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Kumar, Chetan and K.B., Rangappa and S., Suchitra

Department of Studies in Economics, Davangere University,
Department of Studies in Economics, Davangere University,
Department of Studies in Economics, Davangere University

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Empirical analysis of Socio- Economic Factors affecting Deprivation of Years of Schooling among households across Indian Districts

G.K. Chetan Kumar¹, Dr. K.B. Rangappa², Dr. Suchitra S³

¹Research Scholar, Department of Studies in Economics, Davangere University

²Professor, Department of Studies in Economics, Davangere University

³ Professor & Chairman, Department of Studies in Economics, Davangere University

Abstract

Education is seen as the best mechanism to achieve upward economic and social mobility by vulnerable masses. Even by the government, education is regarded as a proactive initiative through which it can hope to address the problem of regional imbalance in a sustainable manner. Many prior studies have identified various factors which have played significant role in depriving education for masses. However, studies which have identified magnitude of factors impact in depriving of education are scarce. The present study identifies the causal factors which have deprived years of schooling among households across Indian districts along with the magnitude of their impact. Present study affirms that although the causal factors of deprivation in years of schooling are same across all Indian districts, the magnitude of causal factors' impact significantly differs across better off vis-à-vis worse off districts.

Keywords: Socio-Economic Factors, Horizontal spread, Literacy Rate, Indian Districts, Binomial Logistic Regression, Predictive Probability

INTRODUCTION:

India is a vast and diverse nation with its share of unique challenges. Although according to Deutsch Bank Report India is on its way of becoming third largest economy in near future, regional inequalities and their subsequent negative externalities form a hard reality of Indian landscape which cannot be ignored. The need for planned intervention to address regional disparity and to bring about balanced regional development was recognized as early as in Second Five Year Plan (1956-61) itself, wherein it was stated, "In any comprehensive plan of development, it is axiomatic that the special needs of the less developed areas should receive due attention. The pattern of development must be so devised as to lead to balanced regional development."

Despite various policy interventions since the dawn of independence, regional and economic inequalities seem to relentlessly persist in India. Various studies (Williamson (1964), Sastry and Dhar (1969), Gupta (1973), Rao (1973), Dholakia (1994), Ahluwalia (2000), Kurian (2000), Nagraj et al. (2000), Nayyar (2008), Kalra & Sodsriwiboon (2010)) have been undertaken which have tried to analyse the severity and magnitude of regional imbalance in India and have come up with inferences which doesn't seem to be unanimous.

As early as 1964, Williamson investigated persistence of regional inequalities during 1950s and concluded that regional inequalities were on the rise. However, some studies haven't supported this inference. For instance, a study on regional imbalance undertaken by Sastry and Dhar (1969) which dealt with inter-state disparity of industrial output, found out that there was a tendency of narrowing down of regional imbalances. In yet another investigation undertaken by Rao (1973), in which he had used factor analysis and grouped states into categories based on set of indicators over a period of time found out that there was no tendency among the states to either converge or diverge.

On the other hand, some studies have found that regional imbalances trend in India hasn't followed a uniform pattern, it tended to diverge during some period and converge during other period. For instance, Nair (1983) based on compilation of State Gross Domestic Product (SGDP) Data inferred that inter-state disparities in Net State Domestic Product had displayed signs of convergence from 1950-51 to

1964-65. However, regional disparities increased from 1964-65 to 1976-77. Another empirical study undertaken by Dholakia (1994) has inferred a significant tendency of convergence of growth rates of State Domestic Products among 20 states during the period from 1960-1990.

Early years of 1990s witnessed Indian economy undergoing a structural change with advent of economic reforms. Although, Indian economy witnessed a spectacular growth it was largely driven by service sector. In fact, many economists have referred the period from 1990 to early decades of twenty first century as a period of jobless growth. According to a study undertaken by Shaban (2002) there was a clear indication of divergence in NSD. Another comprehensive study undertaken by Nair (2004), found that during post reform period, particularly in the context of levels of living per capita NSDP, there were definite evidence of inter-state divergence. According to recently published “Inequality Kills” report of Oxfam India, it was found that there is glaring inequality present in India. According to the report richest 10 percent held 77 percent of nation’s wealth, whereas bottom half held 13 percent. In addressing this glaring inequality and to bring in balanced regional development Government has an important role to play. In fact, by as early as 1973, Gupta empirically ascertained that public investment had played a significant role in reducing the regional inequalities from 1950 -1966. Several studies have asserted that education can play a very important role in bringing about sustainable economic growth and development in an equitable manner. Our study tries to analyse the various factors accentuating the deprivation of years of schooling across households among all the Indian districts. By doing so we want to identify the factors by prioritizing which government can reduce horizontal deprivation of years of schooling among households across Indian districts.

LITERATURE REVIEW:

Many prior studies (Sutradhar et al. 2023; Gorain et al. 2023; Papadaki et al 2023; Asif Va et al. 2022) have ascertained the role and significance of education in addressing regional imbalances and promoting equitable and sustainable economic growth. According to existing literature, we have identified nutrition, housing, maternal health, school attendance, assets, and financial inclusion to be affecting education. The relationship between the said variables are discussed in the subsequent subsections:

Nutrition and Education: Socio economic and demographic factors are regularly cited as important factors in determining academic performance. Many studies have ascertained that malnourished children have lower attendance, lower academic performance, lower attention span and are more vulnerable to health-related issues than their well-nourished counterparts. In this backdrop it is argued that policy makers must give due emphasis on nutrition in designing policy interventions to improve participation and academic performance of school age children.

Earlier studies were under the impression that if children survived till four or five years, then their nutritional status would gradually improve with their age. However, recent studies have contradicted this misconception. It is found that children at the age of four or five had a better nourishment than their school going counterparts who were a few years elder. Studies in Philippines (Mendez & Adair 1999), Guatemala (Pollitt et al. 1993), Jamaica (Chandler et al.1995), Kenya (Bwibo & Neumann 1999) have shown strong interlinkages between development of children and nutrition. Even if malnourished children enter school, they are unable to cope up with benefit of school education on account of deteriorating physical and mental health. One of the most common and widespread problem faced by children is iron deficiency. Mild to moderate anemia is associated with lowering work productivity. Children afflicted with severe anemia are susceptible to childhood mortality. Case of malnutrition on account of iron deficiency is more so prevalent in context of India. A recent study which based its analysis on sample of 112714 children from 2015-16 Indian National Fertility and Health Survey found that 52.9 percent of children belonging to well to do families and 63.2 percent of children belonging to poor households suffered from anemia.

Housing and Education: Recent studies have tried to trace out the relationship between access to good housing and education. The inferences from the study vary from one extreme to another.

Teodor et al (2010) in their study have pointed out that access to housing and education cannot be just seen in isolation. As in between them, there lies another prominent variable, which is 'poverty'. In this regard the study ascertained that housing is just an indicator of welfare. Good housing condition need not necessarily be associated with better educational credentials as credentials are far more influenced by socio economic conditions and linguistic knowledge than mere housing conditions. Housing conditions is just an indicator of welfare and economic success rather than educational achievement.

On the contrary, there is a growing body of research which suggests that better housing facility may increase the likelihood of children's success by providing safety and nurturing better living environment. Studies indicate that frequent residential moves has seen to adversely affect children's attention span and learning behavior. Veronica Gaitán (2018) in her study has found that, students of households who have relocated three or more times before the student has attained six years often demonstrated attention and learning behavior related problems. These negative repercussions have been noticed to dramatically increase among students in later grades.

Affordable housing can reduce the likelihood of foreclosure, eviction or any other financial challenges faced by the households. Gaitán's (2018) study further pointed out that households affected by foreclosure are more likely to send their children to worse performing schools than the households which were not affected by foreclosure. Furthermore, academic performance of students seemed to deteriorate when their families were subject to foreclosure.

In addition to these recent studies have shown that students residing in substandard housing are more susceptible to health issues. Poor housing conditions- notably persistence presence of cockroaches, mold and pesticides were found to increase the vulnerability of children to asthma. This could lead to absenteeism. This would consequently increase out of pocket expenditure of households which is likely to push family to poverty which would obstruct education of their children. Other related studies also assert that children facing the problem of homelessness are found to be more susceptible to educational barriers. This may include adverse impact of their cognitive development due to living in unhygienic and depressing environment, problems of obtaining personal records for enrollment in public schools and the like. In our study, to understand the impact of housing conditions on years of schooling, we considered to examine the effect of quality of housing along with assets on years of schooling.

Maternal Health and Education: Particularly with regards to students belonging to lower economic strata, their mother's health plays a very important role in determining their own wellbeing. A healthy mother can raise a healthy child. If mother herself is suffering from malnutrition, it is going to adversely impact the physical and mental development of child. This more so reflects in early years of children's life as most of their cognitive faculties develop in this stage.

School Attendance and Education: Segal (2008), in his study rightfully observes that, absenteeism disturbs teaching-learning dynamic and adversely affects the overall wellbeing of classes. Negative repercussions of student's absenteeism is not only felt in student's own life, but its adverse effect in real time is suffered by teachers as well as by other students who attend classes regularly (Lalek 1995; Rumberger, 1997). For instance, to do justice to their students who were absent, teachers need to re-teach them. If teachers re-teach them during class period, it shall take time away from regular students who would feel that re-teaching is a waste of time. On the other hand, if teachers were to re-teach the students in between their class time, that would over burden teachers by taking away their much-needed time for planning and providing individual assistance for other regular students (Weller,1996). Hence, students' absenteeism, if not properly addressed shall result in unnecessary wastage of time, human potential, and educational resources. Absenteeism among students makes them more susceptible of poor academic performance which may result in repetition of classes. Repetition of classes shall result in loss

of self esteem among students due to social stigma of being associated with failure. Ultimately if the student cannot cope with mental agony and social stigma of being a repeater, he or she may drop out of educational system (Lewin, 2007). This empirical research has tried to validate and ascertain the magnitude and impact of school attendance on years of schooling in Indian context.

Financial Inclusion and Education: Financial inclusion plays an important role in affecting quality and quantum of education among children. Yizengaw, (2008) points out that Government is not able to adequately provide infrastructural and financial support to higher educational institutions due to deteriorating economic conditions, other competing public service priorities, lack of international support and the like. This is not only true in context of Indian higher educational institutions but is also equally true in context of Indian Primary and secondary educational institutions. More often than not households which are financially literate are able to secure better education in terms of quantity and quality to their children as opposed to households which are not financially literate. Having financial stability is one of the prominent factors behind a household's investment in health and education.

In our study, we have tried to analyze as to how the deprivation of nutrition, housing, maternal health, school attendance, assets of family and financial inclusion are going to impact in deprivation of years of schooling among households across Indian districts.

OBJECTIVES:

- To identify the socio- economic factors affecting the deprivation of years of schooling among households across Indian Districts.
- To estimate the magnitude of socio-economic factors' individual influence in affecting the deprivation of years of schooling among households across better off districts vis-à-vis worse off districts.

HYPOTHESES:

- Socio Economic Factors like Housing, Assets, Sanitation, Banking, Maternal health, and the like affects deprivation of years of schooling among households across Indian districts.
- The magnitude of influence of each socio-economic factor in affecting deprivation of years of schooling varies across better off vis-a vis worse of districts.

METHODOLOGY:

The study is based on analysis of secondary data which has been sourced from National Multi-Dimensional Poverty Index Baseline Report published in 2021. The definition of the variables we have used are based on the official definition given by NITI Aayog. Based on the data available in the report, we have identified relevant variables affecting the horizontal spread of literacy rate across Indian Districts. To identify the socio-economic factors affecting the Horizontal Spread of Literacy Rate, Multinomial Logistic Regression has been used.

Multinomial Logistic Regression Model: Multinomial Logistic Regression Model is an extension of Binary Logistic Regression Model. Hence, before dwelling upon Multinomial Logistic Regression Model, it becomes pertinent to have a brief overview of Binary Logistic Regression Model.

Binary Logistic Regression Models are useful in estimating the probability of one of the two categorical outcomes of a dichotomous variable. The favorable outcome is usually designated as 'success' and the other outcome is deemed as reference category. For a dichotomous variable 'Y', with multiple explanatory variables ($x_1, x_2, x_3 \dots x_k$), the framework of binary logistic regression can be depicted with the help of the following equation (Ari, Erkan.2016),:

$$\text{Logit [P(Y=1)]} = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 \dots + \beta_k x_k$$

Which can be represented by directly specifying $\pi(x)$ as:

$$\pi(x) = \frac{\exp(\alpha + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_k)}{1 + \exp(\alpha + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_k)}$$

In the above equation β_i refers to the effect of x_i on the log odds that $Y=1$, controlling other x_j (Ari, Erkan.,2016).

Multinomial logistic regression model with n independent observations with p explanatory variables and a dependent variable with k categorical outcomes can be derived from the framework of Binomial Logistic Regression Model. In Multinomial model, assuming π_j to be a multinomial probability of falling in j^{th} category, if we have to construct a model showing the relationship between n independent variables, $x_1, x_2, x_3 \dots x_n$, it can be represented with the help of the following equation, Erkan (2016):

$$\log(\pi_j(x_i)) = \frac{\exp(\alpha_{0i} + \beta_{1j}x_{1i} + \beta_{2j}x_{2i} + \beta_{3j}x_{3i} + \dots + \beta_{nj}x_{ni})}{1 + \sum_{j=1}^{k-1} \exp(\alpha_{0i} + \beta_{1j}x_{1i} + \beta_{2j}x_{2i} + \beta_{3j}x_{3i} + \dots + \beta_{nj}x_{ni})}$$

The parameters ($j=1,2,\dots (k-1)$) for the above equation are calculated with the help of multinomial logistic regression model.

Baseline Category Logit Model:

For estimating the parameters in Multinomial logistic regression model, from the given J categorical outcomes, one of them is identified as baseline category. In other words, if $\pi_j(x) = p(Y=j|x)$ for x independent variables with $\sum_j \pi_j(x) = 1$. For dependent variable Y with j multinomial categorical outcomes, $\{\pi_1(x), \pi_2(x) \dots \pi_j(x)\}$, multinomial logistic regression model compares each categorical outcome with baseline outcome. It can be represented with the help of the following equation, Erkan (2016):

$$\log \frac{\pi_j(x)}{\pi_1(x)} = \alpha_j + \beta'_j x,$$

In the above equation, $j=1, 2, \dots, (J-1)$ helps us to understand the effect of x on $(J-1)$ categorical outcomes. The above $(J-1)$ equations help us to calculate parameters for other categorical outcomes as $\log \frac{\pi_a(x)}{\pi_b(x)} = \log \frac{\pi_a(x)}{\pi_j(x)} - \log \frac{\pi_b(x)}{\pi_j(x)}$.

The logit transformation in multinomial logit regression model is obtained by taking the logarithms of the odds ratios after selecting the baseline category. For the three-category multinomial model, with 2 selected as the baseline category, the logarithms of odds ratios can be obtained could be written as under (Kienbaum and Klein, 2010).

$$\ln \left[\frac{p(y = 1|x_1)}{p(y = 0|x_1)} \right] = \beta_1 + \beta_{11}x_1$$

$$\ln \left[\frac{p(y = 1|x_2)}{p(y = 0|x_1)} \right] = \beta_2 + \beta_{21}x_1$$

In the above equations, the reference baseline category is taken as “ $y=1$ ” for analyzing the 2 outcomes. The generalized notation of the model can be written as (Liao,1994)

$$\ln \left[\frac{\pi_j}{\pi_1} \right] = \ln \left[\frac{P(y = j)}{P(y = 1)} \right] = \left(\sum_{k=1}^k \beta_{jk} x_k \right) j = 1, \dots \dots J - 1$$

The above multinomial logistic regression model can be generalized to binomial logistic regression model for $J=2$, Erkan (2016). The results of Multinomial Logistic Regression have been interpreted with the help of Relative Risk Ratio (RRR) estimated through STATA statistical package. In Relative Risk Ratio, a comparison is made between

2 groups with a given reference outcome in terms of likelihood. In this interpretation, we calculate the risk (probability) of a case falling into comparison group to the risk (probability) of the case falling into baseline group, based on estimate values of predictors, Osborne, (2015).

The regression model which has been considered for the purpose of study is depicted in equation (1):

$$Y_1 = \alpha_1 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 \dots \dots \dots (1)$$

Identification of Variables Through our analysis, we wanted to analyse as to how horizontal spread of rate of years of schooling was being affected by the socio-economic factors. In our analysis the dependent variable is percentage of years of schooling.

Dependent Variable (Y₁)

Definition of Deprivation in Years of Schooling: According to NITI Aayog Report, A household is said to be deprived in Years of schooling if not even one member of the household who is 10 years or older has completed even 6 years of schooling.

Based on recent National Family Health survey 2015-16, an estimation of percentage of families which were deprived in years of schooling was estimated by NITI Aayog across 633 districts of India. In our study we wanted to identify and analyse the magnitude of socio-economic factors which were influencing the deprivation of years of schooling in households across Indian districts.

We have used Percentage of Deprivation in Years of Schooling in Households across districts as our response variable. Based on percentage of deprivation, we have categorized the response variable into 3 categories, which is has been summarised in Table 1:

Table 1: Frequencies across tested categories of Dependent Variable

Extent of Deprivation in Years of Schooling across districts	Frequency	Percentage
Least Deprived (0-17)	449	70.93
Moderately Deprived (17-34)	157	24.80
Highly Deprived (34-50)	27	04.26

To ensure that we are not fitting wrong model, we estimated predicted probability of our dependent variable across tested categories with moderately deprived being reference category. Then we plotted the graph of our predicted probability. Our variable exhibited logistic function, hence fitting multinomial logistic regression function for our model was found to be justifiable. Furthermore, our model satisfied other residual diagnostic tests like Pseudo R square, Modified Hosmer-Lemeshow test and Proportion by chance criterion which are used to test stability of multinomial logistic regression models.

Independent Variables

The various academic and socio-economic factors which we have taken into consideration to identify the deprivation in years of schooling along with their definitions are as follows:

Deprivation Of Nutrition (X₁): A household is considered deprived in nutrition, if any child between the age of 0 to 59 months, or woman between the ages of 15 to 49 years, or man between the ages of 15 to 54 years -for whom nutritional information is available - is found to be undernourished.

Deprivation of Maternal Health (X₂): A household is considered to be deprived in maternal health, if any women of the household who had given birth in the 5 years preceding the survey has neither received any assistance from skilled medical professional nor has received at least 4 antenatal care visits for the most recent birth.

Deprivation of School Attendance (X₃): A household is considered to have deprivation of school attendance if any school aged child of the household is not attending school in an age by which he or she should have completed 8th standard.

Deprivation of Sanitation (X₄): When a household has no sanitation facility or shares improved sanitation facility with other households, then the household is said to be deprived of sanitation.

Deprivation of housing (X₅): When the house's roof, floor or wall in which the household is residing is made of either natural or rudimentary materials, then the household is defined to have inadequate housing.

Deprivation of Assets (X₆): When the household in question does not own more than one of any of these assets: Refrigerator, motorbike, Radio, Television, telephone, animal cart, bicycle or computer.

Deprivation of Bank Account (X₇): When none of the members of household have either post office account or bank account.

For all the above independent variables NITI Aayog has estimated percentage of households deprived across Indian districts.

To assess the magnitude of influence of each socio-economic factor in affecting horizontal spread of literacy rate across Indian districts, we have used predictive probability.

Two stage method has been used to estimate predicted probability of success.

Two stage method has been used to estimate predicted probability of success.

- Calculation of odds ratio: The following formula has been used to estimate odds ratio.

$$\ln(\hat{p}/1-\hat{p}) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 \dots \text{ estimated.}$$

- Calculation of estimated probability: Expected Probability of is calculated with the help of the following formula:

$$\hat{p} = \exp(\beta_0 + \beta_1 x_1 + \beta_2 x_2 \dots) / 1 + \exp(\beta_0 + \beta_1 x_1 + \beta_2 x_2 \dots) \text{ estimated.}$$

Reliability of the Model

The reliability of the model was ascertained with the help of modified Hosmer Lemeshow test along with pseudo r square.

Generalized Hosmer-Lemeshow Goodness of fit test for Multinomial Regression Model: Generalised Hosmer-Lemeshow Goodness of fit test can be used to estimate the goodness of fit test for multinomial logistic regression model. The test is based on sorting the observations to $1 - \hat{\pi}_{i0}$ which is the complement of estimated probability. Then 'g' groups are formed, containing n/g observations. Then for each categorical outcome, sums of estimated and observed frequencies are calculated for each categorical outcome,

$$O_{kj} = \sum_{1 \in \Omega_k} \hat{\pi}_{lj}$$

$$E_{kj} = \sum_{1 \in \Omega_k} \hat{\pi}_{ij}$$

In the above equations, $k=1, \dots, g$; $j=0, \dots, c-1$; and Ω_k represents indices of the n/g observations in group k. The goodness of fit for the model can be obtained by tabulating the values of O_{kj} and E_{kj} . From the observed and estimated frequencies of the table, multinomial goodness of fit test statistic is calculated, which is Pearson's chi-squared statistic. The formula for the same is depicted below:

$$\chi_{HL}^2 = \sum_{g=1}^G \frac{(O_g - E_g)^2}{E_g \left(1 - \frac{E_g}{n_g}\right)}$$

In the above equation, O_g represents observed events, E_g represents expected events and n_g represents number of observations for the gth risk decile group; G represents number of groups. Hosmer Lemeshow test statistic follows χ^2 distribution with G-2 degrees of freedom. If the p-value < 0.05 it indicates the model is poor fit. We estimated Hosmer Lemeshow test statistic for our model, the results of which are summarized in table 2:

Table 2. Generalized Hosmer Lemeshow Goodness of fit test

Observations	No. Outcome Values	Base outcome value	Number of groups	χ^2 Statistic	Degrees of Freedom	Prob > χ^2
633	03	01	10	8.198	16	0.943

The null hypothesis for Hosmer Lemeshow test states that, there is no difference between observed and expected proportions across all doses. From the above table, we can see that the value of Hosmer Lemeshow test statistic is statistically insignificant. Hence, we do not have enough evidence to reject null hypothesis, thus, our model appears to be stable.

McFadden’s Pseudo R Square: According to McFadden (1977, p.35), if the value of Mcfadden’s Pseudo R square lies between 0.2 to 0.4, it means that the model is a good fit. The McFadden’s Psuedo R square value for our model was 0.49 as calculated by STATA indicating that our model is a good fit.

Results and discussion:

Multinomial Logistic Regression was used to identify the variables affecting extent of deprivation of years of years in schooling across districts. Among the categorical outcomes namely least deprived, moderately deprived and highly deprived with regards to years of schooling, moderately deprived was considered as baseline reference category. Table 3 summarizes the estimates of categorical outcome of highly deprived districts vis-à-vis moderately deprived districts with reference to years of schooling.

Table 3: Coefficient, Standard Error and Reverse Risk Ratio Estimates and p Values of the Multinomial Logistic Regression Model (Comparison for 1:2)

Deprivation In Years of Schooling	Parameters	Estimates			
		RRR	Std. Err.	Z	Probability>z
Categorical comparison of “Least Deprived districts” vis-a-vis “Moderately deprived districts” with regards to years of schooling	Nutrition	11.15962	20.92103	1.29	0.198
	Maternal Health	36.54074	69.78051	1.88	0.060
	School Attendance	1.25e-18	6.56e-18	-7.86	0.000
	Sanitation	0.0286665	0.0301702	-3.37	0.001
	Housing	1.223304	0.9803285	0.25	0.801
	Assets	0.0012853	0.0019744	-4.33	0.000
	Bank Account	0.0162451	0.0327938	-2.04	0.041
	Constant	232.3737	140.2999	9.02	0.000

In table 3, we can observe that school attendance is significant at 1 percent and having relative risk ratio (RRR) of less than 1. This implies that for each one unit increase in this variable that there is a greater risk of the case falling to base reference category which is predicted to change by a factor of 1.25e-18. In other words, when deprivation of school attendance decreases, there is a greater chance that the district is likely to be less deprived in percentage of years of schooling among households. From table 3, we can draw similar inferences with regards to sanitation, assets and bank account which are statistically significant in the range of 1 to 5 percent. Thus, decreasing the deprivation of school attendance, sanitation, assets and bank account are found to be statistically significant in increasing the likelihood of the district falling in “Least Deprived District” category with regards to deprivation of years of schooling.

Further, with the use of predicted probability we can estimate the impact of independent variable on dependent variable. The results of estimated probability of success among statistically significant independent variable are summarized in Table 4.

Table 4: Results of Estimated Probability of Success among statistically significant Independent Variables pertaining to least deprived districts

Factors affecting Years of Schooling	Coefficient	Deprivation							
Deprivation of Nutrition	2.412302	0	0	0	0	0	0	0	0
Deprivation of Maternal Health	3.598428	0	0	0	0	0	0	0	1
Deprivation of School Attendance	-41.22308	0	0	0	0	0	1	1	1
Deprivation of Sanitation	-3.552028	0	0	0	0	1	1	1	1
Deprivation of Housing	0.2015558	0	0	0	0	0	0	0	0
Deprivation of Asset	-6.656796	0	0	1	1	1	1	1	1
Deprivation of Bank Account	-4.119963	0	1	1	1	1	1	1	1
Constant	5.448347	1	1	1	1	1	1	1	1
log odd ratio		5.44	1.3283	-5.328	-5.328	-8.880	-50.1	-50.103	46.505
Predicted probability		0.995	0.7905	0.0048	0.0048	0.0001	1.7E ⁻²²	1.73E ⁻²²	6.3E ⁻²¹
Change in probability			-0.205	-0.785	0	-0.004	-0.0001	0	6.18E ⁻²¹
Change in Probability (in %)			-20.51	-78.57	0	-0.468	-0.013	0	6.18E ⁻¹⁹

From table 4 we can observe that the impact of deprivation of asset in depriving years of schooling among better off districts is nearly 78 percent. Deprivation of Bank Account adversely affecting years of schooling among the same is 20 percent. Although deprivation of sanitation and school attendance also have their role to play, their influence is negligible at 0.46 and 0.01 percent respectively.

Table 5 summarizes the estimates of categorical outcome, that is, least deprived districts vis-à-vis moderately deprived districts with reference to years of schooling.

Table 5: Coefficient, Standard Error and Reverse Risk Ratio Estimates and p Values of the Multinomial Logistic Regression Model (Comparison for 3:2)

Deprivation In Years of Schooling	Parameters	Estimates			
		RRR	Std. Err.	Z	Probability>z
Categorical comparison of “ Most deprived districts” vis-a-vis “ Moderately deprived districts” with regards to years of schooling (Comparison 3:2)	Nutrition	0.0221767	.1307471	-0.65	0.518
	Maternal Health	10.821777	50.47868	0.51	0.610
	School Attendance	2.27e+13	1.65e+14	4.22	0.000
	Sanitation	503861.2	2436799	2.71	0.007
	Housing	0.030042	0.1012831	-1.04	0.298
	Assets	30771.19	120542.5	2.64	0.008
	Bank Account	9920.273	36844.65	2.48	0.013
	Constant	3.18e-08	1.41e-07	-3.91	0.000

In table 5, we can note that school attendance is significant at 1 percent and having relative risk ratio (RRR) of less than 1. This implies that for each one unit increase in this variable that there is a greater risk of the case falling to comparison category which is predicted to change by a factor of 2.27 e+13. In other words, when deprivation of school attendance increases, there is a greater chance that the district is likely to be highly deprived in percentage of years of schooling among households. From table 5, we can draw similar inferences with regards to sanitation, assets and bank account which are statistically significant in the range of 1 to 5 percent.

Thus, increasing the deprivation of school attendance, sanitation, assets and bank account are found to be statistically significant in increasing the likelihood of the district falling in “Most Deprived District” category with regards to percentage of deprivation in years of schooling among households.

Further, with the use of predicted probability estimation of the impact of statistically significant independent variables on dependent variable is summarized in Table 6.

Table 6: Results of Estimated Probability of Success among statistically significant Independent Variables pertaining to most deprived districts

Factors Deprived	Deprivation in Years of schooling Coefficient	Deprivation						
Nutrition	3.808713	0	0	0	0	0	0	0
MaternalHealth	2.38156	0	0	0	0	0	0	0
SchoolAttendance	30.7523	0	0	0	0	1	1	1
Sanitation	13.13006	0	0	0	1	1	1	1
Housing	-3.505158	0	0	0	0	0	0	0
Asset	10.33433	0	0	1	1	1	1	1
BankAccount	9.202336	0	1	1	1	1	1	1
_cons	-17.26375	1	1	1	1	1	1	1
Log Odd Ratio	$\ln[p/(1-p)]$	-17.263	-8.0614	2.2729	15.4029	46.1552	46.1552	46.1552
Predicted Probability	p-hat	3.10E ⁻⁸	0.00031	0.90660	0.999999	1	1	1

From table 6 we can observe that the impact of deprivation of asset in depriving years of schooling among better off districts is nearly 91 percent. Deprivation of sanitation adversely affecting years of schooling among the same is around 9.33 percent. Although deprivation of bank account and school attendance also have their role to play, their influence is negligible at 0.03 and 2.04 e-05 percent respectively.

POLICY IMPLICATIONS:

As recognized by prior studies even our study ascertained that in improving the literacy rate Standard of living (assets), Health (Sanitation), Financial Inclusion (access to banking) and School attendance have an active role to play. However, the uniqueness in our study lies in the fact that, our study through predictive probability infers that the effect of the given set of variables varies across the districts. In this backdrop the government must be sensitive in its policy formulation to promote horizontal spread of literacy rate. The policy implications of our study are summarized as under:

1. Although our study identifies a common set of factors affecting horizontal spread of literacy rate, its impact across better off and worse of districts vary. In better off districts, assets (78 %) and banking (20%), together were able to influence 98 percent of the probability. Standard of living is expected to increase spending on education as has been ascertained from prior studies. Financial inclusion is also expected to enhance access to education. Financial inclusion, particularly in better off districts is of even more relevance because of the following reasons: As per the definition set for study, better of districts are those wherein the deprivation of education among households is less than seventeen percent. As majority of the households have secured primary education, they would be keen on securing secondary and higher education. In this regard financial inclusion would play a prominent role through assisting in scholarship as well as creating a gateway for saving, investment and insurance. Thereby paving the way to make the family more resilient to adversities. Hence in better off districts to catalyze horizontal spread of literacy central and state government must focus on financial inclusion. Many studies have already illustrated the manifold significance of bringing about financial inclusion in enhancing literacy rate and promoting Human Capital Formation. Although more than 80 percent of Indians have bank account, they are not necessarily financially literate. According to recent All India Rural Financial Inclusion Survey conducted by National Bank for Agriculture and Rural Development (NABARD) in 2016-17, it was found that 52 percent of people preferred to keep their savings at home. Furthermore, only 11 percent of respondents had “good” financial literacy which was defined by NABARD as respondents having a combination of sound financial knowledge and positive financial attitude. Thus, in this context, the Government to truly ensure financial inclusion among masses, just providing them bank accounts is not going to serve the purpose. In addition to bank account, financial literacy

among adults must also be enhanced. Adult Education envisaged by National education Policy 2020 can be leveraged to achieve the same.

2. In the Worse of districts, which were defined as districts with deprivation ranging from 34 to 51 percent, through our model we were able to infer that asset (90 %) and sanitation (9%) together influenced around 99 percent of the probability of categorical outcome. The emphasis on improving the standard of living in worse of districts is on expected lines. It is interesting to note that in worse of districts as opposed to financial inclusion, sanitation, which is a health indicator is playing a significant role. Children spend more time in their house than in school premises. In this regard, absence or presence of sanitation facility in house is expected to have a significant influence on their health. Many studies have underlined the significant interlinkages between sanitation and health. According to recent World Health Organization report out of pocket expenses on health services in India continue to push over 55 million people in India to poverty, with over 18 percent of households incurring catastrophic levels of health expenditure annually. In India 65 percent of all health expenditure is from out of pocket. Given the strong correlation between sanitation and health, lack of adequate sanitation facility, particularly in less educated districts is going to make them more susceptible to diseases which in turn may affect drop out rates among students by making their families financially vulnerable. Although according to National Family Health Survey 5, sanitation in India has increased from 48.5 percent in 2015-16 to 70.2 percent in 2019-20, there is still a great deal of scope for increasing sanitation coverage. Another disturbing note in this regard is, although sanitation coverage has increased by nearly 22 percent in past 5 years, utilizing toilets hasn't increased in the same proportion. Many studies cite lack of water supply and awareness pertaining to hygiene as prominent causal factors in people not using the same in a regular manner. Hence, catalyze the spread of horizontal literacy among households in worse of districts, the central and state government must not only lay thrust on building toilets, but also provide complementary infrastructure along with literacy on hygiene and its consequent impact on improvement of horizontal literacy and social mobility among the households in worse of districts.

CONCLUSION:

Regional imbalances are a common occurrence in a vast and diverse nation. To promote sustainable growth in an equitable manner, addressing regional imbalance is going to be a prime concern for any responsible government. In a democracy which aspires to promote fiscal federalism in devolution of funds, the government while disbursing funds must be sensitive to the needs and aspirations of the districts at hand. Furthermore, given the intricate interlinkages in behavior of macro-economic variables, an attempt has to be made by the policy makers to understand as to which of the causal factors are playing a prominent role in influencing the occurrence of an outcome. Prior studies have already highlighted the interlinkages between literacy, health, standard of living and financial indicators. However, while forming policy to as vast and as diverse a nation as India, it becomes pertinent to be sensitive as to which of the factors should be readily addressed in a proactive manner. This shall maximize returns by optimizing scarce resources. The importance of literacy rate in facilitating upward social mobility of vulnerable masses is well known strategy to initiate economic growth and development among policy makers. At the same point of time pursuing one size fits all top-down approach in socio economically diverse districts would not be in the spirit of parsimony. In this regard our study, with the help of multinomial logistic regression and predictive probability has identified the factors affecting horizontal spread of literacy among better off vis-à-vis worse off districts of India. Inferences from our study reiterates that macroeconomic variables don't behave in isolation. Furthermore, factors affecting a particular macroeconomic variable is sensitive to the socio-economic factors governing that region. Hence, when it comes to fiscal devolution and policy formulation, Government must be sensitive to the socio-economic factors affecting the macroeconomic variable in focus.

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