

COMPARATIVE ADVANTAGE OF DAIRY FARMING IN LEVERAGING THE RELIEF OF RURAL COMMUNITIES FROM POVERTY TRAP: AN EVIDENCE FROM RURAL TAMIL NADU

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ABSTRACT

An attempt was made to measure the comparative advantage of dairy farming among different occupational groups of rural Tamil Nadu (540 households and 2500 persons) for its poverty alleviation role. The most commonly used measures of poverty viz., head count index (P_0), poverty gap index (P_1) and squared poverty gap (poverty severity) index (P_2), the Watts index and average exit time from poverty were calculated. About 59 per cent of the total sample households and close to 65 per cent of sample population were found to stay below poverty line. P_1 , P_2 and W index were observed to be the highest among agricultural labourers and the lowest among dairy farmers. At four per cent of hypothetical income growth rate, the time required to exit out of poverty was estimated to be the least for dairy farmers (4.66 years for buffalo and 4.91 years for cattle), followed by fishermen (5.09 years). Keeping in view of poverty reduction potential of dairy farming, it shall be included in poverty alleviation programmes.

Key words: Cropping, dairy, fishing, livestock, non-farm, occupation, poverty

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INTRODUCTION

India is the third largest economy in the world in purchasing power parity (PPP) terms and has been one of the world's best performing economies for over a quarter century (World bank, 2013). According to Planning commission (2014), about 363 million Indians (29.5 per cent of the total population) were below poverty line. Among

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them, 260.5 million are in rural areas (30.9 per cent of rural population), while 102.5 million in urban localities (26.4 per cent of urban population). As the poverty is considered to be a serious issue of the society, which also often hinders economic growth, alleviating poverty becomes an essential part of the macro plan objective in India (Narayanamoorthy and Hanjra, 2010). It has been estimated that almost 150 million farm households, i.e. more than 750 million people, are engaged in milk production, the majority of them in developing countries (FAO 2010). To poor people, farm animals are a major asset, representing both capital, source of income and also being a source of high quality nutrients (FAO, GDP and IFCN, 2018). Many studies have also investigated the effects of livestock on rural poverty. (Birthal and Taneja, 2006, Birthal and Negi, 2012 and Bijla, 2018). Dairy farming holds a great promise providing income, employment and poverty alleviation (Jaiswal *et al.*, 2018). With this background, the present study was undertaken to ascertain the poverty reduction potential of dairy farming in comparison with other occupations to suggest policy interventions.

MATERIALS AND METHODS

A Composite Index (CI) was constructed through factor analysis based on secondary data pertaining to poverty and livelihood. The variables *viz.*, rural human population, rural women population, rural scheduled caste population, rural scheduled tribe population, number of households and workers registered in Mahatma Gandhi

National Rural Employment Guarantee Act (MGNREGA), number of male and female agricultural labourers, number of below poverty line (bpl) families, population in below poverty line (bpl), percentage of bpl to total rural population, rate of illiteracy in per cent (2011), 100 - life expectancy rate, percentage of households not having safe drinking water and not having electricity connection, human development index (2011) and number of male and female cultivators were used for construction of composite index. Based on the CI value, the districts were ranked, where six districts *viz.*, Thiruvannamalai, Villupuram, Dharmapuri, Pudukottai, Ariyalur and Ramanathapuram had the composite index value ≥ 1.5 and were selected for the present study.

From each selected district, 90 respondents were selected through multi-stage random sampling leading to the sample size of 540 sample households, which comprised 2500 persons. The sample respondents were post-stratified into six occupational groups *viz.*, cropping, livestock farming, crop and livestock farming, fishing, agricultural labour and non-farm. The data pertaining to the objectives of the study were collected through personal interview using structured pre-tested interview schedule. The period of data collection was from August 2013 to October 2014.

Per capita income and the poverty line were the two major indicators considered for measuring poverty in the study area. In the present study, the per capita income of

Rs.1081.94 per month was taken as the state specific poverty line for rural Tamil Nadu as recommended by Planning commission (2014). The most commonly used measures of poverty viz., head count index (P_0), poverty gap index (P_1) and squared poverty gap (poverty severity) index (P_2), the Watts index and average exit time from poverty were calculated in the present study by adopting the methodology prescribed in World bank poverty manual (2005)

Head count index (P_0)

Most widely used measure of poverty is head count index / ratio, which simply measures the proportion of the population that is counted as poor.

$$P_0 = \frac{N_p}{N}$$

where, N_p is the Number of poor and N is the total population.

Poverty gap index (P_1)

Moderately popular measure of poverty is the poverty gap index, which adds up the extent to which individuals on average fall below the poverty line and expressed as percentage of the poverty line. Poverty gap (G_i) is defined as the poverty line (z) less actual income (y_i) for poor individuals; the gap is considered to be zero for everyone else.

$$G_i = (z - y_i) \cdot I(y_i < z)$$

Then the poverty gap index (P_1) was taken as

$$P_1 = \frac{1}{N} \sum_{i=1}^N \frac{G_i}{z}$$

Squared poverty gap (Poverty severity) index (P_2)

Squared poverty gap (Poverty severity) index (P_2) takes into account inequality among poor. It is the weighted sum of poverty gaps (as a proportion of the poverty line), where the weights are the proportionate poverty gap themselves; a poverty gap of (e.g.) 10 per cent of poverty line is given a weight of 10 per cent alone, while one of 50 per cent is given a weight of 50 per cent; this is in contrast with poverty gap index, where they are weighed equally. Hence, squaring poverty gap index measure implicitly puts more weight in observations that fall well below the poverty line.

The squared poverty gap index (P_2) was taken as

$$\frac{1}{N} \sum_{i=1}^N \left(\frac{G_i}{z}\right)^2$$

It may be more generally calculated as proposed by Foster *et al.* (1984) as

$$P_\alpha = \frac{1}{N} \sum_{i=1}^N \left(\frac{G_i}{z}\right)^\alpha \quad (\alpha \geq 0)$$

where,

- α = Measure of the sensitivity of the index to poverty
- z = Poverty line
- G_i = Poverty gap ($z - x_i$) with $G_i = 0$, when $x_i > z$
- x_i = Value of per capita income / expenditure for the i^{th} person's household

If $\alpha = 0$, P_α becomes head count index, if $\alpha = 1$, P_α becomes poverty gap index and if $\alpha = 2$, P_α becomes poverty severity index.

The Watts Index (W)

The Watts index is the most widely used measurement of poverty index for derivation of poverty incidence curve over different time period / growth rates of income. In the present study, the Watts index was calculated using the following formula:

$$W = \frac{1}{N} \sum_{i=1}^q [\ln(z) - \ln(y_i)]$$

where, N is the individuals in the population which were indexed in ascending order of income and sum was taken over the q individuals whose income (y_i) fell below poverty line (z).

Average exit time from poverty

The average time taken to exit from the poverty was calculated as the Watts index divided by the expected income growth rate among poor as presented below:

$$t_g^j \approx \frac{\ln(z) - \ln(x_j)}{g} = \frac{W}{g}$$

Based on the Watts index values, average time to exit out of poverty was worked for scenarios of different hypothecated income growth rates. Further, the rate of income growth required to exit out of poverty in a definite period of time was also calculated.

RESULTS AND DISCUSSION

Measures of poverty: Various poverty indices *viz.*, head count index (P_0), poverty gap index

(P_1) and squared poverty gap (poverty severity) index (P_2), the Watts index and average exit time from poverty were calculated among various districts and occupational groups. The results are shown in Table 1.

Head count index (P_0): About 59 per cent of the total sample households and about 56 per cent of sample population were found below poverty line (Rs.1081.94 per capita per month). All the agricultural labourers in the sample were below poverty line, which was indicated by the head count index of 1.000. Amongst others, the head count index (household basis) was high in crop cultivators (0.6389) group, followed by exclusive livestock farmers (0.5775), fishermen (0.5667), crop + livestock farmers (0.5256) and non-farm workers (0.4857).

Poverty gap index (P_1): The extent to which the individuals fell below the poverty line and expressed as percentage of the poverty line was calculated as poverty gap index (Table 1). The P_1 (on household basis) was calculated to be the highest among agricultural labourers (0.4779), followed by crop (0.2446), crop + livestock (0.1842) farmers. Fishermen had the least poverty gap index (0.1352)

Squared Poverty gap (Poverty severity) index (P_2): Poverty severity index measures inequality among poor and it was calculated among various occupational groups and districts on household basis and sample population basis. Among various occupational groups, P_2 values were found to be the maximum among agricultural labourers (0.2588) and minimum among fishermen

(0.0428). The livestock farmers had the P_2 value of 0.0717, indicating less severity when compared to other occupations. Among different livestock entrepreneurs, P_2 value was calculated to be the highest for goat farmers (0.1054) and the lowest for buffalo farmers (0.0373).

The Watts Index (W): In the present study, the Watts index was calculated for derivation of poverty incidence curve over different time period / growth rates of income. The calculation based on the sample population indicated that 'W' values were 0.7440 for agricultural labourers, 0.4295 for crop cultivators, 0.3145 for non-farm workers, 0.2859 for crop + livestock farmers. The fishermen and exclusive livestock farmers had the lesser and least 'W' with the values being 0.2035 and 0.2612, respectively. Various poverty indices indicated that the potential of livestock sector in reduction of poverty when compared to crop and other occupations. The results concurs with the previous studies of Birthal and Taneja (2006), Ohja (2007) and Bijla (2018). The incidence, depth (poverty gap index) and severity of poverty (squared poverty index) was observed to the least among crop + livestock farmers, which concurred with previous study of Ogunniyi *et al.* (2011).

Exit time from poverty: The average time taken to exit from poverty was estimated based on scenarios of different growth rates of income and presented in Table 2 and Figure 1. From the table and figure, it is clear that at four per cent of income growth rate, the time required to exit out of poverty was estimated

to be the least for fishermen (4.08 years), followed by exclusive livestock farmers (5.91 years), non-farm workers (6.06 years) and crop + livestock farmers (6.27 years). The agricultural labourers required 17.59 years to exit out of poverty when their income growth rate is four per cent. Even at the double rate of income growth (8%), they required 8.79 years to exit out of poverty. Among various occupations, livestock farming required less time to exit out of poverty at different income growth rates. Although fishing occupation had the least exit time out of poverty than livestock, the scope of fishing is limited only in coastal regions. Further, fishing occupation requires comparatively higher investment and it has more life risk, when compared to other selected enterprises. Thus for any poverty alleviation programmes, livestock component especially cattle (3.87 years to exit poverty at four per cent income growth) and buffaloes (3.55 years to exit poverty at four per cent income growth) might be incorporated, as they had greater potential to quickly lift the poor above poverty line (Figure 2).

The growth rate required among different occupational groups to bring forward the households out of poverty in a fixed number of years were also calculated and presented in Table 3. For example, If the Government / policy makers proposed the households to exit out of poverty in five years, the expected rate of income growth was estimated to be 4.73 per cent for exclusive livestock farmers, 4.85 per cent for non-farm workers, 6.82 per cent for crop cultivators and 14.07 per cent for agricultural labourers.

Table 1: Occupation-wise poverty indices among sample respondents

S.No.	Primary occupation	Household basis					Population basis						
		Number of households	BPL# households	Head count index	Poverty gap index**	Poverty severity index**	The Watts index**	Number of Persons	BPL# persons	Head count index	Poverty gap index**	Poverty severity index**	The Watts index**
1	Cropping	72	46	0.6389	0.2446 (0.0221)	0.1155 (0.0176)	0.3409 (0.0397)	358	257	0.7179	0.2973 (0.0105)	0.1512 (0.0087)	0.4295 (0.0196)
2	Livestock farming	213	123	0.5775	0.1832 (0.0037)	0.0717 (0.0010)	0.2363 (0.0043)	940	615	0.6543	0.2099 (0.0050)	0.0824 (0.0034)	0.2612 (0.0078)
	a. Cattle	80	37	0.4625	0.1277 (0.0122)	0.0406 (0.0068)	0.1546 (0.0171)	381	222	0.5827	0.1613 (0.0059)	0.0523 (0.0032)	0.1963 (0.0082)
	b. Buffalo	20	9	0.4500	0.1173 (0.0291)	0.0373 (0.0140)	0.1419 (0.0387)	75	44	0.5867	0.1541 (0.0141)	0.0491 (0.0069)	0.1865 (0.0189)
	c. Sheep	35	20	0.5714	0.1985 (0.0103)	0.0874 (0.0041)	0.2680 (0.0129)	157	98	0.6242	0.2136 (0.0144)	0.0933 (0.0103)	0.2870 (0.0235)
	d. Goat	78	57	0.7308	0.2503 (0.0073)	0.1054 (0.0015)	0.3301 (0.0081)	327	251	0.7676	0.2775 (0.0030)	0.1199 (0.0006)	0.3690 (0.0033)
3	Crop + Livestock farming	156	82	0.5256	0.1842 (0.0023)	0.0830 (0.0002)	0.2509 (0.0024)	756	437	0.5780	0.2085 (0.0069)	0.0958 (0.0050)	0.2859 (0.0116)
4	Fishing	30	17	0.5667	0.1352 (0.0209)	0.0428 (0.0059)	0.1633 (0.0244)	136	91	0.6691	0.1676 (0.0118)	0.0546 (0.0050)	0.2035 (0.0152)
5	Agricultural Labourer	34	34	1.0000	0.4779 (0.0212)	0.2588 (0.0091)	0.7034 (0.0273)	155	155	1.0000	0.4961 (0.0143)	0.2778 (0.0123)	0.7440 (0.0275)
6	Non-farm occupation	35	17	0.4857	0.1741 (0.0240)	0.0836 (0.0078)	0.2424 (0.0289)	155	84	0.5419	0.2185 (0.0174)	0.1131 (0.0126)	0.3145 (0.0290)
	Overall	540	319	0.5907	0.2070 (0.0027)	0.0918 (0.0005)	0.2802 (0.0030)	2500	1639	0.6556	0.2379 (0.0037)	0.1088 (0.0028)	0.3265 (0.0064)

BPL – Below Poverty line; Monthly per capita income <Rs. 1081.94

(Figures in parentheses indicate standard error)

** Significant at one per cent level for all the mentioned indices for different categories

Table 2: Exit time to get out of poverty under different growth rate of income (number of years)

S.No.	Primary occupation	Exit time required to get out of poverty under different growth rate of income (in per cent) - Household basis								Exit time required to get out of poverty under different growth rate of income (in per cent) - Population basis							
		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	Cropping	34.10	17.05	11.37	8.52	6.82	5.68	4.87	4.26	42.95	21.47	14.32	10.74	8.59	7.16	6.14	5.37
2	Livestock farming	23.63	11.82	7.88	5.91	4.73	3.94	3.38	2.95	26.12	13.06	8.71	6.53	5.22	4.35	3.73	3.26
	i. Cattle	15.46	7.73	5.15	3.87	3.09	2.58	2.21	1.93	19.63	9.81	6.54	4.91	3.93	3.27	2.80	2.45
	ii. Buffalo	14.20	7.10	4.73	3.55	2.84	2.37	2.03	1.78	18.65	9.33	6.22	4.66	3.73	3.11	2.66	2.33
	iii. Sheep	26.80	13.40	8.93	6.70	5.36	4.47	3.83	3.35	28.69	14.35	9.56	7.17	5.74	4.78	4.10	3.59
	iv. Goat	33.01	16.51	11.00	8.25	6.60	5.50	4.72	4.13	36.90	18.45	12.30	9.22	7.38	6.15	5.27	4.61
	Crop + Livestock farming	25.10	12.55	8.37	6.27	5.02	4.18	3.59	3.14	28.59	14.30	9.53	7.15	5.72	4.77	4.08	3.57
4	Fishing	16.33	8.17	5.44	4.08	3.27	2.72	2.33	2.04	20.35	10.18	6.78	5.09	4.07	3.39	2.91	2.54
5	Agricultural Labourer	70.35	35.18	23.45	17.59	14.07	11.73	10.05	8.79	74.40	37.20	24.80	18.60	14.88	12.40	10.63	9.30
6	Non-farm occupation	24.26	12.13	8.09	6.06	4.85	4.04	3.47	3.03	31.45	15.72	10.48	7.86	6.29	5.24	4.49	3.93
	Overall	28.02	14.01	9.34	7.01	5.60	4.67	4.00	3.50	32.65	16.32	10.88	8.16	6.53	5.44	4.66	4.08

Note: Each row indicates time required to get out of poverty at hypothetical growth rate of income (1 to 8) for the respective occupational groups

Table 3: Required growth rate of per capita income to exit out of poverty in fixed number of years (per cent)

S.No.	Primary occupation	Number of years - Household basis					Number of years - Population basis						
		5	10	15	20	25	30	5	10	15	20	25	30
1	Cropping	6.82	3.41	2.27	1.70	1.36	1.14	8.59	4.29	2.86	2.15	1.72	1.43
2	Livestock farming	4.73	2.36	1.58	1.18	0.95	0.79	5.22	2.61	1.74	1.31	1.04	0.87
	i. Cattle	3.09	1.55	1.03	0.77	0.62	0.52	3.93	1.96	1.31	0.98	0.79	0.65
	ii. Buffalo	2.84	1.42	0.95	0.71	0.57	0.47	3.73	1.87	1.24	0.93	0.75	0.62
	iii. Sheep	5.36	2.68	1.79	1.34	1.07	0.89	5.74	2.87	1.91	1.43	1.15	0.96
	iv. Goat	6.60	3.30	2.20	1.65	1.32	1.10	7.38	3.69	2.46	1.84	1.48	1.23
3	Crop + Livestock farming	5.02	2.51	1.67	1.25	1.00	0.84	5.72	2.86	1.91	1.43	1.14	0.95
4	Fishing	3.27	1.63	1.09	0.82	0.65	0.54	4.07	2.04	1.36	1.02	0.81	0.68
5	Agricultural Labourer	14.07	7.04	4.69	3.52	2.81	2.35	14.88	7.44	4.96	3.72	2.98	2.48
6	Non-farm occupation	4.85	2.43	1.62	1.21	0.97	0.81	6.29	3.14	2.10	1.57	1.26	1.05
	Overall	5.60	2.80	1.87	1.40	1.12	0.93	6.53	3.26	2.18	1.63	1.31	1.09

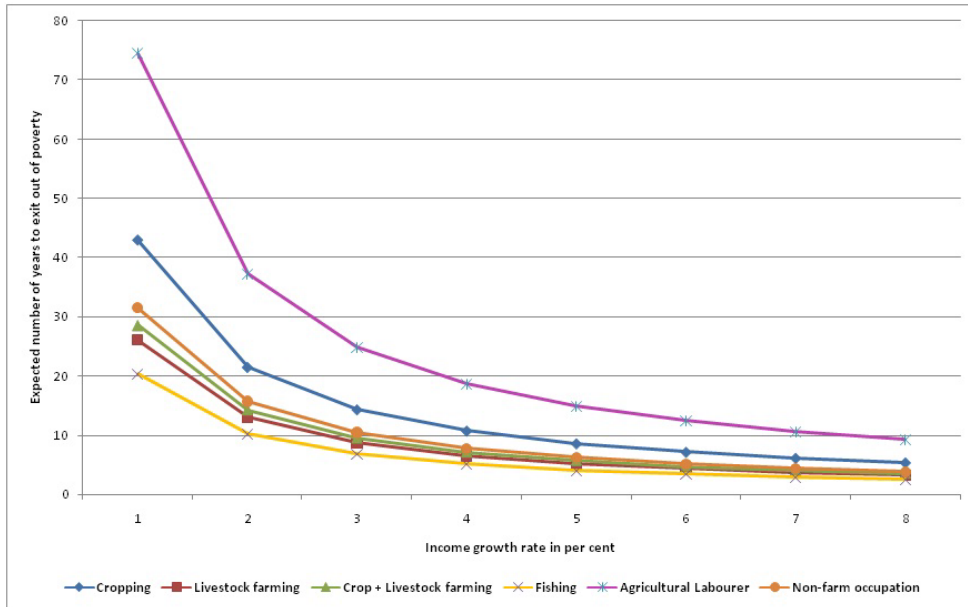


Figure 1: Expected exit time out of poverty at different growth rates of income among different occupational groups

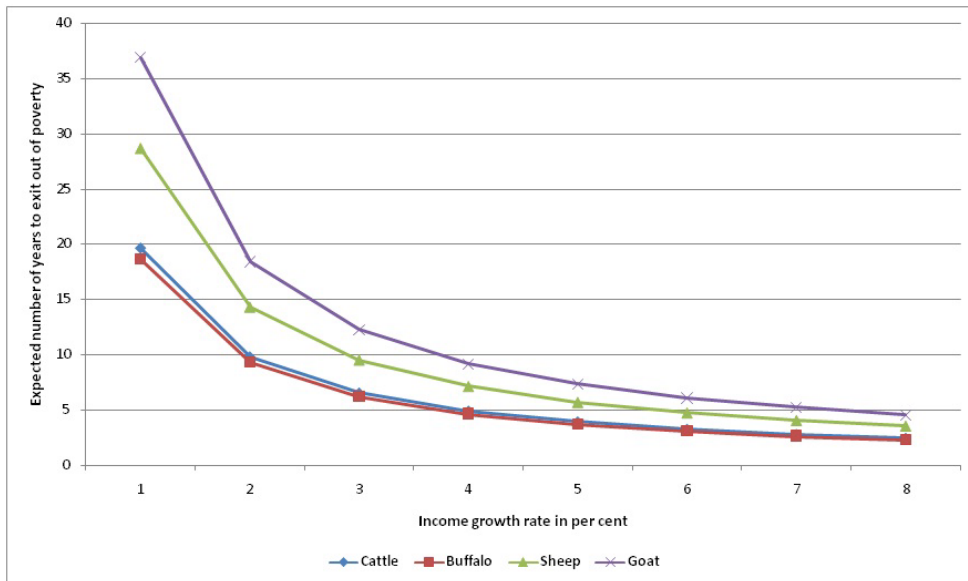


Figure 2: Expected exit time out of poverty at different growth rates of income among various livestock species

Up on setting the target period for poverty exit, suitable rural development programmes might be implemented among the rural poor, considering their income growth potential.

CONCLUSION

About 59 per cent of the total sample households and close to 56 per cent of sample population were found to stay below poverty line (Rs.1081.94 per capita per month). It is unfortunate to note that all the agricultural labourers were below poverty line. Following the agricultural labourers, the poverty indices were found to be high among crop cultivators, followed by livestock farmers and fishermen. Among various occupations, exclusive livestock farming required less time to exit out of poverty at different income growth rates. The results indicated that cattle and buffaloes has greater potential to quickly lift the poor above poverty line and hence these elements can be incorporated in any economic development and poverty alleviation programmes.

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