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Changes in Agrarian Structure and Agrarian Relations in States of India Since Independence

CHANGES IN AGRARIAN STRUCTURE AND PRODUCTIVITY: AN ENTROPY ANALYSIS IN INDIA

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Agrarian structure is dependent upon the structures of land use and cropping, the patterns of tenurial relationships, size class distributions of operational holdings and lastly upon non-agrarian structure. Variation in any one of these constituent structures thus causes variation in the agrarian structure, thereby resulting in variation in agricultural productivity. We shall examine the changes in the size class distribution of operational holdings and tenurial relationships together with their impacts on agricultural productivity in India during the period 1970-71-1976-77. To maintain consistency of data we have depended upon Agricultural Census in different States of India for two years 1970-71 and 1976-77. Section I deals with the size class distribution of operational holdings, section II with the entropy analysis of concentration of holdings and section III with the impacts of agrarian structure on agricultural productivity. The last section presents the conclusion.

I

SIZE CLASS DISTRIBUTION

The average size of operational holdings is factorised into the number of holdings and area operated. Its change over time is thus dependent upon relative changes in the number and area of holdings. Table I shows that the average size has varied widely across States and over time. During the period under study all the States except Tripura have witnessed significant upward variation in the number of holdings. The percentage rise in the number of holdings ranges from 7 in Karnataka to 25 in West Bengal. But States are, however, not very few where there have occurred downward variations in the operational areas. Andhra Pradesh, Assam, Gujarat, Haryana, Kerala, Madhya Pradesh, Tripura and West Bengal have recorded increase in areas while all other States have witnessed decrease. Interestingly, in all the States except Tripura, the percentage rise in the number of total holdings has exceeded that in total area and as a result, the average size of holdings has declined. Across States the average size ranges from 0.57 hectare in Kerala to 5.45 hectares in Rajasthan in 1970-71. And after a lapse of only six years the two limits have changed to 0.49 hectare and 4.65 hectares respectively without in fact affecting the relative position of Kerala and Rajasthan.

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TABLE I—AVERAGE SIZE OF OPERATIONAL HOLDINGS AND PERCENTAGE VARIATION IN THE NUMBER AND AREA OF OPERATIONAL HOLDINGS IN 14 STATES OF INDIA DURING 1970-71-1976-77

Sr. No.	State	Average size (hectare)		Percentage variation in											
		1970-71	1976-77	Marginal		Small		Semi-medium		Medium		Large		All groups	
				No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
1.	Andhra Pradesh ..	2·51	2·21	15	23	8	20	13	14	8	11	— 8	—14	13	6
2.	Assam	1·46	1·36	20	16	9	8	7	6	3	0·6	3	— 4	15	6
3.	Gujarat	4·11	3·71	13	11	11	—10	17	18	11	10	—16	—20	11	0·7
4.	Haryana	3·77	3·58	23	16	8	8	2	2	5	4	— 3	2	9	4
5.	Karnataka	3·20	2·98	17	16	6	8	4	3	2	2	—10	— 9	7	— 0·1
6.	Kerala	0·57	0·49	28	30	4	9	—12	— 5	38	31	—38	—21	24	7
7.	Madhya Pradesh ..	4·00	3·58	19	20	25	22	21	17	10	6	— 6	—11	14	2
8.	Maharashtra ..	4·28	3·66	4	22	30	29	23	22	10	8	—17	—22	16	— 0·4
9.	Orissa	1·89	1·60	13	10	— 7	—14	32	17	—24	—27	—25	—34	5	—11
10.	Rajasthan	5·46	4·65	40	27	16	16	8	20	9	9	— 3	—35	17	— 0·2
11.	Tamil Nadu ..	1·45	1·26	20	16	— 2	— 3	— 5	— 4	—10	—10	—20	—24	10	— 4
12.	Tripura	1·01	1·25	—17	— 2	28	34	47	52	25	62	18	14	— 1	22
13.	Uttar Pradesh ..	1·16	1·05	14	11	3	2	2	— 2	— 3	— 5	—22	—22	8	— 2
14.	West Bengal ..	1·20	0·99	38	30	15	15	— 1	— 3	—27	—29	—47	—11	25	3

In all the States except Tripura, marginal holdings have gone up in both number and area while large holdings have showed just the opposite trend. The largest percentage increase in the number of marginal holdings is noticed in Rajasthan (40 per cent) followed by West Bengal (38 per cent) and Kerala (28 per cent), while that in area is recorded in West Bengal (30 per cent) followed by Kerala (30 per cent) and Rajasthan (27 per cent). As to the large holdings, West Bengal has registered the largest percentage decline in number (—47 per cent), being followed by Kerala (—38 per cent) and Orissa (—25 per cent), while the largest percentage decline in area is noticed in Rajasthan (—35 per cent), followed by Orissa (—34 per cent), Uttar Pradesh (—22 per cent) and Maharashtra (—22 per cent). Small, semi-medium and medium holdings have increased in most of the States. But Tamil Nadu sets an example in showing downward variations in these holdings.

The case of Tripura is of particular interest to us. It is the only State which has recorded a slight decline (—1 per cent) in the number of holdings and a spectacular rise (28 per cent, being the largest) in area operated and consequently witnessed a rise in the average size (from 1.01 in 1970-71 to 1.25 hectare in 1976-77). It is the only State where marginal holdings have declined in both number and area (—10 per cent and —2 per cent respectively) in favour of expansion of all other types of holdings in both area and number and, therefore, presented contrasting trends. Without conducting elaborate studies it is very difficult to ascertain the causes of these contrasting trends in Tripura. These may seem to be explained not by the mere non-economic factors like vigorous implementation of land reform measures, natural inheritance, etc., but by the fact that production efficiency measured in terms of output-input ratio (in value terms) is lowest for the size class of marginal holdings and, therefore, marginal holdings have been transferred to other classes for relatively more remunerative harvesting.[1] This could be indictive of a land amalgamation trend in Tripura.

II

CONCENTRATION OF HOLDINGS

We shall now look into the summary statistics of structural changes. Most popular and frequently used such statistic is Lorenz ratio. Lorenz ratio of areas operated by holdings provides information regarding relative concentration of operational area, but it fails to identify the parts of the distribution to which concentration is mainly due.[2] That is to say, a distribution may change over time in alternative ways and Lorenz ratio can at best indicate changes in concentration; it cannot reveal the actual process in which concentration has changed. This is because of the fact that Lorenz ratio is not

1. R. K. Lahiri: Family Farming in a Developing Economy: A Study Based on Farm Management Survey of Tripura, Ph. D. Thesis, Kalyani University, Kalyani, 1975.
2. V, S. Vyas, "Some Aspects of Structural Change in Indian Agriculture", *Indian Journal of Agricultural Economics*, Vol. XXXIV, No. 1, January-March 1979.

additively decomposable into groups.[3] Furthermore, concentration coefficient is extremely sensitive to grouping of observations. Fewer the number of size class, the larger the degree of concentration and vice versa. Therefore, concentration coefficient (defined in whatever way) obtained from a fewer number of size class is subject to a higher degree of approximation error compared to that which could have been obtained with larger number of of size class.[4] Estimation of such approximation error (called grouping error) necessitates decomposition of total concentration coefficient into between-groups coefficient and within-group coefficients. Lorenz ratio is not additively separable and, therefore, its grouping error cannot be estimated. Lorenz curve may give some idea of the parts of distribution to which concentration is mainly due. But things get really bad when Lorenz curves intersect one another: here we cannot rank the distributions. This is a serious defect of Lorenz ratio analysis.[5] Vyas[6] has suggested a new measure called 'inter-median lines'. But this is not representative as it is not based on all observations of the distribution.

We have used Theil's Entropy[7] measure of concentration. Entropy is based on all observations, additively separable into groups and it satisfies all the desiderata of a good measure.[8]

Let X be a non-negative variable having n values. Then entropy of X, denoted by E(x), is defined as $E(x) = \sum_{1}^{n} x_i \log (1/x_i)$, $x_i = X_i / \sum_{1}^{n} X_i$. Obviously, max. $E(x) = \log n$ when $x_i = 1/n$ for all i and min. $E(x) = 0$ when $x_i = 1$ and $x_j = 0$, for all j, $j = i$. The closer the value of E(x) to 0, the larger the degree of concentration and vice versa. E(x) is thus an index of equality: concentration is inversely related with E(x). Theil has taken $I(x) = \log n - E(x)$ as the index of concentration: here concentration is directly related with I(x).

In the case of our size class distribution of holdings E(x) serves better. The small value of E(x) will be interpreted as the case of concentration of holdings in a few size classes. And if such concentration is found in the bottom size classes it would imply more equitable distribution of holdings among the holders. That is to say, E(x) would entail the degree of concentration of holdings among the size classes. The more E(x), the less the degree of size class concentration.

We have computed E(x) corresponding to the size class distributions of operational holdings as well as operated areas for 14 selected States in India for two years, 1970-71 and 1976-77. To examine inter-district variations we have estimated entropies for different districts in West Bengal. We have at first taken 12 size classes and computed E(x). Then we have grouped these classes into five broad size classes, namely, marginal (below 1.0 ha.), small

3. F. Bourguignon, "Decomposable Income Inequality Measures", *Econometrica*, Vol. 47, 1979.
4. S. K. Sanyal, "Changes in the Structural Distribution of Land Ownership and Use: A Few Comments", *Indian Journal of Agricultural Economics*, January-March 1979.
5. A. B. Atkinson: The Economics of Inequality, Clarendon Press, London, 1975.
6. Vyas, *op. cit.*
7. H. Theil: Economics and Information Theory, North-Holland Publishing Co., Amsterdam, 1967.
8. Bourguignon, *op. cit.*

(1.0-2.0 ha.), semi-medium (2.0-4.0 ha.), medium (4.0-10.0 ha.) and large (10.0 ha. and above) and examined the sensitivity of E(x) to grouping. That is to say, we have decomposed[9] the total entropy E(x) into between-group entropy $H_b(x)$ and within-group entropies $H_w(x)$. $H_w(x)$ is here the grouping error which would provide valuable guide to the policy makers in assessing the changes in the concentration of holdings. Estimated are also Lorenz ratios just for the sake of comparison. Estimates are presented in Tables II and III.

Total entropy (based on 12 size classes) of operational areas in all the States (excepting Maharashtra) as well as in all the constituent districts of West Bengal is found to be larger than that of the number of operational holdings. This shows that area concentration among the size classes is relatively smaller than holdings concentration. In most of the States, small size-group (including marginal class) has contained greater percentage of holdings than that of areas. In West Bengal, for instance, small group (including marginal one) contains more than 82 per cent of total holdings covering about 47 per cent of total operational areas in 1970-71.

Over time concentration has changed. Area and holdings entropies in most of the States (and also in all districts of West Bengal) have declined, meaning that size class concentration of holdings and areas has increased resulting in more even distribution of areas among the holders. This is also supported by Lorenz ratio.[10] Between-class entropy of areas in most of the States has gone up at the cost of within-class entropy, implying that within broad classes concentration has tended to decline.

III

PRODUCTIVITY AND AGRARIAN STRUCTURE

To examine the impact of agrarian structure on agricultural productivity we have fitted yield (in kg./ha.) regressions in West Bengal with respect to six major crops: rice, wheat, jute, rape and mustard, all foodgrains and sugarcane (Table IV). We have used cross-district data of West Bengal. Explanatory variables are the proportion of irrigated to total land under the crop (X_1), entropy index of size class equality (X_2), the proportion of wholly leased-in to total land (X_3), the proportion of partly leased-in land (X_4), the number of parcels (X_5), the average size of holdings (X_6) and the average size of parcels (X_7). We do not have statistically significant regressions for rape-mustard and sugarcane. For all other crops regressions are statistically significant. The average size of holdings has statistically significant positive relationship with yield while negative relationship is found in the case of the average size of parcels. The number of parcels has no significant impact on yield (except jute). Irrigation ratio has significant positive impact on all crops except wheat. This shows that irrigation as such is not important: the

9. We have used Theil's equation (1·8). See Theil: *op cit.*, p. 93.
10. Lorenz curves in some cases (*e.g.*, Hooghly in West Bengal) have intersected.

TABLE II—LORENZ RATIO AND ENTROPY OF THE NUMBER OF OPERATIONAL HOLDINGS AND AREA OPERATED IN 14 STATES OF INDIA

Sr. No.	State	Lorenz ratio		Entropy of number of holdings						Entropy of operated areas					
				Total		Between-class		Within-class		Total		Between-class		Within-class	
		1970-71	1976-77	1970-71	1976-77	1970-71	1976-77	1970-71	1976-77	1970-71	1976-77	1970-71	1976-77	1970-71	1976-77
1.	Andhra Pradesh ..	0·62	0·59	1·91	1·90	1·38	1·36	0·54	0·54	2.15	2·18	1·49	1·52	0·66	0·66
2.	Assam	0·55	0·56	1·62	1·58	1·10	1·06	0·54	0·51	2·10	2·11	1·56	1·58	0·54	0·52
3.	Gujarat	0·50	0·51	2·08	2·05	1·56	1·54	0·51	0·51	1·97	2·10	1·35	1·35	0·62	0·75
4.	Haryana	0·54	0·56	1·86	2·06	1·55	1·53	0·31	0·53	2·01	2·36	1·34	1·45	0·66	0·91
5.	Karnataka	0·56	0·56	2·03	2·00	1·51	1·49	0·51	0·52	2·10	2·10	1·43	1·46	0·67	0·64
6.	Kerala	0·63	0·61	0·95	0·83	0·56	0·48	0·39	0·35	2·07	2·02	1·51	1·47	0·56	0·56
7.	Madhya Pradesh ..	0·59	0·58	2·10	2·07	1·54	1·52	0·56	0·54	2·09	2·09	1·30	1·35	0·79	0·73
8.	Maharashtra ..	0·55	0·53	2·10	2·06	1·57	1·54	0·53	0·51	1·99	1·94	1·28	1·35	0·71	0·59
9.	Orissa	0·51	0·48	1·71	1·71	1·27	1·24	0·43	0·47	2·07	2·03	1·55	1·54	0·52	0·48
10.	Rajasthan	0·63	0·63	2·19	2·14	1·59	1·56	0·60	0·58	2·19	2·19	1·14	1·21	1·06	0·98
11.	Tamil Nadu ..	0·57	0·57	1·64	1·55	1·13	1·03	0·50	0·52	2·15	2·14	1·58	1·57	0·57	0·57
12.	Tripura	0·54	0·49	1·41	1·57	0·89	1·05	0·52	0·51	2·05	2·00	1·53	1·60	0·51	0·44
13.	Uttar Pradesh ..	0·59	0·58	1·50	1·44	0·99	0·94	0·51	0·50	2·13	2·09	1·56	1·55	0·57	0·54
14.	West Bengal ..	0·51	0·51	1·56	1·43	1·05	0·93	0·51	0·50	1·98	1·92	1·50	1·46	0·48	0·45

TABLE III—LORENZ RATIO AND ENTROPY OF THE NUMBER OF OPERATIONAL HOLDINGS AND AREA OPERATED IN WEST BENGAL

Sr. No.	District	Lornez ratio		Entroy of number of holdings						Entropy of operated areas					
				Total		Between-class		Within-class		Total		Between class		Within-class	
		1970-71	1976-77	1970-71	1976-77	1970-71	1976-77	1970-71	1976-77	1970-71	1976-77	1970-71	1976-77	1970-71	1976-77
1.	Darjeeling	0·66	0·69	1·82	1·71	1·33	1·23	0·49	0·48	1·80	1·79	1·44	1·45	0·36	0·33
2.	Jalpaiguri ..	0·60	0·63	1·64	1·59	1·24	1·12	0·40	0·47	1·75	1·79	1·28	1·51	0·47	0·27
3.	Cooch-Behar ..	0·44	0·43	1·65	1·53	1·06	1·04	0·60	0·49	1·77	1·76	1·35	1·35	0·42	0·41
4.	West Dinajpur ..	0·47	0·47	1·77	1·62	1·28	1·13	0·49	0·49	1·90	1·86	1·39	1·37	0·51	0·48
5.	Malda	0·52	0·53	1·60	1·39	1·09	0·87	0·51	0·52	1·92	1·87	1·42	1·39	0·50	0·48
6.	Murshidabad ..	0·50	0·49	1·50	1·39	0·99	0·90	0·50	0·49	1·88	1·59	1·39	1·35	0·49	0·24
7.	Nadia	0·48	0·48	1·64	1·48	1·14	0·97	0·50	0·51	1·89	1·84	1·40	1·38	0·49	0·45
8.	24-Parganas ..	0·51	0·49	1·42	1·27	0·91	0·78	0·51	0·51	1·87	1·77	1·39	1·32	0·48	0·46
9.	Howrah	0·46	0·45	0·96	0·89	0·47	0·44	0·48	0·45	1·59	1·51	1·10	1·03	0·49	0·49
10.	Hooghly	0·49	0·47	1·39	1·26	0·89	0·77	0·50	0·49	1·81	1·68	1·35	1·25	0·46	0·43
11.	Burdwan	0·48	0·46	1·67	1·57	1·17	1·09	0·50	0·47	1·89	1·81	1·39	1·38	0·50	0·44
12.	Birbhum	0·49	0·47	1·71	1·58	1·21	1·11	0·50	0·47	1·93	1·83	1·42	1·37	0·51	0·45
13.	Bankura	0·46	0·46	1·65	1·50	1·17	1·01	0·48	0·49	1·88	1·77	1·40	1·36	0·47	0·42
14.	Purulia	0·47	0·47	1·61	1·52	1·12	1·01	0·49	0·50	1·93	1·83	1·47	1·39	0·46	0·44
15.	Midnapore.. ..	0·48	0·49	1·46	1·30	0·94	0·67	0·52	0·63	1·84	1·80	1·39	1·33	0·45	0·46
16.	West Bengal ..	0·51	0·51	1·56	1·43	1·05	0·93	0·51	0·50	1·98	1·91	1·50	1·46	0·48	0·45

TABLE IV—YIELD REGRESSIONS IN WEST BENGAL

Crop	Year	Functional form	Constant	Regression coefficient for							R^2	F
				X_1	X_2	X_3	X_4	X_5	X_6	X_7		
Rice	1970-71	Linear	2194·7	477·7‡ (1·42)	—770.9 (—1·03)	—795·5 (—0·24)	—102·5 (—0·11)	38·6 (0·73)	157·9 (0·41)	—184·2 (—0·19)	0·79	3·68 (7,7)
		Log-log	7·54	0·03 (0·61)	—1·28‡ (—1·42)	—0·05 (—1·14)	0·34 (0·95)	—0·57 (—0·73)	1·03‡ (1·50)	—0·75 (—1·09)	0·79	3·81† (7,7)
	1976-77	Linear	1128·3	586·3$ (2·58)	70·5 (0·27)	9396·4‡ (1·53)	475·2 (0·63)	—48·3 (—0·83)	453·9† (1·92)	—3318·2 (—0·19)	0·87	7·02* (7,7)
		Log-log	7·22	0·08* (7·34)	—0·04 (—0·13)	0·05* (3·32)	0·33† (2·80)	—0·14 (—1·40)	0·37* (4·06)	—0·48* (—3·67)	0·97	33·25* (7,7)
Jute	1970-71	Log-log	8·21	—0·01 (—0·11)	—2·71† (—2·24)	—0·08† (—2·06)	0·59 (0·97)	0·04‡ (1·83)	0·43† (1·91)	—0·27 (—1·33)	0·83	4·78† (7,7)
Wheat ..	1970-71	Linear	—2595·6	—303·9 (—0·50)	2523·2 (1·36)	—10669·0‡ (1·49)	1259·3 (0·78)	—44·9 (—0·35)	501·2 (0·61)	—2590·9 (—1·28)	0·85	5·52† (7,7)
		Log-log	4·23	0·01 (0·44)	5·36* (4·15)	0·03 (0·60)	—0·07 (—0·16)	—0·70 (—0·68)	0·27 (0·28)	—0·88 (—0·97)	0·90	8·85* (7,7)
Foodgrains ..	1970-71	Linear	2335·9	763·4* (2·17)	—816·4 (—1·38)	—660·4 (—0·25)	—90·1 (—0·12)	16·9 (0·39)	223·8 (0·73)	—479·6 (—0·63)	0·87	6·66† (7,7)
		Log-log	7·43	0·01 (0·33)	—1·40‡ (—1·75)	—0·05‡ (—1·41)	0·40 (1·29)	—0·67 (—0·96)	1·20† (1·97)	—0·92‡ (—1·52)	0·85	5·71† (7,7)
	1976-77	Log-log	7·29	—	—0·79 (—1·15)	0·03 (1·02)	0·51‡ (1·88)	0·05 (0·22)	0·46† (2·09)	—0·44 (—1·40)	0·73	3·64† (6,7)

* Significant at 1 per cent level.
$ Significant at 2·5 per cent level.
‡ Significant at 10 per cent level.
† Significant at 5 per cent level.
Figures in brackets under the coefficients and F are t-values and d.f. respectively.

manner and types of irrigation are important. Size class equality has significant positive impact in the case of wheat, and negative impact in the case of rice, jute and all foodgrains. Surprisingly, leased-in land (both wholly and partly) has significant positive impact in the case of rice and foodgrains, and significant negative impact in the case of wheat and jute.

IV

CONCLUSION

The average holding size has declined in India (save Tripura). Yield regression establishes significant positive impact of average size, irrigation ratio, size class equality of holdings and leased-in land on the one hand, and significant negative impact of parcellisation of operational holdings on the other.

ECONOMICS OF RENTING AGRICULTURAL LAND IN HARYANA

K. N. Rai, Shri Niwas and Virender Gautam*

Leasing of land is becoming uncommon with the increase in its productivity, population and tenancy legislations. However, the system is still in practice in certain places for various reasons. To some extent, this system of earning can never be eliminated as land belonging to the disabled persons, widows, service people, etc., have to be rented out. Similarly, with the increasing use of mechanical power in farming, renting-in land is found to be economically viable on account of the indivisibilities of certain mechanical resources like tubewell and tractor power, etc. However, this would result in the extension of tenancy system and all the consequent evils of absentee landlordism. Hence, there is need for a constant review of the relative efficiency of tenancy system vis-a-vis ownership cultivation. Further, the study of renting system has some methodological importance for estimating the rental value of land.

METHODOLOGY

For the present study 15 tehsils of Haryana State were selected randomly, and from each tehsil a cluster of three villages was selected. For selecting a cluster, firstly one village was selected randomly followed by two adjoining villages of the selected village. Further, the clusters selected were divided into three groups, *viz.*, clusters having canal irrigation facilities, clusters having tubewell irrigation facilities and clusters having no source of irrigation. From each cluster ten farmers were selected randomly. The selected farmers were

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