Analysis of socio-economic factors affecting deprivation of school attendance across Indian districts and its implication on public expenditure

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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 the factors impact in depriving of education are scarce. The present study identifies the causal factors which have deprived school attendance of students among households across Indian districts along with the magnitude of their impact. Through present study we were able to infer that nutrition of children, maternal health, years of schooling and financial inclusion of household played a significant role in affecting their school attendance. Through predictive probability, we were able to assess the magnitude of the impact of the following factors and their implications on public expenditure.

Keywords: Socio-Economic Factors, Horizontal spread, School attendance, 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 economic landscape. 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 that, "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 be on the rise in India. Various studies (Williamson (1964), Dhar and Sastry (1969), Rao (1973), Gupta (1973), Raj (1990), Dholakia (1994), Ahluwalia (2000), Jha (2000), Kurian (2000), Majumdar (2004), 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 Dhar and Sastry (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 trends of regional imbalances in India hasn't followed a uniform pattern, it has 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 refereed 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 Net State Domestic Product. 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 (Asif Va & Panakaje 2022) 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 across Indian districts. By doing so we want to identify the factors by prioritizing which government can reduce deprivation of school attendance among students of households across Indian districts.

Literature Review: Many prior studies 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 school attendance among primary and secondary students. The relationship between the said variables is discussed in the subsequent subsections:

Nutrition and Education: Socio economic (Sutradhar et al 2023) 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 the age of 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 (Gorain, S & Ansary, S.2023) 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 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 ascertains 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 have 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 demonstrate 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.

Maternal Health, School attendance 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.

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. Often 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 school attendance among students across Indian Districts.
- To estimate the magnitude of socio-economic factors' individual influence in affecting the deprivation of school attendance among students across worse of districts vis-à-vis better of districts

Hypotheses:

- Socio Economic Factors like Housing, Assets, Sanitation, Banking, Maternal health, and the like affects deprivation of school attendance among students across Indian districts.
- The magnitude of influence of each socio-economic factor in affecting deprivation of school attendance varies.

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 deprivation of school attendance among students in households across Indian Districts. To identify the socio-economic factors affecting the same, Binomial Logistic Regression has been used. Further to assess the magnitude of the impact of each socio-economic factor, we have used predictive probability.

Binomial 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 ($x_1, x_2, x_3 \ldots x_k$), the framework of binary logistic regression can be depicted with the help of the following equation (Ari, Erkan.2016),:

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

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

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

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)..

Estimation of Predicted Probability

Further, with the use of predicted probability an attempt has been made to estimate the impact of independent variable on dependent variable.

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

1. Calculation of odds ratio: The following formula has been used to estimate odds ratio;
   ln(p-hat/1-p-hat) = $\beta_0 + \beta_1 x \ \beta_2 y$ ... estimated.

2. Calculation of estimated probability: Expected Probability of is calculated with the help of the following formula:
   p-hat= exp($\beta_0 + \beta_1 x + \beta_2 y$ ...)/1+exp($\beta_0 + \beta_1 x \ \beta_2 y$ ...) estimated.

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

Deprivation of School Attendance: 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

Based on recent National Family Health survey 2015-16, an estimation of percentage of students who were deprived of school attendance among households was estimated through NITI Aayog's data collected across 633 districts.

Based on percentage of deprivation of school attendance, we have categorized the response variable into 2 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 (Deprivation less than 6.17%)	393	62.08
Highly Deprived (Deprivation more than 6.17%)	240	37.92

Our model satisfied residual diagnostic tests like Pseudo R square and Hosmer-Lemeshow test which are typically used to test stability of binomial 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: 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: 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.

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.

Deprivation of Sanitation: 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: 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: 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: 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.

Reliability of the Model

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

Hosmer-Lemeshow Goodness of fit test for Multinomial Regression Model: Hosmer-Lemeshow Goodness of fit test can be used to estimate the goodness of fit test for binomial 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,……..g; j=0,……..,c-1; and Ωk 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:

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

In the above equation, O_g represents observed events, E_g represents expected events and n_g represents number of observations for the g^{th} 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: 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	02	01	10	6.23	16	0.6216

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 0.56 as calculated by STATA indicating that our model is a good fit.

Results and discussion:

Binomial Logistic Regression was used to identify the statistical significance of variables affecting deprivation of school attendance across Indian districts. Table 3 summarizes the estimates of categorical outcome of highly deprived districts vis-à-vis least deprived districts with reference to deprivation of school attendance.

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	Deprivation of Parameters	Estimates			
		Coefficient	Std. Err.	Z	Probability>z
Categorical comparison of " Most Deprived districts" vis-a-vis " Least deprived districts" with regards to years of schooling (Base Reference Category: Least Deprived Districts)	Nutrition	7.387	2.07	3.52	0.000 *
	Maternal Health	11.274	1.98	5.68	0.000*
	Years of Schooling	21.173	3.08	6.85	0.000*
	Sanitation	00.224	1.17	0.02	0.985
	Drinking Water	-1.8582	1.04	-1.78	0.076
	Electricity	2.792	1.77	1.57	0.116
	Housing	-1.555	0.88	-1.75	0.080
	Assets	0.3606	1.79	0.20	0.840
	Bank Account	-4.8512	2.31	-2.10	0.036*
	Constant	-7.8196	0.76	-10.17	0.000

Note: * Denotes Statistically significant at 5 percent

In Table 3, we can observe that Deprivation of Nutrition, Maternal Health and years of schooling is positively related with deprivation of school attendance among worse of districts. This is more so true in case of nutrition. This is in line with studies which have already taken place in this domain. Hence, mid-day meal scheme of the government is an initiative in the right direction. In addition to that Government's Anganwadi Scheme to oversee the neo natal health care of mother and her child in their early vulnerable condition is also a step in right direction.

It is interesting to note that increasing years of schooling tends to increase the attendance among students. As of now Government is providing free education till class 8. If Government were to provide free education for children till class 10 or class 12, it could further help in increasing attendance.

Another significant variable in our model is access to bank account which is taken as a proxy for financial inclusion. In our model, deprivation of bank account seems to have an inverse relationship with deprivation of school attendance. Although, at superficial level, it may seem to be an anomaly, it

can be justified on the following ground: In our study, districts were bifurcated on the basis of average deprivation of school attendance, which across Indian districts was found to be 6.13%. If financial inclusion is taken as a proxy for better standard of living, it implies that primary students belonging to economically worse off households are keener in attending schools as opposed to students belonging to well off households. This does make sense as attending school ensures education and better nutrition for students belonging to economically worse off households.

In line with some studies, which have not found any statistically significant relationship between housing and educational credentials, our study too, did not find and statistically significant relationship between quality of housing and deprivation of school attendance. Interestingly, access to quality sanitation in house doesn't seem to affect school attendance. Given people's acclimatization to traditional norms and culture, attributing too much importance to access to toilet with hygiene and consequent impact on school attendance, particularly among children doesn't seem to hold validity in Indian context.

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

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

Factors Deprived	Deprivation in School Attendance								
	Coeffecient	Deprivation							
Nutrition	7.3087	0	0	0	0	0	0	0	0	1
MaternalHealth	11.274	0	0	0	0	0	0	0	1	1
YearsofSchooling	21.1732	0	0	0	0	0	0	1	1	1
Sanitation	0.2249	0	0	0	0	0	1	1	1	1
DrinkingWater	-1.8582	0	0	0	0	0	0	0	0	0
Electricity	2.7929	0	0	0	1	1	1	1	1	1
Housing	-1.5551	0	0	0	0	0	0	0	0	0
Assets	0.36068	0	0	1	1	1	1	1	1	1
BankAccount	-4.8512	0	1	1	1	1	1	1	1	1
_cons	-7.8196	1	1	1	1	1	1	1	1	1
Log odd Ratio	ln[p/(1-p)]	-7.8196	-12.6708	-12.3101	-9.51722	-9.51722	-9.29232	11.88088	23.15488	30.46358
Predicted Probability	p hat	0.000402	3.14E-06	4.51E-06	7.36E-05	7.36E-05	9.21E-05	0.999993	1	1
change in probability		0.000402	-0.0004	0.000403	-0.00033	0.000403	-0.00031	1.000304	6.92135E-06	8.7836E-11
Impact of significant variable	Years of schooling:	98.8 percent		(excluding maternal health and nutrition)						
	maternal health	98.72 percent		(excluding years of schooling and nutrition)						
	nutrition	93 percent		(excluding years of schooling and maternal health)						

From table 4 we can observe that the impact of deprivation of bank account, although is inversely related, its impact being -0.04% is barely significant. It means that, although primary students belonging to households without financial inclusion attend school more regularly than students belonging to households with financial inclusion, the difference is negligible.

Furthermore, independent factors like years of schooling, maternal health and nutrition were not only statistically significant, but in isolation of the other two, each one by themselves could increase the probability of the student attending school by 98.8 %. 98.72% and 93% respectively. If all the three variables were given due importance, then they could assure, veritable decrease in the deprivation of student's attendance.

Policy Implications:

As recognized by prior studies even our study ascertained that in improving the attendance among primary and secondary students, financial inclusion (Bank account) Health (Nutrition & Mothers health), Infrastructural and financial support from the government (years of schooling) have an active role to play. However, the uniqueness in our study lies in the fact that, through predictive probability

we were able to identify the impact of statistically significant factors. The policy implications of our study are summarized as under:

Although nutrition, maternal health and years of schooling were significant by themselves, even more so was their impact. In this regard, to leverage the demographic dividend, the government must strengthen anganwadi and mid-day meal scheme programs.

Furthermore, although it is financially cumbersome, extending the Right to Education Act to cover up students pursuing 12^{th} standard would go a long way in ushering in not only Right to education but also right to quality education.

In addition to that, particularly in state of Karnataka, although from 8^{th} to 10^{th} standard, education is provided at nominal rate, parents themselves are reluctant to send their children to these as these schools are primarily run-in regional language and parents tend to question the rationale of sending their children to these schools, given the needs and demands of present job market. At the same point of time, sending their children to private school makes them more vulnerable to drop out because of unbearable expenses. In this regard, when it comes to increasing the number of years in schooling, focus must not just be on nominal increase, but it should also give due emphasis on meeting the needs and aspirations of all the stakeholders in question. Only by taking such a wholistic stance, can help in increasing the attendance among school students.

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 must 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 binomial logistic regression and predictive probability has identified the factors along with their impact across Indian districts. 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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