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IMPACT OF TECHNOLOGICAL DEVELOPMENTS ON  
THE PATTERN OF INCOME DISTRIBUTION:  
A CASE STUDY OF LUDHIANA DISTRICT

A. C. SHARMA  
*Farm Economist*

PARKASH MEHTA  
*Research Assistant*

AND  
J. N. SINGH  
*Assistant Farm Economist*

*Department of Economics and Sociology  
Punjab Agricultural University, Ludhiana*

The recent adoption of improved technology, particularly the high-yielding crop varieties, increased use of such non-conventional inputs as fertilizers, pesticides, irrigation and mechanization have increased the income of the Punjab farmers substantially. There is, however, a controversy over the extent of the increase in income on various categories of farm organizations. Some studies<sup>1</sup> have brought out that the large farmers have benefited more than the small ones while certain others<sup>2</sup> have pointed out that in terms of income growth rate, the small farmers have done better than those of the large ones.

This study is an attempt to examine the distribution of the farm family income in relation to farm size and the degree of mechanization in Ludhiana district.

*Technology*

Ludhiana district is one of those districts of the Punjab State where farm technology has been extensively adopted by the farmers. This district was, therefore, purposively selected for this analysis. Multi-stage stratified random sampling technique was used for selecting the study sample. The villages formed the primary and operational holdings the ultimate units of study.

Six villages from Ludhiana district were randomly selected with probability proportional to the cultivated area and without replacement for this inquiry. The operational area of the selected villages was pooled and trans-

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1. Francine R. Frankel: *India's Green Revolution: Economic Gains and Political Costs*, Princeton University Press, Princeton, New Jersey, U.S.A., and Oxford University Press, Bombay, 1971.

2. D. K. Sohoni and R. D. Khandarkar, "Pattern of Income Distribution, Savings, and Expenditure in Rural Areas," (Summary), *Indian Journal of Agricultural Economics*, Vol. XXV, No. 3, July-September, 1970, p. 133.

formed to show the distribution of area in small, medium and large holding size-groups. The holdings in the study zone were stratified into these size-groups and 10 per cent of them was randomly selected from each stratum for this investigation. This provided a sample size of 38 small, 11 medium and 7 large operational holdings with a total of 56 holdings for this study.

The log-normality of existing farm family income distribution per holding and per acre was studied by further sub-classifying the sample farms as non-tractorised and tractorised<sup>3</sup> and fitting the probit functions of the following type for each category of farm organization:

$$Y = a + b \log X.$$

where  $Y$  = probit and  $X$  = farm family income.

The degree of income concentration on the non-tractorised and tractorised holdings was studied by calculating the Gini ratios as below:

$$\text{Gini ratio} = 1 - 2L = 2A$$

$$\text{where, } L = 1 - \sum_{j=1}^K P_j (Q_j + Q_{j-1});$$

$$Q_j = \frac{\sum_{i=1}^j P_i Y_i}{\sum_{i=1}^K P_i Y_i}$$

$$P_j = \sum_{i=1}^j P_i$$

(where  $P_i$  is the estimated proportion of population in the  $i$ -th size class).

$2A$  = twice the area of the concentration.

### *Results and Discussion*

The farm family income during a year was defined as the gross income obtained by aggregating the value of the crops raised, value of the livestock products produced, value of the sale of farm assets, wages received for work on other farms, rent of land received, and non-farm income from such sources as service, sale of non-agricultural assets, non-agricultural labour, gifts received and borrowings from institutional and non-institutional agencies. The level of this income depends, among others, upon the size of holding, produc-

3. Non-tractorised farms were those where field operations were carried on by bullock power and stationary jobs by a diesel engine/electric motor. The tractorised farms were those where bullock power had been replaced by tractors.

tion pattern and level of technology obtained. The distribution of farm income per holding and per acre on the small, medium and large non-tractorised and tractorised holdings is presented in Appendix 1.

The log-normality of farm family income distribution per holding and per acre was tested by fitting the probit functions. The results are shown in Table I.

TABLE I—PROBIT REGRESSION EQUATIONS FOR DIFFERENT CATEGORIES OF FARM ORGANIZATIONS, STUDY AREA: 1971-72

A. Farm family income per holding			Value of $R^2$
(i) Non-tractorised holdings			
Small	$Y = -4.92 + 2.15 \log X$		0.96*
Medium	$Y = -7.06 + 4.82 \log X$		0.94*
Large	$Y = -9.96 + 4.99 \log X$		0.98*
(ii) Tractorised holdings			
Medium	$Y = -8.45 + 3.19 \log X$		0.87*
Large	$Y = -13.27 + 5.42 \log X$		0.92*
B. Farm family income per acre			
(i) Non-tractorised holdings			
Small	$Y = -4.11 + 2.84 \log X$		0.99*
Medium	$Y = -6.69 + 3.25 \log X$		0.95*
Large	$Y = -10.68 + 5.22 \log X$		0.99*
(ii) Tractorised holdings			
Medium	$Y = -8.14 + 3.87 \log X$		0.89*
Large	$Y = -11.32 + 6.15 \log X$		0.91*

\* Significant at 5 per cent level of significance.

It will be observed from Table I that there was a linear relationship between the probits and  $\log X$ . This indicated that there existed log-normality of income distribution on various sized non-tractorised and tractorised holdings. The value of probit coefficients worked out to 86.92, 54.52 and 46.44 per cent for the small, medium and large non-tractorised and 52.04 and 41.16 per cent for the medium and large tractorised holdings respectively.

The degree of income concentration on the non-tractorised and tractorised holdings was examined by calculating the Gini ratios. These ratios came out to 0.41 and 0.11 for these holdings respectively, indicating that the farm family income was more evenly distributed on the latter category of farm organizations.

The relationship between the farm family income, farm size and the degree of mechanization is depicted in the Lorenz curve in Figure 1.

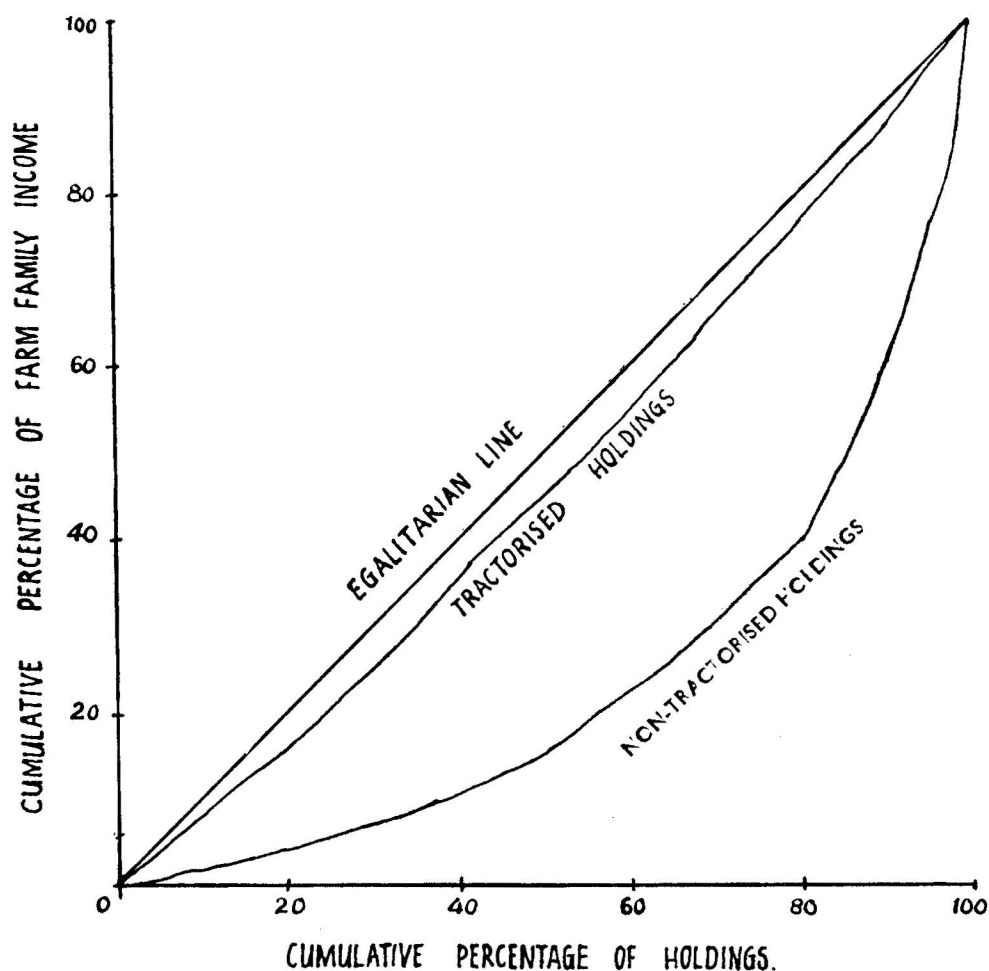


Figure 1—Relationship between the Farm Family Income, Farm Size and Degree of Mechanization.

### *Conclusions*

This study brought out that the farm family income per holding and per acre had log-normal distribution on the small, medium and large non-tractorised and tractorised holdings, and that this income was more evenly distributed on the tractorised holdings.

## APPENDIX 1

## DISTRIBUTION OF FARM FAMILY INCOME IN RELATION TO FARM SIZE AND DEGREE OF MECHANIZATION, STUDY AREA : 1971-72

(Rupees)

Item					Small	Medium	Large
<b>A. Non-tractorised farms</b>							
1. Farm income							
Per holding	..	..	..	..	10,107.14	17,151.09	40,822.17
Per acre	..	..	..	..	1,617.14	1,037.57	1,409.61
2. Non-farm income							
Per holding	..	..	..	..	2,670.43	4,308.36	11,603.91
Per acre	..	..	..	..	427.27	260.64	594.50
3. Gross farm family income							
Per holding	..	..	..	..	12,777.57	21,459.45	51,171.44
Per acre	..	..	..	..	2,041.21	1,298.21	1,766.97
<b>B. Tractorised farms*</b>							
1. Farm income							
Per holding	..	..	..	..	—	22,018.00	46,091.00
Per acre	..	..	..	..	—	1,332.00	1,591.54
2. Non-farm income							
Per holding	..	..	..	..	—	4,604.67	17,392.60
Per acre	..	..	..	..	—	278.56	600.57
3. Gross farm family income							
Per holding	..	..	..	..	—	26,622.67	63,483.60
Per acre	..	..	..	..	—	1,610.56	2,192.11

\* There were no small tractorised holdings in the study sample.