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On Forecasting Enrolment in Primary Schools in India Under EFA Agenda

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Abstract

The year 2015 was the target year for completion of Education for All (EFA) goal of the United Nation. Whether India was able to achieve this goal successfully, depends to a great extent on how the nation has been moving over years, in terms of formulation and implementation of its policies. Monitoring the implementation procedure is equally important. The present study is an investigative attempt towards such an evaluation of the implementation procedures. Projections are useful instruments for such an exercise. School system is expanding progressively and based on this, the broad objectives of this paper are to provide estimates, for the year 2020, of the following : (a) enrolment of students in primary schools, (both at all India level and for major states of India), disaggregated by both gender and social classes; (b) availability of teachers for primary schools; (c) distribution of per student estimated expenditure in elementary education across major states; and (d) ratio of total estimated revenue budget in elementary education to total estimated Gross Domestic Product of the nation and the states of India. These estimates, based on Enrolment Ratio method, identify states which have to struggle to achieve EFA goals. The paper contributes by estimating budgetary forecasts at the elementary level of schooling. However, the technique of projection followed, could not accommodate any policy target. This study could not shed any light on completion of primary schooling, due to paucity of adequate data. Another short coming is that the study was unable to highlight the quality of learning of students in primary schools.

Keywords: Primary Education, Enrollment Projection, Teacher Forecasting, Budgetary Forecasts, Indian States

JEL Classification: I20

Paper Classification : Research Paper

Introduction

Education is an important investment in formation of human capital in a developing country like India. The state agency, in concurrence with the society, aspires to send all children to school. India has been an active partner in the worldwide movement of 'Education for All' (EFA) that was introduced in the conference held in Jomtien, Thailand (1990). The present study makes an attempt to predict the status for primary school enrolment in India for pursuing the goal of universal enrolment. Prediction is an important tool for planning and drawing implementation policies. Such an exercise tracks the monitoring of the enrolment in primary schools in the future. Projections on enrolment involve analytical or mathematical methods.¹

Statement of the Problem

This study proposes to forecast enrolment in primary schools in major states of India, for 2020, thereby enabling the scope for policy direction for the next four years. These projected enrolment figures of students in primary schools, are further disaggregated, by gender and social classes across the major states of India. Along with enrolment forecasting, it is necessary to forecast corresponding availability of teachers by 2020. This is because teachers are necessary accompaniment of universal enrolment. Further, in the era of prioritization of resources, there is a need for proper estimation of education budgeting.

The next section discusses the existing literature, related to primary schools and enrolment forecasting and deliberates upon the research gaps, and the contribution of the study. Section 3 discusses the objectives of the study. The research methodology and data sources are discussed in Section 4. Results of the study are discussed in Section 5. Finally, Section 6 makes concluding observations. The limitations of the study and areas of potential research are elaborated in Section 7.

Literature Survey

The scenario of primary education in India is challenging. There are many choices that the policy makers need to make regarding the scope of primary schooling in India. The research on primary education in India and in other major developing countries in general, focuses upon major issues, like, i) factors determining school enrolment in rural areas; ii) gender bias in school enrolment; iii) decentralization and role of civil society in increasing enrolment; iv) efficacy of cost benefit analysis to improve education and enrolment in developing countries; and v) developing methodology to assess the achievement of Millennium Development Goals related to primary education. Therefore, to assess the achievement of "Education for All" goals, the existing literature suggests projection techniques for enrolment and comprehensive enrolment forecasts.

Drèze & Kingdon (1999) investigate the causes of deprivation in school education in rural India. The authors opine that school participation in rural areas of India is determined by household resources, school quality, motivation generated by parents, school infrastructure and cultural attitudes. Leu (2005) discusses how decentralization appears to be an important tool to increase effectiveness of school enrolment. The study exhibits the importance of bottom up approach in educational reforms. Dhaliwal, Duflo, Glennerste, Tulloch & Latif (2011), deliberate upon the cost benefit analysis as an effective tool to improve education in developing countries.

¹Analytical methods offer the scope of introduction of policy prescriptions. For such kind of methods, data are required for promotion, dropout, and repetition. The computation is based on age specific population particularly of the children belonging to the age group of six to eleven years (UNESCO, 1979). Projections of the number of students can serve as inputs for projecting government investment in the education sector.

Given a situation of resource crunch, policy makers may utilize cost effectiveness analysis to choose among alternative programmes to improve upon education situation at primary level. Muralidharan (2013) discusses the pressing need to take into account cost effectiveness analysis for policy directions in improving outcomes in primary education.

The preceding discussions revolve around research in primary education to improve academic environment, to enhance enrolment, and to evaluate the policies for better outcomes in primary education. The next task is to explore discussions and research on countries' progress towards universal primary education. The global series of enrolment projections for the period 2015-2025 based on background paper for the *Education for All Global Monitoring Report (2008)*, develops cohort based analysis to make enrolment projections. The projections are based on the variable flow of pupils.

The data source for such study is UNESCO Institute of Statistics. A related study on enrolment projections considers fertility, migration and demographic structure data to highlight enrolment forecasts (Projections of full-time enrolment Primary and Second Level, 2013 – 2031). Here, it will be worthwhile to discuss and evaluate some earlier notable studies on enrolment forecasting methods. Gardner (1981) observes that pattern based forecasting is useful since it provides estimates of baseline enrolment. Bayou, Gouel, & Sauvageot (2005) opine that extrapolation approach of enrolment estimation is a simple and appealing method. However, past trend figures may change due to new policy directives. Bhalotra & Zamora (2006) use cross section data for the period of early 1990s to late 1990s to discuss enrolment growth rates. Factors responsible for such growth have been decomposed into (a) responsiveness to school characteristics; and (b) responsiveness of schooling to given characteristics. It has demonstrated, on the basis of a simulation based analysis, that India will be able to achieve universal attendance, but not much progress would be exhibited in primary school completion rates by the year 2015. Tang & Yin (2011) discuss about the accuracy of predictions in different forecasting methods. To summarize, there are diverse and challenging methods on forecasting. However, for developing countries like India, analysis with different methods is not possible owing to lack of availability of suitable secondary data.

Research Gap and Contribution of the Study

The literature on enrolment forecasting at primary school level shows a usage of a number of methodologies. The present study attempts to make a projection using the secondary database. The exercise explores a simple but empirically appealing methodology for predicting enrolment. A disaggregative analysis across states of India was done, where the unit of observation was an individual state of India. Subsequently, this data has further been disaggregated across caste groups. The contribution of the present study will thus, be to utilize the existing database for forecasting enrolment at specific disaggregate levels. Also, the additional budgetary forecasting helps policy planners to prioritize their allocations against the backdrop of inclusive education. Since studies in this area utilizing secondary datasets are sparse in India, the present study tries to fill this gap.

Objectives of the Study

The specific objectives include:

1. Estimating enrolment of students in primary education for the year 2020, both at an aggregated (all-India) and disaggregated (across states) levels. They have further been divided by gender and social classes.
2. Forecasting availability of teachers in primary schools by 2020.

3. Understanding the educational budgetary situation at the elementary level.
4. Estimating expenditure per student at the elementary level by 2020 across major states.

Research Methodology and Data Sources

Type of Study

The study utilises secondary data sets based on official publication of Ministry of Human Development, India, for making empirical analysis of enrolment forecasting behaviour.

Sample

Data used in the present study has been collected from relevant secondary sources. It is based on complete enumeration technique. No primary survey was required to be undertaken for the present study.

Method of Data collection

Different categories of population and related figures have been collected from relevant reports of the Census of India publications. School related data - enrolment statistics and budgetary statistics - have been used from relevant reports of the Ministry of Human Resources Development (MHRD), Government of India.

Variables studied and the definition

The variables considered in the study include enrolment ratio in primary education; enrolment in primary schools of child population belonging to the six-eleven years age group; population figures belonging to six-eleven years age group; teacher pupil ratio; percentage of total revenue budget (education) to Gross State Domestic Product and per capita expenditure on student. Definition of these variables are given below –

Table 1: Variables used for the study and their definition

S.No	Variable	Definition
1.	<i>Population eligible for primary schooling:</i>	Children belonging to the age group of six to eleven years are officially eligible for enrolment in primary schools. These child population figures are decomposed on the basis of sex and caste groups;
2.	<i>Enrolment at the primary level refers to the eligible age group of Enrolment ratios</i>	children who get enrolled in primary schools
3.	<i>Gross Enrolment Ratio</i>	Gross enrolment ratio is defined as enrolment of children in primary schools, irrespective of the age group, in proportion to the population in the age group of six to eleven years
	<i>Net Enrolment Ratio (NER)</i>	Net enrolment ratio is enrolment in primary schools of children belonging to the official age group of six to eleven years, in proportion to the corresponding population age group;
4.	<i>Teacher pupil ratio at the primary school</i>	It refers to number of pupils (expressed in terms of average) per teacher at the primary level, in a particular year in a country, state, district, school, depending on the level of disaggregation

(Continued...)

5.	<i>Percentage of total revenue budget (education) to Gross National (State) Domestic Product –</i>	This basically refers to the percentage of total public expenditure on education in a financial year to Gross National (State) Product of the country (state) under study in the concerned financial year
6.	<i>Per capita expenditure on student</i>	This refers to public expenditure at the elementary level of education in a given year in proportion the number of students in the same year at the concerned level of education.

Hypotheses

The hypotheses for the study are given below:

H_{01} : *The enrolment pattern will follow linear trend at the aggregated level.*

H_{02} : *There are gender and caste group based fluctuations at the state level.*

H_{03} : *Major attention at state level is required for fulfillment of the EFA goals.*

H_{04} : *Inter state variation in budgetary allocation is substantial.*

Research Model, Tools of analysis and Datasets Utilised

Least Square Method and Enrollment Ratio Method (Mehta,1994,1998) have been followed for **projection² of enrollment³** of students. Projected recruitment of teachers is obtained by using Pupil Teacher Ratio (PTR) method. Budgetary allocation to primary schools is made by fitting of linear trends using ordinary least square method. Time series data of absolute enrollment in primary schools, as available in MHRD publications, have been used. Following method of ordinary least squares, linear trend lines have been fitted.

Projected Enrolment Ratio (ER) for the year 2020 multiplied by projected population (of 6-11 years of age group) for 2020, gives projected enrolment in primary schools for 2020. Exercise of projection for both ER and population is made by using Least Square Method (LSM). Projected ER for 2020 is made on the basis of trend behaviour of ERs of the annual series for the period 2006-2014. Projected population for 2020 is obtained from trend behaviour witnessed from population figures of 2001 and 2011. There are however, methods focusing on the student flow between grades used for forecasting in Grade Ratio & **Grade transition⁴**. Conceptually these are better methods for predicting. However, owing to paucity of required data, these methods could not be used.

²Here it is important to distinguish enrolment projections, forecasts and targets:

A projection is a conditional statement about the future. A forecast attempts to give the most likely future outcome of a parameter (say school enrolment). It is obtained by combining further data to projections.

³Targets sometimes form the basis for the estimation of future required enrolments.

a. Overall enrolment ratio = $E_t/P_t * 100$

b. Level enrolment ratio:

@Gross level enrolment ratio = $E_{ht}/P_t * 100$

@Net level enrolment ratio = $E_{h,at}/P_{at} * 100$

Where E_{ht} indicates for enrolment at all levels of education in t-th year; P_t for all the population of school age in t-th year; E_{ht} enrolment at school level h in t-th year; P_{at} is the population in a-th age group corresponding to h level in t-th year; $E_{h,at}$ enrolment from a-th age group of population at level h in t-th year.

⁴The flow of pupils through a cycle of education as analysed by the Grade Transition Model: a) be promoted to next higher grade, b) have to repeat same grade, c) have dropped out, d) have graduated and e) transferred.

Projected enrolment in primary schools for 2020 divided by the projected Pupil Teacher Ratio (PTR) for 2020 gives projected availability of teachers in primary schools required in 2020. Projected PTR for 2020 is made on the basis of trend behaviour of PTRs of the annual series for the period 2006-2014.

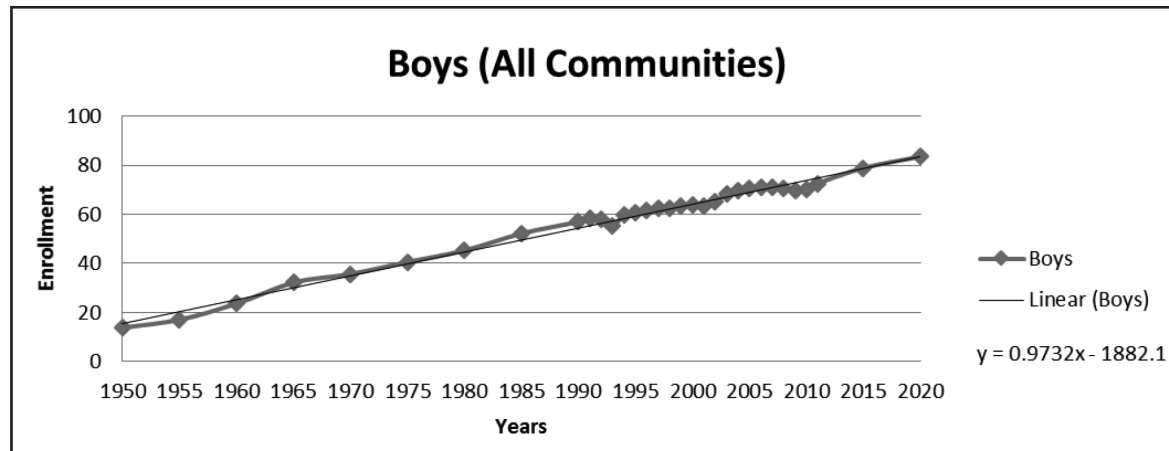
For forecasting budgetary allocation, data available from MHRD publications has been used. Percentages of total Revenue budget to Gross State Domestic Product and Per-capita expenditure on the students have been forecasted by fitting of linear trends using ordinary least square method. Data available in publications of the MHRD (school statistics) and the Census Of India (details reported in reference section) have been used.

Results and Analysis

This section discusses the forecasting results of the three variables: enrollment, teacher recruitment and budget provisions.

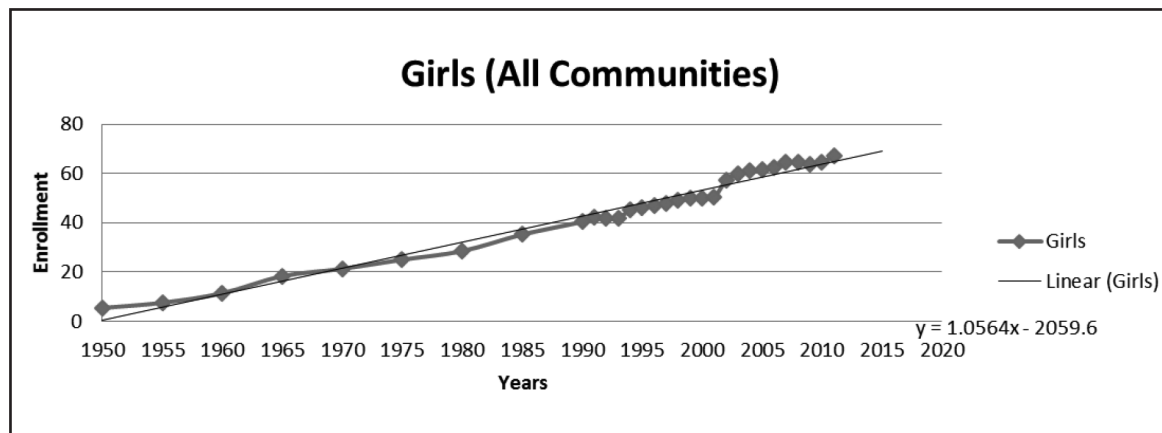
Least Squares Method (LSM)

From the scatter diagrams of enrolment figures in primary schools, across all social classes and gender, at the national level, an increasing linear trend is observed. Thus in every case fitting a linear equation is appropriate (refer to Figure 1 & Figure 2). Table 2 gives the forecasted value of enrolment in primary schools for the year 2020. Following results are worth reporting: i) enrolment of SC students is almost double to that of ST students; ii) considering all communities together, incidence of enrolment of boys is substantially higher to that of girls; iii) enrolment of SC girls is higher than that of ST girls; and iv) however, separately for SC and ST classes, number of boys enrolled is slightly higher than number of girls enrolled.



$R^2=0.987$

Figure 1. Enrolment among boys in Classes (I-V) all communities



R²=0.977

Figure 2. Enrolment among girls in Classes (I-V) all communities

Table 2: Forecasted Least Square figures for (in million); India, 2020

Boys	All Communities	83
	Scheduled Caste	16
	Scheduled Tribe	10
Girls	All Communities	74
	Scheduled Caste	15
	Scheduled Tribe	9
Total	All Communities	158
	Scheduled Caste	33
	Scheduled Tribe	19

Enrolment Ratio Method (ERM)

Here for the year 2020, following ERM results are discussed. The present study tries to trace out those states which have a long road to traverse before reaching the EFA goals, and they require special attention of the policymakers.

All Communities. Table 3 shows that states like, Assam, Kerala, Uttarakhand, Andaman and Nicobar Islands, Dadra and Nagar Haveli, Daman and Diu and Puducherry are far away from achieving EFA across gender and the total Haryana and Chandigarh also need to speed up its NER for boys.

Table 3: Projected Net Enrolment Ratio (NER) by Gender and by States / U.T. in India, All Communities, 2020 (in millions)

States / U.Ts	Boys	Girls	Total
Andhra Pradesh	98	97	97
Arunachal Pradesh	172	177	174
Assam	72	76	74
Bihar	124	137	130
Chhattisgarh	115	114	114
Goa	102	95	98
Gujarat	102	120	112
Haryana	92	104	98
Himachal Pradesh	99	101	100
J&K	93	106	99
Jharkhand	135	150	142
Karnataka	103	103	103
Kerala	90	88	89
Madhya Pradesh	99	117	108
Maharashtra	98	100	99
Manipur	156	160	158
Meghalaya	131	143	137
Mizoram	144	133	138
Nagaland	106	106	106
Orissa	112	115	113
Punjab	110	107	108
Rajasthan	94	99	96
Sikkim	160	156	158
Tamil Nadu	112	116	114
Tripura	106	111	108
Uttar Pradesh	114	130	122
Uttarakhand	84	80	82
West Bengal	114	119	116
Andaman and Nicobar Islands	91	81	86

(Continued...)

Chandigarh	84	108	96
Dadra & Nagar Haveli	39	51	45
Daman & Diu	26	50	38
Delhi	135	141	138
Lakshadweep	135	135	135
Puducherry	56	76	66
INDIA	108	116	112

Schedule Caste. Table 4 shows that Chhattisgarh, Delhi, Puducherry, Goa, and Chandigarh fall short of the EFA goal by a substantial amount across gender and total. Besides total, Gujarat and Kerala lag behind in boys' and girls' enrolment respectively.

Table 4: Projected Net Enrolment Ratio (NER) by Gender and by State/ U.Ts in India, SC Communities, 2020 (in millions)

States/U.Ts	Boys	Girls	Total
Andhra Pradesh	110	109	109
Assam	102	107	104
Bihar	149	149	149
Chhattisgarh	90	71	80
Goa	76	34	55
Gujarat	72	102	87
Haryana	136	141	138
Himachal Pradesh	99	100	99
J&K	95	102	98
Jharkhand	133	149	141
Karnataka	100	99	99
Kerala	93	90	91
Madhya Pradesh	109	127	118
Maharashtra	101	109	105
Manipur	182	195	188
Meghalaya	578	590	584
Orissa	113	113	113
Punjab	106	109	107
Rajasthan	107	112	109

(Continued...)

Sikkim	298	276	287
Tamil Nadu	125	140	133
Tripura	110	111	110
Uttar Pradesh	141	196	168
Uttarakhand	107	110	108
West Bengal	135	136	135
Chandigarh	33	35	34
Delhi	68	70	69
Puducherry	73	71	71
INDIA	123	139	131

Schedule Tribe. Table 5 shows that Himachal Pradesh, Chhattisgarh, Jammu and Kashmir, Andaman and Nicobar Islands, Dadra and Nagar Haveli lack the pace to achieve the EFA. Maharashtra has low NER in boys. Uttarakhand also needs to raise girls and total NER.

Table 5: Projected Net Enrolment Ratio (NER) across Indian States / U.Ts for Scheduled Tribe, 2020 (in millions)

States/U.Ts	Boys	Girls	Total
Andhra Pradesh	137	140	138
Arunachal Pradesh	194	195	194
Assam	99	100	99
Bihar	210	174	192
Chhattisgarh	83	84	83
Gujarat	114	128	121
Himachal Pradesh	81	92	86
Jammu and Kashmir	44	45	44
Jharkhand	136	155	145
Karnataka	115	107	111
Kerala	106	97	101
Madhya Pradesh	111	121	117
Maharashtra	87	107	97
Manipur	164	154	159
Meghalaya	149	161	155

(Continued...)

Mizoram	147	133	141
Nagaland	114	113	113
Orissa	121	123	122
Rajasthan	140	135	137
Sikkim	149	147	148
Tamil Nadu	138	164	151
Tripura	113	119	116
Uttar Pradesh	730	761	745
Uttarakhand	99	84	91
West Bengal	158	173	165
Andaman and Nicobar Islands	87	91	89
Dadra and Nagar Haveli	49	55	52
Daman & Diu	104	107	105
Lakshadweep	137	137	137
INDIA	121	128	124

Forecasting on Requirement of Teachers. Availability of teachers in primary schools is a crucial input in the primary education system. The variables forecasted are PTR and number of teachers. The PTR ranges between forty and fifty at the all- India level between 1990 to 2011 (actual values) and 2020 (predicted value). The forecasted PTR for the year 2020 is 48. The forecasted demand for teacher at the all India level in 2020 is 3655542. Table 6 shows that the requirement of teachers is high for Karnataka, Maharashtra, Gujarat (418009, 410065 and 366130 respectively); while requirements are relatively low for Nagaland, Mizoram and Goa (10807, 8657 and 5485 respectively).

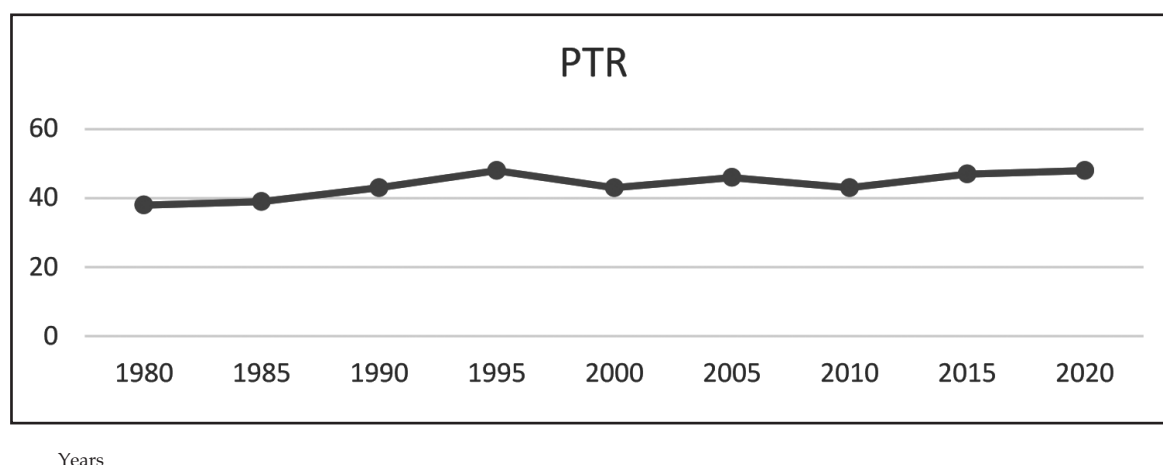
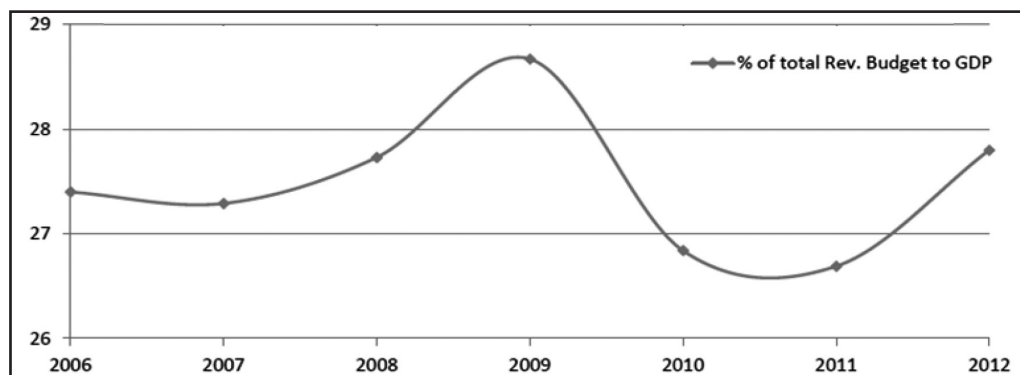


Figure 3. Pupil Teacher Ratio For Classes I –V, India

Table 6: Forecasted Requirement of Teachers in Primary Education across States / U.Ts in India, 2020 (in numbers)

States	Number of Teachers	States	Number of Teachers
Andhra Pradesh	241687	Nagaland	10807
Arunachal Pradesh	13211	Odisha	158532
Assam	125820	Punjab	110404
Bihar	242494	Rajasthan	153087
Chhattisgarh	158851	Sikkim	12133
Goa	5485	Tamil Nadu	312026
Gujarat	366130	Tripura	32976
Haryana	49741	Uttar Pradesh	334316
Himachal Pradesh	53545	Uttarakhand	41920
Jammu & Kashmir	84862	West Bengal	357151
Jharkhand	130139	A&N Islands	2665
Karnataka	418009	Chandigarh	3484
Kerala	115601	D&N Haveli	1443
Madhya Pradesh	277673	Daman & Diu	585
Maharashtra	410065	Delhi	51942
Manipur	15284	Lakshadweep	168
Meghalaya	13124	Puducherry	6247
Mizoram	8657		

Budget Forecasting. In the analysis of financing of expenditure of elementary education, two features are relevant: (1) percentage of total revenue budget (education) to Gross State Domestic Product and (2) per capita expenditure on student. Table 7 shows the forecasted percentage of total revenue budget (education) to Gross State Domestic Product for all States and Union Territories. According to it, States showing highest percentage are Sikkim (70), Mizoram (57) and Manipur (42) and lowest are Tamil Nadu, Andhra Pradesh & West Bengal (17), Haryana (15), and Maharashtra & Gujarat (14).



Years

Figure 4. Percentage of total Rev. Budget to GDP, India

Table 7: Forecasted Percentage of Revenue Budget to GSDP across States / U.Ts in India, 2020 (in Percentage)

States/U.Ts	Percentage	State	Percentage
Andhra Pradesh	17	Meghalaya	33
Arunachal Pradesh	31	Mizoram	57
Assam	31	Nagaland	39
Bihar	21	Orissa	20
Chhattisgarh	20	Punjab	19
Goa	20	Rajasthan	18
Gujarat	14	Sikkim	70
Haryana	15	Tamil Nadu	17
Himachal Pradesh	26	Tripura	30
Jammu and Kashmir	37	Uttarakhand	22
Jharkhand	20	Uttar Pradesh	22
Karnataka	18	West Bengal	17
Kerala	18	A & N Islands	63
Madhya Pradesh	21	Chandigarh	13
Maharashtra	14	Delhi	10
Manipur	42	Pondicherry	31

Table 8 shows the forecasted per capita expenditure on elementary education across states and union territories in India and finds that Nagaland and Andaman and Nicobar Islands

register negative value for per capita expenditure on education at the elementary level. Per capita expenditure on education is found to be lowest for the states of Punjab, Uttarakhand; while highest figures are found to correspond to Lakshadweep, Uttar Pradesh and Sikkim.

Table 8: Forecasted Per capita Expenditure on Elementary Level across States/U.Ts in India, 2020 (in Rupees)

States/U.Ts	Per capita Exp.	States/U.Ts	Per capita Exp.
Andhra Pradesh	5016	Nagaland	-8955
Arunachal Pradesh	32469	Orissa	10612
Assam	12637	Punjab	123
Bihar	3616	Rajasthan	10783
Chhattisgarh	12919	Sikkim	32355
Goa	18652	Tamil Nadu	10704
Gujarat	10751	Tripura	11325
Haryana	21829	Uttaranchal	936
Himachal Pradesh	21156	Uttar Pradesh	120494
Jammu and Kashmir	7637	West Bengal	2133
Jharkhand	6319	A & N Islands	-15627
Karnataka	10181	Chandigarh	17823
Kerala	10934	D&N Haveli	18994
Madhya Pradesh	5659	Daman & Diu	25553
Maharashtra	15723	Delhi	3432
Manipur	3889	Lakshadweep	168708
Meghalaya	9429	Pondicherry	21519
Mizoram	22279		
All India		7413	

Conclusion

This paper makes an attempt to project enrolment figures for the year 2020 for the primary level of school education using empirical methods. The projected data indicates that India's scenario is hopeful, though disaggregated state level estimation is concerning. Projected figures for some states for Scheduled Caste and Scheduled Tribes, explicitly accommodating gender dimension, are encouraging. Apart from enrolment projection, the paper has discussed projections of requirement of teachers for 2020. Additionally, the paper has estimated budgetary forecasts at the elementary level of schooling. It has been found that budgetary allocation for education continues to be low in India, even in the decade of "Right to Education".

Limitation of the Study and Scope for Further Research

The major limitation of the study is that the technique of projection followed, could not accommodate any policy target. It could also not throw any light on quality of learning of students after completion of primary schooling. Due to paucity of secondary data, it could not make comparison with other methods of projections discussed in the literature. However, the discussion in the paper amply demonstrates the need to generate data base to conduct disaggregated projection on enrolment and other related school level indicators. The future research areas that could be explored are as follows:

- a. linking enrolment forecasting methods with budgetary forecasting at disaggregate level analysis;
- b. the research area of Quality of Learning particularly with test scores need to be developed, based on Ministry of Human Resource (Government of India) statistics; and
- c. developing a methodology on projection where policy targets are incorporated.

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