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Impact of Education on Economic Growth of Pakistan- Econometric Analysis

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Abstract : *Education plays a vital role in enhancing economic growth by increasing productivity. It is one of the important elements of human capital formation. The study aims to examine the impact of education on economic growth of Pakistan based on an econometric model. To test the relationship between educational expenditure and economic growth, time series data has been used for the period of 1981-2010 for econometric analysis. The empirical results reveal that there is no relationship between the two factors in short-run. However, in long run a combination of several factors, including Education contribute towards economic growth. The results have been tested for heteroscedasticity, multicollinearity and autocorrelation for validation purposes. The study may be useful for educational sector for policy making and human capital formation to augment economic growth in Pakistan.*

Keywords: *Educational expenditure, economic growth, gross domestic product, human capital, government expenditure, labour force participation.*

I. Introduction

The impact of educational spending on economic growth is one of the critical problems in economic literature. Many economic growth models and theories (such as Romer, 1990 and Lucas, 1988) have been developed, over time related to education and economic growth. Educational expenditure is part of public expenditure and after World War II public expenditures have increased in developed and developing countries. Since the government of many developing nations believe that education plays a vital role in promoting economic growth, has consequently led to investment in the education sector. Theoretically, even literature provides support for such policies (Pissarides, 2000). However, many empirical studies have been unable to provide an economic model to show a relationship between educational expenditures and economic growth. Economic growth is defined as an increase in value of the goods and services produced by an economy. Growth is generally measured in real terms, i.e. inflation-adjusted terms, in order to net out the effect of inflation on the price of the goods and services produced. As economic growth is considered as the annual percentage change in National Income, it has all the merits and demerits of that level variable.

The paper aims to establish a relation between education and economic growth in Pakistan. The study explores that any improvement in the education results in economic growth of Pakistan. There has been difference of opinion among researchers about the positive or negative relationship between educational expenditure and economic growth while some studies indicate no impact of education on economic growth. Time series data from the period of 1981-2010 is used for the analysis and co-integration and error correction models are used to determine the long and short run relationship of education and economic growth. In this study, an attempt is made to determine the significance of education in economic development in Pakistan. The data has been extracted from Ministry of Education and World Bank's websites, and various issues of Pakistan Economic Survey.

II. literature review

Education plays an essential part in developing human capital and accelerating productivity in any country. It is considered as a tool for economic advancement. Over a period of time researchers have found that correlations exist across countries between economic growth rates and schooling enrollment rates including enrollment in higher education. Few empirical studies have tried to examine the relation between investment in human capital and economic growth. Meulmester (1995) suggested that this relationship is not always direct; based advanced econometric techniques. The relationship has been tested for countries such as USA, Pakistan, Tanzania and Zambia, Nigeria and India. The results indicate that education expenditure has positive effects on growth.

According to Hanushek and Kimko (2000), Countries that have a high rate of enrollment in schools grow faster in terms of per capita income, causing rapid improvement in productivity. According to Krueger (2000), country that improves its educational policies is more likely to improve other economic policies as well, that will enhance its national growth. Bils and Klenow (2000) revealed that there is causality between education

spending and GDP. He tested for a relationship between education investments and economic growth using Granger causality model.

2.1 Educational Structure in Pakistan

Pakistan is has been an international outlier in terms of gender gaps in education. The education system in Pakistan is largely distributed into five levels: primary (grade one through five); middle (grade six through eight); high school or Secondary School Certificate SSC (grade nine and ten); intermediate or Higher Secondary School HSC (grade eleven and twelve), leading to university degree programs i.e. undergraduate and graduate and post graduate.

While Only 5.1 per cent of people aged 17-23 years are currently enrolled in higher education in Pakistan. To augment the human capital, government of Pakistan has taken numerous steps to improve the education system and educational standards. According to the Education Statistics of 2008-9, literacy rate remains low in rural areas (48%) as compared to urban (74%). Literacy rate in terms of gender was men (69%) and women (45%). Province vise literacy rate indicates, Punjab (59%), Sindh, (59%), Khyber Pakhtoonkhwa (50%) and Balochistan (45%). Total adult literacy rate remained at 57%. 156, 653 Primary Schools with 465,334 Teaching staff are functioning in Pakistan. There was an increase of 0.6 % in Primary enrolment (18.468 million) in 2009 compare to (18.360 million) in 2008. Statistics indicates that, 24,322 Secondary Schools with 439,316 Teaching staff are functioning in Pakistan. Moreover, the enrolment rate of 2.9 % (2.556 million) is observed in 2009-2010. [1]

Due to lack employment opportunities, and inadequate research activities, many students and professionals have left Pakistan for the sake of healthier vocation and life. Various measures have been taken by the government to deal with the issue of brain drain in Pakistan over the last few years to promote improve the quality of education and educational facilities. Many scholarships programs are developed and offered throughout the year to support individuals for higher education, including indigenous scholarship.

III. Hypothesis

There is a positive relationship between educational expenditure and economic growth of Pakistan.

IV. Methodology

The model used in this paper is based on aggregate output function:

$$LnY = \alpha + \beta_1 Ln(EDUEXP) + \beta_2 Ln(LFPR) + \beta_3 Ln(GFCF) + \mu_i$$

Where:
Ln = Natural Logarithm
Y = Real GDP
EDUEXP = Government Expenditure on Education % of GDP
LFPR = Labor Force Participation Rate
GFCF = Gross Fixed Capital Formation
μi = Error Correction Term

V. Analysis Of The Model

To check the hypothesis OLS technique was run, on a time series data sample from the year 1981 to 2010 and below are the results of regression model:

$$LnY = \alpha + \beta_1 Ln(EDUEXP) + \beta_2 Ln(LFPR) + \beta_3 Ln(GFCF) + \mu_i$$

Sample: 1981 2010
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.357915	1.439910	1.637543	0.1136
LEDUEXP	0.419361	0.645301	0.649868	0.5215
LGFCG	-0.044904	0.069065	-0.650178	0.5213
LLFPR	-0.136647	0.198686	-0.687754	0.4977

R-squared	0.077666	Mean dependent var	1.596341
Adjusted R-squared	-0.028757	S.D. dependent var	0.419499
S.E. of regression	0.425489	Akaike info criterion	1.252408
Sum squared resid	4.707053	Schwarz criterion	1.439235

[1] www.worldbank.org

Log likelihood	-14.78612	F-statistic	0.729783
Durbin-Watson stat	1.657983	Prob(F-statistic)	0.543552

*Since Log of all variables has been taken therefore before every variable L is written.

5.1. Interpretation of Results

As per model Y-intercept is 2.36 which mean that Real GDP will have 2.36 growth when all of the variables of our model are '0' This is because GDP does not depend only on education even if there is no expenditure on education. Coefficient of EDUEXP is positive which means that 1% change in EDUEXP will bring on average 0.41% change in Real GDP. Coefficients of GFCG and LFPR are negative but as per priori they are supposed to be positive. This problem will be catered in later part of this report.

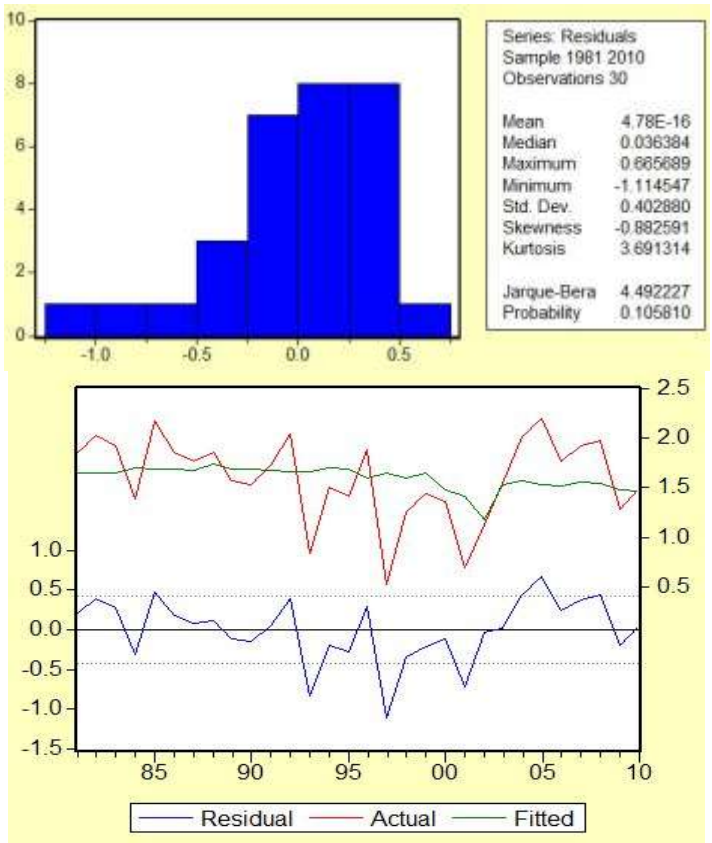
5.1.1 Significance of Coefficients

Individual coefficients of all three independent variables are statistically insignificant.

5.1.2 Coefficient of Determination (R^2)

Value of R^2 is very low which states that approximately 7.76% variation in Real GDP is explained by Government expenditure on education as % of GDP, Labor force participation rate, Gross fixed capital formation.

The below graph shows that the residuals are right skewed and from the JB value of 4.49 with probability of 0.10 suggest that the hypothesis, error terms are normally distributed is not true.



The above graph shows that actual values are not well fitted with the estimated which is the reason of low R^2.

VI. Conclusion

The above regression analysis and its interpretation do not validate that education and economic growth has a long term relationship. Few results are against priori as well. In most of previous researches and literature available education has brought an economic growth in a given country.

We can also say that in short run education does not have relationship with economic growth because our sample size was just 30. Other deduction that can be made is since in Pakistan government has failed to create employment opportunities therefore after completing education people do not find jobs to contribute to the national economy and at times people go abroad causing brain drain in Pakistan. Therefore government must

attract international companies and local investors as well to create such ventures that could lead to the employment opportunities and ultimately increase in economic growth of Pakistan. Spending only on education will not contribute as such towards economic growth, there must be a system to accommodate and utilize those educated people for the best interest of country's economy.

VII. Testing For Heterosedasticity

7.1 Park Test

Sample: 1981 2010
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15.22099	5.142569	2.959804	0.0065
LOGEDUEXP	-1.913353	2.304660	-0.830211	0.4140
LOGGFCG	0.074760	0.246661	0.303087	0.7642
LOGLFPR	-3.561273	0.709597	-5.018725	0.0000
R-squared	0.496908	Mean dependent var		0.245008
Adjusted R-squared	0.438859	S.D. dependent var		2.028601
S.E. of regression	1.519611	Akaike info criterion		3.798352
Sum squared resid	60.03968	Schwarz criterion		3.985178
Log likelihood	-52.97528	F-statistic		8.560149
Durbin-Watson stat	2.020812	Prob(F-statistic)		0.000404

We can see that there is not statistically significant relationship therefore there is no chance of heterosedascticity.

7.2. White Test

White Heteroskedasticity Test:

F-statistic	0.500718	Probability	0.801263
Obs*R-squared	3.465937	Probability	0.748496

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample: 1981 2010
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	63.04697	103.7328	0.607782	0.5493
LOGLFPR	-23.88602	35.43197	-0.674137	0.5069
LOGLFPR^2	2.338438	3.484467	0.671104	0.5088
LOGGFCG	-0.756409	3.113424	-0.242951	0.8102
LOGGFCG^2	0.033143	0.125704	0.263660	0.7944
LOGEEXP	-2.178690	3.897969	-0.558930	0.5816
LOGEEXP^2	1.328884	2.486743	0.534387	0.5982
R-squared	0.115531	Mean dependent var		0.156902
Adjusted R-squared	-0.115200	S.D. dependent var		0.261801
S.E. of regression	0.276470	Akaike info criterion		0.467534
Sum squared resid	1.758020	Schwarz criterion		0.794481
Log likelihood	-0.013017	F-statistic		0.500718
Durbin-Watson stat	2.310125	Prob(F-statistic)		0.801263

n. R^2 = 3.4659, which has asymptotically a chi square distribution with 6 df. The 5% critical chi-square value for 14 df is 12.5916. 10% critical value is 10.6446 and 25% critical value is 7.84. For all practical purposes we can conclude on the basis of white test that there is no heteroscedasticity.

7.3. Spearman's Rank Correlation Test

Spearman's Rank correlation					
Residual	Ranking	RGDP	Ranking	d	d^2
0.20	13	6.4	24	-11	121
0.38	22.5	7.6	26	-3.5	12.25
0.28	16.5	6.8	23.5	-7	49
0.31	19	4	8	11	121
0.48	26	8.7	28	-2	4
0.17	10	6.4	19.5	-9.5	90.25
0.08	5	5.8	17.5	-12.5	156.25
0.11	6	6.4	19.5	-13.5	182.25
0.12	7.5	4.8	15	-7.5	56.25
0.16	9	4.6	13	-4	16
0.05	4	5.6	16	-12	144
0.38	22.5	7.7	27	-4.5	20.25
0.83	29	2.3	3	26	676
0.19	11.5	4.5	12	-0.5	0.25
0.28	16.5	4.1	9	7.5	56.25
0.29	18	6.6	22	-4	16
1.11	30	1.7	1	29	841
0.35	20	3.5	5	15	225
0.21	14	4.2	10	4	16
0.12	7.5	3.9	7	0.5	0.25
0.72	28	2	2	26	676
0.04	3	3.1	4	-1	1
0.01	1	4.7	14	-13	169
0.44	25	7.5	26	-1	1
0.67	27	9	30	-3	9
0.24	15	5.8	17.5	-2.5	6.25
0.37	21	6.8	23.5	-2.5	6.25
0.43	24	7.2	23	1	1
0.19	11.5	3.6	6	5.5	30.25
0.02	2	4.4	11	-9	81
					3784

src = $1 - 6[\sum d^2 / n(n^2$
src = 0.16
t = $r \sqrt{n-2} / \sqrt{1-r^2}$
t = 0.847
df = 28
t value is not significant at 10% level of significance. Therefore there is no heterosedasticity.

7.4. Goldfeld-Quant Test

First 13 observations

Dependent Variable: LOGGDP
Method: Least Squares
Sample(adjusted): 1981 1993
Included observations: 13 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.651573	0.681057	3.893319	0.0025
LOGEDUEXP	-1.257336	0.922248	-1.363338	0.2000
R-squared	0.144548	Mean dependent var		1.731770
Adjusted R-squared	0.066779	S.D. dependent var		0.347328
S.E. of regression	0.335531	Akaike info criterion		0.794433
Sum squared resid	1.238391	Schwarz criterion		0.881348
Log likelihood	-3.163812	F-statistic		1.858692
Durbin-Watson stat	2.202716	Prob(F-statistic)		0.200028

Last 13 observations

Dependent Variable: LOGRGDP
Method: Least Squares
Sample(adjusted): 1998 2010
Included observations: 13 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.049376	2.287818	0.021582	0.9832
LOGEDUEXP	1.555899	2.381743	0.653260	0.5270
R-squared	0.037346	Mean dependent var		1.541882
Adjusted R-squared	-0.050167	S.D. dependent var		0.419886
S.E. of regression	0.430289	Akaike info criterion		1.291919
Sum squared resid	2.036634	Schwarz criterion		1.378834
Log likelihood	-6.397470	F-statistic		0.426749
Durbin-Watson stat	0.919369	Prob(F-statistic)		0.527007

$\lambda = \underline{RSS_2 / df}$
RSS□ / df
$\lambda =$ 1.64

Since it does not exceed the critical value therefore we can say that there is no hetrosedasticity in the error terms.

VIII. Detection Of Multicollinearity

8.1. High R^2 but significant t ratios

R^2 is very low in Log model i.e. 0.077666 while all of the t statistics are statistically insignificant while F statistics is also in significant. It means there is no multicollinearity.

8.2. Correlation matrix

Coefficient Covariance Matrix				
	C	LOGEDUEX	LOGGFCG	LOGLFPR
C	2.073342	-0.629216	-0.064762	-0.176913
LOGEDUEX	-0.629216	0.416413	0.009895	0.037209
LOGGFCG	-0.064762	0.009895	0.004770	-0.001042
LOGLFPR	-0.176913	0.037209	-0.001042	0.039476

The above matrix results reveal that there is no multicollinearity because all of the cross sectional values are significantly low.

8.3. Auxilary Regression

Below are the results of auxiliary regressions (i.e. regressing each independent variable on remaining regressors one by one)

Model's $R^2 = 0.07766$

Dependent Variable	R^2
Logeduexp	0.144137
Loggfccg	0.070811
Loglfpr	0.104947

We can see after running auxiliary regressions that two R^2 are greater than models R^2 (applying rule of thumb) which states that there is some multicollinearity.

IX. Detection Of Autocorrelation

9.1 The runs test

(+++)(-)(++++)(--)(++)(---)(+)(------)(++++++)(-)(+)
N_1= 17
N_2 = 13
Runs = 11

Mean: $E(R) = \{(2N_1 N_2)/N\} +1 = 15.7$
Variance: $(\sigma)^2_R = \{2N_1N_2(2N_1N_2 - N)\}/\{N^2 (N-1)\} = 6.97$
Standard Deviation: $\sigma = 2.64$
Prob $[E(R) - 1.96\sigma_R \leq R \leq E(R) +1.96\sigma_R]$
Prob $[10.525 \leq 11 \leq 20.874]$

Hence we do not reject the hypothesis that the residuals in the model are random. Since number runs are many therefore there is a negative auto correlation.

8.4. Durbin – Watson d Test
n = 30
k = 3
Durbin – Watson *d* stat: 1.657983
d_L = 1.006 and d_u = 1.421

Below is the decision table:

DURBIN–WATSON *d* TEST: DECISION RULES

Null hypothesis	Decision	If
No positive autocorrelation	Reject	$0 < d < d_L$
No positive autocorrelation	No decision	$d_L \leq d \leq d_U$
No negative correlation	Reject	$4 - d_L < d < 4$
No negative correlation	No decision	$4 - d_U \leq d \leq 4 - d_L$
No autocorrelation, positive or negative	Do not reject	$d_U < d < 4 - d_U$

Since d stat is greater than d_u and less than $4 - d_u$. Therefore there is no auto correlation positive or negative.

8.5. Chow Test
RSS_1 = 2.245285
RSS_2 = 0.261074
RSS_R=4.707053

$RSS_{UR}=RSS_1 + RSS_2$= 2.5

$$F = \frac{(RSS_R - RSS_{UR})/k}{(RSS_{UR})/(n1 + n2 - 2k)}$$

F = 0.55/0.113
F = 4.86
F_{tab}= 2.82with Confidence Interval of 0.95
Since $F_{cal} > F_{tab}$
Therefore we do not reject the null hypothesis of parameter stability (i.e. no structural change).

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