Journal of Advances and Scholarly Researches in Allied Education
Vol. XV, Issue No. 4, June-2018, ISSN 2230-7540

Human Capital, Gender & Economic Growth of India: An Auto-Regressive Distributed Lag Approach

Dr. Anupama Rajput[1]* Dr. Bhawna Rajput[2]

[1] Associate Professor, Department of Commerce, Janki Devi Memorial College, University of Delhi, India

[2] Associate Professor, Department of Commerce, Aditi Mahavidyalaya, University of Delhi, India

Abstract – Human Capital is an essential prerequisite of sustainable economic growth. The investment in education allows for improvements in the technical capabilities related to exploring of new ideas and innovations which enables the improvement in the quality of human capital of the country. It enhances the quality of life and leads to collective benefits to individuals and societies. The paper examines the short and long run relationship between defined by education variables and economic growth for India using Autoregressive Distributed Lag (ARDL) method of bound testing approach to co integration and error correction model using the annual data for the period 1970 – 2018. The study has incorporated Gross enrolment ratio at primary, secondary and tertiary level education as a proxy for human capital. The educational variables are also analyzed by gender to see impact of female education on economic growth. The study found the existence of co integration between all educational variables and economic performance of the country. The primary education level is found to be growth inducing factors in the short- run and long run. The tertiary level education is found to have positive and significant contribution to the economic growth in the long run. The gender analysis shows that primary male education level has a higher contribution to the growth in the short as well as long run. The female tertiary education level has the higher contribution to the economic growth of the country in the long run as compared to the males. Though, equal opportunity to education should be provided to male and female yet special attention need to be given to improve the enrolment rates of female in the higher education. The study also provides evidence that the secondary level educated persons generally with low professional and technical skills are unable to contribute to the economic activity of the country. The education system needs to be revamped to focus on skill based professional education at the secondary level with gender neutral policy framework.

Keywords: Economic Growth, Female education, Co-integration, ARDL Co-integration, ARDL Bound Testing Approach

Types of Study: Research Paper

JEL Codes: I21, J21, J80, O1, O15

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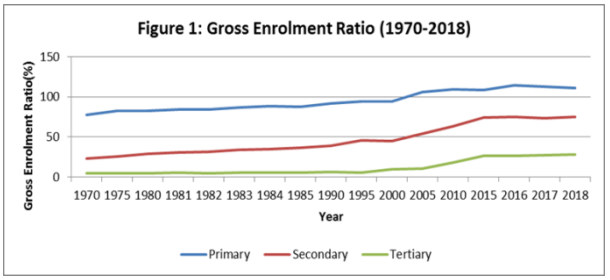
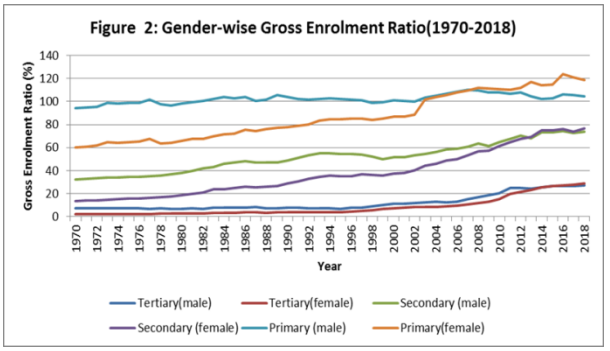
1. INTRODUCTION

The country's ability to effectively manage it economic factors of production is determined by the quality of its Human capital. Education as a measure of human capital is generally believed to be beneficial in fostering economic growth of the country. It improves productivity, allows introduction of creativity and innovation and promotes entrepreneurial environment and built human capital in the economy. The higher educational expenditure as a measure of human capital is found to be an effective instrument for reducing income equality and economic performance. Education expenditure as a proxy for long-term investment in human capital can indicate higher production level for the economy. Lucus (1988) suggested "human capital accumulation leads to sustained economic growth and education is the primary driving force through which knowledge is accumulated." According to Romer, P.(1989) and Rostow (1960) show that "education has spillover effects, improves the adaptation of innovation and research and productivity". Mallick et al., (2016) "clarified that the education sectors of the developing countries significantly contribute to the economic growth. The improvement of education quality at all level is imperative for the development of any economy".

The expenditure on education promotes economic growth through variety of externalities. The effective education system allows for the development of high quality and productive workforce that result in economic growth. The physical capital such as infrastructure creates enabling environment for faster economic growth. The human capital consisting of skill workforce facilitates this process of growth. "Education thus force increased productivity in two ways; education adds skill, increasing the capacity to produce more; and it increases the capacity to innovate to increase the productivity. While education in general is significant for the economic growth of a country, the female education results into various socio-economic gains which are not captured by higher wage or better compensation package for the educated female worker in the labor market (positive externality/ spillover effects). Women education lessens the population growth rate and fertility growth rate" (Dauda, 2012). This helps in reducing population growth and also increases the amount of workers in the labor market. The labor participation increases as more women will be capable and also able to join the labor market instead of raising more children. The lower fertility rate lowers burden of dependency. In fact, the rising level of female education increases family health, child survival, and investment in children's health. The studies have identified the social well-being of the country in terms of improvement of average life expectancy and improved functioning of social and political processes occurs as result of increased female education. The social benefits of female education are much higher than the private individual benefits derived by the female themselves. Thus, the special attention must be paid to the promotion of female education for structural transformation and economic growth of the country. In other words, female education has direct and indirect positive impacts on economic growth. The level of access to education and school enrolment at all levels has shown tremendous progress in India. Figure 1 provides the gross enrolment ratio at different education levels in India during 1970-2018. Gross Enrollment Ratio is referred to as "the total enrolment regardless of age and enrolled in relevant level of school divided by number of total population of the age group that officially corresponds to the level of education shown" (WDI, World Bank, 2017). It is expressed in percentage terms. Overall Gross Enrolment Ratio (GER) has showed a rising trend for all levels of education. The surge in establishment of Government- funded universities and colleges, private aided and grant-in-aid institutions and higher expenditure on higher education has sustained this rising trend.



Source: World Bank Indicators Data Base



Source: World Bank Indicators Data Base.

The Government's decision to provide free and compulsory education to all children up to the age of 14, emphasis of vocational education, encouragement to regional language instruction of teaching, adult education system etc. has improved the primary school education enrolment. Further, the establishment of Non-formal education centres set up in remote rural areas, hilly and tribal areas and in slums for those children who cannot attend full time schools regularly due to poverty and pre-occupation with other works has also increased the GER across all education levels. The GER is increasing for both female and male. The gender disparity in the education level is reducing over the years (Figure 2).

OBJECTIVE OF THE STUDY

In the light of stylized facts of education level of the country it will be relevant to evaluate impact of the government's efforts, measured through increasing the gross enrolment ratio in this study on economic growth in India over the years. The key objectives of the study are:

- To provide the empirical evidence of the impact of human capital improvement measured by the educational levels in general and female education in specific on the economic performance of India using the data from 1970 -2018 and to provide the long-run and short run estimates of the relationship.
- To empirically investigate the effect of level of education (i.e. primary, secondary and

tertiary level of education) on economic growth of India.

The review of literature on relationship between economic growth and human capital with specific reference to the female education is provided in second section. The research method is detailed in section three of the paper and the fourth section discusses the main results and findings with section five provides conclusions and policy suggestions.

2. LITERATURE REVIEW

A number of empirical and theoretical studies have been conducted to find the link between human capital in general and females' education in specific and economic growth. The sizeable literature fails to provide the empirical consensus on the impact of education on economic growth.

Syeda Anam Hassan etal. (2017) investigated the impact of female education on the economic growth of Pakistan using simple Ordinary Least Squares regression and shows "that 1% increase in female education, female labour force participation, education expenditure and fertility rate causes 96% increase in GDP of Pakistan. Female education and female labor force participation has a positive relationship with female labour force participation rate". Afridi, (2016) used ARDL and VECM models and "found a positive impact of birth rate and physical capital on economic growth so the result demonstrates that human capital plays significant role in the progress of the economy". Mallick et al., (2016) evaluated the association between expenditure on education and economic performance for selected Asian countries by using FMOLS and Pedroni co-integration and the results show that "there is long-run positive and significant relationship between education expenditure and economic growth during the time period 1973 to 2012". Nowak and Dahal (2016) employs the OLS and Johansen Cointegration technique to examine the association between education and economic growth and the results reveal that "there is a significant and positive relationship between education and economic growth in a long run". The study emphasized upon the serious policy interventions by the Government to develop education system and consistent improvement of quality of primary, secondary and higher education level to provide impetus to the economic growth. Shahid (2014) applied Augmented Dicky Fuller and Phillip Perron and Johnson co-integration to study "the relationship between labour force participation and economic growth in Pakistan over the time 1980 to 2012**"** and found long run positive and significant relationship between the variables. Dauda (2013) studied "the impact of women education on economic growth in Nigeria during the time period 1975 to 2008**.** By employing co-integration and error correction techniques the results shows that there is long-run relationship equilibrium between variables. The female education has negative and male education has a positive impact on economic growth of Nigerian economy. This study recommends that government should focus on policies regarding educational system, increase female enrollment and improve female contribution to economic growth". Hussin et al., (2012) showed "positive co integration between education expenditure and economic growth in the long run and found short run granger causality between the variables" during time period 1970 to 2010 in Malaysia **by using** Vector Auto Regression (VAR) method. Lahoti and Swaminathan (2013) used dynamic panel models to study the impact of female labor force participation on economic growth and find an "insignificant relationship between Female Labor Force Participation and economic growth". Muktdair-Al-Mukit (2012) studied "the long-run relationship between public expenditure on the education sector and economic growth in Bangladesh from the time period **1995 to 2009.** By using Co integration technique the results reveal that there is a significant and positive association between the variables in the long run. There is 1% increase in education expenditure leads to 34% increase in economic growth in the long run." The improvement in the quality of education and increased public education expenditure is an important prerequisite of economic growth of the country.

3. DATA & METHODOLOGY

In order to estimate the impact of education on economic growth, the variables considered in the study are: the real GDP per capita (GDPPC) is taken as dependent variable to proxy for economic performance, Gross Capital formation to GDP at constant price (GCF) is used as a proxy for physical capital. The improvements and flow in human capital is captured by education level for which the primary, secondary and tertiary level's Gross Enrolment Ratio (GER) is taken. The GER is also evaluated gender -wise (male and female), and Trade as a measure of openness in the economy is measured by total trade, exports plus imports, as a percentage of GDP. "The GER consists of total individuals enrolled in each level, which is stated as a percentage of total population of individual appropriate age at each level, based on UNESCO's classification of age group appropriate with its education level. There are cases where the GER may exceed 100% due to the inclusion of over-aged and under-aged students due to early or late school entrance and grade repetition" (WDI, World Bank,2017)

Data for GDPPC, GCF, Trade and GER of all levels for male and female are sourced from World Bank's Database on development indicators. The yearly time series data for a period of years from 1970 – 2018 were used. The study aims to analyze the long run and short run relationship between

economic growth and three levels of education. The separate models are used to analyze the impact of male and female education for all three levels.

The empirical specifications of three models used in the study are:

$$\ln GDPPC_t = \alpha_0 + \alpha_1 \ln GCF_t + \alpha_2 \ln GPT_t + \alpha_3 GST_t + \alpha_3 GTT_t + \alpha_4 Trade + \varepsilon_t \quad \text{(Model 1)}$$

$$\ln GDPPC_t = \alpha_0 + \alpha_1 \ln GCF_t + \alpha_2 \ln GMP_t + \alpha_3 GMS_t + \alpha_3 GMT_t + \alpha_4 Trade + \varepsilon_t \quad \text{(Model 2)}$$

$$\ln GDPPC_t = \alpha_0 + \alpha_1 \ln GCF_t + \alpha_2 \ln GFP_t + \alpha_3 GFS_t + \alpha_3 GFT_t + \alpha_4 Trade + \varepsilon_t \quad \text{(Model 3)}$$

Where GDPPCt is real GDP per capita for the period t; GFCt is gross capital formation for period t; and GPT, GST, and GTT represent general gross enrolment ratio for three levels of education viz. primary, secondary and tertiary education, Trade denotes the trade to GDP ratio. GMP_t, GMS_t, GMT_t in Model 2 denotes gross enrolment ratio of males for primary, secondary and tertiary education. GFP_t, GFS_t and GFT_t in Model 3 shows the gross enrolment ratio of females for primary, secondary and tertiary education. ε_t is the stochastic error term for all the models mentioned above.

3.1 Unit Root Test

The stationarity of time series is checked by conducting unit root test to avoid the spurious regression. The stationary time series data has time independent mean and variance. The non-stationary variables will have time dependent mean and variance. In this study the Augmented Dickey-Fuller (ADF) test and Akaike Information Criterion (AIC) are used to test the presence of unit root (i.e. stationarity) of all the variables. The Augmented Dickey-Fuller (ADF) test and Akaike Information Criterion (AIC) also identified the order of integration for each level and first difference. The null hypothesis of presence of unit root in the series is tested against the alternative hypothesis of no unit root in the series (stationary).

3.2 Autoregressive Distributed Lag (ARDL) Co Integration Test

The three models are estimated using ARDL to co integration estimation procedure introduced by Pesaran et al. (2001)is used. “This method can be used regardless if the variable are I(1) or I(0) or a mix of both and also it avoids the issue of endogeneity in the model”. “It can simultaneously estimate long-run and short run components in the model as well as is statistically more significant in determining the co integration relationship for small sample size models (Afzal et al., 2010, Sehrawat and Giri, 2016)”. This method requires that no variable should be I(2) . The ARDL co-integration technique is superior to the traditional methods. The following steps are involved in ARDL to co integration model.

3.3 Check Optimal Lag order

First optimum lag order is checked to see the lag to be used in the ADF test for each variable used in the model.

3.4 Conduct of ARDL Bounds Test

The existence of the long-run relationship amongst variables of the model is evaluated using ARDL Bound test. For this purpose the following equations for all the three models is estimated.

$$\Delta \ln GDPPC_t = \alpha_0 + \sum_{i=1}^{n} b_i \Delta \ln GDPPC_{t-i} + \sum_{i=0}^{n} c_i \Delta GCF_{t-i} + \sum_{i=0}^{n} d_i \Delta \ln GPT_{t-i} + \sum_{i=0}^{n} e_i \Delta GST_{t-i} + \sum_{i=0}^{n} f_i \Delta GTT_{t-i} + \sum_{i=0}^{n} g_i \Delta Trade_{t-i} + \lambda_1 \Delta \ln GDPPC_{t-1} + \lambda_2 \Delta GCF_{t-1} + \lambda_3 \Delta \ln GPT_{t-1} + \lambda_4 \Delta GST_{t-1} + \lambda_5 \Delta GTT_{t-1} + \lambda_6 \Delta Trade_{t-1} + \mu_t$$

Δ means the first difference of the variables, intercept is denoted by α_0, is the μ_t white noise term and *t* is time period. “If the computed F-statistics is the greater than the upper bound critical value, I(1), the null hypothesis is rejected and it implies the existence of long-term co- integration between the variables. If the computed F-statistics is the less than the lower bound critical value, I(0), the null hypothesis is accepted implying the absence of long-term co- integration between the variables. However, if the computed F value falls within upper and lower bound critical values, then the result is inconclusive” (Davidson etal.,1993).

3.5 Estimation of Long run and Short run Relationship

If the long run co-integration is established then the long run relationship amongst variable is estimated. The following equation is estimated based on Davidson etal. 1993:

$$\Delta \ln GDPPC_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \ln GDPPC_{t-i} + \sum_{i=0}^{q} \alpha_2 \ln GCF_{t-i} + \sum_{i=0}^{r} \alpha_3 \ln GPT_{t-i} + \sum_{i=0}^{s} \alpha_4 \ln GST_{t-i} + \sum_{i=0}^{t} \alpha_5 \ln GTT_{t-i} + \sum_{i=0}^{u} \alpha_6 \ln Trade_{t-i} + \mu_t$$

The short run parameters are estimated using error correct model (ECM) as specified below:

$$\Delta \ln GDPPC_t = \alpha_0 + \sum_{i=1}^{n-1} \alpha_1 \Delta \ln GDPPC_{t-i} + \sum_{i=0}^{n-1} \alpha_2 \Delta \ln GCF_{t-i} + \sum_{i=0}^{n-1} \alpha_3 \Delta \ln GPT_{t-i} + \sum_{i=0}^{n-1} \alpha_4 \Delta GST_{t-i} + \sum_{i=0}^{n-1} \alpha_5 \Delta \ln GTT_{t-i} + \sum_{i=0}^{n-1} \alpha_6 \Delta \ln Trade_{t-i} + \alpha_7 EC_{t-1} + \mu_t$$

Where α_1 α_2 α_3 α_4 α_5 and α_6 are “short run dynamic coefficients, while EC is the speed of adjustment coefficient towards achieving long run equilibrium after a short run shock i.e. convergence towards equilibrium position in case of any disequilibrium situation” (Davidson etal. 1993)

3.6 Diagnostic Tests

The diagnostic tests are conducted to check the adequacy and goodness of fit of ARDL model used in the study. The serial correlation, normality and

heteroscedasticity are examined through diagnostic tests. The cumulative residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) to the residuals of the error-correction model are used to check the stability of the model used in the study. The null hypothesis of coefficients' stability in the error correction model is not rejected if the plots of CUSUM or CUSUMSQ statistics stay within critical bounds of 5 % significance level.

4. EMPIRICAL RESULTS

The dynamics of the variables used in the study are analyzed using Descriptive statistics. The average (mean and median), Maximum and Minimum values of the variables are presented. The variation is evaluated using Standard Deviation. The symmetry and normality of the variables are checked by Skewness, Kurtosis, Jarque-Bera statistics and its Probability values of the estimated model. The results of the descriptive statistics are presented in Table-1.

Table 1: Descriptive Statistics for the Variables Used (1970-2018)

	GDPPC	GCF	TRADE	GPT	GST	GTT	GMP	GMS	GMT	GFP	GFS	GFT
Mean	10.488	9.24	3.079	4.55	3.743	2.14	4.627	3.913	2.367	4.436	3.491	1.77
Median	10.364	9.29	3	4.53	3.794	1.8	4.627	3.949	2.082	4.433	3.564	1.413
Maximum	11.553	11.9	4.022	4.74	4.32	3.34	4.704	4.308	3.303	4.817	4.339	3.37
Minimum	9.848	6.74	2.037	4.35	3.152	1.58	4.544	3.48	1.924	4.098	2.601	0.767
Std. Dev.	0.525	1.56	0.601	0.12	0.359	0.6	0.038	0.25	0.481	0.226	0.539	0.83
Skewness	0.493	0.03	0.093	0.19	-0.02	0.87	-0.02	-0.19	0.935	0.197	-0.002	0.629
Kurtosis	1.975	1.77	1.794	1.75	1.941	2.29	2.603	2.042	2.326	1.673	1.858	2.125
Jarque-Bera	4.131	3.12	3.042	3.48	2.295	4.26	0.326	2.2	8.056	3.913	2.666	4.796
Probability	0.127	0.21	0.219	0.18	0.318	0.21	0.85	0.333	0.018	0.142	0.264	0.091
N	49	49	49	49	49	49	49	49	49	49	49	49

Source: Authors own compilation. The natural log values of variables are shown.

All the variables except the secondary level gross enrolment, male primary level gross enrolment and female secondary gross enrolment are skewed positively. The positive Kurtosis value is observed for all the selected variables of the model. The data of the variables is normally distributed as Skewness and Kurtosis are reported to be insignificant and different from zero.

The estimated results of Jarque-Bera also confirm that the variables are normally distributed. Table-2 presents ADF unit root test results. The results show that the variables are not stationary at level. The empirical results show that all the variables are I(1) i.e. become stationary at first difference.

Table 2: Results of the Stationarity Test (1970-2018)

Variables	Level	First Difference
InGDPPC	4.287219	-5.715809***
InGCF	-0.064145	-4.82184***
InTRADE	-1.416536	-3.60556***
InGTP	-0.848628	-3.855047***
InGTS	-0.65554	-3.949073***
InGTT	1.948516	-5.046017***
InGMP	-2.439743	-6.700622***
InGMS	-0.782725	-6.033197***
InGMT	1.42616	-5.489932***
InGFP	-0.400135	-7.176736***
InGFS	-0.528915	-6.195587***
InGFT	1.271414	-4.758543***

Note: ***, **, * indicates that the null hypothesis of non-stationary is rejected at significance level of 1%, 5% and 10%. Source: Authors Own Calculations. ADF test results of stationarity are shown.

Table-3 shows the calculated ARDL results of the model. In order to test the presence of co-integration amongst the variables of the models, F-statistic tests are used.

Table 3: Bounds Test Results of Co integration with Intercept and No Trend (1970-2018)

Critical bound values based on F-statistics							
	k	10% Level		5% level		1% Level	
		Lower	upper	lower	upper	lower	upper
	5	*2.08*	*3*	*2.39*	*3.38*	*3.06*	*4.15*
Model	**Lag Length (optimal)**	**Value of F-Statistics**				**Results**	
Model 1	2	14.07844***				Co integrated	
Model 2	2	7.027078***				Co integrated	
Model 3	2	7.441118***				Co integrated	

K shows the number of regressors. *, ** and *** shows the coefficient is greater than the upper critical bound value at 10%, 5% and 1% level of significance.. Source: Authors own compilation.

The values of F-statistics for all the models are higher than the upper bound value at 1 percent level of significance. Thus, the null hypothesis of no co-integration is rejected and alternative hypothesis is accepted which confirms the presence of co-integration among the variables of the all the three models. The long run results of the model are presented in Table-4.

Table 4: Estimated long-run coefficients of ARDL Model (1970-2018)

Critical bound values based on F-statistics							
	k	10% Level		5% level		1% Level	
		Lower	upper	lower	upper	lower	upper
	5	*2.08*	*3*	*2.39*	*3.38*	*3.06*	*4.15*
Model	**Lag Length (optimal)**	**Value of F-Statistics**				**Results**	
Model 1	2	14.07844***				Co integrated	
Model 2	2	7.027078***				Co integrated	
Model 3	2	7.441118***				Co integrated	

The estimated results show in the long-run, all variables contribute positively and significantly to economic growth with the exception of trade and secondary education variables in all the three models. It can be concluded that there is significant and positive contribution of primary education on the economic growth of India. The results are consistent with the findings of Shaihani et al. (2011) as well as Zhang and Zhuang (2011) and Tichaona Zivengwa (2013) which suggests that investing in education is important for economic growth.The 86th amendment Act, 2002 of the Indian Constitution that make elementary education a fundamental Right for children in the age group of 6-14 years has been a significant step in the right direction. The secondary education is found to have negative significant impact on GDPPC. This provides evidence that the joblessness amongst the educated persons with low professional and technical skills are unable to contribute to the economic activity of the country. Dessuss's (1999) results also suggested that "as education enrollment level increases, the standard of education decreases. As a result, education investment in developing countries fails to generate higher economic growth". The tertiary education has significant and positive relationship with the economic growth as tertiary level of education contributes most widely to innovation through the skills, professionalism and knowledge that enhance productivity levels of the economy. The effect of gross capital formation is found to statistically significant and positive in all models.

The gender analysis of effects of education on economic growth shows that male and female primary education has significant and positive impact on GDPPC. Table 5 shows that the male's gross enrolment ratio at primary level has greater impact on economic growth than female primary education levels. However, the female's tertiary education has little higher impact on economic growth than male's tertiary education level. It is an evidence that of improvement of women in employment with education level. The overall results provide the support to Government initiatives to enhance women education in India.

Table 5: Error correction representations for ARDL Model according to AIC (1970-2018)

Model 1 (2,2,1,0,0)		Model 2 (2,2,1,0,0)		Model 3 (2,2,1,1,0)	
Regressand: Δ **InGDPPC$_t$**					
InGCF$_t$	0.287413*** (7.363449)	**InGCF$_t$**	0.387044*** (5.859777)	**InGCF$_t$**	0.322826*** (3.182144)
InGPT$_t$	0.83164*** (3.023846)	**InGMP$_t$**	1.374101** (2.272442)	**InGFP$_t$**	0.762827*** (2.63079)
InGST$_t$	-0.475604*** (-3.267223)	**InGMS$_t$**	-0.671975*** (-2719703)	**InGFS$_t$**	-0.728027*** (-2.657212)
InGTT$_t$	0.330556*** (13.491951)	**InGMT$_t$**	0.332307*** (7.951807)	**InGFT$_t$**	0.361046*** (10.344584)
InTrade$_t$	0.016343 (0.371422)	**InTrade**	0.036106 (-0.533226)	**InTrade**	0.006441 (-0.096672)
Constant	0.330556*** (5.178513)	**Constant**	2.648517* (1.076383)	**Constant**	6.133626*** (6.425887)

Note: t-statistics values are given in parentheses, while (*), (**), (***) indicate that the coefficient is significant level at 10%, 5%, 1%, respectively Source: Authors own compilation

The short run dynamic coefficients show that the gross capital formation and total and male primary education level has positive and significant impact on the economic growth in the short run also at 5% level of significance. The coefficient of tertiary level of education is insignificant.. The tertiary education level has indirect long term effects on the economic growth but it may not have the short run impact. The secondary education is found to have negative significant impact on GDPPC in the short run also. The secondary level education system with low component of vocational courses fails to provide enough job opportunities and so unable to contribute positively to the economic activity of the country. The coefficient of the error correction term is significantly negative for all the models and shows convergence in the short run model. In model 1 it means that it will take (1/ -0.60626) =1.6 years to reach to equilibrium again following a shock in the regressors. In model 2 it will take (1/ -0.3988)= 2.5 years and for model 3 it will take 1.8 years to reach to equilibrium.

Table 6: Diagnostic Test (Model 1)

Model 1 (2,2,1,0,0)		Model 2 (2,2,1,0,0)		Model 3 (2,2,1,1,0)	
Dependent Variable: Δ **InGDPPC**t-1					
Δ **InGCF**$_{t-1}$	0.174247*** (3.875603)	Δ **InGCF**$_{t-1}$	0.154354*** (3.748028)	Δ **InGCF**$_{t-1}$	0.176882*** (3.203551)
Δ **InGPT**$_{t-1}$	0.2977* (1.939625)	Δ **InGMP**$_{t-1}$	0.547993*** (3.661567)	Δ **InGFP**$_{t-1}$	0.1001 (0.729541)
Δ **InGST**$_{t-1}$	-0.397014*** (-3.398875)	Δ **InGMS**$_{t-1}$	-0.378558*** (-3.039571)	Δ **InGFS**$_{t-1}$	-0.326962*** (-2.871359)
Δ **InGTT**$_{t-1}$	0.07959 (1.496114)	Δ **InGMT**$_{t-1}$	0.012262 (0.230331)	Δ **InGFT**$_{t-1}$	0.131177* (1.931335)
Δ **InTrade**$_{t-1}$	0.090258** (-2.090576)	Δ **InTrade**$_{t-1}$	0.107954*** (-2.467955)	Δ **InTrade**$_{t-1}$	0.098645* (-1.946681)
EC$_{t-1}$	-0.606258*** (-4.345794)	**EC**$_{t-1}$	-0.398801*** (-3.135351)	**EC**$_{t-1}$	-0.547919*** (-3.627666)

Note: t-statistics values are given in parentheses, while (*), (**), (***) indicate that the coefficient is significant level at 10%, 5%, 1%, respectively. Source: own compilation

Table 7: Diagnostic Test (Model 2)

Test Statistics	LM Version	F Version
A: Serial Correlation	CHSQ(2)=1.608306(0.4475)	F(2,27)= 0.500375(0.6118)
B: Normality	Jarque-Bera =0.468518(0.791157)	
C: Heteroscedasticity	CHSQ(15) =21.46767(0.1225)	F(15,29)=1.763708 (0.0926)

Note: t-statistics are given in parentheses, while (*), (**), (***) indicate that the coefficient is significant level at 10%, 5%, 1%, respectively. Source: own compilation

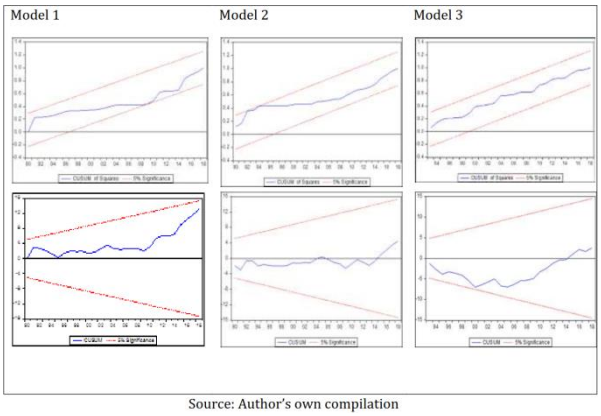
Table 8: Diagnostic Test (Model 3)

Test Statistics	LM Version	F Version
A: Serial Correlation	CHSQ(2)=1.821602(0.4022)	F(2,27)=0.569535(0.5724)
B: :Normality	Jarque-Bera = 0.15978(0.923218)	
C: Heteroscedasticity	CHSQ(15) = 19.45449(0.1939)	F(15,29)=1.472353(0.1806)

Note: t-statistics values are given in parentheses while (*), (**), (***) indicate that the coefficient is significant level at 10%, 5%, 1%, respectively. Source: own compilation

The test results of diagnostic test (Table 6.7& 8) shows that there is no serial correlation among the variables of all three models. The results of Skewness and Kurtosis confirm the normal distribution of the time series data of all variables. The Jarque-Bera test also provides the presence of normality amongst the variables. The results show that there is no heteroscedasticity in the data for all models.

The shift in the estimated model (stability or instability) over selected time is evaluated using stability tests. The Cumulative Sum (CUSUM) and the Cumulative Sum of the Squares (CUSUM sq) tests are used to examine the stability of short run and long run coefficients of the model. The Figure 3 depicts the results of Cumulative Sum (CUSUM) and the Cumulative Sum of the Squares (CUSUM sq) testsof stability**.** The figures show that Cumulative Sum (CUSUM) and the Cumulative Sum of the Squares (CUSUM sq) are well within the two critical boundary lines and do not go out the critical boundaries. For all 3 models both test confirms the correct specification of the models.



Source: Author's own compilation

Figure 3: Results of the Stability Test for all Models

5. CONCLUSIONS AND POLICY SUGGESTIONS

The study has investigated the impact of human capital (specifically education variables) on economic growth and provides the long-run and short run estimates of the impact for the sample period of **1970-2018.** The improvement of human capital is measured by proxy variable of the enrolment ratio (gross) at all levels of education. The GER by gender is also evaluated. Human capital appears to have positive and significant impact on economic growth in the country. The present study finds the positive and significant effects of primary and tertiary level of education on economic growth. In the short run the primary education level has positive and significant effect on economic growth. The empirical results indicate that in the long- run, the primary education of male has higher impact on the economic growth of India. However, the female tertiary level education has slightly higher effects on economic growth. The jobs created in the more technical areas (which requires tertiary level of education) of the economy that could employ more women, will allow the improved economic performance with the inclusion of trained and educated women. The results provide the strong support to Government policy of Universalization of elementary education in India. The steady increase is witnessed in the total enrolment at the primary and upper primary levels of education. This has also resulted in the drastic reduction of gender inequality in the primary level education. Based on the results, the government should develop a policy to make improvements in the tertiary level of education or higher education as the impact is found to be positive and significant on the economic growth. The measures will have greater positive spillover effects and externalities on the other sector of the economy. The study also suggests that the secondary level educated persons generally with low professional and technical skills are unable to contribute to the economic activity of the country. The education system needs to be revamped to focus on skill based professional education at the school level with gender neutral policy framework.

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Syeda Anam Hassan, 2 Nazish Rafaz International Journal of Innovation and Economic Development ISSN 1849-7020 (Print) ISSN 1849-7551 (Online) Volume 3 Issue 5 December, 2017 Pages 83-93.

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Corresponding Author

Dr. Anupama Rajput*

Associate Professor, Department of Commerce, Janki Devi Memorial College, University of Delhi, India