

Reducing Poverty in India: The Role of Economic Growth

Pradeep Agrawal



सत्यमेव परमो धर्मः

IEG Working Paper No. 349

2015

Reducing Poverty in India: The Role of Economic Growth

Pradeep Agrawal



सत्यमेव परमो धर्मः

IEG Working Paper No. 349

2015

ACKNOWLEDGEMENTS

I thank Shruti Tripathi and Durairaj Kumarasamy for excellent support in the preparation of this paper.

Pradeep Agrawal is Professor and Head, RBI Unit, Institute of Economic Growth, Delhi.
email: pradeep@iegindia.org

Reducing Poverty in India: The Role of Economic Growth

ABSTRACT

This paper empirically examines the relation between economic growth and poverty alleviation for the case of India. We provide evidence that higher growth rates were associated with faster decline in poverty, partly because growth helped increase employment and real wages which contributed to poverty reduction. The increase in government social expenditure is also shown to have contributed significantly to poverty alleviation. However, we also find that higher GDP growth increased government revenues, which enabled the government to increase expenditure on the social sectors. Overall, this evidence suggests that for rapid reduction in poverty, sustaining high growth is the most crucial element.

Keywords: Growth, poverty, inequality, education expenditure, health expenditure, social assistance, India.

JEL Codes: O40, I32, H50, O53

1 INTRODUCTION

Poverty continues to remain a serious problem in India, with its consequent toll on human welfare in the form of poor health, low levels of education and a poor quality of life. Unfortunately, about 33 per cent of India's population still lives in acute poverty (less than \$1.25 per person per day). Thus, a careful analysis of the determinants of poverty and of various government policies that can help reduce poverty is very desirable. This is the purpose of this paper.

Many economic studies have emphasised the role of higher economic growth to tackle the problem of poverty. This has been supported empirically by the work of Tendulkar (1998), Ravallion and Datt (1996) and Besley and Robins (2000). Using data from nearly 80 countries, Kray (2006) shows that in the medium-to-long-run, 66–90 per cent of the variation in changes in poverty can be accounted for by growth in average incomes, and all of the remainder is due to changes in relative incomes. The role of economic growth in poverty reduction has also been supported by Deaton and Drèze (2001), Bhagwati (2001) and Datt and Ravallion (2002). Sen (1996) has strongly emphasised the need for higher government expenditure on social assistance to the poor, especially in provision of education, as the most important determinants of poverty reduction. However, since government social expenditure that helps the poor is dependent on government revenue, which in turn grows with economic growth, the key role of economic growth is likely. In this paper, we examine these issues empirically for India and show that economic growth indeed plays a key role in poverty reduction.

The change in poverty over a period can be broken into two components: the impact of income growth over the period and the impact of change in income distribution over the period. Thus, if the income distribution does not change much (which is often the case with most countries), countries with higher growth rates tend to be associated with more rapid reduction in poverty. We show with the help of national-level data that this result holds for India.

Growth is considered pro-poor if the income share of the poor rises with growth (their incomes grow faster than that of the non-poor). We found evidence that inequality has declined slightly over the recent high growth period in India, and that it has also been accompanied by reduction in the poverty gap and severity. This evidence provides support for the view that the recent high growth period in India has been pro-poor.

We consider how growth might reduce poverty. We show that higher growth was associated with higher employment creation and higher real wages. We also examine whether government revenue and expenditure improved with growth in India, which helped reduce poverty. We show that real government revenue and expenditure per capita increased

with growth and, in turn, these translated into a corresponding improvement in expenditure on the social sectors (education, health and welfare expenditures). These contributed to poverty reduction and making growth pro-poor during the recent high-growth period.

Given the importance of growth, India needs to follow policies helpful in sustaining high rates of growth. These include the creation of a stable macroeconomic environment, good infrastructure, well functioning education and health services for the poor, well functioning and inclusive financial system and good governance. We also need to pay special attention to the education sector and developing our human resources. Failure to sustain high growth will prove quite disastrous in terms of poverty reduction and development. But if we are able to sustain high growth, it will give India an excellent chance to reduce poverty significantly and meet various development goals, especially if the government takes steps to increase support for infrastructure development, education and health services, etc.

2 THE RELATION BETWEEN POVERTY, GROWTH, AND INEQUALITY

This section presents a simple decomposition of the changes in the poverty rate in a country to show that the changes in per capita income and the income distribution are the main determinants of changes in the poverty rate.

The head count ratio of poverty (HCR) is defined as the percentage of the population whose income is below a given poverty line. Thus, HCR will generally depend on average income per capita (Y^*) and the poverty line (\underline{Y}), both expressed in constant prices. It will also depend on the income inequality or distribution (D):

$$HCR = HCR(Y^*, \underline{Y}, D)$$

Thus, change in HCR stems from changes in either of the two determinants of Y^* , given the constant poverty line.

1. If income growth is distribution-neutral, or the income of every individual grows by the same proportion, then the Lorenz curve will stay unchanged and change in HCR is due entirely to changes in the mean income.
2. When the mean income neither grows nor contracts, a change in poverty will occur if and only if the Lorenz curve shifts, i.e., there is income redistribution among some individuals.

The reasoning that change in poverty, ΔHCR , can be separated into two components: growth and distributional effects can be presented mathematically as follows (to keep the notation simple we suppress \underline{Y} from HCR since \underline{Y} is constant over the period 0 to t):

$$\begin{aligned}\Delta\text{HCR} &= \text{HCR}(Y^*_t, D_t) - \text{HCR}(Y^*_0, D_0) \\ &= [\text{HCR}(Y^*_t, D_t) - \text{HCR}(Y^*_0, D_t)] + [\text{HCR}(Y^*_0, D_t) - \text{HCR}(Y^*_0, D_0)]\end{aligned}\quad (1)$$

The first term in equation 1 above is the *growth effect*, which measures the change in poverty due to change in the average income over the period 0 to t for a given income distribution. Clearly, for a given income distribution and poverty line, growth in average income of the population would lead to reduction in poverty, since in that case $\text{HCR}(Y^*_t, D_t) < \text{HCR}(Y^*_0, D_t)$. The second term above is the *distribution effect*, which measures the change in poverty due to the change in the income distribution over the period 0 to t for a given average income. Clearly, for a given average income and poverty line, a more equal income distribution (lowering of income inequality) would lead to reduction in poverty, since in that case $\text{HCR}(Y^*_0, D_t) < \text{HCR}(Y^*_0, D_0)$.

Given that the income distribution often tends to remain relatively stable in most countries, the above decomposition suggests that the growth in income per capita is the main source of reduction in poverty in most countries. This has been supported by the work of Dollar and Kray (2002), Tendulkar (1998), Ravallion and Datt (1996), Bhagawati (2001), and Datt and Ravallion (2002).

2.1 Policies for More Rapid Poverty Reduction

While there is consensus on the relationship between growth, inequality, and poverty reduction, there continues to be significant debate on the reasons why countries with comparable growth performances show considerable variation in poverty reduction. This led to considerations of how to conceptualise and measure pro-poor growth. The debate seems to have boiled down to the 'relative' and 'absolute' camps. In the 'relative' sense, growth can only be called pro-poor if the growth rate of income of the poor (suitably aggregated) exceeds the average income growth rate. In other words, growth needs to have a relative bias to the poor in the sense that the income growth of the poor exceeds the average so that inequality (e.g. as measured by the Gini coefficient) declines. This definition has been widely used in the literature due to its intuitive appeal, but it also has some limitations. Concentrating solely on the inequality aspect disregards the absolute levels of growth and might end up favouring growth strategies that are sub-optimal for both the poor and the rich. The 'absolute' definition avoids this problem by concentrating on the absolute level of growth for the poor. Growth is considered pro-poor in the absolute sense if the poor population benefits from it in absolute terms, irrespective of how the total gains are distributed within the country in question. Most economists and policymakers, however, consider both absolute as well as relative aspects of poverty, thus recognising the possible trade-offs between high growth and distribution of growth according to class.

Why has economic growth been more pro-poor in some countries than in others? Is it mainly due to differences in the rate and sectoral pattern of economic growth, or are there

important differences in the poverty-reducing impact of that growth across countries? Is it due to differences in government policies in support of the poor, or is it due to initial conditions (level of literacy, health facilities, etc.) existing across countries/regions? Some economists have argued that a high initial level of inequality can be harmful to the pace of economic growth in poor countries (Myrdal 1968; Aghion et. al 1999). A plausible argument in this context is that credit market failures mean that the poor are unable to exploit growth-promoting opportunities for investment in human and physical capital. The higher the proportion of poor (and hence credit-constrained) people in the economy, the lower the rate of growth. A support for the argument can be found in Binswanger et al. (1995), Benabou (1996), and Aghion et al. (1999), among others. Some economists, like Drèze and Sen (1995), have argued that effective government intervention in favour of the poor through social welfare policies is most important for poverty alleviation, and growth plays only a minor role (so that government focus should be on education and welfare promotion rather than growth promotion). The World Bank (1993 and 1997) suggests that poverty reduction depends not only on rapid economic growth but also on basic human development, that is, the level of social indicators such as literacy, life expectancy, health facilities, etc. could also be important.

Empirical research has long been trying to analyse the factors affecting poverty in various countries. The factors most often cited as being important for effective poverty reduction include economic growth, inequality and government social expenditure on sectors such as health, education, welfare programmes, and social security, which subsidise important services for the poor and reduce vulnerability of elderly, single mothers and children. To examine what factors were significant for reducing poverty in India, the impact of some of these factors for India is evaluated in the next two sections.

3 GROWTH, INEQUALITY AND POVERTY REDUCTION: EMPIRICAL EVIDENCE

The analysis of Section 2 showed that poverty reduction should increase with higher economic growth and lower inequality. It also argued that increased social expenditure on education, health and welfare measures should also help reduce poverty. In this section, we will examine these issues empirically.

Data and Econometric Procedures

Until 1997, the time series for poverty rate (HCR), inequality (Gini coefficient) and MPCE is taken from Ravallion and Datt (1998). After that, it is the author's calculations based on the data from the household expenditure surveys of the National Sample Survey Organisation (NSSO) (see Appendix A1 for details of poverty measurement issues and definitions of poverty measures). The data on GDP are taken from the Handbook of Statistics, RBI. Finally, data on central and state government expenditure on social services and their components are taken from the EPW Research Foundation. While data on macro indicators is available from 1950, composite data on total central and state government expenditure is available only from

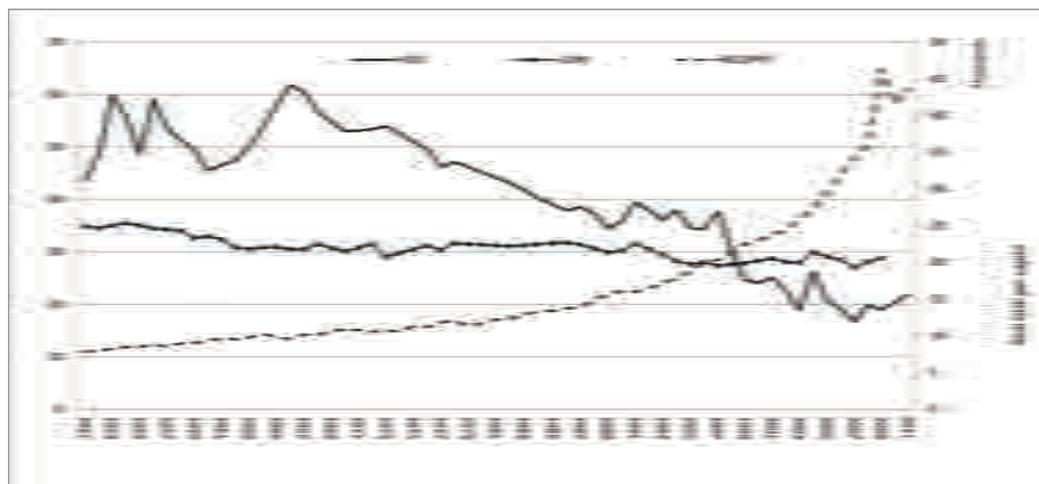
1971. The survey periods of the NSSO rounds do not always coincide with the financial year, and all the variables are available only on an annual frequency. Therefore, we have constructed *values corresponding to a given NSSO round* as (1) the value of the variable for the financial year if the midpoint of survey period coincides with the ending of financial year, or otherwise, as (2) a weighted average of the values for financial years overlapping with the survey period of that round.

All econometric relations reported in this paper are the long run relations estimated from auto-regressive distributed lag (ARDL) co-integration procedure proposed by Pesaran et al. (2001). The procedure is briefly explained in Appendix A2.

3.1 Poverty Alleviation and Economic Growth

Equation (1) derived in Section 2 above implies that as long as average income or GDP per capita increases (i.e., GDP grows faster than the population growth rate), incidence of poverty should decline due to the income growth effect. To present the impact of growth on poverty in India, Figure 1 plots real GDP per capita, and incidence of poverty given by HCR (percent of population with incomes below the national poverty line). The plot of HCR and GDP per capita gives a negative correlation between poverty and income of individuals. As income has increased over the period, HCR has declined correspondingly; this is most evident in the post-1990 period. The figure shows that the incidence of poverty in the country has declined continually, from as high as 57 in 1970 to 20 in 2010. This decline in HCR matches well with the increase in income per capita, and became more rapid after 2003 following the more rapid growth in GDP per capita since then.

Figure 1 HCR, GINI and Real GDP per Capita, 1951–2011



Source: RBI and Author's Calculation

To further examine the relation between growth and poverty reduction, econometric analysis was also carried out between (the logs of) poverty rate (LHCR) and GDP per capita (LGDPpc). We used the ARDL co-integration procedure (see Appendix) to obtain the long run relation between poverty rate and GDP per capita. The analysis was undertaken for the period 1955-2010. The following results were obtained (t-statistics of coefficients are given in brackets below them and *, ** denote significance at 5 per cent and 1 per cent levels respectively).

$$\text{LHCR} = 11.16 + 0.78 \text{ LGDPpc}$$

(19.7**) (-13.2**)

$R^2=0.90$; $DW = 2.00$; Serial correlation $[^2(1)] = 0.793$; Functional form $[^2(1)] = 0.037$

Normality test $[^2(2)] = 0.330$; Heteroskedasticity $[^2(1)] = 13.30$

The estimation results shows that the coefficient of log GDP per capita (LGDPpc) is -0.78 which is large, negative and statistically significant at 1 per cent confidence level. The results imply that an increase in GDP per capita is strongly associated with decrease in poverty and a 1 per cent increase in GD per capita should reduce poverty by about 0.78 per cent. These results imply that that higher GDP growth rate reduces poverty and confirm that the international evidence that higher GDP growth is associated with more rapid decline in poverty is equally applicable for India.

Poverty and Population Growth

Another insight emerges from the above result: rising GDP per capita is a major factor that helps reduce poverty. Given our surplus-labour economy, the marginal product of labour to output is close to zero. Thus, along with raising GDP growth, reducing population growth rates also has an important role to play in raising GDP per capita and thus reducing poverty, especially in the case of labour surplus and land scarce countries like India. Therefore, the government should actively promote smaller family norms and try to move towards a zero population growth target for the country at the earliest. Thus, near abandonment of active government support for smaller family norms over the last decade is highly regrettable and needs to be changed.

3.2 Poverty Alleviation, Growth, and Inequality

Equation (1) derived in Section 2 above also implies that declining inequality (falling Gini coefficient) is likely to result in a faster decline of poverty for any given level of growth. In a World Bank study of 88 instances where a country achieved positive per capita GDP growth for a decade, inequality improved slightly in about half of the cases and worsened slightly in the other half (World Development Report 2000). Thus, it is of interest to examine what has happened to inequality in India, especially over the period of growth since 1990, the year marking the beginning of liberalisation.

Figure 1 also shows the Gini coefficient of expenditure inequality as well as the GDP per capita for India. It is seen that inequality followed a higher path until liberalisation, and that there has been a gradual decline in the level of inequality¹, even more so after 1990—the value of the Gini coefficient has shifted from the 30–31 band to the 27–29 band.

The estimation of the long run relation between (logs of) poverty rate (LHCR), Gini coefficient of inequality (LGINI) and GDP per capita (LGDPpc) using the ARDL cointegration procedure yielded the following result (t-statistics of coefficients are given in brackets below them and *, ** denote significance at 5 per cent and 1 per cent levels):

$$\text{LHCR} = 2.01 \text{ LGINI} - 0.32 \text{ LGDPpc}$$

(5.84**) (-2.42*)

*R*²=.91; *DW* = 2.07; *Serial correlation* [*F*(1)] = 1.66; *Functional form* [*F*(1)] = 2.36

Normality test [*F*(2)] = 0.79; *Heteroskedasticity* [*F*(1)] = 5.12

It is seen that while poverty in India declined with increasing GDP per capita (LGDPpc), it increased with increasing inequality. Note the rather large co-efficient of Gini, implying a 1 per cent decrease in Gini would have reduced poverty by an additional 2 per cent. These results are fully consistent with the theoretical predictions of equation (1). The rapid decline of poverty since 1998 is seen to be largely the result of high growth of incomes per capita, aided by some decline in the Gini coefficient of inequality. This is despite the contribution of growth being much larger (since GDP per capita has increased over 150 per cent between 1991 and 2010) than that of decline in inequality (which declined by about 10 per cent from about 0.31 to 0.28).

This estimation was also repeated using the monthly per capita consumption (MPCE) data obtained from the same NSSO household surveys used to measure poverty rates. This data directly measures the average income of the same sample of households and is thus more accurate than the GDP per capita, which is a general proxy for per capita income from nationwide GDP calculations. The result should thus be more accurate using the MPCE measure of household income. The results we obtained are given below (t-statistics of coefficients are given in brackets below them and *, ** denote significance at 5 per cent and 1 per cent levels).

¹ It may be noted here that this data on inequality relates to expenditure (or consumption) inequality. It is possible, as some economists have argued, that income inequality may not have declined or even increased while expenditure inequality declined (say, due to welfare support for the poor or because the rich consume a smaller proportion of their income). However, to our knowledge, no reliable data is available on income inequality (probably because true income is often not revealed, especially by the rich—to avoid taxes). In view of this problem, we have used the expenditure inequality data, which we believe is acceptable for poverty-related analysis, since poverty rates are largely calculated from expenditure on consumption data.

$$\text{LHCR} = 8.66 + 1.16 \text{ LGINI} - 2.15 \text{ LMPCE}$$

(3.01*) (1.85*) (-7.54**)

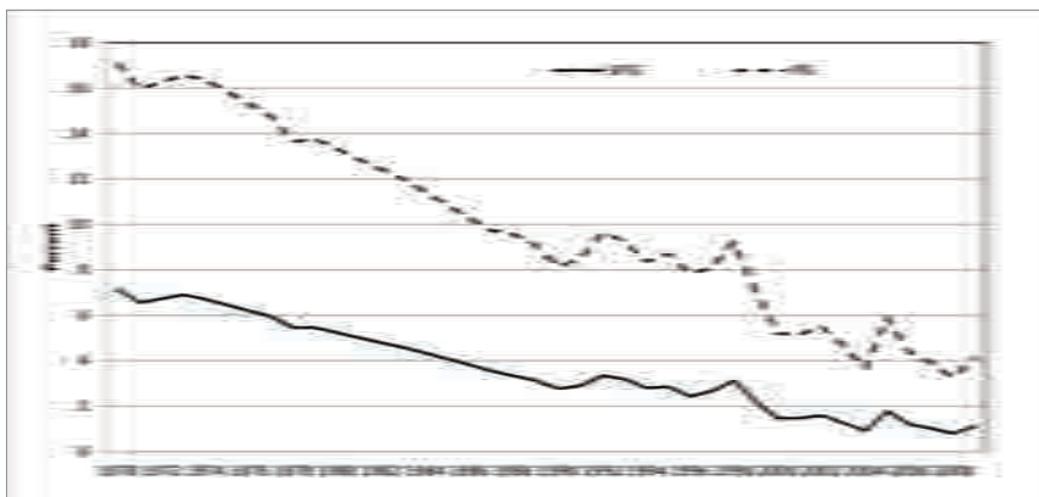
$R^2 = .98$; DW = 2.13; Serial correlation [$t^2(1)$] = 1.41; Functional form [$t^2(1)$] = 3.02

Normality test [$t^2(2)$] = 1.23; Heteroskedasticity [$t^2(1)$] = 7.79

The estimation results show that the coefficient of MPCE and GDPpc came out negative and significant, and that the coefficient of GINI came out positive. This implies that while poverty in India declines with a high GDP per capita and MPCE, it increases with increasing inequality. The coefficient of MPCE came out considerably higher than that of GDPpc, implying that change in the incidence of poverty is more sensitive to change in consumption expenditure than change in total income. Partly, this could also be due to MPCE being a more direct measure of consumer expenditure than GDPpc. Thus, the international evidence that high income and expenditure is associated with declining poverty is found to be equally applicable for India.

Also, that the poverty gap index and the poverty severity index (or squared poverty gap)² had improved further suggests that not only the incidence of poverty but also the condition of the population still under the poverty line improved over the high-growth period of 1970–2010 (Figure 2).

Figure 2 Trend in Poverty Gap (PG) and Squared Poverty Gap (SPG) index



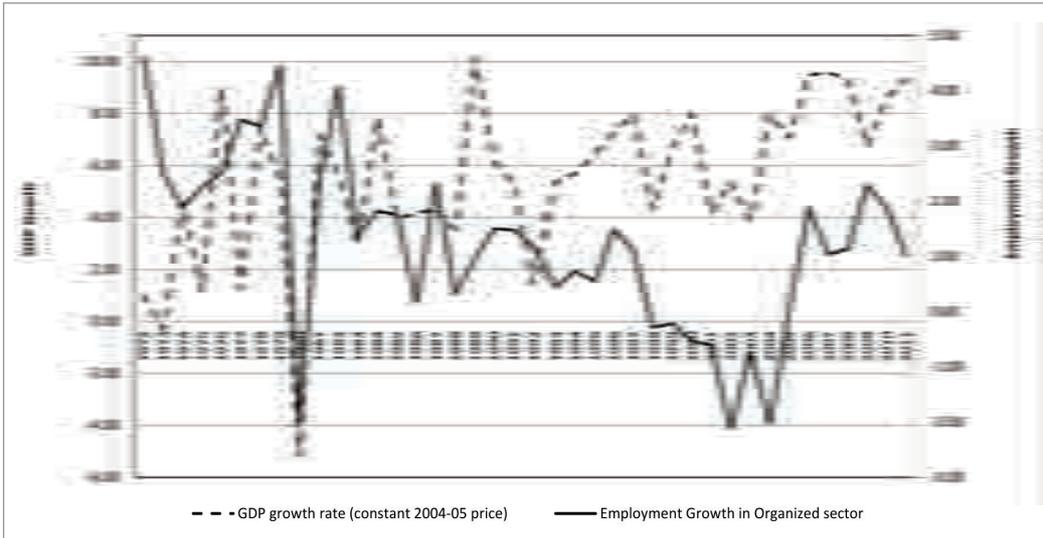
Source: Author's Calculation

² The poverty gap index is a measure of inequality that gauges how far the average income of the poor is below the basic subsistence minimum. The poverty severity index or squared poverty gap shows how poor the poorest of the poor are (see the appendix for definitions).

3.3 Poverty Alleviation, Growth, Employment, and Wages

How does economic growth reduce poverty? The linkage between poverty and growth can be conceptualised as follows: high rates of economic growth lead to sustained increase in production of various goods and services, which require more workers and thus lead to generation of more employment opportunities. With this increased demand for labour, some new workers get employment. At the same time, some workers may be able to get higher wages in their existing occupations, or shift to new occupations, thus also leading to a possible increase in their real wages. Higher levels of earnings can enable workers to spend more on education and skill formation of their children, thus raising the productive capacity of the future workforce, and creating conditions for achieving higher future economic growth. The process would thus complete the virtuous circle of economic growth, leading to poverty reduction via growth of employment and wages, and reduced poverty creating the possibility of further increases in productivity and higher rates of economic growth.

Figure 3 Relation between Growth of Real GDP Per Capita and Growth of Employment in India (1971–2011)



Source: Author's Calculation

Figure 3 plots the growth rates of employment in the organised sector (reliable annual data was not available for the unorganised sector) and of the growth rate of real GDP for 1971–2011. The figure shows a significant correlation between the two variables, and higher GDP growth is generally associated with a faster increase in employment, albeit with an additional negative trend. There appears to be a general decline in organised sector employment, due to structural changes in the economy (including greater use of contractual

labor). We also carried out an econometric analysis of the long run relation between employment growth (EMPLOYgr) and GDP growth (GDPgr) and time trend (T) using the ARDL cointegration procedure. The results were as follows (t-statistics of coefficients are given in brackets below them and *, ** denote significance at 5 per cent and 1 per cent levels):

$$\text{EMPLOYgr} = 3.83 + 0.85 \text{ GDPgr} - 0.17 \text{ T}$$

$$(4.37)** \quad (3.71)** \quad (4.88)**$$

$R^2 = .66$; $DW = 1.93$; *Serial correlation* $[F(1)] = .09$; *Functional form* $[F(1)] = 0.48$

Normality test $[F(2)] = 0.97$; *Heteroskedasticity* $[F(1)] = 1.60$

The results show that various diagnostics tests for a good fit are satisfied. Each 1 per cent additional GDP growth is seen to lead to 0.85 per cent increase in employment in the organised sector, but at the same time, it is seen that there is indeed a significant negative trend in the employment in this sector.

Economic growth results in employment growth, which in turn can lead to increase in real wages as well as the demand for labour increases. Thus, we also analyse the impact of economic growth on real wages as it affects the poverty rate as well as workers' standard of living. Unfortunately, time series data on real wages are not readily available for a long period; we could find data only for 1999–2012 for the real average daily wage rate (for rural unskilled workers averaged over all states). Figure 4 shows that the relationship between the real average daily wage rate for rural unskilled workers and real GDP per capita. The figure shows a close and long-run association between GDP per capita and the wage rate, which suggests that higher GDP growth rate also leads to higher growth in real wages over time as the demand for labour increases.

We also carried out an econometric analysis of the long run relation between log of real wages (LWAGE) and log of real GDP per capita (LRGDPpc) using the ARDL cointegration procedure. The results were as follows (t-statistics of coefficients are given in brackets below them and *, ** denote significance at 5 per cent and 1 per cent levels):

$$\text{LWAGE} = 0.41 \text{ LRGDPpc}$$

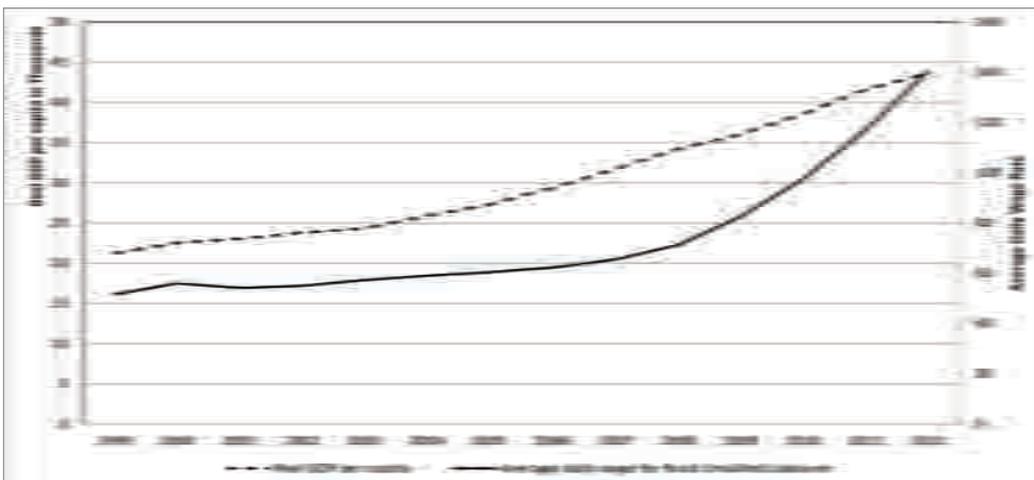
$$(72.98)**$$

$R^2 = .98$; $DW = 2.03$; *Serial correlation* $[F(1)] = .20$; *Functional form* $[F(1)] = 1.81$

Normality test $[F(2)] = 0.71$; *Heteroskedasticity* $[F(1)] = 1.35$

The result show that all diagnostic test for a good fit are satisfied and that each 1 per cent increase in GDP per capita is accompanied by an increase of 0.41 per cent in real wages for unskilled workers.

Figure 4 Trend in Real GDP Per Capita and Average Daily Wage Rate



Source: RBI and Author's Calculation

4 SOCIAL EXPENDITURE, GROWTH, AND POVERTY ALLEVIATION

In this section we examine empirical evidence from India on the impact of increased social expenditure on education, health and welfare on poverty alleviation (Section 4.1), and then consider the role that economic growth plays in enabling increased social expenditure (Section 4.2). The analysis addresses the controversy over the relative importance of economic growth and social expenditure in alleviating poverty.

4.1 Social Expenditure and Poverty Alleviation

One of the important channels through which poverty can be reduced is increased government expenditure on social sectors such as education, health services, and other welfare services for the poor, elderly, widows, etc. (Drèze and Sen 1995; Bhagwati 2001).

The importance of education and health has been strongly emphasised by several economists (see for example, Shultz 1993; Becker 1978 and 1995; Sen 1996). Sen has argued that education and health are among the necessities that give value to human life. Education and health are the basis for work productivity; the capacity to learn; and the capability to grow intellectually, physically, and emotionally. In economic terms, education and health are the two cornerstones of human capital that, as Shultz and Becker have argued, are the basis of an individual's economic productivity.

Education has a clear and comprehensive effect on the quality of life. A society with better quality of education and better access to education for all provides its citizens a better

quality of life and better economic opportunities and, at the same time, reduces poverty and inequality (as many from poorer families also get good education and subsequently are able to live productive lives with high incomes). Thus, an improved education level in a country—other factors being equal—should lead to higher labour productivity, increased GDP, and reduced poverty. Improved education, especially of girls and women, improves their health status as well as of their children and family members. At the same time, education alone is not a panacea for all social problems—for example, not everyone has the same ability for higher education, and all the educated ones may not necessarily be absorbed by the labour market, which could de-motivate people from pursuing education. Therefore, rapid growth is also important to create enough jobs.

Table 1 reports some education indicators from 1990 to 2011.

Table 1 Indicators for Access to and Quality of Education in India

Indicator	1990	1995	2000	2005	2011
Literacy rate, adult total (% of people aged 15 and above)	48.5	54.3	61.1	67.3	74.04
Literacy rate, youth total (% of people ages 15-24)	61.9		76.4	81.1	82.8
School enrollment, primary (% gross)	91.2	94.8	93.8	110.4	111.9
School enrollment, secondary (% gross)	36.8	45.05	45.3	53.8	63.2
School enrollment, tertiary (% gross)	5.8	5.5	9.4	10.8	17.9
Pupil-teacher ratio, primary	43.2	44.4	39.9	40.2	35.2
Pupil-teacher ratio, secondary	38.0	37.1	33.6	32.6	25.3
Average years of schooling	3	3.3	3.6	4	4.4

Data Source: World Development Indicators, 2012

While most of the developed and emerging economies achieved a literacy rate of close to 100 per cent in 2011, India was way behind at 74 per cent, although a long way from 48.5 per cent in 1990. The divide in the case of youth was somewhat smaller, with India being at 81 per cent. In addition to the literacy rate, the average number of years of schooling is an indicator commonly used to measure education attainment. Indians obtained just 4.4 years of schooling on average, which is marginally greater than 3 years in 1990, showing very slow improvement in educating the population. Enrolment rates have significantly improved in elementary education; the gross enrolment ratio (GER) for primary sections grew from 91.2 per cent in 1990 to 111.9 per cent in 2011. The secondary enrollment rate was about 36.8 per cent for India in 1990; it has improved steadily and is now around 63.2 per cent. The tertiary enrollment rate has increased from 6 per cent to 18 per cent over two decades. Nevertheless, by international standards, enrolment at the secondary and tertiary level remains low,

particularly the latter. Teaching staff constitutes a vital aspect of education. The pupil–teacher ratio (PTR), a critical indicator and measure of the quality of education, is excessively high at primary and middle level averaging 35.2 and 25.3 respectively in the year 2011 (Table 1). Thus, it is imperative to lower the PTR and improve the institutional structure of schools and colleges to enhance the quality of education and to make our human resources globally competitive.

Some economists have also argued that ill-health can lead to poverty (especially for those who are only somewhat above poverty line), and have shown that poor health has a negative impact on households' income and economic growth rate (Barro 1996; Mayer 2000; Bhargava 2001). Poor health would reduce a household's capacity to earn income and accumulate wealth by limiting work, raising medical expenses, and reducing savings. Individuals affected by certain diseases, such as tuberculosis and HIV/AIDS, may never develop the capacity to earn enough income to get out of the illness–poverty trap. Moreover, health is increasingly recognised as an attribute of human capital. As such, better health increases the productivity of other forms of capital and contributes to economic growth.

Table 2 reports some real indicators of access to health care from 1990 to 2011. The table shows that generally, medical facilities have remained stagnant over the period. For example, the number of beds per 1000 people has increased marginally from 0.8 beds in 1990 to 0.9 beds in 2011. Similarly, the number of physicians available per 1000 population has also remained stagnant in recent years, increasing marginally from 0.5 to 0.65 from 1990 to 2011. However, overall life expectancy has increased from 58.4 years to 65.5 years during the same period; this improvement is supported with corresponding improvement in access to water and sanitation facilities both in rural and urban areas.

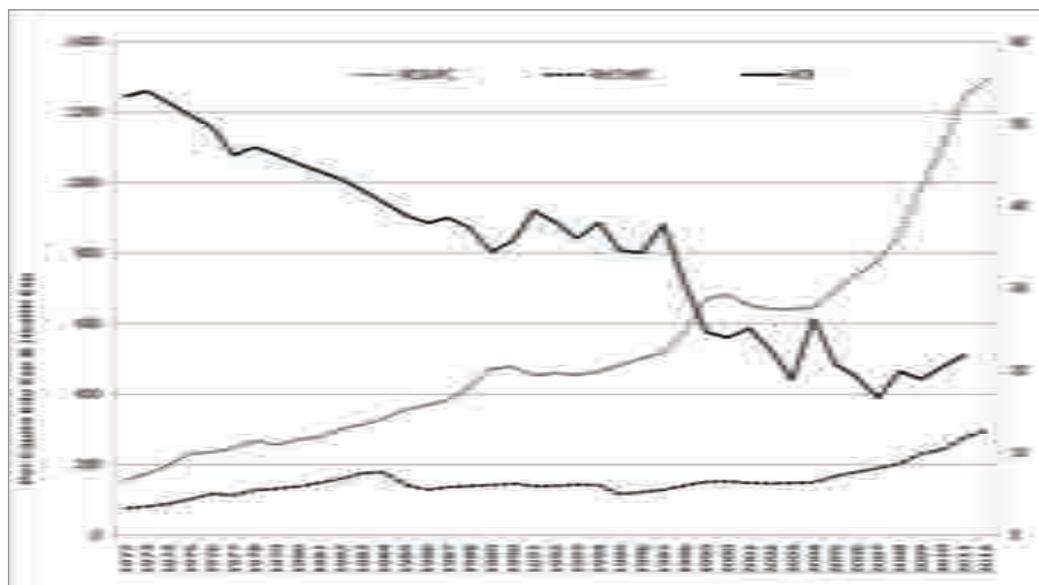
Table 2 Indicators for Access to and Quality of Health in India

Indicators	1990	1995	2000	2005	2011
Life expectancy at birth, total (years)	58.4	59.8	61.6	63.4	65.5
Hospital beds (per 1,000 people)	0.8	0.7	0.7	0.9	0.9
Physicians (per 1,000 people)	0.5	0.5	0.6	0.6	0.65
Improved Water source (% of population with access)	70	76	81.0	86	91.6
Improved Sanitation facilities (% of population with access)	18	21	26.0	30	35.1

Data Source: World Development Indicators, 2012

When we plot HCR against per capita expenditure on education and health, we can see both the plots (Figure 5) exhibit a negative relationship between the two variables, especially since 2004–05, when the government increased the expenditure on both education and health. HCR is highly correlated with the values -0.93 and -0.85 for education and health respectively.

Figure 5 Education and Health Expenditure Per Capita and HCR



Source: EPW Research Foundation and Author's Calculations

To further examine the question whether increased expenditure on social sectors helps to reduce poverty, regression analysis was carried out between the incidence of poverty (*LHCR*) and expenditure on social sectors per capita. Further regressions to check the relative merit of the different types of social expenditure in reducing poverty were also undertaken. One-fifth of the total expenditure on the social sector in India is borne by the central government, and four-fifths by state governments. Therefore, we have included expenditure incurred by both central and state governments in our analysis.

Ideally, we should estimate the relationship between the head count ratio of poverty (HCR) as a function of GDP per capita, Gini coefficient of inequality and with the per capita social expenditure, either total (total social expenditure per capita (TSOCpc)) or its components: education expenditure per capita (EDUpc), health expenditure per capita (HEALTHpc) and other welfare expenditure (WELFAREpc). Thus, using logarithmic functional form (variable names prefixed by L indicate their logarithmic form) the equation to be estimated should be as follows:

$$LHCR = a + bLGINI + cLGDPpc + dLEDUpc + eLHEALTHpc + fWELFAREpc$$

Poverty rate, HCR, would be expected to increase with increasing inequality, so that the coefficient, *b*, of the Gini measure of inequality should be positive. On the other hand, HCR should decline with rising GDP per capita, or rising social expenditures on education, health and welfare. Thus the coefficients of each of these variables, *c*, *d*, *e*, and *f* are expected to have a negative sign. Unfortunately, we found that there was high co-linearity among these social expenditure and GDPpc variables (because rising GDP is accompanied with increase in each of the social expenditures (Figure 6)). The co-linearity problem can lead to estimation problems and unreliable results. Thus, unfortunately, we were unable to estimate the above equation. However, we were able to estimate it one social expenditure variable at a time. This means that while we are unable to determine the individual contribution of each social expenditure, we can at least check that each does contribute to poverty reduction by including them one at a time. Since the results for the case where only Gini and GDPpc were included in the equation were estimated earlier and the coefficient *c* found negative (Section 3.2), here we estimate results with Gini and each of the social expenditures, one at a time as well as with their sum, namely total social expenditure (LTSOCpc).

Table 3 Estimation Result for Social Expenditure

	Model 1	Model 2	Model 3	Model 4
Dependent Variable	LHCR	LHCR	LHCR	LHCR
LGINI	0.57	0.14	0.42	1.40**
LSOCPC	-1.01***			
LEDUPC		-1.06***		
LHLTHPC			-1.40***	
LWELPC				-0.90
C	8.68***	9.75***	9.44***	4.040*
R-Squared	0.86	0.85	0.85	0.86
DW-statistic	1.91	2.22	1.75	2.56
Serial Correlation	0.02	1.45	0.06	3.58
Functional Form	1.05	0.15	0.01	0.74
Normality test	0.62	0.12	0.25	0.43
Heteroscedasticity	0.37	0.15	1.13	0.11

Source: Author's Calculation

The results of the estimation are shown in Table 3. The results show that each of the three variables had a negative sign (meaning increase in each social expenditure-reduced poverty), and the coefficients for total social, education and health expenditure turned out significant at the 1 per cent level of significance, although not the coefficient of expenditure on welfare.

Overall, the results show that the incidence of poverty declines faster if the government increases its expenditure on social services.

These results show that increased expenditure per capita on social sectors, such as education, health and social welfare, are associated with reduced poverty, and as such are highly desirable. The above results suggest the need for increasing expenditure on social sectors in India, especially on education and health, to help reduce poverty and improve human development.

Finally, we compare the expenditure on education and health sectors as a percentage of GDP for India and several other transitional and developed countries. These countries comprise East Asian countries (such as Malaysia, South Korea, Indonesia, Thailand, and the Philippines); the average of Brazil, Russia, China, and South Africa (i.e., BRICS countries other than India); and the average of high income countries (as defined by World Bank). The data are shown in Table 4 below.

It is seen that expenditure on education and health as a share of GDP is considerably lower in India than in other emerging and developed economies. Government expenditure on education was just 3.1 per cent of the GDP and on health was 1.2 per cent in 2010–11, much less than 5.3 per cent and 3.7 per cent in the case of other BRICS countries, and far below the 5.2 per cent and 8.7 per cent for high income countries, where we aspire to reach. Similarly, annual health expenditure per capita in 2010-11, with purchasing power parity adjustments, was just \$141 in India while it was \$432 (about three times) in China, \$678 in East Asia, \$933 in BRICS countries and a whopping \$4680 (about 30 times) in developed countries. The data support the need to increase such expenditure in view of the impact this is likely to make on reducing poverty and promoting human development in India.

Table 4 Public Education and Health Expenditures for Selected Countries, 2010-11

Indicators	India	China	East Asia	BRICS	High Income
Public expenditure on education, total (% of GDP)	3.1	-	4.3	5.3	5.2
Health expenditure, public (% of GDP)	1.2	2.9	2.2	3.7	8.7
Health expenditure, public (% of government expenditure)	8.1	12.5	9.9	11.0	18.4
Health expenditure per capita, PPP (constant 2005 international \$)	141.0	432.0	677.6	933.4	4679.6

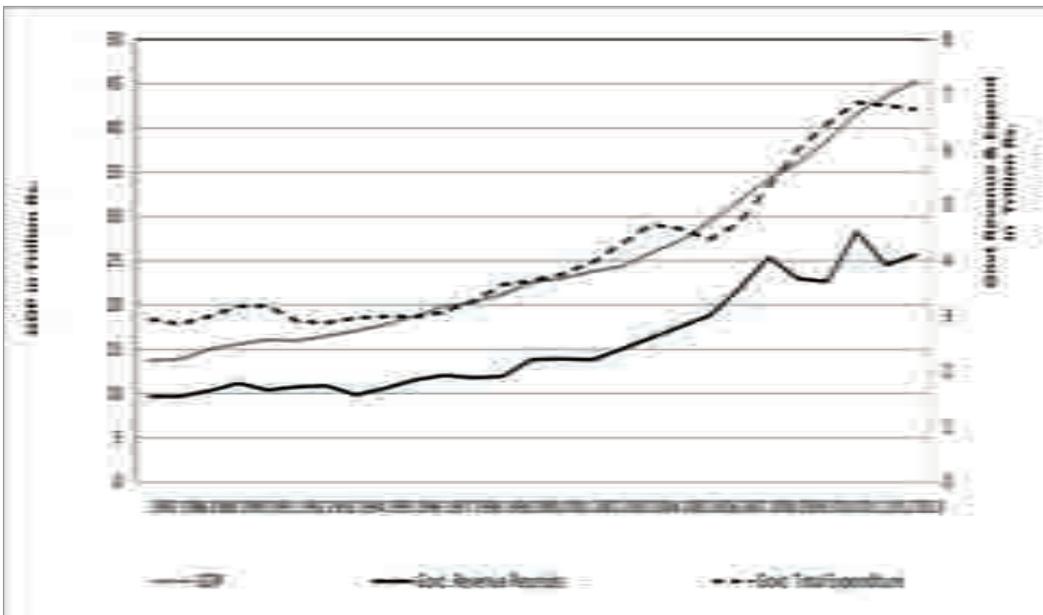
Source: World Development Indicators

Government Revenue and Social Expenditure

We have seen above the importance of social expenditure in poverty alleviation. Next, we consider the role of growth in enabling higher social expenditure. Figure 6 plots India's GDP, government revenue receipts, and government total expenditure in real (constant 2004–05) prices, and demonstrates that GDP growth leads to higher government revenue which, in turn, allows the government to increase its total expenditure and again, in turn, social expenditure. This is evident from Figure 7, which plots the real government total and social expenditure (comprising expenditure on social security and welfare and relief because of natural calamities, education, sports, youth affairs, health and family welfare, water supply and housing, labour and employment). This increased social expenditure on welfare schemes for the poor, subsidised education and health facilities for the poor helps reduce poverty. Thus, the evidence in Figures 6 and 7 show the importance of higher GDP growth as well as good fiscal policy in providing increased social expenditure, which helps to reduce poverty.

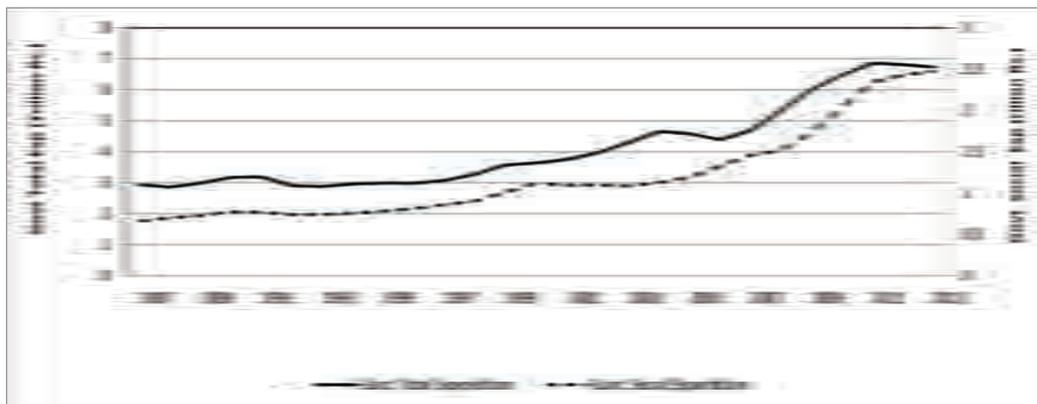
Thus, government policy should always focus on rapid GDP growth. For developing countries like India, this is best achieved with the help of increased expenditure on infrastructure, education and skill formation.

Figure 6 India's GDP and Government Revenue Receipts and Total Expenditure (Real Prices, 2004–05)



Source: EPW Research Foundation's India Time Series Database <http://www.epwrfits.in/>

Figure 7 Government Total and Social Expenditure in Real (2004–05) Prices



Source: EPW Research Foundation's India Time Series Database <http://www.epwrfits.in/>

As government revenues rise with rapid GDP growth, a pro-poor government can increase expenditure on social sectors such as education, health services, infrastructure, and other welfare services for the poor (Bhagwati 2001). The increased social sector spending enhances the opportunities of human development and promotes poverty alleviation in the long run.

Table 5A shows the composition of public spending on the social sectors in India from 1980-81 to 2010-11. When we consider social expenditure as a percentage of GDP, the table shows that the expenditures have remained more or less constant over the last three decades. While the expenditure on education as a percentage of GDP has increased slightly—from 3.1 per cent to 3.6 per cent—expenditure on health has remained in the range of 1 per cent to 1.3 per cent of GDP and on agriculture in the range of 1.6 per cent to 2.2 per cent of GDP. Expenditure on infrastructure declined from 3.9 per cent of GDP in 1980 to 3.5 per cent in 2010. Only the expenditure on anti-poverty programmes increased from 0.9 per cent in 1980 to 2.4 per cent in 2010–11. Overall, the total expenditure on all these social sectors together remained largely constant from 1980 to 2000 at about 11 per cent of GDP. Only in 2010-11, it has shown a significant increase to 13 per cent of GDP.

However, when we look at these expenditures in per capita terms over the same period, a very different picture emerges (see Table 5B). Between 1980 and 2010, the per capita expenditure in all the social sectors has increased at least three times. This reflects the increase in real expenditure in these sectors in alignment with the increase in GDP over these three decades. This again demonstrates the magic of growth: even when social expenditures as share of GDP and as share of total government expenditure stagnated (which is the most likely scenario in most countries, given various pressures on the budget from different sectors), more rapid GDP growth has enabled threefold increases in the per capita social expenditure and helped improve the condition of the poor.

Table 5A Government Social Expenditure as % of GDP, 1980–2010

Govt Social Expenditure as % of GDP	1980–81	1990–91	2000–01	2010–11
Education	3.1	3.3	3.2	3.6
Health	1.1	1.2	1.2	1.3
Agricultural support services	2.1	2.2	1.6	2.2
Infrastructure	3.9	3.1	3.2	3.5
Anti-poverty programmes	0.9	1.2	1.4	2.4
Total	11.1	11	10.6	13

Source: EPW Research Foundation's India Time Series Database <http://www.epwrfits.in/>

Table 5B Government Social Expenditure per Capita, 1980–2010

Govt Social Expenditure per capita	1980–81	1990–91	2000–01	2010–11
Education	457	526	737	1476
Health	162	199	282	519
Agricultural support services	310	354	356	902
Infrastructure	576	505	720	1418
Anti-poverty programmes	133	193	319	982
Total	929	1079	1375	2897

Source: EPW Research Foundation's India Time Series Database <http://www.epwrfits.in/>

This evidence shows that while Sen's (1996) emphasis on social expenditure, especially on education, as a way of reducing poverty is certainly valid, his de-emphasis on growth is certainly not. Indeed, growth is seen to be crucial to enable the government to increase the social expenditure that Sen advocates.

5 CONCLUSIONS

Poverty continues to remain a serious problem in India, with its consequent toll on human welfare in the form of poor health, low levels of education, and a poor quality of life. Unfortunately about 33 per cent of India's population still lives in acute poverty (less than \$1.25 per person per day). Thus, a careful analysis of the determinants of poverty and of various government policies that can help reduce poverty is very desirable. This is the purpose of this paper.

Thus, in this study we empirically examine the various factors that affect the poverty level in India and shows that growth is the key to rapid poverty reduction in India. We show that main factors affecting poverty can be decomposed into the growth of income per capita

and the distribution of income and then undertakes empirical analysis to show that poverty rate declined with growing of GDP per capita and declining inequality of income distribution. However, the impact of growth in GDP per capita (which nearly tripled over the last 20 years) in reducing poverty was much larger than that of reduced expenditure inequality (which declined by about 10 per cent over the same period).

We show that growth reduced poverty by leading to increased employment and higher real wages. Further, both government revenue and expenditure increased considerably in real per capita terms, even while not changing much as a percentage of GDP—this demonstrates the magic of growth. Government revenue, which has tripled since 1993, was used partly to increase expenditure on education, health, and welfare measures. This increased social expenditure has helped reduce poverty, as Sen (1996) had argued. However, the increase in the real social expenditure per capita was made possible by rising government revenues due to rapid growth. In fact, social expenditure as a percentage of GDP or of government revenue has not increased significantly over the past 20 years. Therefore, in the absence of growth, even a very well-meaning government would not have been able to achieve much in terms of increasing social services or reducing poverty.

Our analysis shows that growth is indeed the most crucial element in the fight against poverty by creating increased output and government revenues, increased employment, and higher wages. Government social expenditure on education, health, and welfare, etc. also helps in reducing poverty, but even a well-meaning and pro-poor government can increase social expenditure only with the help of increased tax revenue generated by high growth rates. Thus, in the final analysis, growth should be the paramount concern of government. India's experience of the past five years under the Congress Party-led United Progressive Alliance government—which focused on populist welfare measures, leading to high inflation and slowing growth, followed by a disastrous election loss—is a lesson that other governments will do well to learn.

Another insight emerges from our analysis: given that raising per capita income (or output) is the most crucial factor in reducing poverty, controlling population growth also has a significant role to play in the fight against poverty, at least in a surplus labour economy like India, where the marginal contribution of labour to output is close to zero. The government should, therefore, actively promote smaller family norms and try to move towards a zero-population-growth target for the country at the earliest. Thus, the near abandonment of promoting smaller family norms by the government over the last decade is highly regrettable and needs to be changed.

REFERENCES

- Aghion, Philippe, Caroli,-Eve, Garcia-Penalosa,-Cecilia (1999), Inequality and Economic Growth: The Perspective of the New Growth Theories, CEPREMAP Discussion Paper: 9908, June, pages 87.
- Barro, R. J. (1996). Determinants of economic growth: a cross-country empirical study (No. w5698). National Bureau of Economic Research.
- Benabou-Roland (1996), "Inequality and Growth", *C.E.P.R. Discussion Papers*, CEPR Discussion Papers: 1450.
- Becker, G (1978), "The effects of the State on Family", Centre for Study of Economy and State, University of Chicago.
- Becker, G (1995), "Human Capital and Economic Growth", *Prague-Economic Papers*, September 1995, Vol. 4(3) pp. 223-28.
- Besley, T., & Burgess, R. (2000). Land reform, poverty reduction, and growth: evidence from India. *The Quarterly Journal of Economics*, 115(2), 389-430.
- Bhagwati, J (2001), "Growth, Poverty and Reforms", *Economic and Political Weekly*, march 11, Mumbai.
- Bhargava, A. (2001). Nutrition, health, and economic development: some policy priorities. *Food & Nutrition Bulletin*, 22(2), 173-177.
- Binswanger,-Hans-P and Khandker,-Shahidur-R (1995), "The Impact of Formal Finance on the Rural Economy of India", *Journal-of-Development-Studies*, December 1995, 32(2), 234-62.
- Datt, G., & Ravallion, M. (1998). Farm productivity and rural poverty in India. *The Journal of Development Studies*, 34(4), 62-85.
- Datt, G and M. Ravallion (2002), "Is India's Economic Growth Living the Poor Behind", Mimeo, World Bank, WashingtonD.C.
- Deaton, A and J. Dreze, (2001), "Poverty and Inequality in India: A reexamination", *Economic and Political Weekly*, September 7, Mumbai, pp 3729-3748.
- Deaton, A., & Dreze, J. (2002). Poverty and inequality in India: a re-examination. *Economic and Political Weekly*, 3729-3748.

- Dollar, D. and A. Kraay (2002), "Growth is Good for the Poor", *The Journal of Economic Growth*, Vol 7(3), pp195-205.
- Dreze, Jan and Amartya Sen (1995), 'India: Economic Development and Social Opportunity', New Delhi, Oxford University Press.
- Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. *Oxford Bulletin of Economics and statistics*, 52(2), 169-210.
- Kraay, A. (2004). When is growth pro-poor? Cross-country evidence. International Monetary Fund.
- Myrdal,-Gunnar (1968), *Asian Drama: An Inquiry into the Poverty of Nations*, New York, Pantheon.
- Patnaik, P. (2008). The accumulation process in the period of globalisation. *Economic and Political Weekly*, 108-113.
- Pesaran, M. and Shin, Y. (1999), "An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis" in S. Strom, (ed) *Econometrics and Economic Theory in the 20th*
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, 16(3), 289-326.
- Ravallion, M. and G. Datt (1996), "India's Checkered History in Fight Against Poverty: Are There Lessons for the Future?", *Economic and Political Weekly*, September, pp. 2479-2485.
- Ravallion,-Martin and Datt,-Gaurav (1996), "How Important to India's Poor is the Sectoral Composition of Economic Growth?", *World-Bank-Economic-Review*, 10(1), 1-25
- Schultz, T. Paul. 1993. "Returns to Women's Education," in *Women's Education in Developing Countries: Barriers, Benefits, and Policies*. Elizabeth M. King and Anne M. Hill eds. Baltimore and London: Johns Hopkins University Press for the World Bank, pp. 51-99.
- Sen,-Amartya (1996), "Consumption Externalities and the Financing of Social Services: Comment", In: *Fuchs,-Victor-R., ed. Individual and social responsibility: Child care, education, medical care, and long-term care in America. National Bureau of Economic Research Conference Report series. Chicago and London: University of Chicago Press*, 190-94

Sen, A., & Himanshu. (2004). Poverty and Inequality in India: II: Widening Disparities during the 1990s. *Economic and Political Weekly*, 4361-4375.

Sundaram, K., & Tendulkar, S. D. (2003). Poverty in India in the 1990s: an analysis of changes in 15 major states. *Economic and Political Weekly*, 1385-1393.

Tendulkar,-Suresh-D (1998), "Indian Economic Policy Reforms and Poverty: An Assessment", In: Ahluwalia,-Isher-Judge; *India's economic reforms and development: Essays for Manmohan Singh*. Little,-I.-M.-D., eds. Delhi; Oxford and New York: Oxford University Press, 280-309

World Bank (1993), *'The East Asian Miracle'*, Oxford Press for the World Bank, Washington D.C.

World Bank (1997), *'India, Achievements and Challenges in Reducing Poverty'*, WashingtonD.C.

APPENDIX

A1 Poverty Measurement Issues

The measurement of poverty and inequality is based on the base poverty line and on the distribution of household expenditure from various Consumer Expenditure Surveys by the NSSO. The poverty line specified by the Indian Government has been fixed at monthly per capita expenditure (MPCE) of Rs. 49 for rural areas and Rs. 57 for urban areas in 1973-74 prices. These lines meet the recommended per capita daily intake of 2400 calories for rural areas and 2100 calories for urban areas as per observed NSSO consumption pattern for 1973-74.

Ravallion and Datt (1998) of the World Bank have estimated poverty in India using data from various NSSO rounds for the period 1951 to 1997. In this study, we have updated these estimations up to the latest NSSO survey of 2009-10 following the World Bank methodology using the POVCAL software of the World Bank. The updating of the poverty line is carried out using the adjusted consumer price index for agricultural labourers for the rural poverty line, and for industrial workers for the urban poverty line, with appropriate weights that reflect the consumption pattern of people around the poverty line. Three alternative measures of poverty can be calculated: (1) the head count ratio (HCR), which measures the percentage of population below the poverty line; (2) poverty gap (PG), which measures how far below the poverty line is the average expenditure of the poor in the country; and (3) square of the poverty gap (SPG), or poverty severity index, which gives more weight for the poorest, and thus can be used to examine how the poorest of the poor are doing over time or across districts, states, etc.

The exact formulas for these (Foster-Greer-Thorbeke) measures can be expressed as:

$$P_k = \frac{1}{n} \sum_{i=1}^q (z - y_i / z)^k$$

where z is the poverty line, y_i is the income of various individuals below the poverty line (income gap $z - y_i$ is taken as zero for those above the poverty line), q is the total number of people below the poverty line, n is the total population and k takes the values 0, 1 and 2. The measure P_k reduces to the head count ratio (q/n) when $k=0$, to the poverty gap when $k=1$ and to the poverty severity index when $k=2$.

Official estimates of the extent of poverty, i.e. the head count ratio below the official poverty line, have been the subject of much debate. One commonly cited recent problem relates to the comparability of consumption expenditure estimates over time, especially given the problems with the 1999–2000 survey. The NSSO used a 30-day recall period for expenditure information from its inception in the early 1950s until 1993-94. In 1999-2000 (55th round) survey NSSO collected consumption data on food items using two different

recall periods of 7 days and 30 days from the same households. Critics pointed out that the respondents in the survey overestimated food consumption due to the mix-up of the recall periods. Alternative estimates by Deaton and Drèze (2002) and Sundaram and Tendulkar (2003) show that poverty reduced during the 1990s, but by 5–7 percentage points, lower than the 10-percentage-point official estimate. Sen and Himanshu (2004) make a critical and comprehensive examination of the comparability of the 55th round data with various adjustment procedures and argue that comparable reduction in HCR was lower by about 3 percentage points, at the most; also, they do not rule out the possibility of no reduction.

However, concerns have also been expressed over the determination of the poverty line itself (Patnaik 2005, 2008). The line and method of estimation, determined in 1973 by the Lakdawala Committee, has been extended for subsequent years based on the consumer price indices for agricultural laborers in rural areas and for industrial workers in urban areas. Several criticisms can be directed against such a method: that it does not consider the changing consumption basket of explicit and implicit necessities, including health care and energy costs, and therefore the weights assigned to these commodities; that it no longer bears any relation to actual calorie intake, which was the basis for deriving the original line; and that it does not even always ensure that households at or above the poverty line can purchase sufficient food to meet the calorie requirements at prevailing prices.

Since the 1973–74 poverty lines were adjusted over time to reflect inflation using different inflation indices, they moved in different ways because of different rates of measured inflation in urban and rural areas. For 2004–05, the rural poverty lines appeared much lower than the urban poverty lines. While the all-India rural poverty line was 87 per cent of the all-India urban poverty line in 1973-74, it had come to be only 66 per cent in 2004-05 using the present (Lakdawala) methodology.

In a Gol report published in November 2009, the Tendulkar Committee used a new methodology to show that the actual ratio in 2004-05 was around 76 per cent, and recommended that the rural poverty line should be recomputed to reflect the money value in rural areas of the same basket of consumption associated with the existing urban poverty ratio. Using this methodology, rural poverty is significantly higher than by the Lakdawala methodology (followed in the World Bank calculations and our extension of the same to 2009-10). Given that the official measures of poverty based on the Tendulkar committee methodology is available only for 2009-10, we have used the Lakdawala methodology throughout the 1951-2009 period to get comparable series over the years. Further, it is worth noting that both measures give essentially the same trend in poverty changes. Hence, the difference is not important in understanding the various factors determining poverty reduction.

A2 The Econometric Estimation Procedure (ARDL)

In this study, we estimate the drivers of incidence of poverty using the long run equation derived from auto-regressive distributed lag (ARDL) co-integration procedure proposed by Pesaran et al. (2001). The ARDL model is valid for non-stationary variables as well as for a mixture of I(0) and I(1) variables. Further, we have a small sample size of about 40 annual observations, which is not sufficient for a Johansson and Juselius (1990)-type vector error correction procedure. Thus, the ARDL estimation procedure is appropriate in our case for determining the long-run relation for HCR, GINI, MPCE and social expenditure.

The augmented ARDL model can be written as follows:

$$\alpha(L)y_t = \mu_0 + \beta_i(L)x_{it} + u_t \quad \dots(1)$$

where $\alpha(L) = \alpha_0 + \alpha_1 L + \alpha_2 L^2 + \dots + \alpha_n L^n$; $\beta(L) = \beta_0 + \beta_1 L + \beta_2 L^2 + \dots + \beta_k L^k$; μ_0 is a constant; y_t is the dependent variable; L is the lag operator such that $L^i x_t = x_{t-i}$. In the log-run equilibrium $y_t = y_{t-1} = \dots = y_0$ and $x_{it} = x_{i0}$.

Solving for y , we get the following long-run relation:

$$y = \alpha + \sum b_i x_i + \gamma_t \quad \dots(2)$$

$$\text{where } a = \frac{\mu_0}{\alpha_0 + \alpha_1 + \alpha_2 + \dots + \alpha_n}; b_i = \frac{\beta_{i0} + \beta_{i1} + \beta_{i2} + \dots + \beta_{ik}}{\alpha_0 + \alpha_1 + \alpha_2 + \dots + \alpha_n} \text{ and}$$

$$\gamma_t = \frac{\mu_0}{\alpha_0 + \alpha_1 + \alpha_2 + \dots + \alpha_n}$$

In this procedure, the existence of the long-run relationship is confirmed with the help of an F-test that tests if the coefficients of all explanatory variables are jointly different from zero. Pesaran and Shin (1999) have provided upper and lower critical bound values for an F-test when all or some of the variables are I(1).

The error correction (EC) representation of the ARDL method can be written as follows:

$$\Delta y_t = \Delta \hat{\alpha}_0 - \sum_{j=2}^p \hat{\alpha}_j \Delta y_{t-j} + \sum_{i=1}^k \hat{\beta}_{i0} \Delta x_{it} - \sum_{i=1}^k \sum_{j=2}^q \hat{\beta}_{i,t-j} \Delta x_{i,t-j} - \alpha(1, p) ECM_{t-1} + \mu_t$$

where $ECM_t = y_t - \hat{\alpha} - \sum_{i=1}^k \hat{\beta}_{i0} \Delta x_{it}$ is the first difference operator; $\hat{\alpha}_j$ and $\hat{\beta}_{i,t-j}$ are the coefficients estimated from Eq. 1; and $\alpha(1, p)$ measures the speed of adjustment.

RECENT WORKING PAPERS

Title	Name of Author(s)	Paper No.
Socioeconomic Backwardness Increases Vulnerability to Climate Change: Evidence from Uttar Pradesh	Amarnath Tripathi	E/337/2014
Heat Waves Decrease Labour Supply: Evidence on low-income urban workers in weather-exposed occupations	Saudamini Das	E/338/2014
The Reserve Bank of India's Reaction to Exchange Rate Variation: A time-varying parametric approach	A Vadivel M Ramachandran	E/339/2014
Demand for Price Insurance among Farmers in India: A Choice Experiment-based Approach	Thiagu Ranganathan Sarthak Gaurav Ashish Singh	E/340/2014
Social Capital as Obstacle to Development: Brokering Land, Norms, and Trust in Rural India	Michael Levien	E/341/2014
Boom and Bust? A Political Economy Reading of India's Growth Experience, 1993-2013	Kunal Sen Sabyasachi Kar	E/342/2014
Anomaly in Decision Making Under Risk: Violation of Stochastic Dominance Among Farmers in Gujarat, India	Thiagu Ranganathan Sarthak Gaurav Ashish Singh	E/343/2014
China's Manufacturing Success: Lessons for India	Pravakar Sahoo Abhirup Bhunia	E/344/2014
The Role of Exports in India's Economic Growth	Pradeep Agrawal	E/345/2015
Financing for Health Coverage in India: Issues and Concerns	Indrani Gupta Samik Chowdhury	E/346/2015
Women Police in the City of Delhi: Gender Hierarchies, 'Transgression', and 'Pariah Femininities'	Santana Khanikar	E/347/2015
Bank Regulation, Supervision, and Performance around the World: What has been the Change since the Global Financial Crisis?	Vighneshwara Swamy	E/348/2015



सत्यमेव परमो धर्मः

Institute of Economic Growth
University Enclave, University of Delhi
Delhi 110007, India
Tel: 27667101/288/424; Fax : 27667410
Website : www.iegindia.org