery using Pakistan's time series data over the period of 1972-2012. The stationary properties of the variables are examined by applying unit root test accommodating structural breaks. The ARDL bounds testing approach to cointegration is applied to examine the long run relationship between the variables. Our findings show that cointegration between the variables is confirmed. Moreover, health spending improves life expectancy. Food supply contributes to life expectancy. A rise in economic misery deteriorates life expectancy. Urbanization enhances life expectancy while illiteracy declines it. The causality analysis reveals that life expectancy is Granger cause of health spending, food supply, economic misery, urbanization and illiteracy. This paper opens up new insights for policy making authorities to consider the role of economic misery while formulating comprehensive economic policy to improve life expectancy in Pakistan.

Keywords: Life expectancy, Economic misery, Pakistan

I. Introduction

From the last two decades, life expectancy at birth is considered one of the most important indicators of economic development in developed as well as in developing countries (UNDP, 1991). This indicates that how countries particularly developing economies invest in their social sector development like education, environment, sanitation and other social safety nets. A change in income per capita of developed countries has changed the structure of expenditures which results in, reduced poverty level, high adult literacy rate, improved sanitation, easy access to drinking water and better nutrition. All of which has contributed towards increase in life expectancy. But, this is not a case for majority of developing countries in Africa, where life expectancy is still decreasing although they have improved their income level as well as health expenditures.

For example, recent human development report (2013) highlighted that Japan has the highest life expectancy i.e. 83.6 years whole Sierra Leone has the lowest life expectancy i.e. 48.1 years. Historically, the improvement in life expectancy is an important topic of population studies. The population of Pakistan is 179.2 million in 2012 and fertility rate was 3.34 (births per women) in 2011 but annual growth of population is 1.7% in 2012. The life expectancy in Pakistan is 65.7 years in 2013 (male: 64.52 and female: 68.28 in 2012)[1]. Over the same period, population of Bangladesh is 154.7 million, fertility rate is 2.20 (births per women) and population growth is 1.2%. Bangladesh's life expectancy is 69.2 years in 2013 (male: 68.48 years and female: 72.31 years in 2011). In case of India, population is 1.237 billion in 2012 with 2.59 (births per women) in 2011but life expectancy is 65.8 years in 2013 (male: 66.04 years and 68.33 years in 2012). The income per capita is $ 1256.8, $ 838 and $ 1501 in 2012 of Pakistan, Bangladesh and India

[1] See for more details http://hdrstats.undp.org/en/countries/profiles/PAK.html

respectively. The current paper contributes in existing demographics literature while investigating the determinants of life expectancy by incorporating economic misery index in life expectancy function using data of Pakistan. We apply the unit root test to test the integrating properties of the variables in the presence of structural breaks in the series. The cointegration is investigated by applying the ARDL bounds testing to examine whether cointegration exists or not in the presence of structural breaks in the series. We find that the variables are cointegrated for long run relationship in case of Pakistan. Furthermore, health spending and food supply increase life expectancy. An increase in economic misery decreases life expectancy. Urbanization is positively linked with life expectancy. Illiteracy has negative but insignificant impact on life expectancy. The causality results exposed the bidirectional causal relationship between economic misery and life expectancy. Health spending Granger causes life expectancy and in resulting, life expectancy leads public health spending. The relationship between economic misery and health spending is bidirectional.

II. Literature Review

Finding the determinants of life expectancy is now-a-days one of an important topic in the field of development and demographic economics. For example, Preston (1975, 1976, 1980), Grosse and Aufiey (1989) and Kakwani (1993) indicated that socioeconomic factors play an important role in determining life expectancy. But, Shen and Williamson (1997) and Mahfuz (2008) mentioned that income per capita, level of education, expenditures on health, access to safe water and urbanization cannot be considered as influential factors determining life expectancy in developing countries. Lake and Baum (2001), Franco et al. (2004), Gerring et al. (2005) and Navarro et al. (2006) exposed that life expectancy in democratic countries is high as citizens enjoy different types of freedoms. These citizens are also aware about their social needs and rights. There are few studies which unveiled that health services play a critical role in life expectancy. But Cumper (1984), Wolfe (1986), Poikolainen and Eskola (1988) and, Hertz et al. (1994) are not convinced by this argument. On contrary, Lake and Baum (2001) and, Navarro et al. (2006) mentioned that increase in public health expenditures and medical care improves the quality of life of population.

Rogers (1979) explained the conceptual framework for life expectancy and income. Later on, Rogers and Wofford (1989) investigated the six main determinants of life expectancy for 95 developing countries. They found that urbanization, agriculture related population, illiteracy rate, access for drinking water, average calorie per person and doctor per population play an important role in the determination of life expectancy. Mahfuz (2008) exposed the positive relationship between primary health care program and life expectancy. Rogot et al. (1992) examined the determinants of life expectancy of white female and male of US by family income, education, employment status. They concluded that life expectancy varies with mean years of schooling. Using cross-country data, Hitiris and Posnet (1992) found that there is negative association between primary health spending and child mortality rates. World Bank (1997) reported that income per capita increases life expectancy in case of developing countries. Guralnik et al. (1993) unveiled that race also plays an important role in life expectancy. He noted that life expectancy of black men is less than white men but it is education attainments which change the results.

Anand and Ravallion (1993) investigated the relationship between life expectancy and income per capita and found a positive and significant relationship between both variables but it works through national income and public expenditures on health. They also reported that when public expenditures on health and poverty used as independent variables then results are changed. Grubaugh and Santerre (1994) reported a positive association with certain health inputs (doctors per population, hospital per population) and mortality rates. Collins and Klein (1980), Hadley (1982), Forbes and Mcgregor (1984) and Elola et al. (1995) also noted a positive relationship between primary health spending and health status. Wilkinson (1996) examined the nonlinear relationship between life expectancy and economic growth and reported that after achieving a threshold level of per capita income, the relationship between life expectancy and standard of living disappears and further increase in income does not affect life expectancy[2]. Hill and King (1995) and Gulis (2000) investigated the impact of female education on life expectancy. They noted that female's education contributes to life expectancy. Williamson and Boehmer (1997) exposed that educational status improves the female life expectancy significantly using data of 97 developed and developing countries. Sen (1999) pointed out that education plays an important role in determining life expectancy via affecting health. He exposed that education enhances the productivity of labor which increases income that further affects the health of child as well as education improves the health awareness of people[3]. Cemieux et al. (1999) noted that public health spending has significant effect on life expectancy in case of Canada. They reported that lower health spending is associated with low life expectancy and high infant mortality rate in case of Canada. Gulis (2000) examined the determinants of life expectancy of 156 developed and

---

[2] Moreover, author reported the positive impact of income per capita on health and after threshold level, the relationship between both variables becomes insignificant.

[3] He found that rising education improves the health of women inside and outside of the home which help them for improving the health of their family and child survival.

developing economies. He concluded that income per capita, public health spending, safe drinking water, calorie intake and literacy are the main determinants of life expectancy.

Kalediene and Petrauskiene (2000) unveiled that urbanization is one of the important indicators of life expectancy both for developed and developing nations. They claimed that population of urban areas has better medical cares, better education opportunities and improved socio-economic infrastructure which have positive impact on health and hence life expectancy. Szwarcwald et al. (2000) contradicted with the findings of Kalediene and Petrauskiene (2000). They reported that the health conditions are worse where population concentration is high and big cities' life expectancy is seven years less than the other part of Lithuania. Macfarlane et al. (2000) examined the role of water availability in determining life expectancy and noted that safe drinking water is an important determinant of life expectancy in case of developing countries. Furthermore, they noticed that those parts where safe drinking water is in easy access, life expectancy is high in Asian and African countries. Veugelers et al. (2001) used multi-level logistic regression to examine the impact of education on life expectancy using Canadian data. They noted that education attainment increases awareness among the people about health and in resulting, life expectancy is increased. Similarly, Kalediene and Petrauskiene (2000) and Grabauskas and Kalediene (2002) pointed out that female's education puts negative impact on mortality rate whereas positive impact on life expectancy. Subramanian et al. (2002) examined impact of poverty, income per capita, health spending and life expectancy. They found that income per capita and public health spending exert positive impact on life expectancy while poverty declines it. Hussain (2002) investigated the determinants of life expectancy by using the cross-sectional data of 91 developing countries. He used fertility rate, per capita GNP, adult literacy rate and per capita calorie intake as independent variables, unlike other studies, his analysis is based on both linear as well as log-linear models. The results of his study showed that in the sample countries all the explanatory variables have significant relationship with life expectancy. Starfield and Shi, (2002) mentioned that Costa Rica has achieved the highest level of life expectancy due to strong social and political infrastructure as well as primary health care program. We find that there is no research on such topic in case of Pakistan and this paper is a humble effort to fill research gap for case of Pakistan.

III. Model Construction and Data Collection

The prime objective of present paper is to investigate the impact of health spending, food supply, economic misery, illiteracy and urbanization on life expectancy in case of Pakistan. The empirical model is given as following:

$$\ln E_t = \beta_1 + \beta_2 \ln H_t + \beta_3 \ln F_t + \beta_4 MI_t + \beta_6 I_t + \beta_7 \ln U_t + \mu_i \quad (1)$$

Where, $\ln E_t$ is natural log of life expectancy per capita, $\ln H_t$ is natural log of public health spending per capita , $\ln F_t$ is natural log of food supply proxies by agricultural food supply index, MI_t is natural log of economic misery proxies by interaction between inflation and unemployment, I_t is illiteracy rate, $\ln U_t$ is natural log urbanization per capita and μ_i is white noised error term.

The data on food supply proxies by food production index[4] and urbanization is collected from world development indicators (CD-ROM, 2013). The data on life expectancy and illiteracy rate is combed from Social Policy and Development Center's annual report (SPDC, 2007)[5]. The economic survey of Pakistan (various issues) has combed to collect data on public health spending. The data on economic misery index is generated by authors. The study covers the period of 1972-2012.

III.I Misery Index in Pakistan

Inflation is defined as "a general increase in the prices of goods and services" which affects the purchasing power of individual during their life period. This decrease in purchasing power of money is linked with a decline in welfare of the household and in resulting, life expectancy is affected. Life expectancy is one of the important determinants of economic development. Barro (1991), Fischer (1983, 1993), and Bruno and Easterly (1998) exposed that inflation affects economic growth inversely. The decline in economic activities is positively linked with unemployment. Although empirical findings between unemployment and mortality rate is controversial but Forbes and McGregor (1984) reported the positive association between unemployment and mortality rates. This implies that unemployment affects life expectancy by affecting income of individuals and mortality rate in an economy. Inflation affects life expectancy by affecting the purchasing power of individuals. The existing economic literature provides various studies, where misery index is used as a measure of economic misery (for example see, Treisman (2000), King and Ma (2001), Neyapti (2004), Martinez-Vazquez and

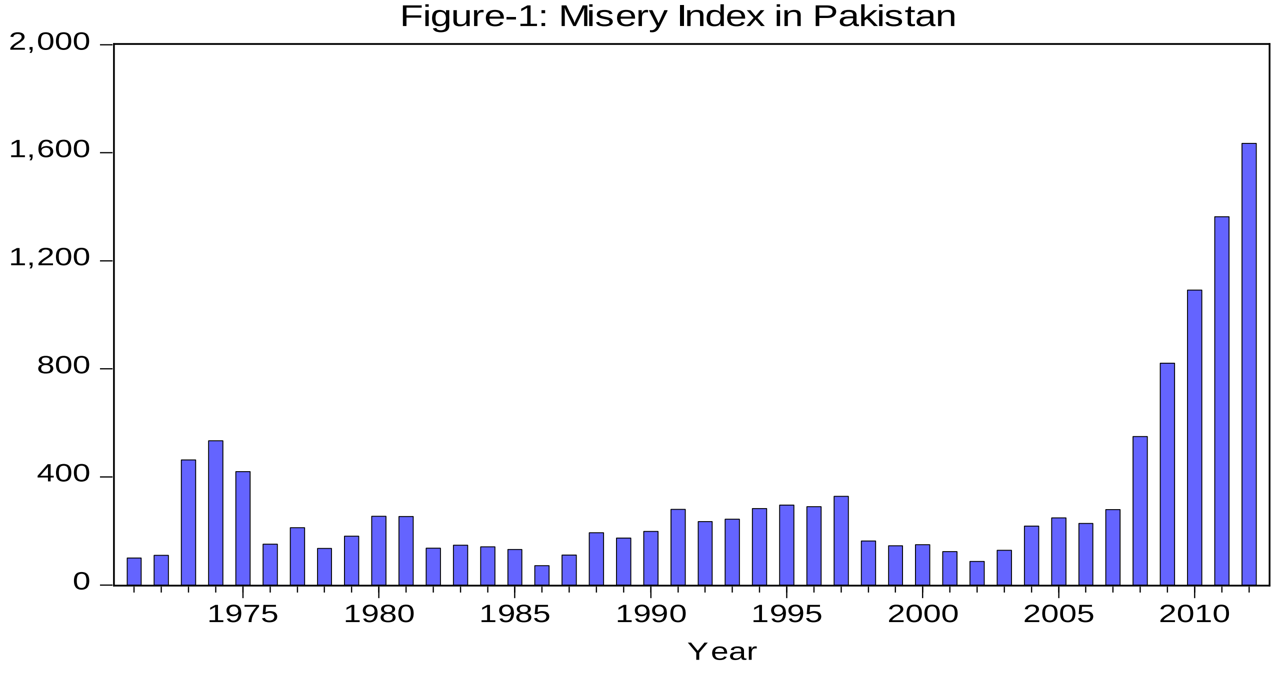
[4] Food production index covers food crops that are considered edible and that contain nutrients. Coffee and tea are excluded because, although edible, they have no nutritive value.
[5] SPDC, (2007). Trade liberalization, growth and poverty. Annual Review 2005-06. Social Policy and Development Center. Karachi, Pakistan.

McNab (2006), Shah (2006), Thornton (2007) and, Iqbal and Nawaz (2010)). In 1960s, Arthur Okun generated misery index combining inflation and unemployment rates. For understanding the real picture of economic misery, we have constructed misery index (MI) following Arthur Okun. The misery index (MI) is computed by taking the sum of inflation and unemployment in case of Pakistan for the period of 1972-2012. The data on inflation and unemployment rates is collected from economic survey of Pakistan (various issues).

$$MI = Inflation + unemployment \qquad (2)$$

Where MI is misery index, inflation is the annual percentage change in consumer price index (CPI) and unemployment is comprised of all persons sixteen years age and above during the reference period, this definition is according to International Labor Organization (ILO). The MI is presented in Figure-1.

Figure-1: Misery Index in Pakistan



IV. Econometric Methodology

Nelson and Ploser, (1982) claim that unit root is the problem of nearly all macroeconomic variables. They unveil that the absence or presence of unit root in the data helps to identify some of main problems which occurred in the process of data generation. If the data is stationary then the series has constant mean with finite variance which does not rely on time period. But on other hand, if the data is non-stationary then the mean of error is not constant and variance of series is infinite. In existing applied economics literature, a lot of work has been done to test the unit root problem in the series. Dickey-Fuller (1979), Augmented Dickey-Fuller (1980), Perron (1990), and Perron (1997) presented their unit root tests but do not highlight the importance of structural breaks in the data. Lee and Strazicich, (2003) propose the minimum Lagrange multiplier (LM) accommodating single and two unknown structural breaks in the series which is ignored in the previous tests. This test stands out as it provides for structural breaks under both the null and alternative hypotheses. Allowing for the break under the null hypothesis is necessary in order to circumvent spurious rejections and invalid results (Lee and Strazicich, 2001). The test proceeds as follows:

$$\Delta S_{it} = \delta_i^{'} \Delta Z_{it} + \phi_i \overline{S}_{i,t-1} + \sum_{j=1}^{p} \chi_i \Delta \overline{S}_{i,t-j} + \mu_{it} \qquad (3)$$

Here, Δ represents the first difference operator and $\overline{S}_{it}$ is a de-trended value of S_{it}. Z_{it} is the exogenous variables characterised by the data generating process and represented as $Z_{it} = \left[1, t, D_{1it}, D_{2it,} DT_{1it}, DT_{2it}\right]'$ with two changes in level and trend, where $\mathrm{D_{kit}} = 1$ if $\mathrm{t} \geq T_{Bki} + 1, k = 1, 2,$ and 0 otherwise, and also $\mathrm{DT_{kit}} = t$ if $\mathrm{t} \geq T_{Bki} + 1, k = 1, 2,$ and 0, otherwise. The locations of T_{Bki} which are break dates, given by $\lambda_k = T_{Bki} / T, k = 1, 2$. $\text{LM}_{\tau i} = \text{Inf}_{\lambda i}\tilde{\tau}(\lambda_i)$ is used to find the break periods, which minimises τ_i (*t-statistics)* for the null of unit root (ϕ_i=0). Augmented lag terms $\Delta\bar{S}_{i,t-j,}\ j = 1,\ldots k$ are incorporated to avoid the challenge of serial correlation in errors (Lee and Strazicich, 2003; 2004)[6].

Prior to testing for cointegration, it is standard way to check the stationary properties of the series. The study period witnessed some major upheavals in the global stage which can cause structural breaks in the macroeconomic dynamics. The ARDL bounds test works regardless of whether or not the regressors are I(1) or I(0) / I(1), the presence of I(2) or higher order renders the F-test unreliable (See Ouattra, 2004). We choose the ARDL bounds testing approach for its advantages. First, it is flexible and applies regardless the order of integration, as noted. The simulation shows that this approach is superior and provides consistent results for small sample (Pesaran and Shin, 1999). Moreover, a dynamic unrestricted error correction model (UECM) can be derived from the ARDL bounds testing through a simple linear transformation. The UECM integrates the short run dynamics with the long run equilibrium without losing any long run information. For estimation purposes, following the ARDL model to be used:

$$\begin{aligned}\Delta\ln E_t &= \alpha_1 + \alpha_{DUM}DUM + \alpha_E \ln E_{t-1} + \alpha_H \ln H_{t-1} + \alpha_F \ln F_{t-1} + \alpha_{MI}MI_{t-1} + \alpha_I I_{t-1} + \alpha_U \ln U_{t-1} + \sum_{i=1}^{p}\alpha_i \Delta\ln E_{t-i} \\ &+ \sum_{j=0}^{q}\alpha_j \Delta\ln H_{t-j} + \sum_{k=0}^{r}\alpha_k \Delta\ln F_{t-k} + \sum_{l=0}^{s}\alpha_l \Delta MI_{t-l} + \sum_{m=0}^{t}\alpha_m \Delta I_{t-m} + \sum_{n=0}^{u}\alpha_m \Delta\ln U_{t-m} + \mu_t\end{aligned} \quad (4)$$

[6] Sen (2003a) suggested that models which allow both breaks is better than models with single break(s) in level(s). Sen (2003b) used Monte Carlos simulations to confirm the superiority of models that allow break(s) for both level(s) and trend(s). To determine the lag length of *k* we follow the process recommended by Campbell and Perron (1991). Starting with an upper bound k_{max} on *k*, k=$k_{\max}$ is chosen if the existing lag is significant. If not, *k* is reduced by a unit, until the lag is significant. If none of the lags are significant, then k=0. In the empirical section, we set $k_{\max}$=8 and use the 10% value of the asymptotic normal distribution, 1.645, to determine the significance of the last lag.

$$\Delta \ln H_t = \alpha_1 + \alpha_{DUM} DUM + \alpha_H \ln H_{t-1} + \alpha_E \ln E_{t-1} + \alpha_F \ln F_{t-1} + \alpha_{MI} MI_{t-1} + \alpha_I I_{t-1} + \alpha_U \ln U_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta \ln H_{t-i} + \sum_{j=0}^{q} \alpha_j \Delta \ln E_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta \ln F_{t-k} + \sum_{l=0}^{s} \alpha_l \Delta MI_{t-l} + \sum_{m=0}^{t} \alpha_m \Delta I_{t-m} + \sum_{n=0}^{u} \alpha_m \Delta \ln U_{t-m} + \mu_t \quad (5)$$

$$\Delta \ln F_t = \alpha_1 + \alpha_{DUM} DUM + \alpha_F \ln F_{t-1} + \alpha_E \ln E_{t-1} + \alpha_H \ln H_{t-1} + \alpha_{MI} MI_{t-1} + \alpha_I I_{t-1} + \alpha_U \ln U_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta \ln F_{t-i} + \sum_{j=0}^{q} \alpha_j \Delta \ln E_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta \ln H_{t-k} + \sum_{l=0}^{s} \alpha_l \Delta MI_{t-l} + \sum_{m=0}^{t} \alpha_m \Delta I_{t-m} + \sum_{n=0}^{u} \alpha_m \Delta \ln U_{t-m} + \mu_t \quad (6)$$

$$\Delta \ln H_t = \alpha_1 + \alpha_{DUM} DUM + \alpha_H \ln H_{t-1} + \alpha_E \ln E_{t-1} + \alpha_F \ln F_{t-1} + \alpha_{MI} MI_{t-1} + \alpha_I I_{t-1} + \alpha_U \ln U_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta \ln H_{t-i} + \sum_{j=0}^{q} \alpha_j \Delta \ln E_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta \ln F_{t-k} + \sum_{l=0}^{s} \alpha_l \Delta MI_{t-l} + \sum_{m=0}^{t} \alpha_m \Delta I_{t-m} + \sum_{n=0}^{u} \alpha_m \Delta \ln U_{t-m} + \mu_t \quad (7)$$

$$\Delta I_t = \alpha_1 + \alpha_{DUM} DUM + \alpha_I I_{t-1} + \alpha_E \ln E_{t-1} + \alpha_F \ln F_{t-1} + \alpha_H \ln H_{t-1} + \alpha_{MI} MI_{t-1} + \alpha_U \ln U_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta \ln I_{t-i} + \sum_{j=0}^{q} \alpha_j \Delta \ln E_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta \ln F_{t-k} + \sum_{l=0}^{s} \alpha_l \Delta H_{t-l} + \sum_{m=0}^{t} \alpha_m \Delta MI_{t-m} + \sum_{n=0}^{u} \alpha_m \Delta \ln U_{t-m} + \mu_t \quad (8)$$

$$\Delta \ln U_t = \alpha_1 + \alpha_{DUM} DUM + \alpha_U \ln U_{t-1} + \alpha_E \ln E_{t-1} + \alpha_F \ln F_{t-1} + \alpha_H \ln H_{t-1} + \alpha_{MI} MI_{t-1} + \alpha_I I_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta \ln U_{t-i} + \sum_{j=0}^{q} \alpha_j \Delta \ln E_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta \ln F_{t-k} + \sum_{l=0}^{s} \alpha_l \Delta H_{t-l} + \sum_{m=0}^{t} \alpha_m \Delta MI_{t-m} + \sum_{n=0}^{u} \alpha_m \Delta I_{t-m} + \mu_t \quad (9)$$

where DUM is dummy for structural break based on LS unit root test and μ_t is residual term having normal distribution. Test of cointegration involves comparing the computed F-statistic with the critical bounds generated by Pesaran et al. (2001) i.e. upper critical bound (UCB) and lower critical bound (LCB). The null hypothesis $H_0 : \alpha_E = \alpha_F = \alpha_H = \alpha_{MI} = \alpha_I = \alpha_U = 0$ of no cointegration is tested against the alternate $H_a : \alpha_E \neq \alpha_F \neq \alpha_H \neq \alpha_{MI} \neq \alpha_I \neq \alpha_U \neq 0$ of cointegration[7]. The series are cointegrated if the computed F-statistic exceeds the UCB and not cointegrated if the computed F-statistic is less than LCB. If computed F-statistic falls between the UCB and LCB, the test is uncertain. We use the critical bounds from Narayan (2005), which

[7] Pesaran et al. (2001) have computed two asymptotic critical values - one when the variables are assumed to be *I(0)* and the other when the variables are assumed to be *I(1)*.

are more appropriate for small sample i.e. 31 observations, compared to Pesaran et al. (2001). The parameter stability is checked by applying the CUSUM and CUSUMSQ tests proposed by Brown et al. (1975). For the long run relation among the series we use the following equation:

$$\ln E_t = \theta_0 + \theta_1 \ln H_t + \theta_2 \ln F_t + \theta_3 MI_t + \theta_4 I_t + \theta_5 U_t + \mu_i \qquad (10)$$

where, $\theta_0 = -\beta_1/\alpha_E, \theta_1 = -\alpha_H/\beta_1, \theta_2 = -\alpha_F/\beta_1, \theta_3 = -\alpha_{MI}/\beta_1, \theta_4 = -\alpha_I/\beta_1, \theta_5 = -\alpha_U/\beta_1$ and μ_t is the error term assumed to be normally distributed. Once the long run relationship is established among the series, we test the direction of causality using the following error correction representation[8]:

$$(1-L)\begin{bmatrix} \ln E_t \\ \ln H_t \\ \ln H_t \\ MI_t \\ I_t \\ \ln U_t \end{bmatrix} = \begin{bmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \\ \beta_5 \end{bmatrix} + \begin{bmatrix} B_{11,1} B_{12,1} B_{13,1} B_{14,1} B_{15,1} \\ B_{21,1} B_{22,1} B_{23,1} B_{24,1} B_{25,1} \\ B_{31,1} B_{32,1} B_{33,1} B_{34,1} B_{35,1} \\ B_{41,1} B_{42,1} B_{43,1} B_{44,1} B_{45,1} \\ B_{51,1} B_{52,1} B_{53,1} B_{54,1} B_{55,1} \end{bmatrix} \times \begin{bmatrix} \ln E_{t-1} \\ \ln H_{t-1} \\ \ln F_{t-1} \\ MI_{t-1} \\ I_{t-1} \\ \ln U_{t-1} \end{bmatrix} + \ldots\ldots + \begin{bmatrix} B_{11i} B_{12i} B_{13i} B_{14i} B_{15i} \\ B_{21i} B_{22i} B_{23i} B_{24i} B_{25i} \\ B_{31i} B_{32i} B_{33i} B_{34i} B_{35i} \\ B_{41i} B_{42i} B_{43i} B_{44i} B_{45i} \\ B_{51i} B_{52i} B_{53i} B_{54i} B_{55i} \end{bmatrix} \times \begin{bmatrix} \ln E_{t-1} \\ \ln H_{t-1} \\ \ln F_{t-1} \\ MI_{t-1} \\ I_{t-1} \\ \ln U_{t-1} \end{bmatrix} + \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \\ \alpha_5 \\ \alpha_6 \end{bmatrix} ECT_{t-1} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{bmatrix} \qquad (9)$$

where, $(1-L)$ is the lag operator and ECT_{t-1} is the lagged residual obtained from the long run ARDL relationship; $\varepsilon_{1t}, \varepsilon_{2t}, \varepsilon_{3t}, \varepsilon_{4t}, \varepsilon_{5t}$ and ε_{6t} are error terms assumed to be N$(0, \sigma,)$. Long run

[8] If cointegration is not detected, the causality test is performed without an error correction term (*ECT*).

causality requires a significant t-statistic on the coefficient of ECT_{t-1}. A significant F-statistic on the first differences of the variables suggests short run causality. Additionally, joint long-and-short runs causal relationship can be estimated by the joint significance of both ECT_{t-1} and the estimate of lagged independent variables. For instance, $B_{14,i} \neq 0 \forall_i$ shows that economic misery Granger causes life expectancy while Granger causality runs from life expectancy to economic misery is indicated by $B_{41,i} \neq 0 \forall_i$.

V. Empirical Findings and their Discussion

We have applied the Lee and Strazicich unit root test and results are reported in Table-1. The results report that life expectancy, public health spending, food supply, economic misery, illiteracy and urbanization has unit root problem at level in the presence of structural breaks. Over the selected period of time, Pakistan implemented various economic reforms to improve the performance of economic and social indicators. For example, Pakistan implemented Structural Adjustment Program (SAP) in 1988, the companies' ordinance in 1984, in 1980s government introduced incentive schemes to enhance production in agriculture sector which increased the food production in 1988, all government efforts to lower inflation and unemployment rates in late 1970s, adoption of educations sector reforms package by government in 2004 and local government system implemented by government in 1977. All the variables have found to be stationary at first difference. This shows that our variables have unique order of integration that leads to apply the ARDL bounds to compute F-statistic for cointegration decision.

Table-1: Results of Lee and Strazicich Unit root test with one and two structural breaks

Series	T_{B1}	T_{B2}	S_{t-1}	K	T_{B1}	T_{B2}	S_{t-1}	K
Model 1: Crash model					Model 2: Trend break model			
One break case								
$\ln E_t$	1989	---	-3.2409	0	1989	---	-4.9508	0
$\ln H_t$	1985	---	-1.9674	0	1986	---	-3.1042	0
$\ln F_t$	1988	---	-1.7427	0	1992	---	-2.0465	0
MI_t	1979	---	-3.8457	4	2000	---	-4.1407	0
I_t	2005	---	-4.4743	0	2000		-3.6015	0
$\ln U_t$	1978	---	-1.3637	0	1983	---	-2.2417	0
Two break case								
$\ln E_t$	1979	1989	-4.3379	0	1979	1989	-4.3600	0
$\ln H_t$	1985	1998	-2.1610	0	1984	2003	-4.2246	0
$\ln F_t$	1985	1992	-2.0048	0	1984	2000	-4.6308	0
MI_t	1979	1991	-4.2098	4	1979	1996	-4.7729	4
I_t	1984	2005	-4.8232	0	1983	2003	-1.4269	4
$\ln U_t$	1978	1986	-1.3950	0	1982	2004	-4.2733	0

Note: Mode 1 presents Results for univariate LM unit root test with one structural break in intercept/constant only and Model 2 presents Results for univariate LM unit root test with one structural breaks in intercept/constant and trend both. T_{B1} and T_{B2} are the dates of the structural breaks; k is the lag length; S_{t-1} is the LM test statistic. Critical values of $S_{t-1}$of both test (that is when breaks occur intercept and intercept and trend jointly are reported in Lee-Strazicich (2003, 2004) two-break and one-break cases respectively. * denotes statistical sisgnificance at 1% level.

To examine the cointegration between the variables, we have applied the autoregressive distributive lag model or the ARDL bounds testing approach to cointegration, developed by Pesaran et al. (2001). This approach is used as it has many advantages over other cointegration approaches as it can be applicable on mix order of integration or variables are integrated at I(0) or I(1). Table-2 provides the information of leg length of the variables. The appropriate lag length is necessary to avoid the problem of ambiguous results because F-statistic varies at different lag orders. We choose appropriate lag order following Akaike information criterion which provides consistent and reliable results compared to SBC and other lag length criterions. The data span of our study is 41 years so we cannot take lag more than 2 suggested by AIC lag length criterion.

Table-2: Lag Order Selection Criteria

VAR Lag Order Selection Criteria

Lag	Log L	LR	FPE	AIC	SC	HQ
0	44.92175	NA	5.19e-09	-2.048513	-1.789947	-1.956517
1	281.1629	385.4460	1.41e-13	-12.58752	-10.77756*	-11.94355
2	336.8870	73.32124*	5.79e-14*	-13.62563*	-10.26427	-12.42968*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table-3: ARDL Bounds Testing Analysis

Variables	$\ln E_t$	$\ln H_t$	$\ln F_t$	$\ln MI_t$	$\ln U_t$	I_t
F-statistics	7.658**	5.587***	2.600	7.830**	3.215	0.525
Break Years	1989	1985	1988	1979	1978	2005
Critical values#	1 per cent level	5 per cent level	10 percent level			
Lower bounds	7.527	5.387	4.477			
Upper bounds	8.803	6.437	5.420			
Diagnostic tests						
R^2	0.8012	0.8124	0.7558	0.8918	0.8914	0.9558
$Adj-R^2$	0.4802	0.3624	0.1697	0.7323	0.5899	0.8323
Durbin-Watson	2.6301	2.2585	2.3898	2.3326	2.3614	2.1695
$\chi^2 NORMAL$	0.2283(0.8876)	0.7558 (0.6852)	0.0301(0.9850)	0.8248(0.6220)	0.8664(0.6484)	0.4061(0.8162)
$\chi^2 SERIAL$	2.1527(0.1845)	0.4759(0.6370)	2.5120 (0.1474)	1.4562(0.2888)	3.3702(0.2478)	0.3373(0.5773)
$\chi^2 ARCH$	0.3227(0.5739)	1.2573 (0.2705)	0.0718(0.7903)	0.6778(0.2733)	0.1050(0.7480)	0.0050(0.9436)
$\chi^2 REMSAY$	2.2229(0.1716)	5.9327(0.1521)	0.1149(0.7423)	1.7295(0.2209)	0.5835(0.4668)	0.0107(0.9200)
Note: 5 percent and 10 percent levels of significance is shown by ** and *** respectively.						

After choosing appropriate lag length, next is to compute the ARDL F-statistic to examine whether cointegration exists. We report the results of the ARDL bounds analysis in Table-3. Table-3 reveals that the value of computed F-statistic exceeds upper critical bound at 5 per-cent and 10 per-cent levels respectively as we treated life expectancy, public health spending and misery index as dependent variables. This confirms the existence of three cointegrating vectors. The existence of cointegrating vectors validates the presence of long run relationship between the variables. We find that estimated empirical equations of the ARDL bounds testing full the assumptions of classical linear regression model (CLRM). The results show that error terms are white noised with zero mean and finite variance. There is absence of serial correlation and autoregressive conditional heteroskedisticity. White heteroskedisticity is absent and Ramsey reset test statistics confirm the well construction of empirical models. Moreover, D.W test shows the absence of autocorrelation problem.

Long run marginal impacts of public health spending, food supply, economic misery, urbanization and illiteracy on life expectancy are reported in Table-4. The results show that public health spending has positive and significant impact on life expectancy. All else remain same; a 1 per-cent increase in public health spending increases 0.46 per-cent life expectancy. The impact of food supply is positive and it is statistically significant at 10 per-cent level. A 0.1786 per-cent increase in life expectancy is linked with 1 per-cent increase in food supply by keeping other things constant. The relationship between economic misery and life expectancy is negative and statistically significant at 1 per-cent. We note that a 1 per-cent increase in misery decreases life expectancy by 0.3641 if other things remain constant. Urbanization adds in life expectancy at 1 per-cent level of significance. Illiteracy has negative but insignificant impact on life expectancy. All else is same, a 1 per-cent increase in illiteracy lowers life expectancy by 0.0463 per-cent. Long run model fulfils the assumptions of CLRM such as normality of error term, no serial correlation, no ARCH and white heteroskedisticity and well construction of model.

Table-4: Long Run Results

Dependent variable = $\ln E_t$				
Variables	Coefficient	Std. Error	T-Statistic	Prob. values
Constant	93.5670	7.4190	12.611*	0.0000
$\ln H_t$	0.4633	0.2268	2.0430**	0.0489
$\ln F_t$	0.1786	0.0972	1.8359**	0.0751
MI_t	-0.3641	0.0711	-5.1157*	0.0000
$\ln U_t$	0.3584	0.0510	7.0223*	0.0000
I_t	-0.0463	0.0641	-0.7217	0.4754
R^2	0.9977			
F-statistic	28.9663*			
D. W	2.0301			
Short Run Diagnostic Tests				
Test	F-statistic	Prob. Value		
χ^2 *NORMAL*	0.2831	0.8679		
χ^2 *SERIAL*	0.5668	0.9469		
χ^2 *ARCH*	0.3101	0.5811		
χ^2 *WHITE*	2.9751	0.0111		
χ^2 *REMSAY*	1.1922	0.2832		
Note: * and ** show significant at 1 and 5 per cent level of significance respectively.				

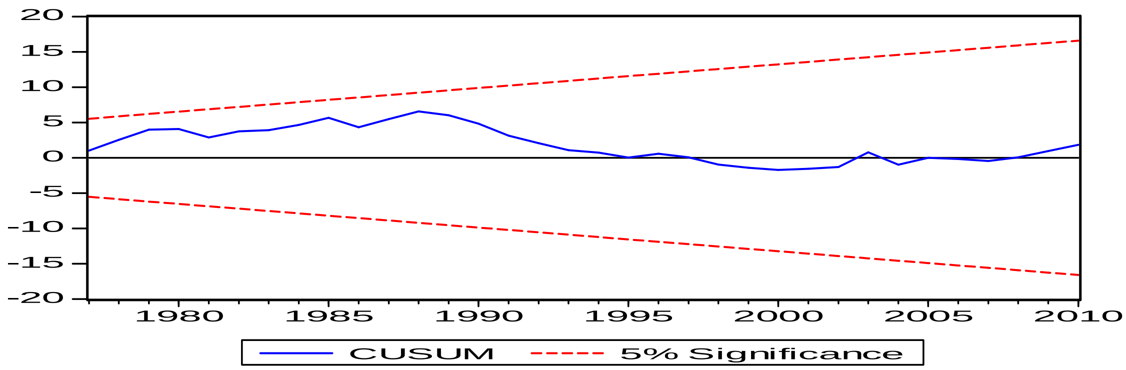
Table-5: Short Run Results

Dependent variable = $\ln E_t$				
Variables	Coefficient	Std. Error	T-Statistic	Prob. values
Constant	0.0873	0.1172	0.7453	0.4618
$\ln H_t$	-0.4135	0.2395	-1.7262***	0.0946
$\ln F_t$	0.2865	0.1076	2.6624**	0.0123
MI_t	-0.4343	0.1527	-2.8426*	0.0080
$\ln U_t$	0.2766	0.0979	2.8253*	0.0083
I_t	-0.0121	0.0071	-1.6966***	0.1001
ECM_{t-1}	-0.8877	0.1881	-4.7189*	0.0001
R^2	0.6459			
F-statistic	9.1227*			
D. W	1.8634			
Short Run Diagnostic Tests				
Test	F-statistic	Prob. value		
χ^2 *NORMAL*	0.0188	0.9901		
χ^2 *SERIAL*	0.5513	0.4637		
χ^2 *ARCH*	1.0319	0.3168		
χ^2 *WHITE*	3.5698	0.0038		
χ^2 *REMSAY*	2.5642	0.1201		
Note: * and ** show significant at 1 and 5 per cent level of significance respectively.				

The results of short run dynamics are shown in Table-5. The results show that public health spending has negative and significant impact on life expectancy. Food supply positively and significantly affects life expectancy. The impact of economic misery on life expectancy is negative and it is statistically significant. Urbanization adds in life expectancy. The relationship between illiteracy and life expectancy is negative but significant. The estimate of ECM_{t-1} is negative and statistically significant. The coefficient of lagged of ECM is equalent to -0.8877. The negative value of ECM is theoretically correct which shows the speed of convergence from short run toward long run. It implies that short run variations are corrected by 88.77 per-cent every year. The significance of lagged error term further confirms our ascertained long run relationship between the variables.

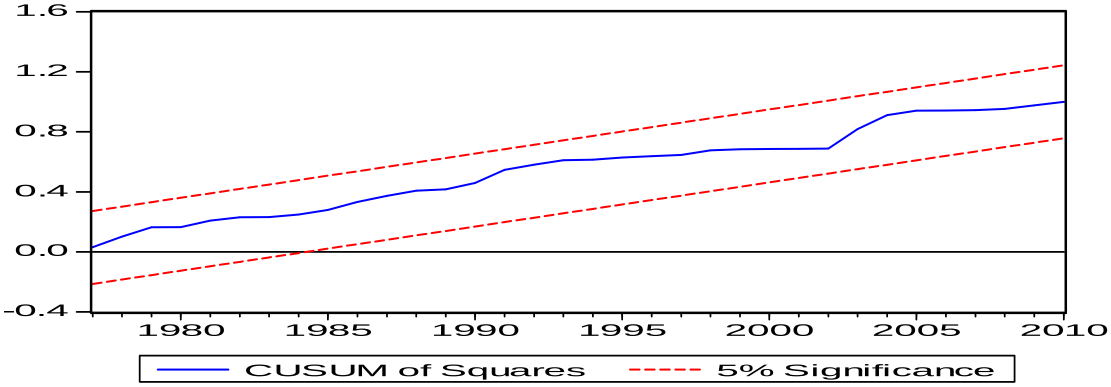
The significance of stability of the model is necessary and we apply the Cumulative Sum (CUSUM) and the Cumulative Sum of the Squares (CUSUMsq). Our results are reported in Figure-2 and 3. We find that graphs of CUSUM and CUSUMsq are between critical bounds at 5 per-cent level of significance. This shows that long-run and short-run estimates are stable and efficient.

Figure-2: Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level.

Figure-3: Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level.

After investigating the long run and short run impacts of public health spending, food supply, economic misery, urbanization and illiteracy on life expectancy, we apply the VECM Granger causality to examine cause and effect of each variable. The results are detailed in Table-6. In long run, public health spending Granger causes life expectancy and in resulting, life expectancy Granger causes public health spending. Food supply, urbanization and illiteracy Granger cause life expectancy. The feedback effect is found between life expectancy and economic misery. The relationship between public health spending and economic misery is bidirectional.

Table-6: VECM Granger Causality Analysis

Variables	Type of Causality								
	Short Run						Long Run	R^2	D. W
	$\Delta \ln E_{t-1}$	$\Delta \ln H_{t-1}$	$\Delta \ln F_{t-1}$	ΔMI_{t-1}	$\Delta \ln U_{t-1}$	ΔI_{t-1}	ECT_{t-1}		
$\Delta \ln E_t$	...	1.7601 [0.1944]	1.4952 [0.2638]	17.2903* [0.0000]	5.8761* [0.0084]	02232 [0.8015]	-0.8738* [-4.9538]	0.7373	2.0326
$\Delta \ln H_t$	0.5855	...	1.7652	0.5670	0.6264	0.1499	-0.3737**	0.3226	2.1628

	[0.5529]		[0.1918]	[0.5743]	[0.5427]	[0.8615]	[-2.5269]		
$\Delta \ln F_t$	0.0317 [0.9617]	0.3594 [0.7015]	…	0.0492 [0.9521]	0.0737 [0.9291]	0.2488 [0.7816]	…	0.0974	1.8738
ΔMI_t	7.9134* [0.0022]	1.9913 [0.1573]	1.7102 [0.2013]	…	0.4844 [0.6217]	1.1622 [0.3273]	-0.5617* [-3.0400]	0.6955	2.5016
$\Delta \ln U_t$	5.5801* [0.0096]	3.4001** [0.0488]	0.8342 [0.4452]	0.4583 [0.7376]	…	4.6341** [0.0190]	…	0.7094	1.8736
ΔI_t	1.6089 [0.2089]	1.2880 [0.3093]	0.0572 [0.9445]	1.6315 [0.2150]	9.3648* [0.009]	…	…	0.8383	2.0476
Note: * and ** show significance at 1% and 5% levels respectively.									

The short run causality analysis reveals that food supply Granger causes life expectancy. Life expectancy is Granger cause of economic misery and same is true from opposite side. The bidirectional causal relationship exists between urbanization and life expectancy. Public health spending Granger causes urbanization. The feedback effect is found between illiteracy and urbanization.

VI. Conclusion and Policy Recommendations

Increasing life expectancy is changing the age structure of the world, as recent estimates show that the number of people over the age of 60 is projected to reach 1 billion by 2020 and almost 2 billion by 2050, representing 22 per-cent of the world's population. Moreover, proportion of individuals aged 80 or over is projected to rise from 1 per-cent to 4 per-cent of the global population between today and 2050 (UN, 2009). This development has raised concerns about a future slowing of economic growth as rising overall life expectancy of the world. This study examined the impact of economic misery on life expectancy by incorporating public health spending, food supply, urbanization and illiteracy in life expectancy function using Pakistani data over the period of 1972-2012. We have applied the structural break unit root test to examine the integrating properties of the variables. The ARDL bounds testing approach to cointegration is applied to test whether cointegration exists in the presence of structural breaks in the series.

Our results indicated that the variables are cointegrated for long run relationship in the presence of structural breaks in the series. Further, public health spending increases life expectancy. Availability of food also enhances life expectancy. The relationship between economic misery and life expectancy is negative. Urbanization has positive impact on life expectancy. The causality analysis exposed that the feedback effect is found between public health spending and life expectancy. Economic misery Granger causes life expectancy and in resulting, life expectancy Granger causes economic misery. The relationship between economic misery and public health spending is bidirectional.

Our finding of the existence of trade-off between economic misery and life expectancy has immense implications in policy perspective. Pakistan has faced severe energy crisis since early 1990s which has taken its toll on the employment level. Energy crisis also affected domestic production which created demand-supply gap and in resulting, inflation has increased. No wonder that this persistent increase in inflation and unemployment has contributed towards economic misery through rise in consumer prices and lesser income generating possibilities for the bulk of the population. So, the government must focus to generate employment opportunities in the country by ensuring the consistent supply of energy to agriculture and industrial sectors. Our findings show the positive impact of food supply on life expectancy where the availability of food primarily depends on its prices. For the last two decades, a phenomenal rise in food prices has been seen all over the world and Pakistan is no exception. This hike in food prices has accelerated food inflation in Pakistan which has led to increase in economic misery. From a policy perspective, the government should minimize the market imperfections in the food market by implementing mechanisms such as discourage hoarding, effective price control etc. to keep a check on the rise in food prices. Side by side, government should pay her attention to encourage R & D activities for agriculture sector development to enhance its production which not only will sustain the food supply in the country for long span of time but also helpful in lowering food prices to a affordable levels.

Public spending on health in Pakistan is largely progressive and our finding confirms its positive impact on life expectancy. In Pakistan, health services are provided both by public and private sector where public sector largely caters to the relatively less privileged class. Therefore, the government should increase the scope and coverage of its existing health provisions through further increases in its spending which will contribute to human development through improvement in life expectancies. Last but not least, urbanization has positive impact on life expectancy. This indicates that government policy is to enrich urban sector by increasing urban infrastructure is on right way. Urbanization directly and indirectly is contributing to life expectancy via income generating, education and medical factors. The government should give more attention to improve urban infrastructure for improvement of basic necessitates and hence life expectancy.

References

1. Anand, S. and Ravallion, M. (1993). Human development in poor countries: on the role of private income and public services. *Journal of Economic Perspectives*, 7(1): 133-150.
2. Barro, R. (1991). Economic growth in a cross-section of countries. *Quarterly Journal of Economics*, 106(2): 407-43.
3. Bruno, M. and Easterly, W. (1998). Inflation, crises and long-run growth. *Journal of Monetary Economics*, 41(1): 3-26.
4. Collins, E. and Klein, R. (1980). Equity and the NHS: self-reported morbidity, access and primary care. *British Medical Journal*, 281: 1111-1115.
5. Crémieux, P., Ouellette, P. and Pilon, C. (1999). Economics of health care systems: health care spending as determinants of health outcomes. *Health Economics,* 8(7): 627-639.
6. Cumper, G. E. (1984). Determinants of health levels in developing countries. New York, Wiley.
7. Dickey, D. and Fuller, W. (1979). Distribution of the estimators for autoregressive time series with a unit root. Journal of the American Statistical Association, 74: 427-431.
8. Dickey, D. and Fuller, W. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica, 49: 1057-1072.
9. Elola, J., Daponte, A. and Navarro, V. (1995). Health indicators and the organization of health-care systems in Western Europe. *American Journal of Public Health*, 85(10): 1397-1401.
10. Fischer, S. (1983). *Inflation and growth*, NBER Working Paper No. 1235 (Cambridge, Massachusetts: National Bureau of Economic Research).
11. Fischer, S. (1993). The role of macroeconomic factors in growth. *Journal of Monetary Economics*, 32(3): 485-512.
12. Forbes, J. F. and McGregor, A. (1984). Unemployment and mortality in post-war Scotland. *Journal of Health Economics*, 3: 239-257.
13. Franco, A., Alvarez-Dardet, C. and Ruiz, M. T. (2004). Effect of democracy on health: ecological study. *British Medical Journal*, 329(7480): 1421–1423.
14. Gerring, J., Bond, P., Barndt, W. T. and Moreno, C. (2005). Democracy and economic growth: a historical perspective. *World Politics*, 57(3): 323–364.
15. Grosse, R.N. and Auffrey, C. (1989). Literacy and health status in developing countries. *Journal of* Annual Review of Public Health, 10: 281-297.
16. Grubaugh, S. G. and Santerre, R. E. (1994). Comparing the performance of healthcaresystems: An alternative approach. *Southern Economic Journal*, 60(4):1030-1042.
17. Gulis, G. (2000). Life expectancy as an indicator of environmental health. *European Journal of Epidemiology*, 16(2): 161-165.
18. Guralnik, J. M., Land, K. C., Blazer, D., Fillenbaum, G. G. and Branch, L. G. (1993). Educational status and active life expectancy among older blacks and whites. *The New England Journal of Medicine,* 329(2): 110-116.
19. Hadley, J. (1982). *More medical care, better health*, The Urban Institute Press, Washington, DC.

20. Hertz, E., Hebert, J. R. and Landon, J. (1994). Social and environmental factors and life expectancy, infant mortality, and maternal mortality rates: results of a cross-national comparison. Social Science and Medicine, 39: 105-114.
21. Hill, M. A. and King, E. M. (1995). Women's education and economic well-being. *Feminist Economics*, 1(2): 21-46.
22. Hitiris, T. and Posnet, J. (1992). The determinants and effects of health expenditure in developed countries. *Journal of Health Economics,* 11: 173-181.
23. Husain, A. R. (2002). Life expectancy in developing countries: a cross-section analysis. *The Bangladesh Development Studies,* 28(1&2): 161-167.
24. Iqbal, N. and Nawaz, S. (2010). Fiscal decentralization and macroeconomic stability: theory and evidence from Pakistan. Paper present at 26th AGM and Conference, Pakistan Institte of Development Economists, Islamabad, Pakistan.
25. Kakwani, N. (1993). Performance in living standards: an international comparison. Journal of Development Economics, 41: 307-336.
26. Kalediene, R. and Petrauskiene, J. (2000). Regional life expectancy patterns in Lithuania. *European Journal of Public Health,* 10: 101-104.
27. King, D. and Ma, Y. (2001). Fiscal decentralization, central bank independence and inflation. *Economic Letters*, 72: 95-98.
28. Lake, D. A. and Baum, M. A. (2001). The invisible hand of democracy: political control and the provision of public services. *Comparative Political Studies*, 34(6): 587–621.
29. Lee, J. and Strazicich, M. C. (2003). Minimum lagrange multiplier unit root test with two structural breaks. *Review of Economics and Statistics*, *85*(4): 1082-1089.
30. Macfarlane, S. M. Racelis and MuliMusiime, F. (2000). Public health in developing countries. *Lancet*, 356(2): 841-846.
31. Mahfuz, K. (2008). Determinants of life expectancy in developing countries. *Journal of Developing Areas*, 41(2): 185–204.
32. Martinez-Vazquez, J. and Macnab, R. M. (2006). Fiscal decentralization, macrostability and growth. Hacienda Pública Española / Revista de Economía Pública, 179(4): 25-49.
33. Moser, K., Shkolnikov, V. and Leon, D. A. (2005).World mortality 1950–2000: divergence replaces convergence from the late 1980s. *Bull World Health Organ*, 83(3): 202–209.
34. Navarro, V., Muntaner, C., Borrell, C., Benach, J., Quiroga, A., Rodriguez-Sanz, M., Verges, N. and Pasarin, M. I. (2006). Politics and health outcomes. *Lancet,* 368(9540):1033–1037.
35. Neyapti, B. (2004). Fiscal decentralization, central bank independence and inflation: a panel investigation. Economics Letters, 82(2): 227-230.
36. Perron, P. (1990). Testing for a unit root in a time series with a changing mean. *Journal of Business & Economic Statistics*, *8*(2): 153-162.
37. Perron, P. (1997). Further evidence on breaking trend functions in macroeconomic variables. *Journal of econometrics*, *80*(2): 355-385.
38. Pesaran, M. H., Shin, Y. and Smith, R. (2001). Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 16: 289–326.
39. Poikolainen, K. and Eskola, J. (1988). Health services resources and their relation to mortality from causes amenable to health care: a cross-national study. International Journal of Epidemiology, 17: 86-89.
40. Preston, S. H. (1980). Causes and consequences of mortality declines in less developed countries during the Twentieth century, in Easterlin, R.A., ed., Population and Economic Change in Developing Countries, Chicago, University of Chicago Press.

41. Preston, S.H. (1976). Mortality patterns in national populations. *Academic Press, New York.*
42. Rogers, G. B. (1979). Income and inequality as determinants of mortality: an international cross-section analysis. *Population Studies*, 33 (3): 343-351.
43. Rogers, R. G. and Wofford, S. (1989). Life expectancy in less developed countries: socio-economic development or public health? *Journal of Biosociological Science*, 21(2): 245-252.
44. Rogot, E., Sorlie, P. D. and Johnson, N. J. (1992). Life expectancy by employment status, income, and education in the national Longitudinal Mortality Study. *Public Health Reports*, 107(4): 457-461.
45. Shah, A. (2006). Fiscal decentralization and macroeconomic management. International Tax and Public Finance, 13: 437-462.
46. Shen, C. E. and Williamson, J. B. (1997). Child mortality, women's status, economic dependency, and state strength: a cross-national study of less developed countries. *Soc Forces*, 76(2): 667–694.
47. Starfield, B. and Shi, L. (2002). Policy relevant determinants of health: an international perspective. *Health Policy*, 60(3): 201-218.
48. Subramanian, S.V., Belli, P. and Kawachi, I. (2002). The macroeconomic determinants of health. *Annual Review of Public Health*, 23: 287-302.
49. Szwarcwald, C. L., Bastos, F. I., Barcellos, C., Pina, M. F. and Esteves, M. A. P. (2000). Health conditions and residential concentration of poverty: a study in Rio de Janeiro, Brazil. *Journal of Epidemiology and Community Health*, 54: 530-536.
50. Thornton, J. (2007). Further evidence on revenue decentralization and inflation. Economics Letters, 95(1), 140-145.
51. Treisman, D. (2000). Decentralization and inflation: commitment, collective action, or continuity. American Political Science Review, 94(4): 837-857.
52. UNDP, *of 'National* Human Development Report (1997), New York, Oxford University Press, 1997.
53. Vagero, D. (2007). Health inequalities across the globe demand new global policies. *Scand Journal of Public Health*, 35(2): 113–115.
54. Veugelers, P. J., Yip, A. M. and Kephart, G. (2001). Proximate and contextual socioeconomic determinants of mortality: multilevel approaches in a setting with universal health care coverage. *American Journal of Epidemiology*, 154(8): 543-546.
55. Wilkinson, R. G. (1996). *Unhealthy societies: the afflictions of inequality*, Routledge, London.
56. Williamson, J. B. and Boehmer, U. (1997). Female life expectancy, gender stratification, and level of economic development: a cross national study of less developed countries. *Social Science and Medicine*, 45(2): 305-317.
57. Wolfe, B. (1986). Health status and medical expenditures: Is there a link? Social Science and Medicine, 22: 993-999.
58. World Bank, (1997). World Development Indicators 1997, Washington D.C.