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What Drives Public Health Care Expenditures? Evidence from Pakistan

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Abstract

This study is about to investigate the main factors affecting health care expenditure in Pakistan. For this purpose, annual data are put into ARDL framework. The time period of the data was 1990-2019. Firstly, data descriptive statistics are tested and found that the data are normally distributes. Secondly, unit root tests ADF and PP are employed and revealed that the variables are of mixed order of stationarity. After stationarity checking ARDL technique is used to test the long run relationship between the variables. Bound test confirm the existence of long run relationship in variables of the model. Long run and short variables are estimated and found that in the long-run all the variables are statistically significant. The impact of GDPG and CO_2 are positive while the impact of INF and PG is negative. Diagnostic tests are i.e. serial correlation, heteroscedasticity, normality and stability of the parameters. No serious econometric problem is reported by the diagnostic tests.

Introduction

World Health Organization defined health as a complete state of mental, physical and social wellbeing and not merely the absence of disease or infirmity and health care is a very essential commodity to all humanity. It is the means through which a person is maintained pursuant to illness. All expenditures made for prevention, development, care, nutrition and emergency programs with an aim of improving and protecting health are accepted as "Health expenditures"(Dhoro, 2011; Boyacioglu, 2012 & Boachie *et al*., 2014). Human beings are at the centre of concerns for sustainable development," according to one of the Rio Declaration's key principles. They have a right to a healthy and productive life in the natural world". Sustainable development goals can only be met if there is a low prevalence of incapacitating diseases and communities can achieve a condition of physical, mental, and social well-being. It is convinced that health action, both for the poor and for the entire population, is critical for the creation of inclusive, equitable, economically productive, and healthy societies, because health is an important indicator of a country's living standards, and labor productivity can be affected by health, educational status, and labor force conditions Because healthy employees work harder and longer than others and have a more creative and prepared mind, as well as they are more productive. (Boyacioglu, 2012 &Erçelik , 2018). Therefore, health expenditures made by the government is an important factor to accumulate human capital. Apart from this direct impact, health improvement in the human force will be followed by motivation to continue education and obtain better skills, because improved health conditions will increase investment attraction in education and educational opportunities on one hand, and will prepare individuals to continue education and obtain better skills on the other. Similarly, improving society's health and health indexes will encourage individuals to save more money by lowering mortality and increasing life expectancy. Physical capital is boosted as a result of increasing saving in society, and this issue will have an

indirect impact on labor force productivity and economic growth (Boussalem *et al.,* 2014**)**. Moreover, the impact of health on the accumulation of human and physical capital can have an impact on economic growth. Increasing national healthcare spending would tend to enhance labor productivity, quality of life, and general welfare because healthcare is a basic component of human capital investment. Spending on healthcare is also credited for extending life expectancy and lowering morbidity and infant mortality rates (Bedir, 2016). Health provides positive externalities for society as a whole, as well as issues about equity, as only the rich section of the population would be able to afford reasonable healthcare services without public sector financial support (Akram & Khan, 2007). The prevalence of large-scale health problems, such as high infant mortality rates and short life expectancy, is a result of insufficient health resources and infrastructure, particularly in developing nations. Statistics show that, in addition to healthcare spending significantly below those in industrialized countries, the little health infrastructures that exist are uneven between urban and rural areas. Access to and availability of improved healthcare services reduces mortality and financial risk in the population while also addressing poverty issues. Appropriate and efficient health spending remains critical in improving health status in this regard (Edme *et* al., 2017). Another compelling argument for government investment in basic health-care services is to lower illness burden (BOD) during productive years of life. The BOD and the societal rate of return compel policymakers to divert public funds to better health-care facilities (Akram & Khan, 2007). Pakistan is a developing country facing the problem of low GDP rate, high population growth and high inflation rate i.e. 3.9 % in 2018. Currently Pakistan's GDP is 312.6 USD billions with the growth rate of 5.4 %, while GDP per capita 1467.7 USD which is low. Because of this low GDP rate expenditure in every sector is affected. Such as in health sector it spent 384.57 billion, while in terms of GDP it is 1.12%, which is far below the standard level. Due to this low expenditure in health sector many problems took place such as many diseases in infants and elderly aged population cannot cure properly which causes high infant mortality rate and low life expectancy. Now a day in Pakistan number of children aged below ten years is 30.45% and elderly aged population aged above 60 years is 5.54%. As Pakistan is the 6th most populous country of the world. Its total population is 207.77 billion with the average annual growth rate of 2.40%. In which 75.58 million people lived in urban areas and cities which is 36.38 % of the total population of total population with average annual growth rate of 2.70%, and 132.19 million people lived in rural areas with average annual growth rate of 2.23%. The growth rate in urban population is high because of movement of people from rural areas to cities in search of better life standard such as education, job and better health facilities etc, because after food, cloth and shelter education, good job and better health are basic needs of any developing society. In now a days, Pakistan spend 331.276 billion on education, while literacy rate of both male and female is 70% and 48% respectively, while total literacy rate is 58%. On the other hand this rapid urbanization causes environmental problems because of high vehicles due to which emission of poison gases such as carbon die oxide is 189.1 Mt which is very harmful for human life on space (CEIC, Economic survey of Pakistan and Pakistan Bureau of statistics, 2017-18).

Objectives of the Study

The objectives of the study are discussed below:

- To investigate the factors affecting public health care expenditures in Pakistan.
- To examine the impact of environmental and institutional factors on public health expenditures.

The research is divided into five sections. The first chapter of the introduction contains a summary of the problem, the scope/importance of the investigation, the research question, the study's objectives, and the study's hypothesis. The second part contains reviews of literature by various

researchers. The study's methodology will be explained in chapter three. In chapter, four result and discussion will be made. Conclusion and recommendations will be discus in chapter five.

Introduction

Literature review is the details of the past concepts, theories and empirical research studies. It is one of the important aspects of conducting any type of research. The study of literature provides an inner sight of topic under consideration. It provides the different aspects of research study in deep i.e. nature of the research study, techniques used and findings and conclusion. The detail literature is overviewed here under.

Review of the Most Relevant Studies from Literature

In 2004, Bilgel led a review of research study in the Canadian regions utilizing penal data over the time spam of 1975 to 2000. The results of the study show that income, transferred payments by government, and the portion of senior populace have genuinely huge impacts on medical care consumption. Further, the income flexibility of medical care use is less than one, but due to contradictory outcomes of Pesaran & Shin (IPS) & Hadri's panel tests, Bilgel (2004) was indifferent. Generally, past investigations about determinants of all health care consumption explicitly have hypothesized a few troubles in assessing the subject. Those hardships incorporate the value contrasts of medical services among OECD nations when cross-country information were applied (Gerdtham and Jonsson, 1991), and non-stationary factors of specified regression models condition with identified autocorrelation issues when in case of UK (Roberts, 2000). Toor & Butt (2005) explored the elements of health care expenditure. This study was conducted for Pakistan. The researchers employed conventional log linear model to find the health care expenditure aspects. Co-integrating technique is also used by the investigators to examine the long and short run association. It was concluded that GDP and literacy rate have positive association with health care expenditures. Akram & Khan (2007) inspected Health Care Disbursements at regional level in Pakistan. Primary source was used by the researchers to gather the data. Three-step Benefit Incidence Approach was used by the investigators to test the connection between public expenditure and health care. Finding determined that system of health care is costly, rare because of poverty, starvation, high population progression and proportion of infant deaths. In another study conducted by Rao *et al.,* (2008) elucidated the relationship between expenditure made on health and income i.e. per capita Gross Domestic Product. As per their discoveries, on account of five ASEAN nations, the GDP could Granger cause the development of wellbeing consumption in Malaysia and Singapore. There is bidirectional Granger causality among GDP and wellbeing use on account of Indonesia and Thailand. Rehman (2008) find out the aspects which influence the public health outlays. The existing study was carried out for India. Panel data from 1971-1991 was used by the investigators. To explore the factors of heath care spending, Husmen test, Random Effect model and finally Wald statistic were employed. It is concluded from the study that per capita income and literacy rate are the central factors of public health expenditure and there exist positive association among the variables. Murthy & Okunade (2009) analyzed the significant determinant of medical care use in African nations. They utilized Ordinary Least Square (OLS) and two-stage least square (TSLS) strategy by utilizing cross-sectional information for the year 2001. Murthy and Okunade inferred that there are two significant determinants, in particular, per capita GDP and per capita foreign aid (FA). By and large, contemplates on the determinants of medical care use talked about above utilized various techniques and kinds of information. Some way or another various factors were incorporated, like age of the populace, general medical care use and relative cost of medical services. Per capita pay is observed to be the significant determinant of medical care use in mostChaabouni & Abednnadher (2010) was carried out a study to inspect the determinants of health care expenditures. The current study was conducted for Tunisia. Time series data were taken by researchers for the period of 1961-2008.

ARDL approach and Granger causality were employed to test the data. The finding concluded that there exist a long-run and constant association among per capita income, GDP, population age, medical density and environmental worth. Tang (2010) find out health expenditure determinant for Malaysia. Data was collected through secondary method and a time series data for the period of 1967-2007 was taken. To explore the impact multivariate Johnson-Juselius and co-integration test was used by the investigators. Result of the study determined that health care expenditure factors such as per capita income, health care prices and population beyond 65 year are significantly interrelated with each other. Abbas & Hiemens (2011) carried out a study to inspect the Determinants of health expenditures. This study was conducted for Pakistan. The investigators used time series data from 1972-2006. To analyze the data and examine the long- and short-term influence of independent variables over dependent variables, co-integration and error correction model was used. The outcome of the study specifies that unemployment and urbanization had negative effect on health expenditures. Dhoro *et al.*, (2011) studied the Economic determinants of health care expenditures. The existing study was conducted for Zimbabwe. The researchers were taken time series data for the period of 1975-2005 yearly. To examine the outcome, Engle-Granger co-integration technique was employed. It's concluded from the outcomes that GDP per capita, literacy rate and foreign aid are significantly associated with health care expenditure. Population and life expectancy are found trivial, which means that these variables does not affecting the public health care expenditures. Magazzino & Mele (2012) conducted a research to examine the determinants of health expenditures for Italy. Secondary data were taken by the investigators for the period of 1980-2009. Two methods were used to analyses the existing study. Firstly Generalized Least Square-Fixed Effect was used to explore the static panel analysis and secondly Generalized Method of Moments test were used for the vibrant estimates. Results of the finding indicated that unemployment rate, urbanization and percentage of population influence the health care expenditures directly, whereas there is no linked among mortality rate, resident population and birth rate. Mehrara *et al.,* (2012) explored the connection between health expenditures and economic growth. This study was carried out for MENA countries. Researchers had taken annual data from 1995 to 2005. Panel co-integration technique was employed to analyze the data. The results specify that there found long run association between GDP and health expenditures. Samadi & Rad (2013) examined the Bases of Healthcare Spending. The existing study was conducted for the member countries of Economic Cooperation Organization. To carried out the study, Panel data was taken by the researchers for the period of 1995 to 2007. In this exploration the investigators used, Pearson cross sectional dependency test, Panel unit root tests and panel co-integration tests. To check the stationarity, Pearson cross sectional dependency test was employed and to test the short and long run association among variables the researchers used the panel co-integration tests. It's concluded from the outcome that there found a long run association between health care expenditures, GDP and population proportion. The populations which are beyond the age of 65 years have a short term associations with health care expenditures. Rezaei *et al.,* (2016) inspected health care expenditures determinant for Iran. They took data from secondary source and for the period of 1978 to 2011. Two methods was used by investigators to explore the health care determinant, Firstly ARDL approach is used examine long and short run connection between variables and secondly, error correction method is employed to check short and long run affects. The results revealed that the GDP per capita, illiteracy rate and urbanization enhance the health expenditures, whereas no. of physician only for 10,000 individuals and population, age above from 65 reducing the health expenditures. Shamsi & Waqas (2016) explored the impact of Unemployment, urbanization and income on public health care expenditure. This investigation was done for Pakistan. Time series data for the period of 1980 to 2009 was taken for this purpose. The researchers employed Augmented Dickey–Fuller unit root test to analyze the data. The conclusions exposed that income, enrollment in primary school and urban population had optimistic influence over public health expenditure, while the influence of unemployment is found

insignificant. Turgut *et al.,* (2017) investigated the association between inflation and health expenditures for Turkey. The researchers took data yearly from 2003 to 2016. Pearson Correlation Analysis and Regression Analysis were employed to estimate the results. The finding concluded that there exist significant association between inflation and health expenditure. Nesrin *et al*., (2017) explored the determinants of health expenditures. This study was carried out for OECD countries. Through secondary source the data were collected from 35 OECD countries. The dependent variable of the this study was health care expenditure whereas GDP per capita, percentage of total population, total number of hospitals per million and physicians per 1000 and age dependency ratio and life expectancy are independent variables. The study resulted that there exist positive and optimistic association between dependent and independent variables. Ali *et al*., (2017) research the impact of medical services expenses on GDP in Pakistan China, India and Bangladesh. The review utilized period spreading over 1995-2014. For this purpose, they used panel STATA 11. The Husman test gives affirmation. The importance of wellbeing spending is featured in this article since it is a vital indicator of monetary development. Ercelik (2018) analyzed the connection between medical care consumptions and financial development in Turkey. They utilized the ARDL way to deal with discover the connection between the chose factors. They time series information for the time of 1980-2005. They presumed that there GDP, GDP per capita and wellbeing uses are co-incorporated with one another and have critical and long connection between them. Ullah *et al*., (2019) analyzed the linkages between Trade, CO_2 Emissions and Healthcare Spending in China. They utilized time series information for the time of 1990-2017. They utilized ARDL strategy for the examination. They analyze the connection between exchange transparency, CO_2 discharge and medical care uses. They infer that CO_2 emanation and exchange transparency essentially influencing medical services uses in China. Since the utilization of efficient power energy in modern area increment the CO_2 outflow, which emphatically influence the medical care uses.

Methodology

This aimed to investigate the key factors affecting health care expenditure in case of Pakistan. Here in this study some socio-economic and environmental factors are used to put in the model. Indeed, this research work is devoted to examine Health-Led hypothesis. Literature tells us that the very first study devoted to examine the relationship of growth and health care expenditure is defined by Mushkin (1962). This concept is later on named health-led growth hypothesis and extensively examined in literature. As growth is remained one of the most demanded objectives of every society of all the times. In literature it is claimed that health care spending (health status of the society) determines growth. Labor is one of the most important inputs in every productive process and deal health as a capital. Therefore, expenditure made on health is investment in health improves the status of human capital and as result growth can be boost (Atilgan, 2015). Theme of the present study is to find out the factors affecting public health care expenditures in Pakistan. The effect of growth on public health care expenditures is positive (i. e increase in growth increase helps to increase Health Care Expenditure). While the demographic, environmental and institutional factors could affect Health Care Expenditure. On the other hand, inflation has a negative impact on HCE. Because in inflationary situation the prices of health care services are high.

Conceptual Framework

This study emphasis on some major factors such as population, CO2 emission and deforestation that can affect the economic growth in Pakistan. Utilizing the above variables, the conceptual framework is as follows:

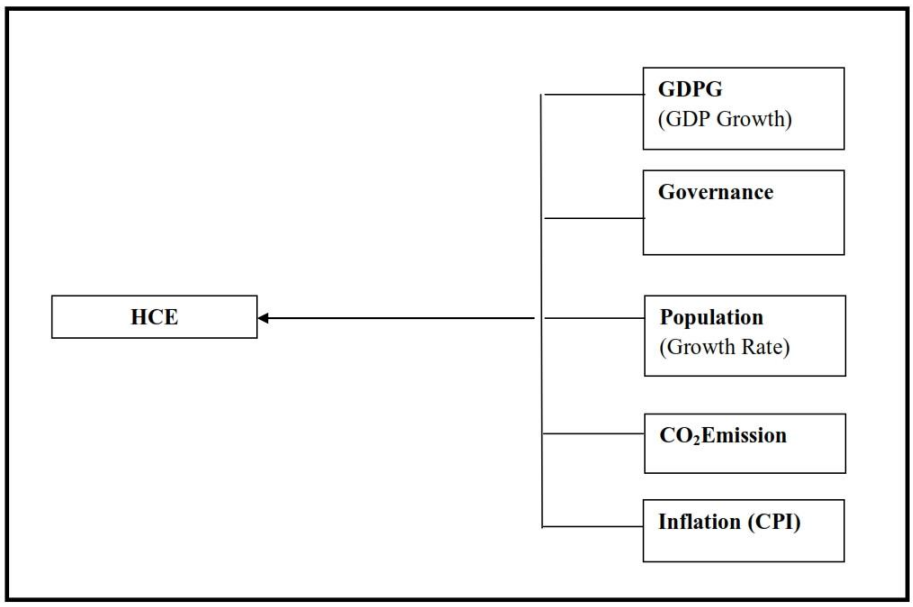

FIGURE-3.1: Conceptual Framework

The Model

To examine and provided parameters value estimates it is necessary to provide a concrete relation between the variables. The concrete relationship could be presented by model of the study. Model of the study is the mathematical cum statistical association between the dependent variable with the independent variables. This study mapped based in the past studies mentioned in theoretical framework.

The mapped model is defined as:

Health Care Expenditure =∫ **(**Income, Population, Carbon Dioxide Emission, Governance and Inflation) 3.1

The functional form can be written as:

HCE =∫ **(**GDPG, PG, CO_2, GOV, INF) 3.2

And the econometric form of the model is as:

$$HCX_t = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\, GDPG_t + \boldsymbol{\beta_2}\, PG_t + \boldsymbol{\beta_3}\, CO_{2t} + \boldsymbol{\beta_4} GOV + \boldsymbol{\beta_5} INF_t + u_t \quad 3.3$$

The dependent variable is Health Care Expenditure, while the independent variables are Gross domestic Product Growth is measured by GDPG. Where PG represents population growth and environmental degradation or environmental pollution is taken proxy by Carbon Dioxide emission (CO_2). INF stands for inflation. The 't' in base is for the representation of time series data. While Governance is representing by GOV. The term 'u' represents the error term.

While $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$ and β_5 are the parameters.

The next step in methodology is the data, data sources and variables description.

Variables and Data Source

Gross Domestic Product (GDP) Growth, Population Growth (PG), emissions of CO_2, Governance and inflation are being utilized as variables in the current study. This study is based on time series data, for the time period of 1990-2019. This research proposed GDPG as dependent variable, while population density, emissions of CO_2 and governance is taken as independent variables.

Table3.1:1 Variable Description and Data Sources			
Variable	**Description**	**Units**	**Source**
GDPP	"Gross Domestic Product Growth: GDP growth is % increase in **gross domestic product or the** sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the product definition.		World Bank
Pop	Population Growth: Annual population growth rate for year t is the exponential rate of growth of **midyear population from year t-1 to t**, expressed as a percentage. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship.	%Change	World Bank
CO_2	Carbon Dioxide Emission: Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring per capita in matric toms".	Metric tons Per capita	World Bank
INF	**Inflation:** Consumer price index reflects changes in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. Data are period averages".	% change	World Bank
GOV	**Governance** Measures the likelihood of political instability, violence, or terrorism.		World Bank

Econometric Techniques

Stationarity of the Data

To get the objective of the current research study time series data are used. When research deals with time series data, it should be kept in mind that stationarity is needed to examine. If data are not treated under stationarity testing the results could be spurious. For the purpose of stationarity testing literature suggested the most common used tests i.e. Augmented Dicky Fullar (ADF) and Phillips Peron (PP) tests. The ADF test is proposed in 1979 based on given condition:

$$\Delta Y_t = \beta + \delta Y_{t-1} + \sum_{i=0}^{k} Y\Delta_{t-1} + \mu_t \qquad 3.4$$

In equation 3.4 the variable on left side represents the first change in 'Y', and the term 'μ' is for the description of auto correlation. The Greek words are parameters of the model. To decide about stationarity, the following hypotheses are designed:

H_0: there is no unit root in the data/ data is stationary

H_1: there is unit root in the data/ Data is non-stationary

Estimation Technique

To deal with time series data and to get the estimated values of the parameters of the independent variables several estimation techniques could be used. The techniques are mostly depends on the outcomes of the stationarity tests. The very first technique provided by Engle and Granger (1987) which could be used in the presence of unit root in the data and efficient results could be achieved. Another approach was designed by Johansen and Juselius (1990); which is a more powerful tool for the estimation of long run relationship among the variables in the model. In the most recent literature, a new addition to the estimation techniques was also added which named Autoregressive Distributor Lag (ARDL) model designed by Pesaran *et al*., (2001). This study preferred to use ARDL technique for estimation of the model. ARDL has some interesting feature i.e. it provides results very easily by taking different lags of the variables of the model and provide short and long run efficient results for short data span. The results of the techniques are very simple and easily understandable. It can be used in verity of the outcomes of the stationarity while other estimation technique does not allow us to use in the different outcomes of the Unit root tests. The definition of the ARDL technique is given in the following equation:

$$\Delta HCE_t = \alpha_1 + \sum_{i=1}^{p} \eta_{i1} \Delta HCE_{t-1} + \sum_{i=0}^{q} \eta_{i2} \Delta GDP_{t-i} + \sum_{i=0}^{q} \eta_{i3} \Delta CO_{2.t-i} +$$

$$\sum_{i=0}^{q} \eta_{i4} \Delta PG_{t-i} + \sum_{i=0}^{q} \eta_{i5} \Delta INF_{t-i} + + \theta_1 HCE_{t-i} + \theta_2 GDP_{t-i} + \theta_3 CO_{2.t-i}$$

$$+ \theta_4 PG_{t-i} + \theta_5 INF_{t-i} + \varepsilon_t \text{.....} (3.5)$$

Bounds Testing Procedure

To take decision about the existence of the co-integrational relationship between the in-dependent variables with dependent variable is the very first step in this process. The same decision is taken based on the value of the F-statistic of the Bond Testing technique. Null and alternative hypotheses are pre-defined. Null hypothesis is that the coefficients of the parameters are equal to zero means there is no relation between the variables of the model and the alternative is true. It can be written as

$$H_o : \theta_1 = \theta_2 = \theta_3 \cdots = \theta_k = 0$$

$$H_1 : \theta_1 \neq \theta_2 \neq \theta_3 \cdots \neq \theta_k \neq 0$$

In the null and alternative hypothesis the notation ‘k’ represents the number of parameters. Decision is made on the bases of the value of the F-Statistics and it comparison with lower and upper bound critical values.

According Pesran *et* al., (2001) define the rules as:

If F-calculated > upper Bound Critical value decision will be co-integration is existed

If F-calculated fall between Lower and upper Bound Critical value we will be in indifferent situation. No-decision zone

If F-calculated > Lower Bound Critical value decision will be No co-integration is existed.

After the existence of long run relationship, the long run coefficient can be estimated by means of equations (6.9), (6.10) and (9.11).

$$HCE_t = \alpha_1 + \sum_{i=1}^{p} \eta_{i1} HCE_{t-1} + \sum_{i=0}^{q} \eta_{i2} GDP_{t-1} + \sum_{i=0}^{q} \eta_{i3} CO_{2.t-1} + \sum_{i=0}^{q} \eta_{i4} PG_{t-1} + \sum_{i=0}^{q} \eta_{i5} INF_{t-1} + \sum_{i=0}^{q} \eta_{i5} GOV_{t-1}. \quad \text{.....(3.6)}$$

The short run dynamics of the ARDL could be written for Health Care Expenditure. The measured values of the parameters are the short run and the value of ECM term is the speed of adjustment towards long run equilibrium.

$$\Delta HCE_t = \alpha_1 + \sum_{i=1}^{p} \eta_{i1} \Delta HCE_{t-1} + \sum_{i=0}^{q} \eta_{i2} \Delta GDP_{t-1} + \sum_{i=0}^{q} \eta_{i3} \Delta CO_{2.t-1} + \sum_{i=0}^{q} \eta_{i4} \Delta PG_{t-1} + \sum_{i=0}^{q} \eta_{i5} \Delta INF_{t-1} +$$

$$\sum_{i=0}^{q} \eta_{i5} \Delta GOV_{t-1} + \Omega ECM_{t-1} \text{.....(3.7)}$$

ECM could be defined as:

$$ECM_t = \sum_{i=1}^{p} \eta_{i1} \Delta HCE_{t-1} + \sum_{i=0}^{q} \eta_{i2} \Delta GDP_{t-1} + \sum_{i=0}^{q} \eta_{i3} \Delta CO_{2.t-1} + \sum_{i=0}^{q} \eta_{i4} \Delta PG_{t-1} + \sum_{i=0}^{q} \eta_{i5} \Delta INF_{t-1} +$$

$$\sum_{i=0}^{q} \eta_{i5} \Delta GOV_{t-1} \text{.....(3.8)}$$

Parameters estimated under the use of (4.7) and (4.8) are short-run parameters and the magnitude with ECM factor the tendency towards equilibrium, the value of it must be negative and significant.

Results and Discussion

Introduction

This section includes results of various econometric tools used to find out the relationship among the selected variables.

Descriptive Statistics

Descriptive statistics give the basic summaries of the data of the variables under consideration. These statistics are used to describe the characteristics of data. Table 4.1 shows the results of descriptive statistic on a logarithmic scale.

Table-4.1: Descriptive Statistics

	GDPG	POP	GOV	INF	CO_2
Mean	3.754	2.010	4.010	6.016	0.209
Median	4.012	2.304	3.054	7.722	0.066
Maximum	6.140	3.570	6.740	11.889	1.729
Minimum	2.172	1.500	3.150	3.007	2.908
Std.Dev.	1.601	1.401	3.051	5.829	1.113
Skewness	-0.899	-1.001	9.101	0.401	0.905
Kurtosis	3.024	3.018	4.105	2.015	2.941
Jarque-Bera	9.001	8.907	12.012	6.556	7.328
Probability	0.019	0.012	0.001	0.020	0.060

Table-4.1 described the detail of descriptive statistics for the variables of the study variables ranging from 1990 to 2019. The data for the period of 30 years are analyzed. The mean value of GDPG is 3.754 along with standard deviations of 1.6. The highest value of GDPG is 6.14 and minimum value is 2.17. The GDPG is skewed towards left represented by Residuals for GDP variable are left skewed. The kurtosis value revealed that the variable GDPG is leptokurtic with long tail. To test about normality of the variable GDPG Jarque-Bera statistic is used. The p-values of Jarque-Bera test reported that the variable is normal. We can conclude that the variable's residual is distributed normally. The explanation for the other variables can

be done on the same procedure. To take decision about the descriptive statistics Mean, Standard deviation, Maximum and minimum and normality of the variables. All the variables are normally distributed clear from the P-values of the variables.

Unit Root Results

As earlier discussed, that this study deals with time series data therefore stationarity testing is needed. The most common used tests i.e. ADF and PP are used to investigate the order of integration of stationarity. The results of both the tests are presented in the following two tables i.e. Table-4.2 and Table-4.3.

Table4.2: ADF Test Results

Variables	Augmented Ducky Fuller Test				
	Level		First Difference		Decision
	T-	P-value	T-	P-value	
HCE	2.404**	0.017**	-5.811***	0.000	I(0)
GDPG	0.459	0.785	-4.988***	0.000	I(1)
PG	0.559	0.552	-6.990***	0.000	I(1)
INF/CPI	-2.022	0.211	-4.044***	0.000	I(1)
CO_2	-1.077	0.306	-6.036***	0.000	I(1)
GOV	0.601	0.819	-5.082***	0.000	I(1)

Table-4.2 the results of ADF test is presented. It is clear from the results that the variables are GDPG, PG, INF and CO_2 emission are not stationary at level, the same variables become stationary after first difference. It means that these variables are stationary of the first order. The decision about the unit root/stationarity is shown in column 6th I(1). The dependent variable health care expenditure is stationary at level i.e. I(0).

Table4.3: PP Test Results

Variables	Phillips Peron Test				
	Level		First Difference		Decision
	T-statistic	P-value	T-Statistics	P-value	
HCE	2.542**	0.012**	-5.967***	0.000	I(0)
GDPG	0.552	0.804	-5.019***	0.000	I(1)
PG	0.601	0.492	-7.038***	0.000	I(1)
INF	-1.982	0.190	-4.162***	0.000	I(1)
CO_2	-1.128	0.298	-5.927***	0.000	I(1)
GOV	0.712	0.705	-5.122***	0.000	I(1)

Table-4.3 the results of PP test is presented. It is clear from the results that the variables are GDPG, PG, INF and CO_2 emission are not stationary at level, the same variables become stationary after first difference. It means that these variables are stationary of the first order. The decision about the unit root/stationarity is shown in column 6th I(1). The dependent variable health care expenditure is stationary at level i.e. I(0). Both the tests provided the same outcomes about the order of stationarity of the variables of the model.

Co-Integrational Relationship Testing

After testing the order of stationarity, the next step is the selection of suitable technique for estimation the impact of selected variables on Health care expenditure or the determinants of Health care expenditure. The selection of suitable technique is based on the outcomes of the stationarity Tests. The results of the ADF and PP suggested that suitable technique for estimation is ARDL, because it deals with the mixed order of stationarity of the variables in the model.

Autoregressive Distributive Lags Model

There are three different steps in ARDL. These steps are as under:

(I) Testing for the Existence of Co-integrational Relationship

(II) Estimation of the Long Run estimates

(III) Estimation of the Error Correction model or short run estimates

(I) Existence of Long Run Relationship

The existence of the co-integrational relationship among the model's variables is checked with the help of Bound Test. The results of the Bound test are Table-4.4 show that there is co-integrational relationship between the variables. It is clear from the values of the F-Stat i.e. 6.281. The comparison of the F-Stat value with the values of the Upper Bound and Lower Bound critical values enable to take decision about the existence of long run relationship. The value of the F-Stat is greater than the upper bound critical value. Therefore, we can decide that there is long run relationship in the model under consideration and will reject the null Hypothesis.

Table 4.4: Bound Test Results

	Value	**K**
F-Stat	6.281	5
Bounds Test Critical Values		
Sig. Level	**lower Bound**	**Upper Bound**
10%	2.19	3.04
5%	2.48	3.52
2.50%	2.82	3.85
1%	3.29	4.28

Table-4.4. shows that there long run association between variables selected in the model under consideration.

(II) Estimation of the Long Run estimates

The results of the long run calculated from the use of ARDL techniques are given in the following table.

Table-4.6: The Results of ARDL (Long Run)

Variables	Coefficient	S.E	T	Pro.
C	0.891	0.250	3.564	0.000
GDPG	0.702	0.045	15.60	0.000
POPG	-0.299	0.040	-7.475	0.000
CO_2	0.472	0.230	2.052	0.007
INF	-0.184	0.052	-3.538	0.000
GOV	0.020	0.009	2.2223	0.0251

Table-4.6 describes the estimates of the long run model. In the first column the variables of the model are given, in column two the long run coefficients of the variables are presented. In column four and five the values of standard error and probability values are given. The coefficient of gross domestic product growth is 0.891, and found statistically significant. The value of t-stat is 3.564 and their corresponding probability value is 0.000 shows that the variable is significant at 1% level of significance. This means that an increase in GDP growth leads to increase in health expenditure in Pakistan. The result of the present study is in line with the findings of the study conducted by Wang et al., (2019). The results revealed that there is negative and significant relationship between Population growth and health expenditure, an increase in population growth will leads to decrease in health expenditure. The same type of result is also reported by Wang et al., (2019) and Ullah et al., (2021). Environmental factor is also added to the model i.e. CO_2 the variable is found positive and significant, means an increase in CO_2 leads to increase in health care expenditure. The environmental variable is significant at 1% level of significance means the variable is very much important for policy maker to put it in policy formulation. It may be positive because of an increase in environmental tax will leads to increase government income and leads to increase in health expenditure. Institutional factor is important and its measure largely debatable in the literature. In this study we have used a proxy for institutional factor is used as inflation. Inflation is measured the performance of institutions, higher inflation is consider failure of institution and lower inflation successfulness. The variable inflation is found negative and statistically significant in the long run. This means that increase inflation leads to decrease in health care expenditure in case of Pakistan. The impact of GOV on health care expenditure is positive is found positive and statistically significant. It's Mean that good governance leads to increase health care expenditure as health problems increase with the passage of time. This is desirable and will affect health status of the residents of the country.

(III) Estimation of the Error Correction model or short run estimates

Table-4.7: The Results of ECM (ARDL: Short Run)

Variables	Coefficient	S.E	T	Pro
C	0501	0.196	2.556	0.009
dGDPG	0.02	0.005	4.000	0.000
dPOPG	-0.19	0.040	-4.750	0.000
dCO_2	0.02	0.230	0.087	0.810
dINF	-0.04	0.052	-0.769	0.402
dGOV	0.200	0.08	2.50	0.0101
ECM-1	-0.695	0.253	-2.747	0.004

Table-4.7 shows the estimates of the short run of model. In the first column the variables of the model are given, in column two the short run coefficients of the variables are presented. In column four and five the values of standard error and probability values are given. The

coefficient of gross domestic product growth is 0.02, and found statistically significant. The value of t-statistics is 4.00 and their corresponding probability value is 0.000 shows that the variable is significant at 1% level of significance. This means that an increase in GDP growth in the short run leads to increase in health expenditure in Pakistan. The result of the present study is in line with the findings of the study conducted by Wang et al., (2019). The results revealed that there is negative and significant relationship between Population growth and health expenditure, an increase in population growth will leads to decrease in health expenditure. The same type of result is also reported by Wang et al., (2019) and Ullah et al., (2021). The other variables i.e. CO_2 and inflation are found statistically insignificant in the short. This means that environmental factors and institutional factor don't affect health care expenditure in the short run. Again, in the short run the impact of GOV on health care expenditure is found positive and statistically significant. It means that good governance leads to increase health care expenditure as health problems increase with the passage of time. This is desirable and will affect health status of the residents of the country. The coefficient of ECM is negative and statistically significant which confirm the outcome of the Bound Test that there is stable long run relationship between the variables of variables included into the model. The coefficient is 0.693 means that any disequilibrium in the short run will be adjusted in the long run with the speed of 69 % percent per year; or we can say that 69 percent of the dissertation in equilibrium will converge in the long run.

Diagnostic Tests

To ensure the reliability of the model, several key diagnostic tests were conducted. The LM test confirmed the absence of serial correlation, as the null hypothesis of no serial correlation was accepted. The Breusch-Pagan-Godfrey test indicated no evidence of heteroscedasticity, while the Jarque-Bera test validated the normality of residuals. Overall, these results suggest that the model is free from major econometric problems, ensuring the robustness and validity of the estimated results.

Table-4.8: Diagnostic Tests

DIAGNOSTIC TEST	Serial-Correlation	Heteroscedasticity	Normality
LM Test	0.070		
Breusch-Pagan-Godfrey		0.2542	
Jarque-bera			0.9962

Stability Test

To test the stability of the parameters of the model ARDL technique also deals with the testing of CUSUM and CUSUMSQ (Brown *et al*., 1975). These tests tell us about the stability of the parameters. In Figure-4.1 and Figure-4.2 the plots of CUSUM and CUSUMSQ tests are depicted respectively at 5% level of significance. It is clear from the figures i.e. 4.1 and 4.2 that the sketch of the graph is in the 5% percent bounds level. The curves of both the tests are with the bonds values which confirm the stability of parameters absence of any distortion in parameters.

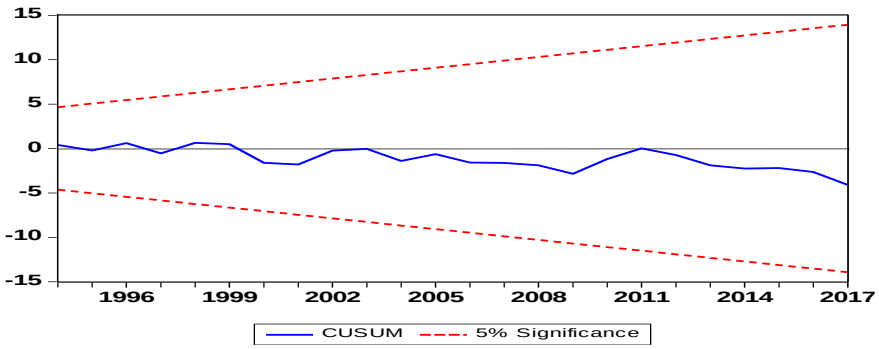

Figure 4.1: CUSUM

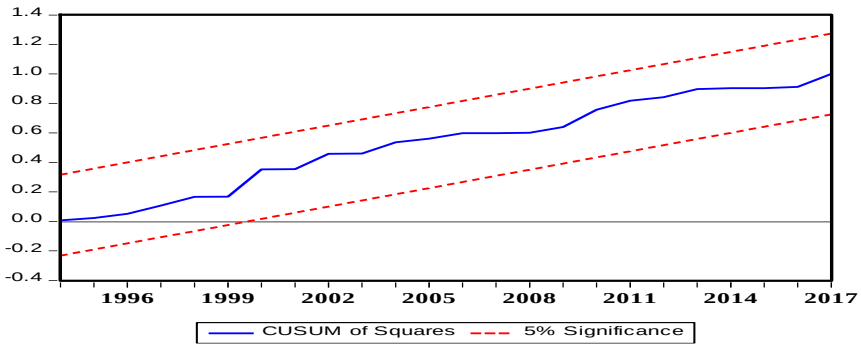

Figure 4.2 CUSUMSQ.

Conclusion

This chapter presents a summary of the key findings, conclusions, and policy recommendations of the study. The study investigates the main factors affecting health care expenditure in Pakistan by employing the ARDL model using annual data from 1990 to 2019. Initially, descriptive statistics confirmed that the data were normally distributed, and unit root tests (ADF and PP) revealed that the variables were of mixed order of stationarity. This justified the application of the ARDL framework. The Bound Test confirmed the existence of a long-run relationship among the model variables. Both long-run and short-run estimates were generated. In the long run, GDP growth (GDPG), CO_2 emissions (CO_2), and governance (GOV) were found to have a positive and statistically significant impact on health care expenditure, whereas inflation (INF) and population growth (PG) showed a negative impact. In the short run, only GDPG and PG were significant. Diagnostic tests, including checks for serial correlation, heteroscedasticity, normality, and parameter stability, indicated no serious econometric issues, confirming the model's robustness. Based on these findings, the study concludes that economic growth plays a critical role in enhancing health care expenditure, suggesting that policies promoting GDP growth can positively influence public health investment. On the other hand, population growth negatively affects per capita health spending, highlighting the need for population control measures such as family planning, increased female education, and delayed marriages. Although CO_2 emissions show a positive link with health spending—likely due to increased production and tax revenue—environmental sustainability must still be considered in policy design. Lastly, the study underscores the importance of good governance in ensuring effective allocation of health resources. Improving governance mechanisms will not only enhance the efficiency of health expenditure but also improve health outcomes across the country.

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