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AND OTHER ASPECTS OF RURAL INCOME IN
THE SEMI-ARID TROPICS OF INDIA**

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SIZE, COMPOSITION, AND OTHER ASPECTS OF RURAL INCOME
IN THE SEMI-ARID TROPICS OF INDIA

R.P. Singh, M. Asokan, and T.S. Walker[†]

For economists, income is the best single yardstick to gauge human welfare. The level and distribution of income strongly influence the technologies that farmers adopt and the pace of technical diffusion which, in turn, condition the size and distribution of income. The limited aim of this paper is to present estimates and preliminary findings on rural income in six villages of the Semi-Arid Tropics (SAT) of India. The villages are the sites for ICRISAT's intensive Village Level Studies (VLS) where the farming and socioeconomic activities of a panel of 40 households have been monitored in each village starting in 1975. The panel is drawn from a random stratified sample of small-, medium-, and large-sized farming and landless agricultural labor households.¹

The six villages are located in three broad soil, climatic, and cropping regions of SAT India. Salient features of each region are listed in Table 1. Although the adoption of improved technologies in dryland farming has been much slower than for irrigated agriculture, some components of higher yielding technologies have been partially adopted by farmers, but the level of diffusion has not been uniform across the six villages. Kanzara and Dokur are the most agriculturally, technically advanced villages, while the adoption of recommended inputs in Kalman and Shirapur has been negligible.

Rural incomes are estimated for three cropping years from 1975-76 to 1977-78 for Kanzara, Shirapur, Aurepalle, and Dokur.² Income estimates for Kinkheda and Kalman refer to two cropping years, 1975-76 and 1976-77.³

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1. Data collection procedures for the VLS are thoroughly described in Binswanger and Jodha (1978).
2. In the VLS, a cropping year extends from May 31 to June 1 of the following year.
3. After 1978 intensive data collection continued in one village of each district; the other village was left as a "control" for with-and-without comparisons. Data are available to estimate income in 1977-78 for Dokur, one of the control villages.

Table 1. Agroclimatic, socioeconomic, and technological features of six SAT villages of India from 1975-76 to 1977-78.^a

Village (location, soils, annual rainfall)	Average size of operational holding(ha)	Irrigated area (% gross cropped area)	Common cropping systems	Improved technologies partially adopted
AUREPALLE				
(Mahbubnagar dist; Alfisols; 710 mm)	5.6	21	Rainy season castor, sorghum-pearl millet-pigeon-pea mixture	HYV castor, fertilizer on irrigated land
DOKUR				
(Mahbubnagar dist; Alfisols; 710 mm)	3.7	60	Irrigated paddy	HYV paddy, fertilizer
SHIRAPUR				
(Sholapur dist; deep Vertisols; 690 mm)	6.5	13	Postrainy season sorghum	Fertilizer on irrigated land
KALMAN				
(Sholapur dist; deep Vertisols; 690 mm)	8.5	10	Postrainy season sorghum	Fertilizer on irrigated land
KANZARA				
(Akola dist; medium deep Vertisols; 820 mm)	6.5	5	Rainy season cotton mixtures, sole-crop sorghum	HYV cotton, hybrid sorghum, insecticide, fertilizer, mechanical threshing
KINKHEDA				
(Akola dist; medium deep Vertisols; 820 mm)	6.7	4	Rainy season cotton mixtures, sole-crop sorghum	Hybrid sorghum, fertilizer

a. Constructed from Jodha 1980 and unpublished VLS data.

All income data are expressed in nominal prices. Concepts and procedures used to estimate income are detailed in Singh and Asokan (1981). The income measure used in this paper is net household income which represents returns to family labor, owned bullocks, owned capital, owned land, and management.⁴ Income and expenses from both farm and nonfarm activities are considered in estimating net household income.

This report is the second instalment in the VLS income analysis and is long on facts but short on explanation. A sequel to this paper will analyze in greater depth the same aspects of income with real income data for five cropping years (1975-76 to 1979-80) for Aurepalle, Kanzara, and Shirapur. Other instalments will address income fluctuations and stability over time and crop income in SAT India. In the future, recently started VLS villages in Gujarat and Madhya Pradesh will also be included in the analysis.

The analysis relies on village comparisons to make "average" inferences on various aspects of rural income. In an agricultural production environment as variable as the SAT, a three-year period may be too short a period to draw such inferences. Comparing total rainfall data collected in the villages from 1975-76 to 1977-78 with the historical mean of the district reveals that on average total rainfall was 99% of normal for the six villages from 1975-76 to 1977-78. In 1975-76, total cropping year rainfall in Aurepalle and in the more rainfall assured villages of Akola district was less than 70% of average. The cropping year 1976-77 was particularly dry in the drought-prone villages of Sholapur district as total annual rainfall was only about 55% of normal. The next cropping year 1977-78 was a relatively good rainfall year for all six villages.

SIZE OF RURAL INCOME

To say that rural income is extremely low in the six villages is an understatement. The all-village average median and per capita net household incomes in Table 2 fall below Rs. 2000 and 400, respectively. The average median per capita income (Rs. 373) is only equivalent to \$ 42 U.S. in 1977 prices.⁵ The all-village mean net per capita income estimate of Rs. 483

4. Net household income equals disposable income less charges for depreciation on household assets.

5. Using an exchange rate of Rs. 8.85 = \$ 1.00 U.S. (Reserve Bank of India, 1977).

Table 2. Cropping year income (in rupees) in six semi-arid tropical villages of India (1975-76 to 1977-78)

Village	Gross household		Net household		Per capita	
	Mean ^a	Median ^b	Mean ^a	Median ^b	Mean ^a	Median ^b
Aurepalle	4564	2410	2361	1407	422	238
Dokur	6031	3225	2967	1728	560	389
Shirapur	5369	4304	2995	2324	445	365
Kalman	4079	3616	1942	1617	317	275
Kanzara	6358	3991	3856	2687	627	518
Kinkheda	5215	2981	2522	2065	464	433
All village average	5347	3381	2842	1945	483	373

a. Simple average for the three cropping years.

b. The midpoint income estimate over the three cropping years.

is less than one-half of the All-India per capita income estimate of Rs. 1080 for 1977 (Directorate of Economics and Statistics 1979).

For all villages, the distribution of income is skewed to the right as mean estimates exceed corresponding median figures by about 30 to 40%. One should therefore look to the median estimates to provide a more reliable picture of central tendency in village income.

Net household income was about 50% of gross household income for all villages from 1975-76 to 1977-78. Although rankings change by income measures, the data in Table 2 strongly suggest that average rural income varied across villages. Mean income in Kanzara, the richest village, was about 50% higher than in Aurepalle, the poorest village. The shortfall in median income between the two villages approached 100%.

More evidence on village differences in mean net household income is presented in Table 3. These results show a significant difference in average net household income at the five-percent level for 17 of the 36 village-by-cropping year paired comparisons. Aurepalle had a significantly

Table 3. Differences in mean net household income by village within the same cropping year.^a

Village comparison ^b	Cropping year		
	1975-76	1976-77	1977-78
Aurepalle and Dokur	-2.53**	-3.16**	1.70*
Aurepalle and Shirapur	-1.47	-5.07**	0.28
Aurepalle and Kalman	-0.39	-3.69**	-
Aurepalle and Kanzara	-3.38**	-4.36**	-1.24
Aurepalle and Kinkheda	-3.27**	-4.26**	-
Dokur and Shirapur	0.76	-1.61	-1.59
Dokur and Kalman	2.06*	-0.03	-
Dokur and Kanzara	-1.53	-1.12	-3.16**
Dokur and Kinkheua	-0.66	-0.54	-
Shirapur and Kalman	1.25	2.18*	-
Shirapur and Kanzara	-2.18*	0.88	-1.88*
Shirapur and Kinkheda	-1.43	1.85*	-
Kalman and Kanzara	-3.34**	-1.26	-
Kalman and Kinkheda	-2.84**	-0.32	-
Kanzara and Kinkheda	0.92	1.00	-

a. Figures in the table are values estimated with a nonparametric Mann-Whitney *U* statistic to test differences between two means. * and ** indicate significant differences at the 10 and 5% levels, respectively.

b. A positive figure marked with asterisks shows that mean net household income in the first village listed in each comparison was significantly higher than in the second village. A negative value and asterisks means that income in the second village was significantly higher than in the first.

lower mean net household income than other villages in the majority of the comparisons. In contrast, no village had a mean net household income significantly higher than Kanzara from 1975-76 to 1977-78.

DISTRIBUTION OF RURAL INCOME

Drawing concrete inferences about income distribution from a sample of 40 households in each of six villages is a tenuous exercise; therefore, the findings reported in this section should be interpreted with caution. Both net household and per capita incomes are unequally distributed in the six villages (Tables 4 and 5). The modal net household income bracket is Rs. 1001 - 2000 for all villages. Particularly in Aurepalle and Dokur the bulk of the households are clustered in the three lowest income brackets (Table 4). More than 70% of the sampled population in Aurepalle are characterized by a per capita income of less than Rs. 400 (Table 5).

In order to place in perspective the level of indigence in these six villages, only about 8% of the sampled population had net per capita incomes above \$ 150 U.S., which was a common estimate of average per capita income in India for 1976 (World Bank, 1978). Of the 240 sampled households, only one household had a net income superior to \$ 2500 U.S., during any one of the three cropping years from 1975-76 to 1977-78.

The cumulative income distributions charted in Figure 1 show the probability that net household income is less than or equal to an amount given on the horizontal axis. Cumulative distributions that rise steeply and then flatten out rapidly denote more income inequality. For example, in Aurepalle the 70% households with the lowest incomes have less income than the same percentage of households in the other villages, but the richest households have more income than the highest-income households in all villages except Kanzara. In comparison, the uniformly rising cumulative income distributions of Kinkheda and Kalman suggest less income inequality. Apart from the 10 percent lowest income households, all other households in Kanzara were absolutely better off than their relative counterparts in the other villages. But the flat part of the Kanzara curve strongly indicates inequality because a few households had large incomes.

One tentative explanation of the intervillage differences in income inequalities depicted in Table 4 and 5 and Figure 1 focuses on the heterogeneity of the resource base that is more equally accessible in Kalman, Kinkheda, and other villages compared to Aurepalle. In Aurepalle the soils in general are poor but richer farmers have better land in low lying areas and around wells. The heterogeneity of the village resource base tends to generate more inequality in the better endowed villages than in the resource poor villages where all households are rather equally handicapped.

Table 4. Distribution (in %) of households across net income group in six SAT villages of India (1975-76 to 1977-78).^a

Net income group (in rupees)	Village ^b						All Village average
	AR	DK	SI	KL	KZ	KH	
Negative	5.0	3.3	2.5	6.2	2.5	1.2	3.4
0 - 1000	29.2	15.8	10.8	18.8	10.0	10.0	16.0
1001 - 2000	33.3	37.5	31.7	30.0	21.8	35.0	31.4
2001 - 3000	10.8	15.8	19.2	26.3	19.2	30.0	19.3
3001 - 4000	7.5	9.2	12.5	10.0	17.5	13.8	11.8
4001 - 5000	1.6	7.5	10.0	3.7	7.5	3.8	6.0
5001 - 10000	6.6	5.9	10.9	5.0	12.5	3.8	8.1
10001 - 15000	2.5	3.3	0.8	0.0	5.8	2.5	2.6
15001 - 20000	2.5	0.0	1.7	0.0	1.2	0.0	1.1
above 20000	0.0	1.7	0.0	0.0	0.0	0.0	0.3

a. Estimates refer to the entire three-year period.

b. AR, DK, SI, KL, KZ, and KH designate Aurepalle, Dokur, Shirapur, Kalman, Kanzara, and Kinkheda, respectively.

Table 5. Distribution (in %) of households across per capita net income groups in six SAT villages of India (1975-76 to 1977-78).^a

Per capita net income group (in Rs)	Village ^b						All village average
	AR	DK	SI	KL	KZ	KH	
Negative	5.0	4.0	2.6	7.5	1.5	0.5	3.5
0 - 200	37.6	18.2	18.8	28.0	3.6	6.6	19.2
201 - 400	29.3	32.7	34.6	38.6	32.7	33.4	33.3
401 - 600	9.8	17.0	25.4	13.3	26.3	41.4	21.4
601 - 800	4.4	9.2	7.1	8.8	15.0	11.5	9.2
801 - 1000	4.1	8.1	6.1	2.5	6.9	0.0	5.1
1001 - 1200	1.5	0.4	1.7	1.2	4.8	3.8	2.2
1201 and above	8.2	10.4	3.7	0	9.1	2.8	6.1

a. Estimates refer to the entire three-year period.

b. AR, DK, SI, KL, KZ, and KH designate Aurepalle, Dokur, Shirapur, Kalman, Kanzara, and Kinkheda, respectively.

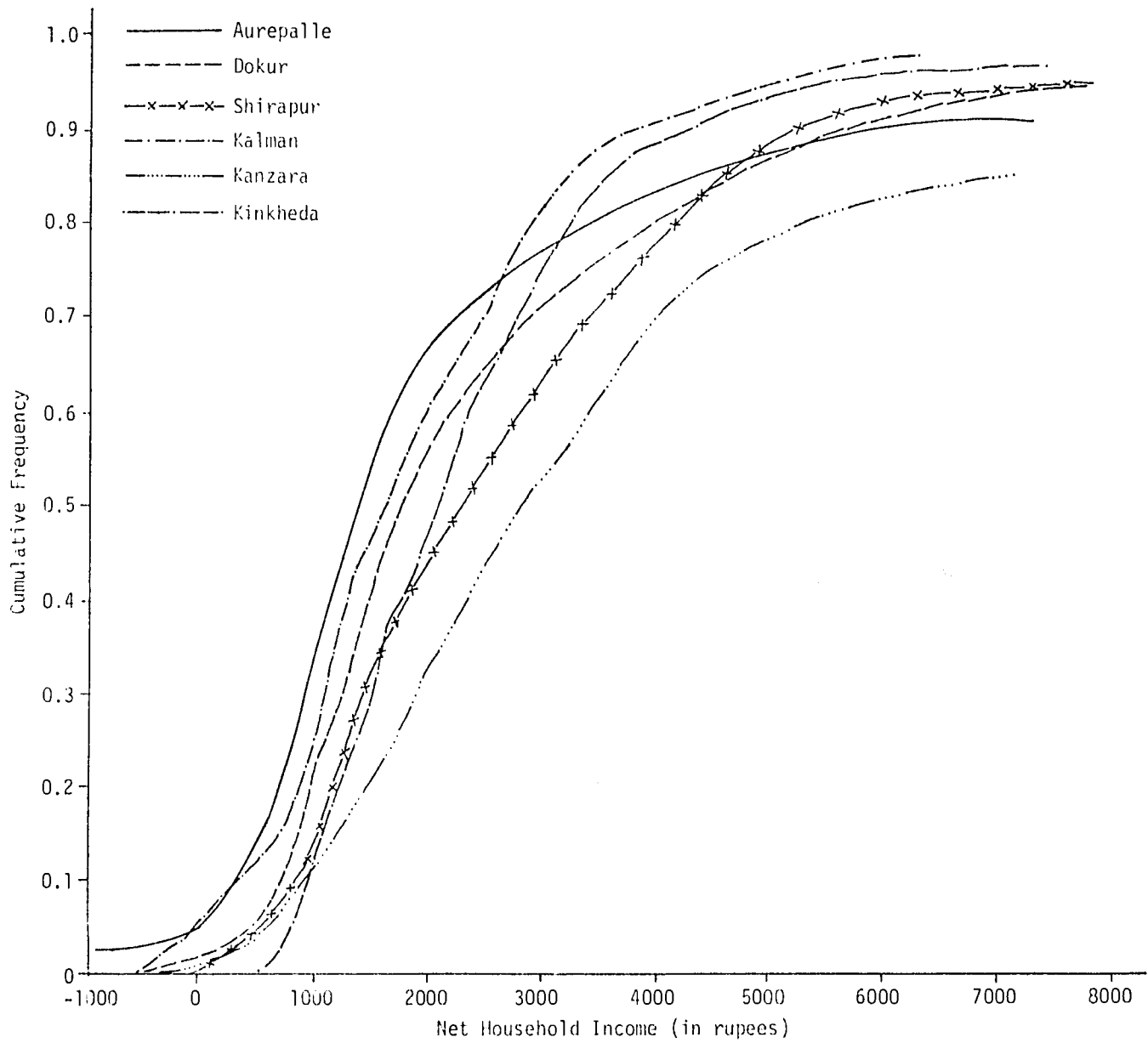


Fig. 1. Cumulative net household income distributions in six SAT villages of India (1975-76 to 1977-78).

RELATIVE INEQUALITY AND ABSOLUTE POVERTY

Relative Inequality

Estimates of income inequality reinforce the descriptive findings suggested by Figure 1. Four measures⁶ commonly used to depict relative income inequality are presented in Table 6 and point to the same conclusion: income inequality was greatest in Aurepalle from 1975-76 to 1977-78. A meager four-percent share in income of the poorest 40% of sampled households is a stark reminder of the incidence of chronic relative income inequality in Aurepalle. This abysmally low figure was partly attributed to a poor crop year in 1975-76 when the income share to the poorest 40% of the households was negative. Nevertheless, the value of this indicator was the lowest in Aurepalle among the six villages for each cropping year. Kanzara and Dokur, the two richest villages with respect to mean per capita income, rank behind Aurepalle in relative income inequality. This ranking is preserved across the four income measures.

Absolute poverty

For a region as impoverished as SAT India, absolute poverty is a much more meaningful index of human welfare than relative inequality (Fields, 1970). Despite its importance, it is impossible to objectively determine absolute poverty; consequently, we follow the normal practice of using a poverty line to define the rural poor. The two poverty lines most often invoked for such comparisons in India are Rs. 15 per month in 1960-61 rural prices and Rs. 65 per month in 1977-78 prices.⁷ The former has a history with scholars [Dandekar and Rath (1971); Bardhan, (1974); Ahluwalia, (1978)] and the latter has been used in the draft of the Sixth Five year Plan 1980-85 (Planning Commission, 1981). Depending upon what standard we use between three-fourths and seven-eighths of the VLS sampled population on average fell below the poverty line from 1975-76 to 1977-78 (Table 7). Kanzara and Dokur, the most technologically advanced and highest income villages, showed the lowest incidence of absolute poverty. Ironically, in the three villages--Saranapur, Kalman, and Kinkheda--where relative income inequality was least, absolute poverty was greatest. Where average levels of income are as low as they are in Semi-Arid Tropical India, higher relative income inequality guarantees that some villagers will escape from absolute poverty as defined in the first two columns of Table 7.

6. The weaknesses and strengths of these static measures of relative inequality are discussed in Szal and Robinson (1974).

7. The first poverty line and its price deflator are tailored to consumption data.

Table 6. Relative inequality in net household income in six SAT villages of India (1975-76 to 1977-78).

Village	Inequality measure ^a			
	Elteto and Frigyes v index ^b	Gini coefficient ^c	Income share of the Poorest 40%	Income share of the Richest 5%
Aurepalle	.85	.43	0.04	0.29
Dokur	.77	.36	0.13	0.27
Shirapur	.71	.30	0.15	0.18
Kalman	.68	.28	0.15	0.15
Kanzara	.74	.32	0.12	0.20
Kinkheda	.64	.25	0.19	0.18

- a. Higher values for the first two measures indicate greater relative income inequality. Estimates for the four measures are simple averages for the three cropping years.
- b. The v index measures inequality in the entire income distribution and equals the mean income of the upper-half of the income distribution divided by the mean income of the lower half. A measure normalized to the range 0 to 1 is calculated by taking the difference in mean income between the upper and lower halves and then dividing by the mean for the upper half (Elteto and Frigyes, 1968).
- c. The Gini coefficient equals the mean of income differences among individuals or groups divided by twice the arithmetic mean (Gini, 1914).

Sen (1976) has suggested a more comprehensive measure of absolute poverty. His index considers two other dimensions of poverty: 1) the shortfall in income of the poor, i.e. the difference between the poverty line and the mean income of the poor, and 2) relative income inequality among the poor. The Sen index increases as a higher proportion of individuals fall below the poverty line, the gap between the poverty line and the average income of the poor widens, and as relative income inequality among the poor rises.⁸

8. The Sen Poverty Index is defined as $P = H[\bar{I} + (1-\bar{I})G_p]$ where H is the head count of the poor, \bar{I} is the average income shortfall of the poor and G_p equals the Gini coefficient of income inequality among the poor. When normalized so that \bar{I} is expressed as a proportion or a poverty gap ratio the index is bound from 0.0 to 1.0. A technical and conceptual appraisal of the Sen Poverty Index and other competing measures can be found in Clark et al. (1981).

Table 7. Absolute poverty in six SAT villages of India (1975-76 to 1977-78).

Village	Absolute poverty measure		Sen Poverty Index ^c
	Rs.15 per month per caput in rural 1960-61 prices ^a (% population with less)	Rs.65 per month per caput in 1977-78 prices ^b (% population with less)	
Aurepalle	75	86	.67
Dokur	65	81	.53
Shirapur	78	88	.62
Kalman	85	96	.74
Kanzara	64	79	.50
Kinkheda	83	93	.64
All village average	75	87	.62

- a. Constructed for each state with the Consumer Price Index for Agricultural Labor (CPIAL) from the Indian Labour Journal (1978). A comprehensive description of this measure and its use is contained in Ahluwalia (1978). Estimates are simple averages of the three cropping years and are based on per capita income.
- b. From India, Planning Commission (1981).
- c. Sen (1976). Estimates in the first column include persons with negative net per capita income while figures in the second column are estimated without negative observations. About 3% of the sampled population had negative net per capita income.

Sen's definition of poverty does not drastically alter the inter-village ranking presented in the first two columns of Table 7. Kanzara and Dokur clearly have the lowest incidence of absolute poverty. High absolute negative incomes tend to inflate the Sen index, and this partially explains why Aurepalle has a large value of 0.67. When these observations are deleted in column 4 of Table 7, the spread among villages narrows but the overall ranking remains the same.

The average estimates of the Sen index for Kalman and Kinkheda where income is not calculated for 1977-78 are somewhat deceiving because the index is extremely sensitive to intertemporal income variability.

1977-78 was a good crop year for all villages, and it is likely that the average Sen index would be lower for Kalman and Kinkheda if income for this cropping season could be included. What the index does show is that among the four villages with observations for three cropping years, Kanzara and Dokur had a lower incidence of absolute poverty than Aurepalle and Shirapur. More buoyant and fluid labor markets for agricultural labor [Binswanger et al. (1980)], higher quality resource endowments (Jodha, 1980), and enhanced availability of suitable technologies are probably three contributing reasons why Kanzara and Dokur have a reduced incidence of absolute poverty.

Comparative Evidence on Relative Income Inequality and Absolute Poverty

How high are the levels of relative inequality and absolute poverty estimated in Tables 6 and 7? While income distribution is a heavily researched theme in India (Bardhan and Srinivasan, 1974), most research is based on data from the National Income Accounts or the National Sample Survey (NSS). The NSS data record consumption expenditure and the National Income Accounts address issues at the macrolevel (Ahluwalia, 1978). At the microeconomic level, the Indian Farm Management Studies contain a wealth of information but largely focus on cost of cultivation issues and therefore do not explicitly address household income analysis (Directorate of Economics and Statistics, 1976). Income, investment, and savings studies by the agro-economic research centers are largely confined to irrigated regions where the Intensive Agricultural Development Program (IADP) has been active.

The only direct source of rural income information at the national and state level is provided by surveys from the National Council of Applied Economic Research (NCAER) (Bardhan, 1974). When we adjust the VLS income estimates to correspond to the procedures adopted by Bhatta (1974) to analyze the 1968-69 NCAER data,⁹ rough comparisons can be made at the state level (Table 8). The estimated incidence of relative inequality and absolute poverty was much higher in Aurepalle and Dokur during 1975-76 to 1977-78 than that calculated by Bhatta for Andhra Pradesh from the 1968-69 rural NCAER data (Table 8). The Telengana region in general and Mahabubnagar district in particular are probably much poorer than the rest of the state; therefore, this finding is not unexpected. In sharp contrast, both data sources generate the same level of relative inequality for Maharashtra. Estimates of the incidence of absolute poverty are slightly higher for the VLS sample.

9. Depreciation is not subtracted from household income.

Table 8. Comparative evidence on relative inequality and absolute poverty based on per capita income estimates from the VLS (1975-76 to 1977-78) and from the NCAER (1968-69).^a

Village/state	Relative inequality Gini Coefficient	Absolute poverty by level and index ^{b,c}					
		Rs. 240/year		Rs. 300/year		Rs. 360/year	
		H	P	H	P	H	P
Aurepalle	.52	67	.49	73	.55	82	.62
Dokur	.41	54	.27	61	.35	68	.42
VLS Andhra Pradesh	.48	61	.39	68	.46	75	.53
NCAER Andhra Pradesh	.37	32	.11	43	.19	57	.27
Shirapur	.30	51	.24	71	.35	80	.44
Kalman	.34	71	.41	84	.51	89	.59
Kanzara	.38	39	.18	50	.26	65	.34
Kinkheda	.30	41	.17	59	.26	77	.37
VLS Maharashtra	.36	46	.24	63	.33	75	.42
NCAER Maharashtra	.35	39	.17	55	.26	67	.35

- a. The NCAER estimates are taken from Bhattu (1974). In order to compare estimates, the income concept used for the VLS data is net household income plus depreciation which is then divided by family size to give per capita income. Estimates are simple averages of the three cropping years.
- b. Poverty levels are in 1968-69 prices and were inflated by the wholesale price index (Directorate of Economics and Statistics, 1976) to derive comparable poverty lines for 1976-77.
- c. H refers to the head count (in %) of individuals who fell below the poverty line, and P denotes the Sen Poverty Index.

COMPOSITION OF INCOME

In terms of gross household income, crop production was the most important source of income in all the villages, but the contribution made by crop production and labor to net household income was roughly the same for the six villages and was equal at 40.6% in the all village average (Table 9). Livestock, trade and handicraft, rental of family owned assets, and other sources of income were important in some villages but not in others. The composition of minor sources in income varied greatly even within the same region. For instance, livestock was important in Aurepalle but was a negligible contributor to income in Dokur; households in Kinkheda derived on average about 10% of gross

Table 9. Composition (in %) of gross and net household income by source in six SAT villages of India (1975-76 to 1977-78).

Village	Income sources					
	Crops	Labor ^a	Trade and handicraft	Rental	Livestock ^b	Others
Aurepalle	48.5 (29.8) ^c	20.0 (32.8)	8.0 (11.6)	1.0 (-0.8)	19.0 (25.5)	3.5 (1.1)
Dokur	58.3 (46.1)	26.7 (46.3)	1.5 (1.1)	1.8 (2.2)	9.2 (2.0)	2.5 (2.3)
Shirapur	41.2 (33.7)	26.2 (42.6)	6.2 (0.2)	2.4 (2.2)	16.2 (15.0)	7.8 (6.3)
Kalman	46.7 (46.0)	23.8 (42.1)	5.4 (4.1)	5.0 (4.4)	15.3 (0.8)	3.8 (2.6)
Kanzara	53.4 (43.9)	25.3 (38.7)	2.4 (2.6)	1.7 (1.5)	11.5 (9.0)	5.7 (0.3)
Kinkheda	49.3 (43.4)	23.0 (40.8)	10.1 (5.3)	0.9 (0.6)	15.3 (13.1)	1.4 (-3.2)
All village average	46.0 (40.6)	26.3 (40.6)	5.8 (3.9)	2.2 (1.6)	15.2 (10.9)	0.5 (2.4)

- a. Labor income includes the value of labor used for crop production and livestock maintenance as an indirect contribution to income from family labor.
- b. Livestock income includes the value of owned bullock labor used on own farm as an indirect contribution to livestock income.
- c. Figures in parentheses are % to net household income. Negative values indicate losses.

income from trade and handicrafts which generated little income in Kanzara; and other sources such as gifts, transfers, and gambling were more than twice as important in Shirapur as in Kalman.

Most households received income from crop and livestock production and from labor earnings (Table 10). An exception was Aurepalle where 34 percent of the households did not participate in the labor market. In Kalman, sharecropping was common and the majority of households derived income from

Table 10. Proportion (in %) of households receiving income from different sources in six villages of SAT India (1975-76 to 1977-78).

Village	Income sources					
	Crops	Labor	Trade and handicraft	Rental	Livestock	Others
Aurepalle	70	66	51	10	83	73
Dokur	75	85	15	35	65	72
Shirapur	74	96	22	43	96	91
Kalman	73	89	49	59	83	69
Kanzara	71	88	32	31	85	100
Kinkheda	75	84	16	23	90	59
All village average	73	86	30	32	83	79

the rental market. In Aurepalle, trade in toddy was a source of income for more than 50% of the households. Income from other sources such as gifts, transfers, and money lending was common in all six villages.

FARM SIZE AND INCOME

Size of Income

The VLS sampling procedure of randomly selecting and monitoring 40 households equally divided into four farm-size categories in each village offers an excellent format to analyze the influence of farm size on income determination.¹⁰ The data in Tables 11, 12, and 13 paint a rather complicated and heterogeneous picture of the relationship between income and farm size. As expected for all villages, average gross household income is strongly correlated with farm size, but the association between size of operated holding and average net household income is much weaker (Table 11).

10. The VLS households were selected on a criterion of the relative size of operated area within the village. An active rental market for land in some villages means that not all households stay in the same farm-size category each year. It is important to recognize that households are allocated to farm-size categories on the basis of operated and not owned area each year.

Table 11. Cropping-year average net (gross) household income (in rupees) by farm size class in six SAT villages of India (1975-76 to 1977-78).^a

Village	Farm size class			
	Landless labor	Small	Medium	Large
Aurepalle	1056 (1239) ^b	1771 (2374)	1779 (3345)	4932 (11553)
Dokur	1658 (1987)	1524 (3763)	2719 (5436)	7939 (13796)
Shirapur	1709 (2016)	2003 (4067)	3356 (5585)	4517 (9043)
Kalman	1199 (1669)	2593 (3742)	1978 (4909)	2098 (6195)
Kanzara	1928 (2071)	3001 (3864)	2318 (4223)	8472 (15923)
Kinkheda	1968 (2108)	1854 (3059)	2064 (3547)	4305 (12200)
All village average	1583 (1843)	2712 (3427)	2373 (4547)	5216 (11506)

a. Average for the three-year period from 1975-76 to 1977-78.

b. Estimates of average gross household income are given in parentheses.

Table 12. Differences in mean net household income by farm size class by village from 1975-76 to 1977-78.^a

Village	Farm size class comparison ^b			
	Small and landless labor	Medium and small	Large and medium	Cultivator and land- less labor
Aurepalle	3.05**	-0.26	2.10*	3.64**
Dokur	-0.66	2.81**	2.08*	2.49**
Shirapur	1.49	2.49**	0.45	3.79**
Kalman	3.53**	-1.25	0.00	3.08**
Kanzara	3.76**	-1.57	5.23**	4.94**
Kinkheda	-0.08	0.56	3.09**	1.32

a. Figures in the table are values of z corresponding to estimated Mann-Whitney *U* statistics used to test nonparametrically the difference between two means. * and ** indicate significant differences at the 10% and 5% levels, respectively.

b. A positive figure marked with asterisks shows that mean net household income of the first farm size class is significantly greater than the second.

Table 13. Net per capita income (in rupees) by farm size in six SAT villages of India (1975-76 to 1977-78).^a

Village	Farm size class			
	Landless labor	Small	Medium	Large
Aurepalle	247 (231) ^b	279 (226)	288 (340)	878 (753)
Dokur	571 (421)	316 (306)	588 (461)	756 (575)
Shirapur	302 (320)	458 (439)	435 (392)	563 (449)
Kalman	229 (195)	364 (319)	331 (307)	353 (281)
Kanzara	515 (485)	513 (469)	346 (406)	1119 (747)
Kinkheda	423 (380)	408 (416)	367 (410)	618 (543)
All village average	393 (320)	388 (328)	398 (367)	730 (540)

a. Average for the three year period from 1975-76 to 1977-78.

b. Figures in parentheses represent the simple average of the median estimates for the three cropping years.

In testing for significant differences in mean net household income by farm-size class, four paired comparisons are made: 1) landless labor and small-farm households, 2) small-farm and medium-farm households, 3) medium-farm and large-farm households, and 4) landless labor and cultivator households (Table 12). In Aurepalle, Kalman, and Kanzara average net household income for landless labor was significantly less than for small farmers from 1975-76 to 1977-78 (Table 12). The inferior relative income position of landless agricultural labor in Aurepalle can at least partially be attributed to an inefficient and immobile labor market (Binwanger et al. 1980) and to a dryland cropping pattern that is not intensive in its demand for labor. For Kanzara the significant difference in income between labor and small-farm households is most likely conditioned by a more adequate resource endowment and access to productive technological opportunities that facilitate income generation from land. In drought-prone Kalman, lack of demand for agricultural labor coupled with a relative scarcity of off-farm employment opportunities may contribute to the income gap between landless agricultural labor and small-farmer households. The disparity in coverage across the six villages by public works programs and employment guarantee schemes could also contribute to income differences between landless labor and small-farm households. Other potential explanations are given in Ryan and Ghodake (1980).

The distinction between small- and medium-farm households is accompanied by significant household income differences in only two of the villages. For irrigated Dokur one would expect income to be more closely correlated with farm-size than for the five dryland villages. Small farmers as a group are also characterized by relatively low incomes in Dokur.

A paired comparison between large- and medium-sized farm households suggests much sharper income differences. Increasing farm-size translates into higher household income in four of the six villages. A low quality resource endowment and limited technical opportunities may explain why large farmers in Cholarpur district cannot effectively exploit land-based, income-generating opportunities.

The last comparison in Table 12 superficially documents the potential for conflict between landless labor and cultivator households in village India (Hayami, 1981). On average, cultivator households were significantly better off in five of the six villages.

The data in Table 11 and the analysis in Table 12 are somewhat misleading because family size and farm size are positively correlated.¹¹ The sharp differences in net household income across farm-size classes in Table 11 are dampened when per capita income estimates are compared in Table 13. All-village average per capita income estimates are surprisingly close for the first three farm-size classes. On a per capita basis, large-farm households retain an income superiority of about 185% over landless labor, small-farm and medium-farm households.

Composition of Income

Some patterns emerge in Table 14 when the composition of gross household income is tabulated by farm size class. Labor income not only contributed significantly to the welfare of the landless but also to small- and medium-farm households. The negative correlation coefficients suggest that labor activities contributed more heavily to gross household income for the poorer cultivator households within each farm size class. The average share of income derived from livestock production was about equal for the three cultivator size classes. Not surprisingly crop production was a more important source of income for the larger farm size classes. Asset rental and other sources, particularly transfer income, were more important for landless labor households. In general, the composition of income from rental, trade and handicraft, and other sources displayed fairly erratic behavior across farm size classes.

Returns to Farming

As the low income levels documented in Table 2 indicate, farming was not very profitable in these six SAT villages from 1975-76 to 1977-78. We use net returns to owned farm capital, owned land, and management as an efficiency measure of farm profitability. This measure is arrived at by deducting the imputed cost of family and owned bullock labor, valued at market wage and rental rates respectively, and net non-farm income from net household income.¹²

11. The average family size for landless labor and small-, medium-, and large-farm-size classes across villages and cropping years was 4.9, 5.8, 6.1, and 6.7, respectively. The correlation between family size and operated area for the 180 cultivator households in the sample in 1975-76 was .22 which is significant at the 1% level.

12. See Singh and Asokan (1981) for details.

Table 14. Composition (in %) of gross household income by farm size class and source in six SAT villages of India (1975-76 to 1977-78).

Source of income	Farm size class			
	Landless labor ^c	Small	Medium	Large
Crop	2.0 (-.03) ^d	30.3 (.07)	50.5 (.21)**	62.3 (.32)**
Livestock ^a	7.0 (.00)	13.0 (-.01)	12.7 (-.07)	15.2 (-.14)*
Rental	5.1 (.10)	1.8 (.08)	2.7 (-.06)	1.5 (-.14)*
Labor ^b	66.0 (-.04)	39.6 (-.20)**	26.1 (-.19)**	13.4 (-.42)**
Trade and handicrafts	9.9 (-.14)*	12.0 (.18)**	4.4 (-.08)	4.0 (.01)
Others	10.0 (.18)**	3.3 (-.02)	3.6 (.19)**	3.6 (.21)**

- a. Livestock income includes the value of owned bullock labor used on own farm as an indirect contribution to livestock income.
- b. Labor includes the value of family labor used for crop production and livestock maintenance as an indirect contribution to income from family labor.
- c. In the VLS, a household is defined as landless labor if its operated area in any cropping year is less than 0.2 hectares. Some landless labor households in Bokur receive income from small irrigated plots.
- d. Simple correlation coefficients between gross income share by source and net household income. * and ** denote statistical significance at the 10 and 5% levels, respectively.

Average net returns to capital, land, and management as a percent of real and imputed values were uniformly low throughout the six villages from 1975-76 to 1977-78 (Table 15). Average farm profitability varied from about 6.4% in rainfall-assured Kanzara, to about 1.1% in drought-prone Kalman. In general, large farm households had slightly higher average returns from farming.

On a whole-farm basis, economic losses were common in all villages except Kanzara (Table 16). On average, 62% of the farmers in Aurepalle registered losses during any one cropping year. Irrigation in Dokur did not make farming activities immune to economic losses. The proportion of farmers recording negative net returns to land, capital, and management did not vary appreciably from the estimate for drought-prone Sholapur district. Small farmers in Dokur would have fared better as landless laborers from 1975-76 to 1977-78.

ASPECTS OF LABOR INCOME

Family Composition in Labor Income

The role of women in their participation in the rural daily labor market has been highlighted by Ryan, Ghodake, and Sarin (1979) and Ryan and Ghodake (1980). Despite receiving wages that are significantly lower than what men receive, women contribute heavily to household income (Table 17). Nevertheless, the share of women's earnings in labor income varies considerably by village and by region. In Aurepalle and Dokur, women earn the bulk of household labor income but for contrasting reasons. In the irrigated paddy village of Dokur a strong demand for female labor, which leads to higher probabilities of employment and wages (compared to the other five villages), coupled with high female labor participation rates results in enhanced potential for women's income earning opportunities (Ryan and Ghodake, 1980). In Aurepalle, the relatively important position of women in household labor income is obtained by default--the labor market participation rates for males in Aurepalle are extremely low (Ryan and Ghodake, 1980).

Women are relatively less important as contributors to labor income in the drought prone villages of Sholapur district. Their probability of finding a job, daily wage rates, and market participation rates were lower in 1975-76 than for women in the more rainfall-assured district of Akola district (Ryan and Ghodake, 1980).

Form of Remuneration

The data in Table 18 suggest monetarized economies in five villages where cash is the prevailing form of wage payment. Once again Aurepalle is the exception as most wage payments are made in kind in sorghum or rice. The prevalence of in-kind payments in Aurepalle could be attributed to informal

Table 15. Net returns (in rupees) to owned farm capital, land and management by farm size class in six SAT villages of India (1975-76 to 1977-78).^a

Village	Farm-size class			All farm average
	Small	Medium	Large	
Aurepalle	-239 (-5.07) ^b	-272 (-2.48)	2394 (4.24)	631 (2.59)
Dokur	-550 (-6.68)	332 (2.07)	2626 (6.08)	834 (3.68)
Shirapur	461 (3.46)	1437 (5.72)	1572 (3.17)	1252 (4.39)
Kalman	708 (4.84)	219 (0.75)	-105 (-0.32)	284 (1.11)
Kanzara	657 (13.14)	397 (3.45)	4007 (6.38)	1715 (6.40)
Kinkheda	249 (4.44)	398 (2.81)	1389 (2.77)	691 (2.89)
All village average	214 (2.50)	419 (2.35)	1980 (4.14)	899 (3.56)

a. Simple averages of the three cropping years.

b. Figures in parentheses are average net returns in % of total farm capital (land + nonland assets).

Table 16. Proportion (in %) of households having negative net returns to farm capital, management, and land by farm-size class in six SAT villages of India (1975-76 to 1977-78).^a

Village	Farm-size class			
	Small	Medium	Large	All farm average
Aurepalle	74	69	43	62
Dokur	61	41	28	43
Shirapur	35	31	46	35
Kalman	26	61	57	48
Kanzara	14	26	7	15
Kinkheda	35	42	24	33
All village average	42	44	32	39

a. Estimates are calculated by counting the number of households with negative income for the three-year period and dividing by the total number of household cropping years.

Table 17. Family contribution to labor income (in rupees) in six SAT villages of India (1975-76 to 1977-78).

Village	Family member category			Total
	Male adults	Female adults	Children	
Aurepalle	58 (24) ^a	154 (63)	32 (13)	244
Dokur	235 (29)	563 (62)	15 (2)	813
Shirapur	507 (69)	184 (25)	48 (7)	739
Kalman	351 (68)	134 (26)	35 (7)	520
Kanzara	574 (61)	328 (35)	46 (5)	948
Kinkheda	355 (56)	257 (40)	25 (4)	637
All village average	346 (53)	279 (42)	34 (5)	659

a. Figures in parentheses are percentages to total labor income.

Table 18. Proportion (in %) of wages paid in cash and in kind in labor income in six SAT villages of India (1975-76 to 1977-78).

Village	Type of wage payment	
	Cash	Kind
Aurepalle	15	85
Dokur	82	18
Shirapur	95	5
Kalman	94	6
Kanzara	91	9
Kinkheda	84	16
All village average	84	16

lending arrangements where moneylenders make loans in kind to farmers who in turn use the same medium of exchange to pay labor. Liquidity constraints particularly during harvesting could also induce employers to pay workers in kind.

CONCLUSIONS

For many readers, this progress report will probably appear as a numerical rendering of the obvious: income levels in Semi-Arid Tropical India are low. The level of income in these six villages was pitifully low from 1975-76 to 1977-78. Average per capita income across villages was less than \$ 50 U.S. per annum in nominal prices. Only one of the 240 sampled households had a net income exceeding \$ 2500 U.S. during any one of the three cropping years. Absolute poverty was more pervasive in the villages where mean net household income was lower. Impoverishment is further reflected by the finding that absolute poverty was greatest in the three villages with lesser relative income inequality. Comparative evidence with other income studies weakly suggests greater relative income inequality and absolute poverty in the VLS households than in the rest of rural Andhra Pradesh. This finding does not appear to apply to VLS households in rural Maharashtra where estimates from the VLS data and NCAER surveys gave similar results.

Large-farm households had significantly higher per capita income than medium- and small-farm, and landless labor households. Surprisingly, the latter three farm-size classes had average net per capita incomes across villages and cropping years that were almost the same. Because larger farm-size was associated with larger family size, income differences between farm-size classes were much sharper for total net household income comparisons than per capita comparisons.

The across-village income comparisons partially confirm what other studies have suggested are powerful determinants of income in SAT India. The functioning of the agricultural labor market [Ryan, Ghodake, and Sarin, (1979); Binswanger et al. (1980)], the quality of resource base (Jodha 1980), and access to more productive cropping technologies appear to condition intervillage income differences.

Low income levels, especially for small and medium-sized farm households, magnify the potential for lack of access to credit to be a constraint to the adoption of improved technologies particularly those that are indivisible. The results, therefore, underscore the need for understanding the workings of rural financial markets in SAT India. They also reflect the consequences of underinvestment in dryland agriculture (Jodha, 1975).

These conclusions are vulnerable to the vagaries of the weather. Three years may be too brief a time horizon to draw reliable "average" inferences about the dimensions of village income in Semi-Arid Tropical India. It is certainly too short a period to detect secular trends in the size, composition, and distribution of income. A follow-up study in 1982 will analyze these and other aspects of income with deflated data for five cropping years from 1975-76 to 1979-80.

REFERENCES

- Ahluwalia, M.S. 1978. Rural poverty in India: 1956/57 to 1973/74. Pages 1-42 in India: Occasional Papers. World Bank Staff Working Paper 279, Washington, U.S.A.
- Bardhan, P.K. 1974. The pattern of income distribution in India: a review. Pages 103-138 in Poverty and income distribution in India. T.N. Srinivasan, and P.R. Bardhan (eds.). Calcutta, India: Statistical Publishing Society.
- Bhatty, I.Z. 1974. Inequality and poverty in rural India. Pages 291-336 in Poverty and income distribution in India. T.N. Srinivasan, and P.K. Bardhan (eds.). Calcutta, India: Statistical Publishing Society.

- Binswanger, H.P., and Jodha, N.S. 1978. Manual of instructions for economic investigators in ICRISAT's village level studies. Vol. II, ICRISAT Economics Program Village Level Studies Series, Patancheru, A.P., India.
- Binswanger, H.P., Doherty, V.C., Balaramaiah, T., Bhende, M.J., Kshirsagar, K.C., Bhaskar Rao, V., and Raju, P.C.S. 1980. Common features and contrasts in labor relations in the semi-arid tropics of India. ICRISAT Economics Program Progress Report 10, Patancheru, A.P., India.
- Dandekar, V.M., and Rath, N. 1971. Poverty in India: dimensions and trends (I). Economic and Political Weekly 6: 25-48.
- Clark, S., Hemming, E., and Ulrich, B. 1981. On indices for the measurement of poverty. The Economic Journal 91: 515-526.
- Directorate of Economics and Statistics. 1976. Studies in the economics of farm management in Ahmednagar district. Ministry of Agriculture and Irrigation, Government of India, New Delhi.
- Directorate of Economics and Statistics. 1979. Bulletin of Food Statistics. Ministry of Agriculture and Irrigation, Government of India, New Delhi.
- Elteto, O. and Friayes, E. 1968. New income inequality measures as efficient tools for causal analysis and planning. Econometrica 36: 383-396.
- Fields, G.S. 1980. Poverty, inequality, and development. Cambridge, England: Cambridge University Press.
- Gini, C. 1914. Sulla misera della concentrazione e della variabilita dei caratteri. Transactions of the Real Instituto Veneto di Scienze, Lettere ed Arti. Vol.53, Part 2.
- Hayami, Y. 1981. Agrarian problems of India: an east and southeast Asian perspective. Economic and Political Weekly 16: 707-712.
- Labor Bureau. 1978. Indian Labor Journal. Ministry of Labor, Government of India, Simla.
- Jodha, H.S. 1978. Effectiveness of farmers' adjustment to risk. Economic and Political Weekly 13(25): A38-A48.
- Jodha, H.S. 1980. Some dimensions of traditional farming systems in semi-arid tropical India. Pages 11-24 in Proceedings, International Workshop on Socioeconomic Constraints to Development of Semi-Arid Tropical Agriculture. ICRISAT, 19-23 February 1979, Hyderabad, India.

- Planning Commission, 1981. Sixth Five Year Plan 1980-85. New Delhi: Government of India.
- Reserve Bank of India. 1978. Reserve Bank of India Bulletin: Weekly statistical supplement. Reserve Bank of India, Bombay.
- Ryan, J.G., and Ghodake, R.D. 1980. Labor market behavior in rural villages of South India: effects of season, sex, and socioeconomic status. ICRISAT Economics Program Progress Report 15, Patancheru, A.P., India.
- Ryan, J.G., Ghodake, R.D., and Sarin, P. 1980. Labor use and labor markets in semi-arid tropical rural villages of peninsular India. Pages 357-379 in Proceedings, International Workshop on Socio-economic Constraints to Development of Semi-Arid Tropical Agriculture. ICRISAT, 19-23, February 1979, Hyderabad, India.
- Sen, A.K. 1973. Poverty, inequality, and unemployment: some conceptual issues in measurement. Economic and Political Weekly 8:1457-1464.
- Singh, R.P. and Asokan, M. 1981. Concepts and methods for estimating rural income in ICRISAT village level studies. ICRISAT Economics Program Progress Report 28, Patancheru, A.P., India.
- Siegel, S. 1956. Nonparametric statistics for the behavioral sciences. New York: McGraw-Hill Book Company.
- Srinivasan, T.H., and Bardhan, P.K. 1974. Poverty and income distribution in India. Calcutta, India: Statistical Publishing Society.
- Szal, R. and Robinson, S. 1974. The analysis and measurement of income inequality: static and dynamic approaches. (Unpublished paper.) The Brookings Institute, Washington, U.S.A.
- World Bank. 1978. World Bank development report. Washington, U.S.A.: The World Bank.