

# Incidence and Determinants of Poverty in Smallholder Dairy Sector in Sri Lanka

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## ABSTRACT

Dairy industry in Sri Lanka is dominated by smallholding farmers who operate at near subsistence levels. Low production in the sector is related with inherent poverty of individual producers. This study was carried out to assess the incidence, depth and severity of poverty and income inequality in terms of Head Count Index (HC), Poverty Gap Index (PG), Squared Poverty Gap Index (SPG) and Gini coefficient. Further, social, economic and technical factors that may have an impact on poverty were assessed. Primary data on household consumption expenditure gathered through a questionnaire survey were used to develop poverty and inequality measures using parameterized Lorenz curve. A binary logistic model was applied to analyse the factors that determine poverty in the sector.

The results revealed that, incidence, depth and severity of poverty among dairy small holders in Sri Lanka are extremely high, although the income inequality is quite low. Among the selected districts, dairy farmers in Nuwara eliya district show the highest level of poverty while dairy small holders in Monaragala district show the highest income inequality. Education level of farmers, owned land extent, daily milk yield and number of dependents in the farm family significantly affect poverty level of dairy small holders in Sri Lanka. Since the survival of the sector is depending upon the existence of small holders, an urgent action is needed to raise income level of smallholding dairy farmers.

**KEY WORDS:** Dairy industry, Income inequality, Poverty, Small holder

## INTRODUCTION

Milk production has been a traditional industry in Sri Lanka that has survived thousands of years. It is important not only because of the nutrition it provides, but also due to the extensive employment opportunities the industry offers. The local dairy industry has a tremendous potential to increase its contribution to economic growth, particularly the development of the rural economy. The growth rate of the local dairy industry over the last decade has been estimated at around 2.5 percent per annum, whilst the projected market growth rate of 5.2 percent (Bandara, 2002).

Dairy farming in Sri Lanka, predominantly a small holder mixed crop-livestock farming operation. Livestock activities in Sri Lanka are often considered as an integral part of small scale agricultural systems. Although many components come under livestock activities, dairying is the most important activity practiced by the average farmer of the country (Abegunawardane, 1991 cited in Rathnayake et al, 1991). In 2002, 70.6 percent of the total cattle and 43 percent of the total buffalo population was held by dairy small holders (Anon, 2002).

Dairying plays a vital role in maintaining sustainability and crop yields in most small holder mixed farming systems and has provided them with a source of regular daily income and a way of cushioning the risk of frequent crop and marketing failures (Bandara, 2002). Besides being a source of supplementary income and nutrition, the sector also provides draft power, fuel and organic manure.

The dairy sector in South Asian countries including Sri Lanka is mainly characterized by small

scale, poor, scattered milk producers and low productivity (Singh et al, 2002) Low productivity of milk animals is a serious constraint for dairy sector development. This is due to low genetic potential of milk animals, inadequate and inappropriate feeding and animal health care.

In the various production systems and less favorable climates of Asian countries, low production is related to the inherent poverty of individual producers (Singh et al, 2002). Poverty limits the farmers from use of high yielding but expensive breeds, appropriate feeding, animal health care and other management practices adequately. Average number of milk animals held by a small holder family in Sri Lanka is only 2-3. Improved dairy animals are being used for a certain extent by smallholders, but there is a serious problem in exploiting the genetic potential of them due to lack of good quality year around feed at farm level (Bandara, 2002). Therefore poverty can be a cause for low productivity in the smallholder dairy sector in the country. Being a primary reason for low productivity, poverty of smallholders limits the development of the sector.

Considering the present cost of living and cost of milk production, a minimum of 15 liters daily production is needed to earn a reasonable income from dairy farming at small holder level. However Majority of the small holders do not have minimum requirements to achieve this. On average a minimum of US\$ 500 of new investments is needed for each smallholder in this case, but this is beyond their capacity at present (Bandara, 2002). Nevertheless, the small holder dairy sector has high potential to be a dependable source of livelihood for a vast majority

of the rural poor in South Asian countries including Sri Lanka. It is viewed as a mean of alleviating poverty and improving the livelihood of small holders (Singh et al, 2002).

Although it is said that the dairy smallholder sector in Sri Lanka is characteristically poor, there is no detailed information available on status of poverty in the sector in both relative and absolute terms. Thus, this study aims to identify the level of poverty in dairy small holder sector in terms of incidence, depth and severity and income inequality. Further related social, economic and technical features that may have an impact on poverty in the smallholder dairy sector in Sri Lanka are identified.

## METHODOLOGY

### Data collection

Primary data was collected using a pre tested, structured questionnaire through a household survey in collaboration with Milco Private Limited, Narahenpita. The survey was conducted during the period July-August 2006 and covered eight dairy regions in Sri Lanka viz. Nuwara-Eliya, Kandy, Anuradhapura, Kurunegala, Colombo, southern, Uva and Monaragala. The sample consisted of 370 small holding dairy farmers selected by Multistage Probability Sampling technique.

### Data analysis

Household consumption expenditure data that was gathered by the pre tested questionnaire was used to develop poverty and inequality indicators viz. Head Count Index (HC), Poverty Gap Index (PG), Squared Poverty Gap Index (SPG) and Gini Coefficient (GINI).

These poverty and inequality measures were developed using parameterized Lorenz curve. The Lorenz curve can be given as,

$$L = L(p; \pi)$$

And the poverty measure can be stated as;

$$P = P(\mu / z, \pi)$$

Where, L denoted the share of bottom p percent of the population in aggregate consumption.  $\pi$  is the parameter to be estimated in the Lorenz curve, P is the poverty measure.  $\mu$  denotes the mean consumption while z represents the poverty line.

There are two major Lorenz curves estimated in literature namely, the Generalized Quadratic (GQ) model and the Beta Lorenz curve (Datt, 1998). Both models were estimated for each selected district and country as whole. Of these two models the best fitted model for each sub group was selected by comparing the sum of squared errors over the part of the Lorenz curve up to the head count index of poverty. The poverty and inequality measures for each group were assessed based on the results of the best fitted model for the relevant group. The models for GQ and Beta Lorenz curves are as follows.

### GQ Model

$$L(1-L) = a(P^2-L) + bL(P-1) + c(P-L)$$

### Beta Model

$$L(P) = P - \theta P^\gamma (1-P)^\delta$$

Where, P is the cumulative proportion of population and L is their share in aggregate consumption.  $\theta$ ,  $\gamma$  and  $\delta$  are parameters to be estimated in Beta Lorenz curve while a, b, and c are parameters to be estimated in GQ Lorenz curve.

Foster-Greer-Thorbecke (FGT) class of poverty measures has been used in this analysis as it is said to have some important properties such as additive decomposability (Datt, 1998).

This analysis was done using computer software POVCAL developed by World Bank Institution ([www.worldbank.org/html/prdph/lms/tools/povcl](http://www.worldbank.org/html/prdph/lms/tools/povcl)).

Social, economic and technical information gathered by the questionnaire was used to examine the factors that may have an impact on poverty in dairy small holder sector. Binary logistic regression model was fitted to find out relationship between poverty and social, economic, technical factors identified. Based on hypothesis the following empirical model was formulated to be tested.

$$Y = \beta_0 + \beta_1 * GEN + \beta_2 * AGE + \beta_3 * EDU + \beta_4 * DEP + \beta_5 * EXP + \beta_6 * HERD + \beta_7 * YIELD + \beta_8 * MGT + \beta_9 * LAND + \beta_{10} * TIMEOCCU$$

Where,

$$Y = \log \frac{P_L}{(1-P_L)}$$

$P_L$  = probability of living above poverty line

GEN = Gender of farmer

AGE = Age of farmer

EDU = Education level of the farmer

DEP = Number of dependents

EXP = Experience in dairy farming in years

HERD = Herd size

YIELD = Milk yield per day

LAND = owned land extent

MGTSYS = Type of management

TIMEOCCU = Time occupying on dairying

$\beta_0, \beta_{10}$  = parameters to be estimated

In this model dependent variable is a binary variable. Of the selected independent variables, gender of farmer, type of management, dairying as an occupation was treated as categorical variables, while others as continuous. Maximum likelihood estimation technique was used to estimate parameters.

## RESULTS AND DISCUSSION

### Poverty and Inequality

The estimated values of sum of squared error up to the head count index (SSEZ) of the two Lorenz curves of small holder dairy sector in Sri Lanka and each selected district is shown in Table 1. Smaller the

SSEZ value, better the fitness of the Lorenz curve specification. Therefore, the smallholder dairy sector in Sri Lanka as whole fits the Beta specification better. Anuradhapura, Gampaha, Kandy, Kurunegala and Monaragala districts also fit the Beta model better while Badulla, Galle and Nuwaraeliya fit the GQ specification better. Poverty and inequality measures for these groups are discussed based on the results of the best fitted model for the each.

**Table 1 - Estimated SSEZ of two Lorenz curves:**

	GQ Lorenz curve	Beta Lorenz curve
Sri Lanka	1.957955*10 <sup>-6</sup>	1.910188*10 <sup>-6</sup>
Anuradhapura	1.139776*10 <sup>-5</sup>	9.875653*10 <sup>-6</sup>
Badulla	2.046300*10 <sup>-6</sup>	1.054701*10 <sup>-5</sup>
Nuwaraeliya	1.329706*10 <sup>-5</sup>	8.511181*10 <sup>-5</sup>
Kurunegala	3.886455*10 <sup>-5</sup>	1.374450*10 <sup>-5</sup>
Kandy	5.967827*10 <sup>-6</sup>	5.234695*10 <sup>-6</sup>
Gampaha	3.544626*10 <sup>-7</sup>	2.571876*10 <sup>-7</sup>
Galle	2.648048*10 <sup>-7</sup>	3.093172*10 <sup>-7</sup>
Monaragala	7.843012*10 <sup>-6</sup>	2.371258*10 <sup>-6</sup>

HC of poverty captures the prevalence of poverty by measuring the proportion of population for whom consumption is below the poverty line. Table 2 implies that incidence of poverty estimated for small holding dairy farmers in Sri Lanka is higher than the national HC of poverty of 22.7 percent.

The sector also experiences higher PG over the figure of 5.1 percent which is the national figure. Higher PG implies higher depth of poverty in the sector based on the aggregate poverty deficit of the poor relative to the poverty line. The dairy small holder sector in Sri Lanka is also experiencing higher

**Table 2 – Estimated measures of poverty and Inequality:**

	Mean consumption (Rs./month/person)	HC (%)	PG (%)	SPG (%)	GINI(%)
Sri Lanka	2690	45.5891	12.7004	4.7497	31.0804
Anuradhapura	2964	36.9645	09.3751	3.2806	31.9120
Badulla	2480	43.0600	11.8105	4.5647	25.8862
Nuwaraeliya	2056	64.3672	20.0743	8.0354	26.1473
Kurunegala	3309	26.8206	05.7549	1.8552	32.1850
Kandy	2204	58.5490	16.3829	7.2125	26.0522
Gampaha	3163	34.5590	09.7947	3.6855	28.4735
Galle	3732	25.4028	07.9247	3.3634	30.1065
Monaragala	3266	29.3529	07.0970	3.0150	35.4352
Full time	2643	47.6939	13.2938	4.9240	31.3123
Part time	2727	43.0301	11.8577	4.3728	29.9835

severity of poverty in terms of Squared Poverty Gap index (SPG).

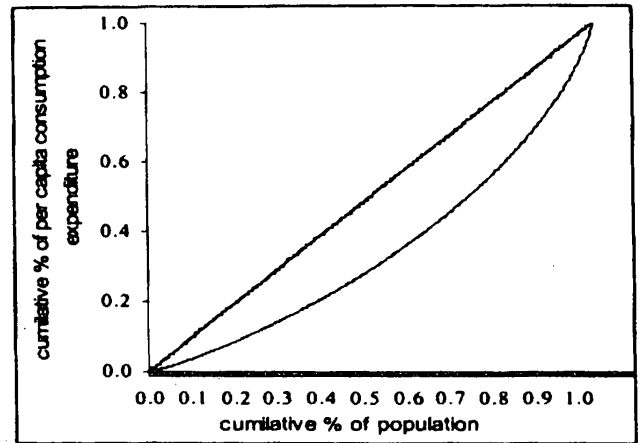
Inequality in consumption expenditure is indicated in terms of Gini Coefficient (GINI) which is considered as a fair proxy measure of relative poverty. It is interesting to note that GINI of small holder dairy sector in Sri Lanka is relatively low compared to national Gini coefficient figure of 0.47 (Table3).

**Table 3 - National figures for poverty measures:**

Poverty line (Rs./month/person)	HC (%)	PG (%)	GINI
2094	22.7	5.1	0.47

Source: Department of censuses and statistics

The estimated Lorenz curve for the smallholder dairy sector in Sri Lanka shown in Figure1 also implies the smaller Gini coefficient.



**Figure1 - Estimated Lorenz curve for smallholder dairy sector in Sri Lanka:**

Smaller the area between Lorenz curve and line of perfect equality, smaller the inequality in consumption. It means that, actual per capita consumption expenditure does not highly differ from

## POVERTY IN SMALLHOLDER DAIRY SECTOR IN SRI LANKA

the hypothetical distribution in which each person receives an identical share.

Dairy smallholders who engage in dairying as a full time occupation experience rather higher level of poverty in terms of higher Head count index, Poverty Gap index, Squared Poverty Gap index and higher Gini coefficient compared to part time occupying dairy farmers (Table 2).

Incidence of poverty (HC) and Depth of poverty (PG) measures estimated for each selected district are higher than the relevant national figures (Table3). Among the selected districts, Nuwara-eliya has the largest figure for incidence of poverty while Galle having the lowest figure. Highest Depth of Poverty (PG) and Severity of Poverty (SPG) also can be seen in Nuwara-eliya district while Kurunegala has the lowest figures for both indices.

Inequality in consumption expenditure is lower among dairy small holders in each district compared to national coefficient. However in Monaragala district, Gini coefficient is quite higher than other selected districts, whereas Kandy shows the lowest Gini Coefficient implying lowest inequality in distribution of per capita consumption expenditure.

### **Determinants of Poverty**

Parameter estimates of Binary Logistic Regression model show a change in log odd ratio for a unit change in relevant predictor variable (Table 4). Exponential values of estimates imply the predicted change in odd ratio which means, likelihood of living above poverty line relative to the likelihood of living below poverty line, for a unit change in predictor variable. The results show that, education level of farmer, time spent on dairying (whether full time or part time), owned land extant, milk yield per day and number of dependents in the household significantly affect on poverty status of dairy smallholder family.

The change in odd ratio for a unit change in predictor variable was transformed into instantaneous or marginal probabilities in Table 5. The result shows that when education level of the farmer goes up by one level, the probability of being non poor is increased by 15 percent. Although education level make positive influence on shifting out of poverty, a problem may arise with possibility of carrying on

dairy farming by high educated farmers who may most probably seeks for professional jobs rather than dairying. Reluctance of participating on dairy farming activities by educated young generation hints the problem obviously.

**Table 5 - Instantaneous/Marginal probabilities:**

Variable	Exponential B	Marginal Probability
AGE	0.996	-0.001
GEN	0.891	-0.029
EDU	1.851	0.150
EXP	1.012	0.003
TRIMEOCCU	0.602	-0.124
HERD	0.990	-0.002
MGTSYS	1.428	0.088
LAND	1.245	0.054
YIELD	1.085	0.020
DEP	0.535	-0.152

If the dairy smallholder shifts from part time occupying to full time occupying, he will have a risk to fall in poverty with 12 percent decline in probability of living above the poverty line. This may be the reason why most farmers try to engage in dairy farming as a part time activity rather than a full time activity. However if such other activity seems to be profitable than dairying, farmers may tend to abandon cattle rearing with its low profit margin at present.

Due to one acre increase in land extent owned by dairy farmer, and one liter increase in daily milk yield, probability of switching towards non poor level is augmented by 5.4 percent and 2 percent respectively. With the increase in land extent owned, farmer is capable of generating more income by using land for agricultural and non agricultural activities. In relation to dairying, feeding cost of roughages may decrease by using farmer's own land for grazing and grass cultivation purposes.

However cost of roughage feeding is negligible at household level dairy farming. Furthermore, with one more member increase in farm family probability of escaping from poverty is reduced by 1.5 percent, which means, higher the number of dependents, likelihood of being poor is rather higher.

**Table 4 - Results of Binary Logistic Regression analysis:**

Variable	Parameter estimate(B)	Exponential B	Standard error	Significance
AGE	-0.004	0.996	0.012	0.729
GEN	-0.116	0.891	0.282	0.681
EDU	0.616	1.851	0.170	0.000*
EXP	0.012	1.012	0.013	0.357
TRIMEOCCU	-0.508	0.602	0.250	0.042*
HERD	-0.010	0.990	0.012	0.401
MGTSYS	0.356	1.428	0.196	0.070
LAND	0.219	1.245	0.098	0.025*
YIELD	0.081	1.085	0.023	0.000*
DEP	-0.625	0.535	0.104	0.000*
Constant	0.174	1.190	0.941	0.853

\* Significant at 5%

Dairy smallholders in Nuwaraeliya district which shows highest incidence, depth and severity of poverty, have very low extent of land compared to other districts (Figure 2). Particularly they are landless estate workers whose average education level falls under the category of no schooling to year eight.

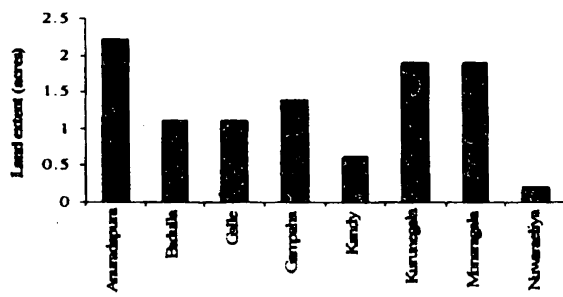


Figure 2 - Average land extent owned by dairy small holders in selected districts:

However, average milk yield in Nuwaraeliya district shows fairly higher figure (Figure 3), mainly because of the use of high yielding breeds, though herd is limited to one or two cattles. Highest milk yield can be seen in Kurunegala and Anuradhapura districts in which poverty among dairy smallholders is relatively low.

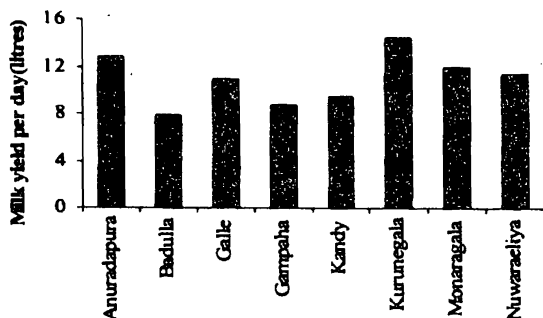


Figure 3 - Average milk yield per day in selected Districts:

### CONCLUSION

The results of the study revealed that the incidence, depth and severity of poverty in small holder dairy sector in Sri Lanka are extremely high although inequality in consumption expenditure is quite low. Dairy smallholders who engage in dairying as a full time occupation experience rather higher level of poverty. Dairy smallholders in Nuwara-eliya district are experiencing worst situation of poverty with highest incidence, depth and severity. Those in Monaragala district having comparatively higher income inequality, but it is also lower than the national Gini coefficient value.

Education level of dairy farmers, Time occupying in dairying, land extent owned, daily milk yield and number of dependents in household significantly affect the level of poverty among dairy small holders in Sri Lanka. Rather than occupying in

dairying as a full time occupation, switching towards part time occupying is more favorable to hinder poverty at household level. The farmers should be made aware to keep on dairy farming with well integrated, diversified agricultural systems with the view of directing to hinder poverty simultaneously with preventing abandoning of small holders from the sector.

Since increase in education level reduce the risk of falling in to poverty, it is needed to promote dairying as a self employment among educated young generation. Effective ways of increasing milk yield should be highly promoted within the country such as introducing use of high yielding breeds, awareness on proper feeding, breeding and animal health care.

The government has given priority for reaching self sufficiency in milk production simultaneously with promoting fresh milk consumption. However no adequate attention has been given to increase income levels of dairy small holders who dominate the sector in the country at present. Since the survival of the sector is contingent upon the small holders, prime concern should be given to raise the level of income of dairy small holders. Sufficient income can direct deprivations in terms of capabilities depending on a person's ability to convert income into well being.

### ACKNOWLEDGEMENTS

The authors wish to express their gratitude to all Regional managers, Assistant regional managers and Extension office staff of Milco (private) Limited, Colombo 5, Sri Lanka.

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