Original Research

Livestock as a Source of Income Equity – An Evidence from Rural Tamil Nadu

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Abstract

A study was conducted to ascertain the role of livestock in ensuring income equity among the rural farmers of Tamil Nadu using randomly selected 540 sample households from six poverty prone districts of Tamil Nadu. The study period was August 2013 to October 2014. The sample respondents were post-stratified based on the occupation as crop cultivators, livestock farmers, fishermen, agricultural labourers and non-farm workers, etc. The measures of income inequality viz. Gini coefficient (G_i), Theil's L index and Theil's T index were calculated and Lorenz curve was plotted to ascertain the income equity among different rural occupations. The income distribution curve of non-farm occupation was at more distance from line of equality indicating higher inequality (Gini co-efficient of 0.4216), followed by crop cultivators and fishing. The inequality was found to be less among livestock farmers (Gini co-efficient of 0.2350), as the livestock are giving stable and year-round income. Among different species of livestock, cattle had lowest income inequality (Gini co-efficient of 0.1868), followed by buffalo, goat and sheep. As the livestock component ensures income-equity, they might be encouraged and incorporated in poverty alleviation programmes. Among livestock based occupations, cattle and buffalo farming should be encouraged as the results indicated that these species ensures income equity.

Key words: Equity, Gini Co-efficient, Income Inequality, Livestock, Lorenz Curve, Theil Index

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Introduction

Poverty is the "*incapability to maintain a minimum living standard anticipated with respect to basic consumption needs or some amount of income required for satisfying the people*" (World Bank, 2006). Among various criteria used to fix the poverty line, nutritional intake and income / expenditure status are widely used. For assessing poverty parameter, in addition to absolute measurement of income (poverty ratios), relative measurement is also measured through calculation of income inequality, which would help in framing of poverty alleviation programmes and policies. Livestock played a key role in livelihood of poor, rural people in developing countries, providing major proportion of their cash income, capital assets, draught power, fuel and manure. Livestock rearing had significant positive impact on equity in terms of income and employment and poverty reduction in rural areas, as distribution of livestock was more egalitarian as compared to land (Ponnusamy, 2006). Livestock development however had a mixed record with regard to poverty alleviation (Heffernan, 2004; Ali, 2007 and Millar and Photakoun, 2008). In this context, study was carried out to ascertain the role of livestock in income equity by reducing the inequality among the rural farmers of Tamil Nadu.

Materials and Methods

A Composite Index (CI) was constructed through factor analysis based on secondary data related to livelihood in order to select six sample districts of Tamil Nadu *viz.*, Thiruvannamalai, Villupuram, Dharmapuri, Pudukottai, Ariyalur and Ramanathapuram which are located in southern part of India. Three blocks from each selected district, six villages from each selected block and five respondents comprising different occupational groups from each selected village were selected through multi-stage random sampling leading to the sample size of 540 sample households. In the present study, the sample respondents were post-stratified based on the contribution of particular occupation(s) to the total household income as crop cultivators, livestock farmers, fishermen, agricultural labourers and non-farm workers, *etc.* In other words, if the income derived from crop cultivation was 50 per cent or more to the total household income of the sample respondents, he/she was classified as crop cultivators. If no source of income equals as much as 50 per cent of household income, combination of occupations namely crop and livestock might be engaged by the farmer to receive more than 50 per cent of total household income and those were classified under crop + livestock farming category.

Among the livestock farming category, cattle and buffalo farmers were selected purposively in North-Eastern and North-Western zone and similarly sheep and goat farmers in Cauvery Delta and Southern zones. The average household income of the selected households earned from different sources like crop, livestock (cattle, buffalo, sheep and goat), fishing, agricultural wage and non-farm were estimated. In order to avoid region-specific variations in income from various enterprises, sufficient steps were taken in

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sampling design with adequate representation from all the species and regions. Following Cuong (2010), the measures of income inequality *viz.*, Gini coefficient (G_i), Theil's L index and Theil's T index were calculated as described below:

Gini Coefficient (G_i)

Most widely used single measure of inequality is Gini co-efficient. It is based on Lorenz curve, a cumulative frequency that compares the distribution of a specific variable (*i.e.* per capita household disposable income) with the uniform distribution that represents equality. In order to construct the Gini coefficient, graph was drawn with the cumulative percentage of households / persons (from poor to rich) in horizontal axis and the cumulative percentage of per capita household disposable income on the vertical axis. The diagonal line representing equality was also drawn. The Gini coefficient is defined as the ratio of area of A and A+B, where A is the area between the line of equality and Lorenz curve and B is the area below the Lorenz curve. If x_i is the point on the X axis and y_i is the point on the Y axis, then Gini co-efficient may be computed as-

$$G_i = 1 - \sum_{i=0}^{N} (x_i - x_{i-1})(y_i + y_{i-1})$$

The value of Gini co-efficient varies from 0 to 1. The closer a Gini co-efficient is to one, the more unequal is the income distribution.

Theil's L Index of Inequality (Theil_L)

The Theil's L index of inequality was calculated as follows-

$$Theil\ L = \frac{1}{n}\sum_{i=1}^{n} \ln\left[\frac{\bar{Y}}{Y_i}\right]$$

where Y_i is the per capita income of i[th] household and $\bar{Y}$ is the overall average per capita income of sample household and n is the number of sample households / persons. The Theil's L index ranges from 0 to infinity and the higher the value of Theil's L, the higher the inequality is.

Theil's T Index of Inequality (Theil T)

The Theil's T index of inequality was calculated as follows-

$$Theil\_T = \frac{1}{n}\sum_{i=1}^{n} \frac{Y_i}{\bar{Y}} \ln\left[\frac{Y_i}{\bar{Y}}\right]$$

where Y_i is the per capita income of i[th] household and $\bar{Y}$ is the overall average per capita income of sample household and n is the number of sample households / persons. The Theil's T index ranges from 0 (lowest inequality) to ln N (highest inequality). The period of data collection was from August 2013 to October 2014.

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Results and Discussion

Measures of Income Inequality

The measures of income inequalities *viz.*, Gini coefficient, Theil's L index and Theil's T index were calculated and discussed in this section.

Gini Coefficient (G_i)

The population was arranged in the ascending order of per capita household disposable income and frequency distribution table was prepared for ten percentile classes of households / population. Based on the percentage distribution table of cumulative population / households and cumulative per capita household disposable income (Table 1), Lorenz curve was drawn for different categories of sample respondents based on their primary occupation *viz.*, cropping, livestock farming, crop + livestock farming, fishing, agricultural labourer and non-farm occupation (Fig.1).

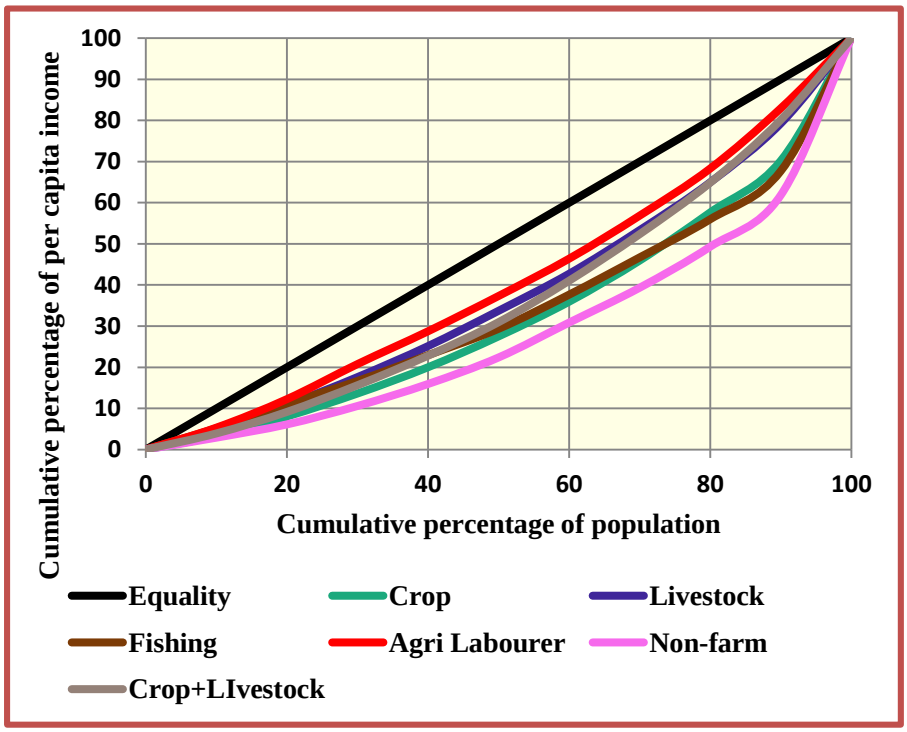

Fig. 1: Lorenz curve of income distribution among different occupational categories

From the Fig., it could be evinced that the income distribution curve of non-farm occupation was at more distance from line of equality indicating the prevalence of higher inequality (Gini co-efficient of 0.4216) among them. The income inequality was found to be more pronounced among fishermen (Gini co-efficient of 0.3135), as their income distribution curve was seen just above the curve of non-farm workers. The inequality was found to be less among livestock farmers (Gini co-efficient of 0.2350) as the curve was

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closer to the line of equality, when compared to crop cultivators (Gini co-efficient of 0.3357). Among all, the agricultural labourers had the least income inequality (Gini co-efficient of 0.1821), as shown in Fig. 1, but higher incidence of poverty (Table 1). Although, income inequality was seemed to be the least among agricultural labourers, their income was found to be the least making them to fell below the poverty line. Among all the other occupations, livestock and crop and livestock farming had less income inequality, which implied that the livestock component ensures income equity. The higher income inequality observed among other occupations like cropping, non-farm and fishing might be due to be the greater variations in the period of income, landholdings and capital, which would lead to higher income variations. Ponnusamy *et al.* (2016) reported that the position of educational and health status of fishers warrants a strong need to improve the access of fishers to health related services for overall development.

Table 1: Impact of livestock and other occupations on income inequality (per cent)

Cumulative per cent of Population	Cumulative Per cent of Per capita Income for Different Occupational Groups					
	Cropping	Livestock Farming	Crop +Livestock Farming	Fishing	Agricultural Labourer	Non-Farm Occupation
0	0	0	0	0	0	0
10	3.26	4.88	3.91	5.18	5.32	2.88
20	8.04	10.83	9.14	11.1	12.25	6.1
30	13.61	17.61	15.63	16.66	20.77	10.58
40	20	25.14	22.81	22.94	28.75	15.93
50	27.5	33.73	30.96	29.35	37.33	22.38
60	35.94	42.73	41.04	37.65	46.4	30.86
70	45.95	53.34	52.36	46.71	56.87	39.34
80	57.64	64.97	64.88	55.98	68.32	49.31
90	70.2	79.26	80.14	67.69	82.96	61.82
100	100	100	100	100	100	100
Gini co-efficient	**0.3357**	**0.235**	**0.2583**	**0.3135**	**0.1821**	**0.4216**
Theil L index	**0.2178** (0.0305)**	**0.0913**(0.0135)**	**0.1129**(0.0176)**	**0.1973**(0.0436)**	**0.0587* (0.2075)**	**0.3341**(0.0568)**
Theil T index	**0.2899*(0.1225)**	**0.0974**(0.0218)**	**0.1083**(0.0197)**	**0.2849(0.1847)**	**0.059(0.0320)**	**0.4367(0.2247)**

*Figures in parentheses indicate standard error; ** Significant at one per cent level and * Significant at five per cent level*

The measures of income inequality were also measured for different species of livestock and depicted in Table 2 and Fig. 2. Among different species of livestock, cattle had lowest income inequality (Gini co-efficient of 0.1868), followed by buffalo (Gini co-efficient of 0.2255), goat (Gini co-efficient of 0.2540) and sheep (Gini co-efficient of 0.2639) and it was also reflected in Fig. 2. Among different livestock, sheep was identified to be highest inequality causing source and the results was in concurrence with Ambika (2003). Irregular and / or forced sale of animals, larger variations in price levels of rams, ewes and lambs, greater exploitation by middlemen, greater variations in flock size among the sheep farmers might be the reasons for higher variations in the income level of sheep farmers leading to higher income inequality.

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Table 2: Impact of livestock species on income inequality (per cent)

Cumulative per cent of Population	Cattle	Buffalo	Sheep	Goat	Overall
0	0	0	0	0	0
10	6.05	6.07	4.29	4.97	4.88
20	12.74	11.62	9.37	10.99	10.83
30	20.03	17.69	15.41	17.3	17.61
40	27.95	25.34	22.43	24.32	25.14
50	36.5	34.11	31.08	32.37	33.73
60	46.23	42.5	40.07	41.88	42.73
70	57.03	53.33	50.39	51.65	53.34
80	68.31	64.77	63.92	62.96	64.97
90	81.78	81.8	81.08	76.54	79.26
100	100	100	100	100	100
Gini ratio	**0.1868**	**0.2255**	**0.2639**	**0.254**	**0.235**
Theil L index	**0.0567**(0.0166)**	**0.0834 (0.0461)**	**0.1199* (0.0233)**	**0.1115* (0.0242)**	**0.0913**(0.0135)**
Theil T index	**0.0597*(0.0221)**	**0.0868 (0.0593)**	**0.1165*(0.0443)**	**0.131(0.0564)**	**0.0974**(0.0218)**

*Figures in parentheses indicate standard error;** Significant at one per cent level and * Significant at five per cent level*

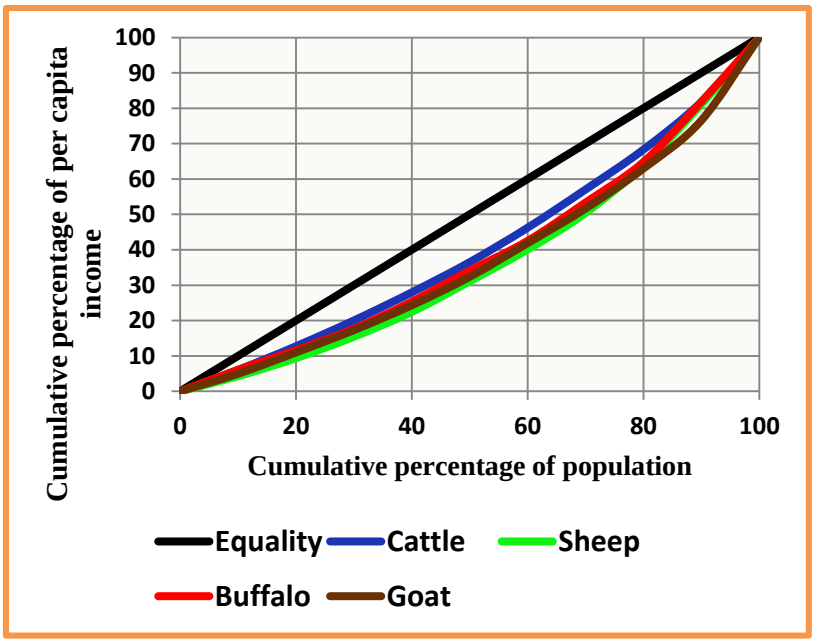

Fig. 2: Lorenz curve of income distribution for different livestock species

Theil's L Index of Inequality (Theil L)

The Theil L was calculated for different groups of occupation and different species of livestock and shown in Tables 1 and 2, respectively. Among various occupational groups, Theil L was measured to be the highest among non-farm workers (0.3341) followed by crop cultivators (0.2178), fishing (0.1973) and crop + livestock farming (0.1129). Theil L was observed to be less among livestock farmers (0.0913) and the least among agricultural labourers (0.0587). Among the various livestock species, sheep had the highest Theil L

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(0.1199), followed by goat (0.1115). Among the large ruminants, cattle had the lowest Theil L (0.0567) when compared to buffaloes (0.0834).

Theil's T Index of Inequality (Theil T)

Similar to Theil L, Theil T was calculated for different occupational groups and livestock species and portrayed in Tables 1 and 2. Among various occupations, the values of TheilT were in the descending order of non-farm, crop, fishing, crop + livestock, livestock and agricultural labourers with values ranging between 0.4367 and 0.0590. Among the various livestock species, Theil T was calculated to be high for small ruminants (0.1310 for goat and 0.1165 for sheep), when compared to large ruminants (0.0868 for buffaloes and 0.0597 for cattle). The present results concurred with previous studies of Ambika (2003), Cuong (2010) and Mandal *et al.* (2010).

Conclusion

The income inequality was found to be minimum among the livestock farmers when compared to other occupations. Further, within the livestock farming, income from cattle and buffalo farming were found to be more equally distributed than the income of small ruminants. Overall, the poverty indices and income inequality indices calculated for the sample respondents clearly warrant that the livestock farming had the potential of poverty alleviation and inequality reduction thereby ensuring income equity among the farmers if rural Tamil Nadu. Among livestock based occupations, cattle and buffalo farming should be encouraged as the results indicated that these species ensures income equity.

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