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28 February 2015

Online at <https://mpra.ub.uni-muenchen.de/62468/>

MPRA Paper No. 62468, posted 28 Feb 2015 14:37 UTC

# **Empirical Analysis of the effect of Human Capital Generation on Economic Growth in India – a Panel Data approach**

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## **Abstract**

Last decade of 20<sup>th</sup> century faced a strong quest for the determinants of the rate of long run economic growth. Post World War II, human capital has emerged as an important and inevitable factor apart from the other general factors that affect the rate of growth. According to economists and existing theories of growth, a nation that invests in human capital generation should contribute positively in the process of economic growth. Human capital embodies qualities that are inherited as well as acquired through education and training. The returns to investment in human capital not only help individuals to enjoy personal growth but in addition affect the growth of the nation as an aggregate. This paper observes the relationship that prevails between human capital and economic growth in the Indian economy based on NSSO unit level household data. With the help of panel data econometric analysis, the study finds out that human capital generation as an aggregate of average general educational level, literacy rate, per capita educational expenditure and primary enrolment rate, positively impact the per capita net state domestic product, taken as a representative for economic growth.

**Keywords:** Human Capital, Economic Growth, Panel Data Econometrics

**JEL Classification:** C12, C13, C23

## **Introduction**

Last decade of 20<sup>th</sup> century faced a strong quest for the determinants of the rate of long run economic growth. Post World War II, human capital emerged as an important and inevitable factor apart from the other general factors that affect the rate of growth. Though human capital was initially de-emphasized at the expense of physical capital, the thought that it assumes an imperative part in clarifying income inequality has been reflected in economists' thinking for quite a while. This can be traced back to the works of Adam Smith in "Wealth of

Nations” (1776)<sup>1</sup> and Alfred Marshall (1890)<sup>2</sup> who also emphasized on the importance of manpower in production process. Some economists like Walsh (1935) and Kiker (1966) are of the belief that Sir William Petty was possibly the first person to mention the inclusion of economic values of human beings in late 17<sup>th</sup> century. The idea of human capital and its contribution to economic growth picked up major importance because of the works of Schultz (1960) and Garry Becker (1962). Both had different approaches towards it. Schultz identified it to be an investment in education, increment in the stock of which leads to increase the national income. Becker, on the other hand, broadened the concept from formal schooling to additional sources like, on-the-job training, informal gathering of information and investment in emotional and physical health that increases productivity of an individual. Again, Becker and Chiswick (1966) argued over the fact that different investments in human capital along with their different rates of return largely determine the distribution of earnings. According to them, *Institutional factors* like inheritance of property income, difference in abilities and opportunities, subsidies to education etc. determine investment in education. In the works of Barro (1991) and Mankiw, Romer & Weil (1992), the previous recognized human capital with formal education measured by enrollment rates to include in the economic growth process while the latter's work used augmented Solow model<sup>3</sup> and focused on both human and physical capital. Other approaches like Benhabib and Spiegel (1994) follows the methodology where growth of output is determined by the accumulation of inputs and TFP (total factor productivity) growth.

Any production process requires labor and capital as its primary inputs. Laborers, the primary source of labor also possess have some skill and knowledge required in a particular production process. This is basically the capital embedded within that labor. Right now the world is witnessing an increase in the technological progress due to high rate of innovation

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<sup>1</sup>“...When any expensive machine is erected, the extraordinary work to be performed by it before it is worn out, it must be expected, will replace the capital laid out upon it, with at least the ordinary profits. A man educated at the expense of much labour and time to any of those employments which require extraordinary dexterity and skill, may be compared to one of those expensive machines. The work which he learns to perform, it must be expected, over and above the usual wages of common labour, will replace to him the whole expense of his education, with at least the ordinary profit of an equally valuable capital. It must do this, too, in a reasonable time, regard being had to the very uncertain duration of human life, in the same manner as to the more certain duration of the machine” (Smith 1776, p. 93)

<sup>2</sup>“... to include all those energies, faculties, and habits which directly contribute to making people industrially efficient” (Marshall, 1890)

<sup>3</sup>The augmented Solow Model includes human capital as a factor in the production process other than the physical capital. See Mankiw, Romer & Weil (1992)

happening all around. But to use these technologies the amount of skill and knowledge required can be obtained only if the labor is aware and educated about these techniques. This education also improves the labor quality and makes the person more skilled. Therefore, it is beneficial to invest in human capital. Any investment has a return, be it monetary or non-monetary. Likewise, investment in human capital also has a return. For example, if a person is highly educated then he has better opportunities in terms of employment. He is capable of getting a job that pays him a lucrative amount which further gives him a monetary return. Again, if a person, belonging to a poor family could only invest up to attaining primary education, he too has a return attached to the knowledge he earns during that course of time which helps him to participate in some other work suitable for him. Therefore, investing in human capital is generally beneficial for the individuals of nation.

The following section of the paper has conducted an empirical study that deals with panel data analysis of different variables taken to measure human capital and economic growth. This study is done taking into account the thirty five states of India in order to check whether the presence of necessary variables impact the income of the Indian economy or not.

### **Empirical Analysis**

The empirical analysis will concentrate mainly on studies that use statistical data from across section of states of India and employ econometric estimation techniques. The empirical literature on the human capital-growth nexus is differentiated by the specification of the estimating equation, the way human capital is defined, the time frame considered, and the states included in the sample. The general result shows that human capital affects economic growth positively. Empirical evidence on this issue has been mixed. The study conducted by Ojha and Bardhan showed that human capital formation is beneficial to economic growth in india and also stressed upon the need of prioritizing secondary education (Ojha and Bardhan, 2006). According to them, physical capital and human capital both should increase simultaneously to maximize the benefits of economic growth (ibid). To provide a flavor for the various approaches discussed in this chapter we deal with the empirics to check whether the early contributions are valid or not. That is we check whether education as measured by literacy rates and average general education rates and taken as a proxy for human capital affects economic growth positively or not.

The early studies tend to emphasize the use of enrollment rates (flows) for primary or secondary education. More recent studies have used stock measures, that is, the literacy rates of a country's adult population. Studies that treat human capital as a direct input to the production function have shown that human capital accumulation exerts an insignificant or sometimes even negative effect on growth (Benhabib and Spiegel 1994; Pritchett 2001). The time dimension over which the growth rate is calculated has also come under scrutiny. Studies range from those utilizing pure cross-section data to those with panel data of varying frequencies. There have been when the temporal dimension of human capital variables is incorporated into growth regressions; outcomes of either statistical insignificance or negative sign have surfaced. In sum, in his survey of the growth literature, Temple (1999) contrasts the success of micro-level studies that have established a positive effect of schooling on wages with the failures of studies at the macro level to do so.

The present study has been conducted over thirty five states of India. Each state has been divided into their rural and urban sectors. The calculations are based on the unit level household data from the NSSO Round (38-61). Per Capita Net State Domestic Product (PCNSDP) is taken as the proxy for measuring economic growth, Average General Educational Level is taken to be the proxy for measuring human capital. We have also included variables like Primary Enrollment Ratio, Per Capita Educational Expenditure and Literacy Rate to check for a combined effect of education on economic growth. We have found out the required estimates through linear regression process across the state in each year. The next section covers a panel data analysis of these thirty five states. The estimates have been studied accordingly to validate our hypothesis.

### Panel Data Analysis

The Augmented Dickey Fuller (ADF) test was carried out first to check the stationarity of the model. The general forms of the ADF can be written as:

$$\Delta Y_{it} = \alpha + \beta \Delta Y_{it-1} + \gamma_1 Y_{it-1} + \dots \quad (1)$$

$$\Delta Y_{it} = \alpha + \beta \Delta Y_{it-1} + \gamma_1 Y_{it-1} + \gamma_2 Y_{it-2} + \dots \quad (2)$$

$$\Delta Y_{it} = \alpha + \beta \Delta Y_{it-1} + \gamma_1 Y_{it-1} + \gamma_2 Y_{it-2} + \dots + \gamma_k Y_{it-k} \quad (3)$$

The hypothesis formed is:

ρ: = 0 Panel data is non-stationary; there is problem of unit root  
\* < 0 Panel data is stationary

Applying pooled regression to obtain Inverse Chi Square values. The p values which shows the probability of occurrence of the event shows how frequent we will get value that helps to determine the significance. PCNSDP came out to be stationary at zero lag.

After this, a simple linear regression on the following set of models for the cross-sectional data for both rural and urban sectors:

- I.  $PCNSDP_t = f(\text{Rural Literacy Rate}_t)$
- II.  $PCNSDP_t = f(\text{Rural Literacy Rate}_t, \text{Rural Average General education}_t)$  III.  $PCNSDP_t = f(\text{Literacy Rate}, \text{PCEE}, \text{Primary Enrollment}, \text{Average General Education})$

Another set of regression was carried out on the following models for the same data at time t

- I.  $Gr\ PCNSDP = f(\text{Literacy Rate})$
- II.  $Gr\ PCNSDP = f(\text{Average General Education})$  III.  $Gr\ PCNSDP = f(\text{Literacy Rate}, \text{Primary Enrollment Rate}, \text{PCEE}, \text{Average General Education})$

## Results

The regression was carried out on the above mentioned sets and the estimates were obtained (see tables, appendix). Results show that the models are overall significant. PCNSDP tends to have a positive relationship with average general education. In most of the cases the coefficients of literacy rate alone came out to be negative, whereas, when combined with average general educational level, the coefficients came out to be mostly positive. The coefficients of average general education were significant at 5% level of significance. We include other variables like primary enrollment ratio and per-capita educational expenditure. Coefficients of PCEE mostly came out to be significant at 5% level of significance, whereas primary enrollment rate mostly showed insignificant and negative results. The results were same when the growth rate of PCNSDP was estimated.

## **Conclusion**

Human capital is undoubtedly an important determinant of economic growth. Theoretical literatures have shown how investment in human capital gives us higher returns and enhances growth. Moreover, from our empirical analysis too, we have seen that investment in human capital acts as a positive catalyst to economic growth. More investment in education reaps of the fruit of economic growth. Not only that, higher education has higher returns if job creation and better employment opportunities are taken care of. In order to make sure that maximum numbers of people get a better education and better training, policies should be implemented to promote education and make it available to a larger section of the society. Apart from general education, technical education should also be emphasized upon. Workers should be given proper training in order to polish their skill and make them suitable for the existing labour market. Literacy status of a person, reflecting his ability to only read and write should not be the sole objective for policymakers. Policies should henceforth focus on increasing per capita expenditure on education and enhance primary, secondary and higher education in order to contribute largely to the national income and benefit the labour market.

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## Appendix

**Table 1: Linear regression coefficients of PCNSDP on other variables for the rural sector (1987-1990)**

Dependent Variable	Model	Constant	Rural Literacy Rate at time t	PCEE at time t	Primary Enrollment at time t	Rural Average General Education at time t	R <sup>2</sup>	F Value
PCNSDP at time t	1	3478.56	46.09				-0.006	0.85
	2	2768.88	-2.79			2585.64*	0.172	3.50
	3	6171.61	-7.18	11.17*	-45.97	1963.39*	0.405	5.08

**Source: Computed by the author from the NSSO unit level household data (43<sup>rd</sup> Round)**

**Table 2: Linear regression coefficients of PCNSDP on other variables for the urban sector (1987-1990)**

Dependent Variable	Model	Constant	Urban Literacy Rate at time t	PCEE at time t	Primary Enrollment at time t	Urban Average Educational Attainment at time t	R <sup>2</sup>	F Value
PCNSDP at time t	1	3978.56	46.09				-0.006	0.85
	2	282.12	1.92*			2079.25*	0.061	1.79
	3	3588.25	-23.18	12.45*	-35.83	1713.10*	0.369	4.50

Source: Computed by the author from NSSO unit level household data (<sup>43rd</sup> Round)

**Table 3: Linear regression coefficients of the growth rate of PCNSDP Gr\_PCNSDP on other variables for time t (1987-1990)**

Dependent Variable	Model	Constant	Literacy Rate at time t	PCEE at time t	Primary Enrollment at time t	Average General education at time t	R <sup>2</sup>	F Value
Gr_PCNSDP at time t	1	3.89	-0.04				0.029	1.70
	2	4.68				-0.85	0.049	2.19
	3	4.72	-0.07	0.08*	-0.03	-0.81	-0.097	0.49

**Source: Computed by the author from NSSO unit level household data (43<sup>rd</sup> Round)**

**Table 4: Linear regression coefficients of PCNSDP on other variables for the rural sector for time t (1994-1999)**

Dependent Variable	Model	Constant	Rural Literacy Rate at time t	PCEE at time t	Primary Enrollment at time t	Rural Average General Education at time t	R <sup>2</sup>	F Value
PCNSDP at time t	1	2283.63	105.76				0.038	2.00
	2	7250.01	107.78 *			-3287.71	-0.003	0.97
	3	-34766.58	44.73 *	14.14 *	-119.89	34085.07 *	0.482	6.81

**Source: Computed by the author from NSSO unit level household data (50<sup>th</sup> Round)**

**Table 5: Linear regression coefficients of PCNSDP on other variables for the urban sector (1994-1999)**

Dependent Variable	Model	Constant	Urban Literacy Rate at time t	PCEE at time t	Primary Enrollment at time t	Urban Average General Education at time t	R <sup>2</sup>	F Value
PCNSDP	1	2283.63	105.76				0.038	1.48
	2	-12023.83	65.46			2973.315*	0.117	0.01
	3	145.68	76.06*	8.94*	-118.95	2259.54	0.459	2.00

**Source: Computed by the author from NSSO unit level household data (50<sup>th</sup> Round)**

**Table 6: Linear regression coefficients of the growth rate of PCNSDP (Gr\_PCNSDP) on other variables (1994-1999)**

Dependent Variable	Model	Constant	Literacy Rate at time t	PCEE at time t	Primary Enrollment at time t	Average General Education at time t	R <sup>2</sup>	F Value
PCNSDP at time t	1	-0.42	0.08*				0.037	1.94
	2	-5.52				1.29*	0.002	1.01
	3	-4.62	0.07*	-0.01*	0.04	0.09*	0.071	0.68

**Source: Computed by the author from NSSO unit level household data**

**Table 7: Linear regression coefficients of PCNSDP on other variables for the rural sector (1999-2004)**

Dependent Variable	Model	Constant	Rural Literacy Rate at time t	PCEE at time t	Primary Enrollment Rate at time t	Rural Average General Education at time t	R <sup>2</sup>	F Value
PCNSDP at time t	1	-7444.42	275.28				0.128	1.23
	2	76165.94	248.78*			-12454.92*	0.373	2.77
	3	21419.98	118.56*	8.70*	-144.88	-1698.77*	0.476	4.58

**Source: Computed by the author from NSSO unit level household data (55<sup>th</sup> Round)**

**Table 8: Linear regression coefficients of PCNSDP on other variables for the urban sector (1999-2004)**

Dependent Variable	Model	Constant	Urban Literacy Rate at time t	PCEE at time t	Primary Enrollment Rate at time t	Urban Average General Education at time t	R <sup>2</sup>	F Value
PCNSDP at time t	1	-7444.31	275.29				0.064	2.72
	2	13825.80	114.59			-20442.28	0.413	9.47
	3	90841.81	76.69*	5.84*	-91.59	-12223.61*	0.470	6.32

**Source: Computed by the author from NSSO unit level household data (55<sup>th</sup> Round)**



**Table 9: Linear regression coefficients of the growth rate of PCNSDP (Gr\_PCNSDP) on other variables (1999-2004)**

Dependent Variable	Model	Constant	Literacy Rate at time t	PCEE at time t	Primary Enrollment at time t	Average General Education at time t	R <sup>2</sup>	F Value
PCNSDP at time t	1	-4.82	0.17				0.388	6.87
	2	14.37				-0.80	0.412	5.38
	3	4.56	0.11*	-0.01	0.03*	-0.72*	-0.042	0.01

**Source: Computed by the author from NSSO unit level household data (55<sup>th</sup> Round)**

**Table 10: Linear regression coefficients of income (PCNSDP) on other variables for the rural sector (2004-2009)**

Dependent Variable	Model	Constant	Rural Literacy Rate at time t	PCEE at time t	Primary Enrollment at time t	Rural Average General Education at time t	R <sup>2</sup>	F Value
PCNSDP at time t	1	2122.96	158.02				-0.09	0.55
	2	671.49	157.07			346.48*	-0.056	0.36
	3	29245.41	-227.96	10.88*	-118.354	262.93*	0.416	5.28

**Source: Computed by the author from NSSO unit level household data (61<sup>st</sup> Round)**

**Table 11: Linear regression coefficients of PCNSDP on other variables for the urban sector (2004-2009)**

Dependent Variable	Model	Constant	Urban Literacy Rate at time t	PCEE at time t	Primary Enrollment Rate at time t	Urban Average General Education at time t	R <sup>2</sup>	F Value
PCNSDP at time t	1	9438.62	109.81				-0.029	0.46
	2	1875.94	687.27			9438.27*	0.077	0.32
	3	32066.32	-319.18	12.38	-142.14	1021.87*	0.424	4.50

**Source: Computed by the author from NSSO unit level household data (61<sup>st</sup> Round)**

**Table 12: Linear regression coefficients of growth rate of PCNSDP (Gr\_PCNSDP) on other variables (2004-2009)**

Dependent Variable	Model	Constant	Literacy Rate at time t	PCEE at time t	Primary Enrollment Rate at time t	Average General Education at time t	R <sup>2</sup>	F Value
Gr PCNSDP	1	-0.46	0.55*				0.011	1.27
	2	2.37				0.15*	0.067	2.75
	3	-4.32	0.06*	0.02*	0.02*	0.17*	0.056	1.36

**Source: Computed by the author from NSSO unit level household data (61<sup>st</sup> Round)**

