Pakistan Institute of Development Economics

CERTIFICATE

This is to certify that this thesis entitled: **"The Socio Economic Determinants of Life of Expectancy: A Panel Analysis of High, Middle and Low Income Countries."** submitted by Mr. Muhammad Tahir is accepted in its present form by the Department of Economics, Pakistan Institute of Development Economics (PIDE), Islamabad as satisfying the requirements for partial fulfillment of the degree of M.Phil in Health Economics.

Supervisor:

Dr. Shujaat Farooq
Director BISP
Islamabad

Co. Supervisor:

Dr. Mahmood Khalid
Senior Research Economist
PIDE, Islamabad.

Internal Examiner:

Dr. Ashan ul Haq
Assistant Professor
PIDE, Islamabad

External Examiner:

Dr. Shahzad Ai Khan
Associate Professor
(HSA) Islamabad

Head, Department of Economics:

Dr. Attiya.Y. Javid

Date of Examination: January 06, 2017

THE SOCIO-ECONOMIC DETERMINANTS OF LIFE EXPECTANCY: A PANEL ANALYSIS OF HIGH, MIDDLE AND LOW INCOME COUNTRIES

By

Muhammad Tahir

Registration NO. 06/MS-HE/PIDE/2014

Supervised by

Dr. Shujaat Farooq

Co -supervised by

Dr. Mahmood Khalid

Department of Health Economics
Pakistan Institute of Development Economics, Islamabad

بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

In The Name of Allah, The Most Beneficent and The Most Merciful

كُلُّ نَفْسٍ ذَائِقَةُ الْمَوْتِ ۗ وَإِنَّمَا تُوَفَّوْنَ أُجُورَكُمْ يَوْمَ الْقِيَامَةِ ۖ فَمَن زُحْزِحَ عَنِ النَّارِ وَأُدْخِلَ الْجَنَّةَ فَقَدْ فَازَ ۗ وَمَا الْحَيَاةُ الدُّنْيَا إِلَّا مَتَاعُ الْغُرُورِ

Every soul shall taste of death. And you shall be paid in full your rewards only on the Day of Resurrection. So who so, ever is removed away from the Fire and is made to enter Heaven has indeed attained his goal. And the life of this world is nothing but an illusory enjoyment, (Al Imran 3:186).

The Almighty says, "Until, when death comes to one of them, he says, 'My Lord, send me back again. So that perhaps I may act rightly regarding the things I failed to do!' No indeed! It is just words he utters. Before them there is an interspace until the day they are raised up. Then when the Trumpet is blown, that Day there will be no family ties between them, they will not be able to question one another. Those whose scales are heavy; they are the successful. Those whose scales are light, they are the losers of their selves, remaining in Hell timelessly, forever. The Fire will sear their faces making them grimace horribly in it, their lips drawn back from their teeth. 'Were My Signs not recited to you and did you not deny them?'" to His words, "'How many years did you tarry on the earth?' They will say, 'We tarried for a day or part of a day. Ask those able to count!' He will say, 'You only tarried for a little while if you did but know! Did you suppose that We created you for amusement and that you would not return to Us? (W23:100-116; H23:99-115).

AL- HADITH

Golden Saying of the Holy Prophet

(Peace Be Upon Him)

Allah s Apostle (PBUH) said, "Keys of the unseen knowledge are five which nobody knows but Allah . . . nobody knows what will happen tomorrow; nobody knows what is in the womb; nobody knows what he will gain tomorrow; nobody knows at what place he will die; and nobody knows when it will rain." **(Narrated Ibn Umar).**

DEDICATATION

I am dedicated this thesis to my parents, brothers and sister and especially to my father **Arbab Nazir Ullah Khan** (late, 2006), brother **Arbab Shakeel Ahmad Khan** (late, 2012) and cousin **Tara Jabeen** (late, 2016-17), May Allah, rest their soul in peace Ameen.

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to Almighty Allah because without his blessings I would have been unable to complete this thesis. I am also thankful to my supervisor**, Dr**. **Shujaat Farooq** for his intellectual advice, guidance, and encouragement. The regular discussions from proposal writing till the final composition, were very valuable and inspiring at every step of this research. I thank him from the core of my heart. I am also thankful to my co-supervisor **Dr. Mahmood Khalid** for his valuable comments, guidance and suggestions. I thank him too, from the core of my heart. I am thankful to my parents whose prayers make difficulties of life into easiness. They always pray for my success. My special gratitude goes to my parents, my brothers **Dr. Arbab Zakir Ullah Jan, Arbab Shakeel Ahmad Khan, Arbab Irfan Ullah Jan and Arbab Zubair Ahmad** because without their support and trust the completion of this thesis would have been difficult. Especially thanks to **Arbab Irfan Ullah Jan**, because without his support today I may not be able to finalized my M Phil.

Last but not the least I am thankful to all my friends specially **Nabila Kanwal, Muhammad Azeem Sarwar, Zeeshan Khan, Sanaullah, Naeem Bahadar** and **Pervez Ahmad** they always support me with their kind suggestions and advises, thanks to all of them and May, Allah bless them all, at all times and flourished them with good nature.

Muhammad Tahir

Muhammadtahir_14@pide.edu.pk

Table of Contents **Page**

LIST 0F TABLES

LIST OF FIGURES

ABSTRACT

Long life signifies the well-being or higher living standard of a country. In modern era, life expectancy at birth has been considered as a key factor for the working age population and economic contribution in a country. The present study attempts to investigate the key determinates of life expectancy at birth among high, middle and low income countries. The empirical analysis is based on a panel of 50 countries over the period of 1990-2014. This impact has been examined for both aggregated and disaggregated level of samples by using dynamic Panel Autoregressive Distributive Lags Model (ARDL).

The long run results obtained for the aggregated samples suggested that there existed negative relationship among life expectancy and Co_2 emissions, population growth and urban population growth while positive relationship among life expectancy with other independent variables. The findings for the High Income Countries shows that in the long run there existed negative and significant relationship among life expectancy and Co_2 emission, while other variables had positively and significantly related with life expectancy, on short run only health expenditure had shown divergence to their original path.

In case of Middle Income Countries, in long run there exists negative relationship among life expectancy, disasters, and urban population growth, while other variables had shown positive effect on life expectancy. In short run only population growth shows that there exists a significant convergence. In case of Low Income Countries, the results suggested that there exists negative relationship in life expectancy with Co2 emission, disasters, and urban population growth. In contrast, there exist positive relationship among other variables with life expectancy. While coming to short run adjustment coefficients, no variable has shown the convergence to their mean paths in case of any shock.

Chapter 1 Introduction

1.1. Background and Introduction

Long life signifies the well-being or higher living standard of a country, as life expectancy has direct association with welfare, human health and economic development. In recent years, anticipated life shows increasing trends at world level though, their pace differs from country to country. This advancement in lifetime is attributable to higher operating and living environments, preventative likewise maternal care, increasing education, and rising per capita income. Life expectancy at birth additionally offers the main points of measuring the health standing of a nation that is suffering from several socio-economic and environmental aspects (Ali and Ahmad, 2014). In modern era, life expectancy has been considered as a key factor for the working age population and economic contribution in a country. There are also several key factors which can move the life expectancy including: economic process, the level of fertility, investment in human capital, intergenerational transfers, improvements in education, health, nutrition and social insurance demand (Ferda, 2010).

The key aim of any health policy is basically to promote the health status; of which one indicator is life expectancy at birth; hence, it is vital to ascertain the key aspects that add to the health of the population. So life expectancy at birth is outlined as a statistical measure of how long a person is expected to live, based on the year of their birth, their existing age and further demographic features as well as gender (WHO, 2015). As life expectancy at birth means the average number of years a person that he is expected to live, so it is considered as one of the critical measures of judging the economic as well as the social adjustment of a locality. However, life expectancy can be determined on the basis of numerous factors including social, political, economic and environmental as well. In both developed and developing countries, life expectancy has been

considered as measure of national health conditions, as it is related to the above mentioned factors (Halicioglu, 2010).

Currently, worldwide average life expectancy at births is 71.4 years (73 years for females and 69 years for males UNWP, 2015). Though, life expectancy at birth varies across the countries and continents. Countries which have designed relevant health policies, like enhancements in the prevention and control of key infant transferrable viruses, nutrition, housing, hygiene, and medical care had improved the value of life expectancy at birth (Yves and Lawson, 2014). According to statistics of Canada (2016), the life expectancy had improved by almost 24 years, from 1921 to 2016, is basically attributed to the deterioration in the infant mortality rate in Canada.

According to World Health Organization (2014), the world had experienced a rise in the average life expectancy at birth throughout the world, on average by 20 years from 1921 to 2014. The surge in life expectancy at globally is mainly with the reduction in infant mortality, however other variables maternal mortality, access to better education, sanitation, housing, growing income and many similar factors had also contributed in this outcome. While the rate of improvement in life expectancy at birth in developed world is faster as compared to developing countries, as they lack in the policies to address the key health issues as well economic issues to tackle it. Furthermore, in developing countries the improvement in medical technology and affordability to health care are not like as in developed states.

Empirical outcome suggests, that there exist a positive association in life expectancy at birth of a country and its GDP (Bilas, 2014). In general; countries with higher GDP have a longer life expectancy. Therefore, one can see that those countries, having highest level of GDP per-capita their life expectancy at birth are also higher, dissimilarities of the life expectancy at birth of

different income groups are shown in below table, which showed a clear difference in life expectancy at birth among high, middle and low income groups.

Table 1 Life Expectancy of Different Income Groups[1]

Countries by Income	Life expectancy at birth (years)						Life expectancy at age 60 (years)					
	Both sexes		Male		Female		Both sexes		Male		Female	
	1990	2013	1990	2013	1990	2013	1990	2013	1990	2013	1990	2013
High	75	79	71	76	78	82	20	23	18	21	22	25
Upper	68	74	66	72	71	76	18	20	17	19	19	21
Lower	59	66	58	64	60	68	16	17	15	16	17	19
Low	53	62	51	61	54	64	16	17	15	16	16	18

Source; World Health Organization (WHO. Report, 2014).

1.2. Life Expectancy at Birth in Developing, Developed and Under Developed Countries

At the start of twenty first century life expectancy at birth for the global population was almost 67

Table 2 Life Expectancy at Birth by Regions 2014[2]

Sub- Continent	Female	Male	Total
World	69	65	67
Developed countries	79	72	77
Less developed countries	66	63	64
Africa	55	52	54
Asia	68	65	67
Asia (excluding China)	66	63	64
Latin America (and Caribbean)	74	68	71
Europe	78	70	74
North America (U.S. and Canada)	80	74	77

Source: (WPDS Washington DC, 2015).

[1] See appendix C1 for Diagram
[2] See appendix C2 for Diagram

years, whereas 69 years for females and 65 years for males, females had an edge of 4 years over male; see Table 2. There existed a clear dissimilarity in the life expectancy at birth of developed and developing countries, as developed countries have higher life expectancy at birth than developing countries, 77 years for developed and 64 years for developing countries showing substantial difference between the life expectancy at birth of both types of countries.

1.2.1. Trends in Developed Countries

In high income nations, the fragmentary data shows a consistent increase in the life expectancy at birth as we move from mid-1700s to mid-1800s and similar increase is there between mid- 1800s to mid-1900s. The figures are 35-40 years, 45-50 years and 66-67 years respectively. It shows that there has been a higher addition to the life expectancy at birth from mid-1800 to mid-1900s. The key contributing factors in the surge life expectancy, specifically at the time of speedy development, were mainly; the better diet, quality health care, education, hygiene practices, nutritious food, and more importantly the level of enhanced knowledge of public health measures. Similarly, due to close relations within the environmental factors and life expectancy, as human depended on natural assets like safe water, fresh air, productive soil, and oil to maintain life, consequently, the high income countries had improved these environmental factors which had increased the life expectancy at birth during the passages of time in the response countries. Although there are health factors which made improvement in life expectancy at birth in developed economy. These improvements were mainly due to dropping infant mortality at that time when mortality rate was not controllable. In young children and infant there is more threats of death due to communicable diseases, which can be controlled with better feed off of the infants. Less number of infant deaths shows a significant portion in surging the life expectancy (World Bank, 2001).

The duration of late 1800s to 1950 in the West, saw substantial development which contribute to the key surge in life expectancy at birth that has ever experienced by developed countries. Advancement in medical field like vaccines for different diseases showed a significant role in increasing the life expectancy in that period by increasing the prospects to live of the older age group people. However, observing at the twentieth century as a whole, in high income nations like Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States, great advancement had occurred in life expectancy, improvement made about to control the infectious diseases in infant, improvement in diet, housing, sanitation, medical care, advances in health technology, particularly in relation to handling heart disease and stroke, along through better lifestyles, advancement in access to health care, and declines in mortality amongst infants had contributed significant role in surging life expectancy ; for instance, Japan life expectancy at birth in 1950 was 57 years and in 2015 it were 84 years, Australia life expectancy at birth in 1950 was 67 years and in 2015 it were 83 years. Similarly, the other high income countries improvement in life expectancy over the time was because of mortality declines and the above mention factors too (National Research Council US, 2015).

1.2.2. Trends in Less Developed Countries

In 1921, there was huge difference of 26 years when the life expectancy at birth was 67 years in the developed and 41years in the developing countries. Little has changed about life expectancy in the third world countries since the middle of twentieth century. But developing countries have shown a huge progress in increasing the life expectancy in the period 1950-70. Life expectancy at birth in developing countries increased by 14 years in that short period. It is attributed to reduction in mortality rate which plummeted more rapidly in the developing countries that in the developed countries even (World Bank, 2001).

Improvement in western developed countries is due to technology as well as special care of the infants and children by reducing the probability and occurrence of infectious diseases to them. But on the other hand, developing and underdeveloped countries were not able to make likewise improvement in life expectancy largely because they lacked development and hence could only benefit from the technology such as pesticides for killing mosquitoes as in developing countries. Besides these there are other health and environmental factors which had a major contribution in increasing life expectancy among middle and low income countries which were not properly noticed by developing and under developed countries during that particular times. These factors are mainly reduction in mortality level, combat the HIV/AIDS crises, access to safe drinking water etc, as lack of safe water caused diarrhea, cholera and malaria which were the major cause of illness and death, mainly among children and the aged (National Research Council US, 2015).

Researchers normally found that economic development, normally measured as surges in per capita GDP, as it is one of the strongest factor which made full contribution in improving life expectancy in developing and less-developed nations. Despite this, many promoters of modernization say that improvement in GDP is the greatest way to surge life expectancy, that poor states might had advantages from technology transfers, higher levels of foreign investment, attracting foreign businesses and increasing exports which ultimately improved life expectancy at birth (McKinney and Austin, 2012).

Certainly, many studies argued GDP growth is not the only factor which had increased life expectancy. There are also some other factors like education, urbanization, and enhancements in health structure, such as access to safe drinking water and hygiene facilities. They are frequently other strong determinants of life expectancy in less-developed nations. Moreover, other factors which had increased life expectancy in developing and less developed countries are mainly

increasing education, urbanization, and sanitation etc. Simultaneously, improvements in education, urbanization, and sanitation are often related with the implementation of healthful behaviors and improvement in availability of health resources (Kabir, 2008).

1.3. Research Gap

Numerous empirical literatures are available, that investigated the determinants of life expectancy at birth; however, most of these studies followed single country analysis by using time series data sets i.e [(Akram (2007), Midhet (2010), Balan (2011) and Nawaz (2015)]. Some studies have also used panel analyses but they are limited to specific countries or specific regions [(Shaw (2005), Kabir (2008), Kossis (2010), Sufian (2013) and Skrepnek, (2014)].

The proposed study is going beyond the framework of those studies. The proposed study adds to the literature by exploring the determinants of life expectancy at birth in the selected 50[3] countries through both aggregate and disaggregates samples by adding new prospects in terms of variable such as disasters occurrence to the current study by using panel data analysis. Furthermore, the proposed study also contributes by splitting the sample into developed, under developed and developing countries, to also investigate the determinants at countries development level.

1.4. Objectives of The Study

The primary determination of the study is to examine the socio-economic determinants of life expectancy at birth by using panel data covering the period of 1990-2014 for selected sample countries. Followings are the specific objectives of the study:

1. To identify the key socio-economic determinants of life expectancy at birth for the aggregate sample.

[3] List of countries can be seen at Appendix-A.

2. To examine the disaggregate analysis of the socio-economic determinants of life expectancy at birth for each group containing low, middle and high income nations.
3. To examine the magnitude of each included variable and its effect both positive and negative on life expectancy at birth of high, middle and low income nations.

1.5. Research Questions

1. Is there any variation in the socio-economic determinants of life expectancy at birth among low, middle and high income nations?
2. Is there any association between health expenditure and life expectancy at birth?
3. Is there any relationship among environmental factors and life expectancy at birth?
4. Is there any association between GDP per-capita and life expectancy at birth?

1.6. Significance of The Study

Health is considered something important for sustainable development of a country. It's not only promoting economic development but more importantly have ultimate effect on the economic development of any nation. This research is very much significant in regards to the objectives, but more importantly this empirical study will identify not only the socio-economic determinants of life expectancy but more importantly it will add some new dimensions with the model, by placing natural disasters as new variable. Socio-economic determinants are the key factors which affects the life expectancy at birth of developed, developing as well as under-developed countries. These determinants are of very much importance as it has been widely tested with mix results by the findings of Kossis (2010), Kabir (2008), Mustafa and Seraf (2016), Agheli (2015), Nawaz (2015), Farid (2010) and Shaw et al (2005). However, the mentioned determinants and addition of a new variable increase the importance of this study in the context of low, middle and high income nations from different region of the world. Further, the proposed study has a valuable addition to

the current literature, it improved the literature on life expectancy in numerous ways stated above which were not done by previous studies.

1.7. Organization of The Study

The structure of the proposed study is ordered as follows. The first section deal with introduction in which the study presenting a clear view of life expectancy at birth and its related determinants inside different income groups, further showing the divergence of life expectancy at birth among different income groups due to income level. i.e., high, middle and low income countries, lastly showing, trends in developed and less developed countries. The second chapter is based on the prior theoretical as well as empirical works. In the theoretical model, justification for independent variables are discussed that how these variables link and effect the dependent variable life expectancy at birth. Chapter three consist of methodological structure which shelters the economic models, econometric models, estimation technique and variables definition. Chapter four consist of descriptive statistics of the data for full and sub samples, result and discussion for aggregated and disaggregated samples. Chapter five is based on conclusion and policy implications.

Chapter 2 Literature Review

2.1. Introduction

A number of theoretical and empirical literatures evaluate the role of the determinants of life expectancy at birth among the countries to made prediction for life expectancy and more precisely, how to increase average life expectancy at birth with the passage of time which have greater contribution in an economy growth. Hence before to working on the proposed study it is essential to take a broad idea about the current development in theoretical and empirical literature on the role of determinants of life expectancy at birth. In this chapter, the discussion is based on the theoretical as well as the empirical literature related to our study. There are various theories scheduled the association of socio-economic variables and life expectancy of the human beings. A wide range of studies have been investigated both theoretically as well as empirically in the impact of socio-economic variables on life expectancy. It varies from pool to time series data while explaining different dimensions of life expectancy. The debate involves in findings the determinants of life expectancy as well as explaining the differences or homogeneities that affect the life expectancy. Our key objectives are to find the research gap and explain the mechanism to insured the lifted research gap. Following are presented the comprehensive review of some relevant literature on the topic of life expectancy.

2.2. Economic Determinants of Life Expectancy

There are different economic factors which move the life expectancy of a country. Economic factors which mainly include GDP per-capita, education, labor force participation and urbanization etc, have been extensively studied by the researchers and policy makers to analyze the influence of these economic factors on life expectancy. This section will briefly review the relevant literature

which affects life expectancy of high, middle and low income countries. This section will have dealt with the early studies of Agheli and Emamgholipour (2015), Nawaz (2015), Bilas (2014), Sufian (2013), Balan (2011), Kossis (2010), Kabir (2008) and Akram (2007), etc.

Agheli and Emamgholipour (2015) studied the determinants of life expectancy for Iran covered the period of 1980-2012, the authors used Johanson Co-Integration techniques to develop the long and short run effects of independent variables over life expectancy. The authors found that there existed positive and significant association between education and per capita income with life expectancy. The study concluded that more the peoples were educated the more would be the probability to live as educated societies were more accountable for obtaining healthy life style.

Peter et al (2015) studied the socio economic determinates of life expectancy at birth for Nigeria over the period of (1980-2011). The key objective of the study was to achieve 70 years' life expectancy up to 2020, as this was included in the millennium development goal. The study used the VECM and VAR model to found the possible relationship among the variables. The study concluded that GDP per capita, attained education level and unemployment were not significantly associated to life expectancy. The authors suggested that life expectancy at birth in Nigeria can be better if serious actions were taken in the reduction of unemployment.

Nawaz (2015) analyzed the determinants of life expectancy at birth for Pakistan. The author used time series data for the period 1972-2012 and ARDL approach was used for the study. The study found long run association amongst the variables by showing that illiteracy and economic misery had negative but insignificant relationship with life expectancy at birth while urbanization had positive and significantly related with life expectancy. The study suggested that upgrading economy and reduction in illiteracy would made improvement in life expectancy for Pakistan.

Bilas et. al (2014) studied the determinants of life expectancy at birth in case of European Union. The authors used panel data from 2001-2011 and by applying Johnson Co-Integration method, the empirical findings suggested that GDP per capita had positively and significantly affected life expectancy at birth and attained education level had negatively but insignificantly affected the life expectancy at birth. Both, variables jointly explain the variances in life expectancy at birth by 73 and 83 percent among the regions.

Mohsen et al (2013) studied the determinants of life expectancy in case of Eastern Mediterranean region over the period of 1995-2007 on the base of Grossman model. To found out the relationship between life expectancy and independent variables panel data model were used in the study. The possible applied mode was fixed effect for the estimated parameters after confirmation of Huasman test. The study found that there exited positive and significant relationship between urbanization, food availability, per capita income, employment and education with life expectancy. The study suggested that for improvement of health status the sample countries needed to focus on the above factor and mainly to reduce the unemployment ratio.

Sufian (2013) studied the determinants of life expectancy for 106 countries, furthermore the study classified in three different categories low, middle and upper values of life expectancy by using the canonical discriminate analysis. The study found that poverty is the second highly influential variable among the groups which indicated that if the poverty rate increased in a groups of countries then ultimately life expectancy would be decreased for the resultant country. The study also found negative relationship between life expectancy and urban population.

Balan (2011) studied the determinants of life expectancy, used regression analysis on time series data. The study found that illiteracy rate and Romanian population had significantly and negatively affected the life expectancy at birth while higher nominal monthly incomes had positive and

significantly affected the life expectancy at birth among the regions. The study suggested that reduction of illiteracy rate would be increased life expectancy at birth among the region, if positive steps were taken towards education.

Kossis (2010) analyzed a study on eight different factors which determined the life expectancy. The author used panel data analysis for the study. The study took 117 samples from developed, under-developed and developing countries. The author found positive and significant relationship between GDP and increasing rate in education with life expectancy. The study suggested that improvement in GDP and attained education level jointly increased life expectancy.

Kabir (2008) studied the determinants of life expectancy for developing nations a multiple regression and probity model were used to investigate these determinants for both aggregated and disaggregated level of data. The study found that per capita GDP had positive and significantly related with life expectancy at birth while adult illiteracy rate had negatively and insignificantly related with life expectancy. The study suggested that per capita GDP and attained education are definitely important for better life and social development.

Akram (2007) studied the long term health effect on Pakistan economic growth by applying time series data over the period 1972-2006. The author used Co Integration, Error Correction and Granger Causality techniques for the study. The author found that GDP, secondary school enrolment and openness trade had positively and significantly related with the life expectancy in case of Pakistan. The study suggested that improvement in GDP, secondary school enrolment and openness trade leads to increased life expectancy.

2.3. Environmental Determinants of Life Expectancy

Environment contributes a significant role in the determinant of life expectancy in any country, including developed, developing and under-developed countries. This area has been empirically tested by the researchers numerously. The findings of different empirical studies are as follows:

Mustafa and Seraf (2016) studied the environmental determinants of life expectancy in case of Turkey, taken 81 provinces for the period of (2015) using OLS regression model. The author found that forest area had positively related with life expectancy and other variables like air pollution, safe water and noise pollution were not related to life expectancy in case of Turkey. The study concluded that forest area was one of the main indicator for the healthy life of the locals.

Audi and Ali (2016) studied the impact of income inequality, environmental degradation and globalization on life expectancy at birth in Pakistan. The study used time series data over the period of 1989-2015 by uses ARDL approach. The authors found that there exited negative and significant association between income inequality and environmental degradation, while globalization had positively and significantly affected life expectancy.

Agheli (2015) studied the determinants of life expectancy in case of Iran over the period of 1980-2012. The author used Johanson Co-Integration techniques for the study. The aim of the study was to spot that issues which influence the production of health. The author found that in case of Iran smoking and uses of alcohol had shown negative and significant result. The study suggested that factors responsible for longer life expectancy at birth was attributed to spending on better housing and no or negligible spending on alcohol and smoking.

Most of the studies related to Co_2 emissions, and Co_2 emissions had found negatively with life expectancy. As Co_2 emissions had negatively affected the life expectancy, such findings are

supported by Kossis (2014), his findings suggested that there existed negative relationship between Co_2 emissions and extended period of conflict with life expectancy.

Hong and Ruiz (2008) examined the risks of life expectancy for Egypt for low-birth-weight children. The study used multivariate model for 11,361 child birth. The study concluded that death ratio in low birth weight children remained three times higher when compared with other countries and it is mostly because of low level of hygienic toilet facilities for women and low level access to safe sources of drinking water.

Kabir (2008) studied the determinants of life expectancy at birth in developing states a multiple regression and probity model were used to investigate these determinants for both aggregated and disaggregated analysis of data. The study found that most of independent variables are insignificant but the study suggested some policy implication for these countries, that population planning and safe drinking water are absolutely vital for better life and community development.

Gulis (1999) Conducted study on life expectancy as indicator of environmental health. The primary objective of the study was that quality of life is related to life expectancy at birth or not. Two type of models were tested for the same five variables a linear regression model and a multivariate linear model for 196 countries, to estimate life expectancy. The study concluded that cigarette consumption has negative and significant relation while access for safe drinking water had positive and significant relation with life expectancy. The study suggested that life expectancy could be increased by decreasing the cigarette consumption and availability of access to safe drinking water.

2.4. Health Determinants of Life Expectancy

Better health has good implication not only for the person nor for family but for the whole nation. So for any government health involvement must undertake because people health status

contributes a vital role in the social and economic development of a nation. Life expectancy is mainly attributed to the health care system of the given country, its economic process and the income differences exist in that country. In real meaning, the most object of a public health care policy is to keep up and develop the nation's health standing. So health contributes a significant role in the determinant of life expectancy for any country and this area has been empirically tested by the researchers numerously. The findings of different empirical reading are as follows:

Agheli (2015) studied the determinants of life expectancy in case of Iran over the period of 1980-2012 and by using Johanson Co-Integration techniques. The aim of the study is to observe that issues which influence the production of health. The production function is specified in multivariate linear regression. The results indicated that, there is no guarantee that health expenditure will be constantly effective. But longer life expectancy at birth is attributed to spending on good nutrition habits and no or negligible spending on alcohol and smoking.

Nawaz (2015) analyzed the determinants of life expectancy at birth for Pakistan applying time series data for the period 1972-2012. This empirical study used the structural break unit root test for knowing the assimilating belongings of the determinants. Co-Integration is run for long run association between variables. The study found out that there exited long run association within the variables, shown that spending on health care and availability of food improved life expectancy.

Balan (2011) studied the socio-economic determinants of life expectancy. The study used regression analysis on time series data. The study found that high average numbers of doctors in hospital and average number of beds in hospital had positive and significant relation with life expectancy. The study suggested that availability of health facilities increased life expectancy.

Ferda (2010) studied modelling life expectancy in Turkey. The study was consistent on the associated determinants of life expectancy from 1965-2005 in Turkey. ARDL approach was applied for the selected variables to found the long run association among the variables. The study suggested that there existed positive and significant association among nutrition, food availability and health expenditure and negative relation of life expectancy with smoking. The study suggested that better nutrition and investment in health will leads to improve life expectancy.

Kossis (2010) studied the determinants of life expectancy. There are almost 117 countries, which has been taken into consideration for this study. The study concluded that health care expenditures, national healthcare system and physicians per 1,000 people, all are significantly contributed to higher life expectancy. The study further suggested that highest impact on life expectancy was attributed to the ratio of infants mostly caused by HIV.

Farid (2010) Studied the impact of community-based interventions on maternal and neonatal health indicators, in rural Baluchistan, Pakistan. This is a new study in rural Pakistan in which women's play key role give information to expecting women from books and audiocassettes. They were trained and information was given to them about delivery and its difficulty. The men are also educated for safe motherhood and family planning. The study shows that the effect of prenatal care is more on those pregnant women who take part in intervention cluster and less on control cluster. The study found that prenatal mortality was reduced significantly in only those wives, which were trained and information and education was given to them properly for safe motherhood. The study found that given proper knowledge to the expected women, having increased prenatal care and utilization of health services for obstetric problems which leads to increased life expectancy.

Kabir (2008) studied the determinants of life expectancy for developing nations, a multiple regression was used to investigate these determinants for both aggregated and disaggregated level of data. The author concluded that most of independent variables are insignificant but the study suggested some policy implication for these countries, that to increase spending on health, population planning and number of physicians are definitely significant for better life and social development.

Shaw et al (2005) studied the determinants of life expectancy on OECD countries, they had used the panel model on health data. The authors used different OLS regressions for 6 groups, male and female life expectancy at ages (40, 60, 65) respectively. Shaw et al used the determinants like life style variables, age distribution, health expenditure and eating behavior. The results concluded that pharmaceutical expenditure (part of health spending) had positively related with life expectancy. It adds up to one year to the male life expectancy at age 40 and a little less than a year is added to the female life expectancy at age 65. Further of their findings suggested that life expectancy could be increased by decreasing the cigarette consumption and also extra usage of fruits by 30 percent increased life expectancy at birth by one year.

2.5. Social Determinants of Life Expectancy

The determinants of life expectancy are associated with several selected social, economic and environmental factors. In real meaning, the key objective of any government health care policy is to sustain and progress the nation's health standing. So, it is necessary to ascertain those aspects which had a great contribution into the promotion of the health of the population. The findings of some empirical reading are as below.

Khalil and Amjad (2014) studied the impact of socio-economic factors on life expectancy in case of Sultanate of Oman. The variables which were taken for the study are mainly school enrolment,

inflation, Co_2 emissions, food production, population growth and per capita income. The study consisted on time series data from 1970-2012 and ARDL approach is used for the possible data. The study conclude that food production and school enrolment had positive and significantly related with life expectancy while, inflation and per capita income had negative but insignificantly related to life expectancy in case of Sultanate of Oman. Furthermore, the study conclude that Co_2 emissions had positive and insignificantly related with life expectancy in long run but in short run it is negatively but insignificantly related with life expectancy. The authors suggested that Sultanate of Oman had need to take positively and seriously these factors for improvement of life expectancy in the locality.

Mondal and Shitan (2013) studied the impact of socio-health factors on life expectancy among 91 lower middle and low income countries for single year (2012). The contained variables in the study were entire fertility rate, teen-age fertility rate, mean years of schooling, GNI per capita income, physician density and HIV prevalence rate. To confirmed the effects of these independents variables over dependent variables the study used multiple regression analysis. The study concluded that all the variables had positive and significant association with life expectancy. The obtained result suggested that HIV occurrence, teen-age fertility rate and illiteracy elimination would increase life expectancy at birth among the sample countries.

Bilas et al (2014) concluded that good health suggested several socio-economic preconditions like increased education level, surges in employment and even improvement in life circumstances. Besides, as a dimension of life, health outlooks being for strength, energy and fitness which individuals can draw upon to drive their targets and determination. Empirical data indicated that public health care expenditures, education, environmental contamination and income existent had significant health determinants and have statistically supreme effect on the life expectancy.

Bayati et al (2013) studied the socio - economic determinants of life expectancy at macro level for developed and developing economies. The study suggested that nowadays sustaining, surging, and refining the health of social population is measured as one of the main strategies for sustainable development in developing nations. As displayed in macro level studies that numerous aspects, such as the socioeconomic development level, education, environment, health expenditures, urbanization, and life style were linked to general health status and average year of life expectancy. Peter et al (2011) studied that the role of life expectancy is very much crucial in case of developing world because they are seriously motivated to realizing socio-economic growth by participating meaningfully in public parts like health, education, environmental management and sustainability, sanitation, and community protection.

Kabir (2008) studied the socio economic determinants of life expectancy in developed and developing states. The study analyzed that from the last twenty years, life expectancy was measured one of the significant indicators of economic development in developed and developing nations. The author further suggested that countries needs to communicate and implement suitable social sector programs in supporting to surge physician's availability, decrease illiteracy and increase nutrition, eventually elongate life expectancy.

Husain (2002) studied the socio economic determinants of life expectancy in case of developing republics. The study found that income, healthcare expenditure, education, urbanization and contributions with the number of physicians, convenience of safe drinking water, and nourishing were the important determinants of life expectancy across developing countries.

Skrepnek et al (2014) examined the determinants of life expectancy in case of East Mediterranean Region, used panel data over the time period of 1995-2010. There are 21 countries included in the sample, by clustered the countries into two groups in first group they included 15 developed

industrialized countries and in second group 6 least developed and non- industrialized countries. The authors argued that life expectancy at birth for industrial and non-industrialized nations are not the same there was a huge difference among there life expectancy. The study concluded that gross domestic product (GDP) and vaccination averages were significant positive forecasters of life expectancy at birth in first group while physician density, health expenditures and vaccination averages were significant positive predictors in second group. The study also found that urbanization had negative and insignificant relationship in cluster one countries.

2.6. Conclusion

One of the primary goals of every government is to elongate life expectancy at birth of its population by dropping its mortality rate to its minimum possible level because it is one of the important indicator that shows the level of development in a nation (HDI is one estimate that is affected by life expectancy and higher life expectancy means higher rank in HDI). Economic growth determines enhancements in overall situations and surge in life expectancy. Health and development together need advancement of social morals, political and civil, as well as economic, social and cultural rights. It can be determined that there is a dual association between development and health. Development is the process of improving health and quality of life, and health is an essential element of the development process. In addition to these all, there are environmental issues that can change the life expectancy of the masses. The better the environmental quality, the higher will be the expectancy of life and vice versa. This fact could be related to the fact that better environmental quality ensures lesser diseases and hence higher immunity to new diseases and consequently higher life expectancy is the result.

The issue of possible socio-economic determinants of life expectancy has been extensively studied in the exiting literature supported that economic factors such as GDP of a country had positive

association with life expectancy. Moreover, environmental factors such as safe drinking water, Co_2 emission are the key factor for life expectancy. However, health factors including major diseases (HIV), population planning's, hospitals etc., are the major determinants of life expectancy. Socio-economic determinants as the key for life expectancy at birth which mainly includes education, safety nets programs and urbanization etc. All these studies deal with each and every determinants of life expectancy at birth differently. However, the major objective of the proposed study is to examine the socio-economic determinants of life expectancy at birth as well as economic, environmental and health determinants of life expectancy as a whole. Further, this study will use most advanced panel data to analyze the socio-economic determinants of life expectancy at birth in high, middle low and income countries.

Chapter 3 Data and Methodology

3.1. Introduction

To obtain the objectives of this empirical study, a theoretical and methodological structure have been specified. First section discuses theoretical framework while second section discusses methodological framework that applied for the sake of this study. The third part of this chapter is about variables descriptions, and last part is dealt with econometric methodology and estimation technique.

3.2. Theoretical Model

In this section, the theoretical framework of the study has been presented to analyze the possible theoretical channels and links through which explanatory variables like per-capita income, Co_2, emissions health expenditure, population growth and disasters etc, can affect the dependent variable, life expectancy.

Basic model of life expectancy depends on different variables including per-capita income, Co_2 emissions, health expenditure, population growth and disasters etc, which are to be dealt in this research. Different theories of life expectancy exist with different dimensions and arguments. According to Preston Curve by Preston (1975), average life expectancy at birth was higher in those nations where majority of peoples were wealthier and less in those nations where majority of peoples are poor. The association of income and life expectancy is spread out, meaning that if the level of per capita income is low and there are further surges came into income level then it leads to improve life expectancy. Although low level of improvement occurred in life expectancy at birth when income level is increased.

According to Preston curve in many nations, due to variations in income level life expectancy at birth is increased or decreased independently. Preston argued that the respond factors which brings

ups and downs in life expectancy because of income level are education, better technology, vaccinations, better facility of public health services and well diet. Further, Preston mentioned that life expectancy at birth had increased independently in poor nations but he assumed that this improvement in life expectancy in the poor countries are not gained from medical technology. Since, with the fact that in 1990s and 2000s in poorest nations like Sub- Saharan Africa, life expectancy had decreased because of widespread of HIV/AIDS, although their per capita income was increased. However, Wilkinson (1997), suggested that if there are lower health returns to flow in income, income redistribution might be Pareto improvement as redistribution of income creates at least the poor better off without creating those in the higher income groups worse off.

Wilkinson (1997), recognized that if GDP per capita is measured in absolute income level then it appears significantly on mortality because the surges in income is as of lowest to middle range of income group, and there was no further improvement exited in life expectancy outside the assured threshold of income brackets. The fragmentary evidence indicated that the important determinants to improve life expectancy at birth and to reduce mortality rate are mainly the better education, expenditure on health care, reduction of environmental pollution and safe water.

For so many years the role of safe drinking water has been familiar in public health. Wilkinson, referred to an environmental study of Slovakia (1997) on mortality rate, the study suggested that when mortality rates was compared to environmental indicator like pollution, access to health care, urban rural occupational conditions and availability to safe drinking water, the study showed that high air pollution and availability to safe drinking water decreased the mortality rate. Although, availability to safe drinking water in overall population is about the similar in East and West Europe, but the estimation recommended more clearly that there was one main difference. That is

in Eastern European Nations round about 36 percent of the whole population not accessed to 100 percent of safe water in rural parts. On the other side in Western Europe 19 percent of the whole population have not access to safe water in their rural parts, which have been suggested that there is a strong correlation between availability to safe drinking water and life expectancy at birth.

Similarly, economic situations also inclined life expectancy. For example, in the United Kingdom, in high income areas life expectancy at birth is several years longer than in low income areas. These variances in life expectancy at birth is due to several factors like nutrition, lifestyle and availability to medical care. It might be considering a selective effect: peoples with chronic life-threatening diseases are less probable to become rich or to live in wealthy areas. For example, in Glasgow[4], there exited highest disparity in life expectancy at birth when it was equated to the world, and that is that life expectancy at birth in highly poor Calton area stands at 54 years for males, which was 28 years less than in the wealthy area of Lenzie, the distance between the areas are only 8 km. The difference of life spam was mostly due to the dissimilarities in public health, medical care and nutrition (Department of health UK, 2011).

Roux and Jose (2013) argued that, life expectancy at birth surge throughout the Great Depression and through recessions and depressions overall. They suggested that during good economic times peoples worked hard they suffer more stress, increasing tendency towards pollution, and probabilities due to other damages between other longevity-limiting reasons.

Furthermore, occupation had also caused life expectancy, perhaps due to high level of industrial and highways air pollution life expectancy is affected. Average life expectancy had also been affected due to coal miners, nutrition, smoking, obesity and access to health care (World Bank, 2005).

[4] Glasgow is the biggest and busiest city in Scotland.

However, there are other factors which had augmented life expectancy at birth such as level of education, which can be measured as literacy rate, school enrollment ratio and enrolment of university students, etc. furthermore, educated peoples take effective decisions towards influencing the quality of life for example choices regard to job, well diet, averting from risky habits and a reliable use of health care (Agheli and Sara, 2015).

This study will check the implication of the above key findings in order to identify whether these conditions prevails in our samples countries are not, whether income, health expenditure, Co_2 emissions, population growth and disasters affect life expectancy at birth or not.

3.3. Methodological Frameworks

In order to identify the socio-economic determinants of life expectancy, this empirical study will have used panel data for 50 countries covering the period of 1990-2014. It mainly includes low, middle and high income nations. The division of the nations are built on their respective GNI per capita. The lists of countries which will be sampled for this study are as under:

High income countries: High income nations are considered those nations whom GNI per capita is of $ 12,746 and above. The below 17[5] countries are selected for the proposed study as a high income country on the basis of their GNI per capita respectively.

Norway, Switzerland, Australia, United States, Singapore, Canada, Austria, Germany, Belgium, France, United Kingdom, Japan, New Zealand, Italy, Spain, Uruguay, and Russia.

Middle income countries: Middle income nations are those with a GNI per capita of more than $ 1,045 and less than $ 12,746. The below 22[6] middle income nations are further dived into two groups the upper middle and lower middle income groups. the upper middle income countries are those with a GNI per capita between $4,036 and $12,475 and lower middle income countries are

[5] List of countries can be seen at Appendix-B
[6] List of countries can be seen at Appendix-C.

those with a GNI per capita between $1,046 and $4,035 The list of 12 upper middle and 10 lower middle income nations are mentioned below.

Upper middle income countries: Brazil, Turkey, Malaysia, Mexico, Costa Rica, Romania, China, Iran, South Africa, Angola, Albania, and Paraguay.

Lower middle income countries: Samoa, Bangladesh, Georgia, Indonesia, Ukraine, Sri Lanka, Nigeria, Zambia, India and Pakistan.

Low income countries: Low income countries are clear as those with a GNI per capita of $ 1,045 or below. The 11[7] low income countries which are selected for the proposed study are as below. Tanzania, Zimbabwe, Nepal, Afghanistan, Uganda, Mali, Ethiopia, Gambia, Niger, Malawi, Togo. The basic objective of the study is to analyze the impact of the socio-economic factors on life expectancy. The proposed model is as below;

$$LE_{it} = \alpha_0 + \alpha_1 CDE_{it} + \alpha_2 GDPPC_{it} + \alpha_3 HE_{it} + \alpha_4 SSE_{it} + \alpha_5 PG_{it} + \alpha_6 D_{it} + \alpha_7 UP_{it} + \alpha_8 LF_{it} + \varepsilon_{it}$$

Where "i" represent country index and "t" represent time index. LE_{it} is life expectancy, CDE_{it} is carbon dioxide emissions per-capita, $GDPPC_{it}$ is GDP per-capita, HE_{it} is health expenditure, SSE_{it} is secondary school enrolment, PG_{it} is population growth, D_{it} is disaster, UP_{it} is urban population growth and LF_{it} is for labor force participation.

3.4. Variables and description

Variables	Description	Date Sources
Life Expectancy At Birth	The number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same through the rest of its life.	WDI (2015)

[7] List of countries can be seen at Appendix-D.

Carbon Dioxide Emissions, Per Capita	The per capita emissions, (annual) in metric tons, stemming from the burning of fossil fuels and the manufacture of cement. This variable is an indicator of a country's overall pollution rate.	WDI (2015)
Gross Domestic Product, Per capita	GDP per-capita (annual) is a measure of the total output of a country that takes gross domestic product (GDP) and divides it by the number of people in the country.	WDI (2015)
Health Expenditures, Per Capita	Per capita health expenditures (annual) is defined as the per capita dollar amount of a country's public and private health expenditures in current. Health expenditures include the provision of health services (preventative and curative), family planning activities, nutrition activities, and emergency aid designated for health services.	WDI (2015)
Secondary School Enrollment	SSE indicates the total number of students enrolled at public and private secondary education institutions regardless of age during a specific time say one year or yearly. It includes enrollment from class 8^{th} to class 12^{th}.	WDI (2015)
Population Growth	Population growth is defined as surge of a country population during a period of time, generally one year, frequently expressed as a percentage of the population at the beginning of that period. It reflects the number of births and deaths during a period and the number of people migrating to and from a country.	WDI (2015)
Labor force participation	LFP indicates the proportion of the population ages 15 and older that is economically active: all people who supply labor for the production of goods and services during a specified period (per year).	WDI (2015)

Urban Population Growth	Urban population growth (UB) refers to people living in urban areas as defined by national statistical offices. It is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects.	WDI (2015)
Disaster	It can be defined as the number of technological, natural and composite disasters occurred per year.	WDI (2015)

3.4.1. Explanation of Variables: Dependent Variable

Life Expectancy at Birth (LEB)

The dependent variable for this study is average life expectancy at birth, which is defined as the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same through the rest of its life. Data for this variable will be obtained from the World Bank's "World Development Indicators" report for 2014-15.

3.4.2. Independent Variables

Carbon Dioxide Emissions, Per Capita (Carbon)

Per capita carbon dioxide emissions is defined as the per capita emissions, (annually) in metric tons, stemming from the burning of fossil fuels and the manufacture of cement. This variable is an indicator of a country's overall pollution rate. Data for this variable will obtained from the World Bank's "World Development Indicators" report.

Pollution levels directly affect the health of a country's citizens. Greater carbon dioxide emissions mean that more of a country's air is polluted with this harmful chemical. Continual inhalation of this chemical has been shown to lead to health problems including the lungs, heart and cardiopulmonary system. In those nations where carbon dioxide emissions are higher than there are more chances of other detrimental materials and pollutants and the possibility of risk in health

problems among the residents also increased. Consequently, it is hypothesized if per capita carbon dioxide emissions increases, average life expectancy will decrease.

Gross Domestic Product, Per-Capita (GDPPC)

GDP Per-capita (annually) is defined as the total production of a country that takes gross domestic product (GDP) and splits it by the number of people in the country. The per capita GDP is specifically valuable when associating one country to another, because it shows the comparative performance of the countries. An increase in per capita GDP indications growth in the economy and tends to reflect an increase in productivity and hence it has ultimate effect on the lives of human beings of that specific country. Data on this variable will be collected from WDI and World Bank Statistics 2015.

GDP per-capita has direct effect on the life expectancy of different countries. Numerous findings suggest that a country having high GDP per-capita is normally having high life expectancy as compare to the lower GDP per-capita income countries.

Health Expenditures, Per Capita (Health Ex)

Per capita health expenditures (annually) is defined as the per capita dollar amount of a country's public and private health expenditures in current. Health expenditures include the provision of health services (preventative and curative), family planning activities, nutrition activities, and emergency aid designated for health services. Data for this variable will be obtained from the World Bank's "World Development Indicators" report for 2014-15.

Increases in health expenditures per capita mean that a country is allocating more of its resources to the provision and improvement of health services. In addition, more health expenditures per capita would imply that advancements in medical technology are improving at a faster rate, due to the fact that more resources are being funneled towards health expenditures, and thus health research. Lastly, greater health expenditures per capita may be a subtle indication that a country

places a high value on health and long life, especially in richer countries. Therefore, it is assumed if health expenditures per capita increases, average life expectancy will increase.

Secondary School Enrollment (SSE)

Secondary school enrollment is defined as the total number of students enrolled at public and private secondary education institutions regardless of age during a specific time say one year or yearly. It includes enrollment from class 8^{th} to class 12^{th}. Data for this variable will be obtained from the World Bank's "World Development Indicators" report for 2014-15.

It has been realized that more educated peoples earn high real wages. More real wages indicated that household average income is high, allowing individuals to surge the quality and quantity of the healthcare services they purchase. Further, people with more education can well understand information about proper nutrition, hygiene, and healthcare services, as well as common illness-preventative measures. So, it is assumed that as secondary school enrollment increases, average life expectancy will increase.

Population Growth (PG)

Population growth is defined as surge of a country population during a period of time, generally one year, frequently expressed as a percentage of the population at the beginning of that period. It reflects the number of births and deaths during a period and the number of people migrating to and from a country. Data for this variable will be obtained from the World Bank's "World Development Indicators" report for 2014-15.

It is one of the key variables which affect the life expectancy rate of country. Population growth has both positive and negative affect on life expectancy for example an extreme scarcity of food, widespread occurrence of an infectious disease in a community at a particular time or war could cause a significant decline in life expectancy but this change might be short run. But on the other hand it will improve the life expectancy such as better nutrition, access to better health and

education. Data for this variable will be obtained from the World Bank's "World Development Indicators" report for 2014-15.

Urban Population Growth (UPG)

Urban population growth is defined as the number of people living in urban areas as defined by national statistical offices. It is calculated by using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects. Data for this variable will be obtained from the World Bank's "World Development Indicators" report for 2014-15.

It has both negative and may have positive effect on life expectancy. As the more and more people move towards urban areas, the more facilities for health, sanitation and education are available there which will help in the rise of life expectancy, but in contrast, if the urban population isn't settled properly then it can become a burden and further worsen the condition of that area, which ultimately lessening life expectancy.

Labor Force Participation (LFP)

Labor force participation indicates the proportion of the population ages 15 and older that is economically active: all people who supply labor for the production of goods and services during a specified period (per year). Data for this variable will be obtained from the World Bank's "World Development Indicators" report for 2014-15.

Improved labor force can effectively increase the productivity of a country or total output, which further effect the income level of that specific country leading to augment the life expectancy of a country.

Disasters

It can be defined as the per year occurrence of disasters, which mainly include technological, natural and complex disasters.

Disasters can be categorizing in three ways, the first one is natural; it includes mainly flood, earthquakes, storms etc, second one is technological disaster, as it refers to an incident create by a fault of a technological composition and or some human error in managing or handling the technology. The effects of such disaster on families and individuals may be long lasting and can endure for years.

Last one is complex disasters, as it refers to emergencies combine internal conflict with large-scale displacements of peoples, mass famine or food shortage, and fragile or failing economic, political and social institutions. Often, complex emergencies are also exacerbated by natural disaster.

Data for this variable will be obtained from the World Bank's "World Development Indicators" report for 2014-15.

3.5. Econometric Methodology and Estimation Techniques

In order to identify the relationship among life expectancy, Co_2 emissions, GDP per-capita, disasters, health expenditures, urban population growth, secondary school enrollment, population growth and labor force participation. There are different models with their specific requirements, as we can only use a specific methodology by satisfying its assumptions. In order to proceed for any of the panel data techniques, it is essential to test the order of integration of each variable. There are two major and common methods which are mostly employed that is fixed effect and random effect.

In case if fixed or random effect is applied, it is known that in the proposed study the time series are more than cross sectionals, so therefore we are expecting no problem of endogeneity and still these are single equation models, so it is assumed to have no endogeneity problem. However, both of these models are applied when the data in hand is stationary. However, both fixed and random

effects ignore the issue of unit root, (in case of time series analysis) and, heterogeneity (in case of cross-sectional) data.

In order to check for the possible stationarity/non-stationarity proper unit root test were applied. Panel unit root tests mainly included; Levin and Lin (1992), Im, Pesaran and shin (1997) and Maddala-Wu (1999). But IPS unit root test is preferred over the LL unit root test because it has more power. In this study IPS unit root test is applied on the panel data because Im Pesaran (2003) compares the efficiency of both tests through conducting Monte-Carlo simulation and results supports the Im Pesaran-Shin (1997) (IPS) unit root. However, for the presence of unit root in panel data the IPS test has been found to have superior test power. So, this study has also employed this procedure.

If there exist any problem of unit root in this study, then both fixed and random effect aren't valid to be used further. If the order of integration of each is same such as all variables are either stationary at 1st difference or 2nd difference then this study will use Panel Co-Integration, which mainly includes Pedroni-Co-Integration test, Kao Co-Integration test and Johansen-fisher Co-Integration test. In contrast if there exist mixed order of Integration of variables then this study will use Panel Autoregressive Distributive Lags Model (ARDL).

3.5.1. Im, Pesaran-Shin Unit Root Test (1997)

The general form of IPS test is

$$\Delta y_{it} = \alpha_i + \rho_i X_{i,t\text{-}1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta X_{i,t\text{-}j} + \varepsilon_{it}$$

Where i = 1, 2 …, 4 and t = 1, 2 ..., 3. i represents number of countries and t represents the number of time dimensions. ΔX_{it} is dependent variable in autoregressive model. Whereas αi is a drift term in i cross-sections, which vary across each cross-section. β is its vector of parameters which

also vary across cross-sections and. $X_{i,t-1}$ is lag of level dependent variable and inference about unit root is being done through comparing its coefficient $\rho_i \Delta Y_{i,t-k}$ are lags of dependent variables which are incorporated in the model tackle the problem of autocorrelation. $\varepsilon_{i,t}$ is error term, which should be white noised.

Hypothesis Testing for Unit Root

H_0: ρ_i =0 for all i

H_1: ρ_i <0 for at least one i

Under null hypothesis all ρ_i are equal to zero indicates that panel series contain unit root. Alternatively, the ρ_i parameter for any cross-section is less than zero then the panel series is said to be stationary.

IPS use separate unit root tests for the *N* cross-section units. Their test is constructed on the Augmented Dickey-fuller (ADF) statistics averaged across groups. After estimating the separate ADF regressions, the average of the *t*-statistics for ρ from the individual ADF regressions,

$t_{iT_i}(\rho_i)$:

$$\bar{t}_{NT} = \frac{1}{N}\sum_{i=1}^{N} t_{iT}(\rho_i \beta_i)$$

The *t*-bar is then standardized and it is shown that the standardized t-bar statistic converges to the standard normal distribution as N and $T \to \infty$. IPS (1997) showed that t-bar test has better performance when N and T are small. Moreover, if the evidence of unit roots with same order of integration is found then we will use Panel Co Integration. Moreover, if the issue of unit roots with mixed order of integration is found then we will use panel ARDL (Autoregressive Distributive Lags Model). Keeping all other the same, if order of integration is found to be of order zero (0) then we are justified to use the fixed effect or the random effect.

3.5.2. Levin, Lin & Chu and Im, Pesaran & Shin. Panel Unit Root Tests

In order to analyze the long run and short run association between life expectancy and independent variables over the period of 1990-2014 for selected samples, the proposed study used Panel Autoregressive Distributive Lags Model (PARDL). Although there are some properties for selecting PARDL model. Firstly, we can use PARDL model when all the variables are stationarity at first difference. Secondly, when all the variables are stationarity at level and lastly if some variables are stationarity at first difference and some are stationary at level meaning that mixture level of stationarity then we can use PARDL. Furthermore, we cannot apply PARDL test if any of the variable is stationarity at second difference because if we add this variable then F- statistics value is not valid. So, before applying PARDL, it is imperative to check the order of integration of each variable and also to check cross sectional dependency.

Table 3 Results of Panel Unit Root Test

Variables	Test Name	Level	1st Difference	Coefficients
LE	Levin, Lin & Chu	I (0)	-	-21.25*
	Im, Pesaran and Shin	I (0)	-	-11.59*
CO_2	Levin, Lin & Chu	-	I (1)	-13.0744*
	Im, Pesaran and Shin	-	I (1)	-17.1882*
DS	Levin, Lin & Chu	I (0)	-	-91.1518*
	Im, Pesaran and Shin	I (0)	-	-25.9335 *
GDP	Levin, Lin & Chu	-	I (1)	-6.84010*
	Im, Pesaran and Shin	-	I (1)	-10.0313*
HE	Levin, Lin & Chu	-	I (1)	-17.7511*
	Im, Pesaran and Shin	-	I (1)	-17.7236*
LF	Levin, Lin & Chu	-	I (1)	-3.93377*
	Im, Pesaran and Shin	-	I (1)	-8.48866*
PG	Levin, Lin & Chu	I (0)	-	-9.24058*
	Im, Pesaran and Shin	I (0)	-	-8.08776 *
SSE	Levin, Lin & Chu	-	I (1)	-10.5296*
	Im, Pesaran and Shin	-	I (1)	-13.4881*
UP	Levin, Lin & Chu	I (0)	-	-4.53904 *
	Im, Pesaran and Shin	I (0)	-	-2.35294*

***, **, *** indicates significant at 1%, 5% and 10% respectively.**

In order to check the level of stationarity of each variable this study uses Levin, Lin & Chu and Im, Pesaran and Shin. The results obtained from both Unit root tests are given in table 3. The results indicated that there existed mixed orders of integration for different variables. Some of the variables are integrated at level, while most of them are integrated at first difference. So on the basis of mixed order of integration in the series we can proceed to apply the panel ARDL for this study. Panel ARDL approach is categorized by varieties of advantages[8] of which it highlights and consent for the possibilities of estimating different variables with different order of stationarity like in this case. We have also noticed that our data is integrated in form of I (0) and I (1). On the basis of this, these estimators let us to gauge short run and long run association alongside with error correction coefficient.

3.5.3. Panel Autoregressive Distributive Lags Model (ARDL) Methodology

As already mentioned that (ARDL) model is used when the variables are stationary at different levels, as in this technique all the variables are assumed to be integrated of different orders. One of ARDL procedure is that it does not involve pre testing of the variables, the variables can stationary at first difference or stationary at level or mixed of both. So, in this situation standard Co-Integration becomes unstable because the power of the test to determine Co-Integration between variables is quite low while the standard Co-Integration estimates the long run relationship among variables involving a system of equations and the ARDL model only takes reduced form equation Pesaran and Shin, (1995). Different variables are having different lags in

[8](One of the essential benefits of ARDl methods is that it estimates the independent variables even when they are endogenous "Alam and Quazi 2003". Besides this when ARDL is free of residuals association, endogeneity is rarer of a problem "Pesaran and Shin" 1999).

ARDL technique which can't be estimated by standard Co-Integration, and most importantly, it can use with limited sample set of critical values developed by Narayan (2004).

ARDL process compromises of two stages. First it tests the long run relationship by using the F-statistics for the determination of the significance of lagged variables in the unrestricted error correction model. Secondly, the coefficients of both long run and error correction model (short run) are estimated. These models can be written as below.

3.5.4. Panel ARDL Model

$$\Delta LE_{it} = \alpha + \beta_1 \sum_{i=1}^{p} \Delta LE_{i,t-1} + \beta_2 \sum_{i=1}^{p} \Delta CO2_{i,t-1} + \beta_3 \sum_{i=1}^{p} \Delta GDPPC_{i,t-1} + \beta_4 \sum_{i=1}^{p} \Delta D_{i,t-1} + \beta_5 \sum_{i=1}^{p} \Delta HE_{i,t-1} + \beta_6 \sum_{i=1}^{p} \Delta PG_{i,t-1} + \beta_7 \sum_{i=1}^{p} \Delta UP_{i,t-1} + \beta_8 \sum_{i=1}^{p} \Delta LF_{i,t-1} + \beta_9 \sum_{i=1}^{p} \Delta SSE_{i,t-1} + \lambda_1 LE_{i,t-i} + \lambda_2 CO2_{i,t-i} + \lambda_3 GDPPC_{i,t-i} + \lambda_4 D_{i,t-i} + \lambda_5 HE_{i,t-i} + \lambda_6 PG_{i,t-i} + \lambda_7 UP_{i,t-i} + \lambda_8 LF_{i,t-i} + \lambda_9 SSE_{i,t-i} + \varepsilon_{it}$$

Where β is a drift component, t as a deterministic time trend, Δ as the first difference operator or change between two consecutive periods and $\mathcal{E}_t$ as white noise error. Moreover, the error correction dynamics are signified with summation sign. First portion of the equation specifies the short run while second portion of the equation corresponds to long run association. In the PARDL model testing system first we estimate the equation (I) through PARDL and select optimum lags, which provides us efficient model. There are three main criteria for lags selection for the model which mainly include; Aikaike Information Criteria (AIC), Hannan-Quinn Criteria (HQC) and Shwarz Information Criteria (SIC). After lags selection, long run relationship will be find, if there is an evidence of long run association, then the below equation will be used to evaluate the long run model.

$$LE_{it} = \alpha + \beta_1 \sum_{i=1}^{p} LE_{i,t-1} + \beta_2 \sum_{i=1}^{p} CO2_{i,t-1} + \beta_3 \sum_{i=1}^{p} GDPPC_{i,t-1} + \beta_4 \sum_{i=1}^{p} D_{i,t-1} + \beta_5 \sum_{i=1}^{p} HE_{i,t-1} + \beta_6 \sum_{i=1}^{p} PG_{i,t-1} + \beta_7 \sum_{i=1}^{p} UP_{i,t-1} + \beta_8 \sum_{i=1}^{p} LF_{i,t-1} + \beta_9 \sum_{i=1}^{p} SSE_{i,t-1} + \varepsilon_{it}$$

If there is an indication of long run association, we move towards the testing of short run adjustment process that whether in short run do the variables converge to their long run path?

3.5.5. Error Correction Mechanism (ECM)

When long run equilibrium relation is confirmed between dependent and independent variables, then it enables us to capture short run dynamics of the model by applying ECM. For estimating the short run impact of dependent variables on independent variables, error correction model has been used (ECM), based on Westerlund (2007). The error correction term is incorporated in ECM model to detect that how long time a dependent series will take to be at equilibrium, when an external shock deviates the equilibrium of dependent variable. ECM is no longer valid if there is no long-run relation amongst variables. Significant coefficient of ECM explains that a short run variation between dependent and independent variables will yield persistent long run relation amongst these variables. Error correction model is for present analysis is;

$$\Delta LE_{it} = \alpha + \beta_1 \sum_{i=1}^{p} \Delta LE_{i,t-1} + \beta_2 \sum_{i=1}^{p} \Delta CO2_{i,t-1} + \beta_3 \sum_{i=1}^{p} \Delta GDPPC_{i,t-1} + \beta_4 \sum_{i=1}^{p} \Delta D_{i,t-1} + \beta_5 \sum_{i=1}^{p} \Delta HE_{i,t-1} + \beta_6 \sum_{i=1}^{p} \Delta PG_{i,t-1} + \beta_7 \sum_{i=1}^{p} \Delta UP_{i,t-1} + \beta_8 \sum_{i=1}^{p} \Delta LF_{i,t-1} + \beta_9 \sum_{i=1}^{p} \Delta SSE_{i,t-1} + \lambda_1 EC_{i,t-i} \ldots .$$

i= 1, 2…, N and t = 1, 2…, T.

The above model covers the short run effects ($\Delta LE, \Delta SSE$) as well as Error Correction term $\sum^{p}_{i=1}$ Δ is co-efficient vector of lags of the dependent variable whereas β is co-efficient attached with the error correction term, λ indicates the speed of adjustment towards equilibrium, which explains that how much time dependent variable is require to bringing back at equilibrium, if there is a shock to the independent side of the model and due to this shock equilibrium of dependent series is disturbed.

Chapter 4 Results and Discussions

4.1. Introduction

Since checking the stationarity of each variable, as we have found mixed order of integration in our results by using panel unit root tests, now this study will use Panel Autoregressive Distributive Lags Model (PARDL) in order to identify the long as well as the short run relationship among each variable. This study will first estimate the descriptive statistics for all samples then estimates the full sample for aggregate samples, followed by disaggregate analysis for each group including high, middle and low income countries.

Table 4 Descriptive Statistics for Full Sample

	Mean	**Median**	**Maximum**	**Minimum**	**Std. Dev.**
LE	67	70.9	83.6	40.7	11.5
CO_2	4.4	1.9	20.3	0.2	4.2
GDP	12496.4	3147.1	102910.4	111.5	17748.1
HED	6.6	6.6	17.1	1.2	2.7
DS	488	66	764	1	453
UPG	2.3	2.4	7.0	-3.1	1.8
SSE	6883569	1702253	1.19E+08	7.3	16793870
PG	1.4	1.3	5.3	-2.7	1.4
LF	64.2	63.2	89.6	41.3	10.6

4.2. Interpretation of Descriptive Statistics for Full Samples

Table 4 shows the descriptive statistics for full sample which indicated that average life expectancy at birth for all samples are 67 years. The median, maximum and minimum values are respectively 71,84 and 41 years, showing the range of the data. The value of Co_2 emissions per year metric tons is 4.4 metric tons for all samples which means that on average 4.4 metric tons per year Co_2 emissions emitted from the selected countries, Similarly the average per-capita income of the selected countries is 12496 dollars per year. Further, the average number of health expenditure as

a percentage of GDP for the full selected sample is 6.6 percent. On average there around 488 disasters occurred per year in all selected samples. Urban population and population growth at the selected countries in terms of percentage on average is 2.3 and 1.4 percent. On average at full sample around 6883569 numbers of students are enrolled for secondary school education. Around 64.2 percent on average of the total population at age 15 and above participates in the labor force per year. Table 4 indicate one thing very clear that is in the entire descriptive statistics of disaggregated samples, the mean, median, minimum and maximum values of all the variables follows under the range of aggregated samples. i.e., their mean, median, minimum and maximum values are relying in that rang. Furthermore, one thing is more interestingly that average life expectancy shows by table 4 which is 67 years, exactly the same average life expectancy is reported by (WPDS, 2015).

Table 5 Descriptive Statistics for High Income Countries

	Mean	**Median**	**Maximum**	**Minimum**	**Std. Dev.**
LE	78.2	78.7	83.6	64.5	3.6
CO_2	9.6	8.9	20.2	1.3	4.4
GDP	32383.0	30440.0	10291.0	1330.7	17731.0
HED	8.9	8.8	17.1	2.4	2.4
DS	302	33.0	457.0	1.0	229.7
UPG	1.0	100.0	5.3	1.5	0.8
SSE	4696898.0	0.9	2473102.0	205683.0	5748342.0
PG	0.7	2568791.0	5.3	1.5	0.8
LF	61.0	0.6	68.5	47.1	5.6

Table 6 Descriptive Statistics for Middle Income Countries

	Mean	Median	Maximum	Minimum	Std. Dev.
LE	66.7	69.7	79.4	41.1	9.2
CO_2	2.6	1.5	12.3	0.2	2.6
GDP	3097.2	2119.9	13039.1	153.1	2775.3
HED	*5.2*	*4.9*	*10.5*	*1.9*	*2.0*
DS	503.4	129.0	669	1.0	543.3
UPG	2.4	2.6	6.7	-3.1	1.7
SSE	11675630.0	27416597.0	1194005.0	20.2	2368605.8
PG	1.3	1.1	4.2	-2.7	1.0
LF	61.5	60.5	80.1	41.3	8.9

Table 7 Descriptive Statistics for Low Income Countries

	Mean	Median	Maximum	Minimum	Std. Dev.
LE	53.6	54.0	69.6	40.7	6.3
CO_2	0.2	0.1	0.8	0.0	0.1
GDP	560.6	433.3	1534.2	111.5	396.8
HED	5.9	6.0	12.1	2.5	1.7
DS	360.44	95.0	653.0	1.0	213.2
UPG	4.3	4.1	7.1	0.9	1.0
SSE	678846.8	322999	4736263.	7.3	915732.2
PG	2.6	2.8	4.0	-0.4	0.8
LF	74.5	78.2	89.6	47.6	12.9

4.3. Interpretation of Descriptive Statistics of Disaggregated Samples

Table 5, 6 and 7 are respectively represent the descriptive statistics for low, middle and high income nations. Mean and median both are the central values for the data set. Mean values of life expectancy on average for high income nations are 78 years, for middle income nations are 67 and for low income countries are 54 years, meaning that life expectancy on average for high income countries are high 78 years as compare with middle and low income nations which are lower than high income states that are 67 and 54 years respectively. This is due to the fact that GDP per capita in high income states are more than middle and low income which has a great contribution in

surging life expectancy, easily access to health care, and availability of clean and clear environment to high income nations leads to increase their life expectancy.

The mean value for Co_2 emissions per year metric tons for high, middle and low income nations are 9.6, 2.6 and 0.2 respectively, which depict that the per capita Co_2 emissions per year metric tons is high, in high income states as compared with middle and low income states. The reason for more Co_2 emissions per year metric tons in high income countries as compared to middle and low income countries is because that high income countries are more industrialized countries so the ratio of Co_2 emissions metric tons per year is higher in high income countries.

The mean value of GDP per capita for high, middle and low income countries are 32383, 3097.2 and 560.6 respectively. The reason behind greater GDP per capita in developed nations is due to some ground realties, in their economy there is further value addition exited through time by time or in other way there is more income or higher expenditures on good and services which suggested that the living standard of the masses goes up and due to higher income there will be more expenditure on numerous goods and services like more spending on healthcare, food and education etc. Which indicated that due to high share of GDP per capita in high income countries their life expectancy is also high while in contrast there is low life expectancy in lower and middle income countries as their GDP per capita is also lower (Saurabh, 2014).

The mean value for health expenditure in high, middle and low income nations are respectively (8.9, 5.2 and 5.9), this indicated that in high income nations health expenditures are more and interestingly these value shows that in low income nations health expenditures are more than middle income. The reason behind more health expenditure in low income countries is that in low income countries out of-pocket expenditure accounts for more than 50 percent of total health expenditure, mainly of catastrophic health expenditures which is closely connected to out-of-

pocket spending meaning that high technological care and expensive medicine in poor countries can both expose households to catastrophic health expenditure (Ke Xu, 2011).

The mean value of average disaster occurred per year for high, middle and low income countries are respectively (302, 503 and 360), indicated that the average disaster occurred per year in middle income countries are higher than other income groups as here the proposed study taken more sample countries than other groups and some of the countries chosen for this sample are more populated for example China and India etc so the ratio of technological disaster is high in that countries, therefore the mean value are also high in middle income groups.

The mean values on average percentage growth per year of urban population and population growth in high income groups are (1.0 and 0.7), for middle income groups are (2.4 and 1.3) and low income groups are (4.3 and 2.6) respectively. The greater mean value is found in low income groups between in both the variables urban and population growth. The reason behind in population growth is that in low income countries the unemployment ratio is higher than high and middle income countries which is a sign of over-population because it is hard to accommodate the large population in an economic activity. Moreover, the per capita income is very low in low income countries therefore a single person cannot bear his large family so that's why he thinks to have more children to be more earning hands.

The increase in urban population growth in low income countries is due to the fact that peoples from rural areas migrated to urban areas for better facilities like job opportunity, better environment, education, food and other social problems and also with the fact that birth rate is increased and death ratio is low. The mean value for secondary school enrolment are highest in developed countries 4696898, followed by middle income countries 116756 and then low income countries 678846 respectively. The reason behind it is that the developed countries have high per

capita income, employment ratios is high and basic education is also free. The mean values for labor force participation is highest in low income countries 74.5 followed by middle income countries 61.5 and then by high income countries 61.0 respectively. The reason behind is that if we just keep in mind the employment to population ratio, which is the share of the total population currently employed, in low income countries the population is very high if compare to high income countries so their participation in labor force is also high because they are poor and participated in every field like forming, construction and industries etc because they have lack of technologies.

4.4. Comparison of Sampled Countries

There exists vast level of differences among the disaggregated samples, the life expectancy on average for developed countries is 78 years which is higher than both developing and under-develop countries. As developing countries have 67 years and under-develop countries have 54 years on average. The key reason behind the higher life expectancy in developed countries is the higher level of health expenditures, provision of education, low level of population growth and higher level of income per-capita. Furthermore, high level of per-capita income ensures a better life standard in developed countries i.e, causing to avoid health, economic and social issues which further helps in boosting the life expectancy at birth of these developed countries as compare to both developing and under-develop countries.

However, Co_2 emissions per metric tons in developed countries is higher than both developing and under-develop countries, the reason behind this may be that developed countries have more and more industries which causes to emit high level of Co_2 emissions per metric tons. Although the developing and developed countries emissions are not like the same there is a difference between the two, that is developed country emission are lifestyle emissions while developing countries emissions are survival emission. So, the two are not put into the same box meaning that they are

not treated alike. There are some other issues which causes to emit high level of Co_2 emission in per capita metric tons in developed countries like vehicle pollution and population growth (United Nation report on climate change Paris, 2016).

In contrast, developed countries have low level of population growth as compare to developing and under-develop countries. Low population pressure gives an edge to develop countries in terms of resource allocation, while in both developing and under-developed countries population causing serious resource allocation problems as according to (Malthus, 1817) population is surging at geometric rate while resources are surging at arithmetic rate, which causing deficit in food availability further worsening health, education and the income level of a country as well as individual. Furthermore, there are some other serious issues which caused life expectancy at birth of under developed and developing economies like unemployment which is a symbol of over-population this means that in the developing and under developed countries the birth ratio is high because the residents are economically deprived and they need more working hands to support their large family, they think to have more children to be more earning hands. Similarly, reduction in death rate, early marriages, concept of large family and illiteracy rate are the main causes of over-population (Khan, 2012).

The mean value of GDP per capita for high, middle and low income countries are 32383, 3097.2 and 560.6 respectively. The higher GDP per capita in high income countries is due to the fact that there is high ratio of education, high per capita income and more importantly the advanced technologies. If we can think about the individual technologies and their effects in population and production, then it makes a clear sense and importance in the GDP of that country. Technologies such as water plumbing, electricity and the combustion engine have huge, long lasting impacts. The combined effects of increased efficiency, increased production, lower costs of transport

compound for centuries, generating great GDP growth for these countries. But in many developing countries, a large portion of the population doesn't have access to treated water, electricity, or good roads. So you can get an idea of how much work there is to be done, and once it is done, how much of an impact you can expect in these countries' GDPs. The only way a developed country can reach a very high growth rate again is with a very disruptive technology, a technology so hugely beneficial that its impact is as great as say, electricity itself. Secondly the role of population growth in developed countries cannot be neglect, the rate of population growth is lower and in some places even negative. So a high GDP growth rate in this case would signify an incredible wealth creation for the same constant population (Chang, 2015).

The mean value for health expenditure in high, middle and low income countries are respectively (8.9, 5.2 and 5.9), this indicated that in high income countries health expenditures are more and interestingly these value shows that in low income countries health expenditures are more than middle income countries. The reason behind more health expenditure in low income countries is that in low income countries out of-pocket expenditure accounts for more than 50 percent of total health expenditure, mainly of catastrophic health expenditures which is closely connected to out-of-pocket spending meaning that high technological care and expensive medicine in poor countries can both expose households to catastrophic health expenditure (Ke Xu, 2011).

The mean value of average disaster occurred per year for high, middle and low income nations are correspondingly (302, 503 and 360), indicated that the average disaster occurred per year in middle income countries are higher than other income groups as here the proposed study taken more sample countries than other groups and some of the countries chosen for this sample are more populated for example China and India etc so the ratio of technological disaster is high in that countries, therefore the mean value are also high in middle income groups.

Labor force participation in low income comparing it with middle and high income countries is higher than both. The reason behind high labor force participation in low income countries is they are producing more and more labor intensive commodities while capital is abundant in high income countries, this verifies Hecksher-Ohlin theory. Developed countries have higher level for industries with advanced technology which is mostly capital abundance. Furthermore, labor force participation has a great impact on life expectancy, it could be better clarified by fact that, the difference in life expectancy in context of labor force participation between white men and women in the United Nation was very shocked i.e. in the United Nations the white men lived on average around 12 more years than those not in the labor force, and similarly, white women lived on average about 9 more years from those who are not in the labor force (Eugene et al., 1992).

The secondary school enrolment is highest in developed countries 4696898, followed by middle income nations 116756 and then low income nations 678846 respectively. The reason behind for high enrolment in developed countries is clear as developed countries have high per capita income, employment ratios is high and basic education is also free etc. However, the situation for developing and under developed countries are comparatively different because education is not free in developing countries and the expenses of books, uniforms, and teachers' salaries are borne by the students' families. They are also observing at cumulative widespread schooling so that its comprehends numerous years of secondary school and a new basic education. The contest to keep children in secondary school after completion of primary level is prodigious for developing nations students but there are some barriers for them for their families to face like the cost at secondary school is very high in contrast of primary level beside this secondary schools are far away from home therefore transportation cost is also requiring meaning that the cost is inflated so it is difficult for the families to afford. There is another issue that is the fight between the educational objectives

and getting possible income earned by a teen-age is very crucial. Despite the statistic in developing and low-income nations, each substantial year of education rises a person's upcoming income on average by 10 percent. Illiteracy rate is also high in females of more than 20 developing countries which exceeded almost to 70 percent. So, these are the main issues in developing and under developed countries which causes low enrolment level in secondary education. (United Nations International Children's Emergency Fund, 2014).

4.5. Aggregate Analysis of Full Sampled Countries

In order to identify the socio-economic determinants of life expectancy and it's long as well as short run relationship by using PARDL, it is imperative to select the optimum level of lags for the model. For the purpose of lags selection of the model, this study used Aikaike Information Criteria (AIC), Hannan-Quin Criteria (HQ) and Bayesian Information Criteria (BIC). The propose study will use all the three criteria's but selection will be based on the one having minimum value amongst the rest of criteria's.

In order to apply panel autoregressive distributive lags model (PARDL), For full sample the following results has been estimated. Before applying PARDL it is imperative to select the optimum lags for the model by using AIC, SBC and HQ. In order to select optimum lags, this study will follow the value of each method and will select the one having minimum value. The table given below depicts the results obtained for the model selection for full sample before employing PARDL.

Table 8 Model Selection Criteria for Aggregated Samples

Model	LogL	AIC*	BIC	HQ	Specification
2	**2518.161**	**-3.406***	**-0.959**	**-2.484**	**ARDL (2, 1, 1, 1, 1, 1, 1, 1, 1)**
1	1277.705	-1.338	0.891	-0.496	ARDL (1, 1, 1, 1, 1, 1, 1, 1, 1)

Results obtained from table 8 After estimating different models, this study concluded that the proposed study will select model 2 having lowest AIC value among each criteria's, as the result indicate that this will use ARDL order of (2, 1, 1, 1, 1, 1, 1, 1, 1).

Table 9 Estimated Result of Aggregated Sample

Variables	Coefficient	Std. Errors	t- statistics	Probability
LFP	0.509	0.017	28.379	0.000
Co_2 Emissions	-1.461	0.230	-6.329	0.000
DOPY	#0.000	#0.000	#0.674	#0.500
GDP Per Capita	0.000	0.000	9.511	0.000
HE	0.460	0.091	5.046	0.000
SSC	0.000	0.000	13.251	0.000
UPG	-0.365	0.117	-3.098	0.002
PG	-0.550	0.268	-2.052	0.040

Source: Author's own calculation, Data range is from 1990-2014 and total number of observation is 1250.
Note: All the values are round up to 3 decimals and t-value represents the regression value not after rounding up, for further detail original regression results are given one by one for all samples in appendix D. like for example disaster occurrence per year is written below in the same way. # these values are round up to 3 decimals, otherwise t-value with original values is 0.674.

In table 9, different criteria are tabulated for selecting the dynamic specification for a parsimonious PARDL model among the candidate models. For our model, the study employed the Akaike Information Criterion which is vastly used in the literature. A model with the minimum Akaike value is to be used for selection of the correct model and the one that fulfills the criteria is ARDL of order (2, 1, 1, 1, 1, 1, 1, 1, 1).

After getting optimum lags using AIC, PARDL was employed in order to identify the long run relationship among variables. The results obtained in table 9, by using PARDL indicate that there exists a significant and negative relationship between life expectancy and Co_2 emissions per metric tons, urban population growth and the population growth as a percentage of total population. However, there exists significant and positive relationship between life expectancy and health expenditure as a percentage of GDP, Gross domestic product per-capita, secondary school enrollment as average yearly enrolment, and labor force participation as per year average percentage of total population. Interestingly, number of disasters occurrence per year are positively

related to the life expectancy but insignificant relationship exists between the two. The rationale for this positive relationship could possibly be due to the limitation that we used the number of as our independent variable and we know that if two variables move in the same direction simultaneously, their correlation and hence the coefficient will be positive. There existed negative and significant relationship between life expectancy and population growth, the reason for this negative relationship between life expectancy and population growth may be due to the following, i) as, this is because that fertility rate is high, means birth rate is also high and when the peoples are unaware of health care or health facilities are not available to them then death rate is also high so that's why it has negative impact on health. So fertility causes more infant mortality, so we need to control population growth, as high population growth creates a burden on the existing resources. ii) As these are the results for pool of the sample countries, which comprise of highly populated countries as well as their level of development is also low. So low level of development accompanied by high population growth together create burden on the health, education and social development. Health problems include lack potable water, chronic diseases like, Tuberculosis TB, (TB prevalence is high in big cities) with overcrowding and air pollution which lead to respiratory diseases, high volume traffic (and hence accidence probability), and it leads to decreased life expectancy. These results correspond to the study by (Popkin, 1999, Ahmad and Ali, 2014). Other results that are parallel to the National Obesity Observatory (NOO, 2010 reported the negative and significant relationship between life expectancy and urban population growth. Urban population growth is showing such a relationship possibly due to the fact that in urban areas the residents use high fat diets and there is general tendency of lack of physical activity which causes obesity and consequently the CHD[9] and they become victim of early than expected cardiovascular deaths, for

[9] Chronic Heart Diseases: Only in US, approximately 25 percent of deaths are caused by CHD.

example coronary artery disease, heart attack, stroke etc., which leads to reduced life expectancy. Beside this, due to high fat diet, lazy ness and availability of transportation or as of easy access there is more chances of obesity and obesity caused the Ischemic disease, Arthritis, Diabetic and Hypertensive, that affected the life expectancy of the masses (Popkin,1999, Ahmad and Ali, 2014). In order to find the short run relation among each variable this study uses Error Correction Mechanism (ECM).

Table 10 Short Run Results of Aggregated Sample

Variables	Coefficient	Std. Errors	t- statistics	Probability
COINTEQ01	0.017	0.010	-1.713	0.087
D(LE) (-1)	0.526	0.083	6.311	0.000
D(LF)	-0.016	0.016	-1.023	0.306
D(Co_2 Emissions)	-0.135	0.098	-1,376	0.169
D(DOPY)	1.19E-05	5.24E-05	0.227	0.819
D(GDPPC)	-3.79E-05	2.92E-05	-1.296	0.195
D(HE)	-0.009	0.016	-0.563	0.573
D(SSC)	0.000	0.000	1.004	0.315
D(UPG)	-0.512	0.227	2.247	0.024
D(PG)	-0.466	0.220	-2.111	0.035
C	0.726	0.435	1.667	0.095

In order to find the short run relation among each variable this study uses Error Correction Mechanism (ECM). ECM results are used to interpret the short run adjustment mechanism after having the long run relationship between the dependent and independent variables is confirmed. For short run adjustment to be present, the signs must be negative and statistically significant. In table 10 we have negative signs for labor force participations as a percentage of total population, Co_2 emissions per capita metric tons, GDP per capita, health expenditure as percentage of GDP and population growth as a percentage of total population which confirm the existence of adjustment process but they are all simply not statistically significantly different from zero except the population growth as a percentage of total population. It means that only population growth as a percentage of total population is significantly converges to its long run equilibrium path by 46.6

percent each subsequent year. The rest of variables do not show the convergence to their mean path and undergo the divergence from previous long run path.

4.6. Disaggregate Analysis for High, Middle and Low Income Countries

In order to find the socio-economic determinants of each group including high, middle and low income countries disaggregate analysis has been used for this purpose. In this study we will first deal with high income countries, followed by middle and low income countries.

4.6.1. High Income Countries

In this category the study has included all those countries, that are having highest GNI per-capita. There are 17 Countries in this group, most of these are developed countries.

Table 11 Model Selection Criteria for High Income Groups

Model	LogL	AIC*	BIC	HQ	Specification
1	**1503.763531**	**-4.955587***	**-2.867377**	**-4.136595**	**ARDL (2, 1, 1, 1, 1, 1, 1, 1, 1)**
2	819.098683	-2.336358	-0.431911	-1.589437	ARDL (1, 1, 1, 1, 1, 1, 1, 1, 1)

Results obtained from table 11 After estimating different models, this study conclude that we will select model 1 having lowest AIC value among each criteria's. As the result indicate that we will use ARDL order of (2, 1, 1, 1, 1, 1, 1, 1, 1).

Table 12 Long Run Result for High Income Groups

Variables	Coefficient	Std. Errors	t- statistics	Probability
LFP	0.298	0.066	4.454	0.000
Co_2 Emissions	-0.461	0.138	-3.323	0.001
DOPY	0.000	0.000	2.092	0.037
GDP Per Capita	0.000	0.000	9.556	0.000
HE	0.118	0.074	1.595	0.112
SSC	0.000	0.000	1.010	0.313
UPG	1.014	0.487	2.079	0.038
PG	0.896	0.953	0.939	0.348

Source: Author's own calculation. Note: Data range is from 1990-2014 and total number of observation is 425.

Above are the coefficients of the long run equilibrium and short run adjustment mechanisms of PARDL model for the developed countries. In long run, there exists a significant and negative

relationship between life expectancy (dependent variable) and Co_2 emissions. Disaster occurrence per year are positively related to the life expectancy. Here it has a significant relationship. Coefficient of disaster occurrence per year is positive probably due to the inclusion of too much other variables; and mainly the lags. Other variables that have a significant and positive long run relationship with the life expectancy are, labor force participation as a percentage of total population, urban population growth as an average percentage of total population, GDP per capita and health expenditure as a percentage of GDP. The positive and significant relationship of urban population growth as a percentage of total population is because of the fact that in high income countries, urban population as a percentage of total population is subtly provided with all the basic facilities such as health, education, better infrastructure etc. similar result is ensued in the study of Mohsen et al, (2013). Health expenditure as percentage of GDP is significant at a little bit higher level of significance so we could term it nearly significant. Insignificant relationship exists between population growth as a percentage of total population and secondary school enrollment as percentage of per year average enrolment. The two variables have shown similar results in other studies such as Bilas et al (2014) and Sufian (2013).

Table 13 Short Run Result for High Income Groups

Variables	Coefficient	Std. Errors	t- statistics	Probability
COINTEQ01	0.057	0.036	-1.560	0.120
D(LE) (-1)	-0.132	0.112	-1.179	0.239
D(LF)	-0.025	0.031	-0.801	0.423
D(Co_2 Emissions)	-0.036	0.033	-1.096	0.274
D(DOPY)	0.000	0.000	-0.598	0.549
D(GDPPC)	-0.000	0.000	-0.653	0.514
D(HE)	0.016	0.049	0.322	0.747
D(SSC)	0.000	0.000	1.643	0.101
D(UPG)	1.297	0.623	2.080	0.038
D(PG)	-1.302	0.636	-2.047	0.041
C	3.355	1.971	1.701	0.090

Source: Author's own calculation.

Error correction mechanism (ECM) indicates the short run relationship among life expectancy and other variables. As far as ECM function is concerned, we would only report those variables which had long run significant relationship with life expectancy. As, after confirmation of long run relationship, we check that in case of any shock, would the two (or more in our case) variables tend towards reestablishing of equilibrium? We note from the empirical results in Table 13 which shows that no series is significantly converging to their previous long run paths and hence no ECM exists in case of the determinants of life expectancy in the developed countries.

4.6.2. Middle Income Countries

In this group 22 Countries has been selected on the basis of GNI per capita respectively.

Table 14 Model Criteria Selection for Middle Income Countries

Model	LogL	AIC*	BIC	HQ	Specification
1	**667.083808**	**-1.806055***	**1.381091**	**-0.5428**	**ARDL (2, 1, 1, 1, 1, 1, 1, 1, 1)**
2	290.895621	-0.5775	1.229255	0.138654	ARDL (1, 1, 1, 1, 1, 1, 1, 1, 1)

Source: Author's own calculation.

Results obtained from table 14 After estimating different models, this study conclude that we will select model 1 having lowest AIC value among each criteria's. As the result indicate that we will use ARDL order of (2, 1, 1, 1, 1, 1, 1, 1, 1).

Table 15 Long Run Result for Middle Income Countries

Variables	Coefficient	Std. Errors	t- statistics	Probability
LFP	0.478	0.048	9.839	0.000
Co_2 Emissions	-1.229	0.169	-7.247	0.000
DOPY	-0.000	0.000	-0.377	0.706
GDP Per Capita	0.001	0.000	24.481	0.000
HE	0.260	0.077	3.364	0.000
SSC	0.000	0.000	9.435	0.000
UPG	-2.756	0.214	-12.829	0.000
PG	2.277	0.315	7.212	0.000

Source: Author's own calculation. Note: Data range is from 1990-2014 and total number of observation is 550.

PARDL of lag length 2 for dependent variable and 1 for independent variables had the minimum AIC value when checked among different candidate models. Its results show that in long run GDP per capita, labor force participation as a percentage of total population, health expenditure as a percentage of total GDP, population growth as a percentage of total population and secondary school enrolment on average per year are positively related to the life expectancy. All of these variables are significant and according to the theory and intuition except population growth as a percentage of total population which shows mixed direction of effect. Co_2 emissions per metric tons and urban population growth as a percentage of total population negatively and significantly affect the life expectancy in the long run. Negative relationship between life expectancy and urban population growth indicates that moving towards urban areas in case of middle income countries may not be that much helpful as these areas might be overpopulated indicating that the level of facilities is not even enough for the existing population to take benefit of urbanization, so more increase in urban population may harm the level of life expectancy adversely such result is followed in the study of Sufian, (2013). While, number of disaster occurred per year do negatively but insignificantly affect the life expectancy in the long run and this is due to the fact that number of disaster occurred per year do not directly appears in the life expectancy rather it affects the life expectancy by causing deaths on impact as well as deaths due to epidemic diseases but they might be a small proportion.

While in short run, only population growth shows that there exists a significant convergence, while all others either have no convergence in short run or the convergence is insignificant. The speed of adjustment value is negative and significant, indicates that around 13.3 percent adjustment takes place every year towards equilibrium (as shown in table 16 on next page).

Table 16 Short Run Result for Middle Income Countries

Variables	Coefficient	Std. Errors	t- statistics	Probability
COINTEQ01	-0.020	0.007	-2.848	0.004
D(LE) (-1)	0.831	0.068	12.188	0.000
D(LF)	-0.022	0.014	-1.568	0.117
D(Co_2 Emissions)	0.018	0.076	0.242	0.808
D(DOPY)	0.000	0.000	-0.585	0.558
D(GDPPC)	-0.000	0.000	-1.329	0.184
D(HE)	-0.023	0.021	-1.112	0.266
D(SSC)	0.000	0.000	-0.998	0.318
D(UPG)	1.297	0.623	2.080	0.038
D(PG)	-0.133	0.061	-2.158	0.031
C	0.861	0.323	2.661	0.008

4.6.3. Low Income Countries

In this group 11 Countries has been selected on the basis of GNI per capita.

Table 17 Model Criteria Selection for Low Income Countries

Model	LogL	AIC*	BIC	HQ	Specification
1	**968.6892**	**-5.9685***	**-3.9773**	**-5.1693**	**ARDL (4, 1, 1, 1, 1, 1, 1, 1, 1)**
2	955.2521	-5.9507	-4.1046	-5.2097	ARDL (3, 1, 1, 1, 1, 1, 1, 1, 1)
3	618.6995	-3.5744	-1.8733	-2.8916	ARDL (2, 1, 1, 1, 1, 1, 1, 1, 1)
4	252.3377	-0.9805	0.5754	-0.3560	ARDL (1, 1, 1, 1, 1, 1, 1, 1, 1)

Results obtained from table 17 After estimating different models, this study conclude that we will select model 1 having lowest AIC value among each criteria's. As the result indicate that we will use ARDL order of (4, 1, 1, 1, 1, 1, 1, 1, 1).

Table 18 Long Run Results for Low Income Countries

Variables	Coefficient	Std. Errors	t- statistics	Probability
LFP	7.844	4.164	1.883	0.062
Co_2 Emissions	-30.650	18.851	-1.625	0.106
DOPY	-0.000	0.000	-0.725	0.469
GDP Per Capita	0.033	0.020	1.660	0.099
HE	3.329	1.364	2.434	0.016
SSC	0.000	0.000	2.027	0.044
UPG	-1.450	1.022	-1.375	0.171
PG	51.555	29.826	1.728	0.086

Source: Author's own calculation. Note: Data range is from 1990-2014 and total number of observation is 275.

Results obtained from table 18 shows that GDP per capita, health expenditure as a percentage of total GDP, population growth as average percentage of total population, labor force participation as a percentage of total population and secondary school enrolment on average percentage at per year have shown positive and significant long run relationship with the life expectancy. Co_2 emissions per metric tons are negatively and significantly related to the life expectancy, while number of disaster occurred per year is negative and insignificantly related with the life expectancy. Low income countries are vulnerable to the deaths due to natural disasters and so number of disaster occurred per year is negatively affect the life expectancy in the long run. Urban population growth as a percentage of total population is insignificant in the long run with a negative sign. Negative relation of urban population with life expectancy in case of low income countries may be with the fact that in low income countries the health facilities are not properly provided and furthermore due to over pollution and fat diet which leads to respiratory diseases, Similar results have been reported by Popkin (2016), Ahmad and Ali (2014).

Table 19 Short Run Result for Low Income Countries[10]

Variables	Coefficient	Std. Errors	t- statistics	Probability
COINTEQ01	-0.000	0.000	1.907	0.058
D(LE) (-1)	2.023	0.153	13.197	0.000
D(LE) (-2)	-1.302	0.283	-4.596	0.000
D(LE) (-3)	0.206	0.150	1.373	0.172
D(LF)	-0.004	0.006	-0.672	0.502
D(Co_2 Emissions)	0.176	0.171	1.031	0.304
D(DOPY)	0.000	0.000	0.923	0.035
D(GDPPC)	-0.000	0.000	-1.456	0.147
D(HE)	-0.000	0.001	0.563	0.574
D(SSC)	-0.000	0.000	-0.070	0.943
D(UPG)	0.023	0.016	1.458	0.147
D(PG)	0.021	0.032	0.668	0.505
C	-0.443	0.250	-1.770	0.079

[10] Note all the descriptive statistics and regressions results are Author's own calculation accordingly to data sets taken for each groups as will for full samples.

While coming to short run adjustment coefficients, no variable has shown the convergence to their mean paths in case of any shock.

Chapter 5 Conclusion and Policy Implications

5.1. Conclusion

This study explores the socio-economic determinants of life expectancy in case of high, middle and low income countries for the period of 1990-2014. The study focuses on both aggregate and disaggregates analysis of the socio-economic determinants of life expectancy by using panel autoregressive distributive lags model. The study further finds long and short run relationship among the variables. The long run results obtained for the aggregate sample suggested that there existed negative relationship among life expectancy and Co_2 emissions per year in metric tons, population growth and urban population growth as a percentage of population in the long run. Our findings are consistent with the early findings of (Ali and Khalid, 2014) in their findings they suggested that there exists negative and significant relationship between life expectancy and population growth. According to study of kossis, there is a negative relationship between life expectancy and Co_2 emissions. Moreover, there exist positive relationship among life expectancy, health expenditure as a percentage of GDP, Gross domestic product per-capita, secondary school enrollment on average per year enrollment and labor force participation as a percentage of total population yearly. In many studies related to life expectancy these variables are used and their role are vital in determining life expectancy and mostly these variables had positively affected life expectancy. Such results are support the early findings of (Bilas et al, Kabir, Agheli, and kossis etc.). Disasters occurred per year had positive but insignificant relationship with life expectancy, as this variable has not been used before in determining life expectancy at birth so the proposed study is uses this variable for the first time. The reason for this positive and insignificant relationship between life expectancy and number of disasters occurred per year may be due to the fact that in the aggregated sample the study included all the sample countries so the ratio of average

number of disaster occurred per year is not that much effected to the whole sample as it effects at disaggregate level.

However, in the short run there exists negative relationship among life expectancy, Co_2 emission, population growth, GDP per capita, health expenditure and labor force participation in the short run. It shows that there is convergence of these variables in case of any shock in the short run. Moreover, there exists positive relationship among life expectancy, urban population growth and disaster in the short run which means that in case of any shock, a variable will not come back to the original mean path.

High Income Countries

The findings for the high income countries shows that in the long run there exists negative and significant relationship among life expectancy and Co_2 emission per year metric tons. In contrast, there exists positive relationship among life expectancy, GDP per-capita, urban population growth as average percentage of population, secondary school enrollment average per year enrollment, health expenditures as a percentage of GDP, number of disasters occurred per year, population growth and labor force participation in the long run. The reason for positive relationship between life expectancy and urban population growth is that when people migrate from rural areas to urban areas in high income countries, they basically have more access to health facilities, better infrastructure, high level of jobs and better services which enables them or make their life easier.

Further, in short there exists negative but not statistically different from zero relationship among life expectancy, Co_2 emission, disasters, population growth. GDP per-capita, urban population growth, secondary school enrollment, and labor force participation. It means that there is near zero adjustment or insignificant adjustment process in case of any short run disequilibrium in the relationship. However, there exist positive relationships among life expectancy and health expenditure and it shows divergence from the original path when HE undergoes a shock.

Middle Income Countries

In case of middle income countries, in long run there exist negative relationship among life expectancy, disasters, and urban population growth. Negative relationship between life expectancy and urban population growth indicates that moving towards urban areas in case of middle income countries may be that much helpful as these areas might be overpopulated indicating that the level of facilities is even not enough for the existing population to take benefit of, so more increase in urban population may harm the level of life expectancy adversely. In contrast, there exists positive relationship among life expectancy, GDP per-capita, health expenditures, secondary school enrollment, population growth and labor force participation.

While in short run, only population growth shows that there exists a significant convergence, while all others either have no convergence in short run or the convergence is insignificant. The speed of adjustment value is negative and significant indicates that around -0.020941 percent adjustment take place every year towards equilibrium.

Low Income Countries

In case of low income countries, the results suggested that there exists negative relationship in life expectancy with Co_2 emission, disasters, and urban population growth. In contrast, there exist positive relationship among life expectancy, GDP per-capita, secondary school enrolment, health expenditures, population growth and labor force participation in the long run.

While coming to short run adjustment coefficients, no variable has shown the convergence to their mean paths in case of any shock. The speed of adjustment value is negative and significant indicates that around -0.000653 percent adjustment take place every year towards equilibrium.

5.2. Policy Implications

The study on the socio-economic determinants of life expectancy has been viewed thoroughly, considering it as the basis for developing strong policy implications for the policy makers in order

to overcome the key areas where there is need of improvement. As discussed in the conclusion section, after identifying the socio-economic determinants of life expectancy in high, middle and low income countries, we have some policy suggestions for the policy makers on the basis of our estimation results.

- Life expectancy is a major indicator of the development of a nation. It is also included in widely used Human Development Index (HDI)[11]. Less developed countries lie in lowest percentile on the HDI scale, e.g. Pakistan has an HDI rank of 147 as of 2014. So, following the Co Integration results from ARDL, we come to know that GDP per capita, on average secondary school enrolment, health care expenditure as a percentage of GDP and on average percentage of yearly labor force participation are positively affect the life expectancy, so these variables must be taken care for in such a way that level of education must be augmented. This will lead to higher personal incomes, which in turn will cause the higher spending on health care and finally, higher spending on health care will improve the life expectancy of a nation. Three improved together will lead to a higher rank on the HDI scale.
- Environmental factors that negatively affect the life expectancy are the ones which lead to environmental problems and problems due to congestion. Co_2 emissions per year metric tons and number of disaster occurred per year are the contributing factors in reduction of life expectancy. Intuitively, it is understandable that Co_2 emission causes temperature hikes by blanketing the earth which causes the meltdown of glacial icecaps and hence floods in the lowlands of countries like Pakistan, India and Bangladesh. Co_2 emissions also causes the cracks in ozone layer and hence causing skin cancer as well as high concentration of Co_2 emission in

[11] HDI was developed by Dr. Mahbub ul Haq in 1991 with Amartya Sen. It includes three dimensions, i.e. education, health and income measured by number of average schooling years, life expectancy and per capita income respectively.

atmosphere causes the acid rain too due to which water quality is degraded and serious health problems again cause early deaths than expected life span of human beings. So, Co_2 emission must be tackled through creating and developing natural carbon sinks i.e. increasing forest cover and increasing the use of fuel efficient environment friendly technology in production process. As far as natural disasters are related, they are inevitable but their impact could be dampened through early warning systems, such as earthquake warning system[12], flood and storm warning system and timely rescue activities in the affected areas as well as strengthening of civil defense system will altogether help in reduction of loss of lives in case of a natural disaster and hence low mortality rate will be achieved which will increase the life expectancy.

[12] Although available earthquake warning system is possible to buzzer up just 15-20 seconds before the quake but still it is of great use in saving precious lives.

References

Abbasi-Ghahramanloo, A., Safiri, S., Faramarzi, A., Kabir, M. J., & Chahkoie, M. (2014). Association Between Demographic and Health Indicators Among 174 Countries, 2004-2011.

Agheli, L., & Emamgholipour, S. (2015). Determinants of Life Expectancy at Birth in Iran: A Modified Grossman Health Production Function. European Online Journal of Natural and Social Sciences, 4(2), pp-427.

Akram, N., Ihtsham ul Haq Padda, & Khan, M. (2008). The Long Term Impact of Health On Economic Growth In Pakistan. The Pakistan Development Review, 487-500.

Ali, A., & Ahmad, K. (2014). The Impact Of Socio-Economic Factors On Life Expectancy For Sultanate Of Oman: An Empirical Analysis.

Ali, A., & Audi, M. (2016). The Impact of Income Inequality, Environmental Degradation and Globalization on Life Expectancy in Pakistan: An Empirical Analysis.

Balan, C., Jaba, E., & BALAN, C. (2011). Statistical Analysis Of The Determinants Of Life Expectancy In Romania. The Journal of the Romanian Regional Science Association, 5(2), 25-38.

Bayati, M., Akbarian, R., & Kavosi, Z. (2013). Determinants of Life Expectancy In Eastern Mediterranean Region: A Health Production Function. International Journal of Health Policy and Management, *1*(1), 57–61.

Bilas, V., Franc, S., & Bošnjak, M. (2014). Determinant Factors Of Life Expectancy At Birth In the European Union Countries. Collegium Antropologicum, 38(1), 1-9.

Cockerham, W. C. (1997). The social determinants of the Decline Of Life Expectancy in Russia and Eastern Europe: a Lifestyle Explanation. Journal of Health and Social Behavior, 117-130

Department of Health United Kingdom (DHUK), 2011 Report on Life Expectancy.

Emmanuel Guindon, G., & Contoyannis, P. (2012). A Second Look At Pharmaceutical Spending As Determinants Of Health Outcomes in Canada. Health Economics, *21*(12), 1477-1495.

Eugene Rogot, P. D. (1992), Life Expectancy by Employment Status, Income, and Education in the National Longitudinal Mortality Study. Wisconsin Avenue, Bethesda, MD 20892, telephone 301-496-8887.

Crimmins, E. M., Preston, S. H., Cohen, B., & National Research Council (US) Panel on Understanding Divergent Trends In Longevity In High-Income Countries. (2011). Difference Between Life Expectancy In The United States And Other High-Income Countries.

Gilligan, A. M., & Skrepnek, G. H. (2014). Determinants Of Life Expectancy In The Eastern Mediterranean Region. Health Policy and Planning, czu041.

Gulis, G. (2000). Life Expectancy As An Indicator Of Environmental Health. European Journal Of Epidemiology, 16(2), 161-165.

Halicioglu, F. (2011). Modeling Life Expectancy In Turkey. Economic Modelling, *28*(5), 2075-2082.

Hong, R., & Ruiz Beltran, M. (2008). Low Birth Weight As a Risk Factor For Infant Mortality In Egypt, Volume 14, 2008, Eastern Mediterranean Health Journal.

Kabir, M. (2008). Determinants Of Life Expectancy In Developing Countries. The Journal Of Developing Areas, 41(2), 185-204.

Ke Xu, P. S. (2011). The Determinants Of Health Expenditure. Health Financing For Universal Coverage, 28.

Kelly F. Austin, & Laura A. McKinney. (2012). Disease, War, Hunger, And Deprivation: A Cross-National Investigation Of The Determinants Of Life Expectancy In Less-Developed And Sub-Saharan African Nations. Sociological Perspectives, *55*(3), 421-447. doi:1. Retrieved From http://www.jstor.org/stable/10.1525/sop.2012.55.3.421 doi:1

khan, A. (2012). What are the Causes, Effects and Measurements of Over Population in Pakistan? ahsankhaneco.blogspot.com.

Mondal, M. N. I., & Shitan, M. (2013). Impact Of Socio-Health Factors On Life Expectancy In The Low and Lower Middle Income Countries. Iranian journal Of Public Health, *42*(12), 1354.

Midhet, F., & Becker, S. (2010). Impact of Community-Based Interventions On Maternal And Neonatal Health Indicators: Results From a Community Randomized Trial in Rural Balochistan, Pakistan. Reproductive Health, 7(1), 30.

National Research Council United State (NRCUS), 2015 NRCUS Report on Human Longevity.

Murray, C. J., & Lopez, A. D. (1997). Alternative Projections Of Mortality And Disability by Cause 1990–2020: Global Burden Of Disease Study. The Lancet, 349(9064), 1498-1504.

Popkin, B. M. (1999). Urbanization, Lifestyle Changes And The Nutrition Transition. World Development, 27(11), 1905-1916.

Rogot, E., Sorlie, P. D., & 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.

Sede, P. I., & Ohemeng, W. (2015). Socio-Economic Determinants Of Life Expectancy In Nigeria (1980 – 2011). Health Economics Review, *5*, 2.

Shahbaz, M., Loganathan, N., Mujahid, N., Ali, A., & Nawaz, A. (2015). Determinants Of Life Expectancy And Its Prospects Under The Role of Economic Misery: A Case Of Pakistan. Social Indicators Research, 1-18.

Shaw, J. W., Horrace, W. C., & Vogel, R. J. (2005). The Determinants Of Life Expectancy: An Analysis of the OECD Health Data. Southern Economic Journal, 768-783.

Taşkaya, S., & Demirkiran, M. (2016). Environmental Determinants Of Life Expectancy At Birth In Turkey. International Journal Of Research In Medical Sciences, *4*(4), 995-999.

United Nations International Children's Emergency Fund (UNICEF), 2014. 15 Facts On Education In Developing Countries And Under Developed Countries. Las Vegas: Academic Credentials Evaluation Institute, INC.

United Nation World Population Prospects (UNWPP), 2015 Report On Key Findings And Advance Tables Revision Of Health Analysis.

T. R. MALTHUS, A. M. (1817). An Essay On The Principal Of Population London: W. Clowes, Northum Berland - Court Strand, London.

World Bank (WB) 2005. WB Report On Tackling Health Inequalities.

World Health Organization (WHO), 2015 WHO Report On The Global Life Expectancy.

World Health Organization (WHO), 2014 Health Promotion Glossary. Geneva: WHO Publication.

World Bank (WB), 2014 WB Teaching Activities On Life Expectancy.
http://www.worldbank.org/depweb/english/teach/life.html

World Population Data Sheet (WPDS),2015 WPDS Population Reference Bureau Washington, DC. USA.

Williamson, J. B., & Boehmer, U. (1997). Female Life Expectancy, Gender stratification, health status, and level of economic development: A Cross-National Study Of Less Developed Countries. Social Science & Medicine,45(2), 305-317.

Yves Decady and Lawson Greenberg. (2014). Ninety Years Of Change In Life Expectancy, Statistics of Canada, Journal Of Health At Glance, .82-624.

CHAPTER 6 APPENDIX

Appendix A

Table 20 A1: Countries Included in Aggregated Sample

S.NO	Countries	S.NO	Countries
1	Norway	26	South Africa
2	Switzerland	27	Angola
3	Australia	28	Albania
4	United States	29	Paraguay
5	Singapore	30	Samoa
6	Canada	31	Bangladesh
7	Austria	32	Georgia
8	Germany	33	Indonesia
9	Belgium	34	Ukraine
10	France	35	Sri Lanka
11	United Kingdom	36	Nigeria
12	Japan	37	Zambia
13	New Zealand	38	India
14	Italy	39	Pakistan
15	Spain	40	Tanzania
16	Uruguay	41	Zimbabwe
17	Russia	42	Nepal
18	Brazil	43	Afghanistan
19	Turkey	44	Uganda
20	Malaysia	45	Mali
21	Mexico	46	Ethiopia
22	Costa Rica	47	Gambia
23	Romania	48	Niger
24	China	49	Malawi
25	Iran	50	Togo

Table 21 A2: Countries Included in High Income Groups

S.NO	Countries	S.NO	Countries
1	Norway	10	France
2	Switzerland	11	United Kingdom
3	Australia	12	Japan
4	United States	13	New Zealand
5	Singapore	14	Italy
6	Canada	15	Spain
7	Austria	16	Uruguay
8	Germany	17	Russia
9	Belgium		

Table 22 A3: Countries Included in Middle Income Groups

S.NO	Countries	S.NO	Countries
1	Brazil	12	Paraguay
2	Turkey	13	Samoa
3	Malaysia	14	Bangladesh
4	Mexico	15	Georgia
5	Costa Rica	16	Indonesia
6	Romania	17	Ukraine
7	China	18	Sri Lanka
8	Iran	19	Nigeria
9	South Africa	20	Zambia
10	Angola	21	India
11	Albania	22	Pakistan

Table 23 A4: Countries Included in Low Income Groups

S.NO	Countries	S.NO	Countries
1	Tanzania	7	Mali
2	Zimbabwe	8	Gambia
3	Nepal	9	Niger
4	Afghanistan	10	Malawi
5	Uganda	11	Togo
6	Ethiopia		

Appendix B: Residuals Cross-section Dependency Tests

Table 24 B1: Residuals Cross-Section dependence test (Full Sample)

Test	Statistics	Probabilities
Breusch-Pagan LM	9176.138	0.0000
Pesaran scaled LM	159.6271	0.0000
Pesaran CD	2.150640	0.0315

Table 25 B2: Residual Cross-Section Dependence Test (High Income countries)

Test	Statistics	Probabilities
Breusch-Pagan LM	374.2625	0.0000
Pesaran scaled LM	13.41601	0.0000
Pesaran CD	4.491567	0.0000

Table 26 B3: Residual Cross-Section Dependence Test (Middle income countries)

Test	Statistics	Probabilities
Breusch-Pagan LM	2072.846	0.0000
Pesaran scaled LM	84.66691	0.0000
Pesaran CD	3.310171	0.0009

Table 27 B4: Residual Cross-Section Dependence Test (Low Income Countries)

Test	Statistics	Probabilities
Breusch-Pagan LM	214.8779	0.0000
Pesaran scaled LM	14.19495	0.0000
Pesaran CD	-1.422928	0.0048

Appendix C

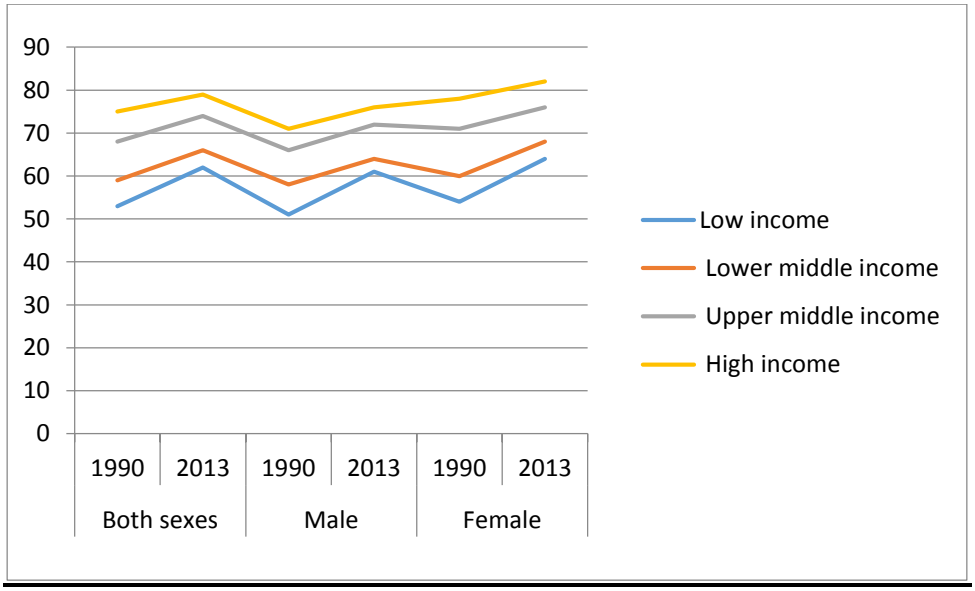

Figure 1 C1: Life Expectancy at Birth in Different Income Groups

Figure 2 C2: Life Expectancy at age 60 in Different Income Groups

Appendix D

Table 28 D1: Aggregated Results for Full Samples

Dependent Variable: D(LIFE_EXPECTANCY)
Method: ARDL
Date: 08/31/16 Time: 01:12
Sample: 1990 2014
Included observations: 1250
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): LABOR_FORCE CO2_EMISSIONS DISASTER_OCCURRENCE_PER_YEAR GDP_PER_CAPITA HEALTH_EXPENDITURE SECONDARY_SCHOOLE_ENROLM URBAN_POP_GROWTH POPN_GROWTH LABOR_FORCE
Fixed regressors: C
Number of models evalulated: 2
Selected Model: ARDL(2, 1, 1, 1, 1, 1, 1, 1, 1)

Variables	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
LABOR_FORCE	0.509895	0.017967	28.37929	0.0000
CO2_EMISSIONS	-1.461462	0.230891	-6.329664	0.0000
DISASTER_OCCURRENCE_PER_YEAR	1.67E-06	2.47E-06	0.674877	0.5000
GDP_PER_CAPITA	0.000480	5.05E-05	9.511317	0.0000
HEALTH_EXPENDITURE	0.460773	0.091303	5.046609	0.0000
SECONDARY_SCHOOLE_ENROLM	1.76E-07	1.33E-08	13.25123	0.0000
URBAN_POP_GROWTH	-0.365263	0.117892	-3.098276	0.0020
POPN_GROWTH	-0.550946	0.268373	-2.052913	0.0405
Short Run Equation				
COINTEQ01	-0.017246	0.010064	-1.713659	0.0870
D(LIFE_EXPECTANCY (-1))	0.526699	0.083453	6.311288	0.0000
D(LABOR_FORCE)	-0.016825	0.016437	-1.023630	0.3064
D(CO2_EMISSIONS)	-0.135150	0.098219	-1.376010	0.1693
D(DISASTER_OCURRENCE_PER_YEAR)	1.19E-05	5.24E-05	0.227803	0.8199
D(GDP_PER_CAPITA)	-3.79E-05	2.92E-05	-1.296106	0.1954
D(HEALTH_EXPENDITURE)	-0.009525	0.016895	-0.563736	0.5731
D(SECONDARY_SCHOOLE_ENROLM)	0.000179	0.000178	1.004340	0.3156
D(URBAN_POP_GROWTH)	0.512180	0.227844	2.247944	0.0249
D(POPN_GROWTH)	-0.466168	0.220806	-2.111214	0.0351
C	0.726519	0.435050	1.669967	0.0954

Mean dependent var	0.312146	S.D. dependent var	0.418853
S.E. of regression	0.122368	Akaike info criterion	-3.136258
Sum squared resid	10.36188	Schwarz criterion	-0.845825
Log likelihood	2518.161	Hannan-Quinn criter.	-2.275208

Table 29 D2: Results of High Income Countries

Dependent Variable: D(LIFE_EXPECTANCY)
Method: ARDL
Date: 08/31/16 Time: 01:30
Sample: 1990 2014
Included observations: 425
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): CO2_EMISSIONS
DISASTER_OCCURRENCE_PER_YEAR GDP_PER_CAPITA
HEALTH_EXPENDITURE LABOR_FORCE POPN_GROWTH
SECONDARY_SCHOOLE_ENROLM URBAN_POP_GROWTH
Fixed regressors: C
Number of models evalulated: 2
Selected Model: ARDL (2, 1, 1, 1, 1, 1, 1, 1, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
		Long Run Equation		
CO2_EMISSIONS	-0.461639	0.138922	-3.323019	0.0010
DISASTER_OCCURRENCE_PER_YEAR	6.15E-05	2.94E-05	2.092860	0.0375
GDP_PER_CAPITA	0.000124	1.30E-05	9.556750	0.0000
HEALTH_EXPENDITURE	0.118552	0.074304	1.595503	0.1120
LABOR_FORCE	0.298210	0.066944	4.454612	0.0000
POPN_GROWTH	0.896016	0.953842	0.939377	0.3485
SECONDARY_SCHOOLE_ENROLM	5.82E-08	5.76E-08	1.010512	0.3133
URBAN_POP_GROWTH	1.014710	0.487951	2.079531	0.0387
		Short Run Equation		
COINTEQ01	-0.057130	0.036609	-1.560528	0.1200
D (LIFE_EXPECTANCY (-1))	-0.132441	0.112329	-1.179045	0.2396
D(CO2_EMISSIONS)	-0.036973	0.033720	-1.096478	0.2740
D(DISASTER_OCCURENCE_PER_YEAR)	7.69E-05	0.000128	0.598787	0.5499
D(GDP_PER_CAPITA)	-5.38E-06	8.24E-06	-0.653391	0.5142
D(HEALTH_EXPENDITURE)	0.016052	0.049751	0.322656	0.7472
D(LABOR_FORCE)	-0.025613	0.031955	-0.801521	0.4237
D(POPN_GROWTH)	-1.302548	0.636145	-2.047563	0.0417
D(SECONDARY_SCHOOLE_ENROLM)	1.17E-06	7.09E-07	1.643251	0.1017
D(URBAN_POP_GROWTH)	1.297316	0.623701	2.080028	0.0386
C	3.355597	1.971603	1.701964	0.0901

Mean dependent var	0.214815	S.D. dependent var	0.260085
S.E. of regression	0.170145	Akaike info criterion	-0.982060
Sum squared resid	6.658363	Schwarz criterion	0.877134
Log likelihood	403.6878	Hannan-Quinn criter.	-0.247572

*Note: p-values and any subsequent tests do not account for model selection.

Table 30 D3: Results for Middle Income Countries

Dependent Variable: D(LIFE_EXPECTANCY)
Method: ARDL
Date: 08/31/16 Time: 01:43
Sample: 1990 2014
Included observations: 550
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): CO2_EMISSIONS
DISASTER_OCCURRENCE_PER_YEAR GDP_PER_CAPITA
HEALTH_EXPENDITURE LABOR_FORCE POPN_GROWTH
SECONDARY_SCHOOLE_ENROLM URBAN_POP_GROWTH
Fixed regressors: C
Number of models evalulated: 2
Selected Model: ARDL (2, 1, 1, 1, 1, 1, 1, 1, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
		Long Run Equation		
CO2_EMISSIONS	-1.229662	0.169670	-7.247371	0.0000
DISASTER_OCCURRENCE_PER_YEAR	-2.98E-06	7.89E-06	-0.377115	0.7064
GDP_PER_CAPITA	0.001123	4.59E-05	24.48130	0.0000
HEALTH_EXPENDITURE	0.260632	0.077464	3.364551	0.0009
LABOR_FORCE	0.478693	0.048651	9.839326	0.0000
POPN_GROWTH	2.277020	0.315708	7.212426	0.0000
SECONDARY_SCHOOLE_ENROLM	1.47E-07	1.55E-08	9.435223	0.0000
URBAN_POP_GROWTH	-2.756570	0.214862	-12.82946	0.0000
		Short Run Equation		
COINTEQ01	-0.020941	0.007351	-2.848723	0.0047
D (LIFE_EXPECTANCY (-1))	0.831592	0.068226	12.18885	0.0000
D(CO2_EMISSIONS)	0.018570	0.076625	0.242351	0.8087
D(DISASTER_OCCURENC_PER_YEAR)	-3.33E-05	5.70E-05	-0.585089	0.5589
D(GDP_PER_CAPITA)	-1.10E-05	8.27E-06	-1.329856	0.1846
D(HEALTH_EXPENDITURE)	-0.023815	0.021399	-1.112902	0.2666
D(LABOR_FORCE)	-0.022172	0.014135	-1.568604	0.1178
D(POPN_GROWTH)	-0.133522	0.061870	-2.158093	0.0317
D(SECONDARY_SCHOOLE_ENROLM)	-9.84E-05	9.85E-05	-0.998601	0.3188
D(URBAN_POP_GROWTH)	0.142349	0.104553	1.361497	0.1744
C	0.861066	0.323474	2.661935	0.0082

Mean dependent var	0.290287	S.D. dependent var	0.330080
S.E. of regression	0.107629	Akaike info criterion	-4.559140
Sum squared resid	3.475215	Schwarz criterion	-2.600086
Log likelihood	1503.764	Hannan-Quinn criter.	-3.793574

*Note: p-values and any subsequent tests do not account for model selection.

Table 31 D4: Results for Low Income Countries

Dependent Variable: D(LIFE_EXPECTANCY)
Method: ARDL
Date: 09/02/16 Time: 14:51
Sample: 1990 2014
Included observations: 275
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): GDP_PER_CAPITA
LABOR_FORCE HEALTH_EXPENDITURE DISASTER_OCCURRENCE_PER_
YEAR CO2_EMISSIONS POPN_GROWTH SECONDARY_SCHOOLE_E
NROLM URBAN_POP_GROWTH
Fixed regressors: C
Number of models evaluated: 4
Selected Model: ARDL (4, 1, 1, 1, 1, 1, 1, 1, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
GDP_PER_CAPITA	0.033924	0.020426	1.660838	0.0993
LABOR_FORCE	7.844285	4.164459	1.883626	0.0620
HEALTH_EXPENDITURE	3.329580	1.364876	2.439474	0.0161
DISASTER_OCCURRENCE_PER_YEAR	-0.000433	0.000597	-0.725219	0.4697
CO2_EMISSIONS	-30.65068	18.85139	-1.625911	0.1065
POPN_GROWTH	51.55584	29.82614	1.728546	0.0864
SECONDARY_SCHOOLE_ENROLM	1.62E-05	8.00E-06	2.027384	0.0448
URBAN_POP_GROWTH	-1.405924	1.022030	-1.375619	0.1714
Short Run Equation				
COINTEQ01	-0.000653	0.000342	-1.907852	0.0587
D (LIFE_EXPECTANCY (-1))	2.023520	0.153332	13.19703	0.0000
D (LIFE_EXPECTANCY (-2))	-1.302933	0.283481	-4.596190	0.0000
D (LIFE_EXPECTANCY (-3))	0.206604	0.150405	1.373659	0.1720
D(GDP_PER_CAPITA)	-4.51E-05	3.09E-05	-1.456368	0.1478
D(LABOR_FORCE)	-0.004318	0.006424	-0.672209	0.5027
D(HEALTH_EXPENDITURE)	-0.000655	0.001163	-0.563350	0.5742
D(DISASTER_OCCURENC_PER_YEAR)	2.11E-06	2.29E-06	0.923980	0.3573
D(CO2_EMISSIONS)	0.176660	0.171271	1.031466	0.3043
D(POPN_GROWTH)	0.021818	0.032660	0.668040	0.5054
D(SECONDARY_SCHOOLE_ENROLM)	-2.77E-05	0.000391	-0.070861	0.9436
D(URBAN_POP_GROWTH)	0.023429	0.016064	1.458439	0.1473
C	-0.443710	0.250537	-1.771038	0.0790

Mean dependent var	0.548846	S.D. dependent var	0.628158
S.E. of regression	0.008337	Akaike info criterion	-5.968534
Sum squared resid	0.008549	Schwarz criterion	-3.977358
Log likelihood	968.6892	Hannan-Quinn criter.	-5.169327

*Note: p-values and any subsequent tests do not account for model selection.