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Investment Pattern and Income Distribution among Farm Families in Punjab

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Abstract

Farm mechanization plays vital role in enhancing farmers' productivity and profitability in Punjab. This study is an attempt to analyse the distribution of farm inventory, investment and income pattern, capital output ratio and factors affecting capital output ratio. The results shows that medium and large farmers have more farm inventory (tractor, electric motor, diesel engine and livestock) as compared to small farmers. About 50percent investment of large farmers is on machinery while marginal invested only 14 per cent. Large farmers earn majority (81%) of their income from crops while, marginal farmers earn 45 per cent from crops, 28 per cent from off-farm and 22 per cent from dairy enterprise. The value of capital output ratio for large farmers is less than other farm categories which indicates that their capital requirement to produce one unit of output is less. The results also show that capital output ratio has negative relationship with adult cattle unit per cent leased-in land and operational holdings. There is a need to encourage the farmers' organizations, custom hiring centres and cooperatives to provides the machinery to marginal and small farmers at the affordable price.

Key words: Investment pattern, Income distribution, Capital output ratio, Farm families, Punjab

JEL Classification: Q12, Q15, C21

Introduction

In the post-green revolution era, Indian agriculture has witnessed significant changes. The country's agrarian economy was altered by the introduction and dissemination of modern technologies, as well as positive government initiatives. Modern agricultural technology, which includes high-yielding cultivars, fertilizers and mechanized equipment has resulted in huge increase in agricultural output, employment, and income. The mechanization of farms ensures the timeliness of agricultural operations, increases labour work output per unit time and improves land productivity and farm operations quality (Raina *et al*, 2021). The agricultural technical breakthrough has expedited the change of India's farm sector from subsistence to commercial farming. As a result, farmers are encouraged to save and invest in order to develop their business and increase their earnings. However, it has exacerbated the divide among large-scale and small-scale growers (Wilson, 2002).

Aside from bringing affluence and improved working conditions, the introduction of modern technology in agriculture has varied effects on income, investment, expenditure, and savings on various types and sizes of farms, resulting in financial imbalances. It is argued that the benefits of agricultural development are not distributed evenly across different areas and farm size groups. Also, the gains from the development of agriculture are not equitable across farm size categories. Many studies provided evidence that small farms are more efficient as compared to large farms due to the inverse relationship between farm size and productivity (Sen, 1962; Rao, 1966; Saini, 1971; Barrett, 1996; Chand *et al,* 2011). Some researchers concluded that the financial gains of agricultural modernization have been highly unequally distributed, favouring large farmers over small farmers (Frankel 1971; Cleaver 1972; Griffin 1974; Grabowski 1979). However, in agriculturally advanced states like Punjab, this inverse relationship is not significant due to the capital-intensive usage of land by medium and large farmers (Das, 2021). Large farmers have easy access to new agricultural technologies, such as chemical fertilisers and High Yielding Variety seeds (HYVs), which allows them to increase their farm production. They can afford to invest more in their farms and convert traditional farming techniques into capital-intensive scientific farming techniques (Singh and Toor, 2005).

Farming as a business enterprise requires constant inflow of investment. Previous studies have shown that investing in agriculture leads to an increase in farm production and

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productivity, which has been dubbed the "green revolution" in India. Punjab, the forerunner of the "green revolution" was instrumental in securing much-needed food security and transforming India into a net exporter of food crops. Since the introduction of the green revolution, Punjab's agriculture has changed significantly (Satish, 2006). In comparison to the national average, the state's land distribution is significantly better, and almost all the state's agricultural land is irrigated (Babu *et al*, 2019). The state's rural economy has been significantly strengthened because of the agricultural sector's growth (Jain and Subramanian, 1999), and this has impacted the thought, perspective, culture, and economic life of the people living in Punjab. In the mid-1960s, farm investments were primarily focused on new high-yielding varieties, insect and pest management measures, water and soil management practices, irrigation infrastructure installation, and farm machinery acquisition, but the state's declining groundwater has forced farmers to increase their farm investments significantly. Furthermore, in Punjab, the paddy-wheat crop rotation monoculture has driven farmers into a serious economic and environmental crisis. Also, the farmers' profit margins have been squeezed due to stagnant agricultural productivity and continually rising production costs (Singh and Sidhu, 2006).

To address above issues, the government is encouraging diversification and the adoption of auxiliary occupations, both of which necessitate additional investments in machinery and technology. As a result, it is critical to keep a vigilant and analytical check on the farmers' investment patterns and income distribution. In addition, the economic situations of farmers must be analysed to develop appropriate policy measures to assist farmers in generating employment opportunities and improving their income levels. With all of this in mind, the purpose of this study is to investigate the investment pattern, income inequality, capital output ratio and factor affecting capital output ratio in the study area.

Data Sources and Methodology

The study has been carried out in the state of Punjab, which lies between 29°33' – 32°3'N and 73°53' – 76°55'E in Northern India (Figure 1). The state of Punjab has 22 districts, 150 blocks and 12581 villages (ESOPB, 2020). Multi-stage random sampling procedure has been used to select sample households. Eight districts were randomly selected in the first stage, one developmental block from each selected district in the second stage and one village from each selected block in the third stage of sampling, respectively. Finally, in the last stage, a sample of 20 farmers from each village was selected. Thus, in total the study comprises a sample size of 160 farmers. Primary data was collected from the farmers pertaining to socio-economic and farm specific characteristics, number of tractors, electric motors and diesel engine, value of farm buildings, livestock value and income from different sources during 2019-20 using a pre-tested well-designed survey schedule. We used descriptive statistics to examine the magnitude of different variables. Gini coefficient was estimated using decile method to find the income disparity among farm families. Further, multiple linear regression model has been used to analyse the relationship between socio-economic characteristics and capital output ratio in the study area.

$$Y=b_0+b_1 X_1 +b_2 X_2 +b_3 X_3 +b_4 X_4+b_5 X_5+b_6 X_6+b_7 X_7$$

Where,

Y = Capital output ratio (Investment (except on land) per unit of gross farm income)

X_1= Family size (number of persons)

X_2= Per cent dependent population (Family size minus earners)

X_3= Adult cattle units (ACUs) per farm

X_4= Per cent leased-in land

X_5=Operational holding (acre)

X_6=Cropping intensity (%)

X_7=Literacy rate (%)

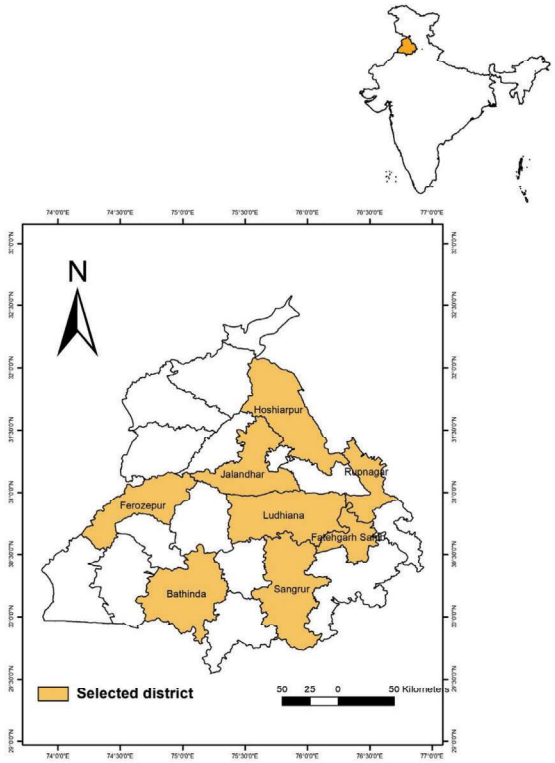

Figure 1. Map of the study area

Results and Discussion

The results have been broadly classified into four sections. First section discuss the socio-economic and farm specific characters of the respondents and distribution of inventory; second section deals with investment pattern; the third section describe the composition of household income

Table 1. Socio-economic and farm-specific characteristics of selected households

Particulars	Marginal	Small	Semi-medium	Medium	Large	Overall
Number of households	24	32	48	48	8	160
Average family size (No.)	5.04	4.88	5.73	5.71	6.88	5.51
% Working force (15-59 years)	65.29	73.72	69.82	68.61	70.91	69.58
% Dependents population	38.66	33.39	40.22	33.38	40.75	36.60
Literacy rate (%)	83.47	83.97	80.36	86.13	81.82	83.31
Average size of operational holding (ha)	0.85	1.64	3.26	6.36	11.39	3.91
% Leased-in land	2.35	4.88	14.11	24.84	36.00	21.48
Cropping intensity (%)	204.41	204.15	200.12	200.58	200.84	200.93

Source: Field survey, 2019-20

and last section summarizes the capital out ratio among different farm size categories and effect of socio-economic and farm-specific characteristics on capital output ratio.

Socio-economic and farm specific characteristics of respondents

A summary of socio-economic and farm-specific characteristics of respondents has been given in Table 1. A perusal of table indicates that average family size in the study area is 5.51, out of which 70 per cent is working population (15-65 years). Among different farm size categories, small farmers has the highest working population (73%) followed by large (71%) and semi-medium (70%) farmers. Further, the medium farmers (86%) are more literate as compared to small farmers (84%). About 37 per cent population is dependent (family size minus total earners) in the study area with large farmers having highest proportion of dependents (41%) followed by semi-medium (40%) and marginal (39%) farmers. The average size of operational holdings is 3.91 ha, out of which 21.48 per cent is leased in land. The results indicate the positive relationship between farm size and per cent leased-in land which means that large farmers' leased-in agricultural land is more as compared to marginal and small farmers. The cropping intensity is around 200 per cent across different farm size categories.

Distribution of farm inventory

The results presented in Table 2 related to the distribution of tractor, electric motors, diesel engine and adult cattle units among farm size categories shows that around 75 per cent of the selected households have owned tractor. Among different farm size categories, all the large farmers have owned tractor while 21 per cent of the marginal farmers also have owned the tractor. Overall, the households have electric motors of 17 HP capacity and horsepower requirement increases with increase in farm size. One of the reasons of requirement of high horsepower electric motors is the increase in rate of ground water depletion in Punjab (Kaur and Vatta, 2015). There are still many households who use the diesel engine for fodder cutting. The average households have 2.74 HP capacity of diesel engine in their farms, and it also has the positive relationship with the farm size. Overall, the adult cattle unit (ACU) value is 4.10 per farm in the study area and among different farm size categories, adult cattle units also increase with increase in farm size which means that large farmers rear more cattle than marginal farmers.

Investment pattern

The pattern and magnitude of capital investment on individual farms depends on many factors such as farm size, income of farmers, and availability and accessibility

Table 2. Distribution of inventory among different categories of farm households

Particulars	Marginal (24)	Small (32)	Semi-medium (48)	Medium (48)	Large (8)	Overall (160)
Households having tractor (%)	20.83	56.25	87.5	97.92	100	75
Capacity of electric motor(s) (HP)	9.7	11.1	15.8	23.1	29.9	16.8
Capacity of diesel engine(s) (HP)	1.98	2.20	2.38	3.63	4.13	2.74
Adult cattle unit (number per farm)	2.83	3.92	4.33	4.48	5.00	4.10

Source: Field survey, 2019-20,
Note: Figure in parentheses indicate number of selected households in the respective category

Table 3. Pattern of investment over different components of capital assets

(Rs. /farm)

Particular	Marginal	Small	Semi-medium	Medium	Large	Overall
Farm-buildings	37625	91406	80510	91215	75750	79230
	(44062)	(55790)	(24689)	(14347)	(6653)	(20260)
Irrigation	94906	99909	119517	157764	195550	127179
	(111143)	(60979)	(36651)	(24815)	(17174)	(32521)
Machinery	36594	85943	269845	408942	494780	251053
	(42854)	(52455)	(82750)	(64324)	(43452)	(64197)
Livestock	91496	121212	151302	196452	237475	154167
	(107149)	(73982)	(46398)	(30901)	(20855)	(39422)
Total capital assets	260621	398470	621174	854373	1003555	611629
	(305208)	(24320)	(190488)	(134387)	(88134)	(156400)

Source: Field survey, 2019-20
Note: Figure in square brackets indicates investment per hectare and in parentheses indicates percentage to total

of technical knowhow. The summary of investment pattern over different components of capital assets on per farm and per hectare basis among different farm size categories has been presented in the Table 3 and Figure 2. The average investment on the total capital assets is Rs. 6.11 lakh per farm with highest (41%) investment on machinery. Livestock also carries the significant share (25%) of the total capital assets. Only 13% investment is made on farm-building while about one fifth of total capital assets' investment is on irrigation.

Among different farm size categories, the investment on machinery shows the positive relationship with farm size as large farmers invest more (50%) on machinery as compared to marginal farmers (14%). Therefore, it can be interpreted that large farmers are more mechanized in the study area as more investment on modern inputs and machines was made by the large farmers. Joshi (2004) also stated that farm mechanization in the state of Punjab increased with time. The total investment on irrigation is Rs. 3.25 lakh per ha with highest investment made by marginal farmers (36%) and lowest by medium farmers (20%). The share of investment on farm building ranges between 7.55 to 22.94 per cent among different farm size categories. Further, the share of investment on livestock shows the negative relationship with farm size. Saini and Kumar (2020) also concluded that large farmers invest around 54 per cent of total capital assets on machinery and implements while marginal farmers spend only 20 per cent. Machinery is the need of the modern farming, but investment made on it by marginal and small farmers increases their cost of production significantly which leads to increase in the debt.

Income distribution

The results related to income distribution of selected households have been presented schematically in Figure 3. The net farm family income of selected households is Rs. 6.62 lakh, of which crops has 75 per cent share followed by dairy (12%), off farm income (7%) and ad-hoc income (5%).

The details of source wise distribution of income across the different farm size categories have been summarised in Table 4 which shows the positive relationship between share of crops in net income and farm size with maximum share (88%) in large farms and minimum (45%) in marginal farms. This is due to the reason that large farmers made more

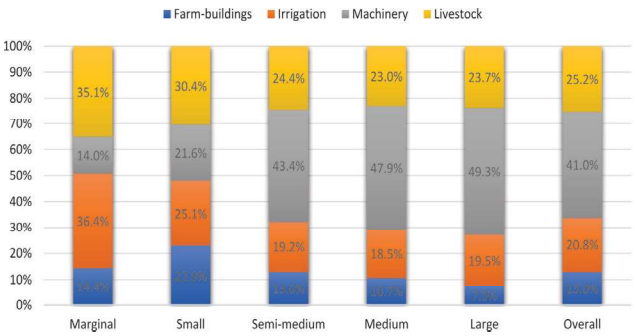

Fig. 2. Per cent distribution of investment over different components of capital assets

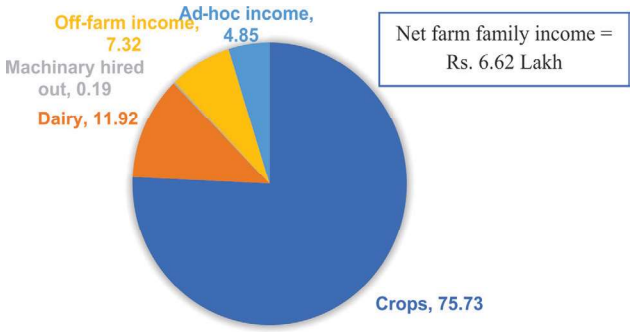

Fig. 3. Distribution of income (%) among different sources of selected households, 2019-20

Table 4. Source wise income distribution among different size of rural households

(Per cent)

Particulars	Marginal	Small	Semi-medium	Medium	Large
Crops	44.60	61.94	74.92	80.88	88.09
Dairy	22.48	20.19	12.96	8.03	10.38
Machinery hired out	-	-	0.72	-	-
Off-farm income	27.69	14.31	7.49	4.50	-
Ad-hoc income	5.22	3.56	3.92	6.60	1.53
Net farm family income (Rs./farm)	269228	389416	580867	970439	1572046

Source: Field survey, 2019-20

farm investments and have better adoption of improved farm technologies in their fields. It can also be seen from the table that share of dairy in net income and farm size have inverse relationship as maximum (22%) share is in marginal farms and lowest (10%) in large farms. Similar negative relationship has been found between share of off-farm income and farm size with its value ranges between 4.5 to 28 per cent across different farm size category. As the marginal and small farmers have small size of holdings, in the search of better livelihood, these farm families also explore the other income sources.

The Lorenz curve and Gini ratio of the selected households in Figure 4 shows the income inequality of the sampled households. The large gap between Lorenz curve and line of equality with high value of Gini ratio (0.52) clearly indicates the high inequality in income distribution of selected households. Choudhary and Singh (2019) also calculated the Gini ratio (0.517) using the NSSO data, 2013 and suggested that promoting non-farm business helps to minimize the income disparity.

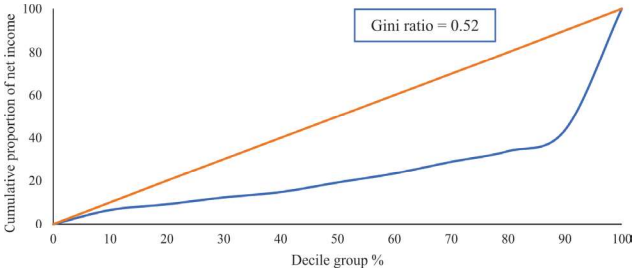

Fig. 4. Lorenz curve of net family income of sampled households, 2019-20

Capital output Ratio

Since the intensity of capital and its productivity varies over farm size categories of farms on account of differentials in the fertility of land and other endowments, hence, it is essential to examine this aspect so that the most efficient category of farm may be identified. The information on capital-output ratio has been given in Figure 5. The size-wise analysis established an inverse relationship between farm size and capital-output ratio which means that large farmers require less amount of capital to produce one unit of output as compared to marginal farmers. We can see in Fig 4 that to produce one unit of output, large farmers require 0.35 units of capital, while marginal farmers require 0.89 units of capital investment. Overall, the capital output ratio in the study area is 0.59.

We also estimated the impact of different socio-economic factors on capital output ratio and the results are given in Table 5. It can be seen in the table that adult cattle units, per cent leased-in land and operational holdings have significantly negative relationship with capital output ratio at 5 per cent level of significance. This negative relationship of ACUs, per cent leased-in land and operational holdings indicates that one-unit increase in these variables would decrease the capital requirement for producing one unit of output by 0.06, 0.004 and 0.04 units, respectively. This signifies that the farmers who have with higher number of adult cattle units, large operational holdings and high proportion of leased-in land are more efficient in terms of capital requirement to produce one unit of output.

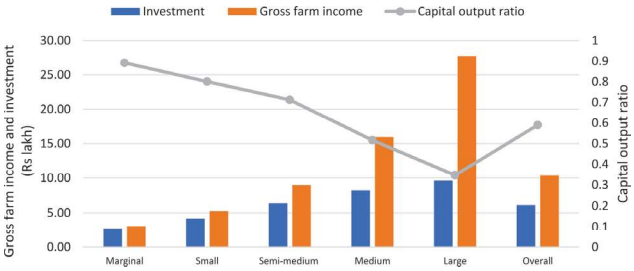

Fig. 5: Capital output ratio different size of households in Punjab (Field survey: 2019-20, Note: Investment includes farm buildings, livestock, and farm machinery)

Conclusion and Policy Implications

Many studies (Frankel 1971; Cleaver 1972; Griffin 1974; Grabowski 1979; Das, 2021) explains that there is a positive relationship between farm size and productivity because large farmers have more access to farm mechanization compared to marginal and small farmers and has the advantage of economies of scale. Our work also adds some facts in this line. First, the relationship between leased-in land and farm size shows positive relationship which indicates that medium and large farmers acquired more land and minimize the

Table 5. Factor affecting capital output ratio

Particulars	Coefficients	Standard Error	t Stat	P-value
Intercept	0.240	1.662	0.144	0.885
Family size (number), X_1	-0.020	0.024	-0.811	0.419
% Dependents population, X_2	0.004	0.003	1.573	0.118
ACUs per farm, X_3	-0.071	0.023	-3.042	0.003
% Leased-in land, X_4	-0.004	0.002	-2.189	0.030
Operational holding (acre), X_5	-0.043	0.018	-2.349	0.020
Cropping intensity (%), X_6	0.005	0.008	0.585	0.560
Literacy rate (%), X_7	0.001	0.003	0.367	0.714
R^2	0.22	F value	6.22	
Adjusted R^2	0.19			

per hectare machinery cost and increase their profitability. Secondly, the share of machinery in the total capital assets for large farmers (50%) was high as compared to marginal farmers (14%) which indicate that large farmers invest more on farm mechanization. Third, large farmers earn about 81 per cent of net family income from crops while the share of marginal farmers is only 45 per cent. Lastly, the capital output ratio for large farmers (0.35) is less than other farm categories which indicates that they require less amount of capital to produce one unit of output. The huge disparity in the income distribution (Gini ratio = 0.52) may be one of the reason for high capital output ratio of other farm categories than large farmers. The study also concludes that capital output ratio has the negative relationship with ACUs, per cent leased-in land and operational holdings. It is suggested that the capital investment through farmer organizations and cooperatives should be encouraged which will decrease the per hectare machinery cost of farmers. It is also suggested that the marginal and small farmers must hire the machinery from farmer organizations and cooperatives instead of investment on it.

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