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The Effect of Agricultural Production and Prices on the Incidence of Rural Poverty : A Tentative Analysis of Inter State Variations*

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Analysis of Inter State Variations

The original attempts to find some measure of the abyssmal levels
of poverty in British India, undertaken towards the end of the 19th
century, were aimed at a critique of the colonial state. [1] In recent
times, however, it is under the auspices of the state itself that
attempts to measure the incidence of poverty in post-independence India
have been revived. This new research of the sixties and seventies was
initiated by the Planning Commission, ostensibly to aid a new kind of
planning which would hopefully eradicate atleast the most intense levels
of poverty. [2] No one was surprised that, all the research not
withstanding, planning failed to make a dent on poverty; for nobody had
really believed that all that stood in the way of eradicating poverty
was the preparation of proper estimates of minimum levels of living,
target groups of population and the like. The effort however was not
entirely wasted for while the ostensible planning goals were not achieved,
the research did contribute enormously to the construction of a fairly
cautious statistical picture of poverty in India. [3] Though it was
essentially preoccupied with problems of measurement the work of this

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[1] See William Digby – 'Prosperous' British India. London, 1901

[2] See Perspective of Development : 1961-1976. Implications of Planning
for a Minimum Level of Living. Perspective Planning Division, Planning
Commission, 1962.

[3] Most of the important work of this period has been put together in the
volume edited by Bardhan and Srinivasan (1974)

period al o prepared the ground to research of the kind reported here which is more concerned with the effect of various economic factors on the incidence of poverty rather than the measurement of poverty itself.

Factors Underlying Rural Poverty:

For our present purpose it is useful to note at the very outset that the rural poor do not form a homogenous category. They are differentiated not only in terms of the intensity of deprivation but also functionally in terms of their roles and positions in the structure of agrarian relation Accordingly the effect of different factors governing the incidence of poverty may also vary between different segments of the rural poor. Analytically they may be classified into two broad strata, i.e., the class of cultivators who earn their livi g _primarily_ from the produce of their operated holdings (whether owned or leased in) and the class of agricultural labourers who earn their living primarily by hiring themselves out as wage labourers. For a cultivating hou hold its income would depend not only on the general level of agricultural production b also on the household's command over land the principal asset in agricultural production — which largely determines the _share_ of its own claim out of total production. To the extent that a portion of the household's share of total produce is also marketed its real income would rise or fall with a rise or fall in the selling price of agricultural commodities relative to the price at which the household may buy inputs or items of consumption from the market. Finally, given a cultivating household's family income the actual level of living or income per capita of the family varies inversely with family size

In the case of agricultural labourers, the number of persons offering themselves for wage labour may rise directly as a consequence of population growth and declining land: man ratio. The number could also rise, however, as a consequence of changes in the distribution of land which may be quite independent of population growth. This rise in the supply of agricultural labourers might be matched by growing demand. However if the growth of agricultural production is not proportionate, or takes a form which is less labour intensive, such that the increased labour supply is only partially offset by the increased labour demand, then this would adversely effect either the wage rate or the average mandays of employment available per labourer or both. Unionisation of agricultural labour may help to protect the wage rate but not the period of employment per worker. The effect of the above factors on the average income per labourer would be either reinforced or neutralised by changes in agricultural (especially foodgrain) prices, depending on the cash: kind composition of wages and the relationship of money wages to foodgrain prices. Finally, given an average annual real income per labourer, the level of living or per capita income for the agricultural labour household would vary directly with the number of earners per family and inversely with family size.

The factors determining the incidence of rural poverty may thus be classified into three broad groups. First we have factors like the distribution of land which directly effect the income of cultivating households and, second, factors like rural wage rates and wage employment which effect mainly the income of rural labour households. Both these

sets of factors have been set aside in the present analysis. Only
the third set of factors such as agricultural prices and production,
which effect the incomes of both segments of the rural poor directly,
have been taken up for analysis in this paper.

In a sense this is a reexamination of some of the conclusions
reached in an earlier exercise where the effects of all the various
factors identified above on the incidence of rural poverty were examined
in the context of rural Bihar and Punjab - Haryana (Mundle 1982a and
1982b). These two regions were studied as representing polar cases in
terms of agricultural performance. The inferences drawn on the basis
of these two polar cases are reexamined here using 'ata covering a set
of fifteen states. However this re-examination is partial since it is
confined to the effects of agricultural production and prices only.
The effects of land distribution and trends in agricultural wages, wage
employment or other factors related to the income of rural labour
households have not been taken up here.

It must also be emphasised that the conclusions presented here
are tentative. We are only reporting here the results of the first
stage of a larger programme of work currently in progress. As any
researcher in this area is well aware, each of the three main sets of
data used here, i.e., the state level agricultural production data, the
state level NSS consumer expenditure data and the state level index of
agricultural and foodgrain prices present formidable problems for

statistical analysis and interpretation. We hope to eventually
present a better set of results based on more rigourous treatment of
the data problems. At the same time we feel that it is important to
report the present set of results, even if these are crude and tentative.
This is because the issues involved here are quite crucial — both
politically and economically — and the positions adopted on these
questions are usually based on casual impressions, some prejudice and
very little by way of real information.

Interpreting the Data

The reference period is 1963-64 to 1973-74 which begins just before
the so-called Green Revolution and extends well into that phase. Hence
the results reported below reflect the forces that have come into play
during this period of agricultural growth. In this context we must
distinguish carefully the question of poverty incidence from that of
income distribution. In particular it must be noted that inferences
drawn regarding the effect of certain economic factors on income
distribution do not necessarily apply to the incidence of poverty as such.

Thus, it is generally believed that agricultural growth has been
accompanied by increasing income inequality in the Green Revolution.
Even if true it does not follow automatically that the incidence of
poverty too should have increased. In principle we can have increasing
inequality along with declining incidence of poverty. Similarly it is
quite plausable that among cultivating households inequality may increase

with rising agricultural prices since the bigger farmers have larger surpluses and are also able to realise better prices – such that their gains are proportionately larger –– compared to the peasants. Indeed there is evidence to confirm that this is the case. But it does not follow that the small peasant is worse off in an absolute sense. On the contrary it is concievable that his income too may have increased. Unfortunately even these elementary distinctions are often lost sight of in the relevant literature. It has to be emphasised therefore that the present paper is concerned exclusively with the effect of agricultural prices and production on the incidence of rural poverty and that alone. The question of rural inequality has not been addressed.

Regarding the analysis of data the standard procedure now employed to test hypotheses regarding the incidence of rural poverty is to regress the relevant independent variables on some measure of poverty such as the proportion below a given poverty line or Sen's index of poverty. [4/] This was also the method adopted by this author in the earlier exercises on Bihar and Punjab – Haryana cited above. However there is some doubt as to the statistical validity of employing this method when we have no clear a priori expectation as to the form of the functional relationship between our measure of poverty and the independent variables. None of the usual functional forms employed in regression analysis may reflect the real form. It is not clear therefore precisely how the estimated coefficients are to be interpreted.

[4/] See for instance Ahluwalia (1978), Griffin and Ghosh (1979), Saith (1981) or the last uncompleted work of the late Dr. Dharan Narain.

Analytically our real concern is to test whether the variables
in question are positively or inversely related and whether the strength
of the relationship is statistically significant. For this purpose
the simple correlation coefficient, along with a test of statistical
significance, seems to be quite adequate. Accordingly we have tested
for the relationships in question using this measure and used the
Z - transformation of the correlation coefficient, $Z = \frac{1}{2} \log_e (1+r)/(1-r)$,
to test for statistical significance where r is the correlation
coefficient and the expression $\sqrt{n-3} \, (Z-0)$ approximately follows the
standard normal distribution, n being the number of observations.

The index of poverty used in the analysis is the proportion of
population falling below the estimated poverty line corresponding to a
daily intake of 2435 calories per capita for each state in each year.
A detailed note on the construction of poverty lines is given in the
appendix. It is sufficient to point out here that a poverty line is
important to our analysis only insofar as it gives us a benchmark at
which to observe whether the population is shifting upwards or downwards
on the consumption scale. As such the choice of one or another poverty
line is not really crucial to our analysis, unless of course the direction
of change itself turns out to be sensitive to the choice of a poverty
line. Sensitivity tests applied in the earlier exercises on Bihar and
Punjab - Haryana using multiple poverty lines showed that while the
actual values of the response elasticities did vary, the sign of the
relationship between poverty incidence and the independent variables

remained unchanged, and the statistical significance of estimated coefficients were similar, across different poverty lines. These tests have not been repeated in this exercise.

The index used for price is the state specific foodgrains price index in the ACPI series. A composite weighted producers price index of agricultural commodities would have been more appropriate but such an index is not available. The food price index, which is mainly a composite index of foodgrain prices, is therefore the most appropriate index available since foodgrains do account for the bulk of agricultural production in most states. For the same reason foodgrain production has been used as a proxy for agricultural production in the absence of a composite official measure of agricultural production or agricultural incomes at the state level. We have taken foodgrain production per head of rural population to capture the effect of rural population growth on rural per capita real income growth.

The Effect of Agricultural Production

Our earlier reasoning on the factors underlying the incidence of rural poverty suggests that unless there are sufficiently strong offsetting forces at work an increase in agricultural production would tend to increase real incomes of both poor cultivating households as well as rural labour households. We may therefore expect an overall decline in the incidence of rural poverty with a rise in agricultural production per capita.

Table 1 gives the coefficient of correlation between these two variables for each of fifteen states.

Table 1

Coefficient of Correlation between Incidence of
Rural Poverty and Per Capita Foodgrain Production

Positive Correlation		Negative Correlation	
Gujarat	0.263	Uttar Pradesh	-- 0.824***
Andhra Pradesh	0.226	Tamil Nadu	— 0.815**
Assam	0.215	Bihar	— 0.718**
Rajasthan	0.146	Punjab & Haryana	— 0.609**
Maharashtra	0.093	West Bengal	— 0.528*
		Karnataka	— 0.396*
		Jammu & Kashmir	— 0.337
		Orissa	— 0.337
		Madhya Pradesh	— 0.175
		Kerala	— 0.032

Note: The asteriks indicate statistical significance at 1% (***)
5% (**) and 10% (*) levels respectively.

In six out of the fifteen states there is a statistically significant negative correlation between poverty incidence and agricultural production (per capita foodgrain production being the proxy variable). In Uttar Pradesh, Tamilnadu, Bihar and Punjab – Haryana the correlation is quite high (significant at 1% or 5% levels) while in West Bengal and Karnataka the correlation is moderate (significant at 10% level). In another four

states, i.e., Jammu & Kashmir, Orissa, Madhya Pradesh & Kerala the sign
of the correlation coefficient is negative but it is not statistically
significant. As against this we have five states where the sign of the
correlation coefficient is positive, i.e., Gujarat, Andhra Pradesh,
Assam, Rajasthan, Maharashtra. However the coefficient is not statistical
significant in a single one of these cases.

This statistical picture is consistent with the hypothesis that
increasing agricultural production tends to reduce the incidence of
rural poverty. At any rate there is no evidence that it increases
the incidence of rural poverty. At the same time our maintained
hypothesis is only tentative since the data does not allow us to test
any ceteris paribus propositions which require controlling for the other
factors at work. Moreover it must be noted that in as many as nine out
of the fifteen states there is no statistically significant correlation
between the two variables. This suggests that the production performance
of agriculture is not a decisive factor underlying the incidence of
rural poverty though improved performance does help to ameliorate poverty.
This view is consistent with our earlier more detailed analysis of the
Bihar and Punjab – Haryana region (Mundle 1982a and 1982b). It is also
consistent with the results derived by Ahluwalia (1978) using different
methods and a somewhat different set of data. By the same token it
differs from the views of Griffin and Ghosh (1979) and Saith (1981).

It has sometimes been suggested that correlation or regression
exercises which basically capture the association between year to year

' variations in poverty incidence and agricultural production are not
appropriate to capture the adverse effects of Green Revolution type
agricultural growth on the rural poor since by their very nature these
effects only work themselves out over the long run. If true this
should show up as a distinct trend increase in rural poverty atleast
in a large number of states since these adverse affects of growth would
be reinforced by other known adverse long term processes such as the
steady decline in land: man ratios.

Table 2

Coefficient of Correlation between

Incidence of Rural Poverty and Time

Positive Correlation		Negative Correlation	
Assam	0.795***	Punjab & Haryana	— 0.752***
Rajasthan	0.432	Tamil Nadu	— 0.726*
Orissa	0.328	Karnataka	— 0.422
Madhya Pradesh	0.257	Uttar Pradesh	— 0.320
		West Bengal	— 0.316
		Andhra Pradesh	— 0.312
		Gujarat	— 0.251
		Jammu & Kashmir	— 0.226
		Maharashtra	— 0.198
		Kerala	— 0.097
		Bihar	— 0.038

Note: The asteriks indicate statistical significance at 1% (***) and
10% (*) levels respectively.

Table 2 snows the state wise coefficients of correlation between
incidence of rural poverty and the time variable. Barring the exceptional
cases of Assam with high positive correlation, Punjab - Haryana with
high negative correlation and Tamilnadu with moderate negative correlatio
we see no statistically significant correlation between rural poverty
incidence and time. Regression enthusiasts can easily verify for
themselves using the same data set that except in these three cases the
time coefficient is statistically insignificant.

In other words except in the three cases cited there has neither
been a trend increase or trend decrease in poverty incidence. These
statistics could be interpreted to mean that agricultural growth is
simply irrelevant to the incidence of poverty. Alternatively it could
also be interpreted to mean that agricultural growth has helped offset
the adverse effects of some long term processes which are known to be at
work. This view would be consistent with our interpretation of table 1.
It would be further reiterated if the NSS survey for 1977-78, which is
yet to be released to the public, were to show that there has been a
sharp decline in poverty in 1977-78 compared to the early seventies in
a number of states.

The Effect of Agricultural Prices

The coefficient of correlation between the incidence of rural poverty
and agricultural prices (the proxy variable used being foodgrain prices) is
presented here in table 3. We find a positive correlation between poverty
incidence and agricultural price in eight out of the fifteen states.
However barring the case of Assam, where the correlation is very high, the

correlation coefficients are all statistically insignificant. Similarly
we have seven other states where the sign of the correlation coefficient
is negative. However except in the case of Punjab-Haryana, where it is
moderately high (significant at 10% level) the coefficients are
statistically insignificant in all other cases.

Table 3

Coefficient of Correlation between
Incidence of Rural Poverty and
Foodgrain Prices

Positive Correlation		Negative Correlation	
Assam	0.937***	Tamil Nadu	— 0.655
Rajasthan	0.461	Punjab & Haryana	— 0.593*
Uttar Pradesh	0.416	Karnataka	— 0.293
Jammu & Kashmir	0.397	Andhra Pradesh	— 0.280
Bihar	0.329	Gujarat	— 0.263
Orissa	0.301	Maharashtra	— 0.093
West Bengal	0.110	Kerala	— 0.039
Madhya Pradesh	0.069		

Note: The astriks indicate statistical significance at 1% (***) and
10% (*) respectively. The coefficient for Tamilnadu is
insignificant though it is higher than Punjab & Haryana because
there are only seven observations for Tamilnadu.

In other words in thirteen out of fifteen states, which between them
account for the bulk of India's population and the rural poor, agricultural
prices seem to have no significant effect on the incidence of rural poverty.
Once again this is consistent with our earlier more detailed analysis of
Bihar and Punjab-Haryana which showed that the observed price-poverty
relationship was quite weak. The important question is how do we interpret

these results ?

For one thing we see that there is no evidence at the state level, barring Assam, to support the view that an increase in agricultural prices has a general adverse influence on the incidence of rural poverty. At the same time it is difficult to believe that agricultural prices leave the rural poor unaffected. In terms of the a priori reasoning presented earlier it would appear that a rise or fall in agricultural prices has opposite effects on the two major strata of the rural poor which tend to offset each other thus leaving a minimal net effect on the overall incidence of rural poverty. In the case of agricultural labourers the kind component of wages only partially protects them from rising foodgrain prices. To the extent that they buy grain from the market rising prices erode their incomes and increase the incidence of poverty in this strata. On the other hand a large portion of the rural poor is made up of cultivating households who may be selling grain and also buying it at different points of the agricultural cycle or they may sell other crops and buy grain. The effect of rising agricultural prices on their real income depends therefore on whether they are net buyers or net sellers. The fact that the adverse effect of rising prices on wage-dependent households does not show up as an increase in the incidence of rural poverty suggests that in general these poor cultivating households are net sellers who enjoy real income gains which tend to offset the real income loss suffered by labour households when agricultural prices rise.

Concluding Remarks

The main conclusions emerging out of our analysis of the effect of agricultural production and prices on the incidence of rural poverty in the states may now be briefly summarised as follows:

i) Neither agricultural production nor agricultural prices seem to have a strong or decisive effect on the incidence of rural poverty. Other factors which have not been taken up here, but were examined in some detail in an earlier study of the Bihar & Punjab-Haryana regions, such as land distribution, wage rates and employment would appear to be more important.

ii) Agricultural production is not significantly positively correlated with rural poverty in a single state whereas these variables have significant negative correlation in six out of fifteen states.

iii) A statistically significant trend increase in rural poverty is noted only in Assam as against a significant trend decrease in rural poverty in Punjab-Haryana and also possibly Tamilnadu. It could be argued that the absence of a trend increase in poverty in all other states, inspite of certain known adverse processes at work such as a declining land: man ratio, is attributable to the positive effects of agricultural growth.

iv) There is no evidence, once again except in the case of Assam, of any significant positive correlation between rising agricultural prices and increased incidence of rural poverty.

v) Since wage dependent rural labour households are clearly adversely effected by a rise in foodgrain prices, (iv) suggests that the real income loss of this strata tends to be offset by real income gains of the other major segment of the rural poor, i.e., cultivating households, who are therefore generally likely to be net sellers rather than net buyers of agricultural commodities.

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Appendix: The Construction of Poverty Lines for
Individual States: 1963-64 to 1973-74

A1

The problems associated with the measurement of poverty lines and
poverty incidence are dealt with briefly as they have been discussed
extensively in the relevant literature. In the original official
attempt to estimate a poverty line the Planning Commission specified
Rs. 20.00 per capita per month at 1960-61 prices as the minimum norm of
required expenditure for all India, including rural and urban areas
(Planning Commission 1962). Allowing for rural-urban price differentials
corresponding to this norm, Bardhan (1974) adopted the all India rural
norm of Rs. 15 per head per capita at 1960-61 prices. The same line was
also adopted by Dandekar and Rath (1971) as meeting a minimum calorie
intake requirement of 2250 calories per head per day. More recently the
same norm has been adopted by Ahluwalia (1978) and Nayyar (1977) who
made adjustments for inter-state price differentials in order to apply
the norm to Bihar state.

However, the difficulty with an all India norm is not only that it
fails to take account of inter-state price variations but also that it
ignores variations across states in food habits and consumption preferences.
Accordingly in some exercises pertaining to individual states such as
Kerala (Panikar 1972), Punjab (Rajaraman 1977), etc. the procedure
adopted was to find a state-specific least cost diet subject to a set of

minimum nutrition constraints and taste preference constraints as a standard linear programming solution. The difficulty with this approach is that a great deal of arbitrariness and personal judgement gets built into the model in the specification of the taste-preference constraints such that it is not very clear what the solution actually represents.

The preferred procedure, therefore, is to examine consumer expenditure patterns state-wise to identify separately for each state which consumer expenditure level satisfies a given nutritional intake norm. This is possible using the NSS 26th round consumer expenditure survey for 1971-72 which gives state-wise data on the daily calorie and protein intake per consumer unit in each per capita expenditure class separately for rural and urban areas. In the present exercise we have followed this procedure, adopting as the intake norm 2435 calories per head per day. This is the norm recently recommended by the Nutrition Experts group set up by the Planning Commission (Planning Commission 1979). The exact minimum expenditure level was computed by linear interpolation between the average per capita expenditure of the two classes with average per capita calorie intakes just above and below the specified norm.

These poverty lines at 1971-72 prices were then extrapolated to all years covering the period 1963-64 to 1973-74 using the state specific Agricultural Labourers Consumer Price Index (ACPI)*. The time series of poverty lines constructed for each state are given here in table A1. The use of the ACPI as a general deflator for consumer expenditure can lead to serious errors since the prices of different items, accounting

* This was available only from 1964-65 onwards for Uttar Pradesh and Jammu & Kashmir and 1967-68 onwards for Tamilnadu.

The Estimated Poverty lines for Individual States: 1963-64 to 1973-74
(Rupees)

State	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74
Andhra Pradesh	22	27	29	33	34	36	37	36	39	44	52
Assam	25	29	32	42	49	46	41	45	47	48	58
Bihar	20	25	30	39	32	32	34	35	35	41	57
Gujarat	25	31	32	36	38	38	40	41	43	53	58
Jammu & Kashmir	---	23	26	27	29	26	28	29	29	35	45
Karnataka	21	28	33	34	38	37	36	38	39	44	56
Kerala	35	43	48	52	55	63	65	69	68	71	89
Madhya Pradesh	14	16	18	23	25	22	24	23	24	28	36
Maharashtra	28	38	40	44	46	44	46	48	52	61	69
Orissa	23	25	28	33	37	38	37	37	39	43	49
Punjab (including Haryana)											
Rajasthan	17	22	23	28	29	30	32	29	29	38	47
Tamilnadu	---	---	---	---	40	42	45	41	41	45	57
Uttar Pradesh	---	26	26	33	37	28	31	29	30	37	47
West Bengal	31	32	40	46	56	47	46	48	49	51	64

Sources: (i) The National Sample Survey, 26th round, July 1971 - June 1972

(ii) Agricultural Labourers Consumer Price Index from various issues of Agricultural Prices in India.

for different proportions of the consumption basket at different
levels of consumer expenditure, have changed at different rates.
However it will be evident that the problem arises mainly in the context
of measuring changes in inequality of consumption expenditure over time.
The ACPI is probably not a bad deflator for computing the current money
value in different years of a fixed basket of 'poverty line' consumption.

The time series of poverty line consumption expenditure constructed
for each state was then applied to the NSS state-wise rural tables of
household distribution by consumer expenditure classes in order to
estimate the percentage of rural population below the poverty line for
all years in the period 1963-64 to 1973-74. The precise percentages were
computed by linear interpolation within the expenditure class enclosing
the poverty line on the assumption of even distribution of the population
within the expenditure class. The proportions so computed were taken as
measures of the incidence of rural poverty over time for correlating
variations in poverty incidence with variations in per capita foodgrain
production and foodgrain prices in each state.

One difficulty with this 'head count' measure of poverty incidence
is that it counts the proportion of population below a poverty line
without taking any account of the distribution of that population below
poverty line expenditure. Sen's Index (Sen 1973) does take account of
this aspect and has been used by Bhatty (1974), Ahluwalia (1978) and
others in India. However it is an extremely complex index, not easily
amenable to intuitive interpretation, especially when applied to grouped

data. A less elegant but in addition, more appealing approach is to
employ the conventional head count method but use multiple poverty lines
to see whether the over time pattern is sensitive to the choice of a
particular poverty line.

The use of multiple poverty lines also takes care of a second
problem, namely, the specification of an appropriate minimum calorie
intake norm. The current debate on this question among statisticians
and nutrition experts in India suggests that the problem is almost
intractable because there appear to be variations in calorie requirements
not only between different persons but also for the same person on
different days, and this is quite apart from the effect of variations in
the nature of work or the environment. The problem can be circumvented
by adopting multiple poverty lines, corresponding to different calorie
intake norms, and checking to see whether the patterns of poverty incidence
are sensitive to the choice of a particular line.

In the present exercise such sensitivity tests have not been applied.
However in an earlier exercise dealing with Bihar and Punjab (including
Haryana), in some sense polar cases with regard to agricultural performance,
the sensitivity tests using multiple poverty lines were applied (Mundle
1982a and 1982b). It turned out that the numerical value of the response
elasticities of poverty incidence with respect to agricultural production
and prices were different at different poverty lines. However the broad
qualitative relationship between these variables, or the lack of it,
was invariant with respect to the choice of a particular poverty line.