

# Measuring the Impact of Growth and Income Distribution on Poverty in India

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## Abstract

Since the economic reforms of the early 1990s, the Indian economy witnessed a rapid rise in the mean income level and, simultaneously, changes in the distribution of income. This paper tries to capture the effects of these two factors on poverty levels in India. The total change in poverty over the last two decades is decomposed into the change due to a rise in the mean income level and the change due to changes in the distribution of income. The analysis is carried out separately for the rural and urban sectors of major states in India. It is observed that the decline in poverty measured in terms of the headcount ratio, the poverty gap and the squared poverty gap is largely due to the rise in the mean income levels. The changes in the distribution of income adversely affected the poor. The results indicate that, in India, the potential of rapid growth for drastically reducing poverty levels has been undermined by changes in the distribution of income.

JEL classification: D30, I32, R11.

Key words: growth, income distribution, poverty, decomposition, economic reforms, India.

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# 1 INTRODUCTION

India has long faced a problem of widespread poverty. Although reduction of poverty has always been a policy concern, India still has the largest concentration of poor people in the world, with nearly 300 million people living in absolute poverty. In 1993-94, every third person in India still lived in conditions of absolute poverty (Datt 1997), and India had 50% more poor people than the whole of Sub-Saharan Africa (World Bank 2000).

But, unlike other countries suffering from extreme poverty, India has recently been one of the fastest growing economies. In the 1990s, when countries across the world experienced economic slowdown, the per capita GDP in India grew at a high rate of 4% per year. This impressive growth performance is a recent phenomenon, mostly seen during the last two decades. During 1990-91, the country faced a severe macroeconomic crisis, as a response to which the Government undertook several economic reforms. Besides stabilizing the economy, the reforms also brought about structural changes. The economy was liberalized from bureaucratic regulations and free markets were introduced in many fields. The reform policies succeeded in placing the economy on a higher growth path.

However the rapid growth in the 1990s was also accompanied by significant changes in the distribution of income. Some recent studies indicate there was a marked increase in income inequality in the years following the reforms (Deaton & Dreze 2002). Thus, in the last decade, the Indian economy experienced major changes in the level and distribution of income. How did these changes affect the poor in India? Did a rise in the income level reduce poverty? Or did the changes in the distribution of income adversely affect poverty? Which of the two factors affected the poverty levels to a greater extent? This paper attempts to answer these important questions.

In order to separate the impact of a rise in the mean income level from the impact of changes in the distribution of income on poverty, we undertake a decomposition of poverty measures. The decomposition is carried out by estimating two counterfactual poverty levels: i) what would have been the poverty level if only the mean income had changed without any changes in the distribution of income; and ii) what would have been the poverty level if the distribution of income had changed with no change in the mean income level. The paper includes a brief discussion of the various methods of decomposition of poverty changes that one finds in the literature.

A distinct feature of this paper is that the decomposition of the changes in poverty is carried out at the state level. In a vast country like India, there exist sharp economic disparities across regions. The mean income levels, the distributional patterns of income, and the poverty levels differ widely across states. Even within the states, differences are observed between the rural and urban sectors. Poverty is more prevalent in the rural areas where nearly 80% of the poor in India live. The paper considers separately the rural and urban poverty levels across the different states in India. Out of a total of 26 states, it includes 15 major states (Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal)<sup>1</sup> which account for nearly 97% of the total population of the country.

The paper is less concerned with prescription and more concerned with establishing the facts. Our main interest is to find out separately what have been the contributions of growth and changes in the distribution of income to reducing poverty. Since estimates of poverty levels in India have become especially controversial over the last few years, we emphasize our qualitative results, al-

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<sup>1</sup>The states of Bihar, Madhya Pradesh and Uttar Pradesh refer to the ones before the formation of the new states of Jharkhand, Chattisgarh, and Uttaranchal in late 2000.

though we do the best we can to estimate poverty levels as precisely as possible.<sup>2</sup> The analysis of the changes in poverty is carried in the context of the economic reforms. The impact of growth and changes in the distribution of income on poverty is studied over a period of two decades, namely, the pre-reform period from 1983-84 to 1993-94 and the post-reform period from 1993-94 to 1999-2000.<sup>3</sup> Our modest aim in choosing this time frame is to examine whether given the new set of policies, a rise in the mean income level or changes in the distribution of income affected poverty to a greater extent. We do not intend to evaluate the reform policies vis-a-vis alternate competing growth policies. Rather, the intention of the paper is to evaluate how growth and changes in the distribution of income brought about by the reforms, contributed in changing the poverty levels. The results in the paper are positive. They are important in promoting a better understanding of the forces affecting poverty levels and can provide guidelines for future policy decisions.

The paper is presented as follows. Section 2 briefly discusses the various methods for decomposing the changes in poverty and issues regarding these decompositions. Section 3 describes the procedure adopted for estimating various poverty measures and Section 4 contains a short description of the data used for the estimation. The main results of the decomposition of poverty levels across the states in India appear in Section 5. Section 6 concludes. An appendix to the paper contains detailed formulae of various poverty measures used in the analysis.

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<sup>2</sup>To get an idea of the debate regarding exact poverty estimates in India in 1999-2000, refer to Sundaram & Tendulkar (2001), Datt & Ravallion (2002).

<sup>3</sup>The post-reform period covered is shorter than the pre-reform period, as 1999-2000 is the latest year for which data is available.

## 2 DECOMPOSITION OF THE CHANGES IN POVERTY

Income poverty as conventionally defined,<sup>4</sup> can be fully expressed in terms of the level of income relative to a benchmark poverty line and the distribution of income. The poverty level can be written as:

$$P = P(z, m, l) \tag{1}$$

where  $z$  is the poverty line;  $m$  is the mean level of income; and  $l$  is the Lorenz curve.<sup>5</sup> If we keep the poverty line fixed overtime, then at any time  $t$ , poverty will solely depend on the mean income level at time  $t$  and the distribution of income at time  $t$ :

$$P_{tt} = P(m_t, l_t) \tag{2}$$

For example, poverty at time  $t = 0$  will be:

$$P_{00} = P(m_0, l_0) \tag{3}$$

and poverty at time  $t = 1$  will be:

$$P_{11} = P(m_1, l_1) \tag{4}$$

Poverty at time  $t = 0$  will be different from poverty at time  $t = 1$ , most likely, because both the mean income level and the distribution of income have changed

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<sup>4</sup>The concept of income poverty defines the poor as all those people whose income is less than or equal to a certain benchmark income level, called the poverty line.

<sup>5</sup>The Lorenz curve is a standard tool used to characterise the distribution of income and is defined as the relationship between the cumulative proportion of population and the cumulative proportion of income received when the population is arranged in an ascending order of income.

over time. However, one can think of hypothetical situations. If only the mean income had changed from time  $t = 0$  to time  $t = 1$ , with no change in the distribution of income, then poverty would have been:

$$P_{10} = P(m_1, l_0) \tag{5}$$

On the other hand, if only the distribution of income had changed, with no change in the mean income level, then poverty would have been:

$$P_{01} = P(m_0, l_1) \tag{6}$$

The total change in the true or observed poverty levels is given by:

$$P_{11} - P_{00} = P(m_1, l_1) - P(m_0, l_0) \tag{7}$$

The hypothetical poverty levels can be used to decompose the total change in poverty, in several ways. Kakwani and Subbarao (1990) carry out the decomposition in the following way:

$$P_{11} - P_{00} = (P_{10} - P_{00}) + (P_{11} - P_{10}) \tag{8}$$

Jain and Tendulkar (1992) propose an alternative way:

$$P_{11} - P_{00} = (P_{11} - P_{01}) + (P_{01} - P_{00}) \tag{9}$$

The first term on the right hand side of both the equations (8) and (9) denotes the growth component, which gives the change in poverty purely due to a change in the mean income. The growth component in (8) is measured by holding the distribution of income fixed at time  $t = 0$  while the growth component in (9) is

measured by holding fixed the income distribution at time  $t = 1$ . Similarly, the second term in both equations is the distribution component, which gives the change in poverty purely due to changes in the distribution of income holding mean income fixed at time  $t = 1$  in (8) and time  $t = 0$  in (9). The growth component and the distribution component as measured in (8) will differ from the growth and distribution components as measured in (9). As there is no theoretical reason to prefer the base year to the final year as the benchmark, there is no reason to prefer the decomposition in (8) to that in (9) or vice versa.

Datt and Ravallion (1992) criticize the above approach to decomposition on the grounds that the decomposition is not path independent. The reduction in poverty due to a change in the mean income (distribution of income) depends on whether the distribution (mean income) is held fixed at time  $t = 0$  or  $t = 1$ . To make each component path independent they suggest the following type of decomposition:

$$P_{11} - P_{00} = (P_{10} - P_{00}) + (P_{01} - P_{00}) + R \quad (10)$$

where  $R$  is the residual.<sup>6</sup> In this case each parameter is changed holding the other parameter fixed at time  $t = 0$ , in general at a common reference period, thus, making the sequence in which the changes are calculated irrelevant. Unfortunately, this path independence property is obtained at a cost. The decomposition in (10) is partial in the sense that the two components do not add to the total change and contains a residual term. Intuitively, if the total change in poverty can be expressed completely in terms of the change in mean income level and in terms of the change in the distribution of income, then there is no reason why the decomposition should have any residual. The decompositions in

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<sup>6</sup>The residual is the difference between the growth (distribution) components evaluated at the final and initial distribution of income (mean income level). It is important to note that this residual can be either positive or negative, thus representing at times an unexplained part of the decomposition and at other times an overexplained part of the decomposition.

equation (8) and (9) are complete but not path independent; whereas the one in (10) is path independent but has a residual.

Of course, the choice of the method of decomposition depends on the properties one wishes the decomposition to satisfy. In this paper, we choose a decomposition which has both the properties of path independence and completeness. From equations (8) and (9) the total change in poverty can be rewritten as:

$$P_{11} - P_{00} = \frac{\mu(P_{10} - P_{00}) + (P_{11} - P_{01})}{2} + \frac{\mu(P_{11} - P_{10}) + (P_{01} - P_{00})}{2} \quad (11)$$

In the above decomposition we take the average of the two growth components; one gives the change in poverty due to a change in the mean income when distribution is held fixed at time  $t = 0$  and the second gives the change in poverty when distribution is held fixed at time  $t = 1$ . Similarly, we take an average of the two distribution components; one gives the change in poverty due to a change in distribution when the mean income is held fixed at time  $t = 0$  and the other gives the change in poverty when the mean income is held fixed at time  $t = 1$ . Taking averages is a standard practise to make the decomposition path independent (Kakwani 1997, McCulloch et al. 2000, Shorrocks & Kolenikov 2001). It also gets rid of the residual<sup>7</sup> and makes the decomposition complete.

Table I contains an example highlighting the differences in the contribution of growth and distribution of income in reducing poverty, when decomposition is carried out in the several different ways discussed above.

Equation (11) can be compactly rewritten as:

$$\Delta P = \Delta P(m) + \Delta P(l) \quad (12)$$

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<sup>7</sup>Datt & Ravallion (1992) mention it as a possible way to make the residual vanish, in a footnote in their paper.

where  $\Delta P$  is the term on the left hand side of equation (11) and measures the total change in poverty,  $\Delta P(m)$  is the first term on the right hand side of equation (11), and measures the change in poverty purely due to a change in the mean income level, and  $\Delta P(l)$  is the second term on the right hand side of equation (11) and measures the change in poverty purely due to changes in the distribution of income. Table II shows six possible ways in which these two factors can affect the total change in poverty.

For positive growth, the total decline in poverty will be more than proportional to the decline in poverty due to a rise in the mean income level, if the distribution changes also lead to a decline in poverty. On the other hand, the total decline in poverty will be less than proportional to the decline in poverty due to growth if the distribution changes tend to increase poverty levels. In this case the growth component dominates the distribution component and so overall poverty still declines. However, if the distribution component dominates the growth component, overall poverty will rise despite positive growth. Thus the total change in poverty will be in the opposite direction to the change in poverty due to growth. Similarly, there will be three such cases for negative growth. A decline in the mean income level will tend to increase poverty levels but the final change in poverty will also depend upon how changes in distribution affect poverty.

### 3 ESTIMATION PROCEDURE

As discussed in the earlier section, in order to decompose the total change in poverty levels, we need to estimate the true poverty levels not only at different time periods ( $P_{00}, P_{11}$ ) but we also need to estimate the hypothetical poverty levels ( $P_{10}, P_{01}$ ). To estimate the four different poverty levels in each state, for each sector and for each time sub period, an indirect method is used.

Using household income data (details of which appear in the next section) we

estimate Lorenz curves separately for the rural and urban sectors of each states for the years of 1983-84, 1993-94 and 1999-00. A parametric Lorenz curve specification is used from the General Quadratic model suggested by Villasenor and Arnold (1989). The general quadratic form has been widely used to fit Lorenz curves (Datt & Ravallion 1992) and it is especially useful since the headcount poverty ratio can be expressed explicitly in terms of the Lorenz curve parameters. The Lorenz curve parameters are estimated by ordinary least squares regression.<sup>8</sup> A detailed description of the exact form of the Lorenz curve used and the different poverty measures derived from the Lorenz curve is given in the Appendix.

With the estimates of the Lorenz curve parameters and the data on the mean income level, the headcount poverty ratio ( $h$ ) is obtained by using the following relation:

$$l^0(h) = \frac{z}{m} \quad (13)$$

i.e. the slope of the Lorenz curve evaluated at the headcount ratio is equal to the ratio of the poverty line to the mean income level. By inverting the above first order derivative, one can solve for the headcount ratio.

Besides estimating the headcount ratio, two other poverty measures, namely, the poverty gap and the squared poverty gap are also estimated. These poverty measures are most commonly used and can be expressed as special cases of the Foster, Greer and Thorbecke (1984) class of poverty indices:

$$P_\beta = \int_0^z \left( \frac{z-x}{z} \right)^\beta f(x) d(x) \quad (14)$$

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<sup>8</sup>The estimated GQ Lorenz curve fits the data closely with R-squared value around 0.99. The poverty estimates do not vary significantly even with alternative Beta Lorenz curve specification.

where  $x$  is the income level,  $z$  is the benchmark poverty line and  $\beta$  is the parameter of inequality aversion. The head count index of poverty ( $\beta = 0$ ) is the proportion of population having per capita income below the poverty line and denotes the incidence of poverty. The poverty gap index ( $\beta = 1$ ) gives the aggregate income shortfall of the poor as a proportion of the poverty line, capturing the depth of poverty. The squared poverty gap index ( $\beta = 2$ ) is the sum of the squared shortfall of the poor people's income as a proportion of the poverty line and is used to measure the severity of poverty.

## 4 DATA

The primary source of data used to calculate the poverty levels in the different states of India is the quinquennial consumer expenditure surveys conducted by the National Sample Survey Organization (NSSO). The NSSO is a unified agency under the Department of Statistics, Government of India, and is one of the chief agencies providing reliable data since 1972.<sup>9</sup> Although in the discussion throughout the paper income levels are used, the NSSO data is available instead on consumer expenditure levels. In the application, hence, income is replaced by consumption expenditure. The expenditure series is not only more stable than the income series but also the difference between the income and expenditure series narrows down considerably for the poor. The NSSO data used for the rural and urban sector of each State, appears in grouped form with 12 to 14 classes of the average per capita per month consumption expenditure and the percentage of people falling in those expenditure classes.<sup>10</sup>

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<sup>9</sup>The comparability of the 1999-00 data with earlier data rounds is widely debated. The new round differs from the earlier quinquennial rounds as it includes a 7-day and a 365-day recall on certain consumption items, in addition to the usual 30-day recall. In the paper, we use the 30-day recall schedule to estimate poverty, following the Planning Commission of India (2001). Sundaram & Tendulkar (2001) maintain that the 30-day recall schedule of 1999-00 is comparable with the previous rounds observations, while Datt & Ravallion (2002) warn that using this schedule leads to an overestimation of the reduction in poverty in 1999-00.

<sup>10</sup>The NSSO data for 1983-84 and 1993-94 was used from the World Bank Data Set collected for the project "Poverty and Growth in India" by Özler, Datt & Ravallion 1996. The raw data for 1999-00, from the NSSO was made available by UNU/WIDER, Helsinki.

The paper refers to the absolute levels of poverty whereby the chosen poverty lines are kept fixed in real terms for all periods. The poverty lines used are the ones defined by the Planning Commission of India (1979). The Planning Commission followed the “food-energy method” by which the poverty lines correspond to the levels of per capita total expenditure required to attain some basic nutritional norm. For the rural sector, this norm was set at a per capita per day intake of 2400 calories and the corresponding per capita monthly expenditure levels were set at Rs.49 at 1973-74 all India prices. The respective figures for the urban sector were an intake of 2100 calories and a per capita monthly expenditure level of Rs.57. The per capita consumption expenditure for all the three years of the survey is converted into real terms and the values are expressed at all India rural/urban prices in 1973-74.<sup>11</sup>

## 5 RESULTS OF THE DECOMPOSITION

### 5.1 Background

For nearly thirty years, the Indian economy grew slowly, with growth of per capita GDP barely 1.5% per year. However, the economy picked up pace in the 1980s as the per capita growth averaged nearly 3.4% per annum. During the mid-80s a few policy changes were initiated. The exchange rate was made more flexible and controls on industries and investment were lowered. But the new pace of economic growth was unsustainable as it was accompanied by high fiscal and current account deficits. By 1990-91, the country faced a severe macroeconomic crisis. The current account deficit shot up to 3% of

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<sup>11</sup>For the years of 1983-84 and 1993-94, the expenditure levels were converted to the base year values of 1973-74 by using Consumer Price Index for Agricultural Labor (CPIAL) for the rural sector and Consumer Price Index for Industrial Workers (CPIIW) for the urban sector with adjustments made to take into account interstate price differentials (see World Bank data set 1996, for further details). For the year 1999-2000, the expenditure levels were first converted to 1993-94 values by using the Poverty Line Price Index and then further converted to 1973-74 values by using the respective Consumer Price Indices. Since poverty lines in India are updated for price changes overtime, keeping the interstate price differentials fixed, the Poverty Line Price Index very closely resembles the official CPIAL for the rural sector and CPIIW for the urban sector (Deaton & Tarozzi (2000), Deaton (2001)).

the GDP, there was a sharp increase in prices with inflation as high as 13% a year, foreign exchange reserves fell drastically and there was a sudden decline in India's international credit rating. Immediate steps like devaluing the Rupee, borrowing from the IMF and maintaining fiscal austerity were taken to rescue the economy from the payments crisis. In addition to these measures to stabilize the economy, major structural reforms were also introduced. For example, many industries previously reserved for the public sector were now opened to the private sector, exports were given a major impetus, tariffs and other restrictions on imports were eased and privatisation of the banking and financial sectors was initiated. The reforms were successful in setting the economy on a high growth path. From 1993-94 to 1999-00, the average growth of real GDP was as high as 6.7% per year with the service sector growing rapidly at 8.6% per year.

## 5.2 Decline in Poverty Levels

The modest growth in the 1980s was accompanied by a decline in poverty in most of the states (Figure 1, 2). In the early 1990s, immediately after the crisis, when reforms were being introduced, there was a slight increase in poverty levels in the rural parts of some states<sup>12</sup> but this rise in poverty was a temporary phenomenon. By 1993-94, growth in the mean income level resumed pace and in fact accelerated in the following years. As a result, the post-reforms period witnessed a significant decline in poverty. Table III shows that on an average the headcount ratio in this period declined by nearly 30% in the rural sector and by nearly 25% in the urban sector. Other studies using different poverty lines too conclude that poverty declined significantly in the 1990s (Planning Commission of India 1999-00, Deaton & Dreze 2002).

It is even more important to note that in the post-reform period, in most of the states, not only did the headcount ratio decline but the poverty gap and the

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<sup>12</sup>The headcount ratio in the rural areas of Assam, Haryana and Punjab showed a slight increase mainly because 1991-92 was a bad year for agriculture due to poor monsoon rains (Joshi & Little 1996).

squared poverty gap also declined (Table III). In fact, the percentage decline in the poverty gap and the squared poverty gap was larger than the percentage decline in poverty as the headcount ratio. This indicates that growth promoted by the reforms did reach the poorest of the poor. A rise in the mean income level pulled the poor closer to the benchmark poverty line income level. The reduction in the poverty gap and the squared poverty gap refutes the claim by some analysts (Dreze & Sen 2002) that post-reform reduction in poverty was largely seen because in 1993-94 poor households were heavily concentrated near the poverty line and a rise in the per capita income helped them to cross the poverty benchmark. This would have been true only if the headcount ratio of poverty had declined but not the poverty gap and the squared poverty gap. The World Bank Country Study (2000) on India supports our finding that the depth and severity of poverty fell at a faster rate than the headcount ratio.

### 5.3 Importance of Growth in Reducing Poverty

The decomposition of the total change in poverty enables us to go beyond the basic question of whether poverty levels increased or declined. Table III shows that not only did poverty over the two decades decline but a large part of the decline in poverty was brought about by a rise in the mean income levels. The contribution of growth in reducing poverty ( $\Delta P(m)$ ) was much greater than the contribution of the changes in distribution of income ( $\Delta P(l)$ ). Thus a significant decline in poverty was brought about by rising mean income levels.

### 5.4 Impediment of Distribution Changes in Lowering Poverty

#### Comparison over Time

In the pre-reform period, a rise in the mean income level along with changes in the distribution of income led to a decline in poverty levels. Hence in most of the states, the total decline in poverty during this period was more than proportional to the decline in poverty due to growth. However, in the post-reform

period, though the mean income accelerated, the changes in the distribution of income worked against the poor people. The distribution changes tended to increase the poverty levels ( $\Delta P(l) \geq 0$ ). As a result, growth's potential in reducing poverty could not be fully realized and, in most states, the total decline in poverty was less than proportional to the decline in poverty due to growth (Table IV).

Recent evidence confirms that there was a drastic rise in income inequality in the post-reform period (Deaton & Dreze 2002). Also, though the reforms led to an overall rise in the mean income level, there were instances where the structural changes brought about impoverishment among specific occupational groups. For example, a deep recession in the powerloom sector, a serious crisis in the edible oil industry after import tariffs were slashed, periodic bankruptcy among cotton growers, the displacement of traditional fishing by commercial shrimp farms indicate localized temporary disruption of livelihood patterns (Deaton & Dreze 2002). More generally, the pattern of the changes in the level and distribution of income affecting poverty levels varied across rural and urban sectors of the states.

#### Comparison across Sectors

In the post-reforms period, changes in the distribution of income adversely affected the poor in both urban and rural areas of most of the states. The adverse impact was particularly more pronounced in the urban than in the rural sector. In the absence of a rise in the mean income level in the 1990s, changes in the distribution of income would have led to a rise in the headcount poverty ratio on an average by 2% in the rural sector and by more than 8% in the urban sector (Table III). Thus the unequal distribution pattern constrained the rising mean income levels from reducing poverty to a much greater extent in the urban sector as compared to the rural sector. In fact in the urban sector, on an average, the

total decline in poverty in the post-reform period was not significantly different from the decline in poverty in the pre-reform period, despite a rapid rise in the mean income level. A rise in the mean income without any change in the distribution of income would have led to a larger reduction in poverty in terms of the headcount ratio or the poverty gap or the squared poverty gap.

The changes in the distribution of income in the rural areas may be explained by some recent evidence. The real agricultural wages in the 1990s grew at only about 2.5% per year, as compared to 5% per year in the 1980s (Dreze & Sen 2002). Thus the proportionate rise in the income levels of the landless agricultural workers may have been lower than the rise in the average income levels. Besides the landless agricultural workers, the rural poor consist mainly of the casual non-farm workers and the marginal farmers. This class of the rural poor may have suffered in the post-reform period due to a sharp rise in the foodgrain prices in the 1990s as compared to the 1980s (World Bank 2000). These are a few plausible reasons which may explain changes in the distribution of income in the rural sector after the reform. In the urban sector, the distribution changes affected poverty levels even more prominently. Recent work by Banerjee & Piketty (2002) uses income tax records to document very large increases in income among the high income earners in the urban areas. A possible explanation is that the economic reforms promoted increased competition from the private sector by opening up many fields formerly reserved for the public sector. In order to retain skilled labor in the public sector, the salaries of employers in the public sector were raised at a rate of nearly 5% per year (Deaton & Dreze 2002). This may have led to a more than proportional rise in the income levels of the middle and higher class and may have been one of the reasons of the increased inequality in the urban areas. Table III shows that in the post-reform period, in the absence of a rise in the mean income level, the rise in the income inequality in the urban areas would have led to an increase in the poverty levels.

## Comparison among States

The changes in the mean income level, the distribution of income and the resulting changes in the poverty levels differ widely across the different states of India. Table V (A, B, C) documents the decomposition of poverty when measured in terms of the headcount ratio, the poverty gap and the squared poverty gap for the rural and urban sectors, across the different states, over the two time periods.

Throughout the two decades, Punjab and Haryana remained the richest states in terms of the mean income levels. In these two states, not only was the level of poverty one of the lowest but the rate of decline was also one of the fastest. Both the states are predominantly agricultural but in the 1990s, the agricultural sector grew at a slow rate of about 3.3% per year. Nevertheless rural poverty in these states continued to decline rapidly perhaps due to a significant rise in the rural non-farm employment (World Bank 2000).

In contrast to the rich states, Bihar and Orissa continued to be the poorer states with very high levels of poverty. Though poverty levels remained high, the headcount ratio in rural Bihar declined by nearly 26% in the 1990s. However, in Orissa, the decline in the headcount ratio in the 1990s was dismally low as compared to the previous decade. In rural Orissa, in the 1990s headcount ratio declined by only 13% as compared to 30% in the 1980s, while in the urban sectors it declined merely by 8% as compared to 25% in the pre-reform period. There is some evidence of localized impoverishment in the poorer districts of this state due to the destruction of the local environmental base and due to the failure of the state sponsored development programs (Dreze 2001). In both Bihar and Orissa, real agricultural wages grew by less than 2 % in the 1990s (Deaton & Dreze 2002) and changes in the distribution of income adversely affected the rural poor. Also, the responsiveness of poverty to growth in the

non agricultural sector was especially low in these states (Datt & Ravallion 2002).

Among the middle income states, consider the states of Andhra Pradesh, Tamil Nadu and Uttar Pradesh. Throughout the two decades, in the rural sector of these states, the total decline in poverty was more than proportional to the decline in poverty purely due to a rise in the mean income levels. In other words, the changes in the distribution of income led to a decline in the poverty levels in the pre as well as post-reform period. The result gains importance especially because all the three states combined, constitute nearly 30% of the country's population. In terms of the mean income level, Andhra Pradesh performed remarkably well in the 1990s. The economic reforms along with major state level policy initiatives helped Andhra Pradesh become one of the leading states in attracting domestic and foreign investment (World Bank 2000). Unfortunately, during the same period, small sections of the population consisting mainly of local artisans working in handwoven textiles were not able to face competitive markets and were forced into starvation when they lost their means of livelihood (Krishnakumar 2001).

In the post-reform period, states like Gujarat, Karnataka, Maharashtra and West Bengal were among the fastest growing states, with real per capita State Domestic Product growing nearly 5% per year. Consequently, during this period, poverty levels in these states declined significantly. The headcount ratio of poverty, in both the urban and rural sectors of these states declined by more than 30%, except for urban Maharashtra where it declined by about 13%. Better social opportunities provided in these states, may have helped growth reach the poor more effectively and resulted in a rapid decline in the poverty levels (Dreze & Sen 2002). Our results indicate that rural poverty levels in all four states would have declined to a greater extent in the 1990s had there been no change in the distribution of income in these states.

Kerala stands out as a state exhibiting a rapid decline in the poverty gap and the squared poverty gap. In the post-reform period, especially in the rural parts of this state, the income of the poor was pulled closer to the poverty line benchmark income level. Again, growth may have been more effective in reducing poverty in Kerala as compared to other states. This is mainly because Kerala has attained remarkably high levels of life expectancy, literacy and has considerably reduced mal-nutrition, infant mortality (Dreze & Deaton 2002). Performance of the quality of life indicators matters even when poverty is defined narrowly as income poverty. For example, a given rise in the mean income level is most likely to benefit a healthy, well trained labor force to a greater extent than to an ill fed, unskilled labor force.

An important result true for all states, for both the sectors and during both the time periods, is that poverty when measured in terms of the headcount ratio never increased with a rise in the mean income level. This means that a positive growth in the mean income level was never accompanied by a simultaneous rise in the proportion of poor people. However, during the post-reform period, in Assam, there was a rise in the mean income level and a rise in the poverty level in terms of the poverty gap (in the urban areas) and the squared poverty gap (in rural and urban areas). This indicates that during this period, the changes in the distribution of income in Assam, were such that despite the rise in the mean income levels, the poor were pushed further below the poverty line and income inequality within the poor increased.

Thus it is seen that each state had its unique experience in lowering the poverty levels depending on how the changes in the mean income levels and the changes in the distribution of income affected the poor.

## 6 CONCLUSION

In the last decade, India adopted a new set of economic policies. These policies propagated a fast rise in the income levels. As our results indicate, in most of the states, this high growth led to a decline in poverty levels. Poverty declined not only in terms of the headcount ratio but also as the poverty gap and the squared poverty gap. The decomposition of the total decline in poverty further reveals that growth was the single most important factor contributing to the decline in poverty. However this does not mean that changes in the distribution of income were unimportant in determining the poverty levels. In the pre-reform period, the distribution changes in many states contributed to lowering the poverty levels. In the post-reform period, though, the changes in the distribution of income in most states adversely affected the poor. The distribution component put an upward pressure on the poverty levels, especially in the urban sector. As a result, the potential of growth in reducing poverty was not fully realized. Had there been no changes in the distribution of income, the rise in the mean income levels after the reforms, would have reduced poverty to a much greater extent.

The results of the decomposition of the changes in poverty provoke interesting policy questions. Were the changes in the distribution of income in India a necessary evil accompanying the growth process? Or could the distribution changes possibly have been prevented from adversely affecting the poor? In the future, what policies may be able to translate a rapid rise in the mean income level into an even faster decline in poverty levels? The paper motivates further research along these lines.

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Table I Decomposition of the Headcount Ratio  
for rural West Bengal during 1983-84 to 1993-94

Alternate ways of decomposition	Contributions of Growth and Distri.		Residual	Total chg in Pov
Kakwani & Subbarao	-35.35	-8.88		-44.22
Jain & Tendulkar	-46.17	1.95		-44.22
Datt & Ravallion	-35.35	1.95	-10.83	-44.22
Method of Averages	-40.76	-3.46		-44.22

\*all changes in % terms

Table II Different Cases of Changes in Poverty

Growth	Contribution of		Total chng Poverty	Change in Total Poverty vis-a-vis Contribution of Growth
	Growth	Distribution		
	$\Delta P(m)$	$\Delta P(l)$	$\Delta P$	
Positive	(-)	(-)	(-)	more than proportional decline
	(-)	(+)	(-)	less than proportional decline
Negative	(-)	(+)	(+)	change in opposite direction
	(+)	(+)	(+)	more than proportional rise
	(+)	(-)	(+)	less than proportional rise
	(+)	(-)	(-)	change in opposite direction

Table III Average Contribution of Growth and Changes in Distribution of Income in Reducing Poverty

Sector	Poverty Measure	1983-84 to 1993-94			1993-94 to 1999-00		
		Contribution of		Total chng	Contribution of		Total chng
		Growth	Distribution	Poverty	Growth	Distribution	Poverty
		$\Delta P(m)$	$\Delta P(l)$	$\Delta P$	$\Delta P(m)$	$\Delta P(l)$	$\Delta P$
Rural	Headct.	-10.98	-3.42	-14.39	-33.08	1.99	-31.09
	Pov. Gap	-13.91	-12.43	-26.33	-44.45	4.17	-40.29
	Sq.Povgap	-15.60	-19.26	-34.87	-54.66	7.98	-46.67
Urban	Headct.	-25.60	-0.04	-25.64	-33.29	8.30	-24.99
	Pov. Gap	-34.70	-1.55	-36.25	-47.62	11.78	-35.85
	Sq.Povgap	-42.08	-2.85	-44.94	-59.90	14.93	-44.97

\*all changes in % terms

\*averages across the states are taken by using sample size as population wts.

Table IV Number of States Under Different Cases of Changes in Poverty

Sector	Poverty Measures	Time Period*	Changes in Poverty					
			Positive growth			Negative growth		
			more than propor.	less than propor.	opposite direction	more than propor.	less than propor.	opposite direction
Rural	Head count	Pre Post	9 6	2 9		1	2	1
	Poverty gap	Pre Post	10 6	1 9		1	1	2
	Squared pov gap	Pre Post	10 8	1 6	1	1	1	2
Urban	Head count	Pre Post	8 1	7 14				
	Poverty gap	Pre Post	9 3	6 11	1			
	Squared pov gap	Pre Post	10 4	5 10	1			

\*Pre-Reform (1983-84 to 1993-94) & Post-Reform (1993-94 to 1999-00)

Table V. A

## Decomposition of the Headcount Ratio

Rural Sector						Urban Sector									
1983-84 to 1993-94			1993-94 to 1999-00			1983-84 to 1993-94			1993-94 to 1999-00						
states	total chng growth	contribution of distri	states	total chng growth	contribution of distri	states	total chng growth	contribution of distri	states	total chng growth	contribution of distri				
<i>more than proportional decline in poverty*</i>						<i>more than proportional decline in poverty*</i>									
Andhra P	-23.15	-19.74	-3.41	Andhra P	-22.31	-10.98	-11.33	Haryana	-45.01	-19.35	-25.66	West Be	-43.26	-34.54	-8.72
Bihar	-8.20	-8.12	-0.08	Haryana	-59.91	-38.27	-21.64	Karnat.	-21.68	-13.15	-8.53				
Gujarat	-12.32	-3.43	-8.88	Mahara.	-33.79	-27.19	-6.61	Kerala	-46.40	-31.41	-14.99				
Karnat.	-9.55	-2.08	-7.47	Rajast.	-29.84	-23.66	-6.18	Orissa	-25.67	-25.15	-0.52				
Kerala	-28.35	-14.83	-13.51	Tamil N	-45.70	-44.09	-1.62	Punjab	-61.81	-34.65	-27.16				
Madhya P	-14.95	-12.10	-2.85	Uttar P	-33.97	-28.60	-5.37	Rajast.	-19.99	-16.69	-3.30				
Tamil N	-33.75	-32.15	-1.60					Tamil N	-28.82	-24.73	-4.09				
Uttar P	-7.63	-5.70	-1.93					Uttar P	-31.47	-30.14	-1.33				
West Be	-44.22	-40.76	-3.46												
<i>less than proportional decline in poverty*</i>						<i>less than proportional decline in poverty*</i>									
Mahara.	-13.14	-15.45	2.31	Assam	-14.92	-26.30	11.38	Andhra P	-15.18	-19.37	4.20	Andhra P	-27.78	-39.06	11.28
Orissa	-30.18	-30.81	0.63	Bihar	-26.94	-30.28	3.34	Assam	-53.28	-73.64	20.36	Assam	-2.57	-67.68	65.11
				Gujarat	-35.97	-43.96	7.99	Bihar	-21.06	-22.41	1.35	Bihar	-10.06	-26.48	16.42
				Karnat.	-38.48	-42.95	4.46	Gujarat	-27.08	-29.56	2.48	Gujarat	-33.94	-44.08	10.14
				Kerala	-57.20	-60.90	3.69	Madhya P	-17.99	-23.34	5.35	Haryana	-53.65	-62.89	9.24
				Madhya P	-14.98	-15.67	0.68	Mahara.	-6.26	-19.81	13.55	Karnat.	-32.73	-41.00	8.27
				Orissa	-13.56	-25.77	12.21	West Be	-30.83	-32.86	2.03	Kerala	-17.16	-30.88	13.72
				Punjab	-45.78	-51.69	5.91					Madhya P	-22.11	-26.56	4.45
				West Be	-36.01	-64.45	28.44					Mahara.	-13.34	-15.78	2.44
<i>other cases</i>						<i>other cases</i>									
Haryana	31.65	11.83	19.82									Orissa	-8.02	-16.71	8.69
Assam	5.92	11.49	-5.58									Punjab	-64.09	-79.77	15.69
Punjab	2.79	13.46	-10.67									Rajast.	-25.95	-31.88	5.93
Rajast.	-4.60	11.41	-16.01									Tamil N	-40.32	-43.00	2.68
												Uttar P	-8.98	-19.09	10.11

\* all changes in % terms

\* total change in poverty as a proportion of the change in poverty due to mean income

Table V. B

## Decomposition of the Poverty Gap

Rural Sector						Urban Sector									
1983-84 to 1993-94			1993-94 to 1999-00			1983-84 to 1993-94			1993-94 to 1999-00						
states	total chng	contribution of growth	distri	states	total chng	contribution of growth	distri	states	total chng	contribution of growth	distri				
<i>more than proportional decline in poverty*</i>						<i>more than proportional decline in poverty*</i>									
Andhra P	-38.89	-25.47	-13.43	Haryana	-73.85	-46.36	-27.48	Andhra P	-27.94	-27.18	-0.76	Mahara.	-22.40	-21.74	-0.66
Bihar	-23.15	-13.06	-10.09	Kerala	-75.02	-74.34	-0.67	Bihar	-33.46	-32.37	-1.09	Rajast.	-44.79	-43.49	-1.29
Gujarat	-14.83	-4.59	-10.24	Mahara.	-47.28	-34.32	-12.96	Haryana	-59.39	-26.49	-32.90	West Be	-61.58	-48.48	-13.09
Karnat.	-25.03	-2.63	-22.40	Rajast.	-43.85	-29.21	-14.64	Karnat.	-32.52	-17.81	-14.71				
Kerala	-38.38	-19.41	-18.97	Tamil N	-59.24	-57.10	-2.14	Kerala	-63.39	-39.02	-24.37				
Madhya P	-25.88	-16.81	-9.06	Uttar P	-47.95	-37.24	-10.72	Punjab	-80.33	-41.97	-38.37				
Orissa	-48.97	-36.98	-11.99					Rajast.	-32.33	-22.08	-10.25				
Tamil N	-51.36	-40.75	-10.61					Tamil N	-43.81	-32.75	-11.06				
Uttar P	-15.70	-7.92	-7.79					West Be	-46.57	-45.41	-1.15				
West Be	-67.56	-43.98	-23.59												
<i>less than proportional decline in poverty*</i>						<i>less than proportional decline in poverty*</i>									
Mahara.	-16.81	-22.82	6.01	Assam	-1.05	-38.68	37.63	Assam	-81.27	-84.86	3.59	Andhra P	-38.50	-58.40	19.90
				Bihar	-38.62	-43.78	5.16	Gujarat	-29.93	-42.56	12.64	Assam	19.39	-129.85	149.24
				Gujarat	-42.50	-55.40	12.90	Madhya P	-22.32	-34.90	12.59	Bihar	-16.03	-41.85	25.82
				Karnat.	-53.02	-54.79	1.77	Mahara.	-10.25	-25.08	14.83	Gujarat	-46.31	-60.54	14.23
				Madhya P	-21.11	-21.72	0.60	Orissa	-32.39	-36.70	4.30	Haryana	-63.82	-88.47	24.64
				Orissa	-9.85	-36.72	26.87	Uttar P	-41.77	-42.65	0.89	Karnat.	-47.20	-55.10	7.90
				Punjab	-52.69	-74.46	21.77					Kerala	-19.20	-46.30	27.10
				West Be	-39.80	-94.46	54.65					Madhya P	-29.40	-38.64	9.23
<i>other cases</i>						<i>other cases</i>									
Assam	4.18	16.27	-12.09									Orissa	-12.48	-24.94	12.46
Haryana	55.12	18.84	36.28									Punjab	-85.93	-102.28	16.36
Punjab	-16.68	18.00	-34.68									Tamil N	-52.99	-59.43	6.44
Rajast.	-24.55	14.33	-38.89									Uttar P	-22.65	-28.13	5.48

\* all changes in % terms

\* total change in poverty as a proportion of the change in poverty due to mean income

Table V. C

## Decomposition of the Squared Poverty Measure

Rural Sector						Urban Sector									
1983-84 to 1993-94			1993-94 to 1999-00			1983-84 to 1993-94			1993-94 to 1999-00						
states	total chng growth	contribution of distri	states	total chng growth	contribution of distri	states	total chng growth	contribution of distri	states	total chng growth	contribution of distri				
<i>more than proportional decline in poverty*</i>						<i>more than proportional decline in poverty*</i>									
Andhra P	-50.98	-29.80	-21.18	Andhra P	-43.04	-18.31	-24.73	Andhra P	-39.56	-36.23	-3.33	Mahara.	-30.61	-26.67	-3.95
Bihar	-34.44	-15.63	-18.81	Haryana	-82.65	-52.09	-30.55	Assam	-92.98	-62.87	-30.11	Rajast.	-59.41	-51.47	-7.94
Gujarat	-15.44	-5.72	-9.72	Karnat.	-64.53	-63.10	-1.44	Bihar	-43.31	-41.03	-2.28	Uttar P	-35.81	-34.91	-0.90
Karnat.	-36.72	-3.03	-33.68	Kerala	-85.87	-81.13	-4.74	Haryana	-69.68	-50.51	-19.17	West Be	-73.89	-57.75	-16.14
Kerala	-45.17	-23.40	-21.77	Mahara.	-57.34	-39.48	-17.86	Karnat.	-41.11	-23.82	-17.29				
Madhya P	-33.77	-20.29	-13.48	Rajast.	-53.97	-33.33	-20.64	Kerala	-74.29	-45.11	-29.18				
Orissa	-62.65	-39.21	-23.44	Tamil N	-69.62	-66.62	-3.01	Punjab	-89.88	-74.55	-15.33				
Tamil N	-63.16	-45.86	-17.30	Uttar P	-58.45	-43.82	-14.63	Rajast.	-42.99	-33.72	-9.27				
Uttar P	-23.20	-9.67	-13.52					Tamil N	-54.91	-40.52	-14.39				
West Be	-81.07	-43.99	-37.08					West Be	-59.14	-56.60	-2.54				
<i>less than proportional decline in poverty*</i>						<i>less than proportional decline in poverty*</i>									
Mahara.	-17.96	-28.92	10.96	Bihar	-46.67	-52.76	6.09	Gujarat	-31.53	-46.40	14.87	Andhra P	-47.86	-74.72	26.86
				Gujarat	-48.88	-65.97	17.09	Madhya P	-25.50	-42.35	16.84	Bihar	-23.07	-55.04	31.97
				Madhya P	-26.68	-26.74	0.05	Mahara.	-19.87	-21.50	1.63	Gujarat	-57.10	-73.71	16.61
				Orissa	-7.42	-47.45	40.03	Orissa	-37.86	-44.21	6.35	Haryana	-71.80	-111.94	40.14
				Punjab	-58.75	-96.38	37.63	Uttar P	-49.14	-51.27	2.13	Karnat.	-58.58	-65.99	7.42
				West Be	-44.86	-125.97	81.11					Kerala	-22.19	-61.37	39.18
												Madhya P	-36.42	-48.90	12.49
												Orissa	-17.19	-32.07	14.88
												Punjab	-94.54	-112.31	17.76
												Tamil N	-63.27	-72.15	8.88
<i>other cases</i>						<i>other cases</i>									
Assam	0.94	20.01	-19.06	Assam	16.91	-51.90	68.81					Assam	46.10	-232.49	278.59
Haryana	80.92	26.89	54.03												
Punjab	-32.99	21.74	-54.73												
Rajast.	-38.16	16.36	-54.52												

\* all changes in % terms

\* total change in poverty as a proportion of the change in poverty due to mean income

# Appendix

A Lorenz curve is often used to characterize the distribution of income and is defined as the relationship between the cumulative proportion of the population and the cumulative proportion of income received when the population is arranged in an ascending order of income. Empirically, a Lorenz curve can be fitted on a given data set, in several different ways. Villasenor and Arnold (1989) suggested the General Quadratic model. The general quadratic form is given by:

$$ax^2 + bxy + cy^2 + dx + ey + f = 0$$

where  $x$  denotes the cumulative proportion of the population<sup>1</sup> and  $y$  denotes the cumulative proportion of income received. The curves of this class satisfy the properties of a Lorenz curve under the following restrictions:

$$\begin{aligned} f &= 0 \\ e &= -(a + b + c + d) \end{aligned}$$

One can also standardize and assume:

$$c = 1$$

Then the GQ Lorenz curve can be expressed as :

$$y(1 - y) = a(x^2 - y) + by(x - 1) + d(x - y)$$

For fitting income distributions, the appropriate solution for the above equation is:

$$\begin{aligned} y &= \frac{1}{2} \left[ 1 - (bx + e) - \sqrt{\gamma x^2 + \delta x + e^2} \right] \\ \gamma &= b^2 - 4a \\ \delta &= 2be - 4d \end{aligned}$$

---

<sup>1</sup>In the main paper,  $x$  is used to denote income levels.

The parameters of the Lorenz curve can be estimated by ordinary least squares method. Poverty measures can be expressed in terms of the estimated Lorenz curve parameters  $(a, b, d)$  and the mean income relative to the poverty line  $\frac{z}{m}$ . The headcount ratio is given by:

$$h = -\frac{1}{2\gamma} \left[ \delta + r \left( \frac{z}{m} \right)^2 + \frac{a}{b+2} \left( \frac{z}{m} \right)^3 - \frac{r}{b+2} \left( \frac{z}{m} \right)^2 - \gamma \right]^{-\frac{1}{2}}$$

where

$$r = \sqrt{\delta^2 - 4\gamma e^{\frac{1}{2}}}$$

The poverty gap measure can be written as:

$$pg = h - \frac{m}{z} y_h$$

where  $y_h$  corresponds to  $y$  at  $x = h$ . The squared poverty gap measure is given as:

$$spg = 2pg - h - \frac{m}{z} \left[ ah + by_h - \frac{r}{16} \ln \frac{1 - \frac{h}{s_1}}{1 - \frac{h}{s_2}} \right]$$

where

$$s_1 = \frac{r - \delta}{2\gamma}$$

$$s_2 = -\frac{(r + \delta)}{2\gamma}$$

The general quadratic form has been widely used to fit Lorenz curves on the India data (Datt & Ravallion 1992) and it is especially useful for the decomposition analysis, since all the three poverty measures can be expressed explicitly in terms of the Lorenz curve parameters.