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School Dropout across Indian States and UTs: An Econometric Study

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Abstract

School dropout depends upon various factors such as poverty level, distance of school from home, transport facilities, quality of teachers, social environment and many other factors. The present study is a quantitative analysis of school dropout rate, which is regressed on various variables referred to as factors here. The data for school dropout rates and many other variables across Indian states and UTs are considered for the session 2009-10. The study found statistically significant impact of state poverty level and the rural populations.

Keywords: School dropout, pupil teacher ratio, adult literacy rate, quality of teachers, poverty.

Introduction

Unlike many other countries of the world today, India is increasingly growing young as reflected in the population profile of the country. According to Census Bureau of India, 40% of population is below the age of 18, and by 2015 it is expected that 55% will be under the age of 20. With a sufficiently large proportion of population in the very young age, it is expected that in 2020, the average Indian will be only 29 years old, compared with the average age of 37 years in China and the US, 45 in west Europe and 48 in Japan. This demographic process will create a large and growing labour force, which is expected to deliver spin-offs in terms of growth and prosperity through a number of routes[1]. People of this young age group are considered to be the most productive class of human resources. Therefore, sustainability of economic development of the country will depend on how this section of people is built up and utilized.

Providing right type of education to the right people at right time is the key to human resource formation. Unleashing the power of these youths, given its other endowments, builds the necessary condition, although not sufficient one, for the success history of a nation like India. This urges for need for high rate of school retention and more educational participation, not to cite the need for research and innovation in the field.

However, being a poverty-striven and rural based economic society, many problems, leaving no margin for unconsciousness, stand before educational participation, which is reflected, among other educational indicators, by higher school dropout; meaning the children those who were earlier in school, but are not now there although they have not completed their school courses. Albeit world program for education for all and the enactment of right of children to free and compulsory education (RTE) in India, many children still today are out of schools due to one or more reasons and discontinuation of education has been a common phenomenon in every corner of the country. Initiatives for encouraging children for education have resulted in overall enrollment ratio which, however, has not been successful in retention of children to our desired level. The reasons for dropping out may be many like, failure in academics, non-availability of schools, inaccessibility of schools, pushing out due to teachers' behaviour/school environment, financial problems etc[2].

Number of school dropouts in India is not small. In a study in 2010, Reddy and Sinha stated that of the more than 27 million children in India, who joined in Class I in 1993, only 10 million of them reached Class X, which is only about 37% of those who entered the school system and in more than half the states, only 30% of children reached Class X[3]. With the implementation of RTE, of course, there has been a gradual decline in the annual average dropout rate from 9.1 in 2009-2010 to 6.9 in 2010-11[4] but there have been more children dropout in 2010-11 as compared to 2009-2010 in 10 out of the 30 states where RTE has been notified, including progressive states like Tamil Nadu and Gujarat that had increased dropout ratio from 0.1% to 1.2% and 3.9% to 4.3% respectively in 2009-10 and 2010-11[5].

The overall school dropout statistics shows a declining trend in the last few decades which is evident from the table-1.

Reasons for School Dropout: Various reasons for school dropouts are there. In a study, Sikdar and Mukherjee specified 20 reasons for school dropouts and categorized them into eight groups[6]. More generally, reasons of school dropouts can be classified in to some broad categories like *school-centric*, *school-centric* and *parent-centric*.

Table-1
Drop-out rates of all categories of students 1999-2000 to 2009-2010

Year	Primary (I-V)			Elementary (I-VIII)		
	Boys	Girls	Total	Boys	Girls	Total
1999-00	39.8	41.0	40.3	53.3	57.7	55.1
2000-01	39.7	41.9	40.7	50.3	57.7	53.7
2002-03	38.4	39.9	39.0	52.9	56.9	54.6
2003-04	35.85	33.72	34.89	52.28	53.45	52.79
2004-05	33.74	28.57	31.47	51.85	52.92	52.32
2005-06	31.81	25.42	29.00	50.49	51.28	50.84
2006-07*	28.71	21.77	25.67	48.67	48.98	48.80
2009-10**	30.25	27.25	28.86	40.59	44.39	42.39

Source: Selected Educational Statistics 2007-08, Ministry of Human Resource Development, GOI, *DISE report. ***Combined dropout rate for India after consideration for all states and UTs. Source: Abstract of Selected Educational Statistics 2009-10; Ministry of Human Resources Development; GOI

Among others, poverty is one of the main determinants of school dropout. Family economic circumstances are important to meet the hidden and upfront costs of schooling, failure of which leads to many temporary as well as permanent dropouts of children. Hidden costs of schooling include opportunity cost, travel cost, uniform, daily expenditures, while upfront costs include admission fee, examination fee, tuition fees etc. Many researches are there which link dropouts, among many other factors, to poverty. Both statistical data and empirical research suggest that children from better off households are more likely to remain in school, whilst those who are poorer are more likely never to have attended, or to drop out once they have enrolled[7]. Besides, income shocks are also associated closely with poor people. Poor people, besides being with an empty wallet, are also often prone to income shocks, which in turn lead to withdrawal of children from schools. These hypotheses would however not be true had there been some options for coping with these shocks. This availability of coping options however depends on the society and the nature of accessible economic opportunities such as bank credit, hire purchase etc. These opportunities are, however, a mere dream for many millions poor.

But, there is a need for a more complex understanding of the relationship between poverty and school dropout. Absolute poverty cannot account for drop-out on its own although it may account for delayed entry into school and high repetition rates. Relative poverty shows how inequalities between learners may make learners more vulnerable to drop out[8].

Poor quality education is another important cause of school dropout. Sen's capabilities approach highlights poor quality education as a primary driver of school drop-out[9].

Family's social and demographic circumstances are an important determinant of school dropout; the members who make up a family of the child, health of the family members, education attained by parents, the activities family members are engaged in, whether the family is single-parent or otherwise etc. influence dropout decision of children. Number of children in the family, although the results are in conflict, is also an important determinant of school dropout.

School circumstances also play an important role in the dropout decision of children. Among others, student teacher ratio is an important determinant of dropout phenomenon. In 2000 Russell W. Rumberger and S.L. Thomas found that public, urban, and large schools and those with higher student–teacher ratios tended to have higher dropout rates[10]. Untrained teachers are also a threat to school dropout. Leslie McCarley, services director for No Disposable Kids once said that we can stop the trend with well-trained teachers, school staff and community members willing to capture and re-capture the academic interests of wayward youth[11]. Failure to find a social environment in school also causes dropout. In 2001 Robert Croninger and Valerie E. Lee found lower dropout rates in schools where students report receiving more support from teachers for their academic work and where teachers report that students receive more guidance about both school and personal matters[12].

Dropout decision also depends upon the academic performance of the student. Poor school performance, low attendance and late enrolment are likely to be signals for teachers that children with these characteristics are more likely to drop out[13]. In another study, Amit Choudhury in 2006 found attitude towards education as an important determinant of school dropout[14].

Besides, there are many other reasons of school dropout as evident from many available research works.

Objective: Education is considered to be the only answer to all socio-economic problems and, therefore, the global organizations have been giving pressure on universalisation of primary education[15]. Prof. Amartya Kumar Sen, Nobel laureate in Economics of 1998, has also pointed out that for sustainable development even the poorest of the poor should be provided proper education and accordingly steps have to be taken to bring primary education to the doorsteps of the rural people, since

more than 75 per cent of Indians live in rural areas[16]. Despite many measures for attainment of Education for All (EFA) goals of the new millennium, there, however, have been high rate of school dropouts in India as reflected in the earlier data. This phenomenon of school dropout, as described earlier, depends upon various factors with unequal degrees of influence. A clear distinction among these variables on the basis of their intensity of influence is needed for policy purpose. This paper is prepared with the objective to identify the variables that have greater impact upon school dropouts.

Research Methodology

Sources of data: Data are collected for 35 states and UTs of India for the year 2009-10. However, for one variable, Literacy Rate (LR), on account of lack of data, the data for the year of 2011 is used as a proxy for this variable for the year 2009-10. Dropout rates of states are regressed on many variables which are described in the later sections. Data were drawn from the Planning Commission, DISE report for 2009-10 and Census Reports, Selected Educational Statistics, MHRD etc.

Variables: Dependant Variable: School Dropout (Class I – VIII) (DROPOUT): Dropout rate data is taken for the session of 2009-10.

Independent Variables: Poverty Level (POV)**:** State-wise percentage poverty levels for 2009-10 as estimated on the basis of different poverty levels for different states are taken as one of the many explanatory variables. This variable is expected to influence DROPOUT rate positively.

Literacy Rate (LR)**:** Literacy rate considered for the year 2011 is used as a proxy variable for the year of 2009-10. This variable is expected to result in a negative influence upon DROPOUT. This is because literate parents and relatives, as compared to illiterate ones, are more conscious to continue the education of their children. In a study, Sengupta and Guha in 2002 found that parental education had the strongest positive influence on girls' school enrolment chances, the impact of mother being stronger of the two[17].

Trained Teachers (TT): Trained teachers, taken as percentage, are expected to influence DROPOUT rate negatively. Trained teachers can motivate the children and devise new technique to build interest of children and thereby can lessen school dropout.

Rural Population (RUP): Rural areas are expected to suffer from more school dropouts as there is lack of all weather roads as well as are inhabited with more unconscious parents and society members. They do not have the required type of perception regarding the need of education for their children. In a study in 2004, Kumar and Das found many strong factors of dropout such as 'disinterest' of parents and children towards acquiring education[18].

Student Classroom Ratio (SCR): Classroom density is likely to have a positive impact upon DROPOUT.

Pupil Teacher Ratio (PTR): Presence of more students per teacher poses problems in service delivery to the students to their needs. This results in lack of motivation among students, feeling of bored and also lack of hope among parents and guardians. This is expected to have positive impact upon DROPOUT.

Gross Enrolment Ratio (GER): It is defined as the total enrolment in a specific level of education, regardless of age, expressed as a percentage of the eligible official school-age population corresponding to the same level of education in a given school year.

Model: In this paper, where three model specifications are used, the dropout rate (DROPOUT) is regression on the independent variables described above.

Model 1: $\mathrm{DROPOUT} = \alpha + \beta_1(\mathrm{POV}) + \beta_2(\mathrm{SLR}) + \beta_3(\mathrm{TT}) + \beta_4(\mathrm{RUP}) + \beta_5(\mathrm{SCR}) + \beta_6(\mathrm{PTR}) + \beta_7(\mathrm{GER}) + \mathrm{U}$

Pre-diagnostic of the data showed that the correlation between variables PTR and SCR is very high. Therefore, another two model specifications were used; one removing the variable PTR and another removing the variable SCR. These models are respectively designated as Model 2 and Model 3.

Model 2: $\mathrm{DROPOUT} = \alpha + \beta_1(\mathrm{POV}) + \beta_2(\mathrm{SLR}) + \beta_3(\mathrm{TT}) + \beta_4(\mathrm{RUP}) + \beta_6(\mathrm{PTR}) + \beta_7(\mathrm{GER}) + \mathrm{U}$

Model 3: $\mathrm{DROPOUT} = \alpha + \beta_1(\mathrm{POV}) + \beta_2(\mathrm{SLR}) + \beta_3(\mathrm{TT}) + \beta_4(\mathrm{RUP}) + \beta_5(\mathrm{SCR}) + \beta_7(\mathrm{GER}) + \mathrm{U}$

Depending on the direction of influence of the explanatory variables, the signs of the coefficients of the variables are expected to vary. In table-2, the expected sign of the coefficients of the variables are presented.

Table-2
Expected sign of Coefficients

Coefficients	
β_1	Positive
β_2	Negative
β_3	Negative
β_4	Positive
β_5	Positive
β_6	Negative
β_7	Positive/Negative

Results and Discussion

Descriptive Statistics of the variables: The descriptive statistics of the variables are presented in table-3. From table it is seen that that variable DROPOUT has the largest standard deviation (28.21) for the considered Indian states and Union Territories. On the other hand, the variable Pupil-teacher ratio (PTR) has the smallest standard deviation (10.02). Similarly, mean value is highest for the variable Gross Enrollment Ratio (GER) and lowest for Poverty level (POV).

Table-3
Descriptive Statistics

Variables	Mean	Standard Deviation	N
DROPOUT	27.9714	28.20909	35
POV	23.1943	13.44700	35
SLR	69.5623	10.77045	35
TT	36.1651	22.10692	35
RUP	61.2140	22.20706	35
SCR	28.6000	13.21586	35
PTR	26.3429	10.02333	35
GER	1.0461E2	20.41512	35

Estimation: The data has been processed through SPSS software and the results are presented below:
Model 1:

$\widehat{DROPOUT} = 5.123 + .981(\text{POV}) - .443(\text{SLR}) - .094(\text{TT}) + .460(\text{RUP}) + .568(\text{SCR}) - 1.186(\text{PTR}) + .203(\text{GER})$

t-ratio:	0.105	2.756***	-.920	-.621	2.324**	1.12	-1.659	1.190
p-value:	0.917	0.010	0.366	0.540	0.28	0.271	0.109	0.244

R-Square: 0.711 Adjusted R-Square: 0.6.36
*** Significant at 1% level of significance, **significant at 5% level of significance

Model 2:

$\widehat{DROPOUT} = 9.035 + 1.043(\text{POV}) - 0.398(\text{SLR}) - 0.145(\text{TT}) + 0.440(\text{RUP}) - 0.561(\text{PTR}) + 0.148(\text{GER})$

t-ratio:	0.184	2.956***	-0.825	-0.993	2.220**	-1.246	0.905
p-value:	0.855	0.006	0.416	0.329	0.035	0.223	0.373

R-Square: 0.698, Adjusted R-Square: 0.633
*** Significant at 1% level of significance, **significant at 5% level of significance

Model 3:

$\widehat{DROPOUT} = -18.388 + 0.844(\text{POV}) - 0.213(\text{SLR}) - 0.176(\text{TT}) + 0.505(\text{RUP}) + 0.187(\text{GER}) - 0.086(\text{SCR})$

t-ratio:	-0.381	2.365**	-0.449	-1.189	2.496**	1.067	-0.262
p-value:	0.706	0.025	0.657	0.244	0.019	0.295	0.795

R-Square: 0.682, Adjusted R-Square: 0.614
**significant at 5% level of significance

Multicolinearty: The problem of multicolinearity arises when there is linear relationship among explanatory variables. Assuming two variables X_1 and X_2, the presence of multicolinearity can be modeled as $X_{2i} = \beta_0 + \beta_1 X_{1i}$.

Two types of multicolinearity are there – Perfect Multicolinearity and Imperfect Multicolinearity. Perfect multicolinearity arises when the correlation coefficient between two variables is +1 or -1. The example above is a case of perfect multicolinearity. Generalizing for *k* numbers of explanatory variables give the equation with perfect multicolinearity as:

$$\beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \ldots\ldots\ldots\ldots\ldots\ldots + \beta_k X_{ki} = 0$$

Perfect multicolinearity poses problems in regression estimation. This is because estimation of coefficient (βs) involve inverse matrix of ($\boldsymbol{X^T X}$), where X is the *n x k* matrix.

The estimated coefficient (β) *k x1* matrix, $\mathbf{B} = (\boldsymbol{X^T X})^{-1} \boldsymbol{X^T Y}$, where Y is an *n x 1* matrix.
When there is imperfect but high correlation between variables, it is referred to as imperfect multicolinearity.

Problems of Multicolinearity: One problem of regression in the presence of multicolinearity is that the influences of the explanatory variables on the dependent variable cannot be separated. Assuming that there is a perfect multicolinearity between variables X_2 *and* X_3 such that $X_3 = \lambda X_2$ in the regression equation $y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + u_i$. Substituting λX_2 for X_3, we get –

$$\begin{aligned} y_i &= \beta_1 + \beta_2 X_{2i} + \beta_3 \lambda X_{3i} + u_i \\ &= \beta_1 + (\beta_2 + \beta_3 \lambda) X_{2i} + u_i \\ &= \beta_1 + \beta_4 X_{1i} + u_i \end{aligned}$$

Where $\beta_4 = \beta_2 + \lambda\beta_3$. Assuming a constant value for λ, we cannot determine a unique value for $\beta_2$and β_3 because for two unknowns $\beta_2$and β_3, we have only one equation.

Another problem of estimating in the presence of multicolinearity is that the standard errors of the estimated coefficients tend to be large. This reduces the value of *t-ratio* and thereby poses problems in decision taking regarding acceptance or rejection of null hypotheses. This is because the variance of an estimated coefficient is defined as:

$$Var(\hat{\beta}_j) = \frac{\sigma^2}{\sum x_j(1 - R_j^2)} = \frac{\sigma^2}{\sum x_j}\text{VIF}$$

Where R_j^2 is the coefficient of determination of regression of jth explanatory variable on the remaining explanatory variables. σ^2 is the true population variance. Variance inflating vector, $VIF = \frac{1}{(1-R_j^2)}$, which shows the speed of increase in variance and covariance. Higher the value of R_j^2, higher will be the value of VIF and when $R_j^2 = 1$the variance of the jth coefficient will be infinite.

Detection of multicolinearity: There are many methods of detecting multicolinearity. Among them, the size of the correlation coefficient between tow explanatory variables is the one. According to this criterion, multicolinearity is said to exist when the correlation coefficient between variables is 0.8 or greater.

Another criterion for detecting multicolinearity is to check the correlation between two variables and their respective correlation with the dependant variables. If the correlation between variable is greater than their individual correlation with the dependant variable, multicolinearity is said to exist.

Pearson Correlations between variables of the models are presented in table-4. From the table, it is seen that the correlation coefficient between variables PTR and SCR is 0.877. Moreover, the correlations between some variables exceed their individual correlation with dependant variables, which is sign that multicolinearity is there in the model.

Another test for detecting multicolinearity is to check the size of $tolerance\ (TOL) = 1 - R_j^2$ or $VIF = 1/tolerance$. A tolerance size of less 0.1 or VIF greater than 10 indicates the presence of multicolinearity. R_j is the coefficient of determination of regression of j^{th} explanatory on other explanatory variables. TOL and VIF can be used interchangeably for detecting the presence of multicolinearity.

Heteroskedasticity and Normality of Residuals: Heteroskedasticity arises most often in case of cross-sectional data as used in this paper. Pure heteroskedasticity does not result in biased coefficient estimates, but it gives incorrect standard error of estimated coefficients. This may give a misleading *t – ratio* because *t-ratio* is the ratio of estimated coefficient and the standard error of that coefficient. This, in turn, will generate a misleading *p-value* and will influence on the decision to accept or reject Null Hypotheses. There are many tests of heteroskedasticity: White Test, Levene's test, Goldfeld-Quandt Test, Breusch Pagan test, Scatter plot of standardized residuals etc. Here, in this paper, the last methods of heteroskedasticity detections – *histogram* and *scatter plot* are used.

Well behaved residuals will be *spherical* or *scattered randomly almost in a circular pattern*. Heteroskedasticity is likely to exist if the plot is a funnel shape. On the other hand, if the residual follows a curve pattern, it is a sign that non-linearities have not been taken into consideration in the model.

Table-4
Pearson Correlation

	DROPOUT	**POV**	**SLR**	**TT**	**RUP**	**SCR**	**PTR**	**GER**
DROPOUT	1.000	.647	-.656	-.283	.702	.207	.227	.431
POV	.647	1.000	-.623	-.056	.437	.563	.655	.264
SLR	-.656	-.623	1.000	.319	-.671	-.388	-.488	-.215
TT	-.283	-.056	.319	1.000	-.196	-.065	.042	-.154
RUP	.702	.437	-.671	-.196	1.000	.021	.119	.359
SCR	.207	.563	-.388	-.065	.021	1.000	.877	-.206
PTR	.227	.655	-.488	.042	.119	.877	1.000	-.091
GER	.431	.264	-.215	-.154	.359	-.206	-.091	1.000

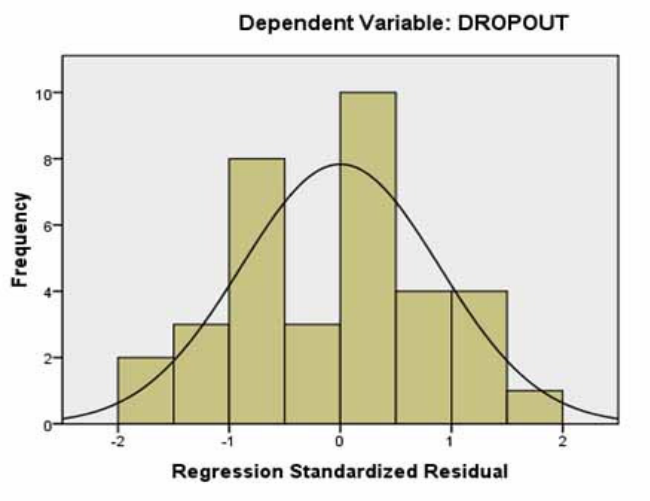

Figure-1
Histogram of standardized residual for model-1

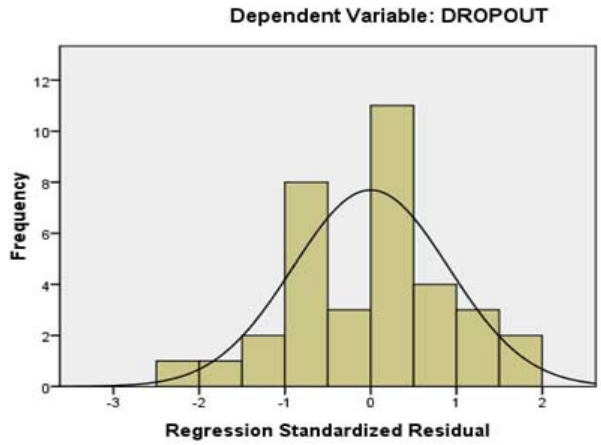

Figure-2
Histogram of standardized residual for model-2

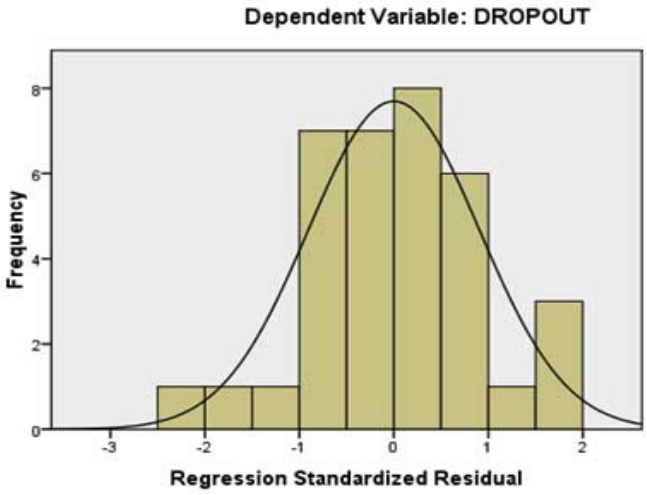

Figure-3
Histogram of standardized residual for model-3

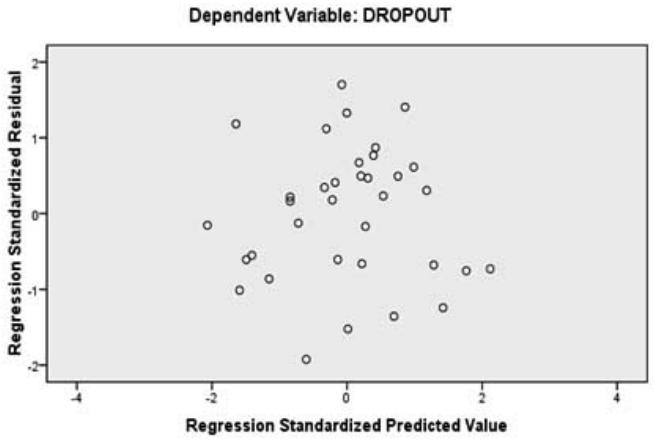

Figure-4
Scatter-plot of standardized residual for model-1

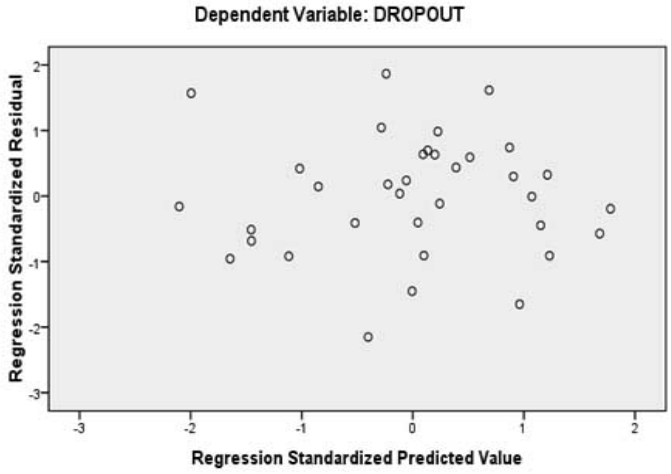

Figure-5
Scatter-plot of standardized residual for model-2

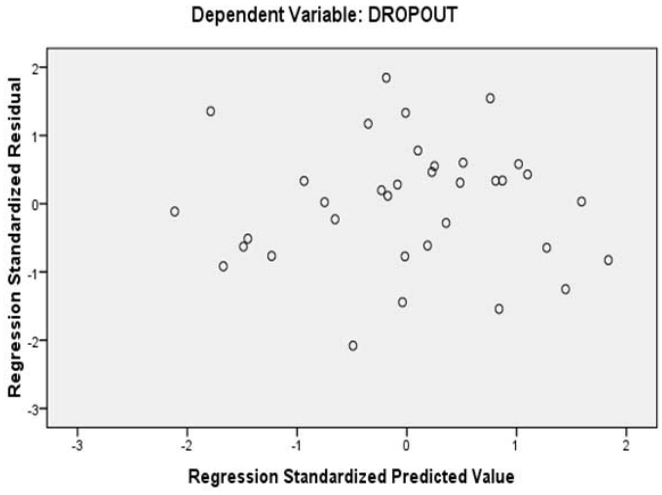

Figure-6
Scatter-plot of standardized residual for model-3

Histograms and scatter plot along with Kolmogorov- Smimov tests were used to test both normality as well as heteroskedasticity. Histograms depicted in figure-1, figure-2 and figure-3 for Model 1, Model 2 and Model 3 respectively show a pattern of normal distribution for the residuals.

Heteroskedasticity is unlikely to be a problem in the present models. The residuals (here standardized residuals) are well behaved and scattered in a circular shape which is evident from figure-4 for Model 1, figure-5 for Model 2 and figure-6 for Model 3 respectively.

Inconsistent Sgin of Estimated Coefficient: The explanatory variable Pupil-Teacher Ratio (PTR) was expected to have positive coefficient. However, from estimation it is found negative. It could be due to omission of some statistically significant variable which is correlated with PTR. The true equation could look as follows:

$$Y = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + U_i$$

Here, U_1 is the error term. But if a variable is omitted, the equation looks as $Y = \beta_1 + \beta_2 X_{2i} + V_i$

Here, V_i is now equal to $\beta_3 X_{3i} + U_i$. The error term is now accounting for the effects of the omitted variable.

The omission of a variable, when correlated with an included one, may cause biased estimation resulting in an incorrect sign of the estimated coefficient. The expected sign of the PTR coefficient is positive, but a negative is found. PTR must be picking up the effects of another variable, so the true estimated beta of PTR is exhibited below:

$(+)\beta_{ptr} = (-)\hat{\beta}_{ptr}$ + bias, where the bias is expanded into the following equation:

$(+)\beta_{ptr} = (-)\hat{\beta}_{ptr} + \beta_{OMIT} * r_{po}$; r_{po} = correlation coefficient between variables PTR and Omitted variables.

The above identity requires a positive bias, which is possible, if *either* both β_{OMIT} and r_{po} are positive, *or* both are negative.

Thus for a non-zero correlation coefficient r_{po}, the size of bias is non-zero.

Main Findings: i. Pupil Teacher ratio across Indian States and UTs are more or less the same. ii. On average, Poverty level and Rural Population percentage have greater impact upon the school dropout rates. These two variables were found statistically significant in all the three models. Standardized coefficients are also found much higher for these two variables.

Conclusion

Number of school dropouts varies from country to countries and even across various regions of the same country. School dropout is caused by many factors. Among many factors, some have greater influence as compared to the others. Possible suitable initiatives are required for mitigating this problem. Policy options, among others, include – elimination of poverty, improvement of school infrastructures, increased numbers of trained teachers, and adaptation of the curriculum to the present needs and so on.

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