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An Empirical Analysis of the Impact of Public Expenditures on Education and Health on Poverty in Indian States

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ABSTRACT

The principal objective of this study is to test whether public expenditures on education, health and other development activities have been effective in reducing poverty in India. To ensure sensitivity and robustness of the results, three different measures of poverty belonging to the Foster-Greer-Thorbecke group of poverty measures are used. We consider various types of education expenditures, viz., government expenditures on elementary, secondary, higher/university and "other" levels. Data for fourteen Indian states from 13th to 53rd rounds of National Sample Survey of India are used for estimating poverty. Using unbalanced panel data techniques, we test Fixed effects, Random effects and OLS models, and conclude that education, health and development expenditures help reduce poverty. In particular, expenditure on higher, university, technical, adult and vocational educations as opposed to elementary and secondary education is more effective in poverty reduction. Several policy conclusions are advanced.

Key Words: India, Poverty Indices, Public Expenditures on Education and Health, Fixed and Random Effect Models, Panel Data

JEL Classification No.: H5, H51, H52, H53, I0, I3, O15, O53

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1. Introduction

In the 1990s, the United Nations Development Programme (UNDP) sought to explore the impact of the economic vicissitudes and adjustments of the 1980s on measures of human development (see UNDP 1990, 1994). UNDP's human development index (HDI) which ranks all countries on a scale of 0 (lowest human development) to 1 (highest human development) is based on three goals or end products of development: longevity, knowledge (adult literacy and mean years of schooling) and standard of living. Empirical findings show that countries at similar levels of per capita income can have significantly different human development indicators depending on how that income was used. Analogous to HDI, UNDP also constructed a Human Poverty Index (HPI). It measures human poverty in terms of three key deprivations – of life (longevity), of basic education (illiteracy) and of overall economic provisioning (access to health services, drinking water, and children under 5 who are underweight). These indices, by taking into consideration various important development factors, have made a major contribution to improving our understanding of what constitutes development, which countries are succeeding (as reflected by rises in their HDI or fall in HPI over time), and how different groups or regions within countries are faring. In this paper we propose to analyze the effects of government expenditure in India on education, health, and other development areas that seem to affect HDI/HPI as defined and initiated by UNDP.

As the Indian economy turned away from the socialist model that traditionally guided its economic development and moved toward greater reliance on free markets and a more open economy, there were increasing concerns that any improvements in economic efficiency and economic growth would be achieved only at the expense of greater income inequality, and declining real income for the poor and middle class. Thus, it is opined that a major challenge for the Indian government is how to balance growth with equity and free market with poverty alleviation. Kuznet's "inverted U" hypothesis suggests that in the early stages of economic growth, the distribution of income tends to worsen, and at later stages it improves. The investigation of the modified Kuznet's hypothesis (relationship between real mean consumption and inequality index calculated using consumption measures) in the context of India suggests that inequality stayed more or less constant during the 1980s and rose slightly during 1990s along with rising real mean consumption during the whole time period under consideration (see Jha(2000a, 2000b). At the same time, it is also observed that poverty as measured by Head-count ratio (HC), Poverty gap (PG) and Foster-Gree-Thorbecke (SPG) indices of poverty have all gone down during the same time period (see Table 1).

Table 1 here.

The broad objective of this paper is to explore whether or not certain key factors as indicated by HDI/HPI indices have contributed to this reduction in poverty. It is well known that economic growth is a necessary but not a sufficient condition for the eradication of poverty. Policy makers, therefore, not only need to understand the factors that affect growth of a particular economy, but also the factors that help redistribute the effects of growth more effectively. Traditionally, tax and expenditures on public goods have been used as the most important forms of redistribution instruments. In recent years, however, public expenditures on education and health have been used as prominent mechanisms for effecting redistribution (See Biswal (1999), Boadway et al (1996), among others.). Another line of reasoning due to Besley and Coate (1992, 1995), Blackorby and Donaldson (1988), Cuff (2000), among others, led to the literature on "Workfare and Welfare". This literature derives conditions for optimality of the work requirement in order to reduce poverty and improve welfare. In India, there are large number of poverty reduction type workfare programs, e.g., Integrated Rural Development Program, National Rural Employment Program and the government is spending a sizeable fraction of its budget on these activities to reduce poverty in the country. It would be pertinent to inquire whether these variables are effective as part of a strategy of poverty reduction.

With changes in government policies and the opening up of the Indian economy, there has been a substantial increase in real national income in both absolute and per capita terms. Although income measures of poverty have traditionally dominated the literature, in recent years, consumption measure of poverty have gained importance. Many studies argue that its consumption is a more appropriate measure of a family's standard of living (McGregor and Barooah (1992), Slesnick (1993), Johnson and Shipp (1997), Jorgenson (1998) and Biswal (2000)). In this paper, we construct and use consumption measures of poverty. For the Indian economy as a whole the results are presented in Table 1 which shows that the real mean consumption has gone up and all three measures of poverty indices have gone down over the years. We hypothesize that the government has adopted a strategy of increasing its expenditure in certain key areas of education, health and other social development. This has benefited the low-income people, and as a result, poverty in India has been going down over time. Many studies have pointed out that it is difficult to infer the effects of these adjustment policies, due to the time lags between policies and outcomes. But, there are very few studies (see

Krueger and Lindhal (1999) and Romer and Romer (1999)), even for developed countries in related areas. To the best of our knowledge there are no studies quantifying the impact of expenditure on education, health and other social developments on poverty for less developed countries.

The principal objective of this study is to fill this gap in the literature by analyzing the impact of government expenditures on education, health and other development purposes on poverty, and to argue the case for using government expenditure in those key areas as an instrument of redistribution. In the light of the HDI/HPI measure of poverty, this paper uses instruments that directly affect the literacy or the education standards of the economy, the health status of its people and their living standards. In the case of education, we analyze public expenditures at various levels of education: elementary, secondary, higher or university, and "other" (vocational, adult, technical, etc.) levels of education.[1] To capture the health factor, we consider expenditures on medical, health care and family planning. Development expenditures incurred for the purpose of the eradication of poverty through various poverty eradication programs, and also for the development of the rural sectors and their infrastructure are also considered. Although we consider all three areas of public expenditures, we give special emphasis to the expenditure on education. This is done in view of the near consensus that human capital augmentation is a precondition for higher incomes and also because of the reliability of data on public expenditure on education. Ministry of Human Resource Development (1995) emphasize that increasing priority to elementary and secondary education has

[1] Total education expenditure includes expenditure on elementary, secondary, higher/university and "other" education expenditures. "Other" education expenditure includes expenditures on adult education, vocational education, technical education and other miscellaneous categories.

brought down the relative share of higher and technical education in central government budget over the years. So far as state governments are concerned, the shares in budgetary allocations of different sub-sectors of education do not vary much over the years. However, there has been some increase in the priority given to elementary and secondary education. The National Policy on Education in 1992 recommended that public expenditure on education should be raised to 6 percent of national income from the then prevailing level of 3 percent. This policy document addresses the issue of budget allocations to different sectors of education, and discusses their implications.

To achieve the objectives of our paper we adopt a two-pronged strategy. First, using the superior consumption measure, we calculate three popular measures of poverty indices for India as a whole and some of its various provinces. Second, using these three poverty indices, we explore whether poverty is relatively stable across provinces, and also test whether factors such as expenditures on education, health and other development activities have contributed to such stability and variations. We are also able to address the relative desirability of certain types of expenditures from the viewpoint of their impact on poverty reduction.

The plan of the rest of the paper is as follows. In section 2, we discuss the data and methodology used. Section 3 analyzes the empirical results. The implications of the results of this study are discussed in section 4.

2. Data and Methodology

For the purpose of the calculations of poverty indices, we use data collected from various surveys of National Sample Survey (NSS), India from its 13th to 53rd rounds of data collection, i.e. from 1957-58 to 1997.[2] Data reported by NSS under the socio-economic categories include details on Consumer expenditure, Demographic characteristics, Labor force statistics and Employment. Households in both rural and urban sectors are considered ***Consumption*** as defined in the NSS reports is the consumer expenditure mostly in value terms relating to domestic consumption of the household only. NSS covers only private households and excludes house-less population and population residing in institutions such as prisons, hospitals, etc. This does not take into account the expenditure by the household for productive purposes. Consumption includes consumption (in value) of goods and services out of (a) home-grown stock, (b) monetary purchases, (c) receipts in exchange of goods and services (d) gifts, loans etc. The NSS provides data in quantity terms for select foodgrains; but this information is available only for a few rounds. The food consumed by the employee at the employer's household is not included in the NSS estimates of food consumption for the former. This is done to avoid double counting of the expenditure on food. But at a given point of time, this procedure involves underestimation of the consumption (of food as well as total) of the employee households who in all likelihood would belong to lower expenditure classes, and overestimation of the consumption of generally richer employer households. As a result, food grain consumption and calorie intake of the poorer households in general would be under-estimated (with implications for estimates of poverty measures based on calorie norms). NSS collects data from sample households with a reference period of a week, a month, or a year preceding the date of enquiry. When the entire

[2] Jha (2000a) provides information on the data collection procedure of NSS, sampling design and definitions of the various variables used for the purpose of calculating consumption based poverty indices. Jha (2000b) reports state level poverty and inequality indices reported in this paper.

sample is considered, the reference period becomes a moving one as the NSS spreads the interviews of different households uniformly over the duration of the survey. The moving reference period averages out the seasonal variations of the characteristics at the aggregate level. The data set used, although rich, has some drawbacks. For an assessment of the quality of NSS data set see Dandedkar (1996), Deaton and Paxson (1998), Ghose and Bhattacharya (1994), Minhas (1988, 1991), Murthy and Roy (1975), Subramanian and Deaton (1996) and Ray and Bhattacharya (1992).

We use data on various components of total public expenditure on education: expenditure on elementary, secondary, university/higher education, and “other education”. We have data on percentages of expenditure on various education categories from the document entitled “Budgetary resources for education: 1951-52 to 1993-94” published by the Ministry of Human Resource Development (1995). Table 2 reports expenditures on each sub-sector of education as percentages of total expenditure on education at the all India level.[3] It can be seen that elementary education receives 45-50 percent of the total expenditure followed by secondary education in the range of 30-35 percent. Higher and “other” education categories together receive only 20-25 percent of total expenditure. The data on health and other social indicators were collected from various publications of the Government of India and other organizations. The set of independent variables included in this study to explain poverty include per capita state domestic product (SDP), per capita spending on health and other social development, and education (Elementary, Secondary, Higher / University and “other” Education)

[3] When expenditure on various categories of education were tried, we encountered multicolinearity between GDP, health expenditure and education expenditure. However, this problem is eliminated when education expenditures are considered in percentage terms.

expenditures expressed in percentage terms. All data are available at the state level. All expenditure variables are expressed in real terms (1980 prices). Table 3 provides summary statistics of all variables used for all fourteen states considered in this study.[4]

Tables 2 and 3 here.

Our discussion of the methodology used is divided into two parts. First, we discuss how the poverty indices are calculated using the consumption measures. Then we discuss the econometric methodology adopted.

a. Calculation of Poverty Indices:

The government of a developing country like India has poverty eradication as a fundamental goal. It is, therefore, important to use appropriate measures that would embody the important characteristics of such poverty. The poverty measures used in this paper are all drawn from the Foster-Greer-Thorbecke class of functions. This is written as:

$$Y_a = \sum_{y_i < z} [(z - y_i)/z]^a / n \qquad (1)$$

where Y is the measure of poverty, y_i is the consumption of the ith household or the ith class of household, z is the poverty line[5], n is the population size, and α is a non-negative parameter. The headcount ratio, *HC*, given by the percentage of the population who are poor is obtained when $\alpha=0$. This measure fails to capture the extent to which individual

[4] The states chosen are Andhra Pradesh, Assam, Bihar, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamilnadu, Uttar Preadesh (UP) and West Bengal. Consistent data for other states are not available.

[5] The poverty line is defined as per capita monthly expenditure of Rs. 49 (Rs. 57) at 1973-74 prices for the rural (urban) sector.

income (or expenditure) falls below the poverty line. Hence we use our second measure: the poverty gap index (PG) given by the aggregate income shortfall of the poor as a proportion of the poverty line and normalized by the population size. This is given by setting α=1 in (1). PG captures the acuteness of poverty since it measures the total short fall of the poor from the poverty line. In other words, it measures the total amount of income necessary to remove that poverty. This measure has the drawback that it does not consider the importance of the number of people who are below the poverty line. For this reason, it is important to use both measures of poverty jointly to evaluate the extent of poverty. There are certain policy changes that favor one group of poor and adversely affect another group. In such cases HC may not register any change but PG may get around this problem to some extent. A further improvement is the Foster-Greer-Thorbecke (P_2) measure which is obtained by setting α=2 in (1). We abbreviate this as SPG.

We calculate poverty measures for each of two parametric specifications of the Lorenz curve, i.e., the Beta model (BETA) of Kakwani (1980) and the general quadratic (GQL) model of Villasenor and Arnoid (1989). Standard tests based on R^2 and log likelihood functions enable us to make a choice between the two functional forms.

HC, PG and SPG measures of poverty are calculated for India as a whole and the fourteen states of India for which complete set of data were available. Instead of the traditionally used income measure of poverty, this study uses the consumption measure of poverty. Consumption based measures have gained importance recently as it has been demonstrated, theoretically as well as empirically, that current consumption is a better measure of standard of living and economic well-being than current money income. This argument is based on the lift-cycle hypothesis, which suggests that people smooth their consumption over their lifetimes even if income varies significantly over the life-cycle. Using consumption data to measure poverty may be a better indicator of "permanent income" and therefore, a better measure of household wellbeing.

Table 1 presents the evidence on poverty at the all India level. Summary statistics of the poverty measures for the chosen states are given in table 3.

b. Econometric Methodology:

We use panel data techniques for regression purpose. We have data for fourteen states from Round 13 (1957-58) to Round 53 (1997). The fundamental advantage of a panel data set over a cross section is that it permits greater flexibility in modeling differences in behavior across states. The following describes the one-way error component model:

$$Y_{it} = \quad + X_{it} b + v_i + e_{it} \ldots\ldots (2)$$

where *i* denotes cross-sections and *t* denotes time-periods. α is a scalar and β is Kx1 and X_{it} is the it-th observation on K explanatory variables. In this model, $v_i + \varepsilon_{it}$ is the residual. v_i is the unit-specific residual; it differs between units but, for any particular unit, its value is constant. ε_{it} is the "usual" residual with the standard properties (zero mean, no serial correlation or heteroskeadasticity, zero correlation with X and with *v*). If the v_i 's are treated as fixed parameters to be estimated, the model is referred to as the fixed-effects model. If the v_i 's are assumed random then the model is referred to as the random-effects model.

Independent of the properties of v_i and ε_{it} if equation (2) is true, it must be the case that averaging over time will yield

$$\bar{Y}_i = a + \bar{X}_i b + v_i + \bar{e}_i \ldots\ldots (3)$$

where Y, X and ε have been expressed in terms of their means. Subtracting equation (3) from (2), we have

$$(Y_{it} - \bar{Y}_i) = (X_{it} - \bar{X}_i)\, b + (e_{it} - \bar{e}_i) \ldots\ldots (4)$$

These three equations provide the basis for estimating β. Equation (4) can be estimated using OLS technique to provide us with fixed-effects estimator – also known as *within* estimator. Equation (3) can be estimated using OLS technique to provide the *between* estimator. The random-effects estimator is a weighted average of the estimates produced by the between and within estimators. The random-effects estimator turns out to be equivalent to the estimation of

$$(Y_{it} - q\bar{Y}_i) = (1-q)a + (X_{it} - q\bar{X}_i)\, b + [(1-q)v_i + (e_{it} - q\bar{e}_i)] \ldots\ldots (5)$$

where θ is a function of the variance of v and ε. If the variance of v is always zero, θ=0 and equation (2) can be estimated by OLS directly. Alternatively, if the variance of ε is zero, θ=1 and the within estimator returns all the information available.

Before using either the fixed or random effects estimation methods, we perform tests to establish if the classical regression model with a single constant term is still appropriate. In case of the fixed effects model, the absence of fixed effects assumption can be readily tested using a F-test. The null hypothesis states that all the fixed effects are jointly zero, therefore, the OLS method of estimation is appropriate. To perform the test, the model is first estimated using OLS (under null), saving the residual sum of squares, RRSS. Under the alternative, the model is estimated under the fixed effects assumption, saving the residual sum of squares, URSS. Then the following

$$F = \frac{(RRSS - URSS)/(N + T - 2)}{URSS/(N-1)(T-1) - K}$$

is distributed as F{N+T-2, (N-1)(T-1)-K} under the null where N is the total number of states, T is the number of time periods, and K is the number of parameters estimated. If the null hypothesis of no fixed-effects is rejected by the data, one can estimate the model under the assumption of fixed-effects. In case of random effects model, the random effects assumption can be tested by using the Lagrange multiplier test developed by Breusch and Pagan (1980) and subsequently modified by Baltagi and Li (1990). Under the null hypothesis of no random effects, the test statistics is distributed as $\chi^2(1)$. If the null hypothesis is true then the variance of (v_i + ε_{it}) must be zero. If the test statistics is significant then we can reject the null hypothesis in favor of the random effects model.

The discussion so far has proceeded on the grounds that there are two competing models, fixed-effects and random-effects, if it is established that simple OLS model is mis-specified. The inevitable question then is which model should be employed. The assumption regarding the nature of v_i 's is a debatable issue. It has been argued that random effects model is an appropriate specification if the sample is drawn from a large population. Given our data on fourteen states, it seems that the fixed-effects assumption is more likely to be appropriate. However, the fixed effects approach is costly in terms of degrees of freedom lost. On the other hand, there is no justification for treating the individual effects, v_i 's, as uncorrelated with other regressors, as is assumed in the random effects model. The random effects model, therefore, may suffer from inconsistency due to omitted variables. To gain further insight, we perform Hausman's (1978) specification test. If the model is correctly specified and if v_i is uncorrelated with the explanatory variables, then the two estimates should not differ systematically. Under the null hypothesis, the test statistic is distributed as $\chi^2(K)$. In case of a non-rejection of null hypothesis, the test suggests that the individual effects are uncorrelated with the other variables in the model, therefore, the random effects model is the better choice. In this paper, we provide estimates of all three methods as well as the specification tests.

In classical regression analysis, R^2 is used as a popular measure of goodness of fit. Since fixed-effects model can be estimated by OLS using dummy variables (often referred to as the LSDV model), one can evaluate the goodness of fit by reporting its R^2. In our tables we refer to this measure as the ordinary R^2. However, similar measure cannot be derived for the random effects model. Instead we report another measure, which is calculated as the correlation squared of the predicted dependent variable. If it is calculated from the predictions of Y from equation (2), it is referred to as the R^2 (overall). If it is calculated from the predictions of the deviations of Y from its mean as in equation (4), it is referred to as R^2 (within). For the fixed effects models, R^2 (within) is also the ordinary R^2, i.e., R^2 (ordinary).

3. The Results

For the purpose of estimation, as discussed previously, the study uses three different techniques: Fixed effects, Random effects and OLS. The dependent variable in all equations is one of the three measures of poverty: HC, PG, and SPG index. The explanatory variables include real per capita state domestic product (SDP), per capita development expenditure, real per capita health expenditure, and an education variable. We use two different specifications based on the description of the education variable.

The purpose of the first specification is to examine the nature of the education variable that facilitates the development of second specification. The data on education includes the percentage breakdown of state government education budget on elementary, secondary, university and "other" education categories. Since all the four categories sum to one hundred, one of these four can be treated as the default category. Therefore, the first specification is given by:

Poverty = f (Constant, SDP, Development, Health, three education categories)

The choice of a default category does not affect the estimates of other explanatory variables, the fit of the regression and the specification tests. The model specification tests for all three poverty measures are presented in Table 4. The assumption of no fixed effects finds no support in the data. Similarly, the assumption of no random-effects is not supported in the panel data. Therefore, we can conclude that the OLS technique, which estimates the model under the assumption of a single constant term, is not appropriate given the panel nature of data. The outcome of the Hausman's specification test (χ^2_6 – Test) points to the rejection of random–effects assumption in the case of two poverty measures; HC and PG. However, for the SPG measure, there are no systematic differences between the two models.

Table 4 here.

The estimation results are presented in Tables 5-7 for all three measures of poverty. In terms of goodness of fit, the ordinary R^2 's are 0.62 for the HC, 0.55 for PG, and 0.50 for the SPG fixed effects regression. The R^2 overall is consistently higher for the random effects model compared to the fixed effects model. As is evident, our regression results are robust across these two specifications. In addition, it is clear that ignoring the panel nature of the data (as in OLS) will result in inappropriate estimates. Based on the results of fixed and random effects model, several conclusions can be drawn, irrespective of the measure of poverty. First, the effect of per capita state domestic product on poverty is insignificant. Second, both development and health expenditures are significant in reducing poverty. In relative terms, an increase of one rupee per capita spending on health will lower the HC by 0.55 points compared to similar increase in development expenditure which will lower the HC by only 0.04 points (approximately). Third, among the education categories, any increment in spending on higher education brings about the most reduction in poverty. Relative to the spending on higher education, the spending on elementary and secondary education tends to increase poverty. The spending on "other" education relative to elementary education reduced poverty as well. These results apply irrespective of the poverty measures employed.

Tables 5 to 7 here.

The specification can be further modified based on the above discussion. Instead of utilizing all four categories of expenditure on education, we construct two measures of education – spending on higher education relative to the total of elementary and secondary spending, and spending on "other" education relative to the total of elementary and secondary spending. Both of these measures are proportions relative to the total of elementary and secondary percentages. We name these two new variables as "Relative Higher Education" and "Relative Other Education". Accordingly, the new specification is given by:

Poverty = g (Constant, SDP, Development, Health, Relative Higher Education, Relative Other Education)

The results of model specification tests and estimation results of the new specification are reported in Table 8. Both the measures of goodness of fit show some improvement over the first specification. Based on the model specification tests it is clear that the assumption of no individual effects, whether fixed or random, is not supported in the data. Therefore, OLS technique is again not appropriate. The null hypothesis of Hausman's test is not rejected in any of the three cases. Therefore, the data points to a random effects model, though the estimates are not statistically different between the two models. We present all these results in Table 8 for comparative purposes.

Table 8 here.

The conclusions regarding the role of development expenditure and health expenditures based on the new specification are unchanged. In terms of education it seems that a proportionate increase in spending on higher education relative to elementary and secondary will lead to significant reduction in poverty. All the coefficients on higher education are statistically significant at less than five percent level of significance. A proportionate increase in "other" education budget may help reduce poverty, though to a much smaller magnitude as compared to higher education, but the coefficients are not statistically significant.

An important policy implication of our analysis is that if poverty reduction is one of the primary goals then any increase in state's education budget must stress the relative importance of higher education compared to the current state of elementary and secondary education. The proportion of spending on elementary education is relatively much higher (close to 50 percent) and secondary education is close to 30 percent. However, the results do not suggest that the spending on elementary or secondary education should be curtailed. The results[6] do, however, suggest that any further increases in expenditure on education in the future should concentrate on higher and other education. The intuition behind these results is that India compared with other LDCs has done extremely well in terms of achieving its objective of elementary and secondary education. Further investment in these areas seems to have negligible marginal impacts on poverty. However, more expenditure on higher or university and “other” education categories opens up more income earning opportunities that help accelerate the reduction of poverty.

In both specifications, the results suggest that further increases in expenditure on development and health sector will help reduce poverty as estimated by all three measures used in the study. Since data with comparable breakups of health and development expenditures are not available we are unable to comment on the relative efficiacies of the components of these expenditure categories. Similar studies, however, can also be done for other countries to find out the areas in which the governments should allocate more or less expenditures in order to reduce poverty.

4. Concluding Remarks

The principal objective of this study was to analyze the factors affecting poverty in India according to the definition used by UNDP. These factors include per capita measures of income, development expenditure, health expenditure and education expenditures on

[6] Our results are in contrast with the popular view (see IMF (2000)) that elementary rather than higher education is central to a program of poverty reduction.

elementary, secondary, higher and “other” levels. To the best of our knowledge, this is the first study of its kind in the context of LDCs as well as developed countries. The principal reason for the lack of such studies is the lack of adequate data. In the case of India, the documents of NSS are a rich source of such information. In addition, they permit use of consumption measure (which is superior to its income counterpart) in calculating the poverty indices. The study uses various types of education expenditure data while controlling for per capita income, per capita health and other development expenditures to test their effects on three different poverty indices. Panel data techniques are used to test the fixed effect, random effect and OLS models.

The results of this study are consistent across all three measures of poverty used. This suggests that the results are not sensitive to the measures of poverty. Our principal conclusions can be summarized as follows: development and health expenditures help reduce poverty in the case of India. Per capita income is not significant in explaining poverty. Education expenditure helps reduce poverty. Within this category, the efficacy of higher education in reducing poverty is greater than that of other types. These results indicate that the government should spend more on university, technical, vocational and adult education which provide immediate income-earning opportunity to the people. This result is important considering the fact that Government of India is committed to spending more on education and other similar sectors such as health and development. The analysis in this paper can go some way in determining the optimal mix of such public expenditures.

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Table 1: Poverty Indices at the All India Level

Year	HC	PG	SPG	Real Mean Consumption
1957-58	53.6	18.37	8.39	61.00
1963-64	47.7	13.75	5.42	55.19
1968-69	56.7	18.15	7.79	56.23
1973-74	53.8	16.29	6.65	58.29
1977-78	48.1	14.2	5.67	67.5
1983-84	42.6	11.77	4.48	68.99
1986-87	37.6	9.76	3.63	74.71
1987-88	38.4	9.56	3.34	74.22
1989-90	34.0	8.03	2.68	75.80
1990-91	35.4	8.60	2.98	74.69
1992-93	40.4	10.23	3.61	70.72
1993-94	35.9	8.82	3.10	80.37
1994-95	32.4	8.19	2.81	85.27
1995-96	32.8	7.84	2.53	85.21
1997-98	32.2	7.83	2.54	87.34

TABLE 2: Expenditure on Components of Education as a percentage of Total Expenditure on Education at the all India level

YEAR	Elementary Education (Percentage)	Secondary Education (Percentage)	Univ/Higher Education (Percentage)	Others (Percentage)	Total
1951-52	46.11	19.13	11.22	23.54	100
1955-56	33.89	17.00	9.33	39.78	100
1961-62	39.99	20.80	13.25	25.96	100
1965-66	38.79	21.07	11.01	29.13	100
1971-72	41.42	29.41	12.24	16.93	100
1975-76	46.16	31.27	13.42	9.33	100
1981-82	43.82	32.33	15.25	8.60	100
1985-86	46.24	30.76	14.04	8.96	100
1990-91	46.27	32.17	13.45	8.11	100
1991-92	46.30	33.05	13.03	7.62	100
1992-93	46.32	32.50	12.92	8.26	100
1993-94	46.17	31.44	12.19	10.02	100

TABLE 3: Summary Statistics

Variable	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
	State 1: AP		**State 2: Assam**		**State 3: Bihar**	
HC Index	50.20	10.7	43.01	7.9	61.52	6.9
PG Index	14.64	4.4	9.27	2.3	19.94	5.3
SPG Index	5.85	2.1	2.90	0.9	8.72	3.5
SDP	1279.98	229.9	1281.49	232.9	900.41	82.9
Development Exp	117.87	71.2	154.24	58.9	65.75	39.0
Health Exp	17.45	9.3	24.89	14.3	9.33	5.6
Total Education	38.49	18.5	58.76	23.1	28.10	18.7
Elementary Edu.	43.76	1.8	46.77	8.2	61.36	4.3
Secondary Edu.	31.03	2.3	31.04	4.1	14.73	4.1
Higher Edu.	15.63	4.4	10.14	1.3	12.18	2.8
Other Edu	9.55	4.6	12.03	6.0	11.71	6.3
	State 4: Gujarat		**State 5: Karnataka**		**State 6: Kerala**	
HC Index	54.69	9.9	48.33	6.6	59.25	15.3
PG Index	16.03	4.9	14.34	2.5	21.3	8.4
SPG Index	6.42	2.6	5.76	1.3	9.84	4.6
SDP	1701.67	356.7	1559.92	226.7	1249.13	250.9
Development Exp	143.73	95.0	185.04	53.50	135.80	61.2
Health Exp	20.29	10.5	26.39	15.2	22.96	10.4
Total Education	50.68	28.6	62.87	18.9	72.39	26.2
Elementary Edu.	55.04	3.1	53.33	2.1	56.85	3.8
Secondary Edu.	25.15	6.8	25.70	3.7	23.88	4.2
Higher Edu.	7.92	1.2	15.17	1.8	9.13	3.8
Other Edu	11.88	5.4	5.78	1.4	10.12	4.6
	State 7: MP		**State 8: MHR**		**State 9: Orissa**	
HC Index	55.88	7.9	58.14	8.8	55.87	9.8
PG Index	17.74	4.3	18.42	4.2	17.04	4.6
SPG Index	7.52	2.4	7.53	2.0	7.36	2.4
SDP	1108.47	221.2	1877.29	478.9	1086.92	155.0
Development Exp	97.36	56.1	145.78	90.0	105.31	46.9
Health Exp	17.11	9.8	23.28	12.1	14.78	8.6
Total Education	34.54	12.7	53.21	27.1	33.97	18.5
Elementary Edu.	50.00	5.5	46.33	2.6	45.79	7.2
Secondary Edu.	29.07	4.5	31.29	7.8	28.23	5.7
Higher Edu.	10.60	1.3	8.34	2.4	12.44	1.4
Other Edu	10.31	4.5	14.02	7.4	13.53	7.4
	State 10: Punjab		**State 11: Rajasthan**		**State 12: Tamilnadu**	
HC Index	27.16	9.8	52.40	8.5	54.40	9.5
PG Index	6.22	3.4	16.67	3.9	16.74	4.2
SPG Index	2.12	1.5	7.15	2.1	6.91	2.1
SDP	3962.67	1012.96	1206.63	187.1	1410.95	324.1

Development Exp	313.67	171.95	113.47	61.2	154.60	79.2
Health Exp	27.54	13.7	22.86	10.7	22.40	9.9
Total Education	70.01	26.6	43.28	19.4	57.03	24.3
Elementary Edu.	30.47	3.0	43.98	9.8	48.39	2.3
Secondary Edu.	49.51	2.5	36.23	5.2	31.67	3.0
Higher Edu.	12.69	2.1	11.41	1.3	9.28	2.9
Other Edu	7.31	4.0	8.36	4.4	10.64	4.6

	State 13: UP		**State 14: West Bengal**	
HC Index	49.57	8.6	48.96	10.8
PG Index	14.26	3.7	13.99	4.8
SPG Index	5.59	1.9	5.54	2.4
SDP	1113.42	135.54	1552.58	137.8
Development Exp	77.09	47.5	98.80	47.5
Health Exp	12.39	7.8	18.71	7.3
Total Education	28.41	15.6	42.82	21.0
Elementary Edu.	49.49	3.8	30.34	13.8
Secondary Edu.	28.12	5.1	31.29	13.8
Higher Edu.	8.38	1.0	11.70	4.6
Other Edu	14.00	7.7	26.65	30.7

TABLE 4: Model Selection Tests

	Test Statistic	**P-Value**
Head-Count Ratio		
F-Test (13,196)	9.57	0.00
χ^2_1 – Test	126.08	0.00
χ^2_6 – Test	27.03	0.00
Poverty-Gap Ratio		
F-Test (13, 196)	10.99	0.00
χ^2_1 – Test	170.83	0.00
χ^2_6 – Test	15.63	0.02
Foster-Greer-Thorbecke Index		
F-Test (13, 196)	10.52	0.00
χ^2_1 – Test	170.83	0.00
χ^2_6 – Test	8.97	0.17

TABLE 5: Head-Count Ratio (HC) Measure of Poverty

(Default)	Elementary Education			Secondary Education			U
	Fixed	Random	OLS	Fixed	Random	OLS	Fixe
Constant	71.546 (0.00)	77.980 (0.00)	84.619 (0.00)	73.239 (0.00)	71.252 (0.00)	59.934 (0.00)	23.17 (0.20)
SDP	0.002 (0.47)	-0.002 (0.44)	-0.002 (0.33)	0.002 (0.47)	-0.002 (0.44)	-0.002 (0.33)	0.002 (0.47)
Development	-0.039 (0.04)	-0.030 (0.10)	-0.055 (0.02)	-0.039 (0.04)	-0.030 (0.10)	-0.055 (0.02)	-0.039 (0.04)
Health	-0.551 (0.00)	-0.512 (0.00)	-0.261 (0.05)	-0.551 (0.00)	-0.512 (0.00)	-0.261 (0.05)	-0.551 (0.00)
Elementary Education				-0.012 (0.87)	0.067 (0.48)	0.246 (0.00)	0.484 (0.02)
Secondary Education	0.017 (0.87)	-0.067 (0.48)	-0.246 (0.00)				0.501 (0.02)
University Education	-0.483 (0.02)	-0.508 (0.01)	-0.692 (-0.00)	-0.501 (0.02)	-0.441 (0.03)	-0.445 (0.02)	
Other Education	-0.145 (0.05)	-0.176 (0.01)	-0.245 (0.00)	-0.162 (0.04)	-0.108 (0.14)	0.002 (0.97)	0.338 (0.06)
R^2 (Ordinary)	0.62		0.63	0.62		0.63	0.62
R^2 (Overall)	0.50	0.60		0.50	0.60		0.50

Note: The term in parenthesis denotes P-value.

TABLE 6: Poverty Gap Ratio (PG) Measure of Poverty

(Default)	Elementary Education			Secondary Education			U
	Fixed	Random	OLS	Fixed	Random	OLS	Fixe
Constant	25.832 (0.00)	28.125 (0.00)	31.001 (0.00)	22.880 (0.00)	22.278 (0.00)	17.52 (0.00)	-1.312 (0.89)
SDP	0.002 (0.19)	0.001 (0.68)	0.000 (0.83)	0.002 (0.19)	0.001 (0.68)	0.000 (0.83)	0.002 (0.19)
Development	-0.018 (0.08)	-0.014 (0.15)	-0.026 (0.02)	-0.018 (0.08)	-0.014 (0.15)	-0.026 (0.02)	-0.018 (0.08)
Health	-0.284 (0.00)	-0.269 (0.00)	-0.136 (0.03)	-0.284 (0.00)	-0.269 (0.00)	-0.136 (0.03)	-0.284 (0.00)
Elementary Education				0.029 (0.58)	0.058 (0.25)	0.134 (0.00)	0.271 (0.01)
Secondary Education	0.029 (0.58)	-0.058 (0.25)	-0.135 (0.00)				0.242 (0.03)
University Education	-0.0271 (0.01)	-0.273 (0.01)	-0.333 (0.00)	-0.242 (0.03)	-0.215 (0.04)	-0.198 (0.05)	
Other Education	-0.092 (0.02)	-0.103 (0.01)	-0.137 (0.00)	-0.063 (0.12)	-0.045 (0.25)	-0.003 (0.94)	0.178 (0.06)
R^2 (Ordinary)	0.55		0.52	0.55		0.52	0.55
R^2 (Overall)	0.40	0.48		0.40	0.48		0.40

Note: The term in parenthesis denotes P-value.

TABLE 7: **Foster-Greer-Thorbecke (SPG) Measure of Poverty**

(Default)	Elementary Education			Secondary Education			U
	Fixed	Random	OLS	Fixed	Random	OLS	Fixe
Constant	11.611 (0.00)	12.896 (0.00)	14.331 (0.00)	9.396	9.125 (0.00)	6.884 (0.00)	-3.452 (0.52)
SDP	0.001 (0.08)	0.001 (0.38)	0.000 (0.57)	0.001 (0.08)	0.001 (0.38)	0.000 (0.57)	0.001 (0.08)
Development	-0.009 (0.09)	-0.007 (0.17)	-0.013 (0.03)	-0.009 (0.09)	-0.007 (0.17)	-0.013 (0.03)	-0.009 (0.09)
Health	-0.152 (0.00)	-0.144 (0.00)	-0.077 (0.02)	-0.152 (0.00)	-0.144 (0.00)	-0.077 (0.02)	-0.152 (0.00)
Elementary Education				0.022 (0.47)	0.037 (0.19)	0.074 (0.01)	0.151 (0.01)
Secondary Education	-0.022 (0.47)	-0.037 (0.19)	-0.074 (0.01)				0.128 (0.04)
University Education	-0.151 (0.01)	-0.148 (0.01)	-0.166 (0.00)	-0.128 (0.04)	-0.111 (0.06)	-0.092 (0.09)	
Other Education	-0.052 (0.02)	-0.057 (0.01)	-0.075 (0.00)	-0.030 (0.18)	-0.020 (0.36)	-0.000 (0.99)	0.098 (0.07)
R^2 (Ordinary)	0.50		0.47	0.50		0.47	0.50
R^2 (Overall)	0.33	0.43		0.33	0.43		0.33

Note: The term in parenthesis denotes P-value.

TABLE 8: Modified Tests

	Head-Count Ratio			Poverty Gap Ra	
	Fixed	Random	OLS	Fixed	Random
Constant	68.743 (0.00)	71.867 (0.00)	75.588 (0.00)	23.038 (0.00)	24.317 (0.00)
SDP	0.002 (0.52)	-0.001 (0.44)	-0.004 (0.01)	0.002 (0.22)	0.000 (0.81)
Development	-0.039 (0.04)	-0.030 (0.10)	-0.039 (0.10)	-0.017 (0.08)	-0.014 (0.16)
Health	-0.513 (0.00)	-0.483 (0.00)	-0.289 (0.03)	-0.264 (0.00)	-0.252 (0.00)
Relative University	-28.073 (0.03)	-27.818 (0.03)	-43.153 (0.00)	-15.551 (0.02)	-15.124 (0.02)
Relative Other	-0.461 (0.48)	-0.418 (0.52)	-0.047 (0.92)	-0.303 (0.38)	-0.295 (0.38)
R^2 (Ordinary)	0.62		0.62	0.55	
R^2 (Overall)	0.51	0.58		0.39	0.46
Model Selection Tests					
F-Test (13,198)	10.57 (0.00)			12.22 (0.00)	
χ^2_1 – Test		168.44 (0.00)			208.01
χ^2_6 – Test		8.55 (0.13)			4.37 (0.49)

Note: The term in parenthesis denotes P-value.