



Does Female Human Capital Matter for Economic Growth in a Developing Country?

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Abstract: This study explores the importance of human capital on economic growth from gender perspective in Pakistan. To proxy human capital, two indices are constructed for male and female separately i.e. health capital and education capital. The study uses ARDL bound test and found cointegration between human capital and economic growth. In the long-run, human capital encourages economic growth regardless of gender specific human capital or type of human capital while in short-run gender specific human capital is more rewarding. Further, granger's causality results reveal two-way causation between gender specific human capital and economic growth for both male and female using health proxy for human capital while there is no causality between human capital (male/education) and economic growth.

Introduction

Early theories on human capital and economic growth trace back to the pioneering works of Mincer (1958) and Becker (1962). They believed that economic growth, as well as the gross output of the economy, can be raised if economies invest generously on population's health and education. The debate on investment in human capital, however, has intensified over the last several decades like (Romer 1994; Romer 1986; Lucas 1988 and Mankiw, Romer and Weil 1992). These empirical studies offer new insights on the role of human capital on economic growth by employing different econometric specifications.

In literature varying proxies have been employed for estimating relationship between growth and human capital. Mankiw et.al., (1992), employed education as a proxy of human capital in the Solow (1956) growth model to assess the effectiveness of human capital in relation to economic growth and late. The debate did not end because as the economies grew and expanded

their overall outreach and the governments pondered on the highly disregarded segment of the society (the underdeveloped and highly underinvested female population) in developing economies. While Knowels et al., (2002) argued that return on spending in gender specific (female) health and education are far greater. Hence, improving health and education of women will empower them socially and economically implying enhancement in human wellbeing and lowering poverty level. Accordingly, the Sustainable Development Goals (SDGs) has prioritized the gender equality particularly in terms of access to health and education in developing world. The prevailing gender disparities in health and education does not allow women to contribute in the productivity. The SDGs advocates for gender equality and empowerment of women implying an equal distribution of wealth to accomplish inclusive economic growth. Gender equality implies that no discrimination in opportunity and access to

fundamental rights of the female population. The equality will not only empower females socially, alleviate poverty, enhance human well-being, but it will also help the government(s) to attain sustained economic growth in the medium to long term. The underinvestment in the female population of the developing countries could be a major obstacle in achieving sustained economic growth.

The case of Pakistan is no exception as appropriate policies have not been adopted to exploit the potential of the female population. Another reason could be low budgetary allocation to education and health sectors. For instance, the total health spending as a percentage of GDP remained at merely 1.12 percent of GDP in 2017, whereas the education sector of the country consumed merely 2.5 percent of the GDP. In terms of education spending, Pakistan stands lowest in South Asia. Neighboring countries such as India spends more than 3 percent of GDP on its education sector whereas Bangladesh spends around 2.5 percent on its education sector. It is, therefore, of paramount significance to invest generously on the female population to accomplish an inclusive economic growth.

Literature Review

There is a vast literature presented on empirical and theoretical studies of economic growth. It has many factors and consistent increase in different dimensions. The most important goal of this workout is to convey the gaps that exist in the literature. Also, an attempt has been made to answer empirically the questions that arise during the literature survey.

Sehrawat & Giri (2017) in their study supported the view that in India, gender specific human capital (female) major contributor to growth. They also recommended policy makers, to spend more expenditure for the development of females' education and health. Lokrantz & Egnell (2017) supported the view that female education, gender equality and human capital accumulation have combined effect on economic growth. So from 76 low and lower middle income nations

within six different regions, data is taken from time period 1999 to 2014 on gender equality and female education, with a random effect panel data model, regression are performed, so estimation with GLS to examined through female education, gender equality and human capital accumulation are interrelated. They found that there is interconnection and they have combined effect on economic growth. Khan, (2016) by using time series data for 30 years' time period in the context of Pakistan tried to check the impact of woman human capital on national output. They concluded that human capital is real contributor for national output in long period, but they also found that female human capital is positive but statistically irrelevant in short run to national output. Their results showed a positive association between women's human capital and economic growth. According to them nations with low maternal mortality, better girl's education, and female health facilities have higher national level profits as compared to other countries. Razmi, Falahi, Abbasian, & Salehifard, (2015) supported the view that female education is positively contributed to development of human. By using panel data of 3 groups of nations with high, low, and medium, human development during 2000–2009. Results showed, countries with high human development, highly literate females contribute to human development.

In Medium human development nations, female education results in increase in human development index. While education are compulsory for improvement in the human development level in low human development levels nations. El Alaoui, (2015) examined effect of female's education on economic growth, by using data set of four countries Morocco, Egypt, Tunisia, and Algeria. By taking data over the period 1960–2012. According to the findings they concluded that women's education especially tertiary education has a vital role in supporting economic growth and development. The results showed that variables of institutional capital play main role on economic growth. so it is essential to enhance females' education by creating economic and social policies, so that to enhance gender

wellbeing and for poverty reduction of the nationalists. Tekabe (2012) explored the influence of school registrations, fertility rate, mortality rate, and life expectancy on economic growth in low-income nations in sub-Saharan Africa. Using mortality rate as a proxy for health and life expectancy, he concluded that mortality and fertility rates have significant effects on economic growth. Miguel (2005) conducted a study using panel data techniques for rural areas in Kenya and India, finding that children's health status and parental survival significantly influence education, particularly school attendance. Kingdon (2002) emphasized the outcomes of women's education, highlighting its direct link to economic productivity through increased participation in the labor force and productivity. He argued that more literate women could contribute more effectively to raising per capita income. Lorgelly and Owen (1999) developed a health capital index for men and women, considering average life expectancy at birth. Sen (1990) raised concerns about the data on women's life expectancy, suggesting caution in drawing conclusions based on such data.

The relevant literature, particularly related to education, and economic growth is extensive, with many studies examining this association using different methodologies and datasets. Shahbaz et al. (2016) found education as important economic growth factor in Asian countries, including Pakistan. Amir (2014) showed that education, has a significant long-run impact on economic growth in Pakistan. Further, a study by, , & (2011) and Ali, Chaudhary, & Farooq (2012) emphasize the multiplier effect of education on economic growth and the importance of various factors such as education enrollment, physical capital, and health in contributing to GDP growth. In terms of health. Hanif & Arshad (2016) also found a positive effect of education on economic growth in SAARC nations.

Overall, the literature indicates a robust and beneficial correlation between human capital, specifically education and health, and economic growth., with many studies emphasizing the

importance of investing in education and health for sustainable economic development. However, there is still a need for further research, especially focusing on the joint influence of women's health and education on economic growth in Pakistan.

In the literature the role of female health and education has been identified. To achieve SDGs related to health, education and gender equality and women empowerment, it has been emphasized to spend considerable proportion of budget on health and education of the females in Pakistan. This research focuses on the work to see how the economic growth would react to female human capital (health and education) in Pakistan.

Data and Methodology

We used data for per capita real GDP, gross fixed capital formation and male and female human capital (for construction of health and education indices – see the Appendix) for the period 1976–2017. The data is obtained from World Development Indicators and Economic Survey of Pakistan. We estimated two models using two different proxies of human capital (Health and Education) for male and female. Stationarity of the variable is tested as suggested by Ng and Perron (2001). The study then uses ARDL bound test to check the co-integration among variables under study. After establishing cointegration, the long-run ARDL model is estimated as

$$\Delta \ln Y_t = \gamma_0 + \sum_{i=1}^j \gamma_i \ln Y_{t-i} + \sum_{j=1}^k \alpha_1 FC_{t-j} + \sum_{j=1}^k \alpha_2 MC_{t-j} + \sum_{j=1}^k \alpha_3 K_{t-j} + \mu_t$$

Where Y_t is economic growth, FC is human capital (Female), MC is human capital (Male) and K is physical capital. And finally, ECM is estimated for short-run dynamic parameters as

$$\Delta \ln Y_t = \delta_0 + \sum_{i=1}^j \delta_i \Delta \ln Y_{t-i} + \sum_{j=1}^k \eta_i \Delta FC_{t-j} + \sum_{j=1}^k \lambda_i \Delta MC_{t-j} + \sum_{j=1}^k \theta_i \Delta PHY_{t-j} + \phi ECT_{t-1} + \varepsilon_t$$

This method is useful for checking cointegration when sample size is small. Further, Engle and Granger (1988) causality test is employed to ascertain the direction of causation among variable under study.

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 \Delta X_{t-1} + \epsilon_t$$

$$\Delta X_t = \beta_0 + \alpha_1 X_{t-1} + \beta_2 \Delta Y_{t-1} + \epsilon_t$$

Results and Discussion

The Ng-Perron unit root results are presented in Table1, demonstrating that all variables are stationary at their first differences.

Table 1

Stationarity of the variables

Variables	LEVEL	First difference	Decision
GDP	-2.79	-4.040***	I(1)
Male Education	-2.654	-8.221***	I(1)
Female Education	-1.904	-6.760***	I(1)
Male Health	-0.773	-4.321***	I(1)
Female Health	2.909	-3.154***	I(1)
Physical Capital	-2.673	-6.136***	I(1)

*** means significant at 1%.

In this study, model 1 represents when health is considered as human capital for male and female while model 2 represents when education is considered as proxy for human capital for male and female. The F-stat is 13.28 for model-1 and

9.97 for model-2 and both exceeds the upper bound critical value which confirms cointegration among variables under study. The diagnostic tests for the model also confirm the stability of the model (see Table2 and Table3).

Table 2

ARDL Bound test and diagnostic tests for Model-1 and Model-2

Critical Level		Model-1(Health)	Model-2(Education)
	F statistics	13.283	9.986
10%	Lower-Bound	3.466	3.47
	Upper-Bound	4.449	4.45
5%	Lower-Bound	4.009	4.01
	Upper-Bound	5.067	5.07
1%	Lower-Bound	5.165	5.17
	Upper-Bound	6.368	6.36
LM test for serial-correlation		1.722	2.7017
p-value		0.5565	0.0942
White test(Heteroskedasticity)		2.652	4.8319
p-value		0.9989	0.9982
Ramsey RESET		2.11	0.1649
p-value		0.1599	0.6899
Jarque-Bera test(normality test)		2.1527	1.1817
p-value		0.3408	0.5538

The long-run results are depicted in Table3. The gender specific human capital is significant at 1% for gender specific human capital in both model 1

and 2. Similarly, K is statistically significant at the 1% level and has a positive effect on economic growth in both models..

Table 3*Long-run relationship (dependent variable: economic growth)*

Variable	Model-1(Health)	Model-2(Education)
	Coefficient	Coefficient
	(SE)	(SE)
Physical Capital K	0.095*** (0.021)	0.288** (0.115)
Female Human Capital	10.142*** (1.347)	0.162*** (0.043)
Male Human Capital	9.821*** (1.453)	0.146*** (0.043)
Constant	23.986*** (0.074)	23.402*** (0.292)
@TREND	0.062*** (0.008)	0.051*** (0.003)
R ²	0.9334	0.9167
Adj-R ²	0.9023	0.8976
F-stat	539.32	412.34
DW stat	2.37	2.19
Serial-Correlation	F = 0.3502	F = 0.3481
Heteroscedasticity	F = 0.4920	F = 0.5231
Ramsey RESET test	F = 0.1943	F = 0.1792

***, **, and * means significant at 0.01, 0.05 and 0.10 respectively.

The diagnostic tests confirm no serial correlation, no misspecification of the model, homoscedastic

and normal distribution of errors. The short-run results are presented in Table4.

Table 4*Short-run dynamics and ECM*

Variables	Mode-1(Health)		Model-2(Education)	
	Coefficient	p-value	Coefficient	p-value
Male Human Capital	3.388	0.228	2.063	0.258
Female Human Capital	20.93***	0.0091	7.171**	0.015
Physical Capital	3.945**	0.0295	0.095**	0.044
ECT	-0.262**	0.044	-0.332*	0.065
R ²	0.8793		0.8979	
DW Stat	1.96		1.88	
SE regression	0.0088		0.0075	
RSS	0.0081		0.0079	

***, **, and * means significant at 0.01, 0.05 and 0.10 respectively.

The short run dynamics are presented in Table 4. The findings reveal that female human capital and physical capital as a significant in determining of economic growth and the possible reason may be the increased public interventions in the health and education for females. The ECT is estimated

as -0.262 for model-1 and -0.332 for model-2. The magnitude of the ECT determines the speed of the economy returns to equilibrium after experiencing a shock. This implies that after experiencing a shock the economy adjusts by 26% and 33% to the equilibrium in a year and requires

almost 3 and 4 years respectively to reach the equilibrium. Further, significant ECT signify the stability of long-run relationship. The stability of model is also examined using CUSUM and CUSUM sum of square test (See figure in Appendix 1). Both

plots lie within the 5% critical bound implying stability of the model. Once long-run relationships are established, granger's pairwise test is employed to establish the causal direction among variables under study.

Granger non-causality results

Table 5

Null Hypothesis	F	p-value	Decision	Direction
Male Education does not Granger Cause GDP	1.17	0.322	Accept H_0	No Causality
GDP does not Granger Cause Male Education	1.17	0.323	Accept H_0	
Male health does not Granger Cause GDP	2.87	0.07	Reject H_0	Bi-directional Causality.
GDP does not Granger Cause Male health	4.95	0.013	Reject H_0	
Female education does not Granger Cause GDP	3.86	0.032	Reject H_0	Bi-directional Causality.
GDP does not Granger Cause Female education	3.66	0.036	Reject H_0	
Female health does not Granger Cause GDP	2.84	0.072	Reject H_0	Bi-directional Causality.
GDP does not Granger Cause Female health	4.70	0.016	Reject H_0	
Physical capital does not Granger Cause GDP	2.95	0.065	Reject H_0	Bi-directional Causality.
GDP does not Granger Cause Physical capital	6.05	0.006	Reject H_0	

The results in Table 5 imply that there is a bi-directional relationship between female human capital (both health and education) and economic growth, while a bi-directional relation is also observed between male human capital and economic growth only in case when male human capital is measured through health index whereas male human capital using education index is insignificant in causing economic growth or vice versa. The findings suggest that policies should be focused on female health and education for both long run and short run growth implications.

Conclusion

The research investigates how human capital affects economic growth in Pakistan using the proxies of health and education for male and female. The study constructs health index using male and female life expectancy while the education index is constructed using school enrollment for both male and female. The results show that female human capital is growth enhancing both in long-run and short-run whereas male human capital is effective in long-run only. Hence, it can be concluded that as compared to men, investment on female health and education are rewarding and contribute to

economic growth. Granger causality test revealed that there is a two way causality between human capital (male and female) and growth except for male human capital when education is used as human capital proxy. The findings suggest that policymakers should make policies in a way to strengthen the health system of the country and the government should spend effectively on health issues to ensure enhanced quality of life and enhance life expectancy. The policymakers should also focus on reducing gender disparities, particularly in education like offer maximum educational services to the females. The government must put efforts to bring female education to the level to get its positive benefits.

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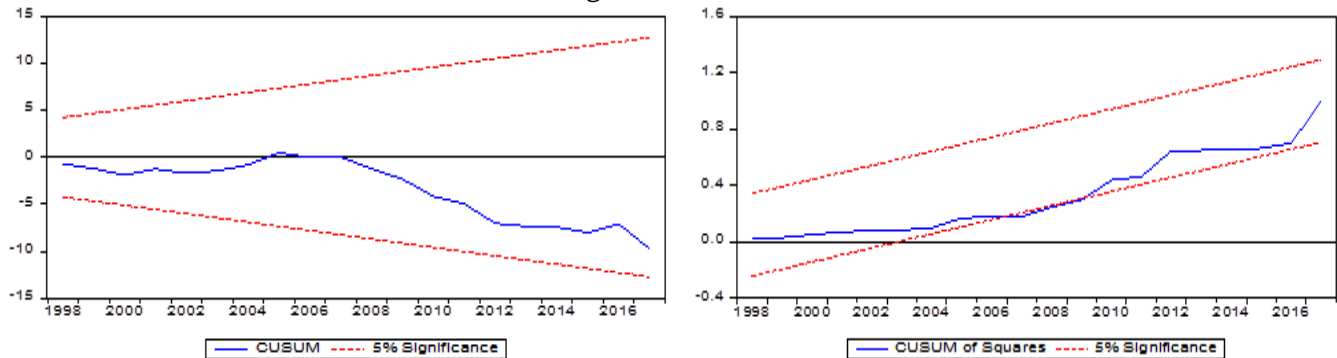
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Appendix 1

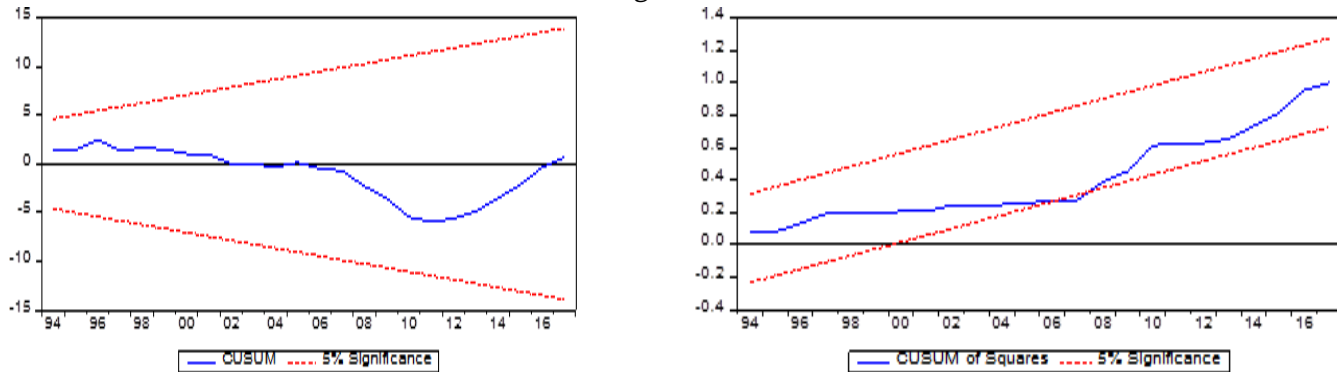
Figure

CUSUM Stability test

CUSUM Test for Model-1(Health-economic growth)



CUSUM Test for Model-2(Education-economic growth)



Appendix 2

Health and education construction formulas are given below.

▪ Weighted Education Index (Enrolments of male and female)

$$\text{Weighted Edu} = \frac{5P_t + 8M1_t + 10M2_t + 12S_t + 14G_t + 16PG_t}{POP_t}$$

Where P is Primary (5 years education), M1 is Middle (8 years education), M2 is Secondary (ten years of education), S is higher secondary (12 years of education), G is Graduate level education (14 years of education) and University level education (16 years of education)

$$\text{Education Index} = \frac{(\text{Actual} - \text{Minimum})}{\text{Maximum} - \text{Minimum}}$$

▪ Health Index (Life Expectancy of male and female)

$$\text{Health Index} = \frac{(\text{Actual} - \text{Minimum})}{\text{Maximum} - \text{Minimum}}$$