Empirical Analysis of the effect of Human Capital generation on Economic Growth

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Abstract. Last decade of 20th 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 other general factors that affect the rate of growth. Initially, enhancement in general education was encouraged to promote human capital, but presently, advancement in technological progress for skill development has gained special attention for its contribution to the formation of human capital. 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. Human capital enters into the production process through the participation of the labourers. The already existing labour productivity gets improved when subjected to skill improvement through technological knowledge building and on-the-job training. This further leads to a positive impact on the production of goods and services paving way for economic growth. But distribution of human capital has seen its shortcomings as well that has given rise to some of the major issues and challenges for policymakers. The firsts section of the paper observes the relationship that prevails between human capital and economic growth in the Indian economy based on panel data econometrics. The second section focusses mainly on the issues and challenges faced due to unequal distribution of human capital which gives rise to some major challenges like migration and brain drain which again negatively affects the growth of the nation.

Keywords: Human Capital; Economic Growth; Panel Data Econometrics; Migration; Brain Drain

JEL Classification: C12, C13, C23

1 Introduction

Last decade of 20th 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)[1] and Alfred Marshall (1890)[2] 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 17th 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 latters' work used augmented Solow[3] model 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 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.

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[1] "...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)

[2] "... to include all those energies, faculties, and habits which directly contribute to making people industrially efficient" (Marshall, 1890)

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

The following study conducted emphasizes on both theoretical and empirical literatures and evidences. The theoretical analysis talks about the already existing models of human capital, inequality and growth, focusing on the success and limitations of those models. Empirical study deals with cross section and panel data analysis of different variables taken. This study is done on Indian scenario taking into account the per-capita net state domestic product, literacy status, and average general education level of the Indian households.

2 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 Bradhan 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.

3 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:

$$\Delta X = \delta X_{t-1,i} + \Delta X_{t-1,i} + e_{1t,i} \ (1)$$

$$\Delta X_t = \alpha + \delta X_{t-1,i} + \sum \emptyset \, \Delta X_{t-1,i} + e_{2t,i}(2)$$

$$\Delta X_t = \alpha + \beta_{t,i} + \delta X_{t-1,i} + \sum \emptyset \, \Delta X_{t-1,i} + e_{2t,i}(3)$$

The hypothesis formed is:

H$_0$: $\delta=0$ Panel data is non-stationary; there is problem of unit root

H$_A$: $\delta<0$ 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. $PCNSDP_t = f \ (\ Rural \ Literacy \ Rate_t \ )$

II. $PCNSDP_t = f \ (\ Rural \ Literacy \ Rate_t, \ Rural \ Average \ General \ education_t \ )$

III. $PCNSDP_t = f \ (\ Literacy \ Rate_t, \ PCEE_t \ , Primary \ Enrollment_t \ , \ Average \ General \ Education_t \ )$

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

I. $Gr \ PCNSDP = f \ (\ Literacy \ Rate_t \ )$

II. $Gr \ PCNSDP = f \ (\ Average \ General \ Education)$

III. $Gr \ PCNSDP = f \ (\ Literacy \ Rate \ , Primary \ Enrollment \ Rate, \ PCEE, \ Average \ General \ Education)$

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 and PCNSDP tends to have a positive relationship with average general education. The t values show insignificance at 5% level. Therefore, we include other variables like literacy rate, primary enrollment ratio, per-capita educational expenditure Literacy rate alone impacts income positively but when other variables are included, the relationship mostly becomes negative. The results also reveal the fact that only investing in primary educational attainment will not help the economy to grow. Every time the average general educational attainment has increased (increase in primary, secondary, tertiary and above, technical education as a whole), the impact on income and the growth rate of income has been significantly positive. The growth rate of income, however, shows a negative

relation with the increase in average educational attainment. This can be due to the unequal distribution of human capital that often leads to an income inequality. As inequality grows, economic growth does get affected. Increase in average educational attainment in rural sector will lead the citizens migrate to the urban sector in search of job opportunities. This hampers production and income generated in the rural sector which in turn decreases the growth rate in the rural sector.

Since most of the urban sector is overpopulated due to mass internal migration from rural to urban areas, most of the income generated is circulated in the urban areas leading to growth in the urban sector. Policies still fail to uplift the rural sector. Since an economy like India is heavily dependent on rural sector, it's growth vastly depends on the growth of its rural regions. The overall growth rate will increase only when the distribution of human capital and income is judicious (if not equal) in both rural and urban sector.

For details, refer to the tables below.

Dependent Variable	Model	Constant	Rural Literacy Rate at time t	PCEE at time t	Primary Enrolment at time t	Rural Average General Education at time t	R^2	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

*5% level of significance, **10% level of significance

Table 1: Linear regression coefficients of PCNSDP on other variables for the rural sector (1987-1990). Source: Computed by the author from the NSSO unit level household data (43rd Round)

Dependent Variable	Model	Constant	Urban Literacy Rate at time t	PCEE at time t	Primary Enrolment at time t	Urban Average Educational Attainment at time t	R^2	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

*5% level of significance, **10% level of significance

Table 2: Linear regression coefficients of PCNSDP on other variables for the urban sector (1987-1990). Source: Computed by the author from NSSO unit level household data (43rd Round)

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^2	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

*5% level of significance, **10% level of significance

Table 3: Linear regression coefficients of the growth rate of PCNSDP Gr_PCNSDP on other variable for time t(1987-1990). Source: Computed by the author from NSSO unit level household data (43rd Round)

Depended Variable	Model	Constant	Urban Literacy Rate at time t	PCEE at time t	Primary Enrolment at time t	Urban Average General Education at time t	R^2	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

*5% level of significance, **10% level of significance

Table 4: Linear regression coefficients of PCNSDP on other variables for the rural sector for time t (1994-1999). Source: Computed by the author from NSSO unit level household data (50th Round)

Dependent Variable	Model	Constant	Rural Literacy Rate at time t	PCEE at time t	Primary Enrolment at time t	Rural Average General Education at time t	R^2	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

*5% level of significance, **10% level of significance

Table 5: Linear regression coefficients of PCNSDP on other variables for the urban sector (1994-1999). Source: Computed by the author from NSSO unit level household data (50th Round)

Depended Variable	Model	Constant	Urban Literacy Rate at time t	PCEE at time t	Primary Enrolment at time t	Urban Average General Education at time t	R^2	F Value
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	3	145.68	76.06*	8.94*	-118.95	2259.54*,**	0.459	2.00

*5% level of significance, **10% level of significance

Table 6: Linear regression coefficients of the growth rate of PCNSDP (Gr_PCNSDP) on other variables (1994-1999). Source: Computed by the author from NSSO unit level household data

Dependent Variable	Model	Constant	Literacy Rate at time t	PCEE at time t	Primary Enrolment at time t	Average General Education at time t	R^2	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

*5% level of significance, **10% level of significance

Table 8: Linear regression coefficients of PCNSDP on other variables for the urban sector (1999-2004). Source: Computed by the author from NSSO unit level household data (55th Round)

Dependent Variable	Model	Constant	Urban Literacy Rate at time t	PCEE at time t	Primary Enrolment Rate at time t	Urban Average General Education at time t	R^2	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

*5% level of significance, **10% level of significance

Table 9: Linear regression coefficients of the growth rate of PCNSDP (Gr_PCNSDP) on other variables (1999-2004). Source: Computed by the author from NSSO unit level household data (55th Round)

Dependent Variable	Model	Constant	Literacy Rate at time t	PCEE at time t	Primary Enrolment at time t	Average General Education at time t	R^2	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*

*5% level of significance, **10% level of significance

Table 10: Linear regression coefficients of income (PCNSDP) on other variables for the rural sector (2004-2009). Source: Computed by the author from NSSO unit level household data (61st Round)

Dependent Variable	Model	Constant	Rural Literacy Rate at time t	PCEE at time t	Primary Enrolment at time t	Rural Average General Education at time t	R^2	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

*5% level of significance, **10% level of significance

Table 11: Linear regression coefficients of PCNSDP on other variables for the urban sector (2004-2009). Source: Computed by the author from NSSO unit level household data (61st Round)

Dependent Variable	Model	Constant	Urban Literacy Rate at time t	PCEE at time t	Primary Enrolment Rate at time t	Urban Average General Education at time t	R^2	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

*5% level of significance, **10% level of significance

Table 12: Linear regression coefficients of growth rate of PCNSDP (Gr_PCNSDP) on other variables (2004-2009). Source: Computed by the author from NSSO unit level household data (61st Round)

Dependent Variable	Model	Constant	Literacy Rate at time t	PCEE at time t	Primary Enrolment Rate at time t	Average General Education at time t	R^2	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

*5% level of significance, **10% level of significance

Table 13: Linear regression coefficients of income (PCNSDP) on other variables for the rural sector (2011-2012). Source: Computed by the author from NSSO unit level household data (61st Round)

Dependent Variable	Model	Constant	Rural Literacy Rate at time t	PCEE at time t	Primary Enrolment Rate at time t	Rural Average General Education at time t	R^2	F Value
PCNSDP	1	2155.96	167.02				-0.06	0.66
	2	571.49	159.01			432.48*	-0.032	0.65
	3	27225.41	-117.54	15.88*	-122.774	261.33*	0.511	6.29

*5% level of significance, **10% level of significance

Table 14: Linear Regression Coefficients of Income (PCNSDP) on other variables for urban sector (2011-2012). Source: Computed by the author from NSSO unit level household data (68th Round)

Dependent Variable	Model	Constant	Urban Literacy Rate at time t	PCEE at time t	Primary Enrolment Rate at time t	Urban Average General Education at time t	R^2	F Value
PCNSDP	1	-6334.36	240.29				0.054	2.78
	2	12845.80	133.59			-18442.28	0.363	7.29
	3	91841.91	65.62*	4.84*	-91.59	-10223.61*	0.421	5.99

*5% level of significance, **10% level of significance

Table 15: Linear regression coefficients of growth rate of PCNSDP (Gr_PCNSDP) on other variables (2011-2012). Source: Computed by the author from NSSO unit level household data (68th Round)

Dependent Variable	Model	Constant	Literacy Rate at time t	PCEE at time t	Primary Enrolment Rate at time t	Average General Education at time t	R^2	F Value
Gr PCNSDP	1	-0.52	0.56*				0.010	1.34
	2	2.95				0.19*	0.022	2.95
	3	-3.22	0.03*	0.03*	0.08*	0.11*	0.025	1.38

*5% level of significance, **10% level of significance

Policy Challenges: Internal Migration and Brain Drain

Contribution of Human Capital is significant from our empirical analysis. In most of the cases, human capital generation and economic growth displays a positive relation between themselves. Despite this fact, human capital has forced policymakers to rethink before framing developmental policies. Two of the major issues that India has been facing are internal migration and brain drain. According to Borjas, internal migration occurs when workers move across the states or provinces within the country because of social and economic conditions as wage differential (Borjas, 2000). Brain Drain on the other hand focusses on the migration of individuals who are endowed with a high level of human capital in search of higher returns to their education (Beine et al).

Considering the case of India, it has been witnessing a human capital flight across states since a long time. Some economists say that lack of good educational policies is a primary reason behind flight of skilled workers from one state to the other. Institutes that offer better and higher education are mostly found in areas that have high human capital and a better performing labour market. Due to this, individuals with higher education tend to move to these areas (Chandrashekhar and Sharma). India has displayed an extremely poor picture in terms of achieving primary education. The latest census data for the year 2011 show that states like Kerala, Tripura, Goa, West Bengal, Delhi, Maharashtra, etc. had high literacy rates (figure 1). In their paper, Chandrasekhar and Sharma have also shown that Delhi, Maharashtra, Karnataka etc. have had the highest number of migrants coming in in search of better education (ibid).

Other than international movement, current times have witnessed a fair amount of brain drain happening internally. This can happen within the country, where due to lack of job opportunities in one state can lead skilled and highly educated individuals to move to some other state that can provide them with better opportunities in terms of job and income. The last migration data that was released by the Census of India in 2001 showed that Maharashtra, Delhi, Karnataka, etc. are the major destination countries where individuals move in in search of better employment opportunities. 42.2% of the population migrated into Maharashtra in search of work. Delhi witnessed 37.6% in-migrants in search of work. Considering figure 2, we can see that states like Kerala, West Bengal, Lakshadweep, Tripura, etc., have higher unemployment rates compared to states like Maharashtra, Karnataka, Delhi, etc., where unemployment rate is comparatively lower. Therefore, it is obvious that skilled workers will move to a place having lower unemployment rate and higher returns to their education and skill.
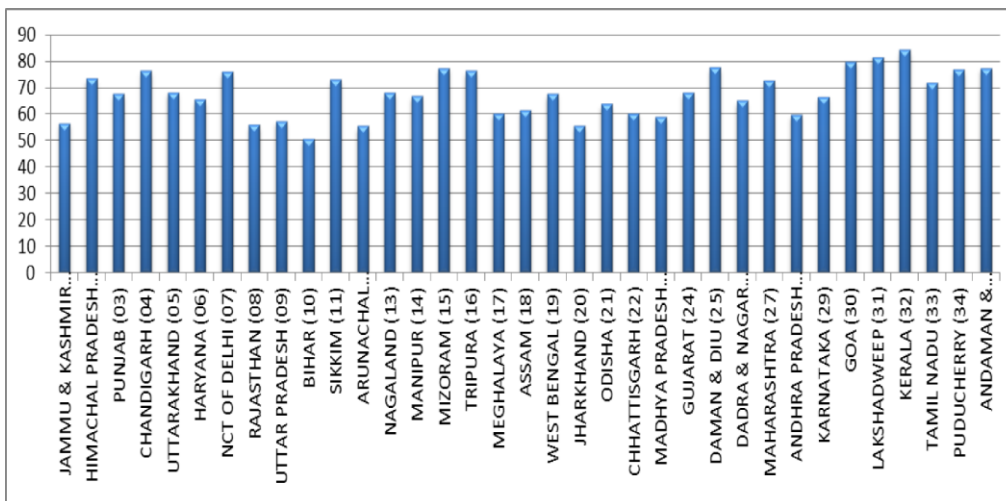

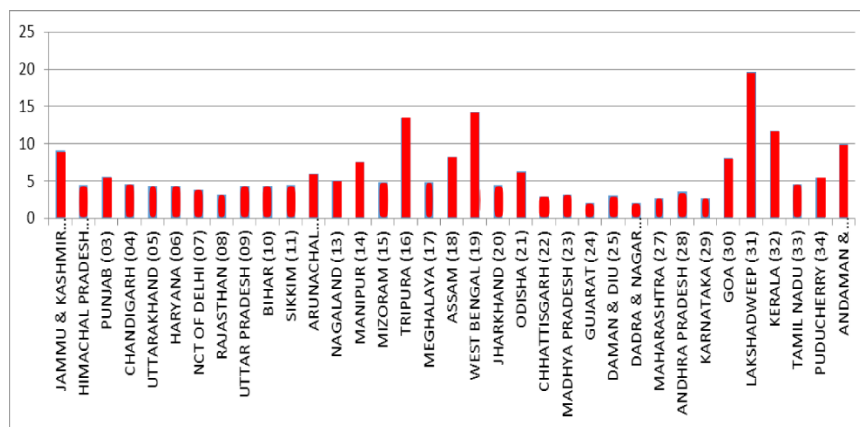**Figure 1:** Literacy Rate across the Indian States. Source: Census of India (2011)

Figure 2: Unemployment Rate across Indian States. Source: Census of India (2011)

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 number of people gets a better education and better training, policies should be implemented to promote education and make it available to a large 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. If we view it from overall country perspective, brain drain has the capability to influence the growth path and economic development. Given the view that migration can affect both source and destination places positively, "brain gain" is what policymakers are emphasizing upon. Individuals, who migrate internationally for better income, are being able to earn more than what they would have in India. A large number of scientists and researchers are coming back to the country to work for the development of their nation. If the similar scenario works in case of internal migration, where individuals come back to the state of their origin aiming to work for its progress, brain drain can definitely lead to brain gain. This can only happen if these individuals are provided with better opportunities, better income and better living facilities. Otherwise, human capital flight will fail to achieve sustainable development and inclusive growth where the benefits will not reach out to every section of the society.

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