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Why Have Some Indian States Done Better Than Others at Reducing Rural Poverty?

Experience in India suggests that reducing rural poverty requires both economic growth (farm and nonfarm) and human resource development.

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Summary findings

The unevenness of the rise in rural living standards in the various states of India since the 1950s allowed Datt and Ravallion to study the causes of poverty.

They modeled the evolution of average consumption and various poverty measures using pooled state-level data for 1957–91.

They found that poverty was reduced by higher agricultural yields, above-trend growth in nonfarm output, and lower inflation rates. But these factors only partly explain relative success and failure in reducing poverty.

Initial conditions also mattered. States that started the period with better infrastructure and human resources — with more intense irrigation, greater literacy, and lower infant mortality rates — had significantly greater long-term rates of consumption growth and poverty reduction.

By and large, the same variables that promoted growth in average consumption also helped reduce poverty. The effects on poverty measures were partly redistributive in nature. After controlling for inflation, Datt and Ravallion found that some of the factors that helped reduce absolute poverty also improved distribution, and none of the factors that reduced absolute poverty had adverse impacts on distribution.

In other words, there was no sign of tradeoffs between growth and pro-poor distribution.

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Why have some Indian states done better than others at reducing rural poverty?

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1 Introduction

A key to sound development policy-making may lie in understanding why some economies have performed so much better than others in escaping absolute poverty.[1] One can postulate factors which could explain why, including differences in technical progress, public spending, macroeconomic stability, and initial endowments of physical and human wealth.[2] A large literature has emerged aiming to test such explanations for cross-country and inter-regional differences in the rate of economic growth.[3] Though it has not, to our knowledge, been done yet, the same approach could also be applied to cross-country differences in (say) the rates of change in poverty relative to some agreed international poverty line.

There are, however, problems in using cross-country data for this purpose, not least of which is the lack of comparable survey data for tracking progress in raising household living standards and reducing absolute poverty. Changes over time in survey methods and differences between countries in survey-data and sources for right-hand side variables have been a long-standing concern in applied work (Deaton, 1995). But for one large developing country one can assemble a long time series of reasonably comparable household surveys for its composite states (some of which are larger than most countries) as well as reasonably comparable explanatory variables. That country is India.

The regional disparities in levels of living in India are well-known.[4] For instance, the proportion of the northeastern state of Bihar's rural population living in poverty around 1990 was about 58%, more than three times higher than the proportion (18%) in rural northwestern Punjab and

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[1] For evidence on differences across countries in rates of poverty reduction see World Bank (1990, Chapter 3).

[2] Recent theories of economic growth have suggested a potentially rich menu of such factors. For a reviews of the theory of growth see Barro and Sala-i-Martin (1995) and Hammond and Rodriguez-Clare (1993).

[3] For a survey see Sala-i-Martin (1994).

[4] See Nayyar (1991), Choudhry (1993), and Datt and Ravallion (1993).

Haryana. (We describe how we have estimated these numbers later.) Some of these differences have persisted historically; for example, Punjab-Haryana also had the lowest incidence of rural poverty around 1960. However, looking back over time the more striking—though often ignored—feature of the Indian experience has been the markedly different rates of progress between states; indeed the ranking around 1990 looks very different to that 35 years ago, as can be seen in Figure 1. For example, the southern state of Kerala moved from having the second highest incidence of rural poverty around 1960 to having the fifth lowest around 1990.

This paper tries to explain the relative successes and failures at poverty reduction evident in Figure 1. We focus on the rural sector because that is where three-quarters of India's poor live (Ravallion and Datt, 1996). Much discussion, and debate, has centered on a number of questions concerning the determinants of poverty in this setting,[5] including the extent to which agricultural growth "trickles down" to the rural poor (many of whom have little or no land of their own), the poverty impact of growth in the non-farm sector, and the extent to which economy-wide variables (such as the rate of inflation and the level of public spending) matter to the rural poor. Questions have also been raised about the extent to which initial investments in infrastructure and human resources pay off in the longer term through higher household welfare, and what "handicap" regions with initially poor infrastructure face in catching up to other regions. We aim to throw new light on these and related questions.

The following section outlines our methodology. After discussing our data and the measures of living standards used, section 3 describes how overall progress in raising rural living standards has varied across states of India. Section 4 then tries to explain the variation over time and across states. Some conclusions are offered in the final section.

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[5] For a review of the literature on these and related topics see Lipton and Ravallion (1995).

2 Modelling progress in reducing poverty

2.1 Motivation

We assume that each region of the economy has a deterministic trend rate of progress in reducing poverty but that there are also period-to-period deviations from the trend. The measured level of poverty is P_{it} for state i at date t. The observed rate of change over time in P_{it} is simply the sum of the deviation from trend plus the trend. The expected value of the trend rate of progress for region i is given by $\gamma' X_i$ where X_i is a vector of regional characteristics, comprising initial conditions (notably the endowments of physical and human infrastructure) and trends in other relevant time-dependent variables (capturing the effects of such factors as technological progress and public spending). The deviation from trend is $\pi'(\Delta \ln Y_{it} - r_i^Y)$ (in expectation), where Y_{it} is a vector of (positive) time-varying exogenous variables with trend (compound) rates of growth of r_i^Y also included in the vector X_i. The rate of progress in reducing poverty is then

$$\Delta \ln P_{it} = \pi'(\Delta \ln Y_{it} - r_i^Y) + \gamma' X_i + residual_{it} \tag{1}$$

Notice that some variables may be common to both the deviation from trend and the trend. For example, agricultural yields may matter in two ways: a higher trend rate of yield growth due to technical progress in agriculture will presumably raise the trend rate of poverty reduction and so the trend in yield will appear significant in the X_i vector, while fluctuations in yield due to the vagaries of the weather would appear in the first term on the right hand side of (1). And the two could have very different effects; if, for example, the poor are well insured against bad weather then the relevant π coefficient could be small, yet the corresponding γ coefficient could be large.

"Growth regressions" such as (1) have been widely used in investigations of the determinants of cross-country and regional differences in growth rates of average consumption or output per worker. Economic theory offers some guidance on the specification of the right-hand-side variables in such a model (Hammond and Rodriguez-Clare, 1993; Barro and Sala-i-Martin, 1995). In principle, any variable which influences the consumption of someone at—and for some measures below—the poverty line will also influence the evolution of the poverty measure. If we were modelling growth rates of consumption for individuals or cohorts, the carry-over from endogenous growth models to the present setting would be straightforward. However, the relationship between determinants of the growth rate for a representative household and the growth rate of a poverty measure defined on the distribution of consumption will be more complex, involving both micro-behavioral factors (preferences, budget, time and borrowing constraints, and the properties of household production functions), as well as the properties of the distribution of endowments and the specific measure of poverty used. We do not attempt to derive an estimable parametric model for poverty measures from explicit functional forms for these factors. Instead, we estimate "poverty-growth regressions" analogous to standard regressions for growth rates in average income or consumption. Our models of average consumption and the poverty measures have the same functional form and explanatory variables, which we discuss in section 4.

2.2 *The econometric model*

On allowing for latent regional effects in the levels and a serially correlated error term to reflect the likely persistence of the poverty measures, we estimate the following econometric model for measured poverty in region i at date t (P_{it}) corresponding to the growth model in equation (1):

$$\ln P_{it} = \pi' \nabla \ln Y_{it} + \gamma' X_i t + \eta_i + \epsilon_{it} \quad (i=1,..,N;\ t=1,..,T) \tag{2}$$

where $\nabla \ln Y_{it} = \ln Y_{it} - r_i^Y t$ measures the deviations of the time-dependent variables from their trend levels, the vector X_i includes the initial conditions as well as the trend rates of growth of the time-dependent variables r_i^Y, η_i are time-invariant state-specific effects, and ϵ_{it} is an error term which we assume to follow an AR(1) process:

$$\epsilon_{it} = \rho^{\tau_t} \epsilon_{it-\tau_t} + u_{it} \tag{3}$$

in which u_{it} is a standard (white noise) innovation error and τ_t is the time interval between the successive household surveys. (Since the household surveys we use are unevenly spaced, the autocorrelation parameter ρ is raised to the power of the time-interval τ_t so as to consistently define an AR(1) process.) We estimate the model in the levels form of (2), rather than the "growth regression" in (1), so as to allow direct estimation of the η_i's and to avoid the complex ARMA error structure of a "growth regression" induced by our unevenly spaced data.

The AR(1) specification imposes the common factor restriction on a more general dynamic model with lags on all variables (Sargan, 1980). However, we are unable to estimate the more general dynamic panel-data model given the form of our data set. The main problem has to do with the unevenly spaced NSS consumption surveys. Starting from an AD(1,1) type model in annual time units, as we re-express the model for the observed NSS survey time periods, we end up not only with a nonlinear dynamic panel data model but also one with a non-uniform dimension of the vector of right-hand-side (RHS) variables. For different time-observations, the RHS variables have lags of different order depending upon the gap between the successive NSS rounds. We do not know of any appropriate estimator for such models.

Our models can be consistently estimated using a nonlinear least squares dummy variable (LSDV) estimator. This is the standard covariance estimator for static panel data models, adapted to deal with the nonlinearity due to the autoregressive error term and the uneven spacing of our survey data. The estimator thus belongs to the class of nonlinear generalized least squares estimators (Hsiao, 1986; Matyas and Sevestre 1992). The estimator is consistent whether or not the state-specific effects are orthogonal to the other explanatory variables in the model, though under orthogonality there may be more efficient estimates.

Note that model (2) can also be written as (2') below:

$$\ln P_{it} = \pi' \ln Y_{it} + \gamma^{*\prime} X_i t + \eta_i + \epsilon_{it} \quad (i=1,..,N;\ t=1,..,T) \tag{2'}$$

where $\gamma^* = \gamma - \pi$. This is a convenient form for estimation and the significance of γ^* directly tests for the equality of the impact of the trend and deviation from trend components.

3 Trends in rural living standards by state

3.1 The consumption data and poverty measures

We shall use a new and consistent set of measures of absolute poverty and mean consumption per person for the rural areas of India's 15 major states spanning the period 1957-58 to 1990-91. The measures are based on consumption distributions from 21 rounds of the National Sample Survey (NSS) spanning this period. However, not all 21 rounds of the survey can be covered for each of the 15 states.[6] Altogether, we use 310 distributions, forming a panel data set which is unbalanced in its temporal coverage for different states. The NSS rounds are also unevenly spaced; the time interval between the mid-points of the survey periods ranges from 0.9 to 5.5 years.

The cost of living index is the state-level Consumer Price Index for Agricultural Laborers (CPIAL). Monthly *CPIAL* indices for the 15 states are collated for the entire period beginning August 1956.[7] We have incorporated inter-state cost of living differentials, using the Fisher price indices estimated by Chatterjee and Bhattacharya (1974).[8] [9] The final indices we use are averages of monthly indices corresponding to the exact survey period of each of the NSS rounds.

[6] For 12 states (Andhra Pradesh, Assam, Bihar, Karnataka, Kerala, Madhya Pradesh, Orissa, Punjab-Haryana, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal) all 21 rounds are covered. (Only from 1964-65 does Haryana appear as a separate state in the NSS data. To maintain comparability, the poverty measures for this and subsequent rounds have thus been aggregated using rural population weights derived from the decennial censuses). For Gujarat and Maharashtra, 20 rounds are included, beginning with the 14th round for 1958-59 (prior to 1958-59, separate distributions are not available for Maharashtra and Gujarat, which were merged under the state of Bombay). For Jammu and Kashmir only 18 rounds can be included beginning with the 16th round for 1960-61. For Jammu and Kashmir, while the NSS consumption distributions are available prior to round 16, we are constrained by the availability of data on the rural cost of living index. The earliest available data on CPIAL indices for Jammu and Kashmir are for 1964-65. For the period 1960-61 to 1964-65, we have used the rate of inflation implied by the consumer price index (for industrial workers) in Srinagar as a proxy, which enabled us to make use of the NSS distributions for rounds 16, 17 and 18. However, for the period before 1960-61, even the Srinagar consumer price index is not available.

[7] For some states, the published data from the Labour Bureau had to be supplemented with the CPIAL estimates reported in Jose (1974). The states (and years) for which we used this source were: Gujarat and Maharashtra (1956/57 to 1959/60), Jammu & Kashmir and Uttar Pradesh (1956/57 to 1963/64), and Tamil Nadu (1956/57 to 1966/67).

[8] These estimates are based on the 18th round of the NSS, for the period February 1963 to January 1964. Minhas and Jain (1989) and Planning Commission (1993) assumed that these differentials for 1993-64 also apply to 1960-61, which is the base period for the CPIAL series. We do not make this unnecessary assumption, which implies the same rate of rural inflation in all states between 1960-61 and 1963-64. The inter-state cost of living differentials for 1960-61 are easily derived using the price relatives for 1963-64 from Chatterjee and Bhattacharya (1974), and the state and all-India CPIAL indices for 1960-61 and 1963-64.

[9] We also adjusted the state *CPIAL* series to correct for the constant price of firewood used by the Labour Bureau in its published series since 1960-61. However, since we do not have data on actual firewood prices for individual states, we assume that the price of firewood increased at the all-India rate in all states. The necessary adjustment to the state indices was then worked out using the state-level weights for firewood in the state CPIALs (ranging from 4.99 % in Punjab and Haryana to 8.79 % in Madhya Pradesh).

For the poverty measures, we use the poverty line originally defined by the Planning Commission (1979), and recently endorsed by Planning Commission (1993). This is based on a nutritional norm of 2400 calories per person per day, and is defined as the level of average per capita total expenditure at which this norm is typically attained. The poverty line was thus determined at a per capita monthly expenditure of Rs. 49 at October 1973-June 1974 all-India rural prices.

The three poverty measures we consider are the headcount index (H), the poverty-gap index (PG), and the squared poverty gap index (SPG) proposed by Foster, Greer and Thorbecke (1984). H is simply the proportion of the population living below the poverty line. PG is the average distance below the line expressed as a proportion of the poverty line, where the average is formed over the entire population (counting the non-poor as having zero distance below the line). SPG is defined the same way as PG, except that the proportionate distances below the poverty line are squared, so that the measure will penalize inequality amongst the poor.[10] The poverty measures are estimated from the published grouped distributions of per capita expenditure using parameterized Lorenz curves; for details on the methodology see Datt and Ravallion (1992).

A complete description of the data set assembled for this study (including sources of all variables) can be found in Özler, Datt and Ravallion (1996). The data set is available on discs.

3.2 The trends by state

We first isolate the unconditional long-run trends, correcting only for the serial correlation in the errors. They are estimated from the following regression:[11]

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[10] For a survey of the properties of these measures and alternatives see Ravallion (1994).

[11] Date t is defined to be the mid-point of the survey period for any given round *minus* 1957. Thus, for instance, for the 38th round survey for January-December 1983, the value of t is 26.5.

$$\ln P_{it} = TREND_i t + \eta_i + \epsilon_{it} \quad (i=1,..,N;\ t=1,..,T) \tag{4}$$

where $TREND_i$ is a regression parameter for the trend rate of poverty reduction for state i and the error term ϵ_{it} is an AR(1) process as in equation (3). The η_i's are interpretable as the initial levels of poverty (for $t=0$).

Our LSDV estimates of the unconditional trend rates of consumption growth and progress in reducing poverty over 1957-91 are given in Table 1. (The trend coefficients and standard errors have been multiplied by 100 to give percentages.) Figure 2 also plots the results for the trend rate of consumption growth and the trend rate of decline in the headcount index of poverty.

The trend rates of progress are diverse across the states. The trend rate of per capita consumption growth ranged from -0.3% to 1.6% per year. The variance in trends is even higher for the poverty measures. There was a trend decrease in poverty for all three measures (significant at the 5% level or better) in 9 of the 15 states, *viz*., Andhra Pradesh, Gujarat, Kerala, Maharashtra, Orissa, Punjab and Haryana, Tamil Nadu, Uttar Pradesh, and West Bengal. The trend was not significantly different from zero at the 5% level in the other 6 states of Assam, Bihar, Jammu and Kashmir, Karnataka, Madhya Pradesh, and Rajasthan; there was not a significant positive trend for any state for any poverty measure. We also found no evidence of an accelerating trend decline in poverty for any state or any measure.[12] There is a strong indication of serial correlation in both mean consumption and the poverty measures (Table 1, last row). There is also a tendency for the absolute size of the trend to be higher for PG than H, and for SPG than PG.

[12] We also tried a quadratic form of the state time trends. But for none of the states and none of the poverty measures, did we find both the linear and the quadratic terms to be negative and significant.

In terms of progress in both raising average household consumption and reducing rural poverty, the state of Kerala turns out to be the best performer over this period. The second, third and fourth highest trend rates of consumption growth were Andhra Pradesh, Tamil Nadu, and Maharashtra respectively. In terms of the rates of poverty reduction, the second, third and fourth states were Andhra Pradesh, Punjab and Haryana, and Gujarat; the ranking is invariant to the choice of poverty measure though differences in their rates of poverty reduction are not large. The worst performer was Assam by all measures. The other poor performers were Bihar, Jammu & Kashmir, Karnataka, Madhya Pradesh and Rajasthan; the exact ranking varies by the measure used.

It is clear from Figure 2 that there is a quite high correlation between the trend rates of consumption growth and poverty reduction. But it is certainly not a perfect correlation. Figure 3 plots the trend in the squared poverty gap against that in mean consumption (the picture looks similar for the other two poverty measures). This illustrates that some states have performed better than others in reducing poverty given their trend rate of growth in average consumption. The best performer in terms of distance from the least squares regression line (indicated in Figure 3) was Punjab-Haryana; in this region the growth process was unusually pro-poor. The worst performer was Maharashtra, with the largest distance below the regression line; here the growth process was associated with adverse distributional impacts from the point of view of the poor. Kerala performed best on both counts, and is quite close to the regression line.

Are the initial consumption and poverty levels correlated with their own time trends? The correlation coefficients across the 15 states are -0.658 for mean consumption (significant at the 1% level), -0.377 for the headcount index (not significant even at the 10% level), -0.532 for the poverty gap index (significant at 4%), and -0.588 for the squared poverty gap index (significant at 2%).[13] These correlations are suggestive of a trend towards unconditional convergence for mean consumption, PG and SPG over this period, but not H.

4 Explaining performance

4.1 Explanatory variables

In our selection of explanatory variables we have been guided by both the literature on poverty in India and considerations of data availability. Past work on the determinants of rural poverty has indicated an important role of both agricultural yields and the rate of inflation.[14] The agricultural yield effect will enter as both a determinant of the trend rate of progress (the trend rate of yield growth will be an element of the vector X_i in equation 2) and as one factor which can influence the deviations from trend due to the effects of changes in the weather from year to year (deviations from the trend thus appearing in the first term in equation 2). We also include net sown area per person in the state as an additional variable in the model to test the homogeneity restriction that it is per capita agricultural output rather than agricultural yield that matters for rural poverty.

The literature also suggests that the sectoral composition of growth is important to poverty reduction; apart from agricultural growth, a significant role is also suggested for growth in the non-farm (especially tertiary) sector (Ravallion and Datt, 1996). We thus also allow for (real) per capita non-agricultural output amongst our explanatory variables.

[13] These are correlation coefficients between the natural log of the poverty measure (or mean consumption) in 1957 and its trend rate of growth over the period 1957-58 to 1990-91.

[14] For recent evidence on both effects see Ravallion and Datt (1994). Also see Ahluwalia (1985) (on agricultural growth and rural poverty in India) and Bell and Rich (1994) (on both inflation and agricultural growth). Other literature is reviewed in Ravallion and Datt (1994).

The rate of inflation is included in the model to capture its induced effect on poverty through real wages.[15] In the (typically unorganized) rural labor markets, nominal wages are not indexed to the cost of living, and the adjustment to changes in cost of living is not instantaneous. We have elsewhere estimated an agricultural wage model of this type using all-India data (Ravallion and Datt, 1994). Our results indicate that a once-and-for-all increase in the price level has only a short-term negative effect on real wages (nominal wages subsequently catch up with the price change). However, a continuing higher rate of inflation erodes real wages over time.

It has also been argued that the rate of growth in public spending by the states has influenced progress in reducing rural poverty in India (Sen and Ghosh, 1993). Under India's constitution, the states are responsible for the bulk of the public services which are likely to matter most to the poor (such as agriculture and rural development, social safety nets, and basic health and education spending). In principle, both the trend in public spending (as an element of X_i) and the deviations from trend could matter. By combining the variation between states with that over time we will hopefully be able to disentangle the effects of these variables.[16]

Combining these considerations, our time-dependent variables are as follows:

i) Real agricultural state domestic product (SDP) per hectare of net sown area in the state (denoted *YPH*).[17]

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[15] As discussed below, we initially began with a model with current and lagged value of the price index. However, the restriction that parameters on these variables add up to zero was found acceptable.

[16] Testing the relative importance of highly correlated variables such as agricultural yields and public spending at the national level is problematic given their high correlation. At the national level, we estimate that agricultural output per acre and the public spending per person have a correlation coefficient of 0.97 over the period 1955-1990.

[17] Two alternative sets of estimates are available on the State Domestic Product (SDP): (i) the estimates prepared by the state governments, though published by the Central Statistical Organization (CSO), and (ii) the "comparable estimates" of SDP compiled and published by the CSO. The latter set of estimates, though methodologically superior in ensuring comparability across states, are only available for a shorter period,

ii) Net sown area per person in the state (*NSA*).

iii) Real non-agricultural state domestic product per person in the state (*YNA*).

iv) The rate of inflation in the rural sector measured as the change per year in the natural log of the (adjusted) *CPIAL*.

v) Per capita real state development expenditure (*DEVEX*); development expenditure includes expenditure on economic and social services. The economic services include agriculture and allied activities, rural development, special area programs, irrigation and flood control, energy, industry and minerals, transport and communications, science, technology and environment. The social services include education, medical and public health, family welfare, water supply and sanitation, housing, urban development, labor and labor welfare, social security and welfare, nutrition, and relief on account of natural calamities.

Real values of agricultural and non-agricultural SDP, and the state development expenditures were calculated using the (adjusted) state-specific *CPIAL* as the deflator.

The trend rate of progress in poverty reduction is assumed to be a function of the trends in these same variables as well as initial conditions determining physical and human capital endowments. The deviations from the trend in the rate of poverty reduction are assumed to be determined by the deviations from trend of each of the time varying variables described above. Also, from a range of data sources, we can identify a number of social and economic sector variables around 1960 which can be hypothesized to influence the trend rates of poverty reduction by

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1962/63 to 1985/86. Hence, we have used the SDP data from the former source; the comparability across states may be less of a concern for tracking *growth* in SDP and its agricultural component over time. See Choudhry (1993) for further discussion.

determining the initial human and physical capital stocks, or by influencing inter-sectoral migration.[18] We opted for the following variables (all are measured in natural logs) for describing initial conditions:

i) Infrastructure: Here, we used three variables: the proportion of villages reporting the use of electricity in 1963-64 (*ELCT*), the rural road density in 1961 defined as the length of rural roads per 100 sq. km. of the state's geographical area (*ROAD*), and the percentage of operated area which was irrigated in 1957-60 (*IRR*).

ii) Landlessness: We used the percentage of landless rural households in 1961-62 (*NOLAND*).

iii) Education: We used the rural male and female literacy rates in 1961 (*LITM* and *LITF*), defined as the number of literate males (females) per thousand males (females) in the rural population.

iv) Health/Demography: We used the infant mortality rate per thousand live births in rural areas, 1963-64 (*IMR*), and the rural general fertility rate during 1958-60 (*GFR*). The *GFR* is defined as the number of children born alive per thousand females in the age group 15-44 years.

v) Urban-rural disparity: Initial inter-sectoral disparity in average living standards may be an important determinant of migration across sectors and hence of the subsequent evolution of rural poverty. We include the ratio of the initial urban real mean consumption to that in the rural sector, where the initial real mean consumption in each sector is formed as an average over the first three NSS rounds available for that state.

Table 2 gives the data on the initial conditions and trends in *YPH*, *YNA* and *DEVEX* by state. Even a cursory look at these data suggests that initial conditions have played a role. Compare Kerala

[18] The sources include the 1961 Census, the Statistical Abstract (Central Statistical Organization) for various years, and reports from a number of NSS surveys dealing with village statistics, land holdings and utilization, fertility, and infant mortality.

with Andhra Pradesh and Punjab-Haryana. All three were good performers in reducing poverty. Andhra Pradesh and Punjab-Haryana also had high trend rates of growth in agricultural yields, per capita non-agricultural output and development spending. Kerala did not. Kerala did, however, start with excellent health and education indicators.

Our ability to disentangle the effects of various initial conditions will depend on their correlations with each other. Table 3 gives the correlation matrix for the initial conditions. While there are a few strong correlations, many of these indicators are only weakly correlated with each other. The infrastructure variables show little pair-wise correlation amongst themselves or with the other variables. And *IMR* is only correlated with landlessness, though the correlation is negative; this appears to be due in large part to Kerala, which simultaneously had the lowest *IMR* and highest landlessness in rural areas.

The following further points should be noted about our explanatory variables:

i) There are gaps in the data on some of the time-dependent variables of interest. The SDP data are available only from 1960-61 onwards, while the latest year for which data on the net sown area by state were available (at the time of writing this paper) is 1989-90. As a result, we have had to exclude NSS rounds 13 (for 1957-58), 14 (for 1958-59), 15 (for 1959-60), and 46 (for 1990-91) from the estimation. The number of NSS rounds covered in this shorter panel is 17, and these rounds span the 30-year period 1960-61 to 1989-90.

ii) In addition to being evenly spaced, the NSS rounds do not all cover a full 12-month period. To match the annual data with those by the NSS rounds, we have log-linearly interpolated the annual data to the mid-point of the survey period of each NSS round.

iii) We do not include variation over time in our initial economic and human resource development indicators as explanatory variables in the model. Firstly, time series data on these variables for the period covered by our analysis are just not available. But, also including these indicators in time-varying form would raise concerns about their potential endogeneity. Note also that *DEVEX* includes social sector spending.

iv) There are other factors that are widely thought to have influenced rates of progress which we do not include as explanatory variables because they are endogenous. For example, the flow of remittances to Kerala from migrant workers in the Middle-East has undoubtedly helped raise rural living standards. However, we would argue that Kerala's superior human resource development poised the state to take advantage of the overseas employment opportunities in a way that was not possible for other states such as neighboring Karnataka and Tamil Nadu. A state's ability to export skilled labor is endogenous.

4.2 The regressions

What accounts for the sizable differences amongst states in performance at raising rural living standards? To answer this question we estimate equation (2'). In the initial specification of equation (2'), the vector of time-dependent variables Y_{it} comprised the current and lagged values of the log *YPH*, log *NSA*, log *YNA*, log *CPIAL* and log *DEVEX*. The initial model was thus:

$$\ln P_{it} = \pi_1' \ln Y_{it} + \pi_2' \ln Y_{it-1} + \gamma^{*\prime} X_i t + \eta_i + \epsilon_{it} \tag{5}$$

where the vector X_i also included the trend growth rates of each of the time-dependent variables. The lagged values of $\ln Y$ refer to values a year before the mid-point of the current survey period, and are estimated by interpolation using $\ln Y_{it-1} = (1-(1/\tau_t))\ln Y_{it} + (1/\tau_t)\ln Y_{it-\tau_t}$. We resort to such interpolation because the NSS survey periods do not coincide with the annual periodicity of the time-dependent variables, which are thus not centered at the mid-point of the survey periods.

Starting with model (5), we tested for a number of restrictions to arrive at our preferred specification. We found the following restrictions on the time-dependent variables in model (5) acceptable: (i) the coefficients on current and lagged log *NSA* are not significantly different from zero, (ii) the coefficients on current and lagged log *YPH* are the same, (iii) the coefficients on current and lagged log *YNA* are also the same, (iii) the coefficients on current and lagged log *CPIAL* add up to zero (so the variable becomes the rate of inflation), and (iv) the coefficient on current *DEVEX* is zero (so that only the lagged value matters).

We also tested for the potential endogeneity of the current values of *YPH*, *YNA*, *CPIAL* and *DEVEX*.[19] The test results reported in Table 4 show that null hypothesis of exogeneity of the four variables is jointly acceptable for all the poverty measures. It is rejected for the mean consumption model, where significant endogeneity is indicated for the log *CPIAL* variable. Hence we retained the residuals for log *CPIAL* (from the instrumenting equation) as an additional variable in our subsequent estimation of the mean consumption model, which ensures consistent estimates. However, with the later pruning of the model, the residual of log *CPIAL* became insignificant and was dropped thereafter.

For the time-dependent variables, we found mixed evidence on whether the coefficients on the deviation from trend $(\ln Y_{it} - r_i^Y t)$ differ significantly from those on the corresponding trends $(r_i^Y t)$. The equality of the two effects was rejected for both per capita non-agricultural output and

[19] Our exogeneity test is an F-test for the joint significance of residuals of the four variables included as additional regressors in the models for mean consumption and the poverty measures. The residuals are obtained from instrumenting equations for each of the four variables, where the instrument set included lagged values of all time-dependent variables, current and lagged log rainfall (state-average for the monsoon months June-September), lagged log urban price index, lagged (log) urban and rural population, state-specific fixed effects, and state-specific time trends. We did not conduct an exogeneity test for the net sown area per capita, which had turned out to be highly insignificant in the initial run of model (5).

state development expenditures. For agricultural yields, the point estimates indicated larger (absolute) effects of the trend component of yield than that of the deviation from trend. However, the difference between relevant π and γ coefficients was not statistically significant. We find this somewhat surprising. Though it is unlikely that poor households are well insured against the vagaries of the weather (and the point estimates are consistent with this), we would still have expected that some limited insurance and consumption smoothing would have ensured a larger trend impact. We decided not to impose the restriction of equal impact of the trend and deviation-from-trend components for any of the time-varying variables.

The other variables in the vector X_i comprised initial conditions, as described in the previous section. With the cross-sectional dimension of our data restricted to 15 states, there are obvious limits to how far we can go in investigating the potential influence of the initial conditions in determining the evolution of living standards. Our initial specification included all the variables described in section 4.1. However, while the full set of variables had joint explanatory power (one could safely reject the null that their coefficients were jointly zero for all three poverty measures), many of the parameters were individually insignificant. Multicollinearity is clearly part of the problem. For instance, when both male and female literacy variables were included, they came out with opposite signs, negative for *LITF* and positive for *LITM*; but when either one of them was used in the model, it had a negative sign. The two variables are highly correlated (r=0.96). Since *LITF* had slightly more explanatory power than *LITM*, we decided to retain *LITF* in the model. But many other variables, including *ELCT*, *ROAD*, *NOLAND* and the initial urban-to-rural mean consumption ratio, were highly insignificant, and they could be safely dropped. On doing so, we found that the restricted model with *IRR*, *LITF* and *IMR* as the measures of initial conditions entailed only a small loss of fit. None of the variables we had dropped were significant if added to the final regression.[20] The F-tests (which are asymptotically justified for our class of models) reported at the bottom of Table 4 indicate that the restrictions are accepted for our models for mean consumption, H, PG and SPG measures at 2.8, 3.7, 17 and 39% levels of significance.[21]

Incorporating the above set of restrictions into equation (5), our final estimated model was:

$$\begin{aligned} \ln P_{it} = {} & \phi_1(\nabla \ln YPH_{it} + \nabla \ln YPH_{it-1}) + \phi_2(\nabla \ln YNA_{it}) + \phi_3(\ln CPIAL_{it} - \ln CPIAL_{it-\tau_t})/\tau_t \\ & + \phi_4 \nabla \ln DEVEX_{it-1} + (\gamma_1 r_i^{YPH} + \gamma_2 IRR_i + \gamma_3 LITF_i + \gamma_4 IMR_i)t + \eta_i + \epsilon_{it} \end{aligned} \tag{6}$$

where ϵ_{it} is an AR(1) process as in (3).

Table 4 gives the nonlinear LSDV estimates of model (6). The following points are notable:

i) Current and lagged agricultural output per hectare (*YPH*) had a significant positive effect on average consumption, and negative impact on absolute poverty. The restriction that current and lagged *YPH* have the same impact was easily accepted. This is consistent with our findings for the determinants of rural poverty at the all-India level (Ravallion and Datt, 1994). The point estimates show that the trend component of yield has a larger impact (in absolute terms) than the deviation-from-trend component, though the difference is not significant statistically which is suggestive of the poor being largely uninsured against yield shocks. The trend growth in yield itself has a strong

[20] We also tried adding the initial female-male literacy differential (log of the ratio of female literacy rate to male literacy rate) to the model, which turned out to be insignificant itself, and also rendered the female literacy variable insignificant, though they were jointly significant.

[21] For mean consumption and the headcount index, the restrictions are accepted only at less than the 5% level of significance. A lower level of significance implies the usual trade-off between the size and power of the test, or between the type-I and type-II errors. However, since the restrictions were found individually acceptable at each stage of the pruning of the model, we opted for a common restricted model for all poverty measures and mean consumption.

impact: the estimated elasticity of mean consumption w.r.t. a steady-state increase in *YPH* is 0.15, while for H, PG and SPG the elasticities are -0.38, -0.55 and -0.70 respectively.

ii) As for agricultural yield, the restriction of equal coefficients on current and lagged values is found acceptable in case of non-agricultural output too. However, a higher per capita real non-agricultural output is found to contribute to rural poverty reduction only insofar as it exceeds the trend level; the trend component has no effect on poverty. The deviations from trend are highly significant though, and their quantitative impact is large, with absolute elasticities (over two periods) ranging from 0.41 for mean consumption to 0.66, 1.05 and 1.37 for H, PG and SPG.

iii) A higher rate of inflation has a significantly negative effect on mean real consumption (elasticity of -0.23), and also a poverty-increasing effect with the elasticities ranging from 0.32 for H, to 0.45 for PG and 0.51 for SPG.

iv) We find that the above-trend values of real state development expenditure per capita have a positive effect on the average living standards and a negative effect on levels of poverty. But these effects are generally insignificant; the closest to a statistically significant effect we observe is the negative impact on the rural headcount index, which is significant at the 9% level. This trend component of development spending was also found insignificant and was dropped from the final model.

v) We find that differences in initial conditions matter to subsequent progress in poverty reduction. There is a significant favorable effect of the initial irrigation rate on the rate of consumption growth and the rate of progress in reducing poverty. For instance, a 20% higher initial irrigation rate would have augmented the annual rate of poverty reduction by 0.1 percentage points for H, by 0.14 percentage points for PG, and by 0.17 percentage points for SPG.

vi) We also find that the rate of poverty decline for all measures was significantly lower in states which started with lower female literacy rates. The estimates indicate that a 20% higher female literacy rate is associated with increments in the rates of decline in H, PG and SPG of 0.1, 0.15 and 0.2 percentage points per year.

vii) There is also a significant adverse impact of the initial level of infant mortality on the subsequent rate of gain in living standards; a 20% higher initial *IMR* is associated with lower rates of reduction in H, PG and SPG of the order of 0.13, 0.17 and 0.21 percentage points respectively.

viii) We also tried excluding the state of Kerala to check if the initial condition effects were contingent on Kerala's unique experience. We found that with Kerala's exclusion, there was little change in the estimates of any parameters or their standard errors (for both the initial conditions and all other variables in the model). The same was true when we deleted Bihar.

ix) In general, the point estimates of the impact of both the time-dependent and initial condition variables on the rates of poverty reduction are in absolute terms larger for SPG than PG, and lowest for H, which parallels the pattern for the unconditional rates of poverty reduction estimated in section 3.

x) It is notable that all the initial conditions exhibit divergent effects, in that worse initial conditions (lower literacy rates, for example) are associated with lower subsequent rates of progress in reducing poverty. Yet (as shown in section 3.2) there are signs of unconditional convergence, in that states with higher initial poverty measures (at least for PG and SPG) tended to have higher rates of poverty reduction. These two observations are not inconsistent. Depending on how the other variables in the model evolve over time, and how initial conditions are correlated with initial levels of living, one can simultaneously have conditional divergence with respect to some initial conditions but unconditional convergence overall. For example, the trend increase in agricultural yields tended to be higher in initially poorer states.[22] Another contributing factor to the overall long-term convergence was that initial literacy rates tended to be higher in initially poorer states.[23]

4.3 *On development spending*

The insignificance of state-development spending in our estimates of equation (6) does not mean that such spending is irrelevant to progress in reducing rural poverty, since other (significant) variables in the model may themselves be affected strongly by development spending. The impact of initial conditions presumably reflects in part past spending on physical and human infrastructure. It can also be argued agricultural and non-agricultural outputs are determined in part by public spending on (for example) physical infrastructure and public services.

To investigated this point further, we regressed both the agricultural yield variable and non-agricultural output per capita on the other explanatory variables, including development spending. The latter had a significant positive impact; agricultural yield had an elasticity of 0.29 (t-ratio=3.18) with respect to lagged development spending, while for non-agricultural output per person the elasticity was 0.34 (t-ratio=5.07). This suggests that state development spending has helped reduce rural poverty largely through its impact on average farm and non-farm output.

4.4 *Isolating distributional effects*

The effects of initial conditions on the trend growth in mean consumption are generally opposite in sign to their effects on the trends in the poverty measures (Table 4). The initial female

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[22] The correlation coefficient between the trend rate of growth in agricultural yields and the initial mean consumption is 0.37, while the correlation with initial headcount index is -0.32.

[23] The correlation coefficient between the initial mean and (log) female literacy is -0.49, while for the headcount index it is 0.48.

literacy rate has a strong positive effect on mean consumption growth while the initial infant mortality rate has a strong negative effect. However, the initial irrigation rate does not seem to exert a significant impact on mean consumption growth. It appears then that the effects of initial conditions on progress in poverty reduction are partly transmitted through growth in average consumption, the rest being mediated through redistribution.

To further test whether the effects revealed in Table 4 are also redistributive in nature, Table 5 gives the results obtained when we add mean consumption as a time-varying right hand side variable to the regressions for the poverty measures; by controlling for mean consumption we hope to isolate the distributional effects on the poverty measures. This test is at best suggestive, since simultaneity bias must be expected given that both the mean and the poverty measures are generated from the same distributions of consumption. We find that the quantitative effects are smaller than in Table 4, and some variables (deviation from trend components of agricultural yields and non-agricultural output, and the rate of inflation) become insignificant. Nonetheless, a number of the factors (including the initial conditions) identified as reducing the absolute poverty measures also have significant pro-poor distributional effects after controlling for mean consumption. And significantly, there are no sign reversals; growth effects and pro-poor distributional effects tend to work in the same direction.

4.5 *Impacts on rates of poverty reduction*

To illustrate the magnitudes involved, we now consider the quantitative contribution of the initial conditions to the observed inter-state differentials in rates of poverty reduction. We select Kerala, the state with the highest trend rate of decline in poverty, as the reference. We then ask: how much of the difference between a particular state's rate of poverty reduction and Kerala's rate is attributable to the differences in their initial conditions? Tables 6-8 show the results for H, PG, and SPG indices; the results for real mean consumption are shown in Table 9. The contribution of the initial conditions to a state's deficit (relative to Kerala) in the rate of poverty reduction is derived from (1) as $\hat{\gamma}'(X_i - X_{Kerala})$ in obvious notation.

Consider Maharashtra, for example. Table 6 shows that the incidence of rural poverty declined at a slower pace in Maharashtra than Kerala, the difference being of the order of 1.05 percentage point per annum. On account of the relatively adverse initial conditions alone, the rate of poverty reduction in Maharashtra would be about 1.6 percentage points lower. Maharashtra made up some of the lost ground by way of more favorable progress in some of the time-dependent variables, which is borne out by its higher rates of growth (relative to Kerala) in the real agricultural output per hectare (Table 2). Amongst the initial conditions, Maharashtra's lower irrigation rate (5% against Kerala's 12%) contributed 0.52 percentage points to the state's deficit in the rate of poverty reduction; its lower female literacy rate (93 per thousand against Kerala's 375) contributed 0.78 points; and its higher infant mortality rate (107 per thousand, against Kerala's 70) contributed another 0.29 points. The effects on the rates of decline in other poverty measures, PG and SPG, are even more pronounced (Tables 7 and 8).

Of course, the differences in the initial conditions do not fully account for the observed differentials in the rates of poverty decline. For instance, the incidence of poverty in Bihar declined at an annual rate 2.1 percentage points below that in Kerala, but only about half of that differential is explained by the initial conditions (Table 6). Other factors, particularly the slow growth in agricultural output per hectare, have been important in explaining Bihar's unimpressive performance. It is nonetheless notable that if Bihar had started off with Kerala's level of human resource development in the 1960s, the differential in the rates of poverty reduction between the two states could have been narrowed to less than half their observed levels. Also the implicit trade-offs can be large. For Bihar to overcome the adverse effects of its initially disadvantageous human resource development relative to Kerala would have required that its agricultural yields grew annually at a rate 3.4 percentage points higher than Kerala's.

However, our results also suggest that Kerala's low growth rate in farm yields inhibited its rate of poverty reduction. Suppose that Kerala had the same trend growth rates in farm yields as Punjab-Haryana (Table 2). Our results indicate that Kerala's trend rate of reduction in H would have been 3.11% per year (rather than 2.26%); for PG it would have been 5.19% per year (rather than 3.93%) and 6.75% for SPG (rather than 5.17%).

5 Conclusions

Long-term progress in raising rural living standards has been diverse across states of India. We have tried to explain why, so as to throw light on the causes of poverty in underdeveloped rural economies and on appropriate policies.

We find that higher growth rates in farm yields and lower rates of inflation led to higher rates of progress in raising average consumption and reducing absolute poverty. And the deviations from the trend rates of progress are partly explained by the fluctuations in farm yields and non-farm output. But such factors are only part of the story. Without taking account of differences in initial conditions it is hard to explain why some states have performed so much better than others. Starting endowments of infrastructure and human resources played a major role; higher initial irrigation intensity, higher literacy and lower initial infant mortality all contributed to higher long-term rates of consumption growth and poverty reduction in rural areas. A sizable share of the variance in the and human resource development—differences which probably also reflect past public spending priorities.

By and large, the same variables determining growth in average consumption mattered to rates of progress in reducing poverty. But the effects on the poverty measures were partly redistributive in nature; after controlling for average consumption, some of the factors that helped reduce absolute poverty also improved distribution from the point of view of the poor, and none of the factors which reduced absolute poverty had adverse effects on distribution. Thus there is no sign here of trade-offs between growth and pro-poor distributional outcomes.

From the diverse experience of India's states, we can identify two routes to rural poverty reduction. One is (farm and non-farm) economic growth. In some states, robust growth in rural areas (fuelled in part by state development spending and combined with beneficial effects of good initial conditions in physical and human infrastructure) appears to have been the main factor in poverty reduction; Punjab-Haryana is the prime example. The other route is human resource development. This can reduce poverty even if there is little output growth in the domestic economy, by enhancing the ability to export relatively skilled labor and so benefit from the consequent remittances; Kerala is the prime example. Unfortunately some states, such as Bihar, were unsuccessful on both counts; there was too little growth, and human and physical resources were underdeveloped. And no state can reasonably be said to have got both right-if it had the rate of poverty reduction would have been rapid. The lesson for the future is clear.

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Table 1: Trend rates of change in rural living standards, 1957-58 to 1990-91

	Mean consumption [0.37]	Poverty measures: Headcount index [0.57]	Poverty gap index [0.85]	Squared poverty gap index [1.13]
	Percent per year			
Andhra Pradesh	1.23	-2.23	-3.56	-4.53
Assam	-0.30	0.35	0.22	0.20
Bihar	0.06	-0.14	-1.15	-2.00
Gujarat	0.84	-1.69	-3.14	-4.28
Jammu and Kashmir	0.29	-0.64	-1.00	-1.23
Karnataka	0.14	-0.67	-1.21	-1.20
Kerala	1.61	-2.26	-3.93	-5.17
Madhya Pradesh	0.21	-0.46	-1.21	-1.82
Maharashtra	0.96	-1.21	-1.91	-2.41
Orissa	0.73	-1.57	-2.70	-3.70
Punjab and Haryana	0.46	-2.17	-3.36	-4.35
Rajasthan	0.33	-0.80	-1.16	-1.48
Tamil Nadu	1.05	-1.44	-2.34	-3.05
Uttar Pradesh	0.60	-1.18	-1.88	-2.49
West Bengal	0.74	-1.49	-2.17	-2.75
Lagged error	0.695 (16.19)	0.670 (13.89)	0.644 (12.73)	0.640 (12.45)

Note: The above estimates of the trend rates of change control for state-specific fixed effects and serial correlation in the error term. Approximate standard errors of the trend rates of change in square brackets []; approximate t-ratios of the lagged error parameter in parentheses (). The number of observations used in the estimation is 310.

Table 2: Variables used for explaining the trend rates of progress

State	Initial conditions around 1960									Trend growth rates (% per year)		
	% of villages with electricity	Km. of rural roads per 100 sq. km. of area	% of operated area irrigated	% of households owning no land	Female literacy rate (per '000 popn.)	Male literacy rate (per '000 popn.)	Infant mortality rate (per '000 live births)	Ratio of urban-to-rural mean consumption (%)	General fertility rate (per '000 females aged 15-44)	Real per capita state develop. expenditure	Real SDP in agriculture per hectare	Real non-agricultural SDP per capita
Andhra Pradesh	11.99	9.93	23.79	6.84	84	251	98.9	124.0	154.6	6.34	2.26	3.98
Assam	1.88	21.21	4.40	27.77	138	348	74.3	124.4	177.5	6.61	1.58	3.51
Bihar	5.65	26.18	16.76	8.63	52	272	90.6	109.7	158.6	5.80	2.74	1.85
Gujarat	5.95	3.68	6.32	14.74	132	345	73.0	109.2	203.9	6.79	3.21	3.36
Jammu and Kashmir	5.51	3.29	26.41	10.93	16	129	68.0	108.3	105.1	5.88	2.83	4.10
Karnataka	12.11	19.18	7.00	18.64	92	305	97.1	99.4	192.7	5.47	1.66	3.70
Kerala	64.39	28.31	12.40	30.90	375	535	69.8	119.3	178.0	4.32	1.02	3.41
Madhya Pradesh	2.67	43.40	4.21	9.14	34	218	134.2	114.2	191.9	5.65	1.82	2.96
Maharashtra	4.06	7.16	4.77	16.03	93	335	106.8	146.8	176.6	6.53	2.55	3.35
Orissa	2.42	10.96	14.96	7.84	75	330	95.1	102.4	167.8	4.53	2.59	2.46
Punjab and Haryana	20.65	12.99	41.02	12.33	87	269	87.7	96.5	214.3	7.57	3.28	4.50
Rajasthan	0.59	5.56	10.75	11.84	27	183	119.1	95.8	210.7	5.08	2.13	2.01
Tamil Nadu	49.67	16.63	38.35	24.20	116	378	104.5	148.6	160.1	5.49	0.84	3.70
Uttar Pradesh	2.74	23.64	34.76	2.78	42	237	187.7	94.9	211.3	6.11	2.01	2.92
West Bengal	3.60	48.06	18.80	12.56	97	329	70.4	145.5	151.5	5.28	2.24	1.99

Note: See text for more details on the initial condition variables.

Table 3: Correlation matrix of initial conditions

	ELCT	ROAD	IRR	NOLAND	LITM	LITF	IMR	GFR
log of % villages using electricity *(ELCT)*	1.000							
log of rural road density *(ROAD)*	0.152	1.000						
log of % area irrigated *(IRR)*	0.388	-0.020	1.000					
log of % of households landless *(NOLAND)*	0.410	0.003	-0.373	1.000				
log of male literacy rate *(LITM)*	0.500	0.398	-0.191	0.533*	1.000			
log of female literacy rate *(LITF)*	0.586*	0.298	-0.158	0.597*	0.958*	1.000		
log of infant mortality rate *(IMR)*	-0.306	0.182	0.081	-0.637*	-0.259	-0.392	1.000	
log of general fertility rate *(GFR)*	-0.134	0.184	-0.260	-0.060	0.314	0.273	0.482	1.000
log of urban-to-rural mean consumption ratio *(MCR)*	0.276	0.214	-0.122	0.449	0.433	0.403	-0.286	-0.378

Note: * indicates significant at 5% level.

Table 4: Determinants of rural living standards

	Mean consumption	Headcount index (H)	Poverty gap index (PG)	Squared poverty gap index (SPG)
Current plus lagged real agricultural output per hectare: deviation from trend	0.075 (4.22)	-0.108 (-3.61)	-0.194 (-4.30)	-0.263 (-4.35)
Real agricultural output per hectare: trend	0.152 (4.22)	-0.375 (-2.46)	-0.554 (-2.53)	-0.699 (-2.44)
Current plus lagged real non-agricultural output per capita: deviation from trend	0.208 (8.02)	-0.330 (-8.40)	-0.527 (-9.00)	-0.686 (-8.81)
Rate of inflation	-0.227 (-4.10)	0.321 (3.62)	0.453 (3.32)	0.512 (2.79)
Lagged real state development spending per capita: deviation from trend	0.056 (1.31)	-0.113 (-1.67)	-0.152 (-1.49)	-0.175 (-1.29)
Initial irrigation rate (IRR)	0.155 (1.58)	-0.541 (-3.76)	-0.744 (-3.59)	-0.914 (-3.38)
Initial female literacy rate (LITF)	0.341 (4.02)	-0.561 (-4.49)	-0.844 (-4.71)	-1.075 (-4.60)
Initial infant mortality rate (IMR)	-0.310 (-3.09)	0.688 (4.14)	0.941 (3.94)	1.147 (3.68)
AR(1)	0.611 (9.17)	0.542 (7.10)	0.486 (5.85)	0.457 (5.24)
R^2	0.861	0.895	0.906	0.902
Exogeneity test for ln *YPH*, ln *YNA*, ln *DEVEX*, ln *CPIAL*: F(4, 189)	3.51	1.00	0.87	0.96
Test of parametric restrictions: F(17,191)	1.817	1.750	1.337	1.070

Note: t-ratios in parentheses. A positive (negative) sign indicates that the variable contributes to a higher (lower) rate of increase in the poverty measure or mean consumption. The estimated model also included individual state-specific effects, not reported in the Table. The number of observations used in estimation is 247. The exogeneity test is the (Wu-Hausman) test for the joint significance of the residuals of the four potentially endogenous variables; the residuals are obtained from instrumenting equations, where the instrument set included lagged values of all time-dependent variables, current and lagged log rainfall (state-average for the monsoon months June-September), lagged log urban price index, lagged (log) urban and rural population, state-specific fixed effects, and state-specific time trends. The second F-statistic tests the restricted model (6) against the unrestricted model (5).

Table 5: Testing for distributional effects on poverty

	Headcount index (H)	Poverty gap index (PG)	Squared poverty gap index (SPG)
Real mean consumption per capita	-1.021 (-12.39)	-1.601 (-13.24)	-1.988 (-11.66)
Current plus lagged real agricultural output per hectare: deviation from trend	-0.021 (-0.88)	-0.056 (-1.60)	-0.092 (-1.87)
Real agricultural output per hectare: trend	-0.359 (-3.10)	-0.540 (-3.58)	-0.690 (-3.41)
Current plus lagged real non-agricultural output per capita: deviation from trend	-0.118 (-3.40)	-0.193 (-3.92)	-0.272 (-3.97)
Rate of inflation	0.089 (1.26)	0.079 (0.74)	0.038 (0.25)
Lagged real state development spending per capita: deviation from trend	-0.048 (-0.94)	-0.035 (-0.46)	-0.024 (-0.23)
Initial irrigation rate (IRR)	-0.380 (-3.46)	-0.479 (-3.33)	-0.573 (-2.97)
Initial female literacy rate (LITF)	-0.214 (-2.18)	-0.301 (-2.31)	-0.393 (-2.23)
Initial infant mortality rate (IMR)	0.442 (3.47)	0.563 (3.37)	0.670 (2.98)
AR(1)	0.537 (6.47)	0.395 (3.90)	0.321 (3.03)
R^2	0.940	0.949	0.941

Note: t-ratios in parentheses, 247 observations.

Table 6: Inter-state differentials in the trend rates of change in the rural headcount index (H) and the contribution of initial conditions

(% points per annum)

	Difference between the state's trend rate of change in H and that for Kerala	Differential in trend attributable to *all* initial conditions	Differential due to differences in the initial levels of		
			Irrigation rate	Female literacy rate	Infant mortality rate
Andhra Pradesh	0.03	0.73	-0.35	0.84	0.24
Assam	2.62	1.16	0.56	0.56	0.04
Bihar	2.13	1.12	-0.16	1.11	0.18
Gujarat	0.57	0.98	0.36	0.59	0.03
Jammu and Kashmir	1.62	1.34	-0.41	1.77	-0.02
Karnataka	1.59	1.32	0.31	0.79	0.23
Kerala	0.00	0.00	0.00	0.00	0.00
Madhya Pradesh	1.80	2.38	0.58	1.35	0.45
Maharashtra	1.05	1.59	0.52	0.78	0.29
Orissa	0.70	1.01	-0.10	0.90	0.21
Punjab and Haryana	0.09	0.33	-0.65	0.82	0.16
Rajasthan	1.47	1.92	0.08	1.48	0.37
Tamil Nadu	0.82	0.32	-0.61	0.66	0.28
Uttar Pradesh	1.09	1.35	-0.56	1.23	0.68
West Bengal	0.77	0.54	-0.23	0.76	0.01

Table 7: Inter-state differentials in the trend rates of change in the rural poverty gap index (PG) and the contribution of initial conditions

(% points per annum)

	Difference between the state's trend rate of change in PG and that for Kerala	Differential in trend attributable to *all* initial conditions	Differential due to differences in the initial levels of		
			Irrigation rate	Female literacy rate	Infant mortality rate
Andhra Pradesh	0.37	1.11	-0.48	1.26	0.33
Assam	4.16	1.67	0.77	0.84	0.06
Bihar	2.79	1.69	-0.22	1.67	0.24
Gujarat	0.79	1.42	0.50	0.88	0.04
Jammu and Kashmir	2.93	2.07	-0.56	2.66	-0.02
Karnataka	2.97	1.92	0.43	1.19	0.31
Kerala	0.00	0.00	0.00	0.00	0.00
Madhya Pradesh	2.72	3.44	0.80	2.03	0.62
Maharashtra	2.02	2.29	0.71	1.18	0.40
Orissa	1.24	1.51	-0.14	1.36	0.29
Punjab and Haryana	0.58	0.56	-0.89	1.23	0.21
Rajasthan	2.77	2.83	0.11	2.22	0.50
Tamil Nadu	1.59	0.53	-0.84	0.99	0.38
Uttar Pradesh	2.05	2.01	-0.77	1.85	0.93
West Bengal	1.76	0.84	-0.31	1.14	0.01

Table 8: Inter-state differentials in the trend rates of change in the rural squared poverty gap index (SPG) and the contribution of initial conditions

(% points per annum)

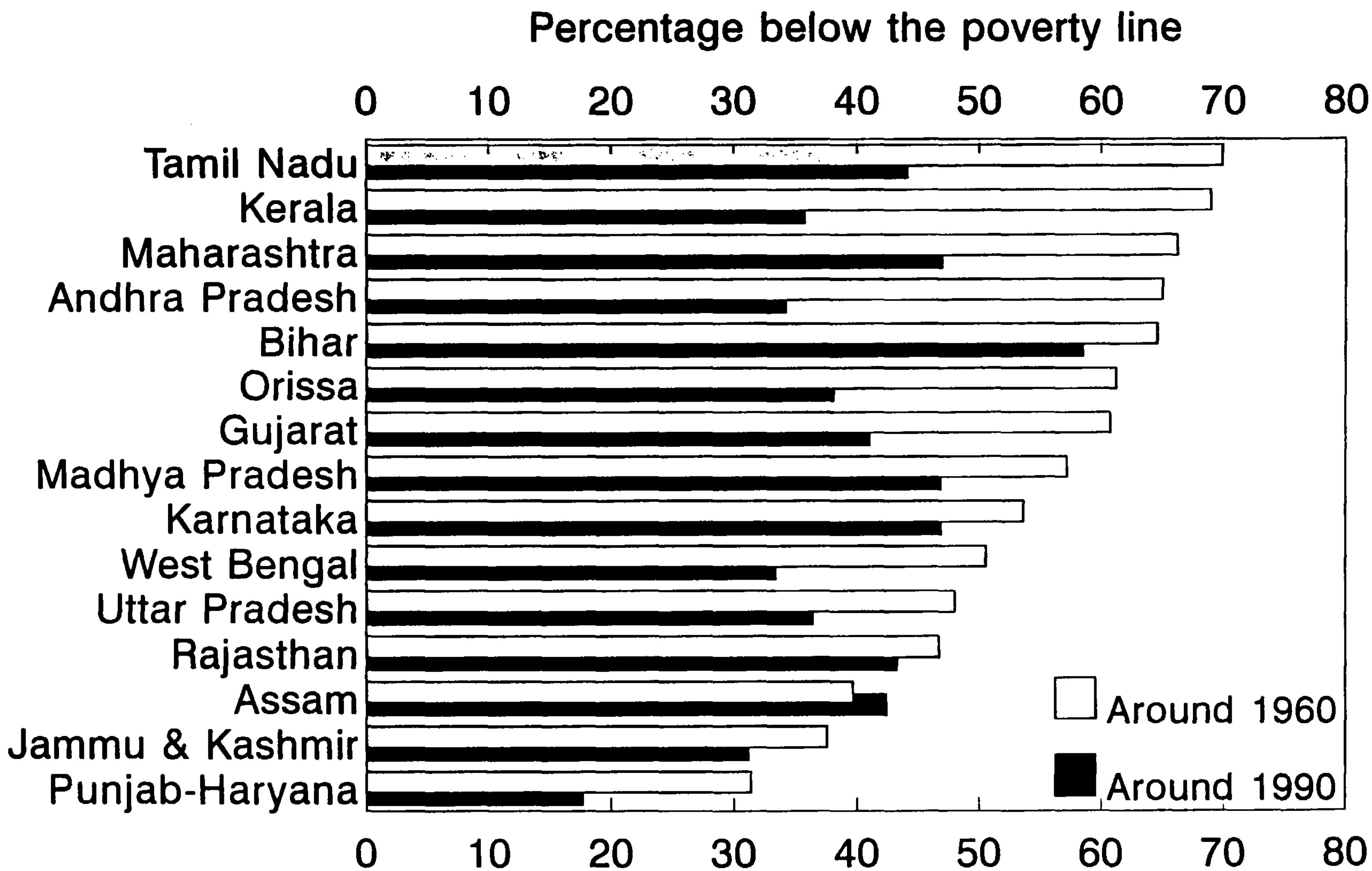
	Difference between the state's trend rate of change in SPG and that for Kerala	Differential in trend attributable to *all* initial conditions	Differential due to differences in the initial levels of		
			Irrigation rate	Female literacy rate	Infant mortality rate
Andhra Pradesh	0.64	1.41	-0.60	1.61	0.40
Assam	5.37	2.09	0.95	1.08	0.07
Bihar	3.17	2.15	-0.28	2.12	0.30
Gujarat	0.89	1.79	0.62	1.12	0.05
Jammu and Kashmir	3.94	2.67	-0.69	3.39	-0.03
Karnataka	3.97	2.41	0.52	1.51	0.38
Kerala	0.00	0.00	0.00	0.00	0.00
Madhya Pradesh	3.36	4.32	0.99	2.58	0.75
Maharashtra	2.76	2.86	0.87	1.50	0.49
Orissa	1.48	1.91	-0.17	1.73	0.35
Punjab and Haryana	0.82	0.74	-1.09	1.57	0.26
Rajasthan	3.70	3.57	0.13	2.83	0.61
Tamil Nadu	2.12	0.69	-1.03	1.26	0.46
Uttar Pradesh	2.68	2.55	-0.94	2.35	1.13
West Bengal	2.42	1.08	-0.38	1.45	0.01

Table 9: Inter-state differentials in the trend rates of change in rural real mean consumption and the contribution of initial conditions

(% points per annum)

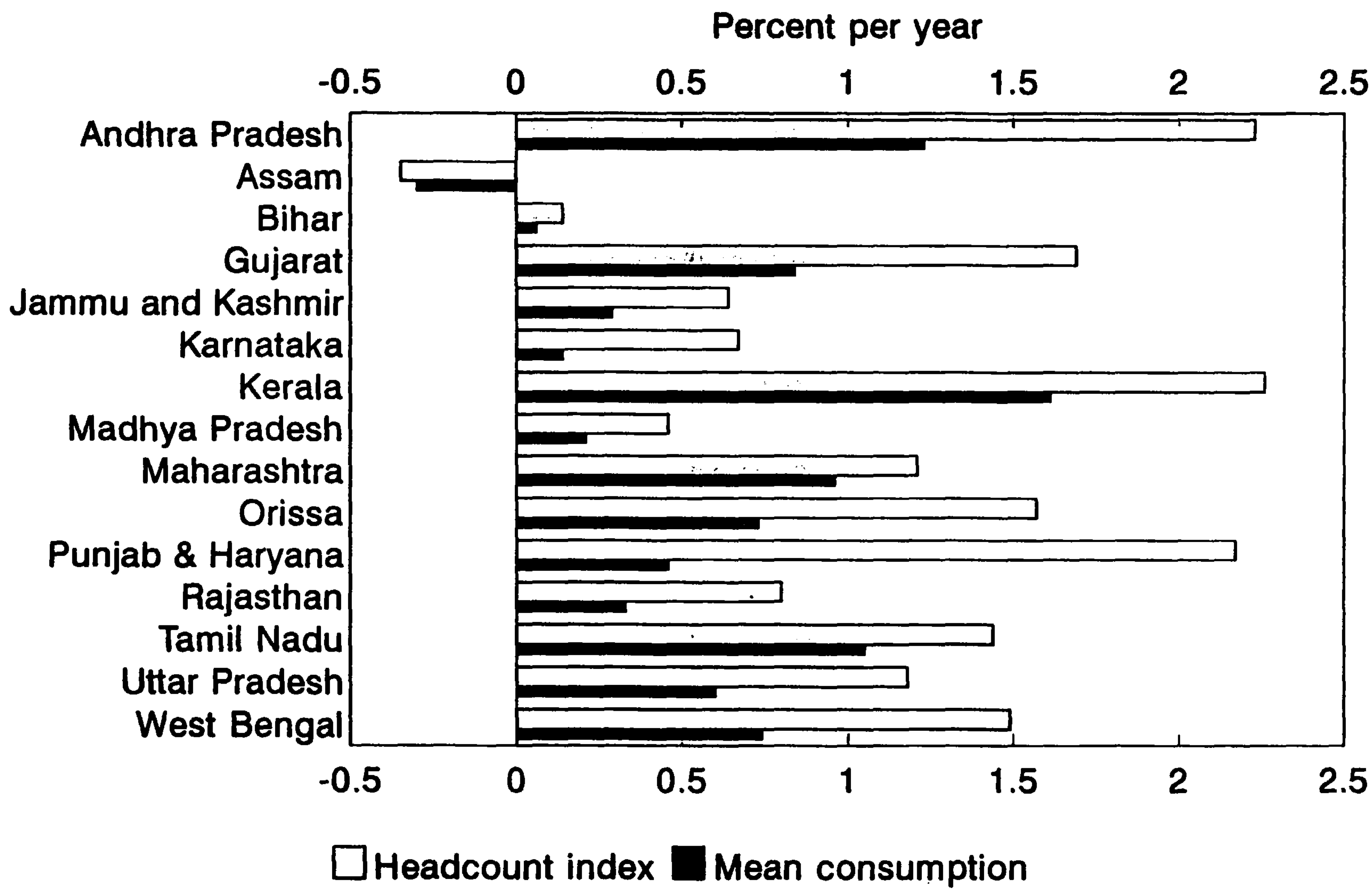
	Difference between the state's trend rate of change in mean consumption and that for Kerala	Differential in trend attributable to *all* initial conditions	Differential due to differences in the initial levels of		
			Irrigation rate	Female literacy rate	Infant mortality rate
Andhra Pradesh	-0.38	-0.52	0.10	-0.51	-0.11
Assam	-1.91	-0.52	-0.16	-0.34	-0.02
Bihar	-1.54	-0.71	0.05	-0.67	-0.08
Gujarat	-0.77	-0.47	-0.10	-0.36	-0.01
Jammu and Kashmir	-1.32	-0.95	0.12	-1.08	0.01
Karnataka	-1.46	-0.67	-0.09	-0.48	-0.10
Kerala	0.00	0.00	0.00	0.00	0.00
Madhya Pradesh	-1.40	-1.19	-0.17	-0.82	-0.20
Maharashtra	-0.64	-0.75	-0.15	-0.48	-0.13
Orissa	-0.88	-0.62	0.03	-0.55	-0.10
Punjab and Haryana	-1.15	-0.38	0.18	-0.50	-0.07
Rajasthan	-1.28	-1.08	-0.02	-0.90	-0.17
Tamil Nadu	-0.56	-0.35	0.17	-0.40	-0.12
Uttar Pradesh	-1.01	-0.89	0.16	-0.75	-0.31
West Bengal	-0.86	-0.40	0.06	-0.46	0.00

Figure 1: Poverty rates by states of India, 1960-90



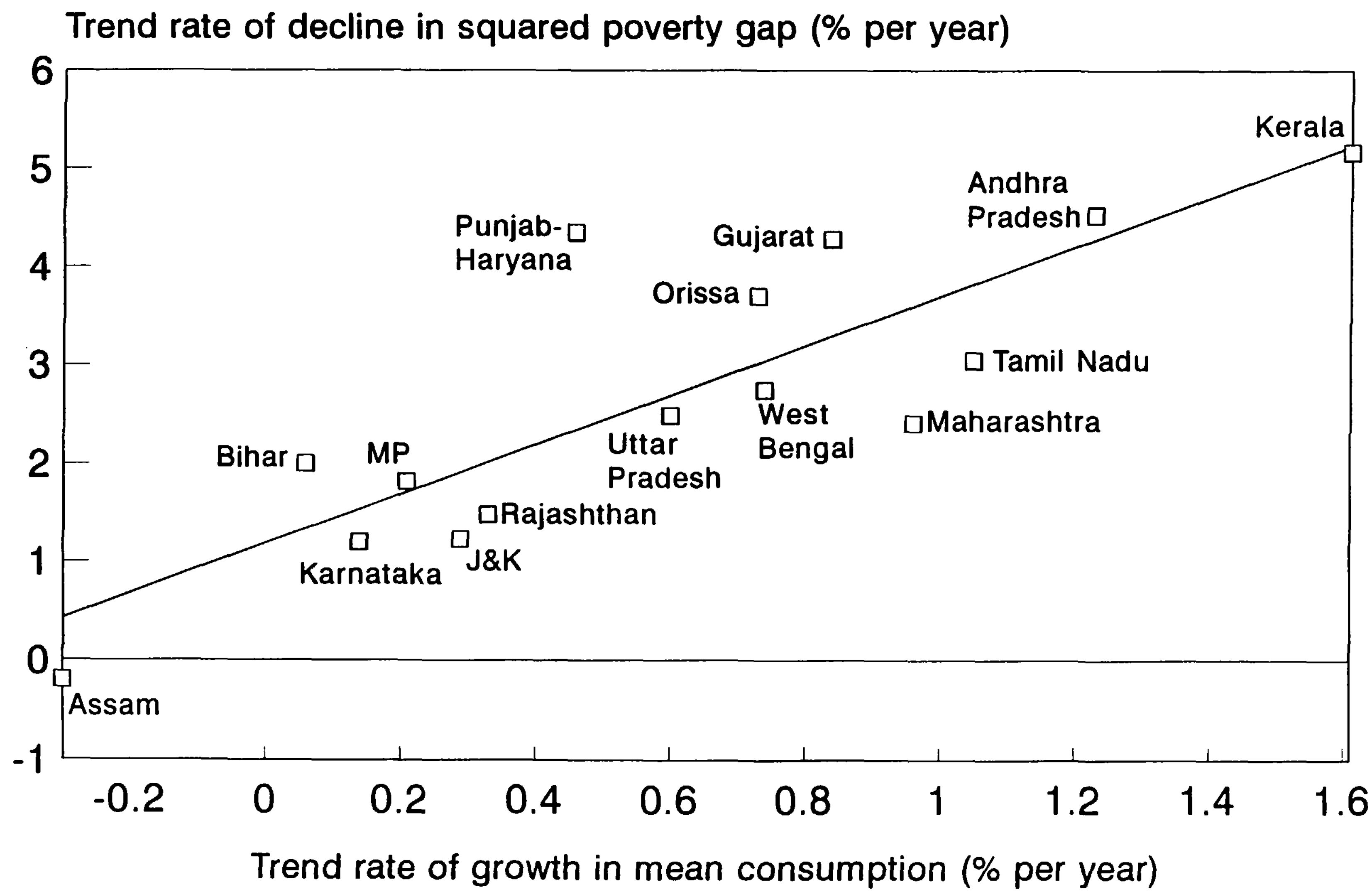
Averages for first three survey rounds and last three

Figure 2: Trend rates of progress



Note: The Figure shows trend rates of decline for the headcount index and trend rates of increase for mean consumption

Figure 3: Rates of poverty reduction and rates of growth in mean consumption



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