The Survey of Living Conditions in the Commonwealth of Dominica: a revision

Gianni Betti, Francesca Ballini, Laura Neri

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1. Introduction

The Caribbean Development Bank (CDB) has supported its borrowing Member Countries (BMC) in undertaking a number of Country Poverty Assessments (CPAs). These CPAs have provided detailed information on the nature, characteristics, extent and causes of poverty and have allowed the bank to develop special policies aimed at poverty reduction. Such interventions have provided support to countries and communities in social and economic infrastructure, Human Resource Development and micro finance.

While CPAs provide useful data at the national or parish level, for effective targeting it is necessary for such data to be disaggregated also at district and neighbourhood level. Community disaggregation will allow for social development and poverty reduction programmes to effectively target the poor with the minimum leakages.

In order to improve its programme targeting, the Government of the Commonwealth of Dominica (GOCD) has requested funding from the CDB to prepare a National Country Poverty Map. The exercise is a collaborative effort also involving technical assistance from the World Bank (WB), through the services of its staff, and coordination as well as supervision from GOCD.

The overall objective of the Poverty and Inequality Map is to provide data that would allow the Government of Dominica and the donor community to improve poverty targeting interventions. The exercise provides disaggregated data at the household level, allowing the benefits of poverty reduction interventions to reach poor households. The mapping exercise includes the analysis of Census and Survey of Living Conditions (SLC) data and the undertaking of a Participatory Assessment to verify the quantitative information. With this aim in mind, the poverty mapping exercise seeks to:

a) identify the specific households, groups and communities;
b) determine locations of poverty in Dominica;

c) identify the areas with the greatest level of poverty;
d) establish the number of households and individuals affected;
e) provide demographic, sex and other economic and social information on the household;
f) confirm the characteristics, severity and extent of poverty in Dominica;
g) identify the coping mechanisms of the poor;
h) suggest ways to better target existing assistance to the poor; and
i) make recommendations on possible interventions to improve the living conditions of the poor.

As part of the activities envisaged under the project, a poverty and inequality mapping analysis, foreseen as part of the project, is being carried out based on the methodology developed by the World Bank and fully described in Elbers, Lanjouw and Lanjouw (2003). This methodology combines census and survey information to produce finely disaggregated maps, which describe the spatial distribution of poverty and inequality in the country.

In fact, in order to produce poverty and inequality maps, large data sets are required which include reasonable measures of income or consumption expenditure and which are representative or of sufficient size at low levels of aggregation to yield statistically reliable estimates.

Household budget surveys or Surveys of Living Conditions covering income and consumption usually used to calculate distributional measures are rarely of such a sufficient size.

The poverty map is expected to involve a quantitative analysis and participatory assessment. The quantitative analysis should be based on data from the census conducted in May 2001 and data generated from the Survey of Living Conditions (SLC) undertaken for the CPA conducted in July-September 2002.

The SLC undertaken in the CPA was based on the framework of a provisional version of the 2001 Population and Housing Census. At the end of 2005 the Central Statistical Office of the Commonwealth of Dominica released the final version of the Census, which appeared to be substantially modified, but considerably updated, compared to the previous version. For this reason, also the SLC data set should have been revised in order to capture the real picture of the country.

The main scope of this paper is to describe the main revisions of the Survey of Living Conditions and their impact on poverty and inequality estimates at national and Parish level. The paper is made up of four Sections and one Annex; after this introduction, Section 2 describes the original version of the 2001 Census and the 2002 SLC, while Section 3 describes the main revisions undertaken as preliminary step of the poverty and inequality mapping exercise. Section 4 defines and evaluates the indigence and poverty lines based on consumption expenditures and reports the measures of poverty and inequality at national and Parish level; finally in the Annex the definition of poverty and inequality measures is reported.

2. The Population and Housing Census and the Survey of Living Conditions

2.1 The Population and Housing Census

The preliminary results of the 2001 Census were extracted from the Census Visitation Record. The Central Statistical Office soon emphasised that the information was based on preliminary findings from the May 2001 Dominica Population Census.

The total population of Dominica as of midnight May 12, 2001 numbered 71,727 as reported in Table 1; 71,727 of them formed the non-institutional population, i.e. the number of persons who lived in private residences on Census Day. This represented a net decrease of 69 or a slight 0.1 percent decline from the 1991 Preliminary Results and a fall below the 2000 mid year population estimate of 76,154.

Table 1: Total Population Dominica, Census Preliminary Results

Parish	Male	Female	Total	Number of Males per 100 Females
St. George	10,051	10,487	20,538	96
Roseau	7,306	7,861	15,167	93
Rest of St. George	2,745	2,626	5,371	105
St. John	3,024	2,908	5,932	104
St. Peter	793	729	1,522	109
St. Joseph	3,111	2,850	5,961	109
St. Paul	4,224	4,298	8,522	98
St. Luke	782	799	1,581	98
St. Mark	921	974	1,895	95
St. Patrick	4,366	4,123	8,489	106
St. David	3,697	3,095	6,792	119
St. Andrew	5,465	5,030	10,495	109
TOTAL	**36,434**	**35,293**	**71,727**	**103**

Source: Central Statistical Office

The Central Statistical Office soon published the Census Report in late 2001, updating the Preliminary Report. The number of individuals living in the 24,108 private residences was fixed at 69,625 as reported in Table 2.

Table 2: Population by Parish, Census Results

Parish	Male	Female	Total
St. George	9,559	10,266	19,825
Roseau	6,850	7,689	14,539
Rest of St. George	2,709	2,577	5,286
St. John	2,689	2,638	5,327
St. Peter	759	693	1,452
St. Joseph	2,960	2,805	5,765
St. Paul	4,164	4,233	8,397
St. Luke	778	793	1,571
St. Mark	935	972	1,907
St. Patrick	4,273	4,110	8,383
St. David	3,658	3,100	6,758
St. Andrew	5,298	4,942	10,240
TOTAL	**35,073**	**34,552**	**69,625**

Source: 2001 Population and Housing Census of Dominica, Central Statistical Office

2.2 The Survey of Living Conditions

The Survey of Living Conditions was conducted in 2002; the questionnaire consisted of a single questionnaire with three sections (CPA):

Section 1 was concerned with basic housing characteristics (Part 1), household information (Part 2) and data on the demographic and economic characteristics of persons living in the household (Part 3);

Section 2 (the most important) collected data on household expenditure including food (Part 1), consumption of home production (Part 2), other recurrent household expenses (Part 3), clothing (Part 4), travel and transportation (Part 5), education and health (Part 6), recreation and leisure (Part 7), housing and household furnishing (Part 8), and other expenses (Part 9);

Section 3 collected data on household income from employment, business, support from family, friends and government pensions.

As reported in the CPA, the sample frame used in the SLC was taken from the 2001 Census structure in Table 2. A systematic sample of one in every ten households in May 2001 was drawn from this frame for every second Enumeration District (ED). Half the EDs were therefore sampled; the original sample size was 1,182 households.

In all, 953 valid questionnaires were received giving an overall response rate of 80% rising to 86% if vacant and closed dwellings are excluded. The SLC therefore covered around 4% of the households listed in 2001, giving an overall weighting factor of approximately 25 as shown in Table 3. Response and sampling weights varied however between EDs and parishes. Accordingly a 2-stage weighting process was adopted that involved the successive calculation of ED and Parish weights; the procedure is described in the CPA.

Table 3: Sampling Information for Parishes

Code	Parish	Census Hholds	EDs in Sample	Parish weight	Sampled Hholds	Actual Sample Rate
10	Roseau	4,815	2,570	1.90	212	4.4%
11	Rest of St. George	1,818	786	2.31	57	3.1%
12	St. John (excl. Portsmouth)	1,478	615	2.40	47	3.2%
22	Portsmouth	814	268	3.04	21	2.6%
13	St. Peter	562	273	2.06	23	4.1%
14	St. Joseph	2,297	1,106	2.08	92	4.0%
15	St. Paul	2,789	1,303	2.14	98	3.5%
16	St. Luke	582	333	1.75	21	3.6%
17	St. Mark	653	374	1.75	28	4.3%
18	St. Patrick	2,808	1,300	2.16	100	3.6%
19	St. David	1,994	1,079	1.85	92	4.6%
20	St. Andrew	3,498	1,866	1.87	162	4.6%
Total		**24,108**	**11,873**	**2.03**	**953**	**4.0%**

Source: Central Statistical Office and Consultants

3. Final version of Census and revised SLC

In order to undertake a Poverty and Inequality Mapping, the Central Statistical Office (CSO) of the Commonwealth of Dominica has revised the Population and Housing, which was released at the end of 2005.

According to the final revised version, in the Commonwealth of Dominica there are 68,646 individuals living in 22,359 households. The distribution of the population throughout the Country is reported in Table 4; the division into urban, semi-urban and rural areas has also been recently revised by the CSO and differs from the one adopted in the Country Poverty Assessment (CPA): at the time the CPA was conducted, the

Central Statistical Office defined as Urban the areas of Roseau and suburban areas, and Portsmouth, while it defined the areas of La Plaine, Marigot, Castle Bruce and Grand Bay as Sub-centres. For the current poverty mapping exercise a new definition from the CSO was adopted; the City of Roseau and Canefiekd/ Morne Daniel have been defined as Urban areas; Loubiere/ Castle Comfort, Portsmouth (Central), Salisbury, St. Joseph, Mahaut, Massacre/ Checkhall, Pointe Michel, Grand Bay (excluding Ravine Banane and Hagley) have been defines as Semi-urban areas.

Table 4: Population in Dominica, Census 2001, revised version as December 2005.

Partition	Number of Households	Number of Individuals
Domenica	22,359	68,646
Urban	5,261	16,946
Semi-urban	5,442	15,734
Rural	11,656	35,966
Roseau	4,416	14,224
Rest of St. George	1,636	5,165
Parish of St. John	1,908	5,276
Parish of St. Peter	527	1,421
Parish of St. Joseph	2,103	5,636
Parish of St. Paul	2,664	8,325
Parish of St. Luke	540	1,558
Parish of St. Mark	617	1,873
Parish of St. Patrick	2,667	8,269
Parish of St. David	1,949	6,743
Parish of St. Andrew	3,332	10,156

Source: Central Statistical Office

The Central Statistical Office, in collaboration with the Principal Investigator of the Poverty and Inequality mapping exercise, also released the final version of the Survey of Living Conditions at the end of 2005. This version is made up of a sample of 938 households and an updated distribution of the Total Household Consumption Expenditure, the most important variable in the poverty mapping exercise. The SLC therefore covered around 4.2% of the households listed in 2001.

Since both 2001 Census and 2002 SLC data sets have been revised and updated, for the present poverty mapping we have repeated the weighting process, in order to adjust the SLC data to the new release of the Census frame.

Table 5 summarises the Parish weights and the updated current sample rate per Parish.

Table 5: Parish weights and sample rate per Parish.

Code	Census Hholds	EDs in Sample	Parish weight	Sampled Hholds	Actual Sample Rate
10	4,416	2,371	1.86	209	4.7%
11	1,636	708	2.31	57	3.5%
12	970	420	2.31	32	3.3%
22*	938	405	2.32	36	3.8%
13	527	255	2.07	23	4.4%
14	2,103	1,059	1.99	83	3.9%
15	2,664	1,318	2.02	98	3.7%
16	540	308	1.75	21	3.9%
17	617	343	1.80	28	4.5%
18	2,667	1,233	2.16	100	3.7%
19	1,949	1,166	1.67	92	4.7%
20	3,332	1,819	1.83	159	4.8%
Total	**22,359**	**11405**	**1.96**	**938**	**4.2%**

*Portsmouth (central): ED=(12010,12020,12030,12041,12042,12043,12050,12060,12071,12072,12081,12082)

4. Poverty measures in Dominica

4.1. Indigence and poverty line definition

The poverty line adopted for the poverty mapping includes non-food and food expenditure, so as to be a quasi-absolute poverty line. The food expenditure is based on a Minimum Food Basket (MFB) defined in the Country Poverty Assessment (June 2003) and prepared by the government nutritionists. It consists of about EC$ 2,000 per annum per adult; it also consists in the so-called indigence line. To allow for the different consumption levels of children, the following adjustments were used (CPA):

Children aged less than 7 years: 0.2 of MFB, about EC$ 400 per annum;

Children aged 7-12 years: 0.3 of MFB, about EC$ 600 per annum;

Children aged 13-17 years: 0.5 of MFB, about EC$ 1,000 per annum.

From the SLC, the average per capita non-food expenditure of 40% of households with the lowest per capita incomes was about EC$ 1,400.

Summing up the food and non-food expenditure, the adult poverty line was defined as about EC$ 3,400 per adult.

Table 6: Caribbean Poverty Lines.

Country/ Island	Year	Expenditure (EC$)			Food #
		Food*	Non-food	Poverty Line***	
Anguilla	2002	3066	4864	7930	39%
Dominica	**2002**	**2011**	**1389**	**3400**	**60%**
BVI**	2002	4400	12000	16400	27%
Turks and Caicos**	1999	2300	4000	6300	36%
St Kitts	1999/2000	2136	1225	3361	64%
Nevis	1999/2000	2448	1493	3941	62%
Grenada	1998	1431	1831	3262	44%
St. Lucia	1995	1003	874	1876	53%
Guyana	1993	759	267	1026	74%
Belize	1996	1014	724	1737	58%

* Equivalent to the Indigence line. ** Converted from US$ at US$1=EC$2.70.
*** For an adult. # Food expenditure as % of poverty line.
Source: Anguilla, Dominica and BVI SLCs; Caribbean Development Bank.

Table 6 from the Country Poverty Assessment summarises the adult indigence and poverty lines in Dominica and compares them to other Caribbean countries. Comparisons are not straightforward as the surveys were not undertaken at the same time and the purchasing power of the EC$1 varies between countries. For surveys undertaken at the same time, the costs of the MFB (the indigence line) provide a de facto PPP comparison. In this respect, the Table shows that the cost of the MFB in Dominica is under half that in BVI and 30% lower than that in Anguilla.

As a consequence, the best indicator of inter-country variation is the proportion of the poverty line expenditure that is required for food. This proportion tends to decrease with affluence. Dominica, with food representing almost 60% of the total expenditure of poor households, is in a similar situation to St. Kitts, Nevis and Grenada. Of the other countries shown, the proportion spent on food is much higher in Guyana (74%) indicating a higher degree of poverty and lower in Anguilla, BVI and Turks and Caicos (27-39%) implying greater affluence.

In the CPA, the Household Poverty Line (HPL) was obtained by adding the non-food component multiplied by the household size to the sum of all the individual expenditure for purchasing the MBF for all the members of the household. For this reason each

[1] In other words, for example, EC$100 will purchase a different amount of goods in Dominica than Anguilla. Currently, the PPP value of the US$ in Dominica is estimated to be around 1.7 times it s value in the United States.

different household had a different Household Poverty Line. The program code used for the current poverty mapping, written in SAS language, does not permit the definition of more than one poverty line. For this reason the total household consumption expenditure has been converted into the so called "equivalent consumption expenditure", i.e. the household consumption equivalent to one adult's consumption. This methodology is typically adopted in poverty analysis by means of the so called "equivalence scales" (see Betti, 1999 for a detailed description). Comparing the total household consumption to the Household Poverty Line (HPL) is exactly the same as comparing the household equivalent consumption to the adult poverty line (EC$ 3,400).

4.2. Poverty measures before and after SLC revision

According to the original version of SLC, the level of indigence or severe poverty is relatively low at around 11% indicating that the great majority of Dominicans can satisfy their basic food needs. The incidence of overall poverty, 29% of households and 39% of the population, is however high reflecting the "… *continuing decline in banana production and the stagnation in other sectors such as tourism and manufacturing*" (CPA, p. 57). On this basis, in mid-2002, there were around 2,500 indigent and 4,400 poor households in Dominica. In all, just under 7,000 households have expenditures below the poverty line.

The poverty line is to a significant extent determined by the non-food expenditure component. This is based around the non-food expenditure of the lowest 40% of households. If a more restrictive assumption were used, e.g. the average non-food expenditure of indigent households (c.$740)[2], the proportion of poor households would be significantly lower at around 20% of all households and 28% of the population, as reported in Table 7.

These figures place Dominica in the second worst position, after Guyana, as percentage of poor individuals among the Caribbean Countries as reported in Table 8. This figure is nevertheless not in line with other poverty and inequality measures such as Indigence Headcount, Poverty Gap, Poverty Gap Squares and Gini coefficient.[3]

[2] From SLC. It is known that the poorest households have some essential non-food expenditure that results in them economising on their food expenditure.

[3] A full description of these and other poverty and inequality measures is reported in the Annex.

Table 7: Poverty indices at individual and household level (%), SLC, 2002.

PARISH	Indigent	Poor	All Poor		Not Poor	Total	% of all poor
St. George (Roseau)	5%	13%	18%	(23%)*	82%	100%	12%
Rest of St. George	11%	12%	24%	(39%)	76%	100%	6%
St. John	7%	21%	28%	(37%)	72%	100%	9%
St. Peter	6%	12%	17%	(31%)	83%	100%	1%
St. Joseph	13%	20%	33%	(44%)	67%	100%	11%
St. Paul	12%	11%	23%	(36%)	77%	100%	9%
St. Luke	4%	28%	32%	(48%)	68%	100%	3%
St. Mark	13%	31%	44%	(62%)	56%	100%	4%
St. Patrick	9%	32%	41%	(48%)	59%	100%	16%
St. David	28%	23%	52%	(67%)	48%	100%	15%
St. Andrew	9%	16%	25%	(32%)	75%	100%	12%
TOTAL	10%	18%	29%	(39%)	71%	100%	100%

Figures in ( ) relate to population. All other figures related to households

Source: CPA, p.52, Table 3.5. Geographic Distribution of Household Poverty

Table 8: Comparative Poverty Indicators

Country/ Island	Survey Year	Indigence Headcount		Poverty Line Headcount		Poverty Gap	Poverty Gap Squared	Gini
		H'holds	Pop.	H'holds	Pop.			
Barbados	1996	1%	1%	9%	14%	2.3	na	0.39
Jamaica	2001	na	na	na	17%	Na	na	0.38
Trinidad & Tobago	1992	na	11%	na	21%	Na	na	0.42
BVI	2002	1%	1%	16%	22%	4.1	1.7	0.23
Anguilla	2002	2%	2%	20%	23%	6.9	3.2	0.31
St. Lucia	1995	5%	7%	19%	25%	8.6	4.4	0.5
Turks & Caicos	1999	3%	3%	18%	26%	5.7	2.6	0.37
St. Kitts	1999	na	11%	16%	31%	2.5	8.9	0.40
Nevis	1999/2000	na	17%	16%	32%	2.8	10	0.37
Grenada	1998	11%	13%	24%	32%	15.3	9.9	0.45
Belize	1996	10%	13%	25%	33%	8.7	4.3	0.51
St Vincent	1995	20%	26%	31%	38%	12.6	6.9	0.56
DOMINICA	**2002**	**11%**	**15%**	**29%**	**39%**	**10.2**	**4.8**	**0.35**
Guyana	1993	na	28%	na	43% (35%)	16.2	8.2	na

NB. Countries are sorted by percentage of the population that which is poor – the only indicator with a complete set of information.

Apart from the fact that the results from the original version of the Survey of Living Conditions based on a preliminary version of the 2001 Census do not necessarily represent the real picture of Dominica, by mistake some families in the SLC recorded a

very large number of individuals, of the size of 15-20. Most of these households were placed between the Indigence and the Poverty line.

During the revision of the Survey of Living Conditions, the Central Statistical Office in collaboration with the principal Investigator of the poverty mapping exercise also solved the problem of household sizes.

The final poverty estimates of Dominica and of the corresponding Parishes are reported in Table 9 below. These are in line with other measures of poverty and inequality and moreover place Dominica in a more correct position among the Caribbean Countries.

This final version of the Survey of Living Conditions will be the base for the Poverty Mapping in the Commonwealth of Dominica, which aims at calculating poverty and inequality measures at Parish, Village and even Enumeration District level.

Table 9: Poverty indices at individual and household level(%); revised SLC, 2002

Code	Parish	# HHs	# Ind	% Poor HHs	% Poor Ind
10	Roseau	209	715	14.7	16.6
11	Rest of St. George	57	194	23.7	36.8
12	St. John	68	206	23.6	30.7
13	St. Peter	23	69	13.5	20.5
14	St. Joseph	83	243	27.9	35.3
15	St. Paul	98	360	22.0	31.3
16	St. Luke	21	69	10.4	17.1
17	St. Mark	28	79	39.1	52.5
18	St. Patrick	100	369	40.2	43.7
19	St. David	92	327	58.8	68.0
20	St. Andrew	159	529	23.6	27.5
Dominica		938	3160	27.0	33.5

References

Betti G. (1999), A Non-parametric approach to equivalence scales, *Statistics in Transition,* **4(2)**, pp. 181-194.

Country Poverty Assessment (2003), Final Report, Caribbean Development Bank, Government of the commonwealth of Dominica, Halcrow, June 2003.

Elbers C., Lanjouw J.O. and Lanjouw P. (2003), Micro-level Estimation of Poverty and Inequality. *Econometrica*, **71**, 355-364.

Foster J., Greer J. and Thorbecke E. (1984), A Class of Decomposable Poverty Measures, *Econometrica,* **52**, pp. 761-766.

Sen A. (1976), Poverty: An Ordinal Approach to Measurement, *Econometrica*, **44**, pp. 219-231.

Annex: Poverty and Inequality indices

A.1. Poverty measures

Poverty measures are used first and foremost for monitoring social and economic conditions and for providing benchmarks of progress or failure. Here, poverty measures are indicators by which policy results are judged and by which the impact of events (e.g., runaway inflation or the introduction of a government transfer program) can be weighed.

Measures used for monitoring and targeting need to be trusted and require rigorous underpinning. The measures will function well as long as everyone agrees that when poverty numbers rise, conditions have indeed worsened (and conversely, when poverty measures fall, that progress has been made). The first question in judging measures is how well does each index reflect basic properties desirable on philosophical grounds.

A second important use for poverty measures is descriptive. Poverty statistics play critical roles in summarizing complex social and economic conditions that inform conversations around economic and social priorities. For this purpose, effective measures need not completely capture all (or even most) morally relevant aspects of poverty. But the limits of measures need to be understood, and transparency and ease of transparency of method is critical in helping to achieve a consensus, and interested parties should be given enough information so as to understand exactly how the numbers were constructed. Beginning with data interpretation is critical here. These two notions of the need for rigor balanced against a desire for ease of interpretation run through the discussion below.

Economists have sharpened discussions by identifying a set of desirable normative characteristics of poverty measures (often stated mathematically as axioms) around which consensus can be built. The search focuses not on identifying descriptively useful measures in the sense above; but on moral relevance even if the outcome is a set of measures that yields numbers with little intuitive meaning.

If we can agree that acceptable poverty measures must satisfy a given set of axioms or must have certain characteristics, it is possible to sharply narrow down the number of potential candidates for poverty measures. In the most desirable case, a single, unique measure would emerge that would be fully ‘characterized’ that is, there would be only

one possible candidate that satisfies all of the axioms on which we agree. So far, though, the search has left a long list of possible poverty measures still on the table, and the task for analysts remains that of understanding the basic properties of the chief contenders.

While not succeeding at singling out a particular, universally-acclaimed poverty measure, the axiomatic approach pushes discussions forward in useful ways, and the central ideas are worth reviewing. Building blocks include concepts such as 'scale invariance'. This is the idea that poverty measures should be unchanged if, for example, a population doubles in size while everything else is maintained in the same proportions.

A second building block focuses on the well-being of those below the poverty line so that changes among better-off people do not affect measured poverty. This 'focus axiom' rules out measures based on relative notions of poverty (i.e., where poverty is not measured by absolute deprivations relative to a fixed poverty line but instead the poor are identified in relation to a shifting statistic like the median income of the whole population). Our focus here is on 'absolute poverty' as measured by a fixed poverty line. A third attribute, the 'monotonicity' axiom, states that, holding all else constant, when a poor person's consumption (or income) falls, poverty measures must rise (or at least should not fall).

The 'transfer' axiom (sometimes referred to as the Pigou-Dalton principle, after those who employed it first in their analyses) has more analytical bite. It states that, holding all else constant, taking money from a poor person and giving it to a less poor person must increase the poverty measure. Conversely, poverty falls when the very poor gain through a transfer from those less poor.

Transfer sensitivity, a related notion, goes further. It is best seen with an example. Consider a population where the poverty line is set at $1,000. Next, imagine that $10 is taken from someone earning $600 and given to a neighbour earning $500. Any poverty measure that satisfies the transfer axiom will fall. Measured poverty should also fall (for such indices) when $10 is taken from someone earning $300 and given to someone earning $200. The transfer-sensitivity axiom says that the reduction in the second case (in which a very poor person is made better off in relation to her neighbour) should be greater than the reduction in the first case (in which the recipient is less poor).

An additional desirable characteristic is the ability to decompose poverty measures by sub-population. Sub-populations may include, for example, residents of different regions. The critical feature for decomposition is that the sub-groups are distinct from each other (so that there is no overlap in membership) and that together they encompass the entire population. All additive indexes are decomposable, and all of the measures described below share the feature.

A.1.1. Headcount index

By far the most widely used measure is the *headcount index*, which simply measures the proportion of the population that is counted as poor. Formally:

$$H = \frac{q}{n} \qquad \text{(A.1)}$$

where n is the total population and q is the total number of the poor.

The great virtue of the headcount index is that it is simple to construct and easy to understand. These are important qualities.

However the measure has some weaknesses, discussed below.

The headcount index does not take the intensity of poverty into account. In other words, as a welfare function, the headcount index violates the transfer principle of Pigou-Dalton that states, as seen above, that transfers from a richer to a poorer person should improve the measure of welfare. Here if a somewhat poor household were to give to a very poor household, the headcount index would be unchanged, even though it is reasonable to suppose that overall poverty has lessened. The headcount index implies that there is a 'jump' in welfare, at about the poverty line, so it is meaningful to speak of the poor and the non-poor. In practice, such a jump is not found.

The headcount index does not indicate how poor the poor are, and, hence, does not change if people below the poverty line become poorer. Moreover, the easiest way to reduce the headcount index is to target benefits to people just below the poverty line, because they are the ones who are cheapest to move across the line. But by most normative standards, people just below the poverty line are the least deserving of the poor. Thus, despite its popularity, many problems result from an undue concentration on the head-count statistic.

It is also important to note that the poverty estimates should be calculated for

individuals and not households. What we calculate, using the headcount index is the percentage of *individuals* who are poor and not the percentage of households. To be able to do so, we make a critical assumption that all household members enjoy the same level of well-being. This assumption may not hold in many situations. For example, some elderly members of a household may be much poorer than other members of the same household. In reality, not all consumption is evenly shared across household members.

A.1.2. Poverty gap index

A moderately popular measure of poverty is the *poverty gap index*, which adds up the extent to which individuals fall below the poverty line (if they do), and expresses it as a percentage of the poverty line. More specifically, define the poverty gap as the poverty line (z) less actual expenditure/income (y_i) for poor individuals; the gap is considered to be zero for everyone else. Using the index function, we have:

$$I = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z - y_i}{z}\right) \qquad \text{(A.2)}$$

This measure is the mean proportionate poverty gap in the population (where the non-poor have zero poverty gap). Some people think of this measure as the cost of eliminating poverty (relative to the poverty line), because it shows how much would have to be transferred to the poor to bring their incomes (or expenditure) up to the poverty line. The minimum cost of eliminating poverty using targeted transfers is simply the sum of all the poverty gaps in a population; every gap is filled up to the poverty line.

However, this interpretation is only reasonable if the transfers could be made perfectly efficiently, for instance with lump sum transfers, which is implausible. Clearly this assumes that the policymaker has a lot of information; one should not be surprised to find that a very 'pro-poor' government would need to spend far more than this in the name of poverty reduction.

At the other extreme, one can consider the maximum cost of eliminating poverty, assuming that the policymaker knows nothing about who is poor and who is not. From the form of the index, it can be seen that the ratio of the minimum cost of eliminating poverty with perfect targeting (i.e. the gap) to the maximum cost with no targeting (i.e.

z, which would involve providing everyone with enough to ensure they are not below the poverty line) is simply the poverty gap index. Thus this measure is an indicator of the potential saving to the poverty alleviation budget from targeting.

The poverty gap measure has the virtue that it does not imply that there is a discontinuity ('jump') at the poverty line. Yet a serious shortcoming of this measure is that it may not convincingly capture differences in the severity of poverty amongst the poor.

To summarize, the *Poverty Gap Index* is the average over all people, of the gaps between poor people's standard of living and the poverty line, expressed as a ratio to the poverty line. The aggregate poverty gap shows the cost of eliminating poverty by making perfectly targeted transfers to the poor (i.e., closing all poverty gaps), in the absence of transactions costs and disincentive effects. This is clearly unrealistic but it does convey useful information about the minimum scale of the financial resources needed to tackle the poverty problem. Moreover, the poverty gap index can show the value of using survey information to learn about the characteristics of the poor. A costly way of eliminating poverty would be to make completely untargeted poverty line-sized transfers to everyone in the population. The poverty gap index gives the ratio of the cost of eliminating poverty using perfectly targeted transfers compared with using completely untargeted transfers. Thus, the smaller the poverty gap index, the greater the potential economies for a poverty alleviation budget from identifying the characteristics of the poor so as to target benefits and programs.

A.1.3. Squared poverty gap index and the FGT class

To solve the problem of inequality among the poor, some researchers use the squared poverty gap index. This is simply a weighted sum of poverty gaps (as a proportion of the poverty line), where the weights are the proportionate poverty gaps themselves; a poverty gap of (say) 10% of the poverty line is given a weight of 10% while one of 50% is given a weight of 50%; this is in contrast with the poverty gap index, where they are weighted equally. Hence, by squaring the poverty gap index, the measure implicitly puts more weight on observations that fall well below the poverty line. This index is also known as Severity Poverty Index. Formally:

$$P_2 = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z - y_i}{z}\right)^2 \qquad \text{(A.3)}$$

The measure lacks intuitive appeal, because it is not easy to interpret and so it is not used very widely. It may be thought of as one of a family of measures proposed by Foster, Greer and Thorbecke (1984), which may be written as:

$$FGT = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z - y_i}{z}\right)^{\varepsilon} \qquad \text{(A.4)}$$

where α is a measure of the sensitivity of the index to poverty. When parameter ε=0, FGT(0) is simply the head-count index. When ε =1, the index is the poverty gap index, and when ε is set equal to 2, *FGT(2)* is the poverty severity index. For all ε > 0, the measure is strictly decreasing in the living standard of the poor (the lower your standard of living, the poorer you are deemed to be). Furthermore, for ε > 1 it also has the property that the increase in measured poverty due to a fall in one's standard of living will be deemed greater the poorer one is. The measure is then said to be 'strictly convex' in incomes (and 'weakly convex' for ε =1). Another convenient feature of the FGT class of poverty measures is that they can be disaggregated for population sub-groups and the contribution of each sub-group to national poverty can be calculated.

The work by Foster, Greer and Thorbecke provides an elegant unifying framework for measures of poverty. However it begs the question of what is the best value of α. Some of these measures also lack emotional appeal.

The measures of depth and severity of poverty provide complementary information on the incidence of poverty. It might be the case that some groups have a high poverty incidence but low poverty gap (when numerous members are just below the poverty line), while other groups have a low poverty incidence but a high poverty gap for those who are poor (when relatively few members are below the poverty line but when there are extremely low levels of consumption).

A.1.4. Sen Index

Sen (1976) proposed an index that sought to combine the effects of the number of poor, the depth of their poverty, and the distribution of poverty within the group. The index is given by:

$$S = \frac{2}{(q+1)nz}\sum_{i=1}^{q}(z - y_i)(q+1-i) \qquad \text{(A.5)}$$

The Sen Index can also be written as the average of the headcount and poverty gap measures weighted by the Gini coefficient of the poor (G_P), giving:

$$S = H\left[I + (1-I)G_p\right]$$

The Gini coefficient ranges from 0 (perfect equality) to 1 (perfect inequality), and is discussed further below in the context of measuring inequality.

The Sen index has been widely discussed, and has the virtue of taking into account the income distribution among the poor. However the index lacks intuitive appeal, and cannot be decomposed satisfactorily into its constituent components, which explains why it is rarely used in practice.

A.2. Inequality measures

The poverty measures we have been discussed depend on the average level of consumption or income in a country, and the distribution of income or consumption. Based on these two elements, poverty measures then focus on the situation of those individuals or households at the bottom of the distribution.

Inequality is a broader concept than poverty in that it is defined over the entire population, not only for the population below a certain poverty line. Most inequality measures do not depend on the mean of the distribution, and this property of mean independence is considered to be a desirable property of an inequality measure. Instead, inequality is concerned with the distribution.

Inequality indicators can be harder to develop than consumption/income poverty indicators because they essentially summarize one dimension of a two-dimensional variable. Note that inequality measures can be calculated for any distribution, not just for consumption, income or other monetary variables, but also for land and other continuous and cardinal variables.

Sometimes we are more interested in measuring inequality than poverty per se. The commonest way to begin is by dividing the population into fifths (*quintiles*) from poorest to richest, and reporting the levels or proportions of income (or expenditure) that accrue to each level.

A.2.1. Gini coefficient of inequality

The most widely used single measure of inequality is the Gini coefficient. The Gini coefficient is based on the Lorenz curve, a cumulative frequency curve that compares the distribution of a specific variable (eg. Consumption expenditure or income) with the uniform distribution that represents equality. To construct the Gini coefficient, plot the cumulative percentage of households (from poor to rich) on the horizontal axis and the cumulative percentage of expenditure (or income) on the vertical axis. This gives the Lorenz curve. The Gini coefficient ranges between 0, which means perfect equality, and 1, which means complete inequality. Formally the index is defined as:

$$Gini = G = \frac{2}{n^2 \bar{y}} \sum_{i=1}^{n} \left(y_i - \bar{y} \right) \tag{A.6}$$

The Gini coefficient is not entirely satisfactory. To see this, consider the criteria that make a good measure of income inequality, namely:

Mean independence This means that if all incomes were doubled, the measure would not change. The Gini coefficient satisfies this.

Population size independence If the population were to change, the measure of inequality should not change, ceteris paribus. The Gini coefficient satisfies this too.

Symmetry If you and I swap incomes, there should be no change in the measure of inequality. The Gini coefficient satisfies this.

Pigou-Dalton Transfer sensitivity Under this criterion, the transfer of income from rich to poor reduces measured inequality. The Gini satisfies coefficient this too.

It is also desirable to have:

Decomposability This means that inequality may be broken down by population groups or income sources or in other dimensions. The Gini index is not decomposable or additive across groups. That is, the total Gini of society is not equal to the sum of the Ginis for its subgroups.

Statistical testability One should be able to test for the significance of changes in the index over time. This is less of a problem than it used to be because confidence intervals can typically be generated using bootstrap techniques.

A.2.2. Generalized Entropy measures

There are a number of measures of inequality that satisfy all six criteria. Among the

most widely used are the Theil indexes and the mean log deviation measure. Both belong to the family of generalized entropy inequality measures. The general formula is given by:

$$GE(\alpha) = \frac{1}{\alpha^2 - \alpha}\left\{\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}\right)^{\alpha} - 1\right\} \tag{A.7}$$

where $\bar{y}$ is the mean expenditure/income. The values of GE measures vary between 0 and ∞, with zero representing an equal distribution and higher value representing a higher level of inequality. The parameter α in the GE class represents the weight given to distances between incomes at different parts of the income distribution, and can take any real value. For lower values of α, GE is more sensitive to changes in the lower tail of the distribution, and for higher values GE is more sensitive to changes that affect the upper tail. The commonest values of α used are 0,1 and 2.

GE(0), also known as Theil's L, is called mean log deviation measure because it gives the standard deviation of log(y):

$$GE(0) = \frac{1}{n}\sum_{i=1}^{n} -\log\left(\frac{y_i}{\bar{y}}\right) \tag{A.8}$$

GE(1) is Theil's T index, which may be written as:

$$GE(1) = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}\right)\log\left(\frac{y_i}{\bar{y}}\right) \tag{A.9}$$

A.2.3. Atkinson's inequality measures

Atkinson proposed another class of inequality measures. This class also has a weighting parameter ε (which measures aversion to inequality) and some of its theoretical properties are similar to those of the extended Gini Index. The Atkinson class is defined as:

$$A = 1 - \left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}\right)^{1-\varepsilon}\right]^{1/(1-\varepsilon)} \tag{A.10}$$