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Health Expenditure, Family planning and Infant Mortality in Punjab

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Abstract
This paper examines the relationship between IMRs and different independent variables. The Augmented Dickey fuller test and unit root test is used for examining the stationarity of the variables. The results obtained from employing Autoregressive distributed lag (ARDL) model to show the strong negative relation between health expenditure and IMRs. We also find strong negative relationship between IMRs and female enrollment, unemployment, inflation, lady health visitors, rural health Centre. To analyze the mortality rate, time series data models are estimated using for the period 1975-2015.

Keywords: health expenditure, infant mortality
JEL Codes: P46, J1

1. Introduction

The present paper is the first try to study the relative importance of private and public health expenditure on IMRs in Pakistan. It also targets to shed light on the other determinants of IMRs. This is done by relating time series data tests on data from Pakistan for the period 1975-2015. In addition to private and public expenditure on health, the regression equations contain a list of other explanatory variables. Directed by the above literature review, the variables we use are unemployment, lady health visitors, rural health Centre, and inflation. Our paper contrasts from other studies in this field in some sides. First, to the best of our understanding it is the only study that disaggregates health expenditure into its private and public mechanisms to study their effects on IMRs. Second, it is the first study that employs time series data techniques to assess the relative importance of private and public health spending on IMRs. The above argument on the role of private and public health expenditure on IMRs along the development process has important policy implications that substances both governments and concerned world organizations for the appropriate design of their health programs that aim to improve child health in general and reduce IMRs in particular. Our results strongly support the argument referred to above. Private health expenditure in the group of high-income countries is significant at the 1% level in three out of four regressions; in the group of low-income countries it is insignificant in three regressions and significant in the fourth one at the 10% level. Public health expenditure is not significant in any of the regressions for the high-income group while it is highly significant in all the four regressions of the low income group. The results of the whole country reveal that private expenditure is significant in two regressions, once at the 5% level and once at the 10% level, and is insignificant in one regression. Public expenditure is significant at the 1% level in two regressions and at the 5% in one regression, and insignificant in the fourth regression. The results show that 1% change in infant mortality will bring 23% change in lady health visitors. It shows that if infant mortality changes by 1% primary enrollment change by 6%. 1% change in infant mortality will effect rural health Centre by 54%. Similarly, 1% change in infant mortality will change unemployment by 4% and inflation by 3%. Concerning the health expenditure, available evidence suggests that at low levels of development public expenditure on health has stronger effect on mortality rates compared with private expenditure while at high development levels the opposite is true. Gupta et. al. (2001) provide evidence from 70 countries that public spending on health is more important for the health of the poor in low-income countries than in the high-income ones suggesting higher returns on health spending in the former countries compared with the latter group. The cross-country study of 22 developing countries by Annand and Ravallion (1993) documents that public spending on health significantly difficulties for life expectancy at birth. Hanmer et. al. (2003) test the strength of the determinants of infant and child mortality for a set of developing countries. Their results show that in addition to the level of per capita income, health and education variables are robust determinants as well. Turner (1991) in the case of Nicaragua found that better access to health care facilities is the most significant determinants of infant mortality.

2. Literature Review

Ouattara et al., (2005) examine the effect of private and public health expenditure on infant mortality. Panel data uses for study purpose on 160 countries. The study considers four different estimation methods. The first estimation consists of OLS method. The second and third consist of Fixed effect and random effect estimation and the last one is consist of GMM technique. The results show the strong negative relationship between health expenditure infant mortality rates. Authors find strong negative relationship between infant mortality rates and per capita income and female education. Mamoon et al., (2011) study Pakistan has the large population contributing to the total of the

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country. With a high population indulged in goods and services production. The health of the workers is an important factor for better growing production. The purpose of this paper is to identify the roots causes of low health standards in working population. Millard (1994) highlight the fact that people have different ideas about distribution of child mortality. In developing countries child mortality has been neglect cultural traditions of child care, population pressure, low maternal education, lacks of medical care and limited resources. Research using child mortality, maternal education, and primary health care, concluded that child neglect and economic scarcity are main reasons of child mortality.

Hakro et al., (2007) analyze the incidence of government expenditure on health by using the benefit incidence approach in case of Pakistan. The distribution of health expenditures at different stages of health e.g. mother childcare level, general hospitals, and clinics level. This is due to the fact that the lower incomes groups are unable to afford the costs at the private maternal hospitals, and prefer government hospital services where the costs are lower. Second the higher incomes groups prefer private hospitals where better qualities services are available. At the provincial level, the expenditures at mother childcare level in Punjab are highly regressive. The share of highest quintile is almost 8 times higher than the lowest quintile's share in Punjab. On the other hand, mother childcare expenditures are progressive in NWFP. Government of Pakistan is spending most of its health budget on preventive measures and health facilities. Public expenditures on preventive measures and health facilities are progressive, as lower incomes groups are getting a higher share as compared to higher income groups.

Akram et al., (2007) examine that a large number of studies have employee the Benefits Incidence Approach (BIA) on the household data for their analysis. The share of the different income groups differs depending upon the delivery of the benefits of the public expenditures across region, caste, religions, gender etc. Gupta, et al. (2002) used 56 country data and conclude that the increase in public expenditures on health reduce the mortality rates in infants and children. Butt et al., (2005) study that the socio-economic factors play an important role in determining health care expenditure in Pakistan. The share of health expenditure in total public expenditure is most significant variable affecting health status in a country. In Pakistan, the probability of dying under five child mortality is at 101 per 1,000 live births with a life expectancy of 62 years. For the attainment of eight millennium goals the UN millennium Declaration fixed 18 targets and 48 indicators; of which Pakistan has adopted16 targets and 37 indicators. Pakistan is signatory to the UN Millennium Development Goals (MDG), 200-2015.Three of the eight MDGs emphasis directly to health sector with four targets and sixteen indicators. Ministry of the health at the federal level and health departments at the provincial levels are responsible for public health service delivery in Pakistan.

Reidpath et al., (2003) explore that the infant mortality rate has criticize as a measure of population health because it is likely to focus the attention of health policy on a small part of the population. More recently it has argued that proxy measures of population health like infant mortality rate are problematic. infant mortality rate data is obtaining from the World Bank and the world health organization for 180 countries. There is a little evidence that the use of infant mortality as a measure of population has a negative impact on older groups in the population. Infant mortality rate remains an important factor of health for whole populations, reflecting the intuition that structural factors affecting the health of entire populations have an impact on the infant mortality rates. Meier et al., (1993) find that the infant mortality rate is defined as the number of deaths in children under 1 year of age per 1000 live births in the same year. Previous studies suggest that the availability of both abortion and family planning services produces public health benefits. The abortion rate is 2.7 times higher for non-White women than for White women.2' Black women are much more likely than White women to have an unwanted birth. The two major variables of interest are policies to fund abortions for Medicaid-eligible women and policies that fund family planning services for low-income women. The measure of abortion funding policy is the fund abortion rate-that is, the number of publicly fund abortions in the state per 1000 women aged 15 to 44.15 The per capita family planning expenditures measure includes all federal and state funds.

Heshaw et al., (1994) highlight that approximately 2,614 agencies are providing family planning services in at least 5,460 clinics throughout the nation, an increase over the 2,462 agencies and 5,174 clinics that are estimates to be providing such services in 1983. Health departments operates an estimates of 52%, 15% of clinic sites, 6% of hospitals and 27% of other agencies. The large majority provides family planning services in separate clinic sessions devote to that purpose. These clinics committed the private health care services in many ways. The study provides subsidies to low income women who are not eligible for Medicaid. Kazml et al., (2009) explore the inequalities in resource distribution and health service provision against the government health expenditures. The dawn of new millennium has place a lot of emphasis on development of human capital as a means to sustainable development. Health is a component of human development and is closely linked to poverty as well as productivity. Good productivity is dependent of good national health. The purpose of this study is to explore the nature of public sector expenditures in Pakistan on health sector by using the primary data of the Pakistan. This study is an observational descriptive study

done from Jan to April 2008. Data on the use of the publicly provided health services, income of the household and the individual expenditures on the health was obtained from PSLM Survey (Round 1) 2004-05, Federal Bureau of Statistics, Government of Pakistan.

Ude et al., (2014) investigate the effect of per capita health spending on child mortality in Nigeria using secondary data from 1980 to 2014.They find that doubling public spending from three to six percent of GDP would improve child mortality by only nine to 13%. They used ordinary least square multiple regression analytical method to examine the relationship between health expenditure and economic growth. Their results show that a significant and positive relationship exist between health care expenditure and economic growth. More importantly, the results and views of previous researchers are conflicting and would require a synthesis. This is because nine of the studies reviewed decomposed child mortality in to infant mortality under five mortality and neonatal mortality rates. Zakir et al., (2010) highlight the two-way relationship between the infant mortality and the fertility rate. The countries with high population growth rates and where a single mother goes through multiple child births have poor health which increases chances of infant mortality. Agha (2000) use primary data for Pakistan from PIHS and concluded that social indicators like family poverty. Parents' education and sanitation facilities are significant in explaining the odds of infant mortality in Pakistan.

Hassan et al (2011) examine occurrence of specific intra partum practices in Sindh province to find out the measures of safe delivery practices. For this purpose, they collected data from 225 participants and 82 health workers by using questionnaires. Researchers applied cross–sectional technique on the study and concluded that safe delivery practices and care for new born need improvement especially in the rural areas. Millard (1994) organizes the factors that leading to high child mortality rates onto three tiers to contextualize the medical causes of death and the debate over civilizations of child care. The first tier includes the immediate biomedical conditions that result in death, typically involving interactions of malnutrition and infection. The second tier includes child care practices and other behavior. The third tier encompasses the broad social, economic, and cultural processes and structures that lead to the differential distribution of basic necessities, especially food, shelter, and sanitation. The ultimate tier thus forms the context of causes located on the other tiers. Research from rural Mexico, Central America, and Africa supports various parts of the model, particularly concerning traditional parental behavior, which has often interpreted as child neglect but appears in many cases to result ultimately from economic scarcity. Links from tier to tier in the model especially warrant further attention from both researchers and policy makers.

Seshamani et al., (2004) find that the effect of demographic change on future health expenditures is a irresistible issue in all developed countries. The study examines the effect of age on health care costs. It uses statistical estimation. For their estimation they select the people who are in age of 65 and over at the end of 1970. It uses a longitudinal hospital dataset which follow 90 929 patients aged 65 and older from 1970 to death, to create an economic model of hospital costs base on patient age and time remaining to death. The study then applied the model to England population projections to forecast the effect of demographic changes on hospital expenditures from 2002 to 2026.The results show the decline in age-specific mortality rates over time postpones death to later ages. Adam et al., (2000) examine the expenses and effect on health on interferences that mark the health related millennium development goals. This paper provides policy makers with the essential information to enable them to evaluate if they are using the resources currently available for maternal and nutritional health. This paper base on observational studies. It uses 2 regions classified by the world health organization. First is Afar-E those countries in sub-Saharan Africa with very high adult and high child mortality. The second is Sear-D that comprising countries in South East Asia with high adult and high child mortality. The results show the preventive interventions at the community level for newborn babies and at the primary care level for mothers and newborn babies are extremely cost effective.

Xu et al., (2003) investigate the extent of catastrophic health expenditure as a first step to developing appropriate policy responses. It uses a cross-country analysis design. Data from household surveys in 59 countries. The study calculates uncertainty intervals around the reported proportion of households with catastrophic expenditure with bootstrap methods. The results show that there is an overall positive relation between the proportion of households with catastrophic health expenditures and the share of out of pocket payments in total health expenditure. Bhargava et al., (1990) investigate the effects of health indicators such as adult survival rates (ASR) on economic growth rates at 5-year intervals in the period 1965-90 in developed and developing countries. Panel data is analyzing in this study on Gross Domestic Product (GDP) series based on purchasing power adjustments and a GDP series based on official exchange rates. First, this study develops a framework for modeling the inter-relationships between GDP growth rates and explanatory variables by re-examining the life expectancy-income relationship. Second, the stochastic properties of the GDP series were analyzing by applying classical tests for unit roots in a fixed effects framework; a dynamic random effects framework is used for testing. The results showed the importance of ASR on growth rates for poor countries; the GDP levels beyond which ASR has a zero impact on growth rates using data from PWT and WDI are

respectively, 3554 international dollars and 690 dollars in 1987 prices.

3. Data Source and Model

The study examines the relationship between health expenditure and infant mortality rate, using the data over the period 1975 to 2015. The data is collected from World Bank maintained data base like world development indicators (WDI) and Economic survey of Pakistan. The economic models that are used to analyses and predict relation/effects of the different variables in the economy. The economic model that is used in this paper including infant mortality as a dependent variable and log of lady health visitor, log of rural health center, primary school enrolment, unemployment and inflation as independent variables to investigate the relationship between infant mortality and health expenditure in the case of Pakistan. Following the existing literature (Ali and Naeem, 2017; Ali, 2011; Ali, 2015; Ali, 2018; Ali and Bibi, 2017; Ali and Ahmad, 2014; Ali and Audi, 2016; Ali and Audi, 2018; Ali and Rehman, 2015; Ali and Senturk, 2019; Ali and Zulfiqar, 2018; Ali et al., 2016; Imran et al., 2021; Ali et al., 2021; Ali et al., 2021; Ali et al., 2015; Arshad and Ali, 2016; Ashraf and Ali, 2018; Audi and Ali, 2017; Audi and Ali, 2017; Audi et al., 2021; Ali and Ali, 2016; Audi et al., 2021; Audi et al., 2021; Audi et al., 2021; Haider and Ali, 2015; Kaseem et al., 2019; Roussel et al., 2021; Senturk and Ali, 2021), the functional expression of the model is express as:

Infant mortality= f (Unemp, Lhw, Rhd, inf gdp, pe)
Unemp = unemployment
Lhw = lady health worker
Rhd = rural health development
Inf gdp = inflation gdp deflator
Pe = primary school enrollment

4. Econometric methodology and Results

This study used Augmented Dickey-Fuller (ADF) unit root test to testify the stationarity of the variables and to prevent the estimation become spurious. All the stationary series will lead to significant results. Table 1 is showing the results ADF unit root test of all the variables at Level and at 1st difference. All the variables have become stationary at 1st difference.

Table 1

At level

Variable	T-statistics	Probability
LHV	8.257554	1.0000
LINFGDP	-5.030447	0.0000
LINM	-1.349104	0.5969
LPE	-1.377328	0.5837
LUNE	-2.686844	0.0852
LRHC	-3.109083	0.0341

At 1st difference

Variable	t-statistics	Probability
LHV	-4.679420	0.0005
LINFGDP	-7.502232	0.0000
LINM	-2.185389	0.2150
LPE	-6.356055	0.0000
LUNE	-7.723713	0.0000
LRHC	-5.965521	0.0000

For the existence of co-integration ARDL Bound test is used in this estimation and result is significant. The calculated results are showing that F-statistic (13.66389) is greater than the critical Bounds which means that co-integration exist between dependent and independent variables. Table2 is showing the result of ARDL Bound test

Table 2

Test statistics	Value	K
F statistics	13.66389	5
Critical bound test		
Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

5. Co-integration form of the model

Co-integration is checked by Bound test and the result of the co-integration is presented by table 3. The co-integration equation of the model is become as

Cointeq = LINM-(-0.2364*LLHV -0.0628*LPE+0.5727*LRHC+0.0453*LUNE -0.0360*LINFGDP+4.4645)

Table 3

Co-integration Results

Variable	Coefficient	Std. Error	t-statistics	Probability
D(LLHV)	0.004449	0.005852	0.760329	0.4545
D(LPE)	-0.000055	0.002381	-0.022951	0.9819
D(LPE(-1))	0.002808	0.002311	1.214733	0.2363
D(LRHC)	0.008581	0.010417	0.823741	0.4182
D(LUNE)	-0.001468	0.001260	-1.164396	0.2557
D(LUNE(-1))	-0.003374	0.001182	-2.855432	0.0087
D(LINFGDP)	-0.000740	0.000538	-1.375473	0.1817
D(LINFGDP(-1))	0.001203	0.000518	2.320927	0.0291
Co-intEq(-1)	-0.077257	0.017057	-4.529361	0.0001

With the existence of co-integration, the long run relation/results are estimated. The paper is using unemployment as dependent and remaining variables as independent variables and estimating long run results. The results are significant and are depicted by table 3

Table 4

Long Run Coefficients

Variable	Coefficient	Std. Error	t-statistic	Probability
LLHV	-0.236422	0.031204	-7.576761	0.0000
LPE	-0.062800	0.021614	-2.905505	0.0078
LRHC	0.572656	0.105387	5.433836	0.0000
LUNE	0.045292	0.020365	2.223983	0.0358
LINFGDP	-0.035999	0.012926	-2.784927	0.0103
C	4.464464	0.468440	9.530496	0.0000

The coefficient LLHV is showing negative effect on infant Mortality which means that 1% increase/decrease in LLHV will effect 23% increase/decrease change in infant mortality. The Coefficient LPE is showing negative effect on infant mortality which means that 1% increase/decrease in LPE will effect 6% increase/decrease change in infant mortality. The next coefficient LRHC is showing positive effect on infant mortality which means that 1% increase/decrease in LRHC will effect 57% increase/decrease change in infant mortality. The variable LUNE is showing positive effect on infant mortality which means that 1% increase/decrease in LUNE will effect 4% increase/decrease change in infant mortality. Variable LINFGDP is showing negative effect on infant mortality which means that 1% increase/decrease in LINFGDP will effect 3% increase/decrease change in infant mortality.

Table 5

	LINM	LLHV	LPE	LRHC	CPI
Mean	5.355483	8.043789	12.52019	6.038198	3.74818
Median	5.345654	8.339262	12.92115	6.210600	3.777919
Maximum	5.560139	9.707959	13.05051	6.514713	4.978807
Minimum	5.183333	4.770685	11.72287	4.897840	2.209769
Std. Dev	0.107783	1.275143	0.490489	0.419020	0.924706
Skewnwss	0.174581	-0.900451	-0.249572	-1.132605	-0.080117
Kurtosis	2.027288	2.997861	1.337240	3.201208	1.674883
Jarque-Bera	1.824640	5.540554	5.148770	8.834924	3.117818
Probability	0.401591	0.062645	0.076201	0.012065	0.210365
Sum	219.5748	329.7954	513.3280	247.5661	157.4377
Sum Sq Dev	0.464684	65.03959	9.623160	7.023095	35.05832
Observations	41	41	41	41	42

The results of the above estimated tables show that all independent variables are negatively skewed and dependent variable infant mortality is positively skewed. The results also show that the variables have positive kurtosis and value

of Jarque-Bera show that all variables have mean and finite covariance, this shows that selected data sets are normally distributed.

Table 6

Correlation t-statistic probability	LINM	LLHV	LPE	LRHC	PE	CPI
LINM	1.0000					
LLHV	-0.970747 -25.24865 0.0000	1.0000				
LPE	-0.926576 -15.38515 0.0000	0.896349 12.62592 0.0000	1.0000			
LRHC	-0.939645 -17.15064 0.0000	0.988579 40.96658 0.0000	0.883831 11.79874 0.0000	1.0000		
PE	-0.907304 -13.47550 0.0000	0.854545 10.27507 0.0000	0.993873 56.15308 0.0000	0.832212 9.373414 0.0000	1.0000	
CPI	-0.987439 -39.02826 0.0000	0.944295 17.91892 0.0000	0.928563 15.62297 0.0000	0.906262 13.38866 0.0000	0.919107 14.56782 0.0000	1.0000

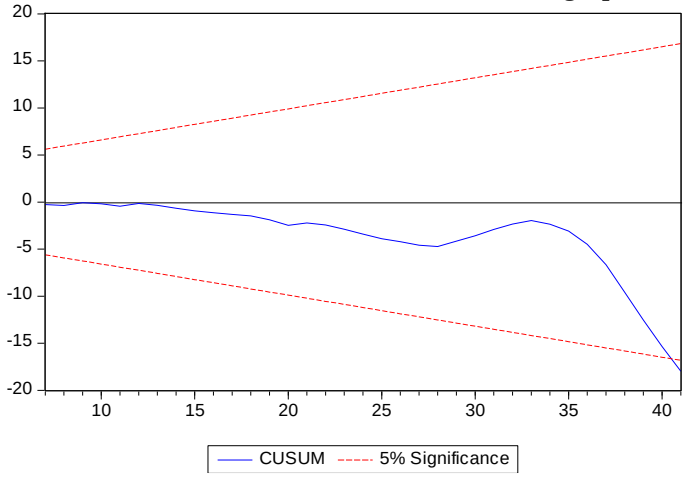
Table 7

VAR Lag Order Selection Criteria INM LHV RHC UNEMINF PE 1995_2015;

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-203.7354	NA	o.002507	11.03870	11.29727	11.13070
1	122.1979	531.7859*	6.07e-10*	-4.220944	-2.410980*	-3.576972
2	158.7983	48.15837	6.81e-10	-4.252542	-0.891181	-3.056595

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

The Cumulative Sum of Recursive Residuals graph;



The Cumulative Sum (CUSUM) and CUSUMQ of recursive residuals are used to detected the structural stability of the equations. The systematic changes in the regression coefficients are detected through diagnostic test while the abrupt changes in the regression coefficients are identified through CUSUM and CUSUMQ. The results of the above figure show that test statistics are within band of 5% confidence interval.

Cumulative Sum of Square Graph;

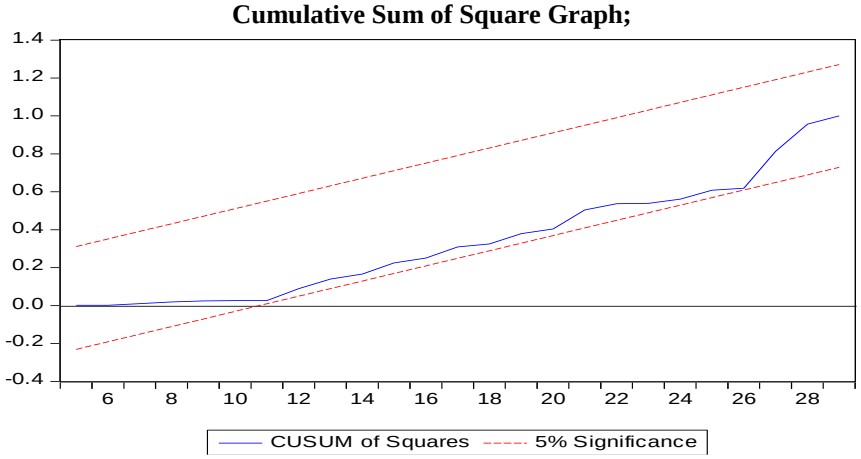
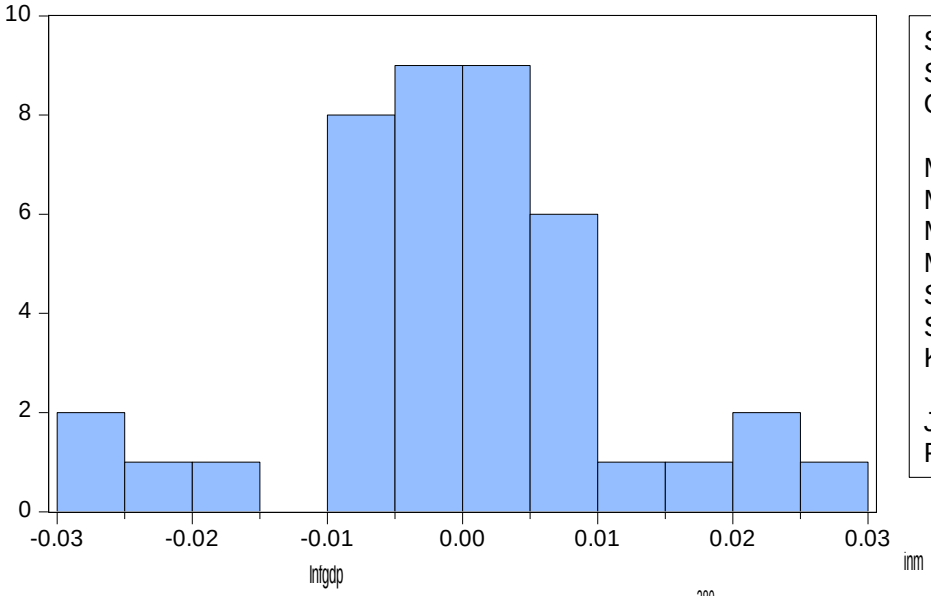


Table 8

Heteroskedasticity Test:

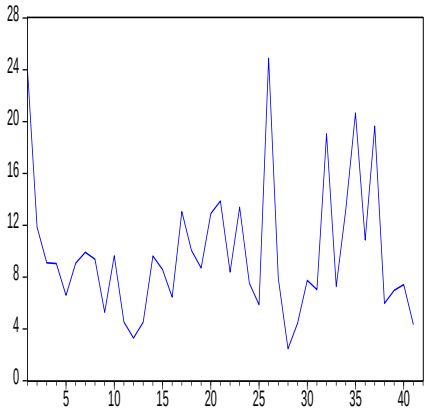
F-statistics	1.965111	Prob. F(4,36)	0.1208
Obs*R-squared	7.347809	Prob. Chi-square(4)	0.1186
Scaled explained SS	4.842447	Prob. Chi-square(4)	0.3038

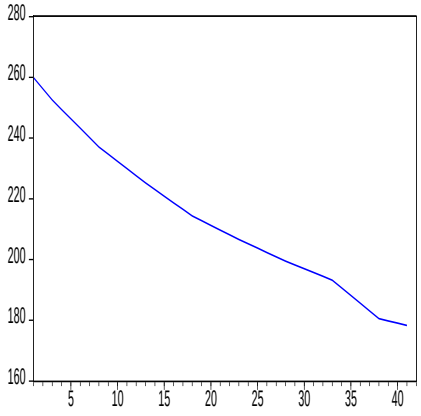
The value of F-statistics is 0.3038 which shows that there is no problem with hetroskedasticity.

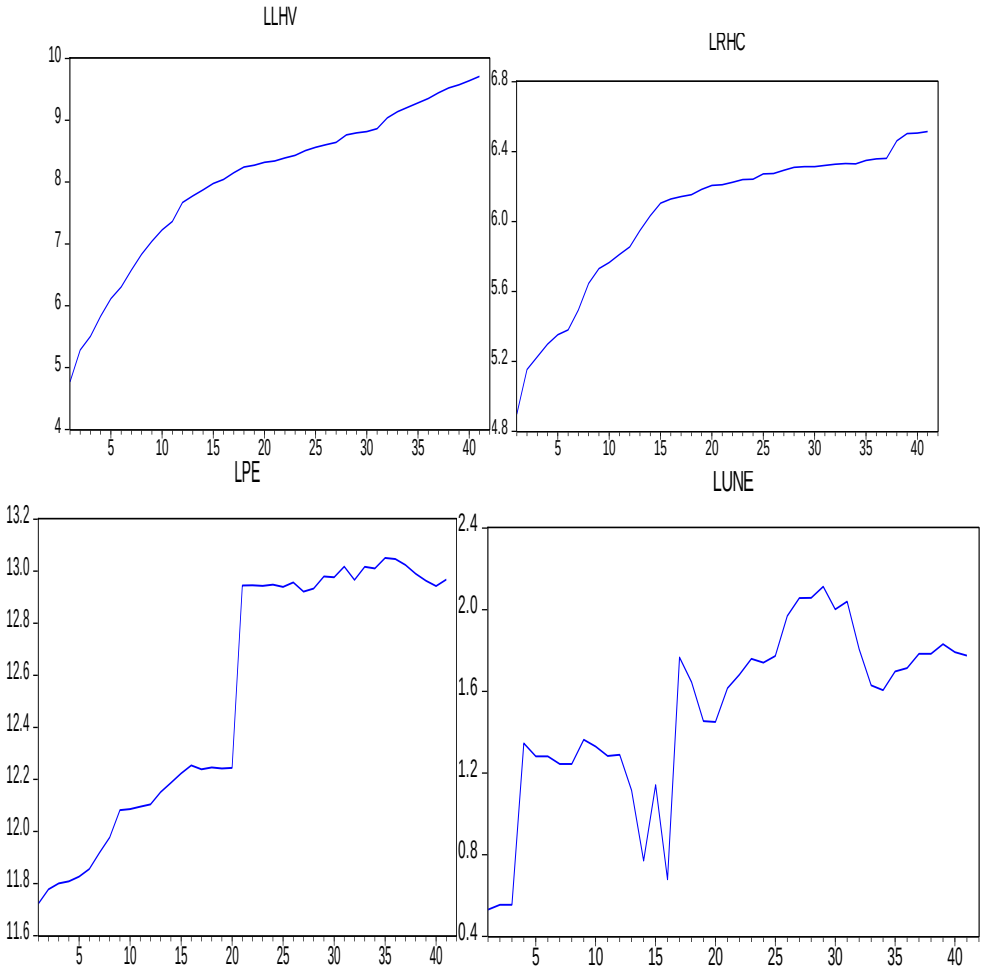


Series: Residuals
Sample 1 41
Observations 41

Mean	-1.32e-15
Median	-0.000199
Maximum	0.025366
Minimum	-0.026676
Std. Dev.	0.011211
Skewness	-0.321071
Kurtosis	3.785311
Jarque-Bera	1.757980
Probability	0.415202







6. Conclusions

The main concern of this paper has been to assess the impact of health expenditure on IMRs. A subordinate objective has been to examine the effect of five other variables (lady health worker, rural health development, unemployment, inflation, primary enrollment). The study examines and conclude the relation and effect of Health Expenditure and Infant Mortality in Pakistan. The study uses Infant mortality a dependent variable and log of Lady health worker, log of rural health development, Unemployment, primary school enrolment and Inflation as independent variables to estimate the effects of Lady health worker, Rural health development, Unemployment, primary enrolment, Inflation on Infant mortality. The data of the model is time series and stationarity of these series is checked by ADF unit root test. All the variables are stationary at 1st difference. But the independent variable is significant at 2nd difference. Auto regressive distributer lag (ARDL) is applied to estimate the variables and for the existence of co-integration ARDL Bound values test is applied. The F-statistics (13.66389) value in Bound test is greater than the critical values which depicts the existence of co-integration in the variables.

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