WORKING PAPER NO. 32

AGRICULTURAL PRODUCTIVITY, OFF-FARM EMPLOYMENT AND RURAL POVERTY: AN ANALYSIS BASED ON NSS REGIONS

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NEW DELHI
2005

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The paper is in two parts. The first part is a preliminary attempt to use region-level NSS data to throw some light on inter-regional differences in the rural economy of India. We start by defining seven "broad regions" on the basis of poverty levels as well as topographical conditions, and contiguity. The characteristics of the broad regions are explored. An important strand in the analysis is the way the land productivity in the broad regions has tended to cope with diminishing land-man ratio over time. The importance of land-man ratio and land productivity relative to other important variables—like non-farm employment and urbanization—in determining rural levels of welfare are explored quantitatively for the broad regions. The contribution of these factors to the differences between broad regions are explored quantitatively both at a point of time and over a decade and a half (1983–99).

In the second part, a cross-sectional analysis for all-India is undertaken with a view to unravelling the relative elasticity of rural per capita expenditure with respect to its principal determinants for each of the three NSS years of 1983, 1993 and 1999. Particular interest is attached to the two opposite hypotheses about the role of the non-farm sector in rural income determination—the Mellor hypothesis of the virtuous circle of land productivity and non-farm sector growth; and the contrasting Foster-Rosensweig thesis of the non-farm sector playing a compensatory role. Our analysis leans against the latter view. But the importance of urban development in enhancing rural welfare is strongly established.

I. MOTIVATION

The time series data from successive NSS surveys have been the basis of work on the subject which firmly establishes the connection between poverty reduction and agricultural productivity growth (Ahluwalia). Ravallion and Datt use state level cross-section and time series data pooled together to establish the connection. The contrary view of Beasley-Burgess is probably due to a dubious fixed-effect model which has been rightly criticized by Peter Timmer. Few studies have used the cross section data available for the 75-odd NSS regions. One exception is Palmer-Jones and Sen. Our paper attempts to push the work based on NSS regions further.

II. THE PALMER JONES-SEN MODEL

A paper by Richard Palmer-Jones and Kunal Sen (2003) has been one of the first to use NSS region level data to explore the relationship between agricultural productivity and the incidence of poverty in a cross-sectional framework They used the 43rd and the 50th rounds of the NSS to calculate the average headcount ratio (HCR) for each of the NSS regions for 1987--8 and 1993--4. The authors use a simple linear relationship to explain the inter-regional variation in poverty incidence by the agricultural growth rates (measured by gross output per hectare -- aggregated from available district level data on NSS regions). An initial level of HCR for the only year available (1973) is used as a control variable, and some socio-economic factors are added to allow for social factors and agrarian structure (see Equation 1). The strong negative effect of agricultural growth remains even after allowing for the other variables (see Table 3), and vindicates the importance of the relationship at a fairly disaggregated cross-section level.

The authors then work out in some detail the proximate determinates of agricultural growth. Their empirical results are based on two propositions: (i) a positive relationship between irrigation and agricultural growth—worked out in a time series production function form (see Equation 2 and Table 4); and (ii) a positive relationship between initial agro-ecological conditions and irrigation—worked out in an empirical relationship between the level of irrigation in the district and the proportion of the district included in one 15 'agro-ecological' zones, the latter capturing the best conditions for irrigation (see Equation 3 and Table 5).

The message seems to be that initial agro-climatic conditions have driven the process of agricultural growth and poverty reduction in India. The amount of detailed work in piecing together different sources of data is impressive. But at the end of it one is left with some points of enquiry.

Critique

1. The role of factors other than agricultural productivity growth, e.g., the role of non-farm sector, is not addressed in the exercise.
2. Any change in the process, e.g., in the post-reform period, is not discussed.
3. Policy implications are very limited. Dividing the whole of India into just two groups of the ecologically "favoured" and "non-favoured" regions does not leave the policy maker with much choice about possible alternatives of approach. The authors were unable even to evaluate the marginal returns to public investment in the two regions in terms of the limited objective of poverty reduction. The only strong result came from region 13 which "seems to have favourable agro-ecological conditions and moderate irrigation levels but has the highest poverty ratio in India". Evidently, this region was an outlier in the model and cried out for better attention to its potential for poverty reduction through agricultural productivity growth. But as we shall see, even for this region more recent developments point to better conditions than what was diagnosed in the Palmer-Jones–Sen analysis.

Broad Regions

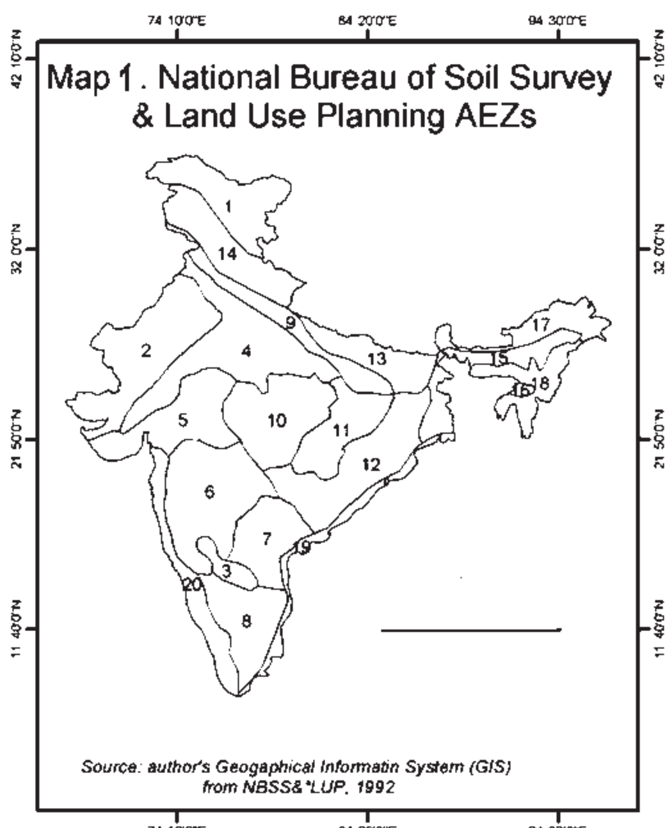
We decided to divide the country into a limited number of "broad regions", grouped from the available 60-odd NSS regions, on the basis of three principles: (i) the average incidence of poverty (as measured by the headcount ratio over the three rounds of the NSS—1983, 1993 and 1999; (ii) the agro-climatic zones into which the NSS regions fell; and (iii) geographical contiguity. After some experimentation, seven regions were distinguished. These are reported in Table 1.

Table 1
Broad Regions of India

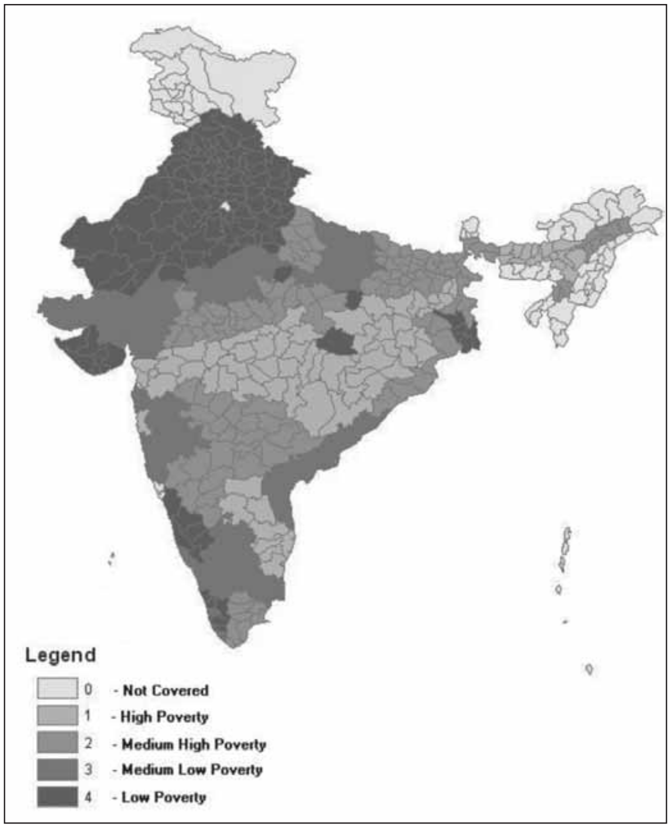
Regions:		Agro-Climatic Regions
1	North -Western Prosperous Regions.	2, 4, 14 and part of 9
2	West Central High Poverty Regions.	11, 12 and part of 6 & 10
3	Central Eastern Medium Poverty Regions.	5, 13 and part of 9 & 10
4	East-Coast and North-Eastern Regions.	15 to 19.
5	West Coast Low Poverty Regions.	20
6	West-Southern Medium Poverty Regions.	3, and part of 6 and 8
7	Southern High Poverty Regions.	7 and part of 8

Note: See Appendix-1 for the definition of the agro-climatic zones.

Map 1
Agro Climatic Zones in India



Map 2
Rural Poverty 1999-2000



Map 1 gives the visual distribution of the agro-climatic zones. It should be read with the representation of poverty incidence in Map 2 to get a fix on the demarcation of the broad regions in our analysis.

It should be noted that in Map 2 we have divided the medium poverty zones into two sub-groups—medium low and medium high. Thus, instead of three groups of poverty incidence specified in Table 1, we have portrayed four groups in Map 2.The range of headcount ratios corresponding to the four shades are as follows.

Defining the Broad Regions

Region 1 is the most clearly demarcated—not only did it have the lowest incidence of poverty in 1999 (less than 6 per cent) but it also exhibits the steepest decline over the period considered. It stretches from the Western Plain, Kutch and part of Kathiawar peninsular into the northern plain and central highlands, and further into the fertile irrigated areas of Punjab and Haryana.

Region 2 is the 'heart' of the poverty belt, which had been identified as early as in early seventies (Jain and Tendulkar), accounting for substantial part of the rural poor in 1999. It covers the area of the eastern plateau (Chhattisgarh) and Eastern Ghats and extending into the central highlands and part of the Deccan plateau. This is a hot semi-arid region with limited scope for irrigation.

Region 3 is the medium poverty region extending over Eastern Uttar Pradesh, Jharkhand and into the central highlands. It has more potential for irrigation than Region 2 though the soil is less favourable for staple agriculture.

Region 4 is a more heterogeneous one stretching along the east coast of India. It includes the hot sub-humid to humid plains of Bengal and Assam and stretches from northeast to include the area of the Eastern Himalayas, and further south into the semi-arid perhumid area of the eastern coastal plain.

Region 5 is the Western Ghats and coastal plain with red laterite and alluvium derived soils and humid to perhumid ecological conditions.

Region 6 is the arid region of the Deccan, including parts of Telengana and the Eastern Ghats with red and black soil.

Region 7 is the Eastern Ghats, Tamil Nadu uplands and the Deccan (Karnataka) plateau with red loamy soil.

Table 2 presents the cropping pattern in seven broad regions. In terms of cropping pattern, broad region 5 clearly stands out.

Table 2

Main Crops Grown during 1997-9

Broad Region	Main Crops Grown
1	Wheat, Bajra, Paddy and Cotton
2	Paddy, Jowar, Wheat and Cotton
3	Wheat, Paddy, Soya bean and Maize
4	Paddy and Jute
5	Rubber, Spices and Paddy
6	Small Millets, Jowar, Paddy and Bajra
7	Groundnut, Small Millets and Paddy

Note: Crops in descending order of importance.

Characteristics of Broad Regions

(i) Incidence of Poverty

Table 3 gives the headcount ratio (% poor) by broad regions for different NSS rounds. The method of calculating the HCR is as follows:

1. The HCR is calculated by using state specific poverty line built up by Deaton for all the three years. Therefore, the portion of each broad region falling in different state would have different poverty line.
2. rpov87 and rpov93u is based on average per capita consumption expenditure (APCE) of uniform reference period (URP); those were given in the NSS unit level data of the year 1987-8 and 1993-4. The rpov99 was based on APCE of mixed reference period (MRP). To make 1993 poverty estimate comparable with that of 1999, we have converted APCE (URP) of 1993-4 to APCE (MRP) by following the procedure followed by Sundaram and Tendulkar.

Table 3

Incidence of poverty in Broad Regions

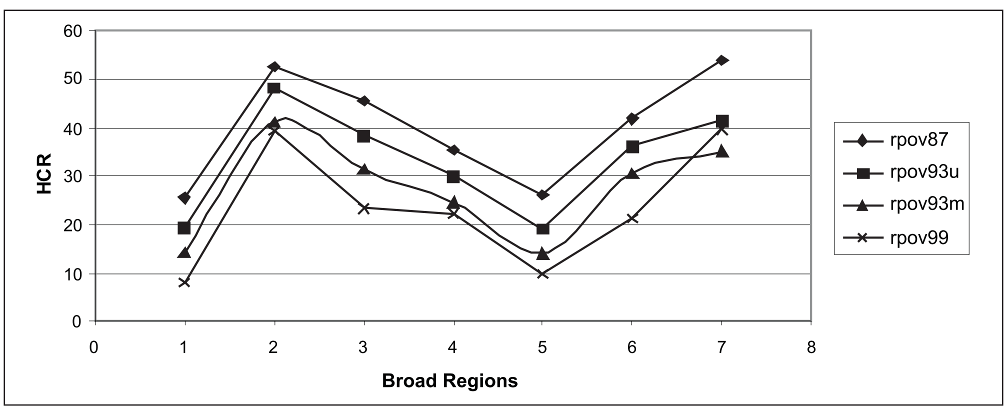
Regions		rpov87	rpov93u	rpov93m	rpov99
1	% poor	25.46	19.35	14.29	8.01
	C.V.	591.46	368.20	372.80	164.46
2	% poor	52.65	48.19	41.30	39.11
	C.V.	60.42	110.18	105.19	247.67
3	% poor	45.57	38.36	31.26	23.40
	C.V.	119.94	159.57	150.65	99.06
4	% poor	35.50	29.97	24.60	22.33
	C.V.	114.90	75.65	67.42	213.53
5	% poor	26.11	19.10	13.90	9.97
	C.V.	79.75	35.49	17.24	169.43
6	% poor	41.67	36.10	30.62	21.30
	C.V.	57.50	94.16	151.03	41.27
7	% poor	53.79	41.61	35.02	39.63
	C.V.	213.32	156.36	143.02	388.14

Note: C.V. is calculated for NSS region around Broad Region

The following figure graphs the HCR by broad regions for the different NSS rounds.

Figure 1

Trends of HCR Across Broad Regions



It is seen that the level and trend in poverty decline in the two low poverty regions – the north-western (1) and the west coast (5) – are very similar. Similarly, the high poverty regions – the central-eastern (2) and southern (7) – are close to each other in terms of the experience of decline in poverty over time. The other three regions have rather similar incidence of poverty in the 1999--00 round, but regions 3 and 6 had substantially higher poverty incidence than region 4 in 1987. That is to say 3 and 6 had a steeper decline in poverty than region 4.

(ii) Land Productivity

Table 4 gives the figures for land productivity (in 1993--4 rupees per hectare) for the broad regions and the data are graphed in the adjoining figure. The method of calculating land productivity is as follows:

Land productivity is obtained by dividing value of output (at constant 1993--4 all-India prices) by net sown area.

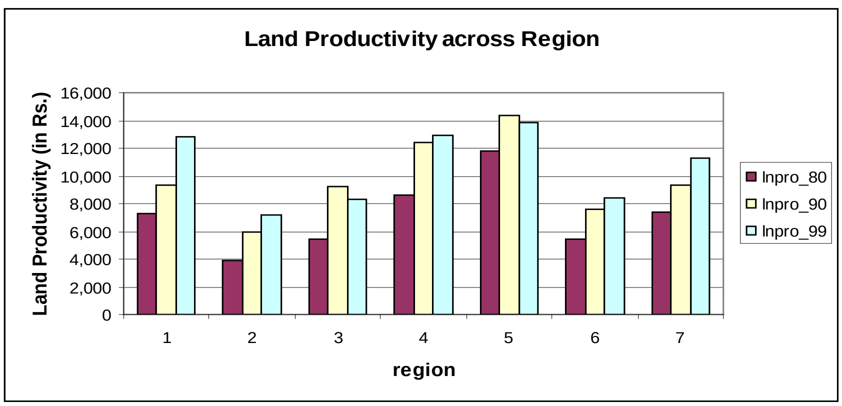
Table 4

Land productivity by Broad Regions (in Rs. at constant prices)

Broad Regions	lnpro_80	lnpro_90	lnpro_99
1	7,304	9,298	12,845
2	3,912	5,936	7,184
3	5,421	9,279	8,293
4	8,644	12,448	12,923
5	11,843	14,394	13,801
6	5,397	7,610	8,450
7	7,384	9,312	11,237

Figure 2

Land Productivity Across Region



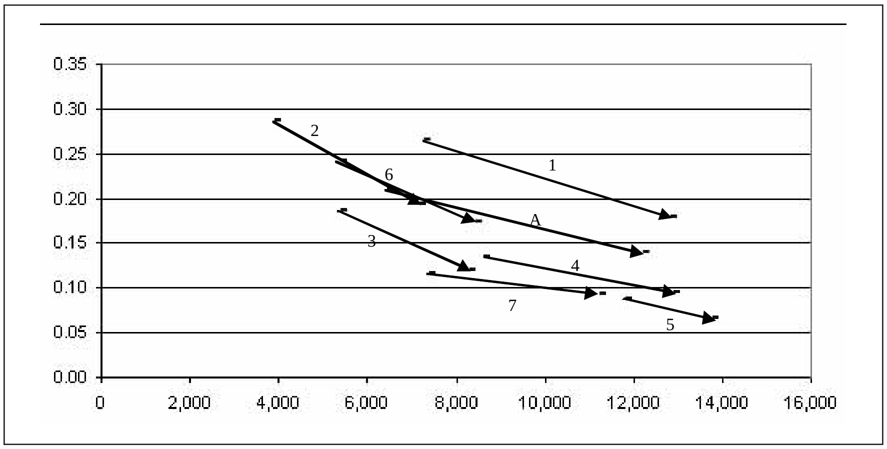
(iii) Land-Man ratio and Land Productivity

Figure 1 maps the position of the seven broad regions at two dates—1983 and 1999—in the man-land ratio and land productivity space.

Ishikawa (1987) suggested that in Asian peasant agriculture, as the man-land ratio deteriorates due to the pressure of population on land, the agricultural economy adjusts by increasing land productivity—that is the movement in the space of Figure 1 would be in the direction of the south-east or the fourth quadrant. A second part of the Ishikawa hypothesis was that the points in the graph will lie along a rectangular hyperbola. The area under this hyperbola remains constant, signifying that the productivity per man remains roughly constant. In other words, more intensive cultivation increases land productivity but only just compensates for the deterioration of the man-land ratio. Technical progress or the availability of co-operant inputs like capital can, of course, shift the curve upwards and to the right, thus increasing land productivity by more than the hypothetical level.

Figure 3

Land-man Ratio and Land Productivity in Agriculture:
1983 data Points connected to 1999 Points by Arrows, across Broad NSS Region



Note: Land Productivity is Value of Output per hectare of Land (in Rs.) at 1993--4 constant prices.
Land-Man Ratio – Hectare of land per person.
1 to 7 show changes in broad regions 1 to 7 and A is the figure for all-India (combined 1 to 7).
Y-axis is land-man ratio.

The following points can be made by looking at the scatter in Figure 3.

(i) The movement of all regions over time has been in the Ishikawa direction—to the south-east.

(ii) Region 1—the low poverty region of the north-west—has a position all of its own lying above and to the right of the other regions. It shows the importance of the higher level of technology—based presumably on irrigation—which enables it to attain a higher level of land productivity for all levels of land-man ratio relative to the other regions. Note that both in 1983 and 1999 it had a lower land-man ratio than region 2 and only slightly higher than region 6, but substantially higher land productivity.

(iii) All the other regions lie close together along a downward sloping non-linear curve. But it should be apparent that the elasticity of this curve is more than the constant unit elasticity of rectangular hyperbola. In fact, at most points of this hypothetical curve the elasticity would seem to be more than unity (This can be shown more clearly by drawing rectangular hyperbola through the 1983 and the 1999 points of region 2) That is to say all regions over time have been able to increase their land-productivity at a higher rate than what would just compensate for the deterioration of the land-man ratio. This is the basis for the increase of productivity per man in all regions, though obviously at different rates (This point is pursued further below).

(iv) Turning now to inter-regional comparisons, it is interesting to note that outside of region 1, as we move down the scale of the land-man, each region at both dates lies to the south-east of the one before it. The only exception would seem to be region 7—whose position at both dates is left or south-west of region. Evidently this southern high poverty region is burdened by particularly low potential for raising land productivity to compensate for its relatively low land-man ratio.

(iv) Rural Non-Farm Sector

1. Employment

The welfare levels of rural households depend on the development of the non-farm sector along with the level of land productivity. Regions with low land productivity or unfavourable land-man ratio might be able to pull up their income levels with active participation in either the rural off-farm sector or employment in the urban areas. The role of the urban sector is portrayed in the next sub-section. Table 5 presents the percentage employment in rural non-farm activities in the seven regions of our study.

Table 5

Percentage of rural employment in the non-farm sector

Regions		t38nfups	t50nfups	t55nfups
1	% NF	20.80	27.11	30.05
	C.V.	107.83	178.77	149.77
2	% NF	14.76	16.05	16.73
	C.V.	74.65	88.92	105.41
3	% NF	16.43	17.45	20.68
	C.V.	56.58	74.83	70.84
4	% NF	26.27	29.07	31.23
	C.V.	150.29	127.04	66.37
5	% NF	36.16	39.76	42.84
	C.V.	248.08	293.57	412.33
6	% NF	19.63	22.93	22.46
	C.V.	89.66	95.27	167.76
7	% NF	21.57	26.35	29.28
	C.V.	43.00	62.04	19.22

Note: C.V. is calculated for NSS region around Broad Region.

Employment in the rural non-farm sector (NFS) can respond to two different types of developments. High growth in the farm sector creates demand for non-farm products (including services) and "pulls" labour into it. On the other hand, limited opportunity for increase in land productivity together with pressure of population on land could "push" labour into the off-farm sector.

The "pull" effect seems to have been important in the prosperous low poverty region 1, particularly in the development over time. The percentage of employment in NFS was relatively low in 1983 (NSS 38th round) but grew to 30 per cent over the period (until 1999) as the farm economy prospered. Although NFS has increased somewhat over time in other regions, the rate of growth has been quite limited in all the regions – with the possible exception of region 7 (see below).

Looking across the seven regions, it is clear that it is the pressure of population on land (as represented by the land-man ratio) that seems to be critical in determining the relative size of NFS. It is striking that the lowest levels of NFS outside region 1 are to be found in the regions with a relatively high land-man ratio: regions 2, 3 and 6 (see Figure 1 above). Since the regions differ a lot in terms of their incidence of poverty and hence levels of income, the conclusion suggested by this evidence is that it is the pressure of population on land that has the dominant influence on the size of the NFS.

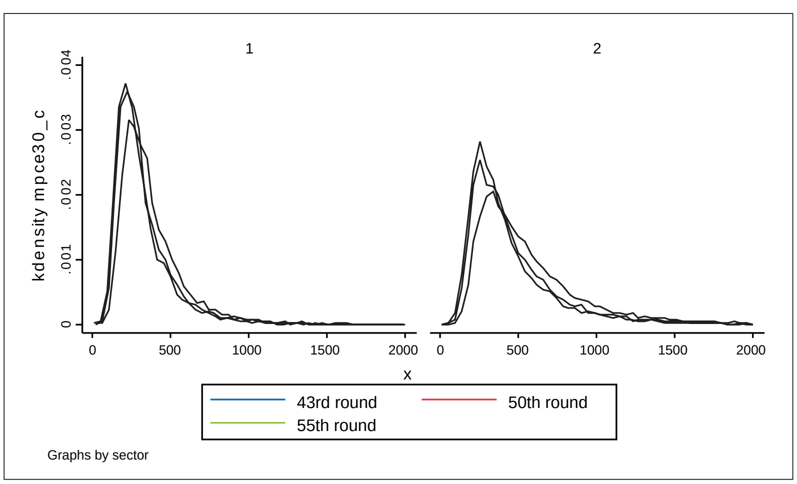
Both regions 5 and 7 are low land-man regions. The NFS sector in region 5 has been at the highest level in India for the entire period of our study, while the sector in region 7 has had a growth rate almost as high as that of the low poverty region 1. But the two regions differ in terms of poverty incidence. Region 5 can clearly point to the successful development of its NFS sector as an instrument in its achievement of a low incidence of poverty in spite of the unfavourable land-man ratio. But region 7 continues to be a high poverty region despite its relatively high growth rate of NFS as well as of land productivity.

2. *Labour Productivity*

The proportion of rural income generated in the non-farm sector does not depend only

Figure 2

Kernel Density Functions of Expenditure Per Capita in the Tertiary Sector, Different Rounds: (1) Rural; (2) Urban



Source: NSSO Various Rounds

on the proportion of employment in this sector. The other variable is the relative level of labour productivity. It is not possible to determine a priori how the latter will vary with the prosperity of the region. On the one hand, we would expect that in a relatively poor region there will be good deal of labour ‘pushed’ into off-farm activity for lack of opportunities in cultivation and related activities—and this will tend to depress the relative productivity in non-farm sectors. On the other hand, we would expect the agricultural sector to be less integrated with the non-farm economy in poorer regions. The enhanced ‘dualism’ in such regions would tend to make the productivity in non-farm relatively higher. We do not know which of these two influences would prevail in an inter-regional comparison. The empirical data presented in Table 9 suggests that in fact the latter has the more dominant influence. High income regions (like 1, 3 and 5) have a lower productivity gap, while the highest productivity gap is found in the poorest regions 2 and 7.

Table 6

Income per Rural UPS Worker in Agricultural and Non-agricultural Sector

Broad Region	lp_ag55	lp_nag55	lp_ag50	lp_nag50	y_gap55	y_gap50	gr_yag	gr_ynag
1	1,224	1,276	1,030	1,073	104	104	2.92	2.93
2	542	812	510	774	150	152	1.03	0.79
3	923	925	777	872	100	112	2.91	0.98
4	807	909	764	878	113	115	0.91	0.59
5	946	1,090	895	965	115	108	0.93	2.05
6	598	882	520	764	147	147	2.37	2.41
7	474	708	466	797	149	171	0.28	-1.94

Note: lp_ag - consumption expenditure of agricultural households divided by total agricultural UPS worker.

lp_nag - consumption expenditure of non-agricultural households divided by total non-agricultural UPS worker.

y_gap – ratio of lp_nag and lp_ag.

Gr_yag and Gr_yanag are annual growth rate of lp_ag and lp_nag.

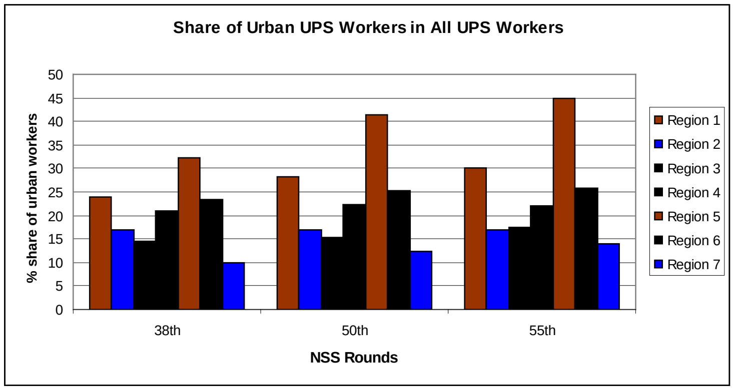
(v) Rate of Urban Employment Growth

How far does creation of employment outside the rural sector provide an additional element to the pattern of inter-regional differences? Table 7 provides the data for the different rounds on this point.

Table 7

Share of Urban UPS Workers in Rural-Urban Combined

Broad	Urban Workers' Ratio		
Regions	38th	50th	55th
1	23.83	28.16	30.24
2	16.94	16.95	16.86
3	14.45	15.39	17.35
4	20.94	22.25	22.07
5	32.27	41.52	44.80
6	23.49	25.21	25.75
7	9.94	12.41	14.00
Total	21.12	23.55	24.82



There is a clear correlation between the incidence of poverty and the rate of urbanization across regions. As with NFS, region 1 again stands apart from the others in not only having a higher than average proportion of employment in the urban areas all along, but also in experiencing a faster growth of this sector than the other regions. The low poverty region 5 shows the highest urban rate which increases by a third between the 38th and the 55th rounds. Clearly, urban employment played as much of a role in poverty reduction as the NFS in this region. The lowest urban rates are found in the two high poverty regions of the central-west and the south (regions 2 and 7). The medium poverty regions 3, 4 and 6 have intermediate levels of urbanization and show only small gains over the period.

Components of RAPCE across Broad Regions

There is a close relationship between the rural household welfare levels (as measured by the average rural household per capita expenditure—RAPCE—and the incidence of poverty as measured by the headcount ratio (see Part II). We, therefore, tried to look at the different components of RAPCE that contribute to its differences across regions.

We make use of the identity:

$$Yr/Pr = Ya/N.\ N/P.Yr/Ya.\ P/Pr \quad (1)$$

Where Yr = total rural household income (expenditure)

P = total (rural +urban) population in region

Pr = rural population

Ya = total income (expenditure) of agriculture households

N = net sown area

Then Yr/Pr is RAPCE

Ya/N is land productivity

N/P is the land-man ratio

Yr/Ya is the ratio of agricultural income to total rural income (an index of the relative importance of the rural non-farm sector)

P/Pr is the inverse of the proportion of the population in the rural sector.

Note that the Yr/Pr as given in the identity will not correspond exactly to the actual RAPCE obtained from the unit level data of the NSS. There is the issue of missing crops, and there is also the problem of the difference between household income and expenditure due to household savings among other things. Furthermore, a critical element missing from Equation 1 is that of net value added per unit of gross output, since detailed data on this point for the NSS regions is not available. Nevertheless, we can treat the Yr/Pr in Equation 1 as a reasonably close index of the actual RAPCE.

Taking logs of all the terms in Equation 1, the percentage difference of all the variables in any region with respect to the base region—say region 1—can be calculated. Thus, the percentage difference in Yr/Pr between region 1 and every other region can be expressed as a sum of the percentage differences of the variables included in the RHS of Equation 1. We can then form some notion about the relative quantitative importance of the latter in accounting for the difference in the hypothetical Yr/Pr.

Table 8 sets out the calculations for the 55^{th} round of the NSS. We also include in the second column the actual value of RAPCE for this round (at 1993--4 prices).It is seen that the signs of the differences of the actual values agree fully with those of the hypothetical values entered in the last column as the sum of the components in columns 3 through 6. It is, however, seen that the differences in the hypothetical values are exaggerated in all the regions except 5 and 7.

Table 8

Change (in %) from Broad Region 1 in the Year 1999-2000

Regions	Yr/Pr	lnpro	N/P	Yr/Ya	P/Pr	sum
1	0	0	0	0	0	0
2	-36	-44	8	-10	-8	-54
3	-30	-35	-32	-13	-16	-96
4	-27	1	-47	4	-8	-51
5	9	7	-63	31	26	3
6	-17	-34	-3	-1	8	-30
7	-32	-13	-48	13	15	-33

The following interesting conclusions emerge from the values of the components in relation to the sum:

(i) Difference in land productivity is of overwhelming importance in the lower value of Yr/Pr in regions 2 and 6. It is also a significant factor in the lower level of rural income in regions 3 and 7. Only in regions 4 and 5 does land productivity seem to be more or less on par with that of region 1.

(ii) The more unfavourable land-man ratio plays a bigger role in the more southern regions 3-5 and 7.

(iii) The important role played by the rural off-farm sector and urbanization (columns 5 and 6) in the southern regions 5 and 7 is striking. Region 5 is able to lift itself to a low poverty region—inspite of a very unfavourable man-land ratio—through major developments in these activities, while region 7 mitigates its unfavourable land productivity and land-man ratio to some extent.

(iv) Off-farm activity and urban development are much less important in the more northern regions where the pressure of population on land is not as great (regions 1, 2 and 6). Regions 2 and 3 are in fact poorer because of the lower level of performance of these sectors compared to region 1, but the dominant factor behind the difference is lower land productivity—as indeed it is so in region 6 as well.

Dynamics of the Broad Regions

Using Equation 1 the growth rate of RAPCE can be decomposed into the algebraic sum of the growth rates of the variables on the RHS. Note that it is expected that N/P will be negative. Yr/Ya is an index of the growth of the non-farm sector in the rural areas, and as we have seen will be positive. P/Pr shows the effect of urbanization and also will be positive. The decomposition exercise helps us to quantify the relative importance of the different variables in the identity in the growth rate of RAPCE in the seven regions. The results are given in Table 9.

Table 9

Different Variables in Regional Growth

	Regions	*Lnpro*	*N/P*	*Yr/Ya*	*P/Pr*	*sum*
For 83-99	1	3.48	-2.37	0.63	0.45	2.20
	2	3.75	-2.36	0.31	0.17	1.87
	3	2.61	-2.60	0.10	0.13	0.24
	4	2.47	-2.16	0.92	0.19	1.41
	5	0.93	-1.67	0.85	1.05	1.15
	6	2.75	-1.97	0.55	0.77	2.11
	7	2.58	-1.38	1.09	0.53	2.81
For 83-93	1	2.33	-2.27	0.65	0.41	1.11
	2	4.05	-2.24	0.40	0.07	2.28
	3	5.25	-2.17	0.00	0.14	3.22
	4	3.53	-1.70	1.21	0.22	3.26
	5	1.88	-0.97	0.40	1.13	2.44
	6	3.33	-0.98	0.94	0.48	3.77
	7	2.23	-0.93	1.64	0.29	3.24
For 93-99	1	5.53	-2.55	0.61	0.54	4.13
	2	3.23	-2.56	0.14	0.35	1.17
	3	-1.85	-3.35	0.28	0.11	-4.82
	4	0.63	-2.96	0.41	0.13	-1.79
	5	-0.70	-2.88	1.63	0.90	-1.05
	6	1.76	-3.69	-0.12	1.28	-0.77
	7	3.18	-2.17	0.12	0.96	2.09

The data presented in Table 9 help us to throw some light on the question: is the difference in land productivity—which was seen to be of such importance in the lower level of rural welfare in most of the regions relative to region 1—a result of differential growth over the 1983--99 period? Considering the period as a whole, the growth rate of land productivity was indeed higher in region 1—with the sole exception of region 2. But looking at the two shorter periods 1983--93 and 1993--99 separately, the striking fact emerges that the differential growth rate is largely due to developments in the 1993--99 period. Over the 1983-93 period, the growth rate of land productivity was significantly lower than that of four of the other regions, was more or less on par with that of region 7 and exceeded the growth rate in only one region (region 5). This changed in the post-reform period 1993--99. The growth rate of land productivity in region 1 shot up, while it became low or negative in four of the other regions. Even in the two regions which had a significant positive growth rate—regions 2 and 7—the growth rates fell far short of the one attained by land productivity in region 1. The point underlines the problem of uneven regional development in agriculture in the immediate post-reform years which have been emphasized by many commentators.

The second point pertains to the role of the rural non-farm and the urban sectors. We had noticed the difference in 1999--00 between region 1 and the other northern regions on the one hand, and the difference between the northern and the southern regions as a group, on the other. It is now seen that theses differences had indeed gathered momentum over the 1983--99 period. It was the result of the differential patterns of growth over the entire period. The low poverty region of the North (region 1) has pulled away from the others largely because of its high growth rate of land productivity, but also partly (with respect to the northern regions 2 and 3 in particular) because of higher growth rate of the rural non-farm and the urban sectors.

The importance of the rural non-farm and urban sectors was seen more in the Southern regions in the 55th round. It is now seen that this is due to the relatively high growth rates of these sectors over the preceding years. They grew at a relatively high rate not because of but to compensate for the low growth of land productivity.

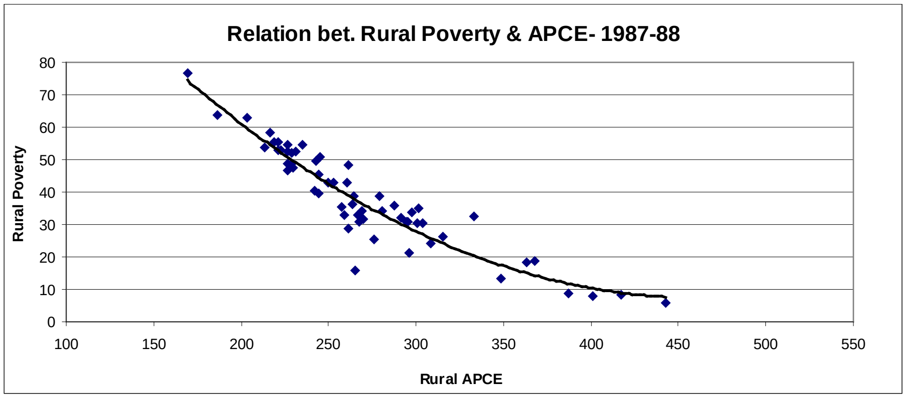
PART II

We have established certain important relationships between the incidence of poverty and rural incomes on the one hand, and certain key variables like land productivity, land-man ratio and non-farm employment on the other. These relationships have been worked out on the basis of observations for 'broad regions'—which have been aggregated from observations for the NSS regions for several rounds of the survey. The advantage of this approach was that we were able to discern interesting differences between the characteristics and evolution of the seven broad regions distinguished in our study. We lost, however, in the process the details of the individual NSS regions and were not able to utilize the inter-regional variations for our analysis. We shall now turn to an analysis based on the NSS regions to provide an over-all picture for all of India.

The thrust of the analysis is to evaluate the relative importance of land productivity, off-farm rural employment and urbanization in determining the level of rural welfare or of rural poverty. In fact, the empirical relationship between the two is very close.

The Relationship between Rural Household Welfare Level and Poverty Incidence

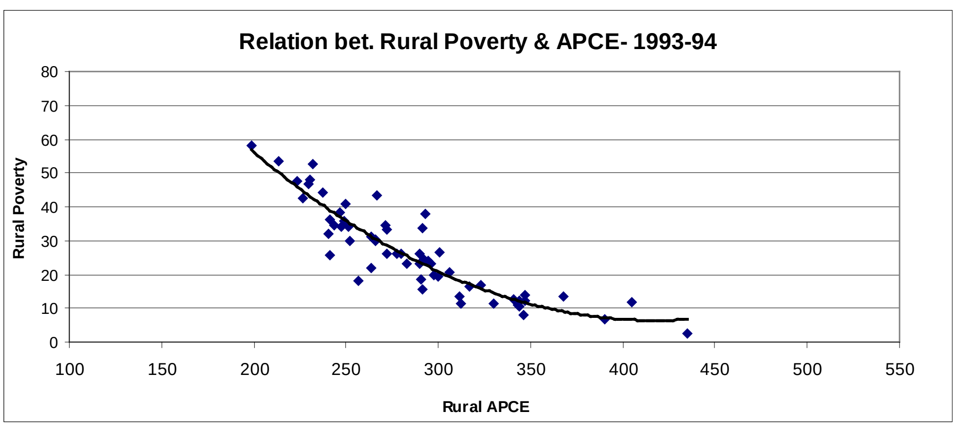
Figures 2-4 depict the relationship between RAPCE and the HCR for all NSS regions for the three rounds of the survey.



$$\text{RPOV87} = 174.71 - 0.73\ \text{RAPCE87} + 0.0008\ (\text{RAPCE})^2,\ R^2 = 0.879$$
$$(11.72)\quad (-7.17)\qquad\qquad (4.72)$$

$$\text{RPOV87} = 95.37 - 0.27\ \text{RAPCE87} + 122.11\ \text{GE}(0),\ R^2 = 0.910$$
$$(27.87)\quad (7.17)\qquad\qquad (7.05)$$

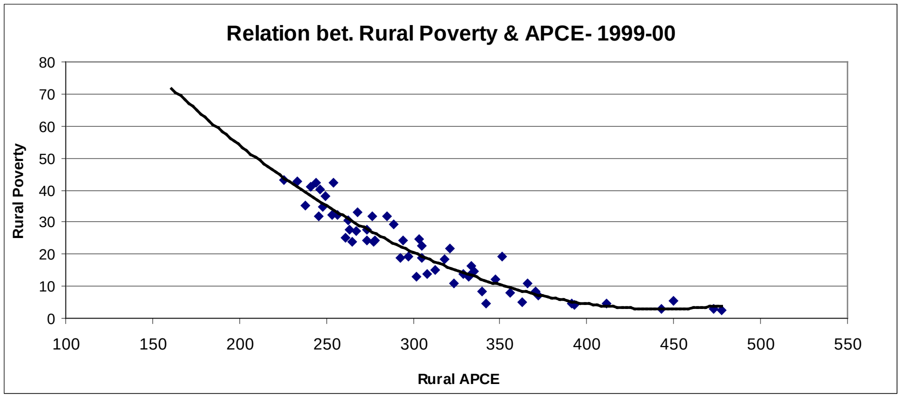
$$\text{RPOV87} = 169.93 - 0.72\ \text{RAPCE87} + 0.0008\ (\text{RAPCE87})^2 + 11.07\ \text{GINI},\ R^2 = 0.885$$
$$(11.39)\quad (-7.26)\qquad\qquad (4.81)\qquad\qquad (1.71)$$



$$\text{RPOV93} = 189.24 - 0.88\ \text{RAPCE93} + 0.0010\ (\text{RAPCE93})^2,\ R^2 = 0.828$$
$$(9.06)\quad (-6.32)\qquad\qquad (4.65)$$

$$\text{RPOV93} = 88.99 - 0.26\ \text{RAPCE93} + 104.83\ \text{GE}(0),\ R^2 = 0.885$$
$$24.67)\quad (-20.69)\qquad\qquad (7.77)$$

$$\text{RPOV93} = 178.69 - 0.97\ \text{RAPCE93} + 0.0011\ (\text{RAPCE93})^2 + 113.22\ \text{GINI},\ R^2 = 0.973$$
$$21.22)\quad (-17.39)\qquad\qquad (12.68)\qquad\qquad (17.08)$$



$$RPOV99 = 172.90 - 0.76\ RAPCE99 + 0.0009\ (RAPCE99)^2,\ R^2 = 0.903$$
(13.52) (-9.98) (7.71)

$$RPOV99 = 59.11 - 0.16\ RAPCE99 + 124.11\ GE(0),\ R^2 = 0.762$$
13.51) (-13.27) (3.36)

$$RPOV99 = 153.44 - 0.82\ RAPCE99 + 0.0009\ (RAPCE99^2) + 134.11\ GINI,\ R^2 = 0.982$$
(26.84) (-24.41) (18.73) (15.34)

The relationship is very close and non-linear (convex to the origin). In fact, it is closest for the last round, the equation showing a massive R-square of 0.903, but the earlier rounds also show r-square in excess of 0.8. The non-linearity is to be expected. It shows that as rural income levels increase across regions, their marginal impact on the headcount ratio diminishes.

It is seen from the regressions reported that the coefficients of the distributional variables like GINI are significant when they are added to the RAPCE variables. But the addition improves the R-square marginally. The largest increase in R-square is in 1993--4 to the extent of 0.15 (with GINI added), but considerably smaller both in 1987--8 and 1999--00.

The overwhelming importance of RAPCE on the HCR might be surprising in view of the considerable attention paid in the literature to distributional aspects on the incidence of poverty. The proportion of landless labourers in the rural population, the level of agricultural wages, the importance of land reforms and the caste composition of the rural population have all been mentioned in discussions of the incidence of rural poverty. The answer to the puzzle is probably that the poverty line is, in most regions, very close to the mean household expenditure, and hence a measure like the headcount ratio would not be very sensitive to supplementary distributional variables. Perhaps other measures of poverty like the poverty-gap ratio or its variations could be looked at for picking up the impact of the latter.

For the purposes of the present analysis we shall concentrate on the determination of RAPCE and not duplicate it with further examination of the determinants of poverty.

Determinates of RAPCE: The Role of Non-Farm Activities

Alternative hypotheses in the literature

One of the important questions to be posed in the determination of RAPCE is the importance of the off-farm sector relative to land productivity. There are two conflicting hypotheses in the literature. In the traditional view, associated with the work of Johnston and Mellor, off-farm activity develops in response to the prior development of agriculture. High land productivity – such as was achieved in selected regions due to the green revolution – increases demand for off-farm goods and services, both in the rural areas and smaller towns. The growth of farm productivity and off-farm activity constitute a virtuoso cycle of mutually supported development.

The contrary view has been most elaborately developed by Foster and Rosensweig. They distinguish between 'traded' and 'non-traded' types of off-farm activities. While the latter could be a function of the development of the local rural economy and hence would be sensitive to the growth of agricultural income in the region, the 'traded' part is not necessarily tied to local development. Further, Foster and Rosensweig suggest that writers have over-emphasized the self-employed part of off-farm employment to the exclusion of wage earners. The development of business activity in the rural economy is expected to be a function of the growth of capital from outside the local economy seeking out labour at affordable cost. Thus, low wage regions with low land productivity would have a preferential pull on such investments. Clearly, this interpretation of the development processes in the rural economy outside agriculture emphasizes the importance of outside capital rather than capital generated by internal savings of rich farmers.

Both the alternative hypotheses, in fact, take a particular and narrow view of NFS, which is in fact a very heterogeneous sector. Kijima and Lanjouw, drawing on the evidence from a host of village studies, distinguish three major categories of NFS: (i) regular employment (generally salaried); (ii) casual employment (daily wages); and self-employed enterprise activities. The first category, which often relates to public sector jobs created by rural development programmes, is generally the most sought after as it not only offers higher earnings but more importantly stability of employment. "Casual non-farm employment is generally thought to be less demeaning to a worker than agricultural wage labour, but returns may be only marginally higher". Finally, the self-employed comprise both low income earners who are pushed into the sector and higher income workers with business activity. Kijima and Lanjouw report that analysis of the NSS for the last three 'thick' rounds shows that the over-all employment share of the non-farm sector as a whole has hovered around 25-30 per cent for all-India, with no evidence of growth over time. Casual labour has been in the neighbourhood of 6 per cent, regular wage workers constituted 7-8 per cent and the self-employed were 12-14 per cent. The three components obviously have different distributional impact—regular workers and a portion of the self-employed in particular would tend to be recruited from the better-off economic classes. But it might be a bit extreme for Kijima and Lanjouw to suggest, as they do, that non-farm employment has only limited impact on poverty. In so far as this sector increases RAPCE, it should impact the value of HCR. While a detailed analysis of this topic would require disaggregated analysis of various types of NFS, in what follows we will try to see from the inter-regional cross-section analysis what the impact of NSS as a whole is on RPACE relative to other factors influencing it.

Correlation of RAPCE with Key Variables

We first examine the relative importance of different variables affecting RAPCE, taking one variable at a time. The correlation matrices for the variables enable us to do so. The definitions of the key variables are as follows:

rapce_ci – Rural average monthly per capita consumption expenditure at constant prices adjusted for inter-state difference in prices.

uapce_ci – Urban average monthly per capita consumption expenditure at constant prices adjusted for inter-state difference in prices.

Rapce – Rural average monthly per capita consumption expenditure at current prices.

lnpro – Land productivity obtained by dividing value of output of crops at constant 93--94 prices divided by net sown area.

hn_ag – Ratio of income. It is proxied by ratio of average monthly household mean consumption expenditure of non-farm to farm households.

tur – Urbanization ratio.

tnfups – Share of UPS non-farm labour to rural labour.

cul_nsa – Net sown area per UPS worker involved in cultivation.

We define the variables in logs so that it is easy to examine the relative elasticity of RAPCE with respect to each of the variables from the regressions.

Table 10

Correlation Matrix

Year 1999-2000	rapce99_ci	lnpro_99	hn_ag55	t55ur	t55nfups	uapce99_ci	cul_nsa99
rapce99_ci	1.0000						
lnpro_99	0.4704	1.0000					
hn_ag55	-0.3203	-0.1538	1.0000				
t55ur	0.5578	0.2592	-0.0150	1.0000			
t55nfups	0.4963	0.4593	-0.2269	0.3166	1.0000		
uapce99_ci	0.4743	0.2334	-0.0373	0.5357	0.4532	1.0000	
cul_nsa99	0.4206	0.0294	-0.4177	0.3570	0.0073	-0.0158	1.0000
Year 1993-4	aapce93_ci	lnpro_90	hn_ag50	t50ur	t50nfups	uaapce93_ci	cul_nsa93
rapce93_ci	1.0000						
lnpro_90	0.5514	1.0000					
hn_ag50	-0.4434	-0.1225	1.0000				
t50ur	0.4817	0.2110	0.0199	1.0000			
t50nfups	0.4516	0.4464	-0.2627	0.1987	1.0000		
uapce93_ci	0.5693	0.3845	-0.0653	0.3708	0.3629	1.0000	
cul_nsa93	0.1760	-0.3683	-0.4117	0.2760	-0.0242	-0.0652	1.0000
Year 1983	raapce83_ci	lnpro_80	hn_ag38	t38ur	t38nfups	uaapce83_ci	cul_nsa83
rapce83_ci	1.0000						
lnpro_80	0.2704	1.0000					
hn_ag38	-0.3704	0.0190	1.0000				
t38ur	0.0361	0.1636	0.1671	1.0000			
t38nfups	0.2790	0.6911	0.0102	0.1953	1.0000		
uapce83_ci	0.3011	0.5384	-0.0907	0.4051	0.4803	1.0000	
cul_nsa83	0.0867	-0.4511	-0.1715	0.2185	-0.3328	-0.0748	1.0000
Year 1983	rapce83	lnpro_80	hn_ag38	t38ur	t38nfups	uapce83	cul_nsa83
rapce83	1.0000						
lnpro_80	0.3947	1.0000					
hn_ag38	-0.3677	0.0190	1.0000				
t38ur	-0.0700	0.1636	0.1671	1.0000			
t38nfups	0.4124	0.6911	0.0102	0.1953	1.0000		
uapce83	0.2568	0.4264	0.0193	0.4916	0.4159	1.0000	
cul_nsa83	-0.0046	-0.4511	-0.1715	0.2185	-0.3328	-0.0354	1.0000

1. The correlation of RAPCE and land productivity increased dramatically between 1983 and 1993, before falling off somewhat in 1999. One of the reasons for the low correlation is the problem with inter-region price conversions. But even when we present the results without these price corrections, as is done in the last section of Table 10, the correlation coefficient at 0.39 is much lower than for the later dates.
2. The non-farm sector shows some interesting behaviour. The employment variable tnfups is positively correlated with RAPCE and the correlation value as much as yield between 1983 and 1993 and continued to increase somewhat in 1999. But the ratio of income (as proxied by household expenditure) of non-farm to farm households is negatively correlated with RAPCE. The obvious inference is that in higher RAPCE areas the productivity per worker in non-agriculture falls relative to that in agriculture. A plausible interpretation is that in a cross-section view of the rural NSS regions, as non-farm employment becomes a source of increasing importance, the 'dualism' between farm and non-farm activities decreases.
3. Both the urbanization variables ur and uapce increased their correlation coefficients dramatically between 1983 and 1993, specially the former. The former in fact increased marginally also between 1993 and 1999, while the latter fell slightly. All this can be interpreted in terms of a greater integration of the urban and rural economies, particularly the development of small towns which has been noticed as an important aspect of development since 1983.
4. The correlation of cul_nsa (the net sown area per cultivator) with RAPCE also increased steeply from 1983 to 1993 and further to 1999. Thus, the impact of the farm sector on the rural expenditure also increased along with the bigger role of urbanization. All this contributed to a very large increase in the explanatory power of these variables in the regression to determine RAPCE.

The Elasticity of RAPCE with Respect to the Explanatory Variables

The results of the double-log regressions explaining RAPCE for the different rounds of the NSS are given in the Appendix-II. Two sets of results are given. The only difference between them lies in the defining dependent variable RAPCE. The difference between rapce_ci and rapce is that the former is price adjusted for change over the years as well as for interstate difference in prices of consumption basket.

Since better results (in terms of R-square and significance of key variables) are obtained for all rounds with the RAPCE set, we will report the results from this set.

The more important conclusions are summarized below.

1. The NFS employment variable is positive for all rounds; it is very significant for the 50th and 55th rounds, less so for the 38th. This finding contradicts the Foster-Rosenweig hypothesis that non-farm employment is more prevalent in poorer regions. The elasticities of RAPCE with respect to tnfs for the different rounds are given in Table 11. Since we want to know the relative values of the elasticity of non-farm

employment and farm productivity, the elasticities with respect to land productivity and the cultivated area per worker are also included in the table.

Table 11

Elasticities of RAPCE with respect to selected variables

Variable	*38th round*	*50th round*	*55th round*
tnfs	.156 (1.53)	.081 (2.08)	.140 (2.83)
Lnpro	.159 (1.91)	.142 (3.73)	.100 (2.77)
Cul_nsa	.132 (1.97)	.111 (3.47)	.144 (3.91)

It is apparent that the elasticity of RAPCE with respect to farm income is much more than that of non-farm employment (note that the elasticity of farm income would be the sum of elasticities of land productivity and cultivated area per worker).

2. The elasticity of RAPCE with respect to income generated in the non-farm sector is probably a more relevant variable to compare with the elasticity with respect to farm income. As already indicated, the labour productivity gap between the non-farm and farm sectors narrows with increase in RAPCE. The elasticity of RAPCE with this variable hn_ag is high in both 38th and 50th rounds at -.21 in the multiple regression framework (see Appendix-II). Since this value is well below unity, it can easily be demonstrated algebraically that the elasticity of the income ratio of non-farm to farm with respect to RAPCE will be positive but below the value of the employment ratio (tnfs). In other words, the positive association of the proportion of employment in non-farm and the rural APCE is moderated to some extent by the narrowing of the productivity gap between the two sub-sectors because of the diminishing 'dualism' between them as regional rural income increases.

   This is the second important finding of relevance to the Foster-Rosensweig thesis. Part of the reason why non-farm employment seems to be of more importance in poorer regions is now seen to be because its relative productivity is higher in such regions due to a stronger incidence of 'dualism'—and not because a greater proportion of non-farm employment is found in them.

3. A surprising finding of our regressions is that the elasticity of RAPCE is very high with respect to the urbanization variables, particularly UAPCE. Table 12 below reports the elasticity value for two such variables used in our regressions.

Table 12

Elasticity Value of Farm Income and Rural Non-farm Employment

Variable	38th round	50th round	55th round
Tu_r	- .132 (-1.76)	.052 (1.44)	.039 (0.80)
Uapce	.163 (0.89)	.427 (3.97)	.414 (3.01)

The relationship seems to be especially strong in the 50th and the 55th rounds and the value of the elasticities well exceeds those of farm income and rural non-farm employment. The importance of urban development—particularly the development of small towns—for rural incomes in recent decades is evidently an important part of the changing rural economic scenario.

Appendix-I
Agro-Ecological Zones

AEZ	Description
1	Western Himalayas, cold arid ecoregion, with shallow skeletal soils and length of GP $<$ 90 days (d)
2	Western Plain, Kutch and part of Kathiawar peninsular, hot arid ecoregion, with alluvium derived soils and GP 90-150 d
3	Deccan plateau, hot arid ecoregion, with red and black soils and GP $<$ 90 d
4	Northern plain and central highlands including Aravelli Hills, hot semi-arid ecoregion with alluvion derived soils and GP 90-150 d
5	Central (Malwa) Highlands, Gujarat Plains, and Kathiawar peninsular, hot arid ecoregion, with medium and deep black soils and GP 90-150 d
6	Deccan plateau, hot semi-aid ecoregion, with mainly shallow and medium but some deep black soils and GP 90-150 d
7	Deccan plateau of Telengana and Eastern Ghats, hot semi-arid ecoregion with red and black soils and GP 90-150 d
8	Eastern Ghats, Tamil Nadu uplands and Deccan (Karnataka) plateau, hot semi-arid ecoregion with red loamy soils & GP 90 –150 d
9	Northern plain, hot subhumid (dry) ecoregion with alluvium derived soils and GP 150-180 d
10	Central highlands (Malwa, Bundelkhand and Eastern Satpura), hot subhumid ecoregion, with black and red soils and GP 150-180 d up to 210 d in some places)
11	Eastern plateau (Chhattisgarh), hot subhumid ecoregion, with red and yellow soils and GP 150-180 d
12	Eastern (Chhotanagpur) plateau and Eastern Ghats, hot subhumid ecoregion with red and lateritic soils and GP 150-180 to 210 d
13	Eastern Gangetic plain, hot subhumid (moist) ecoregion, with alluvium-derived soils and GP 180-210 d
14	Western Himalayas, warm subhumid (to humid and perhumid ecoregion, with brown forest and podzolic soils, GP 180-210+d
15	Bengal and Assam Gangetic and Brahmaputra plains, hot subhumid (moist) to humid (and perhumid) ecoregion, with alluvium-derived soils and GP 210+ d
16	Eastern Himalayas, warm perhumid ecoregion with brown and red hill soils and GP 210+d
17	Northeastern hills (Purvachal), warm perhumid ecoregion with red and lateritic soils and GP 210+ d
19	Eastern coastal plain, hot subhumid to semi-arid ecoregion, with coastal alluvium-derived alluvium-derived soils and GP 210+ d
20	Western Ghats and coastal plain, hot humid-perhumid ecoregion with red, lateritic and alluvium derived soils, and GP 210+ d

Appendix-II
Set I (with rapce as dependent variable)

```
             | . reg rapce83 lnpro_80   t38ur t38nfups uapce83 cul_nsa83
Source       | SS        df       MS            Number of obs =      56
               F(  5,    50) =    3.87
Model        | .161067562     5  .032213512          Prob > F      =  0.0048
Residual     | .415945147    50  .008318903          R-squared     =  0.2791
               Adj R-squared =  0.2071
Total        | .577012709    55   .01049114          Root MSE      =  .09121

rapce83      | Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
lnpro_80     | .1584731   .0829388     1.91   0.062    -.0081143    .3250605
t38ur        | -.1319562    .075141    -1.76   0.085    -.2828813     .018969
t38nfups     | .1557255   .1017384     1.53   0.132    -.0486221     .360073
uapce83      | .1633367   .1835835     0.89   0.378    -.2054015    .5320749
cul_nsa83    | .1316579   .0667064     1.97   0.054    -.0023258    .2656416
_cons        | 1.10119   .3664193     3.01   0.004     .3652151    1.837165

             | reg rapce93m lnpro_90   t50ur t50nfups uapce93m cul_nsa93
Source       | SS        df       MS            Number of obs =      57
               F(  5,    51) =   21.92
Model        | .250831176     5  .050166235          Prob > F      =  0.0000
Residual     | .116705562    51  .002288344          R-squared     =  0.6825
               Adj R-squared =  0.6513
Total        | .367536738    56  .006563156          Root MSE      =  .04784

rapce93m     | Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
lnpro_90     | .1415107   .0379023     3.73   0.000     .0654186    .2176028
t50ur        | .0522135   .0361989     1.44   0.155    -.0204589    .1248859
t50nfups     | .0808681   .0389618     2.08   0.043      .002649    .1590871
uapce93m     | .4270201    .107464     3.97   0.000     .2112771     .642763
cul_nsa93    | .1113981   .0321033     3.47   0.001     .0469479    .1758482
_cons        | .607029   .2650901     2.29   0.026     .0748385    1.139219

reg rapce99 lnpro_99   t55ur t55nfups uapce99 cul_nsa99
Source       | SS        df       MS            Number of obs =      57
               F(  5,    51) =   20.49
Model        | .356126299     5   .07122526          Prob > F      =  0.0000
Residual     | .177263166    51  .003475748          R-squared     =  0.6677
               Adj R-squared =  0.6351
Total        | .533389465    56  .009524812          Root MSE      =  .05896

rapce99      | Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
lnpro_99     | .1000147   .0361578     2.77   0.008     .0274249    .1726044
t55ur        | .0388958   .0488014     0.80   0.429    -.0590771    .1368687
t55nfups     | .1403716   .0496584     2.83   0.007     .0406783    .2400649
uapce99      | .4138352    .137679     3.01   0.004      .137433    .6902374
cul_nsa99    | .143977   .0368685     3.91   0.000     .0699604    .2179935
```

```
_cons        | .8503209   .3584096    2.37   0.021    .1307836   1.569858

             | reg rapce83 lnpro_80  hn_ag38 t38ur  uapce83 cul_nsa83
Source       | SS       df       MS            Number of obs =      56
               F(  5,    50) =    3.96
Model        | .163706552     5   .03274131          Prob > F      =  0.0042
Residual     | .413306157    50  .008266123          R-squared     =  0.2837
               Adj R-squared =  0.2121
Total        | .577012709    55   .01049114          Root MSE      =  .09092

rapce83      | Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
lnpro_80     | .21996   .0693658    3.17   0.003    .0806348    .3592853
hn_ag38      | -.2162554   .1321708    -1.64   0.108    -.4817283    .0492174
t38ur        | -.1021721   .0755503    -1.35   0.182    -.2539194    .0495751
uapce83      | .1920873   .1812939    1.06   0.294    -.1720523    .5562269
cul_nsa83    | .0972498   .0677211    1.44   0.157    -.0387721    .2332717
_cons        | 1.396375   .4489052    3.11   0.003    .4947223    2.298028

             | reg rapce93 lnpro_90  hn_ag50 t50ur  uapce93m cul_nsa93
Source       | SS       df       MS            Number of obs =      57
               F(  5,    51) =   22.14
Model        | .25160038     5  .050320076          Prob > F      =  0.0000
Residual     | .115936358    51  .002273262          R-squared     =  0.6846
               Adj R-squared =  0.6536
Total        | .367536738    56  .006563156          Root MSE      =  .04768

rapce93      | Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
lnpro_90     | .1381909   .038168    3.62   0.001    .0615655    .2148162
hn_ag50      | -.2132832   .0986433    -2.16   0.035    -.411318   -.0152485
t50ur        | .0712565   .0373673    1.91   0.062    -.0037615    .1462746
             | .4943908   .1028294    4.81   0.000    .2879522    .7008293
cul_nsa93    | .0743888   .0381116    1.95   0.056    -.0021235    .1509012
_cons        | .9636487   .3495857    2.76   0.008    .2618261    1.665471

             | reg rapce99 lnpro_99  hn_ag55 t55ur uapce99 cul_nsa99
Source       | SS       df       MS            Number of obs =      57
               F(  5,    51) =   17.02
Model        | .333484355     5  .066696871          Prob > F      =  0.0000
Residual     | .199905109    51  .003919708          R-squared     =  0.6252
               Adj R-squared =  0.5885
Total        | .533389465    56  .009524812          Root MSE      =  .06261

rapce99      | Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
lnpro_99     | .1278541   .0366546    3.49   0.001    .0542669    .2014412
hn_ag55      | -.1457022   .1273479    -1.14   0.258    -.4013638    .1099594
t55ur        | .0557934   .0520762    1.07   0.289    -.048754    .1603408
uapce99      | .5516938   .138185    3.99   0.000    .2742759    .8291118
cul_nsa99    | .11924   .043324    2.75   0.008    .0322635    .2062164
_cons        | .8069993   .4423865    1.82   0.074    -.0811288    1.695127
```

Set II (with rapce_ci as dependent variable)

. reg rapce83_ci lnpro_80 t38ur t38nfups uapce83_ci cul_nsa83

Source	SS	df	MS		
				Number of obs =	56
				F(5, 50) =	1.78
Model	.089669765	5	.017933953	Prob > F =	0.1335
Residual	.502985664	50	.010059713	R-squared =	0.1513
				Adj R-squared =	0.0664
Total	.59265543	55	.010775553	Root MSE =	.1003

rapce83_ci	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnpro_80	.1229745	.0950716	1.29	0.202	-.0679824	.3139314
t38ur	-.0489995	.0788127	-0.62	0.537	-.2072995	.1093005
t38nfups	.0306541	.1119882	0.27	0.785	-.1942809	.2555891
uapce83_ci	.2226305	.1992924	1.12	0.269	-.1776601	.6229212
cul_nsa83	.1163352	.0738117	1.58	0.121	-.0319201	.2645904
_cons	1.443582	.4127923	3.50	0.001	.6144645	2.2727

. reg rapce93_ci lnpro_90 t50ur t50nfups uapce93_ci cul_nsa93

Source	SS	df	MS		
				Number of obs =	57
				F(5, 51) =	15.88
Model	.175498426	5	.035099685	Prob > F =	0.0000
Residual	.112715541	51	.002210109	R-squared =	0.6089
				Adj R-squared =	0.5706
Total	.288213966	56	.005146678	Root MSE =	.04701

rapce93_ci	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnpro_90	.1596623	.037614	4.24	0.000	.0841491	.2351755
t50ur	.0514142	.0348389	1.48	0.146	-.0185278	.1213563
t50nfups	.0407165	.0375578	1.08	0.283	-.0346839	.1161168
uapce93_ci	.3160521	.1109855	2.85	0.006	.0932394	.5388647
cul_nsa93	.1017772	.0316112	3.22	0.002	.038315	.1652394
_cons	.873369	.2709186	3.22	0.002	.3294772	1.417261

. reg rapce99_ci lnpro_99 t55ur t55nfups uapce99_ci cul_nsa99

Source	SS	df	MS		
				Number of obs =	57
				F(5, 51) =	14.31
Model	.241144903	5	.048228981	Prob > F =	0.0000
Residual	.171942556	51	.003371423	R-squared =	0.5838
				Adj R-squared =	0.5430
Total	.413087459	56	.007376562	Root MSE =	.05806

rapce99_ci	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnpro_99	.0924798	.0355601	2.60	0.012	.0210899	.1638697
t55ur	.0645138	.0484788	1.33	0.189	-.0328113	.161839
t55nfups	.113383	.0489567	2.32	0.025	.0150984	.2116677
uapce99_ci	.256066	.163656	1.56	0.124	-.0724871	.5846192
cul_nsa99	.1300625	.0365081	3.56	0.001	.0567693	.2033556
_cons	1.183176	.4139485	2.86	0.006	.3521397	2.014212