Education levels and Life Expectancy of Males and Females: Empirical Evidence from Pakistan

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Abstract

This study investigates the impact of different levels of education on life expectancy of males and females in Pakistan using annual time series data from 1971 to 2017. The research on determinants of population health has proliferated in recent years. A number of indicators such as income, trade openness and climate change have been identified in the empirical literature on health determinants. Surprisingly, the importance of education has been less focused in the literature. In particular, to the best of our knowledge, the relationship of health and education in the case of Pakistan is not analyzed. The empirical analysis for the effect of education on health is based on the ARDL approach to cointegration. Moreover, Generalized Method of Moments (GMM) estimation technique is used to obtain more reliable estimates. The empirical findings show that primary and secondary education significantly and positively enhance population health. This relationship remains robust for a separate analysis of both males and females life expectancy. This study recommends that investment in primary and secondary education will not only improve the education status of Pakistan but it will also improve the health status of both males and females, thereby alleviating health burden of the population.

Key Words: Health, Life Expectancy, Primary Education, Secondary Education, Literacy

JEL Classification**:** I10, I20, C22

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Introduction

According to education literature, education is associated with different non-market outcomes. Among these non-market outcomes, there has been a growing interest in health outcomes in recent years. It is believed that besides human capital, health capital also emerges from the education (Grossman, 1999). It means if health effects of education are significant then education policies can be powerful tools for improving not only education level (human capital) but also health level (health capital) in a country (Lleras-Muney, 2005; Clark and Royer, 2013).

Education and health play an important role in improving productivity and efficiency of the labor force, income of the country and living standard of the masses. Therefore, the "Millennium Development Goals" (MDGs) as well as "Sustainable Development Goals" (SDGs) include education and health in their description of goals. In MDGs, universal primary education is second goal while improvement in health status is fourth goals. Likewise, in SDGs improvement in health status is third while improvement in literacy rate is fourth goal.[1] By supporting education and health outcomes, it will be possible for the masses to develop skills which are pre-requisites for the sustainable work (UNDP, 2015).

However, Pakistan does not show impressive progress in the field of education as literacy rate is only 58% for the country while it is 78 % for Kenya and 93% for Sri Lanka (UNESCO, 2015). Low literacy rate may be because of low education investment by the governments. Pakistan is one of the 12 nations in the world, which spend less than 2% of their GDP on education (UNDP, 2015). It means sufficient resources are not available to be allocated for teacher trainings, schooling inputs and supervision of educational outcomes (Qazi *et al*., 2014).

In the same way, Pakistan shows discouraging picture for health. Although, life expectancy is improving globally at a rate of 3 years per decade however, many countries are still lagging behind in terms of health outcomes and Pakistan is included in those countries. Pakistan has 146th position out of 187 countries on the basis of health indicators. Besides, under-five years mortality rate (per 1000 live births) is 86 per thousand for Pakistan while it is 71 per

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The MDGs were eight development goals set by the United Nations in 2000. All 191 member states of the United Nations committed to achieve these goals by 2015. While the SDGs refer to the 17 global goals and the associated 169 targets set by the United Nations for sustainable development in 2015. The SDGs includes a broad range of social and economic development issues. Whereas, all member states and United Nations Development program (UNDP) are working to fulfill these SDGs by the year 2030.

thousand for Kenya and 42 per thousand for Nepal (UNDP, 2015). Poor health is an important issue in terms of global health because there is an increasing percentage of the world's population which is experiencing some type of mental or physical health problem (Majeed and Khan, 2018; Majeed and Ajaz, 2018). So, there is an urgent need to understand the ways in which national health policies may alleviate this burden.

Pakistan is a low-middle income developing country where on average life expectancy is lower as compared to many other countries. Moreover, illiteracy and lower education level is an important development challenge for Pakistan. Are education levels and life expectancy casually related? To answer this question this study contributes into the literature by empirically determining the health effects of education levels for Pakistan. The analysis is based on annual time series data from 1971 to 2017 and we use ARDL approach to cointegration and GMM estimation technique.

The rest of the discussion is structured as follows. Section 2 explains the relevant literature while section 3 provides a discussion of the model and data. Section 4 presents an econometric methodology for the study. Section 5 puts forward the results and discussion. Finally, section 6 provides a conclusion with some policy implications.

Literature Review

Since long, it is observed that differences in educational level have impact on the health status of the individuals. The pioneering work of Grossman (1972) has perhaps initiated the investigation of the causal links between education level and health status of the population.

Ross and Wu (1995) use three different mechanisms to explain the links of education with health. They argue that the relationship between health and education can be explained through three categories: where the first category is related with work and economic conditions whereas, the second category includes social and psychological resources while, the last category considers healthy lifestyle. These categories are best explained with education that in turn improves health status of the individuals. The study utilizes a cross-sectional data of 2,031 respondents, ages 18 to 90, for the year of 1990. The results show a positive relationship between education level and health status. Therefore, the study concludes that high educational attainment improves health level directly as well as indirectly through jobs and economic conditions, social and psychological support and healthy lifestyle.

Cutler and Richardson (1998) examine changes in health status by race, gender, age and income. The study concludes that measuring changes in health status by education is more difficult than measuring it by gender or race. Moreover, the research on education and health status shows that health inequalities between less and more educated people expand with the introduction of new health technology (Case, 2001). Likewise, Arendt (2005) investigates the possibility of a causal relationship between education and health and finds that education is associated with better Self-reported Health (SRH) for both women and men. This discussion suggests that more educated individuals have better health outcomes even when family background, job characteristics and income are controlled (Cutler and Lleras-Muney, 2006).

Pridmore (2007) argues that due to poor health status and nutrition, school exclusion is increasing and millions of children in developing countries are out of school simply because of health threats. He concludes that to meet the MDGs for education, it is necessary to address the health issues at all levels of education. Although the awareness of addressing health and nutrition is increasing but still it is very slow, unfocused and is limited in scope. He argues that there is a need to investigate and highlight the inter-relationships between health, nutrition and education outcomes that will help to build strong arguments which can influence policy and funding decisions.

Silles (2009) explains that the literature predicts positive correlation between health and years of schooling. However, the causal relationship is not determined. Therefore, the study provides evidence of a causal relationship running from good education to good health. In a recent study, Steingrimsdottir *et al*. (2012) argue that education and longevity are closely linked. They use the data of Norwegian residents from 1961-2009 to explain the links of education with health. Their descriptive analysis shows that all education groups increased their longevity over time.

The literature review suggests that the literature on health and education is largely based on descriptive analysis. Moreover, the literature generally focuses on developed economies to understand the links of education with health. To the best of our knowledge, this issue has not been empirically analyzed for Pakistan. This study contributes into the literature using annul time series data over more than four decades and provides firm econometric based evidence. Moreover, this study takes care of the enodgeneity issue using GMM technique of estimation.

The Data and Modeling

To assess the impact of different levels of education on health status of males and females, we include primary and secondary education alternatively in the health production function given by Grossman (1972). There are many other important variables that affect health. To avoid specification bias these variables must be included in the health-education relationship. These control variables include: trade, CO2 emissions, inflation and GDP per capita.

The data on life expectancy, education, trade, CO2 emissions, inflation, GDP per capita has been derived from World Development Indicators (2018). The study covers time series data over the period 1971–2017.

The general functional form of our model is as follows:

$$LE_t = E_t T_t Inf_t CO_{2t} Y_t \quad (1)$$

The functional form of our empirical health model is developed as follows:

$$LE_t = \beta_0 + \beta_1 E_t + \beta_2 T_t + \beta_3 Inf_t + \beta_4 CO_{2t} + \beta_5 Y_t + \varepsilon_t \quad (2)$$

where, LE_t is life expectancy at birth date, E_t is education levels which are measured using primary school enrolment and secondary school enrolment, T_t is trade openness which is measured as sum of exports and imports as ratio of GDP, Inf_t is the consumer price index, CO_{2t} is carbon dioxide emissions which is a measure of climate degradation and Y_t is the GDP per capita at constant prices of 2010 and ε_t is the error term which is normally distributed with zero mean and constant variance.

Since Pakistan has lower levels of education, we use separate measures of education for primary and secondary education. Equation 3 includes primary enrolment (PE_t) while equation 4 includes secondary enrolment (SE_t).

$$LE_t = \beta_0 + \beta_1 PE_t + \beta_2 T_t + \beta_3 Inf_t + \beta_4 CO_{2t} + \beta_5 Y_t + \varepsilon_t \quad (3)$$

To assess the gender dimension of education and health, we also use two measures of life expectancy for males and females separately. Equation 3.1 and 3.2 include primary education of males (PEM_t) and primary education of females(PEF_t), respectively.

$$LE(Males)_t = \beta_0 + \beta_1 PEM_t + \beta_2 T_t + \beta_3 Inf_t + \beta_4 CO_{2t} + \beta_5 Y_t + \varepsilon_t \quad (3.1)$$

$$LE(Females)_t = \beta_0 + \beta_1 PEF_t + \beta_2 T_t + \beta_3 Inf_t + \beta_4 CO_{2t} + \beta_5 Y_t + \varepsilon_t \quad (3.2)$$

Equation 4 includes aggregate levels of secondary education and life expectancy for both males and females. Equation 4.1 and 4.2 disaggregates secondary education for males and females separately. Thus, we have two models (equation 3 and 4) at aggregate levels of health and education and these two models are further disaggregated according to the education levels of population.

$$LE_t = \beta_0 + \beta_1 SE_t + \beta_2 T_t + \beta_3 Inf_t + \beta_4 CO_{2t} + \beta_5 Y_t + \varepsilon_t \quad (4)$$

$$LE(Males)_t = \beta_0 + \beta_1 SE_t + \beta_2 T_t + \beta_3 Inf_t + \beta_4 CO_{2t} + \beta_5 Y_t + \varepsilon_t \quad (4.1)$$

$$LE(Females)_t = \beta_0 + \beta_1 SE_t + \beta_2 T_t + \beta_3 Inf_t + \beta_4 CO_{2t} + \beta_5 Y_t + \varepsilon_t \quad (4.2)$$

Table 1: Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Life Expectancy	46	60.68607	3.788181	53.38	66.48
Life Expectancy Males	46	60.07967	3.515671	53.37	65.51
Life Expectancy Females	46	61.39552	4.054801	53.46	67.52
Primary Education	46	68.62708	16.28996	49.02182	97.70962
Primary Education Males	46	82.82949	12.1609	64.80072	105.1652
Primary Education Females	46	53.55641	20.82781	26.87712	89.69482
Secondary Education	46	25.37774	8.239114	16.50653	46.10918
Secondary Education Males	46	33.80213	7.127208	23.73229	50.72164
Secondary Education Females	46	19.48476	10.10247	6.78439	41.11619
Trade	46	30.1201	4.580407	10.36948	38.74397
Inflation	46	9.095635	5.287988	2.539516	26.66303
CO2 Emissions	44	0.643382	0.220052	0.308601	0.991029
GDP Per Capita	46	781.3948	214.0617	453.7906	1178.798

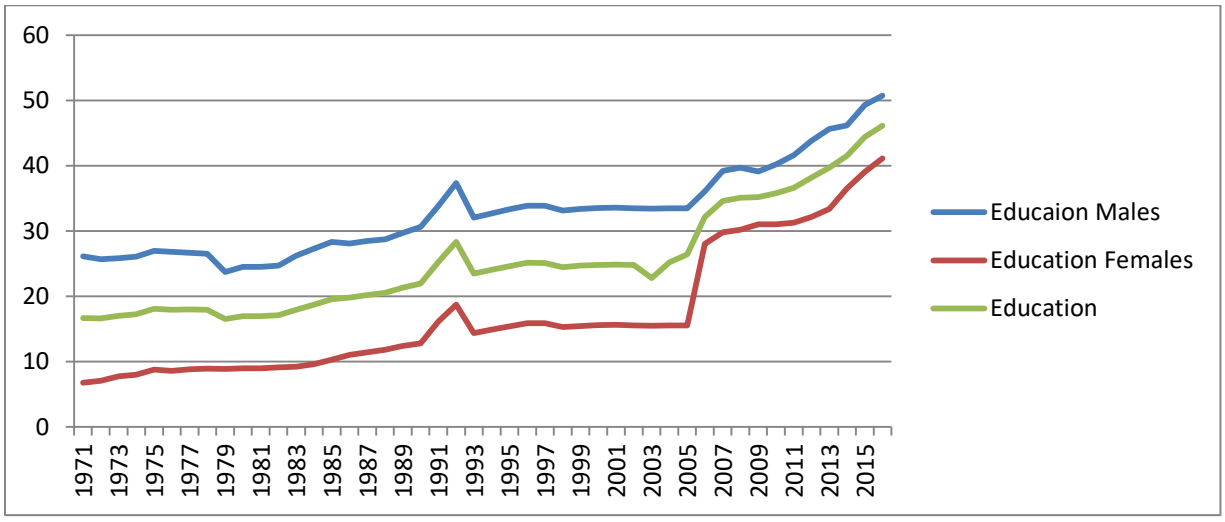
Table 1 reports the descriptive statistics of the indicators used for the analysis. The average life expectancy is only 60 years which is far below from the average life of developed economies. Primary enrolment which is a fundamental right of all humans is on average 68 percent. Secondary enrolment further reduces to an average of 25 percent. It means that only quarter of the population is benefiting from secondary level education.

Table 2: Descriptive Statistics

		1	2	3	4	5	6	7	8	9	10	11	12	13
Life Expectancy	1	1.00												
Life Expectancy M	2	0.99	1.00											
Life Expectancy F	3	0.99	0.99	1.00										
Primary Education	4	0.93	0.93	0.92	1.00									
Primary Education F	5	0.94	0.94	0.93	0.99	1.00								
Primary Education M	6	0.89	0.90	0.88	0.98	0.96	1.00							
Secondary Education	7	0.88	0.88	0.87	0.91	0.92	0.87	1.00						
Secondary Education M	8	0.92	0.93	0.92	0.90	0.90	0.89	0.93	1.00					
Secondary Education F	9	0.96	0.96	0.95	0.97	0.97	0.95	0.91	0.95	1.00				
Trade	10	0.33	0.33	0.33	0.30	0.31	0.27	0.30	0.26	0.29	1.00			
Inflation	11	-0.16	-0.15	-0.17	0.00	-0.02	0.03	0.06	-0.04	-0.07	0.51	1.00		
CO2	12	0.97	0.97	0.97	0.95	0.95	0.92	0.88	0.91	0.96	0.31	-0.11	1.00	
GDP Per Capita	13	0.99	0.99	0.99	0.91	0.92	0.88	0.89	0.92	0.94	0.33	-0.14	0.98	1.00

Table 2 reports correlation matrix of the indicators used for the analysis. It is evident form the table that all measures of education for both males and females are highly and positively correlated with life expectancy. Primary education has 0.93 correlation with health and secondary education has 0.88 correlation with health. The correlation of females with health is comparatively high.

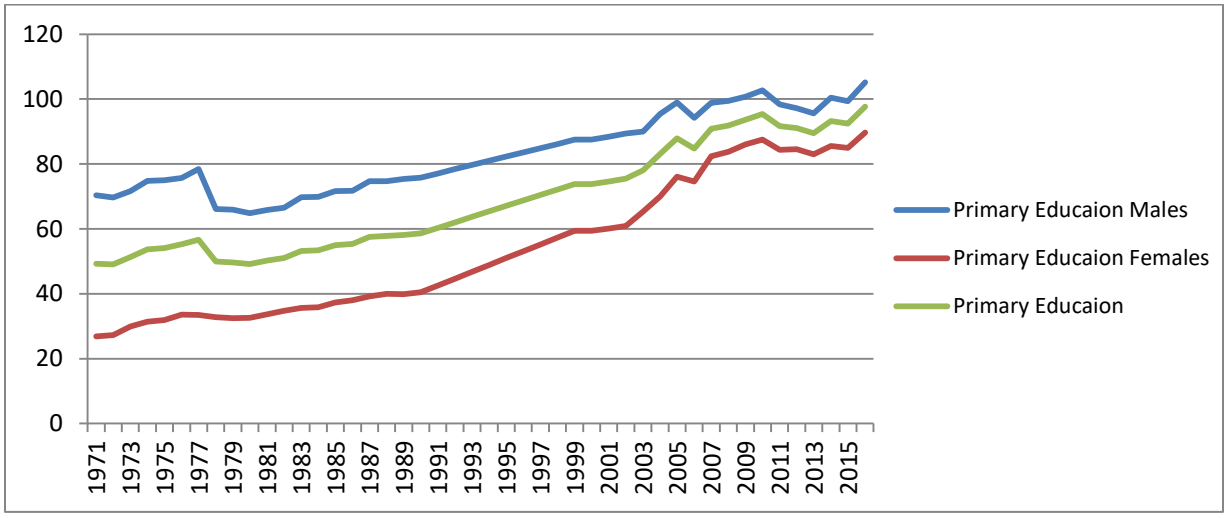
Figure 1: Secondary Education of Males and Females (1971-2016)



The figure 1 shows that in the early 1970s secondary education enrolment was just 16 percent which has increased over the last four decades but still less than 50 percent. On average, only 25% of the population is enrolled for the secondary level. This situation becomes further

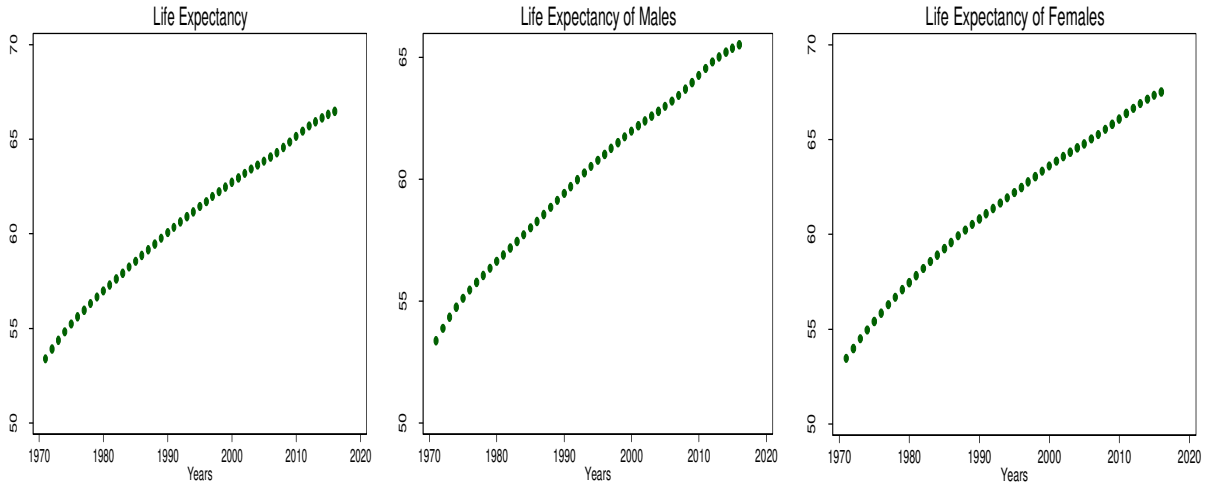
worse in the case of females where only 6 percent females were enrolled for secondary school in the starting period of the study and on average it is only 19 percent for the period of analysis.

Figure 2: Primary Education of Males and Females (1971-2016)



The figure 2 shows that in the early 1970s primary education enrolment was 49 percent while for females it was 27 percent. Over the years, primary education has been improved which has increased over the last four decades. The figure displays a smooth trend for 1970s, 1980s and 1990s. However, in the decade of 2000s and 2010s the enrolment shows some fluctuation in the trend of primary enrolment. The years of 2006 and 2011 show a decline in the enrolment.

Figure 3 (a): Figure 3 (b): Figure 3(c):



The Figure 3(a) shows the plot of life expectancy for both males and females while Figure 3(b) and Figure 3(c) shows the trend of life expectancy for males and females, respectively. Overall, these figures indicate that life expectancy is increasing over time. Comparatively, the trend line is more flat in the case of females which imply that marginal increase in life expectancy of females is lower.

Econometric methodology

In this study we use ARDL approach to cointegration. One of the critical aspects of this approach is that it does not assume same level of integration for all variables. The variables can be integrated of order zero I (0) or it can be integrated of order one I (1) or it can be mixture of both. The standard conintegration techniques become unstable when series are not integrated of the same order because the power of test to determine cointegration becomes low. However, ARDL approach to cointegration has the advantage to test the relationship between variables even though they are not integrated of the same order. The only condition for ARDL model is that no variable should be integrated of order two.

The ARDL procedure is based on two steps. In the first step, using F-statistic, the long run relationship between variables is tested. In the unrestricted error correction model (ECM), F-statistic is used to test the significance of the lagged levels of the variables. While in the second step, the parameter estimates of the long-run relationship and error correction model are determined. The parameter estimates for ECMs are not reported to save the space. However, the results for ECMs are available from the authors upon request.

To test the presence of the long-run relationship between variables, the following hypothesis is tested using F statistics. The null hypothesis is that no long-run relationship exists between variables implying that the coefficients of the lagged variables are simultaneously equal to zero. The alternative hypothesis is that there is a long-run relationship between variables implying that at least one of these coefficients is not equal to zero.

The distribution of F-statistics is non-standard and it depends on the orders of integration of the variables included in the ARDL model. The computed F-statistics are compared with the critical values given by Pesaran *et al.* (2001), and if F-statics is greater than the upper-bound critical value then the null hypothesis of no long-run relationship is rejected implying that there exists a long-run relationship between variables.

Empirical Results

Unit root test

The estimation process for this study is started by testing the time series properties of the data using the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. A unit root test is applied to ensure that variables are not integrated of order two. Table 3 presents the results of ADF and PP tests.

The results of the ADF and PP tests show that most of the variables are integrated of order one at the five percent level of significance. The variable of trade is level stationary at 1 percent level of significance. Similarly, the variable inflation is level stationary at 1 percent level of significance. However, no variable is integrated of order two implying that basic conditions of bound tests are met and we can safely move on next step of the analysis.

Table 3: Results of ADF and PP tests

Variable	**ADF test statistics**		**PP test statistics**		**Order of integration** (5% significance level)	**Order of integration** (1% significance level)
	Level	First difference	Level	First difference		
Life Expectancy	-2.36 (0.16)	-3.19* (0.005)	-4.87 (0.09)	-3.43* (0.006)	I(1)	I(1)
Primary Education	-1.94 (0.61)	-6.95* (0.000)	-1.90 (0.43)	-6.95* (0.000)	I(1)	I(1)
Secondary Education	-1.38 (0.85)	-3.96* (0.000)	-0.89 (0.95)	-3.96* (0.000)	I(1)	I(1)
Trade	-5.63* (0.000)	-6.56* (0.000)	-5.56* (0.000)	-11.74* (0.000)	I(0)	I(0)
Inflation	-3.42 (0.06)**	-6.49* (0.000)	-3.54** (0.04)	-7.30* (0.000)	I(I)	I(0)
CO2	-1.46 (0.82)	-7.16* (0.000)	-2.18 (0.49)	-7.44* (0.000)	I(1)	I(1)
GDPper Capita	-1.84 (0.67)	-5.87* (0.000)	-2.18 (0.49)	-5.88* (0.000)	I(1)	I(1)

Note: The test statistics significant at 1% and 5% levels of significant are indicated by * and ** respectively.

Bound test for cointegration

Following ARDL model, we estimate equations (3) and (4) to determine the long run relationship between variables. We use Schwarz Bayesian Criterion (SBC) to determine the optimal number of lags in the ARDL model. The estimated model satisfies different diagnostic check. The results of different diagnostic tests are reported in Table 4. The White test for

heteroscedasticity shows that our results are not suffering from the problem of heteroscedasticity. The LM test for serial correlation shows that our results are not suffering from the problem of serial correlation. To test the normality of residuals we apply Jarque–Bera test which also shows that the residuals are normally distributed. Finally, our model is correctly specified as it is evident from the Ramsey RESET test reported in Table 4.

Table 4: Results of diagnostic tests

Test statistics	Model 1 (Eq. 3)		Model 2 (Eq. 4)	
	F-statistics	Probability	F-statistics	Probability
White test for heteroscedasticity	1.86	0.10	2.39	0.06
Lagrange multiplier test for serial correlation	1.62	0.21	3.46	0.06
Jarque–Bera test for normality	0.75	0.58	2.04	0.36
Ramsey's RESET for functional form	4.07	0.14	0.72	0.40

We report the results of bounds test for different equations in Table 5. The F statistics of bounds test shows that in the health education specification the calculated F-statistics is greater than the upper bound critical value implying that the long run relationship holds in health education equations.

Table 5: F-Statistics for cointegration relationship

The model	Computed F-statistics	Critical F-statistics at 5% level*		Outcome
		Lower bound	Upper Bound	
$LE_t = f(PE_t, T_t, Inf_t, CO_{2t}, Y_t)$	5.32	2.84	4.29	Cointegration
$LE_t = f(SE_t, T_t, Inf_t, CO_{2t}, Y_t)$	4.98	3.28	4.59	Cointegration

*The critical values are taken from Pesaran *et al*. (2001), Table CI (iii), Case 111: unrestricted intercept and no trend.

Education Levels and Life Expectancy

Table 6 reports the long run results of health and primary education for equation 3, 3.1 and 3.2. Our education and health modelsconfirmthe long run relationship. The impact of primary education on life expectancy is positive and significant at ten percent level of significance (column 1). The parameter estimate on primary education enrolment indicates that one unit increase in primary education causes 0.06 year increase in life expectancy. The results for equations 3.1 and 3.2 are reported in columns 2 and 3, respectively. The effect of education

on life expectancy remains positive and significant for females and males. Nevertheless, the parameter estimate for female model is 0.04 which is lower as compared to male model comprising the 0.07 value of coefficient.

Table 6: Life Expectancy and Primary Education-OLS

Variables	**(1)**	**(2)**	**(3)**
	Equation 3	**Equation 3.1**	**Equation 3.2**
	Life Expectancy (Both)	**Life Expectancy (Females)**	**Life Expectancy (Males)**
Primary Education	0.0670***		
	(0.0139)		
Primary Education Females		0.0458***	
		(0.0114)	
Primary Education Males			0.0707***
			(0.0167)
Trade Openness	0.0359*	0.0382*	0.0323
	(0.0184)	(0.0195)	(0.0193)
Inflation	-0.0494***	-0.0530***	-0.0411**
	(0.0159)	(0.0167)	(0.0167)
CO2 Emissions	-4.714**	-3.892*	-3.966*
	(2.078)	(2.085)	(2.208)
GDP per Capita	12.99***	13.68***	12.32***
	(1.343)	(1.407)	(1.449)
Constant	-27.43***	-29.71***	-25.31***
	(7.773)	(8.046)	(8.633)
Observations	44	44	44
R-squared	0.991	0.991	0.988

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Regarding control variables the effects of GDP per capita and trade on life expectancy are positive and significant. This is consistent with the earlier literature (see, for details, Bergh and Nilsson, 2010). The higher level of income facilitates health related facilities and higher level of trade helps to import health related tools, practices and medicine. The effect of inflation and climate degradation is negative and significant which is also consistent with the earlier literature (Grossman, 1972; Akram *et al*., 2008). The increasing price levels hurt the poor segment of the society and it becomes expensive to afford health related facilities. The environmental degradation increases the risk of many diseases such as heart disease, stroke, chronic obstruction pulmonary disease and acute lower respiratory infections in children. These diseases, in turn, lower the life expectancy of the population.

To address the possible problem of endogeneity, we use GMM estimation technique. Own lag variables are used as instruments. Hansen's J chi2 test is used to determine the validity of the instruments. The results using GMM estimation technique are presented in Table 7. Column 1 indicates that the impact of primary education on life expectancy is positive and significant. Similarly, results obtained for sub-samples of males and females (given in columns 2 and 3) also indicate that enrolment in primary education significantly improves life expectancy of both males and females.

Table 7: Life Expectancy and Primary Education- GMM

Variables	(1)	(2)	(3)
	Equation 3	**Equation 3.1**	**Equation 3.2**
	Life Expectancy (Both)	**Life Expectancy (Females)**	**Life Expectancy (Males)**
Primary Education	0.0743***		
	(0.0120)		
Primary Education Females		0.0465***	
		(0.00677)	
Primary Education Males			0.0784***
			(0.0229)
Trade Openness	-0.00300	-0.0142	-0.00523
	(0.0246)	(0.0205)	(0.0317)
Inflation	-0.0482***	-0.0491***	-0.0553***
	(0.0151)	(0.0139)	(0.0194)
CO2 Emissions	-3.311	-0.782	-3.288
	(2.193)	(1.668)	(3.020)
GDP per Capita	11.34***	10.99***	13.20***
	(1.366)	(1.167)	(1.754)
Constant	-16.75**	-12.38*	-29.59***
	(8.128)	(6.806)	(11.01)
Hansen's J chi2	*0.572769 (p = 0.4492)*	*0.083198 (p = 0.7730)*	*1.08169 (p = 0.2983)*
Observations	42	42	42
R-squared	0.991	0.993	0.990

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The parameter estimates on primary education slightly improve with GMM estimation, indicating that OLS technique has under estimated the strength of marginal effects of education on health. Hansen's J test indicates that instruments are valid and therefore our results are not plagued with the potential problem of endogeneity.

Table 8 reports the long run results of health and secondary education for equations 4, 4.1 and 4.2, respectively. The long run positive relationship between secondary education and life expectancy is also confirmed. The parameter estimate on secondary education enrolment indicates that one unit increase in secondary education causes 0.02 year increase in life expectancy (column 1). The results for equation 4.1 and 4.2 are reported in columns 2 and 3, respectively. The effect of education on life expectancy remains positive and significant for females and males. Nevertheless, the parameter estimate for males is 0.08 which is lower as compared to females comprising the 0.12 value of coefficient.

Table 8: Life Expectancy and Secondary Education- OLS

	(1)	(2)	(3)
	Equation 4	**Equation 4.1**	**Equation 4.2**
Variables	**Life Expectancy (Both)**	**Life Expectancy (Females)**	**Life Expectancy (Males)**
Primary Education	0.0220		
	(0.0273)		
Primary Education Females		0.123***	
		(0.0237)	
Primary Education Males			0.0862***
			(0.0294)
Trade Openness	0.0302	0.0390**	0.0390*
	(0.0250)	(0.0178)	(0.0220)
Inflation	-0.0346	-0.0473***	-0.0363*
	(0.0230)	(0.0148)	(0.0185)
CO2 Emissions	1.963	-3.973**	2.178
	(2.015)	(1.814)	(1.813)
GDP per Capita	10.80***	12.91***	8.296***
	(1.887)	(1.275)	(1.638)
Constant	-13.28	-24.57***	-0.0337
	(10.70)	(7.298)	(9.163)
Observations	44	44	44
R-squared	0.985	0.992	0.986

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Finally Table 9 reports the results using GMM estimation technique. Column 1 indicates that the impact of secondary education on life expectancy is positive and significant. Similarly, results obtained for sub-samples of males and females also indicate that enrolment in secondary education significantly improves life expectancy of both males and females. The parameter

estimates on secondary education improve indicating that the OLS under estimated the strength of marginal effects of education on health.

Table 9: Life Expectancy and Secondary Education- GMM

Variables	(1)	(2)	(3)
	Equation 4	Equation 4.1	Equation 4.2
	Life Expectancy (Both)	Life Expectancy (Females)	Life Expectancy (Males)
Primary Education	0.101***		
	(0.0239)		
Primary Education Females		0.130***	
		(0.0212)	
Primary Education Males			0.133***
			(0.0279)
Trade Openness	-0.00603	-0.0107	-0.00914
	(0.0187)	(0.0150)	(0.0244)
Inflation	-0.0813***	-0.0456***	-0.0454***
	(0.0174)	(0.0102)	(0.0143)
CO2 Emissions	11.52***	-1.444	6.032***
	(1.831)	(2.139)	(1.966)
GDP per Capita	1.084	10.46***	4.019***
	(1.795)	(1.247)	(1.461)
Hansen's J chi2	*5.71438* *(p = 0.0574)*	*2.40334* *(p = 0.1211)*	*2.59603* *(p = 0.1071)*
Constant	44.50***	-8.566	25.83***
	(10.46)	(7.247)	(8.509)
Observations	42	42	42
R-squared	0.985	0.995	0.989

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In addition, Table 9 indicates that the marginal impact of secondary education is higher as compared to primary education implying the significance of higher levels of education for better health outcomes. Hansen's J test indicates that instruments are valid and therefore our results are not plagued with the potential problem of endogeneity.

Stability checking

We check the stability of the model by applying the cumulative sum of recursive residual (CUSUM) and the cumulative sum of square of recursive residual (CUSUMSQ) tests. The Figures 4 and 6 show the plots for CUSUM and Figures 5 and 7 show the plots for CUSUMSQ.

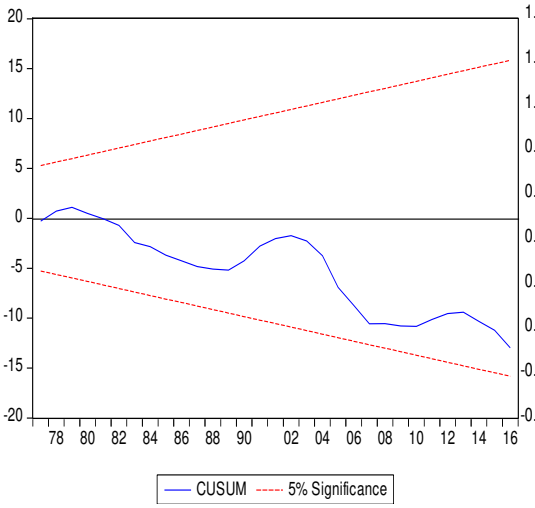


Figure 4 CUSUM Test (Primary Education)

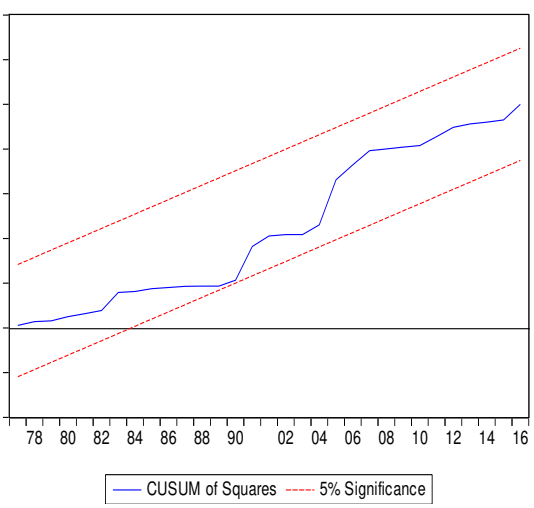


Figure 5 CUSUM Square Test (Primary Education)

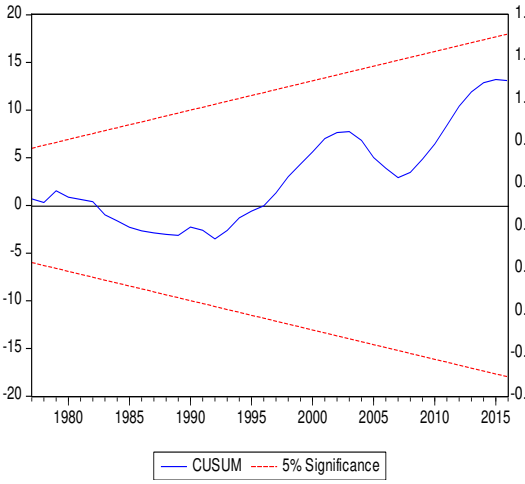


Figure 6 CUSUM Test (Secondary Education)

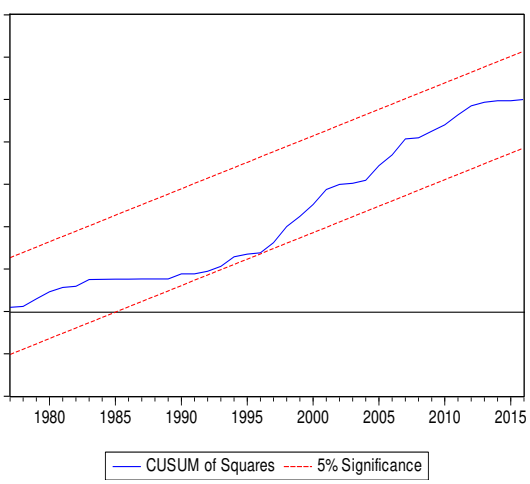


Figure 7 CUSUM Square Test (Secondary Education)

It is evident from all figures that the estimated lines are well within the critical limits at a 5 % level of significance. Therefore, our model is reliable and stable for the estimated period and there is no evidence of miss-specification.

Conclusion

A growing body of the literature has developed a variety of factors that determine population health status of a nation. However, empirical literature has largely ignored the health effects of different educations levels. Particularly, in the case of Pakistan the role of education in determining health has not been empirically analyzed.

This study contributed into the literature by empirically analyzing the role of primary and secondary education in determining population health including a separate analysis for males and females. The empirical analysis is based on annul time series data from 1971 to 2017. The empirical analysis for the effect of education on health is based on the ARDL bound testing approach to cointegration. The study analyzes the relationship between different education levels and health status of the population with ARDL approach. In addition, Generalized Method of Moments (GMM) estimation technique is used to obtain long run parameter estimates.

The empirical findings of this study show a consistently positive and strongly significant impact of education on health. In particular, our empirical estimates suggest that a given increase in education level increases health status of the population. Moreover, to assess the robustness of results we divide population into males and females. The results remain the same that is an increase in education level increases life expectancy of both males and females.

Our study concludes that education exerts a significant positive influence on population health. This conclusion holds even after including different levels of education. Thus the positive effect of education is a pure effect of education irrespective the level of education. In other words, all levels of education matter for the health status of population.

The empirical finding that education acts to improve population health also has implications for the choice of health-oriented policies. In particular, the study suggests that the largest impact on population health is likely to result from polices which not only enhance health but also exert an independent influence on increase in enrolment for primary and secondary education. Therefore, the governments should allocate more funds for investment in education sector.

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