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 how these changes affected poverty levels across major states in India. Total change in poverty is decomposed into the change due to a rise in the mean income level and the change due changes in the distribution of income. It is observed that, in India, rapid growth led to a significant decline in poverty though changes in the distribution of income adversely affected the poor."

Key words: growth, income distribution, poverty, decomposition, India.
JEL classification: D30, I32, R11.

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1. INTRODUCTION

The purpose of this paper is to separate the total change in poverty in India over the last two decades, into the change in poverty due to a rise in the mean income level and the change in poverty due to changes in the distribution of income. An important feature of the paper is that the analysis is carried out to study changes in poverty across 15 major states in India, separately for the rural and urban sectors.

India 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, 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. In 1990-91, the country faced a severe macroeconomic crisis, as a response to which the Government undertook several economic reforms. Besides stabilising the economy, the reforms also brought about structural changes. The economy was liberalised 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.

At the risk of emphasizing the obvious, we would like to clarify one point here. The decomposition analysis does not imply that a change in the distribution of income will never lead to a change in the mean income or vice versa. Without denying the possibility of such interdependence between the mean income and the distribution of income, what the decomposition exercise does is this. It gathers together the changes in the mean income arising from all possible sources including changes in the distribution of income and answers the counterfactual question as to what would have been the reduction in poverty given the change in the mean income level and no change in the distribution of income. Similarly, the decomposition exercise gathers together the changes in the distribution of income arising from all possible sources including change in the mean income and answers the counterfactual question as to what would have been the reduction in poverty given the change in the distribution and no change in the mean income level.

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)[i], which account for nearly 97% of the total population of the country.

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.[ii] 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-à-vis alternate competing growth policies nor do our results provide causal explanations. 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 of the decomposition of the changes in poverty indicate that in most of the states a rapid rise in the income levels, especially since the economic reforms, led to a decline in poverty levels. Poverty declined not only as the head count ratio but also as the poverty gap and squared poverty gap. In the pre-reform period, the changes in the distribution of income in many states contributed to lowering the poverty levels. In the post-reform period, however, changes in the

distribution of income in most states adversely affected the poor. During both the periods, growth in income levels was the most important factor contributing to a decline in poverty in India.

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 contains description of the data and the procedure adopted for estimating various poverty measures. The main results of the decomposition of poverty levels appear in Section 4. Section 5 concludes.

2. DECOMPOSITION OF THE CHANGES IN POVERTY

Income poverty as conventionally defined,[iii] 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 $P = P(z,m,l)$ where z is the poverty line; m is the mean level of income; and l is the Lorenz curve.[iv] When poverty line z is kept fixed and there is no ambiguity about it, we shall write the poverty level as simply $P = P(m,l)$. Thus given the poverty line z, poverty at time $t = 0$ will be denoted by $P_{00} = P(m_0,l_0)$ where m_0 denotes the mean income level at time $t = 0$ and l_0 denotes the Lorenz curve at time $t = 0$. Similarly, poverty at time $t = 1$, will be denoted by $P_{11} = P(m_1,l_1)$ and so on. Poverty at time $t = 1$ will be different from poverty at time $t = 0$ most likely because both the mean income level and the distribution of income have changed over time. However, one can think of hypothetical situations. If only the mean income had changed from m_0 to m_1 and the distribution of income was fixed at l_0, then poverty would have been $P_{10} = P(m_1,l_0)$. On the other hand, if only the distribution of income had changed

from l_0 to l_1, and the mean income was fixed at m_0, then poverty would have been

$$P_{01} = P(m_0, l_1).$$

When the mean income changes from m_0 to m_1 and the Lorenz curve changes simultaneously from l_0 to l_1, the total change in poverty is given by:

$$P_{11} - P_{00} = P(m_1, l_1) - P(m_0, l_0) \tag{1}$$

What part of this total change is due to the change in the mean income level and what part is due to the shift in the Lorenz curve? This is an issue of considerable interest. The question can be answered by decomposing the total change in poverty with the help of the hypothetical poverty levels, P_{10} and P_{01}.

Kakwani and Subbarao [1990] carry out the decomposition in the following way:

$$P_{11} - P_{00} = (P_{10} - P_{00}) + (P_{11} - P_{10}) \tag{2}$$

Jain and Tendulkar [1990] propose an alternative way:

$$P_{11} - P_{00} = (P_{11} - P_{01}) + (P_{01} - P_{00}) \tag{3}$$

The first term on the right hand side of each of the equations (2) and (3) denotes the growth component, which gives the change in poverty purely due to the change in the mean income. The growth component in (2) is measured by holding the distribution of income fixed at l_0 while letting the mean income change from m_0 to m_1. The growth component in (3) is measured by holding fixed the income distribution at l_1 and letting the mean income change from m_0 to m_1. Similarly, the second term in each of the equations is the distribution component, which gives the change in poverty purely due to the change in the distribution of income. In equation (2), the distribution component is measured by holding the mean income level fixed at m_1 and changing

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the distribution of income from l_0 to l_1. In equation (3), the distribution component is measured by holding the mean income level fixed at m_0 and changing the distribution of income from l_0 to l_1. In general, the growth component and the distribution component as measured in (2) will differ from the growth and distribution components, respectively, as measured in (3). As there is no theoretical reason to prefer the base year to the final year as the benchmark or vice versa, there is no reason to prefer either of the two decompositions to the other.

Datt and Ravallion [1992] criticise 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:

$$P_{11} - P_{00} = \left(P_{10} - P_{00}\right) + \left(P_{01} - P_{00}\right) + R \qquad (4)$$

where R is the residual. 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 (4) is partial in the sense that the two components do not add to the total change and contains a residual term. 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. 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 residual term does not arise out of a conceptual necessity, rather, it arises due to the particular procedure adopted to

carry out the decomposition. The decompositions in equation (2) and (3) are complete but not path independent; whereas the one in (4) 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 (2) and (3) the total change in poverty can be rewritten as:

$$P_{11} - P_{00} = \left(\frac{(P_{10} - P_{00}) + (P_{11} - P_{01})}{2} \right) + \left(\frac{(P_{11} - P_{10}) + (P_{01} - P_{00})}{2} \right) \tag{5}$$

In the above decomposition we take the average of the two growth components; one of these 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 of them 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 $t = 0$. Taking averages is a standard practice to make the decomposition path independent[v] [Kakwani, 1997, McCulloch et al., 2000, Shorrocks & Kolenikov, 2001]. Shorrocks [1999] shows that this method of decomposition is formally equivalent to the Shapley value solution in cooperative game theory. He points out that this is the only method of decomposition which satisfies the following requirements: i) the decomposition should be path independent; ii) the decomposition should be complete; iii) and the components of the decomposition should be given by the marginal effect of changing one factor, holding constant all the other factors.

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. From 1983-84 to 1993-94, head count ratio of poverty in rural West Bengal declined by 44.22%. The method of averages shows that out of the total change in poverty, 40.76% change was due to the rise in the mean income level, while 3.46% change was due to the change in the distribution of income. The decomposition method followed by Datt and Ravallion [1992] shows that only 35.35% of the total change in poverty was due to growth and 1.95% due to the change in the distribution of income. The remaining 10.83% is unaccounted for, as the residual. This means that nearly 25% of the total change in poverty is left unexplained. The example also highlights path dependence of the decomposition methods given in equations (2) and (3) respectively. Using equation (2), it is seen that poverty would have declined by 8.88% if the distribution of income had changed from 1983-84 to 1993-94, keeping the mean income level fixed at 1993-94. On the other hand, using equation (3), it is seen that poverty would have increased by 1.95% if the distribution of income had changed from 1983-84 to 1993-94, keeping the mean income level fixed at 1983-84. Thus, not only does the magnitude of the effect of the change in the distribution on the change in poverty differ according to the path followed but also the direction of the change in poverty; in one case, the change in the distribution of income leads to a decline in poverty while in the other it leads to an increase in poverty.

3. DATA AND ESTIMATION PROCEDURE

In order to decompose the total change in poverty levels, we need to estimate actual poverty levels P_{00} and P_{11} as well as hypothetical poverty levels P_{10} and P_{01}.

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 Organisation (NSS). The NSS is a unified agency under the Department of Statistics, Government

of India, and is one of the chief agencies providing reliable data since 1972. We use data from the 38th round, 50th round and 55th round of the NSS to estimate poverty levels for the years 1983-84, 1993-94 and 1999-00 respectively.[vi]

There is a growing concern about the comparability of data collected in the 55th round with data collected in the earlier rounds. The 55th round differs from the earlier quinquennial rounds in two respects. In the earlier rounds, data on food expenditure was collected using a recall period of 30 days while in the 55th round data on food expenditure was collected using a recall period of 30 days and 7 days. Data on the non-food expenditure in the previous rounds was published from 30 days recall schedule while that for the 55th round was published from 365 days recall schedule. We estimate poverty levels in 1999-00 by using the 30 days recall schedule of the 55th round for food expenditure and the 365 days recall schedule of the 55th round for the non-food expenditure. The Planning Commission of India (1999) also uses the same schedules of the 55th round to estimate poverty levels in 1999-00.

However it has been argued that the change in the recall schedule may have led to an overestimation of expenditure levels reported in the 55th round and consequently an underestimation of poverty levels in 1999-00. Hence we check the robustness of our decomposition results by lowering the expenditure levels of the 55th round and re-estimating poverty levels for 1999-00. Even after discounting for a possible overestimation in the data, we find that poverty levels in 1999-00 were lower than those in 1993-94. Several alternate methods have been used to make data from the 55th round comparable with data from earlier rounds. Though none of these methods are fool proof, all of them arrive at the same conclusion that there was a non-negligible decline in the poverty rate in India during the 1990s [Datt & Ravallion, 2002, Deaton & Derez, 2002, Planning Commission of India, 1999, Sundaram & Tendulkar, 2003, World Bank, 2000]. As long as poverty levels in 1999-00 are lower than those in 1993-94,

there are no significant changes in the qualitative analysis of the decomposition exercise. All the conclusions in the paper based on the decomposition of the change in poverty remain valid.

The NSS collects data at the household level and converts the household level data to per capita data by using an adult equivalence scale. Data 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. Hence we have to first estimate a Lorenz curve and then use an indirect method to estimate poverty levels. A parametric Lorenz curve is specified 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 head count poverty ratio can be expressed explicitly in terms of the Lorenz curve parameters. The Lorenz curve parameters are estimated by ordinary least squares regression.[vii]

The estimates of the Lorenz curve parameters are used to calculate three standard measures of poverty, namely, the head count ratio, which gives the proportion of population having per capita income below the poverty line and denotes the incidence of poverty; the poverty gap, which gives the average income shortfall of the poor as a proportion of the poverty line, capturing the depth of poverty; and the squared poverty gap, which 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. To estimate poverty at different time periods, the per capita consumption expenditure for all the three years is converted into real terms and the values are expressed at all India rural/urban prices in 1973-74.[viii] Poverty levels in different periods are measured by keeping the poverty line fixed in real terms. The poverty lines used are the ones defined by the Planning Commission of India in 1979, [Planning Commission of India, 1997]. The Planning Commission followed the "food-energy method"' by which the poverty lines correspond to the levels of per capita total expenditure (including food and non-food 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. Note that although in the discussion throughout the paper income levels are used, the NSS data is available instead on consumer expenditure levels. In the application, hence, income is replaced by consumption expenditure.

4. RESULTS OF THE DECOMPOSITION

4.1 Decline in Poverty Levels

The modest growth in the 1980s was accompanied by a decline in poverty in most of the states. 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[ix] 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 II shows that on an average the head count 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, 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 head count ratio decline but the poverty gap and the squared poverty gap also declined (Table II). In fact, the percentage decline in the poverty gap (40% in the rural sector and 36% in the urban sector) and the squared poverty gap (47% in the rural sector and 45% in the urban sector) was larger than the percentage decline in poverty as the head count ratio (30% in the rural sector

and 25% in the urban sector). 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.

4.2 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 II shows that not only did poverty over the two decades decline but also that 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 was much greater than the contribution of the changes in distribution of income. For example, in the pre-reform period, in the rural sector, changes in the mean income levels on an average led to an 11% decline in the head count ratio while changes in the distribution of income led to a 3% decline in the head count ratio. Thus rising mean income levels brought about a significant decline in poverty.

4.3 The Role of Distributional Changes in Reducing 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

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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. 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. For example, in the post reform period, in the urban sector, growth in income led to a decline in the head count ratio of poverty by 33%. But changes in the distribution of income led to a rise in the head count ratio of poverty by only 25% (Table II).

Table III shows the number of states under different cases, in the pre and post reform period. For positive growth, case I represents a more than proportional decline in poverty. Thus in all the states belonging to case I, poverty was lowered not only because of a rise in the mean income level but also due to changes in the distribution of income. Case II represents a less than proportional decline in poverty. In these states, a rise in the mean income level led to a decline in the poverty levels. But changes in the distribution of income led to an increase in poverty. Thus in these states, the impact of growth in reducing poverty was lowered by changes in the distribution of income. Case III represents an extreme situation where despite positive growth, poverty levels rose since changes in the distribution of income adversely affecting the poor were more dominant.

As seen from Table III, there were a large number of states belonging to case I in the pre-reform period. However, in the post-reform period, especially in the urban sector, few states belonged to case I and a majority of states were under case II, meaning thereby, that in the post-reform period changes in the distribution of income put an impediment in lowering poverty levels. Recent evidence confirms that there was a drastic rise in income inequality in the post-reform period

[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 head count poverty ratio on an average by 2% in the rural sector and by more than 8% in the urban sector (Table II). 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. 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 in terms of the head count ratio or the poverty gap or the squared poverty gap.

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 IV (A, B, C) documents the decomposition of poverty when measured in terms of the head count ratio, the poverty gap and the squared poverty gap for the rural and urban sectors, across the different states, over the two time periods.

In both the decades, Punjab and Haryana were 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. For example, Table IV A shows that in the post reform period, the head count ratio in rural Haryana declined by nearly 60% and that in Punjab by nearly 46%.

In contrast, Bihar and Orissa continued to be the poorer states with very high levels of poverty. Though poverty levels remained high, the head count ratio in rural Bihar declined by nearly 26% in the 1990s. But, in Orissa, the decline in the head count ratio in the 1990s was dismally low as compared to the previous decade. In rural Orissa, in the 1990s head count 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.

Among the middle income states, consider the states of Andhra Pradesh, Tamil Nadu and Uttar Pradesh which belong to Case I for all the three poverty measures (Table IV A, B, C). This means that in 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 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 head count 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% (Table IV A). The figures in Table IV A, B, C indicate that rural poverty measured either as the head count ratio, the poverty gap or the squared poverty gap, 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 (Table IV B, C). 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 [Deaton &Dreze, 2002].

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 head count 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. This is seen from Table III, which shows that for positive growth, there were no states under case III when poverty was measured as the head count ratio. 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, changes in the distribution of income in Assam were such that despite a rise in the mean income levels, the poor were pushed further below the poverty line and income inequality within the poor increased.

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.

NOTES:

i 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.

ii The post-reform period covered is shorter than the pre-reform period, as 1999-2000 is the latest year for which data is available.

iii 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.

iv 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.

v Datt & Ravallion [1992] mention it as a possible way to make the residual vanish, in a footnote in their paper.

vi Grouped data of the NSS rounds for 1983-84 and 1993-94 was used from the World Bank Data Set collected for the project "Poverty and Growth in India" by Ozler, Datt & Ravallion [1996]. For 1999-00, raw data from the NSS was made available by UNU/WIDER, Helsinki.

vii 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.

viii 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].

ix 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].

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Table I. Decomposition of the Head Count Ratio using Different Methods

Different Methods of Decomposition	Total Change in Poverty	Contribution of Growth	Contribution of Distribution	Residual
Kakwani & Subbarao	-44.22	-35.35	-8.88	
Jain & Tendulkar	-44.22	-46.17	1.95	
Datt & Ravallion	-44.22	-35.35	1.95	-10.83
Method of Averages	-44.22	-40.76	-3.46	

*Decomposition of the head count ratio for rural West Bengal during 1983-84 to 1993-94.
*All changes in % terms.

Table II. Decomposition of the Change in Poverty Levels for All-India

Sector	Poverty Measure	1983-84 to 1993-94			1993-94 to 1999-00		
		Total Change in Poverty	Contribution of Growth	Contribution of Distribution	Total Change in Poverty	Contribution of Growth	Contribution of Distribution
Rural	Head count	-14.39	-10.98	-3.42	-31.09	-33.08	1.99
	Poverty Gap	-26.33	-13.91	-12.43	-40.29	-44.45	4.17
	Sq. Pov. Gap	-34.87	-15.60	-19.26	-46.67	-54.66	7.98
Urban	Head count	-25.64	-25.60	-0.04	-24.99	-33.29	8.30
	Poverty Gap	-36.25	-34.70	-1.55	-35.85	-47.62	11.78
	Sq. Pov. Gap	-44.94	-42.08	-2.58	-44.97	-59.90	14.93

*Averages across the states are taken by using sample size as population weights.
*All changes in % terms.

Table III. Number of States Under Different Cases of Changes in Poverty

Sector	Poverty Measures	Time Period	Positive Growth			Negative Growth		
			Case I	Case II	Case III	Case I	Case II	Case III
Rural	Head count	Pre–reform	9	2		1	2	1
		Post-reform	6	9				
	Poverty Gap	Pre–reform	10	1		1	1	2
		Post-reform	6	9				
	Sq. Pov. Gap	Pre–reform	10	1		1	1	2
		Post-reform	8	6	1			
Urban	Head count	Pre–reform	8	7				
		Post-reform	1	14				
	Poverty Gap	Pre–reform	9	6				
		Post-reform	3	11	1			
	Sq. Pov. Gap	Pre–reform	10	5				
		Post-reform	4	10	1			

*Pre-reform (1983-84 to 1993-94) & Post-reform (1993-94 to 1999-00).
* Different cases as explained on page 14.

Table IV 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 change	contribution of growth	distri	states	total change	contribution of growth	distri	states	total change	contribution of growth	distri	states	total change	contribution of growth	distri
Case I								**Case I**							
Andhra	-23.15	-19.74	-3.41	Andhra	-22.31	-10.98	-11.33	Haryana	-45.01	-19.35	-25.66	W Beng	-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 I	-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				
W Beng	-44.22	-40.76	-3.46												
Case II								**Case II**							
Mahara.	-13.14	-15.45	2.31	Assam	-14.92	-26.30	11.38	Andhra	-15.18	-19.37	4.20	Andhra	-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 I	-17.99	-23.34	5.35	Haryana	-53.65	-62.89	9.24
				Madhya I	-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	W Beng	-30.83	-32.86	2.03	Kerala	-17.16	-30.88	13.72
				Punjab	-45.78	-51.69	5.91					Madhya I	-22.11	-26.56	4.45
				W Beng	-36.01	-64.45	28.44					Mahara.	-13.34	-15.78	2.44
												Orissa	-8.02	-16.71	8.69
Other Cases												Punjab	-64.09	-79.77	15.69
Haryana	31.65	11.83	19.82									Rajast.	-25.95	-31.88	5.93
Assam	5.92	11.49	-5.58									Tamil N	-40.32	-43.00	2.68
Punjab	2.79	13.46	-10.67									Uttar P	-8.98	-19.09	10.11
Rajast.	-4.60	11.41	-16.01												

* All changes in % terms

Table IV 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 change	contribution of growth	distri	states	total change	contribution of growth	distri	states	total change	contribution of growth	distri	states	total change	contribution of growth	distri
Case I								**Case I**							
Andhra	-38.89	-25.47	-13.43	Haryana	-73.85	-46.36	-27.48	Andhra	-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	W Beng	-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 I	-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					W Beng	-46.57	-45.41	-1.15				
W Beng	-67.56	-43.98	-23.59												
Case II								**Case II**							
Mahara.	-16.81	-22.82	6.01	Andhra	-38.5	-58.396	19.896	Assam	-81.27	-84.86	3.59	Andhra	-38.50	-58.40	19.90
				Assam	-1.05	-38.68	37.63	Gujarat	-29.93	-42.56	12.64	Assam	19.39	-129.85	149.24
				Bihar	-38.62	-43.78	5.16	Madhya I	-22.32	-34.90	12.59	Bihar	-16.03	-41.85	25.82
				Gujarat	-42.50	-55.40	12.90	Mahara.	-10.25	-25.08	14.83	Gujarat	-46.31	-60.54	14.23
				Karnat.	-53.02	-54.79	1.77	Orissa	-32.39	-36.70	4.30	Haryana	-63.82	-88.47	24.64
				Madhya I	-21.11	-21.72	0.60	Uttar P	-41.77	-42.65	0.89	Karnat.	-47.20	-55.10	7.90
				Orissa	-9.85	-36.72	26.87					Kerala	-19.20	-46.30	27.10
				Punjab	-52.69	-74.46	21.77					Madhya I	-29.40	-38.64	9.23
				W Beng	-39.80	-94.46	54.65					Orissa	-12.48	-24.94	12.46
Other Cases												Punjab	-85.93	-102.28	16.36
Assam	4.18	16.27	-12.09									Tamil N	-52.99	-59.43	6.44
Haryana	55.12	18.84	36.28									Uttar P	-22.65	-28.13	5.48
Punjab	-16.68	18.00	-34.68												
Rajast.	-24.55	14.33	-38.89												

* All changes in % terms

Table IV 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 change	contribution of		states	total change	contribution of		states	total change	contribution of		states	total change	contribution of	
		growth	distri			growth	distri			growth	distri			growth	distri
Case I								**Case I**							
Andhra	-50.98	-29.80	-21.18	Andhra	-43.04	-18.31	-24.73	Andhra	-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	W Beng	-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 I	-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				
W Beng	-81.07	-43.99	-37.08					W Beng	-59.14	-56.60	-2.54				
Case II								**Case II**							
Mahara.	-17.96	-28.92	10.96	Bihar	-46.67	-52.76	6.09	Gujarat	-31.53	-46.40	14.87	Andhra	-47.86	-74.72	26.86
				Gujarat	-48.88	-65.97	17.09	Madhya I	-25.50	-42.35	16.84	Bihar	-23.07	-55.04	31.97
				Madhya I	-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
				W Beng	-44.86	-125.97	81.11					Kerala	-22.19	-61.37	39.18
												Madhya I	-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
Other Cases								**Other Cases**							
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

Considering the restriction on the length of the paper, the following appendices and the results there in are submitted for the referee's review only.

APPENDIX A1.

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 grouped data set, in several different ways. Villasenor and Arnold (1989) suggested the General Quadratic model:

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

where x denotes the cumulative proportion of the population and y denotes the cumulative proportion of income received. For fitting income distributions, the appropriate solution for the above equation is:

$$y = \frac{1}{2}\left(-(bx+e) - (\gamma x^2 + \delta x + e^2)^{\frac{1}{2}}\right)$$

$$\gamma = b^2 - 4a$$

$$\delta = 2be - 4d$$

The parameters of the Lorenz curve can be estimated by ordinary least squares method. With the estimates of the Lorenz curve parameters and the data on the mean income level, the head count poverty ratio (h) is obtained by using the relation $l'(h) = z/m$ i.e. the slope of the Lorenz curve evaluated at the head count 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 head count ratio as follows:

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

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

The poverty gap measure can be written as $pg = h - (m/z)y_h$ where $y_h = y$ evaluated at $x = h$. The squared poverty gap measure is given as

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

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

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

APPENDIX A2.

The 55th round differs from the earlier quinquennial rounds in two respects. In the earlier rounds, data on food expenditure (includes expenditure on food, paan, tobacco and intoxicants) was collected using a recall period of 30 days while in the 55th round data on food expenditure was collected using a recall period of 30 days and 7 days. In order to maintain consistency with the earlier rounds, we use the 30 days recall schedule of the 55th round.[1] Data on non-food expenditure (includes expenditure on clothing, footwear, durables, education, and health care) in the previous rounds was published from 30 days recall schedule while that for the 55th round was published from 365 days recall schedule. However expenditure on non-food items accounts for merely 1/5 of the total expenditure [Datt & Ravallion, 2002]. It is unlikely that overall expenditure on non-food items was overestimated by more than 10%. Thus, even by generous measures, total expenditure levels in the 55th round would have been overestimated by about 2% to 3%.

The change in the recall period may also have led to an underestimation of inequality in expenditure levels [Sundaram & Tendulkar, 2003]. If this is true, it further reinforces our conclusion that a rise in inequality in 1999-00 adversely affected the poverty levels. However, since there is no accurate information as to what extent does the overestimation of expenditure levels vary across different fractiles of the population, we assume that overestimation of expenditure levels was uniform across different expenditure intervals.

We recalculate the poverty estimates for 1999-00 and the components of decomposition of the total change in poverty, by lowering the mean expenditure levels by 2% and 4%. As seen from Table, the values of the change in the head count ratio of poverty certainly vary as the mean expenditure levels are lowered. But poverty levels for all states in both the sectors continue to be lower in 1999-00 as compared to 1993-94. As long as poverty levels in 1999-00 are lower than those in 1993-94, there are no significant changes in the qualitative analysis of the decomposition exercise. All the conclusions in the paper based on the decomposition of the change in poverty remain valid.

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[1] It has been argued that since the 30 days and 7 days recall columns appeared on the same pages of a single questionnaire, respondents may have tried to reconcile the values in both the schedules. As a result, expenditure levels in the 30 days recall schedule may have been overestimated. However, Sundaram & Tendulkar [2003] use data from the Employment-Unemployment Surveys and argue that the 30 day recall numbers on food expenditure from the 1999-00-expenditure survey are comparable with previous rounds.

Decomposition of the Change in the Head Count Ratio from 1993-94 to 1999-00								
	Rural Sector					Urban Sector		

Results used in the paper without changing the 55th round data

states	total change	contribution of growth	distri	states	total change	contribution of growth	distri
Andhra P	-22.31	-10.98	-11.33	Andhra P	-27.78	-39.06	11.28
Assam	-14.92	-26.30	11.38	Assam	-2.57	-67.68	65.11
Bihar	-26.94	-30.28	3.34	Bihar	-10.06	-26.48	16.42
Gujarat	-35.97	-43.96	7.99	Gujarat	-33.94	-44.08	10.14
Haryana	-59.91	-38.27	-21.64	Haryana	-53.65	-62.89	9.24
Karnataka	-38.48	-42.95	4.46	Karnataka	-32.73	-41.00	8.27
Kerala	-57.20	-60.90	3.69	Kerala	-17.16	-30.88	13.72
Madhya P	-14.98	-15.67	0.68	Madhya P	-22.11	-26.56	4.45
Maharash	-33.79	-27.19	-6.61	Maharash	-13.34	-15.78	2.44
Orissa	-13.56	-25.77	12.21	Orissa	-8.02	-16.71	8.69
Punjab	-45.78	-51.69	5.91	Punjab	-64.09	-79.77	15.69
Rajasthan	-29.84	-23.66	-6.18	Rajasthan	-25.95	-31.88	5.93
Tamil Nadu	-45.70	-44.09	-1.62	Tamil Nadu	-40.32	-43.00	2.68
Uttar P	-33.97	-28.60	-5.37	Uttar P	-8.98	-19.09	10.11
W Bengal	-36.01	-64.45	28.44	W Bengal	-43.26	-34.54	-8.72

Results if mean expenditure in the 55th round is lowered by 2%

states	total change	contribution of growth	distri	states	total change	contribution of growth	distri
Andhra P	-17.06	-5.69	-11.37	Andhra P	-23.94	-35.22	11.28
Assam	-10.40	-21.44	11.04	Assam	6.87	-57.82	64.69
Bihar	-23.49	-26.82	3.33	Bihar	-6.44	-22.84	16.40
Gujarat	-31.89	-39.96	8.07	Gujarat	-29.97	-40.21	10.23
Haryana	-56.81	-34.90	-21.90	Haryana	-49.31	-58.22	8.91
Karnataka	-34.71	-39.30	4.60	Karnataka	-29.10	-37.54	8.44
Kerala	-53.78	-57.71	3.93	Kerala	-12.84	-26.52	13.68
Madhya P	-11.04	-11.71	0.67	Madhya P	-18.67	-23.04	4.37
Maharash	-30.36	-23.80	-6.56	Maharash	-10.12	-12.63	2.51
Orissa	-9.30	-21.36	12.07	Orissa	-4.64	-13.35	8.70
Punjab	-41.13	-46.69	5.56	Punjab	-55.91	-72.26	16.36
Rajasthan	-25.59	-19.57	-6.02	Rajasthan	-21.32	-27.52	6.20
Tamil Nadu	-42.31	-40.66	-1.65	Tamil Nadu	-37.05	-39.67	2.62
Uttar P	-30.08	-24.76	-5.32	Uttar P	-4.86	-15.11	10.24
W Bengal	-31.70	-60.33	28.63	W Bengal	-38.85	-30.08	-8.77

Results if mean expenditure in the 55th round is lowered by 4%

states	total change	contribution of growth	distri	states	total change	contribution of growth	distri
Andhra P	-11.51	-0.12	-11.39	Andhra P	-19.97	-31.23	11.26
Assam	-5.72	-16.36	10.65	Assam	16.70	-47.53	64.23
Bihar	-19.97	-23.28	3.31	Bihar	-2.74	-19.09	16.35
Gujarat	-27.53	-35.68	8.14	Gujarat	-25.82	-36.14	10.32
Haryana	-53.49	-31.33	-22.16	Haryana	-44.72	-53.27	8.56
Karnataka	-30.74	-35.47	4.73	Karnataka	-25.31	-33.91	8.60
Kerala	-50.17	-54.34	4.16	Kerala	-8.34	-21.95	13.61
Madhya P	-6.95	-7.61	0.65	Madhya P	-15.10	-19.39	4.29
Maharash	-26.77	-20.26	-6.51	Maharash	-6.80	-9.37	2.58
Orissa	-4.86	-16.75	11.89	Orissa	-1.17	-9.88	8.71
Punjab	-36.19	-41.37	5.18	Punjab	-47.32	-64.36	17.04
Rajasthan	-21.13	-15.29	-5.84	Rajasthan	-16.50	-22.97	6.47
Tamil Nadu	-38.74	-37.05	-1.69	Tamil Nadu	-33.64	-36.20	2.56
Uttar P	-26.00	-20.75	-5.26	Uttar P	-0.63	-10.99	10.36
W Bengal	-27.17	-55.96	28.79	W Bengal	-34.25	-25.43	-8.82

* Only for urban sector in Assam does the head count ratio increase with lowering of expenditure levels
* All changes in % terms