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The Impact of Income Inequality, Environmental Degradation and Globalization on Life Expectancy in Pakistan: An Empirical Analysis

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ABSTRACT
This study has investigated the impact of income inequality, globalization and environmental degradation on life expectancy in Pakistan. The study uses time series data for the period 1980-2015 for empirical analysis. Augmented Dickey-Fuller (ADF) and Phillip and Perron (PP) unit root tests are employed for examining the order of integration of the variables. Auto-Regressive Distributed Lag (ARDL) approach is used for investigating the cointegration among the variables of the model. For examining the causal relationship Granger Causality test is used. The results of the study reveal that income inequality and environmental degradation have negative and significant impact on life expectancy in Pakistan. On the other hand globalization have positive and significant impact on life expectancy in Pakistan. The results of Granger causality show that there is unidirectional causality running from all independent variables to dependent variable.
Keywords: life expectancy, income inequality, environmental degradation and globalization
JEL Codes: J17, D33, Q5, F6

INTRODUCTION
Long Life represents the well-being and better living standard of a nation. During the last century the world has witnessed the growth in overall life expectancy. Better living standard, healthy working environment, educated population, maternal and preventative cares, high income are responsible for this improvement in life expectancy. Now-a-days socio-economic policies of developed and developing countries has given much concern to population health, as it has an influential role in development process which decides investment in human capital and workforce.

The relationship between income distribution and health outcomes has been widely discussed in existing empirical literature which reveals that fair income distribution increases the health outcomes because it enables poor population to get a large share in profits and spend it on food and health cares. Following the linear relationship between income and health, an extra unit of income exerts the same impact on health regardless that income goes to poor or rich. In such situation, the income of poor population may rise which further improves the aggregate health status. This means that rising income inequality has negative impact on aggregate health status of population (Preston, 1975; Deaton, 2003; Babones, 2008). The most important channel through which income inequality worsens life expectancy is income inequality would reduce self-trust, social capital and efficiency. Moreover, the mechanism through which income inequality worsens health outcomes of the people is based on psychosocial hypothesis, relative income hypothesis and absolute income hypothesis (Wilkinson, 1996; Lynch et al. 2004; Mayer and Sarin, 2005).

Environmental quality is an important factor which has deep impact on human health of present and forthcoming generations, the way people value future is crucially affected by others moreover the present long life encourages people to become sympathetic to forthcoming generations. Therefore, if people expect to live longer, they care more for environment. Environmental degradation increases morbidity through natural resources depletion, water and air pollution and soils deterioration (Elo and Preston, 1992; Pope et al. 2004). This shows that environmental degradation may impact life expectancy in Pakistan.

Globalization is a process by which different societies and economies come closer to each and share their experiences of research and development. There are several channels through which globalization impact life expectancy. Globalization increases the movements of goods and services from country to country and the availability of food and lifesaving drugs become accessible to more population. Globalization can change the life style, spread information related to diseases and awareness related to human rights which are necessary for health life (Stroup, 2007; Bussmann, 2009).

Pakistan is a developing country facing the problem of low life expectancy, rising income inequality, rising environmental degradation, less access to globalization, poor health infrastructure, low quality and less amount of per capita food and rising economic misery. The motivation behind this study, in last few years many social scientists in Pakistan are much worried about socio-economic impacts of income inequality, environmental degradation and globalization. But there is hardly any study which investigates the impact of inequality, globalization and environmental degradation on life expectancy in Pakistan. The main objective of study in hand, it will give the depth how income inequality, environmental degradation and globalization impact on life expectancy in Pakistan. The study is healthy contribution in respective literature and help policymakers to set policy targets for enhancing life expectancy in Pakistan.

LITERATURE REVIEW

Numerous studies are available in theoretical and empirical literature which examines the determinants of life expectancy in case of developed and developing countries. Auster et al. (1969), by using population production function, investigated the effects of health care and environmental factors on mortality. Grossman (1972) mentions that macroeconomic factors are responsible for living standard and expected life time. Roger (1979) gives conceptual framework how income impact life expectancy. Rogers and Wofford (1989) investigated the six main determinants of life expectancy for 95 developing nations. 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 for developing nations. Davies and Kuhn (1992) found health intake and availability of food determine the health outcomes. They conclude that investment in health sector, social security programs decide the mortality rate or life expectancy. Barro and Sala-i-Martin (1995) investigate the impact of economic growth on life expectancy, they found that economic growth has positive impact on life expectancy and vice-versa. Williamson (1996) examine the impact of health cares on mortality rate, moreover they conclude that behavior and availability have detrimental impact on life expectancy. Kalediene and Petrauskiene (2000) investigated that urbanization is one of

the important indicators of life expectancy for both developed and developing nations. They claimed that the population of urban areas has better medical cares, better education opportunities and improved socio-economic infrastructure which have positive impact on the health.

Grosse and Perry (1982), Fayissa and Gutema (2005), Kabir (2008) claim that income, education, nutritional status and public health measure are responsible for life expectancy in case of less developed countries. Shaw et al., (2005) investigate the determinants of life expectancy in case of OECD over the period of 1960 to 1999. They found per capita use of pharmaceuticals, vegetables, fruits and butter have positive relationship with life expectancy whereas the consumption of tobacco and alcohol has negative relationship with life expectancy.

Cemieux et al., (1999) examine the impact of public health spending on life expectancy in Canada. They found that lower health spending has low life expectancy whereas low health spending has high infant mortality in Canada. Gulis (2000) investigates the determinants of life expectancy for 156 countries. He found per capita income, health spending, safe drinking water; calorie intake and literacy are the main determinants of life expectancy. Macfarlane et al., (2000) investigated that safe drinking water is an important determinants of life expectancy in case of developing nations. On the base of empirical data of Africa and Asian they found that those parts where safe drinking water is in easy access the life expectancy is high rather than where safe drinking water is not easily available. Veugelers et al., (2001) found that education plays important role in improving the life expectancy in case of Canada. He used multi-level logistic regressions for his analysis.

Kruger et al., (2007) examine the impact of environmental amenities and natural resources on human health. They use open space, scenic beauty, land use diversity and outdoor resources for leisure as amenities. They found natural environmental has detrimental impact on life expectancy, as it increase recreational satisfactions and physical fitness of human being.

Owen and Wu (2007) analyze the relationship between globalization and mortality rate over the period of 1960 to 1995 for 219 countries. They found globalization has negative relationship with infant mortality rate and positive association with life expectancy. Their findings support the positive correlation between globalization and life expectancy that is attributed to knowledge spillovers. Bussmann (2009) investigate the relationship with economic integration, health cares and female life expectancy in case of developing countries. He found female life expectancy is not effected by globalization in case of developing countries.

Ali and Khalil (2014) has investigated the impact of food production, school enrollment, inflation, population growth, per capita income and CO2 emissions on life expectancy for Sultanate of Oman over the period of 1970 to 2012. The estimated results reveal that food production, school enrollment has positive and significant relationship with life expectancy for Sultanate of Oman. On the other hand inflation and per capita income has negative but insignificant relationship with life expectancy for Sultanate of Oman. The results show population growth has negative and significant relationship with life expectancy of Sultanate of Oman. In long run CO2 emissions has positive and insignificant relationship with life expectancy but in short run it has negative and significant relationship with life expectancy. The findings

suggest that government of Sultanate of Oman should seriously check these socio-economic factors for increasing life expectancy.

DATA SOURCES AND THEORETICAL FRAMEWORK

In this study time series data is used from 1980 to 2015 in case of Pakistan. This study is investigating the impact of income inequality, globalization, environmental degradation, health infrastructure, availability of food and economic misery on life expectancy in Pakistan. The data for life expectancy is taken from World Development Indicators. Gini-coefficient is used for measuring income inequality in case of Pakistan, the data for income inequality is taken from various publications of Pakistan Bureau of Statistics. The data for globalization is taken from Freedom House various publications. Globalization is composite index of economic globalization, social globalization and political globalization. CO2 is used for measuring environmental degradation in Pakistan, the data for CO2 emissions is taken from World Development Indicators. Health infrastructure is composite index of total hospitals, health care center and total number of beds, dispensaries, TB centers, rural health centers, total number of doctors and total number of nurses. Health infrastructure index is constructed by using principle component method and data for all the variables of health infrastructure index is taken from various issues of Economic Survey of Pakistan. The availability of food is food production index and the data for food index is taken from World Development Indicators. Economic misery is the composite index of inflation and unemployment which is constructed by using weighted average method. The data for unemployment and inflation is taken from various issues of Economic Survey of Pakistan.

A nation's health status is derived from health production function that have some socio-economic inputs and some outputs. The inputs of health production function are health cares, level of income, level of education, quality of environment, life style, health and medical expenditures following some genetic factors and outputs are life expectancy and reduced morbidity. Grossman (1972) develops the health production function and mentions that people decides the outcomes of health as they have choice for food and health cares. He also mentions that people are the constrained in health, as they have occupancy of financial resources, natural resources. Medez and Popkin (2004) and Deaton (2003) mention that globalization change the style of diet intake and health related knowledge of general public. Mayer and Sarin (2005) explain how income inequality impact population health and become cause for reducing life expectancy. Ali (2015) investigates the impact of macroeconomic instability on social progress in case of Pakistan. So following the methodology of Grossman (1972), Mayer and Sarin (2005) and Ali (2015) the model of the study is as:

$$LEX = F(GINI, GLOB, CO2, \mathrm{HI}, \mathrm{FOOD}, \mathrm{MI}) \quad (1)$$

Where
LEX= life expectancy
GINI= income inequality
GLOB= globalization
CO2= environmental degradation
HI= health infrastructure
FOOD= availability of food
MI= economic misery

The model can be written in following regression form:

$$LEX_t = \alpha_0 + \alpha_1 GINI_t + \alpha_2 LGLOB_t + \alpha_3 CO2_t + \alpha_4 \mathrm{HI}_t + \alpha_5 \mathrm{LFOOD}_t + \alpha_6 \mathrm{MI}_t + \varepsilon_t \quad (2)$$

Where t is time period and ε is for error term

ECONOMETRIC METHODOLOGY

Nelson and Ploser (1982) mention normally most of time series data have unit root problem which makes regression results spurious. Moreover, stationarity of the time series data is necessary for examining the cointegration among the variables of the model. In this study we use life expectancy as dependent variable and income inequality, globalization, environmental degradation, health infrastructure, availability of food and economic misery are independent variable. There are number of unit root tests are available for removing non-stationarity problem in time series data. The well know are Dickey-Fuller (DF) (1979), Augmented Dickey-Fuller (ADF) (1981), Perron (1989), Zivot and Andrews (ZA) (1992) and Phillips Perron (PP) (1988). We use ADF (1981) and PP (1988) for removing unit root problem in our data test. In order to reduce autocorrelation ADF uses an extra lags of dependent variables as explanatory variable. The possible equation of ADF are as follow:

$$\Delta Y_t = \delta Y_{t-1} + \sum_{j=1}^{q} \phi_j \Delta Y_{t-j} + e_t \quad (3)$$

The null hypothesis in the data is non stationary.

With the help of OLS compute τ statistic of Y_{t-1} and compare it with critical τ values. If calculated τ is greater than the critical τ reject null hypothesis and accept alternative. We can conclude data is stationary and vice-versa is non-stationary.

The two main restrictions while applying ADF unit root test are there must be constant variance and uncorrected error term. But the main quality of PP test it has less restrictions for error correction process. We follow the process for PP:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + u_t \quad (4)$$

The δ value will give information about the unit root problem in data. For rejection and acceptance of null hypothesis we use Mackinnon (1991) critical value.

AUTO-REGRESSIVE DISTRIBUTED LAG (ARDL)

Once the stationarity of the data is confirmed we can find cointegration among life expectancy, income inequality, globalization, carbon emissions, health infrastructure, availability of food and economic misery in case of Pakistan over the period of 1980-2015. There are number of cointeration tests available such as Engle-Granger (1987), Johansen (1991/1992), Johansen-Juselious (1990), Perron (1989, 1997) and Leybourne and Newbold (2003). But we use Autoregressive Distributive Lag (ARDL) bound testing approach developed by Pesaran et al., (2001) for empirical analysis. ARDL method has number of advantages over traditional co-integration techniques. Such as being applied on mix order of integration and better results for small sample size data. Autoregressive distributed lag model follows the following procedure:

$$\Delta LEX_t = \alpha_1 + \alpha_2 t + \alpha_3 LEX_{t-1} + \alpha_4 GINI_{t-1} + \alpha_5 LGLOB_{t-1} + \alpha_6 CO2_{t-1}$$
$$+\alpha_7 HI_{t-1} + \alpha_8 LFOOD_{t-1} + \alpha_9 MI_{t-1} + \sum_{h=1}^{p} \beta_h \Delta LEX_{t-h} + \sum_{j=0}^{p} \gamma_j \Delta GINI_{t-j}$$
$$+ \sum_{k=0}^{p} \phi_k \Delta LGLOB_{t-k} + \sum_{m=0}^{p} \phi_m \Delta CO2_{t-m} + \sum_{n=0}^{p} \phi_n \Delta HI_{t-n} \sum_{f=0}^{p} \phi_f \Delta LFOOD_{t-f} + \sum_{s=0}^{p} \phi_s \Delta MI_{t-s} + u_{it} \quad (5)$$

$H_0 : \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = \alpha_7 = \alpha_8 = \alpha_9 = 0$ (no co-integration among the variables)
$H_A : \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq \alpha_7 \neq \alpha_8 \neq \alpha_9 \neq 0$(co-integration among variables)

We will compare the estimated F-Statistic with upper bound value of Pesaran and Pesaran (1997) or Pesaran, Shin and Smith (2001). If calculated F-test statistic is greater than the upper bound value, the null hypothesis of no co-integration is rejected. We conclude, there is cointegration among the variables of the model. The study will test the long run cointegrational relationship among life expectancy, income inequality, globalization, carbon emissions, health infrastructure, availability of food and economic misery. Then Vector Error Correction Model (VECM) will use for short dynamic among the variables. VECM procedure is as under:

$$\Delta LEX_{it} = \alpha_1 + \alpha_2 t + \sum_{h=1}^{p} \beta_h \Delta LEX_{t-h} + \sum_{j=0}^{p} \gamma_j \Delta GINI_{t-j} + \sum_{k=0}^{p} \phi_k \Delta LGLOB_{t-k}$$
$$+ \sum_{m=0}^{p} \phi_m \Delta CO2_{t-m} + \sum_{n=0}^{p} \phi_n \Delta HI_{t-n} \sum_{f=0}^{p} \phi_f \Delta LFOOD_{t-f} + \sum_{s=0}^{p} \phi_s \Delta MI_{t-s} + \omega ECT_{t-1} + u_t \quad (6)$$

ECT_{t-1} represents one time period lagged error correction term. ECM explains the speed of adjustment from short run to long run. For investigating the optimal lag length Schwarz Information Criteria (SIC) or Akaike's Final Prediction Error (FPE) are used.

GRANGER CAUSALITY AND THE VECTOR AUTOREGRESSIVE MODEL

The Granger Causality test Engle and Granger (1987) and Granger (1988) introduced Granger causality test for finding causal relationship among variables. In this study we are going to test the causal relationship among life expectancy, income inequality, globalization, carbon emissions, health infrastructure, availability of food and economic misery in case of Pakistan over the period of 1980 to 2015. By using Granger causality following methodology is adopted:

$$X_{it} = \alpha_1 + \sum_{i=1}^{q} \beta_i Y_{it-i} + \varepsilon_t \quad (7)$$

$$Y_{it} = \alpha_1 + \sum_{i=1}^{q} \theta_i X_{it-i} + v_t \quad (8)$$

For checking the equation (7) we find X variable Granger causes to Y if $H_0 : \beta_i = o$ there is no causal relationship but H_A : at least one $\beta_i \neq o$ there is causal relationship and for equation (8)

Y variable Granger cause to X if $H_0 : \theta_i = o$ there is no causal relationship but H_A : at least one $\theta_i \neq o$ there is causal relationship between variables.

EMPIRICAL RESULTS AND DISCUSSION

The results of descriptive statistics and pair-wise correlation among the variables of the model are presented in table- 1. The results of the table- 1 show life expectancy, income inequality, globalization, carbon emissions, health infrastructure, availability of food and economic misery are normally distributed. Jarque-Bera statistics confirms the normality of the variables as the values of Jarque-Bera are insignificant which means all variables of the model have finite covariance and zero mean. Thus we conclude that time series data of all the variables are normally distributed.

Table. 1
Descriptive Statistics and Correlation Matrix

	LEX	GINI	LGLOB	CO2	HI	LFOOD	MI
Mean	61.27919	0.352917	3.660146	0.721820	1.40398	4.297941	0.382981
Median	61.27707	0.367667	3.673784	0.736694	1.590683	4.370334	0.443562
Maximum	65.81222	0.410000	4.041778	1.101745	2.285176	4.780373	0.730843
Minimum	55.11707	0.275200	3.269124	0.387303	0.028571	3.674781	0.050860
Std. Dev.	3.439667	0.043752	0.280044	0.209207	0.677047	0.342789	0.178109
Skewness	-0.147417	-0.280435	-0.159257	0.240665	-0.656928	-0.273344	-0.312036
Kurtosis	1.685277	1.800503	1.497026	2.150223	2.254281	1.836391	2.065087
Jarque-Bera	2.496207	2.410883	3.245525	1.311476	3.138182	2.272674	1.737352
Probability	0.287049	0.299560	0.197353	0.519059	0.208234	0.320993	0.419507
Sum	2022.213	11.64625	120.7848	23.82005	46.21313	141.8320	12.63837
Sum Sq. Dev.	378.6019	0.061255	2.509588	1.400556	14.66855	3.760140	1.015130
Observations	33	33	33	33	33	33	33
LEX	1.00						
GINI	-0.60 (-4.24)***	1.00					
LGLOB	0.98 (30.35)***	-0.56 (-3.77)***	1.00				
CO2	0.96 (20.22)***	-0.51 (-3.30)***	0.65 (7.42)***	1.00			
HI	0.96 (20.43)***	-0.43 (-2.68)**	0.65 (7.84)***	0.65 (7.03)***	1.00		
LFOOD	0.98 (36.53)***	-0.49 (-3.20)***	0.68 (8.34)***	0.67 (8.99)***	0.68 (9.20)***	1.00	
MI	0.74 (6.27)***	-0.35 (-1.98)*	0.79 (7.21)***	0.72 (5.89)***	0.75 (6.40)***	0.76 (6.55)***	1.00

The results of pair-wise correlation among the variables are presented in the lower part of the table- 1. The results showed that "income inequality" has negative and significant correlation with life expectancy in Pakistan. Whereas globalization, environmental degradation, health infrastructure, availability of food and economic misery has positive and significant correlation with life expectancy in Pakistan. The results show globalization, environmental degradation, health infrastructure, availability of food and economic misery has negative and significant correlation with income inequality in Pakistan. The results reveal that environmental degradation, health infrastructure, availability of food and economic misery has positive and significant correlation with globalization in case of Pakistan. The estimated results show health infrastructure, availability of food and economic misery has positive and significant relationship with environmental degradation in Pakistan. There is positive and significant correlation with economic misery and availability of food in Pakistan. The overall results of pair-wise correlation show that our life expectancy our dependent variable has positive and significant correlation with most of independent variables of the model.

THE RESULTS OF UNIT ROOT TEST

Table. 2
Unit Root Tests

Variables	ADF	PP
LEX	-3.129177**	-2.799385*
GINI	-2.052709	-1.433104
LGLOB	-0.473254	-0.172798
CO2	-1.992714	-1.560738
HI	-5.420642***	-12.77677***
LFOOD	-2.134677*	-2.706073*
MI	-1.488616	-1.872249
At First Difference		
ΔLEX	-4.076244***	-4.092179***
ΔGINI	-3.973495***	-2.990615**
ΔGLOB	-5.856768***	-5.856768***
ΔCO2	-7.905835***	-7.563055***
ΔHI	-11.67157***	-10.87169***
ΔFOOD	-5.415577***	-5.415577***
ΔMI	-6.773534***	-6.819814***
Note: The asterisks ***, ** and * denote the significant at %1, 5% and 10% levels, respectively.		

The stationarity of the time series data is necessary for examining the cointegational relationship among the variables of the model, as most of the time series data has unit root problem which makes regression results spurious. In this study we use ADF and PP unit root test for solving the unit root problem in our time series data. The estimated results of unit root are presented in table-2. The results of both ADF and PP show life expectancy, health infrastructure and availability of food are stationary at level. Whereas income inequality, globalization, environmental degradation and economic misery are not stationary at level so we cannot reject null hypothesis of non-stationary for all variables. But after taking first difference all the variables become

stationary and we reject null hypothesis and accept alternative hypothesis. This shows that life expectancy, income inequality, globalization, environmental degradation, health infrastructure, availability of food and economic misery has mixed order of integration which is suitable for applying ARDL bound testing approach to cointegration.

LAG LENGTH SELECTION

The results of lag length criterions are presented in table- 3. For the lag selection sequential modified LR test statistic (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ) are used. On the sequential modified LR test statistic (LR), Final prediction error (FPE), Akaike information criterion (AIC) and Schwarz information criterion (SC) maximum lag length 2, is selected.

Table. 3
VAR Lag Order Selection Criteria

Endogenous variables: LEX GINI GLOB CO2 HI FOOD MI

Exogenous variables: C

Sample: 1980 2015

Included observations: 33

Lag	LogL	LR	FPE	AIC	SC	HQ
0	209.0997	NA	3.32e-15	-13.47331	-13.14636	-13.36872
1	430.0176	324.0130	3.84e-20	-24.93450	-22.31894	-24.09776
2	506.8359	76.81833*	1.09e-20*	-26.78906*	-21.88487*	-25.22017
3	652.5668	77.72312	1.48e-22	-33.23778	-26.04497	-30.93674*

* 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

RESULTS OF CO-INTEGRATION TEST

Table. 4
ARDL Bounds Testing Approach

Dependent Variable LEX
ARDL(1,0,1,0,0,0,0)

Critical Value	F-Statistics 3.8602		W-statistic 27.0216	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
95%	2.9408	4.3589	20.5855	30.5121
90%	2.4429	3.6988	17.1001	25.8914

ARDL cointegration method is applied for investigating the cointegration among life expectancy, income inequality, globalization, environmental degradation, health infrastructure, availability of food and economic misery in case of Pakistan over the period of 1980-2015. The null hypothesis of no co-integration is tested with the help of F-statistic and W-statistic. The calculated F-

statistic 3.8602 is greater than the upper bound 3.6988 value of Pesaran, Shin and Smith (2001) at 10 percent, the calculated W-statistic 27.0216 is greater than the upper bound 25.8914 value of Pesaran, Shin and Smith (2001) at 10 percent. The null hypothesis of no co-integration is rejected and alternative is accepted. This shows life expectancy, income inequality, globalization, environmental degradation, health infrastructure, availability of food and economic misery have cointegrational relationship in case of Pakistan.

After examining the cointegration among the variables of the model, now we can examine the long run relationship when life expectancy is the dependent variable and income inequality, globalization, environmental degradation, health infrastructure, availability of food and economic misery are the independent variables. The long run results of the model is presented in table- 5. The results show that there is a negative and significant relationship between income inequality and life expectancy in Pakistan. The results show that a 1 percent increase in income inequality leads 8.7759 percent decrease in life expectancy in Pakistan. The estimated results show that globalization has positive and significant relationship with life expectancy. The results reveal that a 1 percent increase in globalization leads 5.6079 percent increase in life expectancy in case of Pakistan. The coefficient of environmental degradation show that there is a negative and significant relationship between environmental degradation and life expectancy. The results show that a 1 percent increase in environmental degradation brings 5.2646 percent decrease in life expectancy in Pakistan. There is a positive and insignificant relationship between health infrastructure and life expectancy in Pakistan. The estimated results show there is a positive and significant relationship between the availability of food and life expectancy. The results show that a 1 percent increase in available food bring 5.8041 percent increase in life expectancy in Pakistan. There is negative and significant relationship between economic misery and life expectancy. The coefficient of economic misery shows 1 percent increase in economic misery bring 1.1989 percent decline in life expectancy in case of Pakistan. The overall long run results reveal that rising income inequality, environmental degradation and economic misery decreased life expectancy in Pakistan. Whereas rising globalization, health infrastructure and available food bring positive increase in life expectancy in Pakistan.

Table. 5
Estimated Long Run Coefficients using the ARDL Approach
ARDL(1,0,1,0,0,0,0)
Dependent variable is LEX
Time Period 1981-2015

Regressor	Co-efficients	Standar d-Error	T-Ratio (Prob)
GINI	-8.7759	2.7219	-3.2242[.004]
LGLOB	5.6079	2.5891	2.1659[.041]
CO2	-5.2646	2.7635	-1.9051[.069]
HI	1.1110	.77395	1.4355[.165]
LFOOD	5.8041	2.8442	2.0407[.053]
MI	-1.1989	.88507	-1.9545[.089]
C	22.5060	7.1731	3.1376[.005]

The results of short run dynamics are reported in table- 6. The estimated results reveal that income inequality has negative and significant relationship with life expectancy. The results reveal that a 1 percent increase in income inequality results in a 2.9662 percent decrease in life expectancy in Pakistan. The short run results show that globalization has negative and insignificant relationship with life expectancy in Pakistan. The short run results reveal there is negative and significant relationship between environmental degradation and life expectancy. The estimated results show a 1 percent increase in environmental would result in 1.7794 percent decrease in life expectancy in Pakistan. The coefficient of health infrastructure shows there is positive and insignificant relationship between health infrastructure and life expectancy in Pakistan. The availability of food has positive and significant relationship with life expectancy, the results show that a 1 percent increase in available food bring 1.9618 percent increase in life expectancy in Pakistan. The economic misery has a negative and insignificant relationship with life expectancy in the case of Pakistan. The negative and statistically significant value of ECM_{t-1}, -0.33800 leads to support a long run relationship among the series in case of Pakistan. The coefficient is statistically significant at 1% level and significant value of ECM shows the speed of adjustment from short run to long run. The short run deviations from the long run equilibrium are corrected by 33.80% towards long run equilibrium path each year.

Table. 6
Error Correction Representation for the Selected ARDL Model
ARDL(1,0,1,0,0,0,0)
Dependent variable is dLEX
Time Period 1981-2015

Regressor	Co-efficients	Standard-Error	T-Ratio (Prob)
dGINI	-2.9662	1.5180	-1.9541[.062]
dLGLOB	-1.3388	1.0784	-1.2414[.226]
dCO2	-1.7794	.65169	-2.7305[.012]
dHI	.37553	.25681	1.4623[.157]
dLFOOD	1.9618	1.2395	1.9827[.027]
dMI	-.40521	.27076	-1.4966[.148]
ECM(-1)	-.33800	.11006	-3.0710[.005]

R-Squared .65178 R-Bar-Squared .53066
S.E. of Regression .15121 F-Stat. F(7,24) 6.1500[.000]
Mean of Dependent Variable .33422 S.D. of Dependent Variable .22072
Residual Sum of Squares .52588 Equation Log-likelihood 20.3286
Akaike Info. Criterion 11.3286 Schwarz Bayesian Criterion 4.7328
DW-statistic 2.3172

The diagnostic tests are used for checking the serial correlation, functional form, normality and Heteroscedasticity among the variables of the model. The results of diagnostic tests are reported in table- 7. The results shows that there is no serial correlation and heteroscedasticiy problem in data. Moreover, the variables of the model have a correct functional form and the time series data is normally distributed.

The stability of the long and short run parameters of the model is of great importance and measuring stability Brown et al. (1975) proposed the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMsq). The cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMsq) are presented in figure 1 and figure 2. The plot of the CUSUM is within the line and significant at 5 percent and the plot of the CUSUMsq is within the line and significant at 5 percent. This ensures the stability of the long and short run coefficients.

Table. 7
Diagnostic Tests

Test Statistics	LM-Version	F-Version
A-Serial Correlation CHSQ(1)	1.2774[.258]*F(1,22)*	.91475[.349]*
B-Functional Form CHSQ(1)	.37676[.539]*F(1,22)*	.26211[.614]*
C-Normality CHSQ(2)	1.3313[.514]*	Not- applicable
D-Heteroscedasticity CHSQ(1)	1.0358[.309]*F(1,30)*	1.0036[.324]*

A: Lagrange multiplier test of residual serial correlation
B: Ramsey's RESET test using the square of the fitted values
C: Based on a test of Skewness and kurtosis of residuals
D: Based on the regression of squared residuals on squared fitted values

Figure- 1

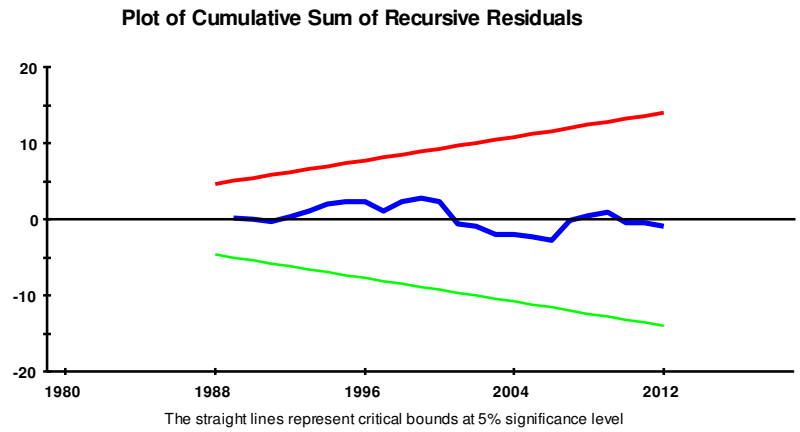
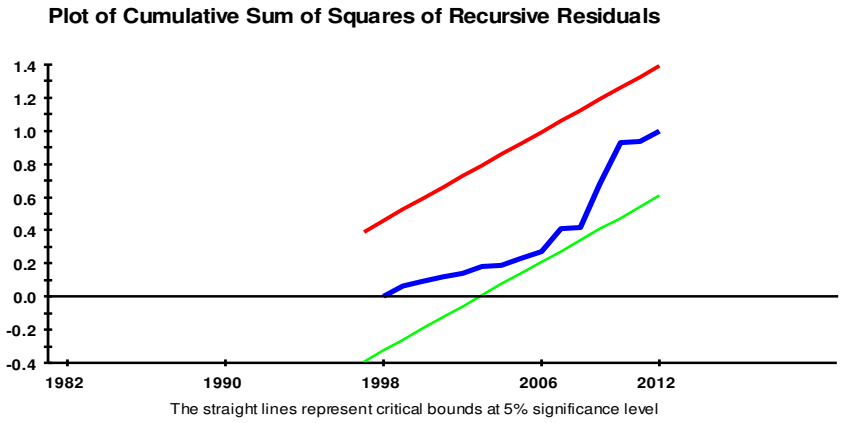


Figure- 2



GANGER CAUSALITY RESULTS

The results of Granger causality are reported in table- 8. The results show there is unidirectional causality is running from income inequality to life expectancy in Pakistan. The estimated results show that income inequality also causes environmental degradation in case of Pakistan. There is a unidirectional causality that runs from globalization to life expectancy in Pakistan. The results show there is unidirectional causal relationship between globalization and economic misery in Pakistan. The estimated results show environmental degradation has unidirectional causal relationship to life expectancy in Pakistan. There is a unidirectional causality that runs from health infrastructure to life expectancy in Pakistan. Health infrastructure also causes globalization in Pakistan. There is unidirectional causality that runs from available food to life expectancy in Pakistan. The results show that "available food" also causes globalization, environmental and health infrastructure in Pakistan. The results show that economic misery has unidirectional causal relationship with life expectancy and income inequality in Pakistan. The overall Granger causality results show all the independent variables that are income inequality, globalization, environmental degradation, health infrastructure, availability of food and economic misery have unidirectional causal relationship with life expectancy in case of Pakistan over the selected time period.

Table. 8
Direction of Granger Causality

Variables	LEX	GINI	LGLOB	CO2	HI	LFOOD	MI
LEX		1.08734	0.75199	1.84217	0.70128	0.48605	0.49202
GINI	8.41699***		0.58697	3.36482**	0.87661	1.57413	0.09696
LGLOB	4.48679**	1.21407		0.49852	0.06255	0.16684	3.71845**
CO2	3.18746**	1.26401	0.67443		0.62914	0.94264	1.64780
HI	2.00128*	0.98340	5.74820***	0.66358		1.78520	3.19189
LFOOD	2.34704*	0.54092	5.54210***	1.91073*	2.52986*		2.29933
MI	1.84541*	1.94852*	1.01118	1.15071	2.30998	0.43382	
Note: *, ** and *** show significance at 10, 5 and 1 per cent levels respectively.							

CONCLUSIONS AND POLICY IMPLICATIONS

This study has investigated the impact of income inequality, globalization, environmental degradation, health infrastructure, availability of food and economic misery on life expectancy in Pakistan. We apply ADF and PP unit root tests for examining the stationarity of the variables. We use ARDL bound testing approach for investigating the cointegration among the variables of the model. The long run results show income inequality, environmental degradation and economic misery has negative and significant impact on life expectancy in Pakistan. The long run results reveal globalization and availability of food has positive and significant impact on life expectancy in Pakistan. Whereas health infrastructure has positive but insignificant impact on life expectancy in Pakistan. In the short run income inequality and environmental degradation has negative and significant impact on life expectancy in Pakistan. The short run results indicate availability of food has positive and significant impact on life expectancy in case of Pakistan. In comparison to long run the short run results indicate that globalization and economic misery have negative but insignificant impact on life expectancy in Pakistan. The results of Granger causality shows there is unidirectional causality is running from income inequality, globalization, environmental degradation, health infrastructure, availability of food and economic misery to life expectancy in Pakistan.

On the basis of the above results and conclusions we can recommend some policy suggestions for improving life expectancy in Pakistan. Income inequality, environmental degradation and globalization would be significant policy options to enhance life expectancy in Pakistan. The policymakers should try to off the negative effects of income inequality and environmental degradation and adopt the positive effects of globalization. Moreover, by reducing the economic misery and increasing the availability of food to the general public, the policymakers will get an increase in the level of life expectancy in Pakistan.

REFERENCES

Ali, A. (2015), The Impact of Macroeconomic Instability on Social Progress: An Empirical Analysis of Pakistan. *Doctoral dissertation. National College of Business Administration and Economics (NCBAE)*, Lahore (Pakistan).

Ali, A., and Ahmad, K. (2014). The Impact of Socio-Economic Factors on Life Expectancy in Sultanate of Oman: An Empirical Analysis. *Middle-East Journal of Scientific Research*, *22*(2), 218-224.

Auster, R. Leveson, I. Sarachek, S. (1969). The production of health: an exploratory study. *Journal of Human Resources*, 4, 411–436.

Barro, R. J. Sala-I-Martin, X. I. (1995). Economic Growth. McGraw-Hill, New York.

Babones, S. J. (2008). Income inequality and population health: Correlation and causality. *Social Science & Medicine*, 66, 1614-1626

Bussmann, M. (2009). The effect of trade openness on women's welfare and work life. *World Development*, 37(6), 1027–1038.

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.

Davies, J. B. and Kuhn, P. (1992). Social security, longevity, and moral hazard. *Journal of Public Economics* 49, 91–106.

Deaton, A. (2003). Health, inequality, and economic development. *Journal of Economic Literature*, 41, 113-158.

Dickey, D. and W. Fuller (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of the American Statistical Association*, 74, 427-431.

Dickey, D. and Fuller, W. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica*, 49, 1057-1072.

Engle, R. F. and Granger, C. W. J. (1987). Co-integration and Error Representation: Estimation and Testing. *Econometrica*, 55(2), 251-276.

Elo, I. T. and Preston, S.H. (1992). Effects of early-life conditions on adult mortality: a review. *Population Index*, 58(2), 186-212.

Fayissa, B. and Gutema, P. (2005). Estimating a health production function for Sub-Saharan Africa (SSA). *Applied Economics*, 37(2), 155–164.

Granger, C. W. (1988). Some recent development in a concept of causality. *Journal of econometrics*, 39(1), 199-211.

Grossman, M. (1972). On the concept of health capital and the demand for health. *J Political Econ*, 80, 223–255.

Grosse, R. N. and Perry, B. H. (1982). Correlates of life expectancy in less developed countries. *Health Policy and Education*, 2(3–4), 275–304.

Gulis, G. (2000). Life expectancy as an indicator of environmental health. *European Journal of Epidemiology*, 16(2), 161-165.

Johansen, S. (1991). Estimation and Hypothesis Testing of Co-integration Vectors in Gaussian Vector Autoregressive models. *Econometrica*, 59(6), 1551-1580.

Johansen, S. (1992). Co-integration in Partial Systems and the Efficiency of Single-Equation Analysis. *Journal of Econometric*, 52(3), 389-402.

Johansen, S. and Juselius, K. (1990). Maximum Likelihood Estimation and Inference on Co-integration with Applications to the Demand for money. *Oxford Bulletin of Economics and Statistics*, 52(2), 169-210.

Kabir, M. (2008). Determinants of life expectancy in developing countries. *The Journal of Developing Areas,* 41, 185–204.

Kalediene, R. and Petrauskiene, J. (2000). Regional life expectancy patterns in Lithuania. *European Journal of Public Health*, 10, 101-104.

Kruger, J. Mowen, A. J. and Librett, J. (2007). Recreation, parks, and the public health agenda: developing collaborative surveillance frameworks to measure leisure time activity and active park use. *Journal of Physical Activity and Health*, 4(1), 14–23.

Leybourne, S. and Newbold, P. (2003). Spurious Rejections by Co-integration Tests induced by Structural Breaks. *Applied Economics*, 35(9), 1117-1121.

Lynch, J. Smith, G. D. Harper, S. Hillemeier, M. Ross, N. and Kaplan, G. A. (2004). Is income inequality a determinant of population health? Part 1. A systematic review. *Milbank Quarterly*, 82, 5-99.

Mackinnon, J. G. (1992). Critical values for cointegration test, in long-run economic relationships, readings in cointegration, eds. R.F. Engle and C.W.J. Granger, New York: Oxford University Press, 266-276.

Macfarlane, S. Racelis, M. and MuliMusiime, F. (2000). Public health in developing countries. *Lancet,* 356(2), 841-846.

Mayer, S. E. and Sarin, A. (2005). Some mechanisms linking economic inequality and infant mortality. *Social Science and Medecine*, 60, 439-455.

Medez, A. and Popkin, B. M. (2004). Globalization, urbanization and nutritional change in the developing world. *Journal of Agricultural and Development Economics*, 1(2), 220–241.

Nelson, C. R. and Plosser, C. R. (1982). Trends and random walks in macroeconomic time series: some evidence and implications. *Journal of monetary economics*, *10*(2), 139-162.

Owen, A. L., and Wu, S. (2007). Is trade good for your health? *Review of International Economics*, 15(4), 660–682.

Perron, P. (1989). The Great Crash, the Oil Shock, and the Unit Root Hypothesis. *Econometrica*, 57(6), 1361-1401.

Perron, P. (1997). Further Evidence of Breaking Trend Functions in Macroeconomic Variables. *Journal of Econometrics*, 80(2), 355-385.

Pesaran, M. H. and Pesaran, B. (1997). Working with Microfit 4.0: Interactive Econometric Analysis. Oxford: Oxford University Press.

Pesaran, M. H. Shin, Y. Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Economics*, 16, 289-326.

Phillips, P. and Perron, P. (1988). Testing for a Unit Root in Time Series Regression. *Biometrica*, 75(2), 335-346.

Preston, S. H. (1975). The Changing Relation between Mortality and Level of Economic Development. *Population Studies*, 29(2), 231-248.

Pope, C. A. III, R.T. Burnett, G.D. Thurston, M.J. Thun, E.E. Calle, D. Krewski and J.J. Godleski (2004). Cardiovascular mortality and long term exposure to particulate air pollution: epidemiological evidence of general pathophysiological pathways of disease. *Circulation*, 109(1), 71-77.

Rogers, G. B. (1979). Income and inequality as determinants of mortality: an international cross-section analysis. *Population Studies*, 33(3), 343-351.

Rogers, R. G. and Wofford, S. (1989). Life expectancy in less developed countries: socio-economic development or public health? *Journal of Bio-sociological Science*, 21(2), 245-252.

Shaw, J. W. Horrace, W. C. and Vogel, R. J. (2005). The determinants of life expectancy: An analysis of the OECD health data. *Southern Economic Journal*, 71, 768–783.

Stroup, M. D. (2007). Economic freedom, democracy, and the quality of life. *World Development*, 35, 52–66.

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.

Wilkinson, R. G. (1996) Unhealthy Societies: the Afflictions of Inequality, London, England: Routledge.

Zivot, E. and Andrews, D. W. K. (1992). Further Evidence on the Great Crash, the Oil Price Shock and the Unit Root Hypothesis. *Journal of Business and Economic Statistics*, 10, 251-270.