Micro-level determinants of poverty reduction in Sri Lanka: a multivariate approach

Indunil De Silva
Department of Economics, Texas Tech University, Lubbock, Texas, USA

Abstract

Purpose – The main purpose of this paper is to construct a poverty profile for Sri Lanka, and examine the micro-level determinants and correlates of poverty.

Design/methodology/approach – The study is based on the latest Sri Lanka Integrated Survey commissioned by the World Bank. The unconditional poverty profile was constructed using three different poverty measures (poverty headcount, average poverty gap and squared poverty gap), nested in the Foster-Greer-Thorbecke index. The conditional poverty profile was constructed on the basis of a multivariate analysis of poverty correlates. Partial correlates of poverty are computed using two comparable methodologies. First, a logistic regression was estimated, with the probability of a household being in poverty as the dependent variable and a set of economic and demographic variables as correlates. Second, the quantile regression approach was utilized to examine the correlates of per capita consumption at different points on the distribution.

Findings – The empirical findings are broadly encouraging. The estimation results show that the education of the household head, being salary employed and being engaged in business have a significant positive effect on the standard of living. The probability of being poor increases with the household size, household head being female, living in a rural area, and being a casual wage earner. These findings indicate the importance of a set of policies which are super pro-poor, namely increasing school enrolment and achievement, effective family planning programs to reduce the birth rate and dependency load within households, and granting priorities for specific cohorts (children-, elderly-, rural- and female-headed households) in targeted interventions.

Originality/value – This is the first study that examines the probable determinants and correlates of Sri Lankan poverty in a multivariate framework employing both logit and quantile regressions.

Keywords Poverty, Regression analysis, Sri Lanka

Paper type Research paper

Introduction

Notwithstanding its achievements in human development, poverty in Sri Lanka is still a pervasive phenomenon. According to the World Bank (2002):

> … Sri Lanka's success in reducing income poverty is less noteworthy, especially when contrasted with that of East Asian countries that were at comparable levels of development only a few decades ago.

During the past decade, there has been a renewed sense of urgency for poverty reduction strategies in Sri Lanka by the government, non-governmental organizations and international donors. The design of effective poverty reduction strategies requires the knowledge of who are the poor, where they live and what their socio-economic profile is. Ideally, policy makers and program designers would like to know:

- the income generating activities of the poor (e.g. whether they are self employed, earning wages, traders, microentrepreneurs, etc.);

International Journal of Social Economics
Vol. 35 No. 3, 2008
pp. 140-158

0306-8293
DOI 10.1108/03068290810847833

- to what degree do the poor have access to services and infrastructure (e.g. piped water electricity sanitation facilities, etc.); and
- housing conditions (e.g. owns a house, lives in a shanty or line room, etc.).

The current paper zeroes on this aspect, with the objective of identifying the poor using a micro-econometric approach. The specific questions addressed in this paper are: firstly, is poverty more prevalent among female-headed households than among male-headed households? Typically in developing countries feminization of poverty occurs mainly due to women being relatively less educated and also as a result of discrimination in the labor market. Grootaert and Braithwaite (1998), finds that female-headed households have a higher probability of being in poverty than their male-headed counterparts. On the other hand, Székely (1998) found no evidence claiming that female-headed households are more likely to be in poverty. The second question examined is that whether and what levels of education contributes positively to higher living standards? Findings of Schultz (1988) and Psacharopoulous (1985) indicate that there is a positive relationship between education and higher earnings. The third major question addressed is whether households in rural and estate (plantation) sectors face a higher probability being in poverty. There is a vast amount of literature demonstrating that poverty is a predominantly rural phenomena in developing countries, World Bank (1990). The final key question examined is whether the occupation of the household head shows a significant association with the likelihood of being in poverty. More specifically, an examination of how living standards vary across households in salaried employment, casual wage and business.

Data and methodology

The study is based on the latest Sri Lanka Integrated Survey (SLIS), commissioned by the World Bank in 2000. The survey is nationally representative and consists of 7,500 households and a 34,330 individual population. The SLIS is unique in the sense that it is the first integrated survey that covered the entire island. The survey collects information on a broad range of topics including demographic characteristics, household income and expenditure, literacy and education, household amenities and employment.

The single monetary indicator of household welfare (or living standard) used is real per-capita consumption[1]. Although the survey collects information on both household income and consumption, consumption rather than income is used as the welfare indicator due to many reasons. Firstly, there is a relatively high rate of under-reporting of income which biases reported household aggregate income. Secondly, consumption captures welfare achievement more precisely then income, since the latter is a more appropriate measure of welfare opportunity. In other words, consumption is a better outcome indicator then income. Furthermore, income tends to fluctuate more than consumption, especially in agrarian economies according to the harvest cycle. Throughout the paper, I use four poverty lines; Rs. 1,206 (national), Rs. 1,391 (urban), Rs. 1,189 (rural), and Rs. 1,067 (estate), estimated by Siddhisena and Jayathilaka (2004)[2].

Unconditional poverty profile: cross tabulations

Poverty is frequently considered as the defining characteristic of underdevelopment and its reduction is the ultimate goal of development policy. To reduce poverty, policy

makers first need to know the incidence, depth and severity of poverty. Three different poverty measures nested in the Foster-Greer-Thorbecke (FGT) class were utilized to capture the different dimensions of poverty. The FGT indices combines income and the poverty line into poverty gaps, and aggregate these gaps to evaluate the extent of poverty. The FGT poverty index can be expressed as:

$$P(z;\alpha) = \int_0^1 [z - Q^*(p:z)]^\alpha \mathrm{d}p$$

Incomes censored at the poverty line z, is given by $Q^*(p:z)$. Thus, the poverty gap at percentile p is $g(p;z) = z - Q^*(p:z)$. When $\alpha = 0$, the FGT index reduces to the simple headcount poverty measure. Poverty headcount is the share of population with incomes falling below the poverty line. Using the poverty lines and per capita consumption levels, the poverty headcount figures show that 25.2 percent of the Sri Lankan population are in poverty (Table I). Furthermore, the highest incidence of poverty is in the estate sector followed by the rural and urban sectors. However, looking only at the percentage of people falling below the poverty may gloss over some vital variation in the depth and severity of poverty in different sectors. The depth in poverty across the three sectors was captured using the poverty gap index. The average poverty gap, $P(z;\ \alpha = 1)$, is the average extra consumption that would be required to bring each poor household up to the poverty line. The second column in Table I, presents the normalized average poverty gap estimates. The national unnormalized average poverty gap (derived from the normalized average poverty in Table I)[3] was Rs. 69.95. After extrapolating the poverty gap of the survey population to that of the nation, the total annual poverty gap in Sri Lanka was estimated at Rs. 315 million. However, in reality this figure will be much higher after accounting for targeting inefficiencies and administration costs in poverty reduction programs. Furthermore, in practice closing the total gap solely through income transfers is not feasible. A more prudent way is through poverty reduction programs that raise the income of the poor via income generating activities. Both the headcount index and the poverty gap violates the transfer principle since they are insensitive to transfers among the poor. To overcome this shortcoming, the squared poverty gap was used to depict the severity of poverty. The squared poverty gap, $P(z;\ \alpha = 2)$, applies more weight on the poverty gaps of those households whose consumption fall further below the poverty line and takes into account the inequality of the poor. According to Table I, the estate sector has the worst situation, with a poverty incidence of 28 percent and an average poverty gap of almost 7 percent. The remaining two measures (poverty gap and squared poverty gap) also indicate that the highest level of poverty is in the estate sector followed by the rural and urban sectors.

Poverty profile cross tabulations with respect to the characteristics of the household, housing and access to services are also summarized in Table I. Firstly, it is important to explore the age and gender dimensions of poverty. Since, household characteristics such as age and gender are easily observable, they serve as important targeting variables. Results show that the incidence, depth and severity of poverty varies significantly with respect to the gender of the household head. Female-headed households are 6 percent more likely to be in poverty compared to male-headed households. Since, this analysis is based solely on the headship of, it might be also be reasonable to believe that the "average welfare" of women is much more lower than

	$\alpha = 0$	$\alpha = 1$	$\alpha = 2$		$\alpha = 0$	$\alpha = 1$	$\alpha = 2$
Sri Lanka	0.252	0.058	0.021	Number of men (17-60 years)			
Urban	0.207	0.054	0.020	1	0.235	0.051	0.017
Rural	0.257	0.059	0.021	2	0.252	0.058	0.020
Estate	0.281	0.067	0.025	3	0.308	0.077	0.030
Characteristics of the head				4	0.347	0.086	0.030
Male	0.242	0.054	0.019	Number of women (17-60 years)			
Female	0.302	0.078	0.031	1	0.237	0.052	0.018
Age ≤29 years	0.224	0.043	0.013	2	0.259	0.059	0.020
Age: 30-59 years	0.248	0.056	0.019	3	0.319	0.077	0.030
Age ≥60	0.270	0.066	0.026	4	0.351	0.091	0.037
Education				Number of elders			
No schooling	0.426	0.116	0.048	1	0.263	0.062	0.024
(primary.edu)	0.336	0.079	0.029	2	0.278	0.069	0.025
(secondary.edu)	0.196	0.041	0.013	3	0.269	0.117	0.054
(tertiary.edu)	0.052	0.008	0.003	*Employment*			
Household size				Salary	0.101	0.018	0.007
0-2	0.143	0.038	0.018	Casual wage	0.376	0.093	0.035
3-4	0.178	0.036	0.012	Business	0.139	0.027	0.009
				Receiving (or entitled) for			
4 +	0.342	0.082	0.030	pension income	0.216	0.052	0.020
Number of children				Not receiving (or not entitled) for			
(0-6 years)				pension income	0.261	0.060	0.022
1	0.296	0.066	0.023	*Housing tenure and type*			
2	0.389	0.097	0.036	Owned by household head	0.234	0.052	0.018
3	0.508	0.136	0.048	Not owned by household head	0.312	0.077	0.029
4	0.800	0.234	0.074	Single house	0.241	0.053	0.019
Number of children							
(7-16 years)				Annexe	0.250	0.117	0.058
1	0.226	0.050	0.017	Shanty or line room	0.550	0.161	0.067
2	0.304	0.068	0.024	*Main source of lighting*			
3	0.407	0.097	0.035	Electricity	0.173	0.036	0.012
4	0.444	0.122	0.048	Kerosene	0.366	0.088	0.032
				Main fuel used for cooking			
				Gas	0.022	0.004	0.002
				Firewood or sawdust	0.284	0.065	0.023

Table I.
Unconditional poverty profile (cross tabulations)

men after accounting for gender wage gaps in the labor marker and/or intra-household distribution of resources[4]. The age of the household does not seem to be significant correlate of poverty. In Table I, increase in the poverty incidence with age is negligible. This fact is proven to a further extent in the conditional poverty profile (based on logit regression) discussed in the next section, which reveals that the marginal effect of age on poverty is statistically insignificant after controlling for other factors such as education and household size.

One of the most significant and extremely pronounced negative correlates of poverty is the level of education of the household. According to Table I, poverty declines monotonically with years of education. Households with no schooling has a 43 percent probability of being in poverty, while a household with tertiary education has only a 5 percent chance of being in poverty.

Another important correlate of poverty is the household size. As indicated in Table I, households consisting of four or more persons being in poverty on average is more than twice, compared to a household with one or two members. Even after the household size was disaggregated into different sub-groups (number of children, women, men and elders), the size of each group shows a positive relationship with poverty incidence. The correlation is strongest with the number children, where households with three or more children have a poverty incidence of more than double the national rate. Furthermore, for households with children in the age group of 0-6 years have a higher probability of being in poverty than households with the same number of children aged 7-16 years. Similarly if one considers two households with the same number of men and women, the one consisting of men has a lower poverty incidence than the household with women. This shows again that gender is critical factor with respect to poverty.

As regards employment status, households with salaried employment have the lowest headcount, compared to the ones in business (including trade and manufacture) and in casual labor (wage). Households engaged in casual labor have 38 percent probability of being below the poverty line, while the salary employed households have a ten percent probability. Furthermore, results indicate that household heads with retirement benefits are less likely to be in poverty than ones without.

The poverty profile with respect to housing characteristics and access to services need to analyzed cautiously, since it reveals only the association between variables and not casual relationships. According to Table I, houses with electricity as the main source of lighting has a 17 percent poverty incidence, while houses using kerosene as the main source of lighting have a poverty incidence of 37 percent. Poverty incidence is also high for houses which uses firewood or sawdust as fuel for cooking than houses using gas. Households living in shanties and line rooms have a poverty incidence twice as much as households in single houses.

An insightful way to depict the incidence, intensity and inequality of poverty is through cumulative poverty gap (CPG) curves or TIP-curves[5] shown in Figure 1. The CPG curve aggregates the average poverty gaps of the bottom p percentiles of the population and is expressed as:

$$G(p : z) = \int_0^p g(q : z)\mathrm{d}q.$$

The poverty gap $g(p: z)$, at a given value of p is given by the slope of $G(p: z)$. The average poverty gap equals the CPG at $p = 1$. Figure 1 shows that when $p = 1$, that the unnormalized average poverty gap are Rs. 75.11, 70.15 and 71.5 for the urban, rural and estate sectors, respectively. The percentile at which the CPG curve becomes horizontal indicates the poverty headcount. For the urban sector, the percentile in which the CPG curve becomes horizontal is 0.207, implying that 20.7 percent of urban household are in poverty. Similarly, in the rural sector 25.7 percent and in the estate sector 28.1 percent of the households are in poverty. Furthermore, the inequality dimension among the poor is captured by the degree of concavity in the non-horizontal section of the CPG curve. Thus, if income among the poor were equal or if the poverty gaps were the same the non-horizontal section in Figure 1 would be a straight line. According to Figure 1, among the bottom $p = 0.25$ proportion of the population the highest level of inequality is found in the urban sector followed by the rural and estate sectors.

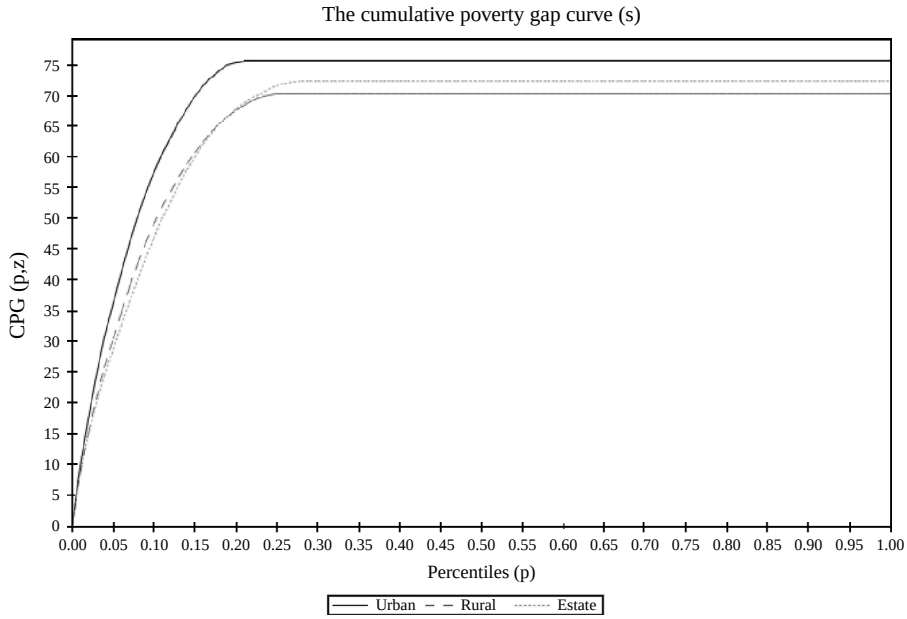

Figure 1.
Cumulative poverty gap curves

Household level consumption inequality across sectors was measured using Lorenz curves and Gini indices. Lorenz curve plots the cumulative percentages of total consumption against the cumulative percentage of households, starting with the poorest household. Lorenz curve can be defined as:

$$L(p) = \frac{\int_0^p Q(q)\mathrm{d}q}{\int_0^1 Q(q)\mathrm{d}q} = \frac{1}{\mu}\int_0^p Q(q)\mathrm{d}q$$

The numerator is the sum of income of the bottom percentile, p. The denominator sums the income of all households. When the size of the population is normalized to one, the denominator can be viewed as the average income μ. Figure 2 shows the Lorenz curves for the three sectors (urban, rural and estate), when $p = 0.25$. From the graph it is evident that the highest level of consumption inequality is in the urban sector followed by rural and estate. In other words, the consumption in the estate sector is more egalitarian than in the rural and urban sector since the poorest people in the estate sector receive a share superior to that of their equivalents in the rural and urban sectors. Furthermore, the Lorenz curve for the estate sector can viewed as having been obtained from rural or urban Lorenz curves through a series of equalizing Pigou-Dalton transfers[6]. When $p = 0.5$ the sectorial estimates for urban, rural and estate are $L(p) = 0.256$, $L(p) = 0.308$ and $L(p) = 0.336$, respectively. These values can be interpreted, for instance in the urban sector as the poorest 50 percent households holding 25.6 percent of the total consumption in the total population.

The ratio between the area enclosed by the line of equality and the Lorenz curve can be summarized by the Gini coefficient. The Gini index can be expressed as:

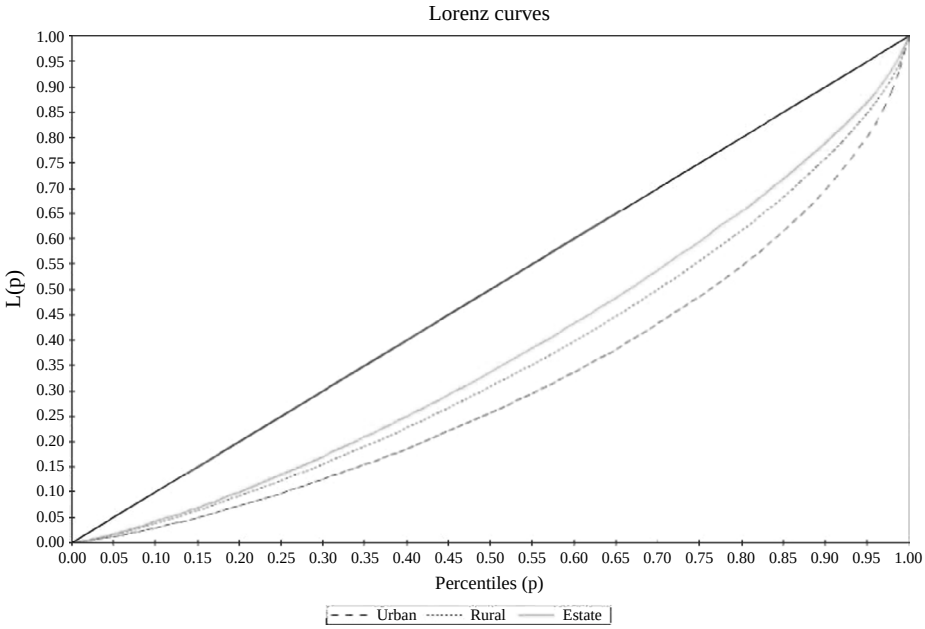

Figure 2.
Lorenz curves

$$\text{Gini index of inequality} = 2\int_0^1 (p - L(p))\mathrm{d}p$$

One of this implicit assumptions in the Lorenz curve is that the distance, $p - L(p)$, from the line of perfect equality in consumption is weighted equally across percentiles, p. A more general version is the class of S-Gini (single parameter Gini) inequality indices which applies percentile dependent weights to the distance $p = L(p)$. The S-Gini inequality indices can be expressed as:

$$I(\rho) = \int_0^1 (p - L(p))\kappa(p :)\mathrm{d}p$$

where, $\kappa(p : \rho)$ are percentile dependent weights expressed as:

$$\kappa(p : \rho) = \rho(\rho - 1)(1 - P)^{(\rho - 2)}$$

Larger the value of ρ, larger will be the weight placed on the inequality of the bottom percentile (or the poorest people). Therefore, larger the value of ρ, greater will be the ethical concern felt for the poor by the social decision maker. Note, when $\rho = 2$, we have the standard Gini index which gives equal weight to all percentiles, p. An alternative inequality measure that explicitly incorporate normative judgments about the social welfare is the Atkinson index. The Atkinson inequality index is based on an additive social welfare function[7] and is expressed as:

$$I(\varepsilon) = \begin{cases} 1 - \dfrac{\left(\int_0^1 Q(p)^{(1-\varepsilon)}\mathrm{d}p\right)^{1/1-\varepsilon}}{\mu}, & \text{when } \varepsilon \neq 1 \\ 1 - \dfrac{\exp\left(\int_0^1 \ln(Q(p)\mathrm{d}p)\right)}{\mu}, & \text{when } \varepsilon = 1 \end{cases}$$

$Q(p)$ is the standard of living of the individual whose rank or percentile in the distribution is p. The parameter ε reflects the strength of society's preference for equality and is bounded by zero and infinity. When $\varepsilon = 0$ an increase in a poor individual's income has the same effect on social welfare as increasing the income of a rich individual by the same amount. However, when $\varepsilon > 0$ increasing the income of a poor individual is socially more enviable than increasing the income of a rich individual.

Table II reports the Gini coefficients (when ρ, is equal to 1.5, 2.0, and 2.5) and Atkinson measures (when ε, equal to 0.5, 1.0, and 2.0) for the urban, rural and estate sectors. According to both the Atkinson and the standard Gini index (when $\rho = 2$), the highest degree of inequality is in the urban sector followed by the rural and estate sector.

Conditional poverty profile: marginal effects

Although, there are numerous studies on the measurement of poverty in Sri Lanka, literature on the determinants and correlates of poverty in a multivariate framework is best at scanty. Siddhisena and Jayathilaka (2004), looked at the composition of the poor according to several demographic and socio-economic characteristics on a one-to-one basis (bivariate analysis). The primary drawback of unconditional bivariate analysis is that it often erroneously oversimplifies complex relationships. For an example, if poverty is higher in rural area, it is not clear if the observed relationship should be attributed to rural areas *per se*, or to some factor that is correlated with rural areas such as low-educational attainment. Bivariate unconditional poverty profiles is useful to a certain extent in the case of geographical targeting, but multivariate conditional poverty profiles are highly desirable for evaluating proposed policy interventions.

The primary objective of this section is to assess the relative importance of various correlates of poverty, and where possible attribute causality to them. Conditional poverty profile is constructed on the basis of a multivariate analysis of poverty correlates. Partial correlates of poverty are computed using two comparable methodologies. Firstly, a logistic regression was estimated, with the probability of a household being in poverty as the dependent variable and a set of economic and demographic variables as correlates. The response variable is a dummy defines as:

$$\mathrm{POV} = \begin{cases} 1, & \text{if the household is below the poverty line} \\ 0, & \text{if otherwise} \end{cases}$$

	S-Gini index			Atkinson index		
	$p = 1.5$	$p = 2$	$p = 2.5$	$\varepsilon = 0.5$	$\varepsilon = 1.0$	$\varepsilon = 2.0$
Urban	0.260	0.375	0.438	0.116	0.213	0.817
Rural	0.197	0.288	0.345	0.072	0.138	0.716
Estate	0.162	0.243	0.296	0.052	0.101	0.222

Table II. Inequality estimates

and:

$$\Pr\langle \mathrm{POV} = 1|\mathbf{X}\rangle = F(\mathbf{X}, \beta)$$

$$\Pr\langle \mathrm{POV} = 0|\mathbf{X}\rangle = 1 - F(\mathbf{X}, \beta)$$

where $\mathbf{X}$ is the vector of economic and demographic variables. β is the set of parameters reflecting the impact of changes in $\mathbf{X}$ on the probability. The vector of economic and demographic variables ($\mathbf{X}$) that are hypothesized to determine consumption and hence poverty can be categorized under, demographic, education, employment, region and dwelling characteristics. The demographic data include household size disaggregated by age and sex: number of children 0-6 years, number of children 7-16 years, number of women 17-60 years, number of men 17-60 years and number of elderly 60 + years. In regressions, a quadratic term in household size is included to capture the nonlinearities in the relationship between household size and living standards. Based on the findings of other developing country studies, (Lanjouw and Ravallion, 1995; Deaton and Paxton, 1998), the expectation is a positive relationship between household size and the probability being in poverty (or a negative relationship between household size and total consumption per capita). The level of educational attainment was measured on three different levels, based on the assumption that human capital (as measured by education) contributes negatively to the probability of being in poverty. The three different levels that was used to measure the maximum level of education attained by the household head are: primary education (studying in year 1-passed year 6), secondary education (passed year 7-GCE O/L), and tertiary education (beyond GCE O/L). In the employment category four variables were used: household head is engaged in casual labor, household head is in salaried employment, if any member of the household receives or entitled to receive pension income (EPF or ETF), and whether the household head is engaged in business (including trade and manufacturing). Four variables were selected to reflect the housing characteristics and access to services: ownership of the dwelling tenure, type of housing, main source of lighting utilized for dwelling and main type of fuel used for cooking. And finally, regional heterogeneity was controlled by allowing for the sector and province in which the household resides. Variable definitions and means are provided in the Appendix.

From the stand point of econometric purity, the set of independent variables used in this study are fairly generous and the argument for exogenity is stronger especially in a short time horizon model. As the time horizon gets longer, most of the economic variables at the household level become endogenous. Except for a few variables (such as gender and age), all other variables end up being a function of the household welfare level to some extent. Even though the ideal solution is instrumental variable technique, reasonable instruments were not available in the survey data. Therefore, special care must be taken when interpreting coefficients, since the regressions will only return results for the degree of association or correlation and not for casual relationships. The probability model is the regression:

$$\mathrm{E}\langle \mathrm{POV}|\mathbf{X}\rangle = 0[1 - F(\mathbf{X}'\beta)] + 1[F(\mathbf{X}'\beta)] = F(\mathbf{X}'\beta)$$

Based on the logistic distribution:

$$\Pr\langle \mathrm{POV} = 1|\mathbf{X}\rangle = \frac{e^{\mathbf{X}'\beta}}{1 + e^{\mathbf{X}'\beta}}$$

Table III presents the parameter estimates for the logistic regression. The column, dy/dx is the marginal effect of a change in a specific element of $\mathbf{X}$ on the probability of being poor.

Since, almost all the variables (except for age, age SQR, urbundum, south and nwest) in the model have estimated parameters significantly different from zero, the model does point at a sharply defined set of potentially useful targeting variables in the context of policy intervention to alleviate poverty. Firstly, there is a significant positive and concave relationship between household size and being in poverty. All five

Independent variable	dy/dx (marginal effects)	z-value
Children (1)	0.126	11.44
Children (2)	0.089	9.55
Men	0.073	7.18
Women	0.082	8.02
Elders	0.089	6.72
HsizeSQR	−0.002	−3.70
Age	−0.003	−1.38
Age SQR	0.000	1.52
Female head	0.068	5.47
Rural	0.105	4.24
Urban	0.031	1.18
Primary.edu	−0.035	−2.40
Secondary.edu	−0.085	−5.37
Tertiary.edu	−0.217	−7.36
Salary	−0.068	−3.79
Casual wage	0.055	4.92
Business	−0.123	−8.04
NoRetBenifit	0.059	4.44
ShantyLineR	0.174	−11.12
HHnotowningHouse	0.024	2.18
Electricity	−0.113	−11.12
Firewood	0.198	8.73
South	0.031	1.83
North	−0.262	−12.11
East	−0.095	−5.21
Uva	−0.067	−3.17
Sabara	0.043	2.31
Central	0.111	6.38
Nwest	−0.022	−1.19
Ncentral	−0.132	−5.94
$N = 7{,}481$	Pseudo $R^2 = 0.225$	
$\Pr > \mathbf{X}^2 = 0.000$	Loglikelihood = −3,274.5261	

Notes: (1) Dependent variable: $\mathrm{POV} = \left\{ \begin{array}{ll} 1, & \text{if the household is below the poverty line} \\ 0, & \text{if otherwise} \end{array} \right\}$;
(2) poverty line = Rs.1,206; (3) variable definitions and means are given in the Appendix

Table III.
Logit regression estimates

variables measuring the household size, disaggregated by age and sex are positive and highly significant. In developing countries, due to low savings and underdeveloped social security systems, fertility rates among the poor are high, since parents receive some economic support from children once they reach old age. Being consistent with the bivariate unconditional poverty profile, the number of children in the age group of 0-6 years has the strongest positive correlation with poverty. After controlling for other factors, age of the household head does not have a significant effect on the probability of being in poverty. This finding is not surprising, since the unconditional poverty profile also indicated that age to be weak correlate of poverty. However, even after controlling for other factors, the gender of the household head is a significant correlate of poverty.

According to Table III, the probability of being in poverty declines monotonically with years of education. All three educational level variables are statistically significant and have the expected negative association with poverty. Tertiary education has the largest impact on poverty (followed by secondary and primary), reflecting the fact that education increases the stock human capital, which in turn increases labor productivity, earnings and consumption. Turning then to the marginal effects of employment-related variables, the findings are policy-wise imperative. Firstly, household heads working as casual laborers increases the probability of being in poverty, while working in a salaried occupation decreases the probability of being in poverty. This fact is not surprising, since occupations which requires low amount of human capital (casual wage jobs) will be associated with low earnings and thereby increases the likelihood of being below the poverty line. Furthermore, the results indicate that the probability of being poor is significantly lower for household heads engaged in business (including trade and manufacturing). Finally, with respect to employment benefits, households with members receiving or entitled to receive EPF or ETF are less likely to be in poverty than those who are not receiving or entitled to receive pension income.

The unconditional poverty profile revealed earlier that the highest incidence of poverty is in the estate sector followed by the rural and urban sectors. According to the multivariate poverty regression, still living in the rural sector significantly increases the probability of being in poverty. But, after controlling for other factors, urban and estate sector dummies turns out as insignificant correlates of poverty. For any permutation of sector dummies included in the poverty regression, urban and estate sector dummies remained statistically insignificant all the time, while the rural sector dummy was positive and significant. The finding suggests two salient features about poverty in Sri Lanka. Firstly, the high incidence of poverty in the estate sector should not be attributed to the estate sector *per se*, but for some other factor[s] (such as low-educational attainment), that might be correlated with the estate sector. Secondly, poverty in Sri Lanka is certainly a rural phenomenon, that needs to be explained by many other factors, which deserves continuing attention and scrutiny.

The estimated coefficients the dwelling tenure and type of housing are both statistically significant and positive. There is a positive correlation between poverty and households not owning their house, living in a shanty room or line room. The marginal effects are strongest for the ones living in shanty and line rooms – both in terms of the magnitude of the coefficient and statistical significance. Ownership of a house is important, especially in rural areas, since it provides the location for a household enterprise and also acts as a collateral for a loan. The two variables used to

capture a household's access to services are also statistically significant and have plausible signs. Firstly, there is a negative correlation between households using electricity (as the main source of lighting) and the probability of being in poverty. Secondly, households using firewood or sawdust as the main fuel for cooking has a positive association with poverty. It is important to note here that the caveat about interpreting the estimated coefficients as partial correlation coefficients is particularly important, since the direction of causation is most certainly from poverty to variables related to housing and access to services.

As a robustness check, it is important to note here that the results of the multivariate poverty regression had corroborated with the findings of the bivariate unconditional poverty profile in the preceding section. Substantively, the pattern of the partial correlates of poverty in the poverty regression is entirely consistent with the pattern of correlates that was revealed by the bivariate poverty profile. All factors which are correlated with an increase (decrease) in the poverty headcount are correlated with an increase (decrease) in probability to be poor.

Next, the quantile regression (Koenker and Bassett, 1978) approach was utilized to examine the correlates of per capita consumption at different points on the distribution. The most appealing feature of quantile regression is that it does not impose constant parameters over the entire distribution. It assumes the effect of economic and demographic characteristics of the ith household to differ across the welfare spectrum. The quantile regression model can be expressed as:

$$y_i = x_i'\beta_\tau + \mu_{i,\tau}$$

Where y_i is the log of per capita consumption of the ith household, and x_i represents the economic- and demographic-characteristics of the ith household. By imposing the assumption that the τ-th quantile of the error term conditional on the regressors is zero, $(Q_\tau(u_{i,\tau}|x_i) = 0)$, the τ-th conditional quantile of y_i with respect to x_i can be expressed as:

$$Q_\tau(y_i|x_i)x_i'\beta_\tau$$

For any $\varepsilon \in (0,1)$, the parameter β_τ can be estimated by:

$$\hat{\beta}_\tau = \arg\min_{\beta_{\tau \in R^k}} \left\{ \sum_{i \in \{i|y_i \geq x_i'\beta_\tau\}} \tau|y_i - x_i'\beta| + \sum_{i \in \{i|y_i \geq x_i'\beta_\tau\}} (1-\tau)|y_i - x_i'\beta| \right\}$$

Note, that when $\tau = 0.5$, we have the special case known as the median regression or the least absolute deviation estimator. Five quantile regressions were estimated at the 10, 25, 50, 75 and 90th quantiles. The standard errors were computed by bootstrapping with 100 replications. OLS regression was also estimated for the purpose of comparison. Table IV reports the results of the OLS and quantile regressions.

Firstly, at all quantiles estimated on the conditional expenditure distribution, household size is inversely related with the standard of living as measured by consumption. All five variables measuring the household size, disaggregated by age and gender are highly significant at all estimated quantiles. Furthermore, additional children have a much larger effect on per capita expenditure than adults. These results reconfirm the earlier findings of both the unconditional poverty profile and the

Independent variable	Quantile 0.1	0.25	0.5	0.75	0.9	OLS
Constant	3.19 (0.065)	3.366 (0.043)	3.473 (0.039)	3.591 (0.040)	3.698 (0.056)	3.431 (0.036)
Children(1)	−0.087 (0.009)	−0.095 (0.006)	−0.106 (0.006)	−0.114 (0.007)	−0.113 (0.009)	−0.097 (0.005)
Children(2)	−0.065 (0.008)	−0.074 (0.006)	−0.078 (0.005)	−0.085 (0.007)	−0.089 (0.008)	−0.074 (0.004)
Men	−0.06 (0.007)	−0.072 (0.006)	−0.075 (0.006)	−0.079 (0.008)	−0.079 (0.010)	−0.069 (0.005)
Women	−0.062 (0.009)	−0.073 (0.006)	−0.078 (0.005)	−0.088 (0.007)	−0.086 (0.009)	−0.069 (0.005)
Elders	−0.064 (0.010)	−0.070 (0.008)	−0.066 (0.007)	−0.078 (0.010)	−0.066 (0.012)	−0.063 (0.006)
HsizeSQR	0.003 (0.000)	0.004 (0.000)	0.004 (0.000)	0.004 (0.001)	0.004 (0.001)	0.003 (0.000)
Age	0.007 (0.002)	0.006 (0.002)	0.005 (0.001)	0.004 (0.001)	0.005 (0.002)	0.006 (0.001)
AgeSQR	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
FemaleHead	−0.042 (0.009)	−0.04 (0.007)	−0.043 (0.008)	−0.033 (0.009)	−0.015 (0.0012)	−0.037 (0.006)
Rural	−0.068 (0.023)	−0.008 (0.016)	−0.057 (0.015)	−0.028 (0.013)	−0.021 (0.029)	−0.056 (0.013)
Urban	−0.025 (0.023)	−0.029 (0.016)	0.007 (0.015)	0.042 (0.015)	0.081 (0.030)	0.013 (0.014)
Primary.edu	0.020 (0.015)	0.021 (0.009)	0.025 (0.008)	0.027 (0.009)	0.028 (0.001)	0.031 (0.008)
Secondary.edu	0.068 (0.016)	0.056 (0.011)	0.058 (0.009)	0.062 (0.008)	0.075 (0.015)	0.072 (0.009)
Tertiary.edu	0.142 (0.019)	0.139 (0.013)	0.164 (0.014)	0.181 (0.016)	0.221 (0.021)	0.179 (0.011)
Salary	0.035 (0.110)	0.024 (0.007)	0.012 (0.006)	−0.002 (0.009)	−0.025 (0.012)	0.007 (0.007)
Casual Wage	−0.017 (0.010)	−0.026 (0.006)	−0.033 (0.006)	−0.042 (0.007)	−0.069 (0.010)	−0.044 (0.006)
Business	0.080 (0.012)	0.008 (0.009)	0.078 (0.007)	0.078 (0.009)	0.089 (0.015)	0.081 (0.006)
NoRetBenifit	−0.037 (0.010)	−0.039 (0.007)	−0.029 (0.007)	−0.016 (0.007)	−0.009 (0.011)	−0.031 (0.006)
ShantyLineR	−0.144 (0.027)	−0.119 (0.019)	−0.087 (0.014)	−0.062 (0.014)	−0.059 (0.027)	−0.110 (0.013)
HHnotowningHouse	−0.028 (0.009)	−0.022 (0.007)	−0.015 (0.006)	−0.019 (0.006)	−0.037 (0.010)	−0.029 (0.005)
Electricity	0.078 (0.008)	0.066 (0.006)	0.060 (0.005)	0.065 (0.007)	0.059 (0.009)	0.069 (0.005)
Firewood	−0.125 (0.013)	−0.138 (0.008)	−0.159 (0.008)	−0.173 (0.011)	−0.180 (0.016)	−0.156 (0.007)
South	−0.050 (0.014)	−0.047 (0.009)	−0.022 (0.009)	−0.016 (0.009)	−0.032 (0.014)	−0.025 (0.009)
	0.116	0.112	0.138	0.144	0.122	0.137

(*continued*)

Table IV.
Quantile and OLS regression estimates

Independent variable	Quantile 0.1	0.25	0.5	0.75	0.9	OLS
North	(0.013)	(0.011)	(0.011)	(0.011)	(0.014)	(0.009)
	0.069	0.037	0.024	0.001	−0.010	0.029
East	(0.012)	(0.009)	(0.008)	(0.009)	(0.017)	(0.009)
	−0.043	0.030	0.019	0.001	−0.024	0.024
Uva	(0.016)	(0.012)	(0.008)	(0.012)	(0.017)	(0.010)
	−0.046	−0.055	−0.019	−0.038	−0.043	−0.026
Sabara	(0.015)	(0.011)	(0.008)	(0.013)	(0.021)	(0.009)
	−0.109	0.104	−0.064	−0.055	−0.050	−0.070
Central	(0.012)	(0.011)	(0.010)	(0.011)	(0.019)	(0.009)
	−0.004	0.001	0.018	0.014	0.002	0.006
Nwest	(0.014)	(0.009)	(0.012)	(0.013)	(0.019)	(0.009)
	0.096	0.058	0.046	0.036	0.048	0.070
Ncentral	(0.023)	(0.010)	(0.010)	(0.012)	(0.024)	(0.010)
N	7,481	7,481	7,481	7,481	7,481	7,481
Pseudo R^2	0.223	0.229	0.240	0.264	0.284	0.373

Notes: Standard errors are in parentheses

Table IV.

logistic regression. A more comprehensive manner of presenting the results is in the form of a graph. Figure 3 (Panel 1-5) shows the development of the coefficients representing household size over the entire conditional consumption distribution. The estimated coefficient for each percentile is plotted as a continuous line and its 95 percent-confidence interval is the shaded area. The OLS estimate is the dark horizontal line and parallel to it is the 95 percent-confidence bands. With the exception of elders, all the other variables reflecting household size tends to have an increasingly larger impact on consumption as one moves up on the expenditure distribution. At the two extreme end of the distribution, estimates for these variables fall outside the confidence interval of the OLS estimate and is quite different from the OLS estimate.

According to the Table IV, age tends to have an extremely weak negative relationship with the standard living of at all estimated quantiles on the conditional distribution. This again confirms the findings of the unconditional poverty profile and the logit regression. However, the gender of the household head has a significant association with the standard of living. At all quantiles there is a negative relationship between per capita expenditure and being a female-headed household. But the gender effect on welfare tends to weaken as one moves up the conditional distribution. Below the median (50th quantile), being a female-headed household reduces per capita expenditure by at least 4 percent, but the fall in per capita expenditure is nearly three times less on the top of the distribution. The significance of the gender effect begins to fade beyond the median and eventually becomes insignificant at the 90th quantile.

Quantile regression results also indicate that households residing in the rural sector are worse off. Figure 3 shows that households in the bottom quantiles and upper quantiles are less sensitive to the rural sector compared to the households in the median quantiles. This implies that the poorest and the least poorest people experience less of the negative impact of living in a rural area than the median poor. Also, as Table IV indicates, for the households on the top of the conditional distribution (90th quantile), living in the rural sector has no significant effect on the standard of living.

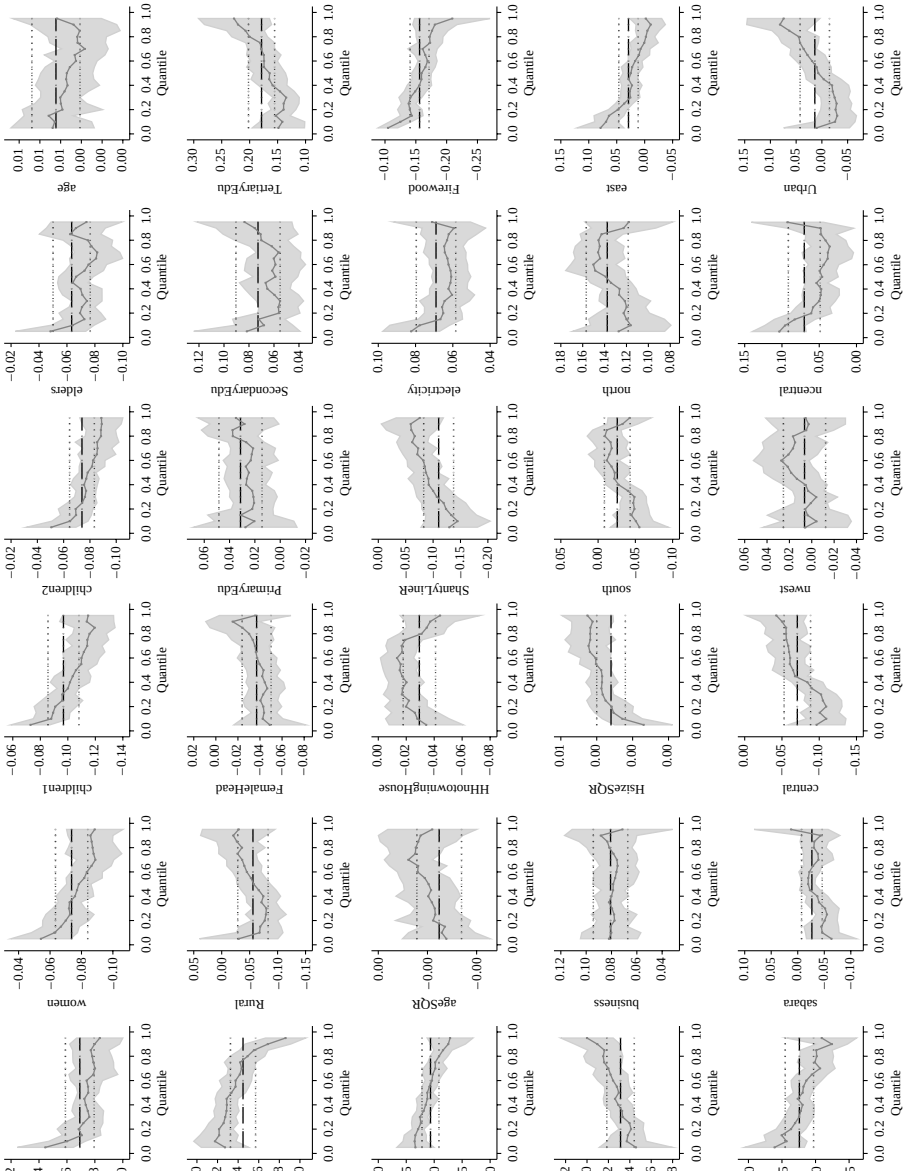

Figure 3.
Ordinary least squares and quantile regression estimates

With respect to education, all three variables indicating the levels of education shows a positive relationship with per capita consumption. Figure 3 shows that the impact of primary education does not vary a lot between quantiles and the quantile coefficients do not differ much from the least-square results. In other words, returns to primary education are not different for the poor and non-poor. Table IV also shows that the primary education variable is not significant for the households in the bottom 10th quantile, implying that the pay off from primary education to the poorest is not significant for the poorest is not significant. But secondary and tertiary education significantly increases the standard of living across all quantiles. Figure 3 also shows that the premium on tertiary education is relatively high for less poor households. It is important to note that at the two extreme ends of the distribution, quantile regression estimates fall outside of the OLS estimates. Thus, the conventional least squares confidence interval does a poor job representing this range for the tertiary education variable.

Turning to the employment-related variables, with the exception of the bottom 10th quantile, the casual wage coefficient is significant and negative across all other quantiles. Being consistent with the earlier findings from the unconditional poverty profile and logit regression, household heads engaged in casual labor are associated with lower per capita expenditure. However, the impact of being in casual labor on per capita is relatively negligible at upper quantiles than at the bottom quantiles. Figure 3 also shows that the OLS method underestimates the effects of being in casual labor on per capita consumption on the upper quantiles of the conditional distribution. According to Table IV and Figure 3, for the poorer households (quantiles 10 and 25), the marginal effect of being in a salaried occupation is relatively high, compared to the less poor households. Results also suggest that households in businesses (including and manufacturing) experience higher levels of per capita consumption. The coefficient for a household being engaged in business is highly significant (Table IV) and stable across all quantiles (Figure 3). With respect to retirement benefits, not receiving or not being entitled to receive pension income has a strong negative effect on per capita expenditure for the households in lower quantiles. The impact of retirement benefits on consumption and its significance level is relatively less at higher quantiles.

With regard to the four variables (shantylineroom, hhnotowninghouse, firewood, electricity) reflecting housing characteristics and access to services, the quantile regression estimates only return the results of the degree of association with per capita expenditure and no influence of causation can be made. All four coefficients are significant across the conditional distribution and have signs consistent with the unconditional poverty profile. Finally, the interpretations of the casual effects of regional dummies are somewhat difficult and can only be described as dramatic. The regional dummies were included primarily for controlling regional heterogeneity.

Conclusion

The paper investigates the probable determinants and correlates of poverty in Sri Lanka. It is worth summarizing some of the main results of this paper. First, poverty remains more acute in rural areas than in urban areas. Furthermore, since 76 percent of the population live in rural areas, the rural shares in the total composition of poverty is more higher. However, the degree of inequality is much more greater in urban areas, compared to the rural sector. Therefore, priority need to be given for policy initiatives aimed at reducing poverty in rural areas, while recognizing the need to tackle urban inequality.

Results also indicate that the pay off to smaller families is higher, and larger families are more likely to be poor. Furthermore, the costs of dependents are significant for all expenditure groups. An extra child or elderly creates a greater economic burden than an extra man or woman in household. With regard to the age of the household, the unconditional bivariate poverty profile indicated age to be a weak correlate of poverty. Confirming this result, multivariate analysis also found the age of the household head to be insignificant correlate of poverty, even after controlling for other factors. The study also found evidence to support the hypothesis of the feminization of poverty. Female-headed households are significantly worse off compared to male-headed households, especially in poorer households.

Household head's education level also had an instrumental effect in determining the vulnerability to poverty. Poverty incidence declined monotonically with years of education. Furthermore, quantile regression results indicate that the pay off from primary education to the poorest is not significant. With respect to the labor market, the incidence and probability of being in poverty is higher for households in casual labor, compared to the ones in salaried employment. Finally, the poor are more likely to live in shanty and line rooms and to use kerosene and firewood for lighting and cooking.

All of the above suggests the need for increasing school enrolment; supplemental educational programs and upgrading of schools are sensible components of a poverty reduction strategy. Clearly, programs of information, micro-credit, marketing, small business incubators, etc. deserves special attention in the design of national poverty reduction strategies. Findings regarding the link between welfare and household size, employment status and the access to services, are invaluable in the realm of indicator targeting. For an example, finer targeting can be done on the basis of household size and composition (e.g. number of children, number of female members). The finding of a strong correlation between poverty and children, suggests that the presence of children need to be considered as a strong indicator candidate for targeting. The beauty of enacting poverty alleviation programs through targeting key poverty indicators is that both administrative costs and leakage can be lowered.

In conclusion, these findings indicate the importance of a set of policies which are super pro-poor, namely increasing school enrollment and achievement, effective family planning programs to reduce the birth rate and dependency load within households, and granting priorities for specific cohorts (children-, elderly-, rural- and female-headed households) in targeted interventions.

Notes

1. Total household consumption divided by the number of household members.
2. The paper provides a detailed explanation for derivation of poverty lines.
3. Unnormalized average poverty is equal to the normalized poverty multiplied by the absolute poverty line.
4. An elegant paper by Deaton (1989) on intra-household resource allocation.
5. The "Three I's of poverty" (Jenkins and Lambert, 1997).
6. Dalton transfers principle states that a transfer of income from someone lower in the income distribution to someone higher in the income distribution, holding everyone else's income constant, should increase the numerical value of an inequality index. If vector $\mathbf{y}'$ which is a transformation of the vector $\mathbf{y}$ obtained by a transfer δ from $\mathbf{y}_j$ to $\mathbf{y}_i$, and $\mathbf{y}_i + \delta > \mathbf{y}_j - \delta$, then the transfer principle is satisfied iff $\mathbf{I}(\mathbf{y}') \geq \mathbf{I}(\mathbf{y})$.

7. Social welfare function $(W) = 1/N(\sum_{i=1}^{N} x_i^{1-\varepsilon})/(1-\varepsilon)$, $\varepsilon \neq 1$, where x is the standard of living. $\ln W = 1/N(\sum_{i=1}^{N} \ln x_i, \ \varepsilon = 1)$.

References

Deaton, A. (1989), "Looking for boy-girl discrimination in household expenditure data", *World Bank Economic Review*, Vol. 3, pp. 183-210.

Deaton, A. and Paxton, C. (1998), "Economies of scale, household size, and the demand for food", *Journal of Political Economy*, Vol. 106, pp. 897-910.

Grootaert, C. and Braithwaite, J. (1998), *Poverty Correlates and Indicator-based Targeting in Eastern Europe and the Former Soviet Union*, Poverty Reduction and Economic Management Network, World Bank, Washington, DC, May.

Jenkins, S.P. and Lambert, P.J. (1997), "Three 'I's of poverty curves, with an analysis of UK poverty trends", *Oxford Economic Papers*, Vol. 49 No. 3, pp. 317-27.

Koenker, R. and Bassett, G. (1978), "Regression quantiles", *Econometrica*, Vol. 46, pp. 33-50.

Lanjouw, P. and Ravallion, M. (1995), "Poverty and household size", *Economic Journal*, Vol. 105, p. 433.

Psacharopoulous, G. (1985), "Returns to education: a further international update and implication", *Journal of Human Resources*, Vol. 20 No. 4, pp. 583-604.

Schultz, T.P. (1988), "Education investments and returns", in Chenery, H. and Srinivasan, T.N. (Eds), *Handbook of Development Economics*, Vol. 1, North-Holland Press, Amsterdam.

Siddhisena, K.A.P. and Jayathilaka, M.D.R.K. (2004), "Identification of the poor in Sri Lanka: development of composite indicator and regional poverty lines", MIMAP Sri Lanka Series.

Székely, M. (1998), *The Economics of Poverty, Inequality and Wealth Accumulation in Mexico*, St.Antony's Series, St.Martin's Press, NewYork, NY.

World Bank (1990), *The World Bank Annual Report 1990*, The World Bank, Washington, DC.

World Bank (2002), *The World Bank Annual Report 2002*, The World Bank, Washington, DC.

Further reading

Appleton, S. (2001), "The rich are just like us, only richer: poverty functions or consumption functions?", *Journal of African Economies*, Vol. 10 No. 4, pp. 433-69.

Deaton, A. (1997), *The Analysis of Household Surveys: A Microeconometric Approach to Development Policy*, Johns Hopkins University Press for the World Bank, Baltimore, MD.

Foster, J., Greer, J. and Thorbecke, E. (1984), "A class of decomposable poverty measures", *Econometrica*, Vol. 52 No. 3, pp. 761-5.

Glewwe, P. (1991), "Investigating the determinants of household welfare in the Côte d'Ivoire", *Journal of Development Economics*, Vol. 35 No. 2, pp. 307-37.

Greene, W.H. (1997), *Econometric Analysis*, 3rd ed., Prentice-Hall, Upper Saddle River, NJ.

Kakwani, N.C. (1980), "On a class of poverty measures", *Econometrica*, Vol. 48, pp. 437-46.

Pudney, S. (1999), "On some statistical methods for modeling the incidence of poverty", *Oxford Bulletin of Economics and Statistics*, Vol. 61 No. 3, pp. 385-408.

Ravallion, M. and Bidani, B. (1994), "How robust is a poverty profile?", *World Bank Economic Review*, Vol. 8 No. 1, pp. 75-102.

Sen, A.K. (1976), "Poverty: an ordinal approach to measurement", *Econometrica*, Vol. 44 No. 2, pp. 219-31.

Shorrocks, A.F. (1995), "Revisiting the Sen poverty index", *Econometrica*, Vol. 63 No. 5, pp. 1225-30.

Appendix

Variable	Definition	Poor	Non-poor	Total
LogPCE	Logarithm of real per capita consumption	2.9466	3.3233	3.2282
Children (1)	Number of children (0-6 years)	0.5896	0.3631	0.4201
Children (2)	Number of children (7-16 years)	1.2062	0.8256	0.9216
Men	Number of men (17-60 years)	1.4569	1.353	1.3793
Women	Number of women (17-60)	1.5711	1.4336	1.4683
Elders	Number of persons (60 + years)	0.3882	0.3545	0.3629
HsizeSQR	Household size squared	30.9974	21.444	23.853
Age	Age of household head	49.6345	49.2157	49.3213
AgeSQR	Age squared	2,660.517	2,602.498	2,617.128
Dummy Variables				
POV	Household is below the poverty line	1	0	0.2521
Female head	Household head is female	0.2009	0.1564	0.1676
Rural	Household resides in the rural sector	0.8138	0.7471	0.7639
Urban	Household resides in the urban sector	0.1132	0.2159	0.1900
Primary.edu	Year 1-Year 6	0.4706	0.3138	0.3533
Secondary.edu	Year 7-GCE (O/L)	0.3527	0.4862	0.4525
Tertiary.edu	Year 12 and above	0.0211	0.1289	0.1017
Salary	Household head in salaried employment	0.0645	0.1965	0.1632
Casual Wage	Household head works for a casual wage	0.3702	0.2077	0.2486
Business	Household head in business (including trade and manufacture)	0.0851	0.1776	0.1542
NoRetBenifit	Household head is not receiving or not entitled to receive retirement benefits	0.8290	0.7896	0.7995
ShantyLineR	Household lives in shanty or line room			
HHnotowningHouse	Dwelling unit is not owned by by household	0.2818	0.2093	0.2276
Firewood	Household uses firewood or sawdust as the main of fuel for cooking	0.9719	0.8248	0.8619
Electricity	Main source of lighting is electricity	0.3968	0.6385	0.5775
South	Household in Sourthen province	0.1644	0.1103	0.1240
North	Household in Northern province	0.0597	0.1269	0.1100
East	Household in Eastern province	0.1094	0.1503	0.1400
Uva	Household in Uva province	0.0766	0.0743	0.0720
Sabara	Household in Sabaragamuwa province	0.1258	0.0750	0.0878
Central	Household in Central Province	0.1930	0.1007	0.1240
Nwest	Household in North Western province	0.0936	0.0941	0.0940
Ncentral	Household in North Central Province	0.0528	0.0731	0.0680

Table AI.
Variable definitions and means

Corresponding author
Indunil De Silva can be contacted at: i.de-silva@ttu.edu