

# Assessing the Distributional Impact of Public Policy

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September 2002



## Abstract

Economic development necessarily changes the welfare of socioeconomic groups to various degrees, depending on differences in their social arrangements. The challenge for policymakers is to select the changes that will be most socially desirable. Essama-Nssah demonstrates the usefulness of distributional analysis for social evaluation and, more specifically, for welfare evaluation, using data from the 1994 Integrated Household Survey in Guinea. Because the international community has declared poverty eradication a fundamental objective of development, the author uses a poverty-focused approach to social evaluation based on

the *maximin principle*. This principle offers a unifying framework for analyzing the socioeconomic impact of public policy by using a wide variety of evaluation functions, inequality indicators (like the extended Gini coefficient), and poverty indices (such as Sen's index and the members of the Foster-Greer-Thorbecke family). The author also examines, within the context of commodity taxation, how to identify socially desirable policy options using both the dominance criterion and abbreviated social welfare functions. He includes computer routines for calculating various welfare indices and for plotting the relevant concentration curves.

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This paper—a product of the Poverty Reduction Group, Poverty Reduction and Economic Management Network—is part of a larger effort in the network to understand the poverty and social impact of public policy. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Oykiao Kootzemew, room MC4-554, telephone 202-473-5075, fax 202-522-3283, email address [okootzemew@worldbank.org](mailto:okootzemew@worldbank.org). Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The author may be contacted at [bessamansah@worldbank.org](mailto:bessamansah@worldbank.org). September 2002. (50 pages)

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## 1. Introduction

The purpose of this paper is to fit distributional impact analysis within *the logic of social evaluation* and to illustrate its implementation using data from the 1994 Integrated Household Survey in Guinea<sup>1</sup>. The perspective of development as empowerment, advocated by Sen(1999) and outlined in the World Development Report (WDR) 2000/2001, entails essentially the expansion and the distribution of socioeconomic opportunities with implications for individual and collective well-being. Distributional analysis, a key input in policy formulation and evaluation, involves a comparison of alternative distributions of some indicator of the living standard.

There is an intimate relationship between evaluation and development to the extent that the very definition of development involves an evaluative judgment. The domain of development hinges on the notion of the things that are worth promoting (Sen 1989). The concept of living standard therefore plays a fundamental role both in the formulation of development objectives and in the assessment of development effectiveness. However, this multidimensional concept is not easy to implement empirically. The identification of the valuable dimensions of the living standard depends essentially on the underlying view about personal characteristics and social arrangements that are deemed important in the realization of any life plan.

The Millennium Development Goals (MDGs) set by the United Nations with respect to development and poverty eradication are consistent with the *empowerment* approach to development. They identify *income, health, education, shelter* and *governance* as critical components of the living standard. In general these goals are set for the year 2015 relative to 1990 and are meant to provide guidance to both national and international policies and programs. For our current purposes, we select consumption *per capita* as an indicator of opportunities for well-being at the household level. It will be obvious that the methodology discussed in this paper can easily be extended to other dimensions of living that may be represented by a quantitative variable distributed over a population.

Fundamentally, evaluation involves the examination and weighing of a phenomenon according to some explicit or implicit yardstick (Weiss<sup>2</sup> 1998). We can learn a great deal about an evaluative approach by distinguishing *the information required for passing judgments* from that which has no direct evaluative role (Sen 1999). The information pertains to the *valuable aspects* of the object of evaluation, and to the rule for *combining* these valuable elements into an aggregative judgment. For instance, the utilitarian approach to social evaluation is based on the utility sum total in the social states under consideration. In this framework, attention is focused on individual well-

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<sup>1</sup> Enquête Intégrale avec Module Budget-Consommation (EIBC). The survey was carried out by the National Statistical Office within the Ministry of Plan and Cooperation.

<sup>2</sup> More explicitly, this author defines evaluation as “a *systematic* assessment of the *operation* and/or the *outcomes* of a program or policy, compared to a set of explicit or implicit *standards*, as a means of contributing to the *improvement* of the program or policy”.

being as represented by the concept of utility, and the goodness of a social state depends on the sum total of utilities associated with that state [regardless of how these utilities are distributed among individuals (Sen 1999)].

Widespread poverty in the developing world remains a serious challenge for the development community and may have prompted the inclusion of poverty eradication among the MDGs. The World Bank has declared poverty reduction its overarching objective and a benchmark measure of its performance as a development institution. In view of these considerations, we emphasize poverty-focused evaluation in this paper. If development is about *empowering people* to take charge of their destinies (Wolfensohn 1998), then *poverty* must be seen as the *deprivation of basic capabilities* to lead the kind of life one has reason to value (Sen 1999). In this perspective, the identification of poverty must go beyond lowness of income. This invitation however does not deny the fact that inadequate income can lead to capability deprivation. The notion of relative deprivation plays an important role in shaping the evaluative framework discussed here.

In the context of applied policy analysis, it is not enough to have an analytical or evaluative framework, available data must be processed according to that framework in order to draw relevant conclusions. Invariably, one needs a computing platform to do the job. We propose to show that the syntax of EViews can easily be exploited to do the job at hand. EViews stands for *Econometric Views*, a Windows version of a software designed by Quantitative Micro Software (QMS) for the processing of time series data and the conduct of econometric analysis. We find that many people who are already using EViews for other purposes and interested in distributional issues may not necessarily be familiar with the fundamental concepts and techniques of distributional analysis. In addition, depending on their level of mastery of the software, they may not even think of EViews as appropriate for handling household survey data. Yet the current version of the software (Version 4.1) can handle 4 million observations per series (variable) and the total number of observations (i.e. number of variables times the number of observations per variable) is limited only by the available Random Access Memory (RAM). In addition the syntax is sufficiently straightforward to allow the user to plot common curves such as cumulative distributions, concentration or Lorenz curves. It is also easy to compute indices of social welfare, inequality and poverty.

The outline of the paper is as follows. Section 2 presents a poverty-focused evaluation framework based on the *maximin principle*. The concept of relative deprivation underpins the distribution of social weights in the formulation of aggregative judgments. Section 3 focuses on the implications of the traditional approach to poverty analysis based on the use of a poverty line. In particular, it is shown that when the distribution of welfare is truncated on the basis of a poverty line, the Gini coefficient can be additively decomposed into two components, one measuring the within group inequality and the other the inter-group inequality. Impact analysis is reviewed in Section 4. In that Section, we show how the ranking of socioeconomic situations can vary with the specification of social weights. The basic EViews routines used to produce illustrations are provided in boxes. Concluding remarks are presented in the last Section of the paper.



## 2. Maximin Approach to Poverty-Focused Evaluation

A poverty assessment is a key ingredient in the formulation of a poverty reduction strategy. It is a determination of the nature, extent and determinants of poverty at both the *individual* and *societal* level. Ultimately, such an assessment is an exercise in social evaluation to the extent that it offers a *criterion* for comparing alternative social arrangements. Before considering the implied distribution of social weights, we first review the logic of evaluation.

### *The Logic of Social Evaluation*

The notion of *evaluation* is usually contrasted with that of *valuation*. The former relates to the assessment of the relative merits of actions while the latter applies to the comparison of things (Dasgupta 2000). Thus, evaluation applies to strategies and policies<sup>3</sup>. Essentially, evaluation entails four basic aspects: (1) the *identification* of the object of evaluation along with its valuable dimensions; (2) the *valuation* of the various components of the object; (3) the formulation of an *overall judgment*; and (4) the *ranking* of alternatives.

We can learn a great deal about an evaluative approach by distinguishing *the information required for passing judgments* from that which has no direct evaluative role (Sen 1999). The information pertains to the *valuable aspects* of the object of evaluation, and to the rule for *combining* these valuable elements into an aggregative judgment. When seen as an assessment of individual advantage and social progress, *the object of social evaluation is the determination of the extent to which the prevailing social arrangements maintain and improve the living standard of the participants*. The distribution of the living standard within the population is thus the yardstick by which we judge the performance of a socioeconomic system. The identification of the valuable dimensions of the living standard corresponds to the specification of what Sen (2000) calls the *focal space* of evaluation.

To arrive at an overall judgment, one needs to aggregate individual conditions into an indicator of a social state. In Sen's terminology, this aggregation rule represents the *focal combination*. One standard approach is to define an additively separable social welfare function as follows.

$$(2.1) \quad W = \sum_{h=1}^n \beta^h x^h$$

where  $\beta^h$  is the social weight attached to the level of the welfare of individual (or household)  $h$ , as indicated by  $x^h$ . We may invoke the concept of *Equally Distributed*

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<sup>3</sup> A strategy is a conditional action that depends on the state of the world or on actions taken by other decision makers. A policy is a definite course of action chosen from a feasible set to govern current and future actions. A policy statement identifies *objectives* and associated *means*.

*Equivalent* (EDE) welfare to abbreviate the above function as follows:  $W(V_\beta)=W(x)$ .  $V_\beta$  is the level of welfare such that, if enjoyed equally by each member of society, collective well-being would be equivalent to the one associated with the observed distribution<sup>4</sup>. The definition of the covariance between two variables allows us to express the EDE welfare as:

$$(2.2) \quad V_\beta = \frac{1}{n} \sum_{h=1}^n \beta^h x^h = \mu_\beta \mu_x + \text{cov}(x, \beta)$$

where both  $\beta$  and  $x$  are  $n$ -dimensional vectors. No generality is lost if we normalized social weights such that  $\mu_\beta=1$ . In that case, average social welfare could be written as:

$$(2.3) \quad V_\beta = \mu_x + \text{cov}(x, \beta)$$

The covariance term would be equal to zero if either  $\beta$  or  $x$  were constant. A constant  $x$  means that everybody has the same level of living, and therefore there is no inequality to worry about. However, a constant  $\beta$  means everybody receives equal consideration in social evaluation regardless of her/his standard of living. In this case, social evaluation is not concerned with inequality. Thus, expressions (2.2) and (2.3) may be viewed as a decomposition of the social welfare function into the *size* and *distribution* components. The former is represented by the mean of the distribution of the living standard indicator, while the second is measured by the covariance between the social weights and the levels of the living standard.

The focal space and the focal combination define the *informational basis* of social evaluation. This may be viewed as a set of value judgments underlying the specification of the objects of value both from the individual and social perspective. Once the relevant indicator of the living standard has been selected, the specification of a social welfare function boils down to the distribution of social weights through the specification of  $\beta^h$  for each individual or class of individuals. How can one go about this? *One possibility is to invoke a theory of social justice to guide the distribution of social weights.* We use the maximin principle in building up a poverty-focused evaluative framework.

### ***Distribution of Social Weights***

A focus on poverty in social evaluation requires that extra consideration be given to the worse-off relative to the better-off both analytically and politically. Sen (1997: 33) explains the ethical underpinning of the ordinary Gini coefficient in terms of the *pairwise maximin principle*. According to this criterion the welfare level of any pair of individuals must be equated to the welfare of the worse off of the two. This is consistent with the *Dalton principle* of transfers according to which rich to poor transfers improve social welfare. This value judgment may be built in the social welfare function by first ranking

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<sup>4</sup> The concept is used by Atkinson (1970) in a normative approach to the measurement of income inequality.

individuals according to some criterion of social desert, then assigning social weights in such a way that of any two individuals the more deserving receives a higher weight. More specifically, suppose that we rank individuals according to their level of consumption  $x^h$ , then we assign social weights on the basis of ranks in such a way that if  $h < i$ , then  $\beta^h \geq \beta^i$ . The Dalton principle is therefore consistent with any nonnegative, monotonic and weakly decreasing social weighing scheme  $\beta^h$  (Mayshar and Yitzhaki 1995: 797).

One such weighing scheme underpins the class of social evaluation functions associated with the Gini family of inequality indices. To see what is involved, consider a group of  $v$  individuals selected at random from a large population. A particular individual with a level of well-being  $x^h$  will feel relatively deprived if there is at least one other individual with a higher level of living than  $x^h$ . The likelihood that the other  $(v-1)$  individuals have a level of well-being higher than  $x^h$  is estimated as:  $(1 - p^h)^{v-1}$  where  $p^h$  is an estimate of the cumulative distribution function of  $x$  in the population (CDF) at the point  $x^h$ . We may select normalized social weights<sup>5</sup> such that:

$$(2.4) \quad w^h(v) = v(1 - p^h)^{v-1}; \quad \frac{1}{n} \sum_{h=1}^n w^h(v) = 1$$

Given that the CDF is monotonically increasing between 0 and 1, it is clear that the weights defined in (2.4) will decrease monotonically as we move from the lower to higher ranking individuals, in terms of living standard.

Average welfare in the whole society is thus equal to:

$$(2.5) \quad V(v) = \frac{1}{n} \sum_{h=1}^n w^h(v) x^h = v \left[ \text{cov}[x, (1 - p)^{v-1}] + \frac{\mu_x}{v} \right] = \mu_x + v \text{cov}[x, (1 - p)^{v-1}]$$

If there were no inequality (i.e. everyone had the same level of living standard), the covariance in the above expression would be equal to zero and average living standard would be equal to  $\mu_x$ . We therefore conclude that the social cost of inequality is equal to:  $v \text{cov}[x, (1 - p)^{v-1}]$ . It is known that  $V(v) = \mu_x [1 - G(v)]$ , where  $G(v)$  is the extended Gini coefficient and  $v$  is interpreted as an indicator of social aversion to inequality (Lambert 1993b). Therefore, expression (2.5) implies that the extended Gini coefficient is equal to:

$$(2.6) \quad G(v) = -\frac{v}{\mu_x} \text{cov}[x, (1 - p)^{v-1}]$$

---

<sup>5</sup> The fact that the average weight is equal to one can be established much easily in the case of a continuous distribution. In this case, we have:  $\int_0^1 (1 - p)^{v-1} dp = -\frac{1}{v} \int_0^1 -v(1 - p)^{v-1} dp = \frac{1}{v}$ .

The ordinary Gini coefficient is obtained by setting the aversion parameter equal to 2<sup>6</sup>.

What happens if individuals are ranked according to some variable other than  $x$ ? For instance, let  $y$  stand for an indicator of needs. Then rank individuals in such a way that the neediest comes first. Let  $q$  stand for the cumulative distribution under  $y$ . The covariance expression now becomes  $\text{cov}[x, (1 - q)^{\nu-1}]$ . The average welfare is:

$$(2.7) \quad V(\nu) = \mu_x [1 - C_{xy}(\nu)]$$

where  $C_{xy}(\nu)$  is the extended concentration index of  $x$  with respect to  $y$  defined as follows:

$$(2.8) \quad C_{xy}(\nu) = -\frac{\nu}{\mu_x} \text{cov}[x, (1 - q)^{\nu-1}]$$

Figure 2.1 reveals the weighing scheme associated with the social evaluation criterion defined by (2.3). The scheme is a function of the aversion parameter ( $\nu$ ). When this parameter is equal to one, the social evaluation function,  $V(1)$ , assigns equal weight to everyone regardless of their level of well-being. This weight is also equal to one. For all values of the aversion parameter greater than 1, the poorest individual receives a weight equal to  $\nu$ . Next, all people whose rank falls below the cut-off point (where the  $\nu$ -level curve is equal to one) receive a weight between  $\nu$  and 1. Finally, the social evaluation function assigns a weight between zero and one to people whose relative rank falls between the cut-off point and 1. On the basis of figure 2.1, it is clear that as the aversion parameter increases above one, the distribution of social weights is tilted such that the weight assigned to the poorest equal  $\nu$  and that assigned to the richest equal zero.

The figure suggests that the cut-off rank is a solution to the following equation.

$$(2.9) \quad \nu(1 - p)^{\nu-1} = 1$$

Thus the rank at which the social weight switches from being greater or equal to one to less than one is given by the following formula:

$$(2.10) \quad p^* = 1 - \left[ \frac{1}{\nu} \right]^{1/(\nu-1)}$$

---

<sup>6</sup> In that case, we note that:

$$-\frac{2}{\mu_x} \text{cov}[x, (1 - p)] = -\frac{2}{\mu_x} [\text{cov}(x, 1) - \text{cov}(x, p)] = \frac{2}{\mu_x} \text{cov}(x, p) = G.$$

This expression says that the ordinary Gini coefficient is equal to twice the covariance between  $x$  and its relative rank, divided by the mean of  $x$ .

Figure 2.1. Distribution of Social Weights as a Function of the Aversion Parameter

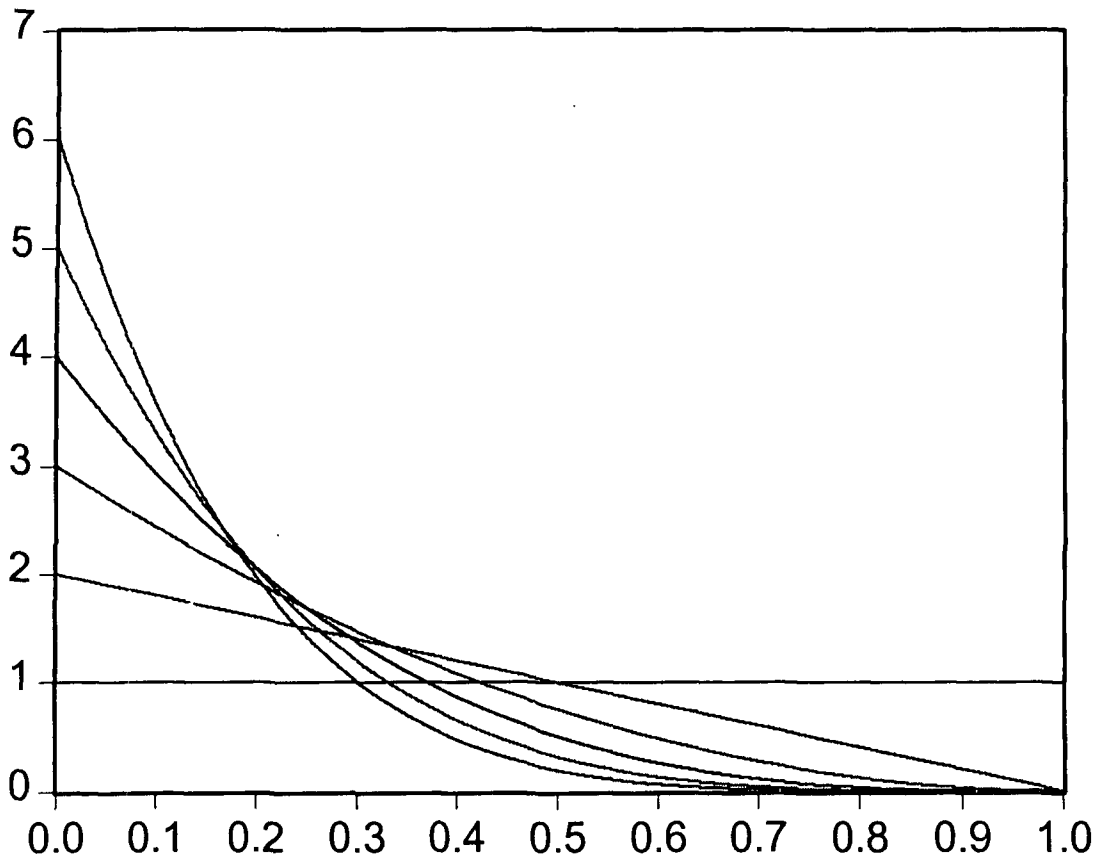


Table 2.1 shows cut-off ranks computed according to (2.10). These results suggest that the cut-off rank is a decreasing function of the aversion parameter. As this parameter increases, the focus is shifted to the lower end of the distribution. Thus social evaluation will attach more weight to the situation of the poorest group. For instance, when the aversion parameter is equal to 100, social evaluation attaches more weight to the lowest 5 percent of the distribution. When the aversion level reaches 200, the focus shifts to the poorest 3 percent of the population. According to this table, the social evaluation function based on the ordinary Gini coefficient assigns more weight to everybody up to the median. The weights then decline at a constant rate of 0.5 from 2 to 0.

Table 2.1. Cut-off Rank as a Function of the Aversion Parameter.

$v$	1.1	1.2	1.5	2.0	3	6	10	20	30	50	100	200
$p^*$	0.62	0.60	0.56	0.50	0.42	0.30	0.23	0.15	0.11	0.08	0.05	0.03

Source: Computed according to (2.10)

The empirical implementation of the framework encapsulated in expression (2.5) requires an estimate of the cumulative distribution function and the computation of a covariance. The cumulative distribution function  $p=F(x)$  gives the probability of observing an individual with a living standard at most equal to  $x$ . The slope of this

function at a particular point gives the associated density function. There are several ways of estimating a cumulative distribution on the basis of a sample of size  $n$ , depending on the method of adjustment for the non-continuity. The ordinary approach is to rank the observations in increasing order of the variable of interest, and divide the rank of each observation by the total number of observations. Let  $p$  stand for the ordinary estimate of the CDF for observation with rank  $r$ , then we may write:

$$(2.11) \quad p = \frac{r}{n}.$$

Box 2.1 Lerman-Yitzhaki CDF Estimator in EViews

```

SUBROUTINE LYCDF( SERIES X, SERIES S, SERIES W)
SERIES YH=X/S
SORT YH
SERIES POPH=S*W
SERIES WH=POPH/@SUM(POPH)
SMPL @FIRST @FIRST
SERIES FH=WH
SMPL @FIRST+1 @LAST
FH=FH(-1)+WH
SMPL @ALL
SERIES F_HAT=WH-0.5*WH
ENDSUB

```

The SORT command in EViews is used to rank observations in increasing or decreasing order of a particular variable (series). The syntax is: SORT(options) SERIES\_NAME. The ascending order is the default option. The other option is D (for descending order). EViews also provides a command, called CDFPLOT, that displays according to the option chosen: empirical cumulative distribution functions, survivor functions, and quantiles with standard errors. In the context of welfare analysis, the survivor function gives the probability of observing an individual with a living standard at least equal to a specified level. The survivor function is therefore equal to one minus the CDF. A *quantile*, also known as *fractile*, is a level of living below which lies a given fraction of the population. The median is an example of a quantile to the extent that it is the value below which lies 50 percent of the population.

Household level data are usually available in the form of a weighted sample. A household of a given size represents a certain number of households in the population at large. In such a case, Lerman and Yitzhaki (1989:44) recommend the following mid-interval estimator for the CDF<sup>7</sup>.

<sup>7</sup> Deaton (1997:154) proposes a similar procedure for converting household ranks into individual ranks. Assuming that there are  $w_h n_h$  people in household  $h$  (where  $n_h$  is the household size and  $w_h$  its absolute weight), then starting from  $\rho_1=1$ , the rank of the first person in household  $h+1$  is given by the recursive formula:  $\rho_{h+1} = \rho_h + n_h w_h$ . These ranks can then be normalized relative to the overall population.

$$(2.12) \quad \hat{F}_h(x) = \sum_{k=0}^{h-1} w_k + \frac{w_h}{2}; \quad w_0 = 0$$

Box 2.2 Covariance Estimator of Gini-based Measures of Welfare

```

SUBROUTINE WEIGHCOV( SERIES X, SERIES S, SCALAR A)
  SERIES XH=X/S
  SERIES XHWT=XH*POPH
  SCALAR MUX=@SUM(XHWT)/@SUM(POPH)

  SERIES DVXH= (XH-MUX)
  SERIES DVXHW=(POPH*DVXH)/@SUM(POPH)

  SERIES QH=(1-F_HAT)
  SERIES QHA=(QH)^(A-1)
  SERIES QHAW=(POPH*QHA)/@SUM(POPH)
  SCALAR MQHA=@SUM(QHAW)
  SERIES DVQHA= (QHA - MQHA)

  SERIES SWT=A*QHA

  SERIES WCOV=DVXHW*DVQHA
  SCALAR GLY= -(A*@SUM(WCOV))/MUX
  SCALAR SOCOST=A*@SUM(WCOV)
  SCALAR EDEX=MUX*(1-GLY)

ENDSUB

```

where  $w_h$  stands for the relative weight of each individual in household  $h$  in the overall population. This relative weight is equal to the household size times the absolute household weight divided by total population.

The subroutines presented in Boxes 2.1 and 2.2 can be embedded into a single program to compute members of the Gini family of indices.

Chotikapanich and Giffiths (2001:543) propose an alternative algorithm based on a linear approximation of the Lorenz curve. This Linear-Segment Estimator of the extended Gini coefficient is defined by the following expression.

$$(2.13) \quad G(\nu) = 1 + \sum_{k=1}^m \left( \frac{\theta_k}{\pi_k} \right) [(1-p_k)^\nu - (1-p_{k-1})^\nu]; \quad \theta_k = \frac{\pi_k x_k}{\sum_{j=1}^m \pi_j x_j}$$

where  $\theta_k$  is the proportion of welfare for group  $k$  and  $\pi_k$  is the population share of that group. Note that the ratio in parentheses in the above expression is also equal

to:  $\frac{x_k}{\sum_{j=1}^m \pi_j x_j}$ . The authors of this formula present results from a Monte Carlo experiment

showing that the linear segment approach outperforms the covariance-based formula only when applied to grouped data with 20 or fewer observations. They observe little or no difference in terms of bias and mean squared error when they test both methods on data set with 30 or more observations. The authors state their main conclusion as follows: “The two estimators have similar properties when calculated from individual observations.” They further claim: “When using grouped data with 20 or fewer groups, our estimator has less bias and lower mean squared error than the covariance estimator. When individual observations are used, or the number of groups is 30 or more, there is little or no difference in the performance of the two estimators.”

### Box 2.3. Linear-Segment Estimator of the Extended Gini Coefficient

```

LOAD %0
SMPL @ALL
SERIES XI={%1}/{%2}
SORT XI
SERIES POPI={%2}*{%3}
SERIES PI=POPI/@SUM(POPI)
SERIES WXI=POPI*XI
SERIES XSHARE=WXI/@SUM(WXI)
SMPL @FIRST @FIRST
SERIES CUMPI=PI
SERIES CUMXSH=XSHARE
SMPL @FIRST+1 @LAST
  CUMPI=CUMPI(-1)+PI
  CUMXSH=CUMXSH(-1)+XSHARE
SMPL @ALL
SERIES RATIO=XSHARE/PI
SERIES QI=(1-CUMPI)
SERIES QH=(1-CUMPI(-1))
!AVMAX=6
!B=2
!CF=!B-1
!RWS=(!B*!AVMAX)-!CF
VECTOR(!RWS) GINU 'EXTENDED GINI
!T=1
FOR !NU=1 TO !AVMAX STEP 1/!B
  SERIES QANU=QI^(!NU)
  SERIES QBNU=QH^(!NU)
  SERIES QCNU=QANU-QBNU
  SERIES QDNU=RATIO*QCNU
  SCALAR QDSUM=@SUM(QDNU)
  GINU(!T)=1+QDSUM
  !T=!T+1
NEXT
'End of Program

```



We applied the two methods(covariance and linear segments) on three data sets. The first is the Guinea 1994 Integrated Household Survey covering 4,416 representative households. As expected, the claim that both methods would produce almost the same results in this case is confirmed by the results presented in table 2.2. Except for the case when the aversion parameter is equal to 1, the estimates presented in table 2.2 are identical up to the third decimal.

Table 2.2. Alternative Estimates of the Extended Gini Coefficient

Aversion Parameter	Covariance Method	Linear Segments
1.0	-4.58E-29	6.47E-06
1.5	0.283868	0.283881
2.0	0.403372	0.403385
2.5	0.472096	0.472112
3.0	0.517874	0.517894
3.5	0.551041	0.551064
4.0	0.576415	0.576442
4.5	0.596588	0.596618
5.0	0.613091	0.613124
5.5	0.626898	0.626934
6.0	0.638656	0.638696

Data Source: Guinea 1994 Integrated Household Survey

In order to test the performance of the two methods when the number of observations is less than 20, we chose the extreme case of a population of two individuals with the following levels of living (25, 75). The results are presented in table 2.3. Both methods produced very different results. However, contrary to the conclusion reached by Chotikapanich and Giffiths (2001), the covariance method outperformed the linear segment approach. We base this observation on the following considerations. In this simple case, it can be shown either by geometry or by integration (Essama-Nssah 2000:54) that the ordinary Gini coefficient is equal to one half minus the proportion of the welfare enjoyed by the worse off of both individuals. For the distribution at hand, we therefore know that the Gini coefficient is equal to 0.25. The covariance method produces exactly this result while the linear segment approach yields a much higher value of Gini: 0.62. We further tested both methods on the following textbook<sup>8</sup> example of a distribution of income in a population of four individuals (10, 20, 30, 40), again the linear segment method produced much higher values compared to the covariance method. The covariance method produced a Gini of 0.25 while the linear segment method gives an estimate of 0.425.

Finally, it is important to note that, when the aversion parameter is equal to one, we expect the Gini coefficient to be zero, the covariance method produces this result, while the linear segment method tends to yield values that are significantly different from zero. These results cast some doubt on the conclusion by Chotikapanich and Giffiths

<sup>8</sup> Lambert 1993b:260

(2001) that the linear segment estimator outperforms the covariance estimator in small samples.

Table 2.3: Alternative Estimates of the Extended Gini Coefficient

Aversion Parameter	Covariance Method	Linear Segments
1.00	0.00	0.25
1.50	0.14	0.47
2.00	0.25	0.62
2.50	0.33	0.73
3.00	0.38	0.81
3.50	0.40	0.87
4.00	0.41	0.91
4.50	0.40	0.93
5.00	0.39	0.95
5.50	0.37	0.97
6.00	0.35	0.98

Source: Computed

### *Decomposition by Factor Components*

Let's suppose for simplicity's sake that the welfare indicator can be decomposed into two components. For instance, household expenditure may be divided into food,  $x_1^h$ , and nonfood expenditure,  $x_2^h$ . Using expression (2.3), average social welfare may be written as follows.

$$(2.14) \quad V_\beta = (\mu_1 + \mu_2) + [\text{cov}(x_1, \beta) + \text{cov}(x_2, \beta)] = V_1 + V_2$$

In the general case where there are  $m$  components, the above expression becomes:

$$(2.15) \quad V_\beta = \sum_{j=1}^m \mu_j + \sum_{j=1}^m \text{cov}(x_j, \beta) = \sum_{j=1}^m V_j$$

Suppose now that we choose social weights according to the maximin principle where individuals (or households) are ranked in increasing order of total expenditure. Using the weights defined by (2.4) leads to the following expression for average social welfare.

$$(2.16) \quad V(\nu) = \sum_{j=1}^m \mu_j + \nu \sum_{j=1}^m \text{cov}[x_j, (1-p)^{\nu-1}] = \sum_{j=1}^m \mu_j [1 - C_j(\nu)]$$

where  $C_j(\nu)$  is the extended concentration index of component  $j$  with respect to the overall level of expenditure.

Given that  $\mu = \sum_{j=1}^m \mu_j$ , expression (2.16) may also be written as:

$$(2.17) \quad V(\nu) = \sum_{j=1}^m \mu_j \left[ 1 - \sum_{j=1}^m \frac{\mu_j}{\mu} C_j(\nu) \right] = \mu \left[ 1 - \sum_{j=1}^m \lambda_j C_j(\nu) \right]$$

where  $\lambda_j = (\mu_j / \mu)$ .

Note that the second expression of (2.16) is obtained by multiplication of each concentration index by a neutral element ( $\mu/\mu$ ). We obtain a different structure of the same information by using another neutral element [ $G(\nu)/G(\nu)$ ]. In that case, average welfare is equal to:

$$(2.18) \quad V(\nu) = \sum_{j=1}^m \mu_j [1 - \eta_j(\nu) G(\nu)] = \sum_{j=1}^m \mu_j \left[ 1 - G(\nu) \sum_{j=1}^m \lambda_j \eta_j(\nu) \right]$$

where  $\eta_j(\nu) = \frac{C_j(\nu)}{G(\nu)}$ . Comparing expression (2.18) to (2.5) we conclude that the extended Gini is equal to a weighted average of the Gini Engel elasticities is equal to one. That is:

$$(2.19) \quad \sum_{j=1}^m \lambda_j \eta_j(\nu) = 1$$

Indeed, the ratio of the concentration index of a component to the overall Gini coefficient is interpreted as an *elasticity* (Lerman and Yitzhaki 1994, 1985; Yitzhaki 1994a). To see this interpretation, rewrite the coefficient as:

$$(2.20) \quad \eta_j(\nu) = \frac{\text{cov}[x_j, (1-p)^{\nu-1}] \mu_x}{\text{cov}[x, (1-p)^{\nu-1}] \mu_j} = \frac{b_j(\nu)}{\lambda_j}$$

The coefficient  $\lambda_j$  is interpreted as the average propensity of component  $j$  to vary with the overall indicator  $x$ . According to Yitzhaki (1994a: 457) the coefficient  $b_j(\nu)$  may be viewed as a nonparametric estimator of the marginal propensity of component  $j$  to vary with  $x$ . This interpretation is clearest when the aversion parameter is equal to 2. Then we see that:

$$(2.21) \quad b_j(2) = \frac{\text{cov}(x_j, p)}{\text{cov}(x, p)}$$

This is the *instrumental variable estimator* of the slope parameter in the regression of the component  $x_j$  on the overall  $x$ , using the cumulative distribution  $p$  as an instrument. Since  $\eta_j(2)$  is the ratio of marginal to average propensity, it is analogous to an elasticity.

Henceforth, we refer to this type of elasticity as Gini Engel Elasticity<sup>9</sup>. Assume now that individuals are ranked according to income. If,  $\eta_j(\mathbf{2}) > 1$ , commodity  $j$  is considered a *luxury*. If the elasticity is between 0 and 1, the corresponding commodity is considered a *necessity*. When this elasticity is negative, the commodity is an *inferior good* (Garner 1993: 135).

Table 2.4. Gini Elasticities for Selected Expenditure Components in Guinea (1994)

Aversion	Total Expenditure	Cereals	Beverages	Food	Electricity	Energy	Non-Food
1.50	1.00	0.43	1.51	1.02	1.83	0.85	1.29
2.00	1.00	0.50	1.43	1.05	1.76	0.92	1.24
2.50	1.00	0.55	1.39	1.07	1.70	0.95	1.21
3.00	1.00	0.58	1.36	1.07	1.65	0.97	1.18
3.50	1.00	0.61	1.34	1.08	1.61	0.98	1.17
4.00	1.00	0.63	1.33	1.08	1.58	0.99	1.15
4.50	1.00	0.65	1.32	1.08	1.55	0.99	1.14
5.00	1.00	0.66	1.31	1.08	1.53	1.00	1.13
5.50	1.00	0.68	1.30	1.08	1.51	1.00	1.12
6.00	1.00	0.69	1.30	1.08	1.49	1.00	1.12

Source: Computed

Table 2.4 presents Gini Engel elasticities for selected expenditure components in Guinea. This information reveals that food expenditure is distributed very much like total expenditure. The distribution of expenditure on energy is also very close to that of total expenditure. Beverages and electricity are clearly luxury goods while cereals are a necessity. In general, it appears that inequality in the distribution of household expenditure in Guinea is due to non-food expenditure.

The area between a concentration curve and the 45 degree line is known as the area of concentration. It is equal to  $-\text{cov}[x_j, (1-p)]/\mu_j = \text{cov}(x_j, p)/\mu_j$ . Therefore,  $\eta_j(\mathbf{2})$  is equal to the area of concentration for  $x_j$  divided by the area between the 45 degree line and the Lorenz curve of  $\mathbf{x}$  (Yitzhaki and Lewis 1996:549). This geometric interpretation provides a necessary condition for characterizing the position of a concentration curve relative to the 45 degree line and the Lorenz curve. Thus when the Gini Engel elasticity is negative, the concentration curve is concave and lies above the 45 degree line. When the elasticity is equal to zero, the curve coincides with the 45 degree line. When the elasticity is between zero and 1, the concentration curve lies between the 45 degree line and the Lorenz curve. Finally, when the elasticity is greater than one the concentration curve lies below the Lorenz curve.

Finally, let  $\mathbf{q}_j$  stand for the cumulative distribution obtained by ranking individuals by increasing order of component  $j$ . Let  $G_j(v)$  be the extended Gini coefficient of component  $j$ . Expression (2.19) also implies that the overall Gini is equal to

<sup>9</sup> Yitzhaki (1994a) calls it Gini income elasticity. Furthermore, (2.19) shows that Engel-aggregation holds for these elasticities to the extent that their weighted sum is equal to one. The weights are the shares of the total budget spent on each commodity.

the weighted average of the concentration indices of the components,  $G(v) = \sum_{j=1}^m \lambda_j C_j(v)$ .

If we multiply each concentration index in this expression by a neutral element  $[G_j(v)/G_j(v)]$ , we obtain the following alternative decomposition of the extended Gini coefficient:

$$(2.22) G(v) = \sum_{j=1}^m \lambda_j \left( \frac{C_j(v)}{G_j(v)} \right) G_j(v) = \sum_{j=1}^m \lambda_j \left( \frac{\text{cov}[x_j, (1-p)^{v-1}]}{\text{cov}[x_j, (1-q_j)^{v-1}]} \right) G_j(v) = \sum_{j=1}^m \lambda_j R_j(v) G_j(v)$$

#### Box 2.4: Plotting Concentration Curves in EViews

```

INCLUDELYCDF
LOAD %0
SMPL @ALL
CALL LYCDF({%1}(1), {%1}(2), {%1}(3))
SERIES P=F_HAT
SERIES L45=P
GROUP LCC P L45
!M={%2}.@COUNT
FOR !K=1 TO !M
    %SV={%2}.@SERIESNAME(!K)
    SERIES X{!K}={%1}(3)*{%2}(!K)
    SERIES SHARES{!K}=X{!K}/@SUM(X{!K})
    SMPL @FIRST @FIRST
    SERIES LP{%SV} =SHARES{!K}
    SMPL @FIRST+1 @LAST
    LP{%SV}=LP{%SV}(-1) + SHARES{!K}
    LCC.ADD LP{%SV}
SMPL @ALL
NEXT
FREEZE(LCCS) LCC.XY
LCCS.SCALE RANGE(0,1)
'End of Program

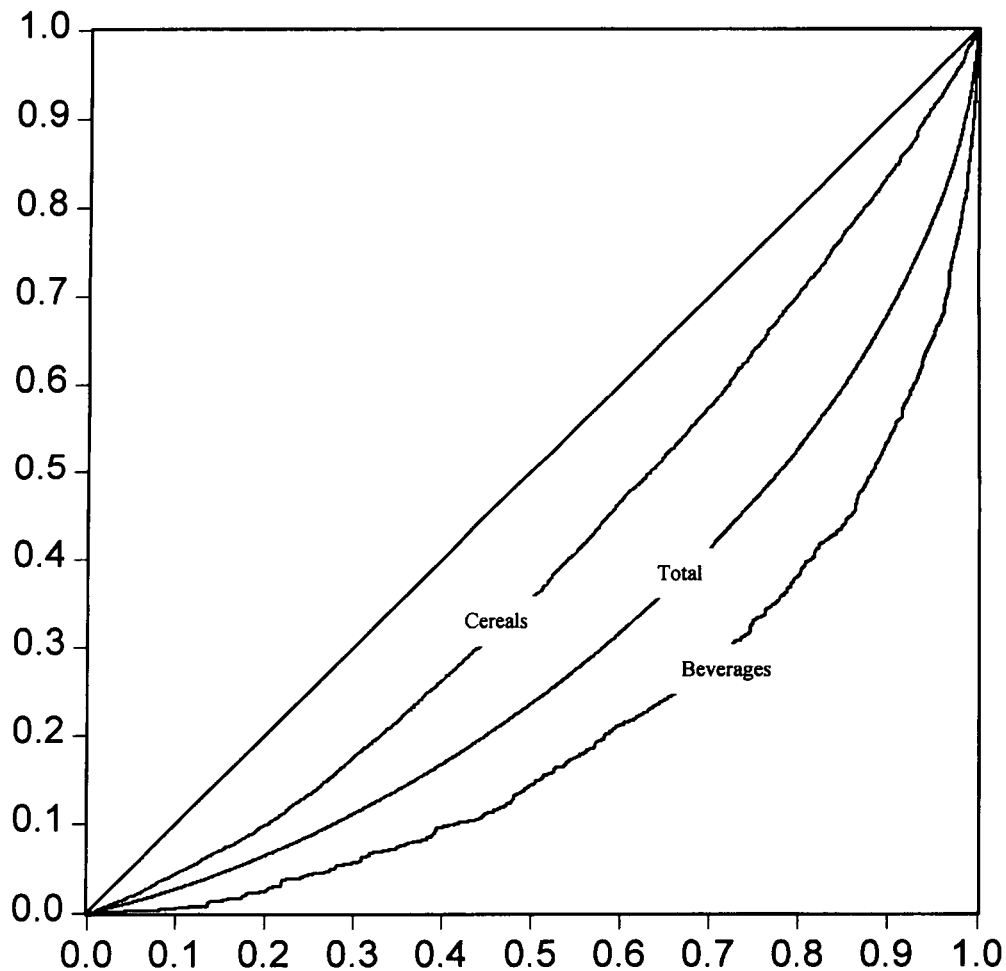
```

The coefficient  $R_j(v)$  is known as the “*Gini correlation*” between component  $j$  and overall  $x$ . This expression thus reveals that the contribution of a component to overall inequality is determined by three factors: (1) the proportion of the component in the total value of  $x$ , (2) the correlation between the component and the total, and (3) the extent of inequality in the distribution of the component.

Figure 2.2 shows the configuration of concentration curves of two items from the 1994 Integrated Household Survey in Guinea. The concentration curve of cereals lies between the Lorenz curve of total expenditure and the 45 degree line. We therefore expect its Gini elasticity to be positive but less than one. Expenditure on beverages is more unequally distributed than total expenditure. The corresponding concentration curve lies below the Lorenz curve. Thus we expect the Gini elasticity of beverages to be greater than one. The values of Gini elasticities implied by this configuration are presented in table 2.4. This table also reveals that the distribution of food expenditure is

very close to that of total expenditure. Expenditures on electricity and nonfood items are more concentrated in high income households.

Figure 2.2. Guinea 1994: Concentration Curves of Cereals and Beverages with respect to Total Expenditure



### 3. Truncation by a Poverty Line

The standard approach to poverty analysis is to partition the population exhaustively into two mutually exclusive groups on the basis of a poverty line, and to assign a weight equal to zero to the wellbeing of anybody whose living standard is above the poverty line. Such a partition raises at least two interesting issues. The first one relates to the decomposability of the Gini family of indices, and the second to the interpretation of some well known poverty indices within the framework defined by (2.1). Before considering these issues, we first examine some implications for the aggregate distribution of the social weights defined by (2.4).

### ***Distribution of Social Weights by Poverty Status***

We focus here on how the relative social weight attached to each of these groups varies with the aversion parameter. Table 3.1 contains the results of such an experiment using household survey data from Guinea. We find that the poor account for 16 percent of the mean rank, and the non-poor for 84 percent. This stems from the fact that the overall mean rank (i.e. the mean of the cumulative distribution) is equal to 0.5. The mean rank of the poor is about 0.20 while that of the non-poor is 0.70. The weighted average of the two numbers is equal to 0.5. The weights used here are the respective population shares. *When the aversion parameter is equal to one, each group receives, on average, a weight equal to its population share.* As the aversion parameter increases above 1, most of the social weight is shifted to the poor.

Table 3.1. Distribution of Average Social Weight in Guinea by Poverty Status in 1994 and by Level of Aversion

	Share of Mean Rank	v=1	v=2	v=3	v=4	v=5	v=6
Poor	0.16	0.40	0.64	0.79	0.87	0.92	0.95
Nonpoor	0.84	0.60	0.36	0.21	0.13	0.08	0.05
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Source: Computed

### ***Decomposability of the Gini Family of Indices by Population Subgroups***

Truncation by a poverty line implies that the ordinary Gini coefficient can be written as:

$$(3.1) \quad G = (s_1 p_1 G_1 + s_2 p_2 G_2) + G_b$$

where the term between parentheses represents within group inequality, while the term outside stands for between group inequality. The term  $s_i$  measures the proportion of total welfare enjoyed by group  $i$ , and  $p_i$  is the population share of that group.

Anand(1983:320) shows that, in this case, between group inequality is equal to:

$$(3.2) \quad G_b = \frac{n_1 n_2}{n^2 \mu} |\mu_1 - \mu_2| = \frac{n_1 n_2}{n^2 \mu} [\mu_1 + \mu_2 - 2 \min(\mu_1, \mu_2)]$$

Assuming that the first group is the poor group, then the above expression reduces to:

$$(3.3) \quad G_b = (p_1 - s_1)$$

*Inequality between the two groups, as measured by the ordinary Gini coefficient, is equal to the proportion of poor in the population minus their income share. This is a particular case of a general case we encountered in Section 2 when testing the covariance and the linear segment approaches to Gini calculation. In general, when the subgroup distributions do not overlap,  $G_b$  can be computed as the Gini for the distribution where everybody has her/his group average welfare.*

Furthermore, in the context of the extended Gini, between group inequality is computed as follows (Yitzhaki 2002: 77):

$$(3.4) \quad G_b(\nu) = \frac{p_1 - s_1}{p_1} [1 - (1 - p_1)^{\nu-1}]$$

Table 3.2 shows the results of a decomposition of the extended Gini coefficients associated with the distribution of household expenditures in Guinea in 1994. The decomposition is based on (3.1) and (3.4). The first column of the table contains levels of the aversion parameter. The second column indicates within group inequality, while the third and fourth columns represent between group inequality respectively in terms of  $G_b(\nu)$  and its share in overall inequality (presented in the last column). These results indicate that, given the poverty line, most of the observed inequality in the distribution of household expenditure in Guinea is accounted for by the between components. When the aversion parameter ranges from 1 to 6, the share of between group inequality increases from 0 to 84 percent. *This suggests that poverty-focused evaluation must also pay attention to inequality between the poor and the rest of the population.*

The use of a poverty line to divide the population into two groups means that the corresponding distributions of welfare do not overlap. It is useful to note the decomposition of the Gini coefficient when the sub-group distributions may overlap. The resulting expression suggests an indicator of social exclusion. Yitzhaki(1994b) proposes an index of the degree of overlapping between distributions which allows a more general and transparent decomposition of the Gini coefficient. In this general case, the Gini coefficient can be decomposed into three distinct components: the first component is linked to intra-group inequality, the second is an indicator of between-group inequality, and the third is an indicator of the overlapping of the distributions. The overlapping index can also be interpreted as a measure of segmentation and stratification. Such an indicator may reveal the extent of social exclusion of some socioeconomic groups.



Table 3.2. Inequality between Poor and Nonpoor in Guinea in 1994

Aversion	Within	Between	Share of between	Overall
1.00	0.00	0.00	0.00	0.00
1.50	0.15	0.13	0.46	0.28
2.00	0.17	0.23	0.58	0.40
2.50	0.16	0.31	0.66	0.47
3.00	0.15	0.37	0.71	0.52
3.50	0.13	0.42	0.76	0.55
4.00	0.12	0.46	0.79	0.58
4.50	0.11	0.48	0.80	0.60
5.00	0.11	0.51	0.84	0.61
5.50	0.10	0.52	0.83	0.63
6.00	0.10	0.54	0.84	0.64

Data Source: 1994 Integrated Household Survey

Suppose that a population has been divided into  $m$  subgroups indexed by  $k$ . Consider any two groups  $j$  and  $k$ . The overlapping of group  $k$  by group  $j$  reflects the fact that some individuals from group  $k$  have a standard of living that falls within the range of the distribution of the living standard within group  $j$ . The extent of this overlapping can be measured by the *covariance* between the level of the living standard in group  $k$  and the relative rank the members of  $k$  would receive, had they been considered as members of group  $j$ . In this context, relative ranks are measured by the relevant cumulative distributions.

To see more clearly what is involved, let  $F(x)$  and  $F_k(x)$  stand respectively for the overall CDF and the CDF within group  $k$ . Also let  $F_{kj}(x)$  be the relative rank that members of  $k$  would get had they been considered as belonging to  $j$ . By definition of the CDF, if all observations in  $k$  have a value that is less than or equal to the minimum in the range of group  $j$ ,  $F_{kj}(x)$  would be equal to zero. If all values in group  $k$  are greater or equal to the maximum in  $j$ ,  $F_{kj}(x)=1$ . In either one of these extreme cases,  $cov_k[x, F_{kj}(x)]=0$ . This is the covariance between the values of  $x$  in group  $k$  and their relative rank in  $j$ . The covariance is calculated using the distribution  $k$  (Yitzhaki 1994b: 149). A non-zero value of this covariance reflects some overlapping of group  $k$  by group  $j$ . A normalized overlapping index is given by the following expression.

$$(3.5) \quad O_{kj} = \frac{cov_k[x, F_{kj}(x)]}{cov_k[x, F_k(x)]}$$

The index has the following properties: (1) It is greater or equal to zero and less than or equal to 2; (2) It is equal to one if the distribution of group  $j$  is identical to the distribution of group  $k$ ; (3) for a given segment of distribution  $j$  that falls within the range of distribution  $k$ , the closer the observations of  $j$  are to the mean of  $k$ , the higher  $O_{kj}$ .

The overlapping of group  $k$  with the overall population (including group  $k$  itself) is defined as:

$$(3.6) \quad O_k = \frac{\text{cov}_k[x, F(x)]}{\text{cov}_k[x, F_k(x)]}$$

It can be shown that (Milanovic and Yitzhaki 2002: 160):

$$(3.7) \quad O_k = p_k + \sum_{j \neq k}^m p_j O_{kj}$$

where  $p_k$  is the population share of group  $k$ . Letting  $s_k$  stand for the share of group  $k$  in total welfare (as represented by income or expenditure), the ordinary Gini coefficient may be written as:

$$(3.8) \quad G = \sum_{k=1}^m s_k O_k G_k + G_b$$

where  $G_b = \frac{2 \text{cov}[\mu_k, \bar{F}_k]}{\mu}$  is an indicator of between group inequality. It is equal to twice the covariance between the mean welfare of each group and the group's mean rank in the overall distribution, divided by the overall mean of the welfare indicator. Using (3.7), we have:

$$(3.9) \quad G = \sum_{k=1}^m s_k p_k G_k + G_b + \sum_{k=1}^m s_k G_k \left( \sum_{j \neq k}^m p_j O_{kj} \right)$$

The first term on the right hand side of (3.9) measures within group inequality as a weighted average of the subgroup Ginis where the weights are equal to the subgroup population share times the share of welfare (as measured by the indicator  $x$ ). The share of group  $k$  in  $x$  is equal to:  $s_k = \frac{p_k \mu_k}{\mu}$ . The second term stands for between-group inequality. The last term, is an indicator of the extent of "cross-overlapping" [to distinguish it from global overlapping measured by (3.6)]. This term is equal to zero when subgroup distributions do not overlap.

An application of the above decomposition to the distribution of per capita household expenditure in Guinea in 1994 produced the following results.

Table 3.3 Gini Decomposition of Inequality in the Distribution of Household Expenditure in Guinea by Area of Residence

	Population Share	Expenditure Share	Mean Expenditure	Mean Rank	Gini	Global Overlap	Cross-Overlap
Conakry	0.17	0.31	849843.00	0.13	0.38	0.58	0.41
Other	0.16	0.20	598799.30	0.10	0.38	0.85	0.69
Urban							
Rural	0.67	0.49	342785.10	0.27	0.33	0.96	0.29
Guinea	1.00	1.00	469461.30	0.5	0.40	1.00	0.00

Data Source: 1994 Integrated Household Survey.

The overall Gini index is estimated at 0.40. The decomposition presented in table 3.3 above implies that the within-group inequality is equal to 0.14, the between-group component is equal to 0.11 while the overlapping component is 0.15. Thus about 28 percent of the observed inequality in Guinea in 1994 is accounted for by the between group component (when the population is classified by area of residence). Looking at the overlapping components, it can be seen that no area stands out as a perfect stratum. However, in relative terms, the rural area has the least amount of overlapping with the rest of the distribution compared to the urban areas. This fact is also supported by the pattern of mean expenditures.

### *The Use of Poverty Gaps*

At the individual level, poverty measurement involves two basic steps: (1) the selection of a poverty line indicating a threshold below which the person is declared poor, and (2) the computation of poverty gaps measuring the relative distance between an individual level of welfare and the chosen poverty line. Kakwani(1999:605) defines a class of additively separable poverty measures starting from the notion of *deprivation*. Let  $z$  be the poverty line, and  $x^h$  the level of welfare enjoyed by individual  $h$  in a society comprising  $n$  individuals. Let  $\psi(z, x^h)$  stand for an indicator of deprivation at the individual level. The following restrictions are imposed on the indicator: (i) it is equal to zero when the welfare level of the individual is greater or equal to that specified by the poverty line; (ii) the indicator is a decreasing convex function of welfare, given the poverty line.

Poverty measures of this class reflect the average deprivation suffered by the whole society and may be written, as:

$$(3.10) \quad P(z, x) = \frac{1}{n} \sum_{h=1}^n \psi(z, x^h).$$

The class of poverty measured defined by (3.10) is called *additively separable* because the deprivation felt by an individual depends only on a fixed poverty line and her/his level of welfare and not on the welfare of other individuals in society.

Furthermore, if the entire population is divided exhaustively into mutually exclusive socioeconomic groups, this class of measures allows one to compute the overall poverty as a weighted average of poverty in each group. The weights here are equal to population shares. Thus, such indices are also *additively decomposable*.

We wish to interpret expression (3.10) in the context of the general social welfare function defined by (2.1). We focus our attention on one prominent subgroup of the class of poverty indices due to Foster, Greer and Thorbecke (1984). The associated deprivation function may be written as follows (Jenkins and Lambert 1997:318).

$$(3.11) \quad \psi_{FGT}(z, x^h, \alpha) = \max\{(1 - x^h / z)^\alpha, 0\}.$$

If we define the relative poverty gap of individual  $h$  as  $g^h = \max\{(z - x^h) / z, 0\}$ , it becomes clear that in the context of poverty-focused evaluation defined by the Foster-Greer-Thorbecke (FGT) class of indices, the individual poverty gap plays a dual role in defining both individual welfare and the social weights assigned to the individual in social evaluation. To see this point more clearly, we rewrite (3.11) as:

$$(3.12) \quad \psi_{FGT}(z, x^h, \alpha) = \max\{\beta^h (1 - x^h / z), 0\}.$$

The social weight attached to the condition of individual  $h$  is now equal to:  $\beta^h = (1 - x^h / z)^{\alpha-1}$ . The parameter  $\alpha$  is an indicator of aversion for inequality among the poor. When  $\alpha=0$ , the social weight assigned to individual  $h$  is equal to:  $\beta^h = \left(\frac{z}{z - x^h}\right)$ .

This coefficient balances individual deprivation in such a way that on the basis of (3.12), each poor person counts for one in social evaluation and each non-poor counts for zero. Using expression (3.10), we find that aggregate poverty is equal to:

$$(3.13) \quad P_0 = \frac{1}{n} \sum_{h=1}^n \psi_{FGT}(z, x^h, 0) = \frac{q}{n}$$

where  $q$  is now the total number of poor people in the population.  $P_0$  is a measure of poverty *incidence* in the population. This measure does not take into consideration inequality among the poor.

When the aversion parameter is equal to one, the relevant social weights are all equal to one, regardless of individual deprivation. Aggregate level poverty is given by the poverty gap ratio defined as follows:

$$(3.14) \quad P_1 = \frac{1}{n} \sum_{h=1}^n \psi_{FGT}(z, x^h, 1) = \frac{1}{n} \sum_{h=1}^n \max\{(1 - x^h / z), 0\} = P_0 \left(1 - \frac{\mu_z}{z}\right).$$

where  $\mu_p$  is the average welfare of the poor. This index is also known as a measure of poverty *intensity*. One possible interpretation of this indicator is based on the following

considerations. Think of  $x$  as income, and consider a situation where  $x$  is observable and it is possible to give everybody a transfer of  $(z-x)$ . Afterwards, there would be no more poverty as every individual would have at least an income equal to  $z$ . Let  $q$  stand for the number of poor. The total income transferred to the poor by this operation is  $q(z-\mu_p)$ . Normalizing by the size of the population, we get  $P_0(z-\mu_p)=zP_1$ . Thus in an ideal world of *incentive-preserving* transfers and perfect targeting,  $zP_1$  is viewed as the minimum amount of resources that must be transferred, on average, from the non-poor to the poor in order to eradicate income poverty. The poverty gap ratio does not account for inequality among the poor. To do so we must set the aversion parameter to values higher than one. Thus setting  $\alpha=2$  produces the following estimator for aggregate poverty.

$$(3.15) \quad P_2 = \frac{1}{n} \sum_{h=1}^n \max\left[(1 - x^h / z)^2, 0\right] = (1 - \mu_p / z)P_1 + \left(\frac{\sigma_p}{z}\right)^2 P_0$$

where  $\mu_p$  and  $\sigma_p$  stand respectively for average welfare of the poor and the standard deviation of the welfare indicator among the poor. If everybody had a level of living equal to the poverty line, the average welfare of the poor would be equal to  $z$ . The term  $\sigma_p/z$  represents the coefficient of variation in these circumstances. The second expression of  $P_2$  on the right hand side of (3.15) thus reveals clearly how this estimator takes into consideration inequality among the poor.

The structure of the FGT family of poverty indicators reveals that a poverty indicator translates the type of concerns policy makers have about aggregate poverty. Typically, three dimensions are of interest: (i) *incidence*, (ii) *intensity* and (iii) *inequality* among the poor. Incidence is the proportion of the total population living below the minimum standard, while intensity (or depth) is the extent to which the well-being of the poor falls below the minimum. Most poverty indicators are designed to capture at least one of these three dimensions. Interestingly, there is a device known as the TIP curve<sup>10</sup> which provides a graphical summary of incidence, intensity and inequality dimensions of aggregate poverty based on the distribution of poverty gaps (absolute or relative, Jenkins and Lambert 1997:317). This curve is constructed in three steps: (1) rank individuals from poorest to richest; (2) form the cumulative sum of the poverty gaps divided by population size; and (3) plot the resulting cumulative sum of poverty gaps as a function of the cumulative population share. Assuming that the  $n$  individuals in the population are ranked from poorest to richest, then for all integers  $k \leq n$  the TIP curve may be defined as (Jenkins and Lambert 1997: 319):

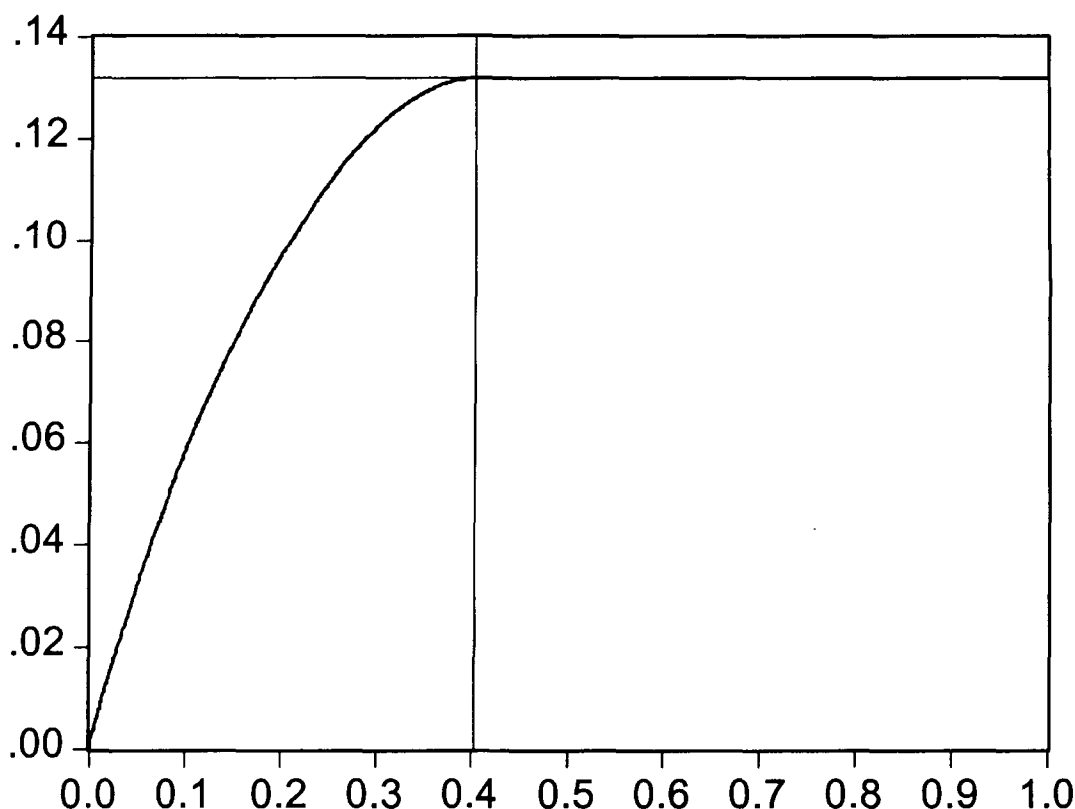
$$(3.16) \quad JL(p) = \frac{1}{n} \sum_{h=1}^k g^h; \quad p = \frac{k}{n}; \quad JL(0) = 0$$

It is clear from the above expression that the computation of the TIP curve is analogous to that of the Lorenz curve. Figure 3.1 below shows a TIP curve for the distribution of per capita expenditure in Guinea using the official poverty line set at

<sup>10</sup> TIP stands for “three ‘i’s of poverty”, that is incidence, intensity and inequality.

Guinean francs (GNF) 293,714 for 1994. This curve is based on normalized poverty gaps obtained by dividing absolute gaps by the poverty line. The curve is an increasing concave curve such that, at any given percentile, the *slope is equal to the poverty gap for that percentile*. In the general framework defined by (2.1) and (3.12), the social weight attached to a percentile is a monotonic transformation of the poverty gap. Thus the curvature of the TIP curve reveals the underlying scheme of social weights. In this normalized case, all weights vary from a maximum of 1 for lower ranking individuals to a minimum of 0 for people above that poverty line. The closer the standard of living is to zero the closer the social weight gets to one. The closer the standard of living is to the poverty line, the closer the social weight is to zero.

Figure 3.1. A TIP Representation of Poverty in Guinea in 1994



The curve represents simultaneously the three basic dimensions of aggregate poverty as follows: (1) the length of the non-horizontal section of the curve reveals poverty *incidence* (in figure 3.1, incidence equal about 40 percent); (2) the *intensity* aspect of poverty is represented by the height of the curve; and (3) the degree of concavity of the non-horizontal section of the curve translates the degree of *inequality* among the poor. The use of relative poverty gaps allows us to read off the horizontal and vertical axes, values of members of the FGT family. For Guinea, intensity is estimated at 13 percent about. This corresponds to the vertical intercept at  $p=1$  in figure 3.1.

### Box 3.1 Computing and Plotting a TIP Curve in EViews

```

INCLUDE LYCDF
LOAD %0
SMPL @ALL
CALL LYCDF({%1}(1), {%1}(2), {%1}(3))
SERIES GAP={%2}-YH
SERIES NGAP=GAP/{%2}
SERIES DUMGP=0
SMPL IF NGAP>0
    DUMGP=1
SMPL @ALL
SCALAR POP=@SUM(POPH)
SERIES PH=F_HAT
SERIES WNGAP=(POPH*NGAP)/POP
SERIES TGAPW=DUMGP*(WNGAP)
SMPL @FIRST @FIRST
SERIES JPW= TGAPW
SMPL @FIRST+1 @LAST
JPW=JPW(-1) +TGAPW
SMPL @ALL
GROUP JC PH JPW
FREEZE(TIPC) JC.XY

'END OF PROGRAM

```

Jenkins and Lambert(1997) explain that if all absolute poverty gaps were equal among the poor, the concave segment of the TIP curve would become a straight line with slope equal  $z$ , the poverty line. In addition, there are maximum and minimum poverty situations that set boundaries to the TIP curve in a manner analogous to a Lorenz curve. The TIP curve would coincide with the horizontal axis if there were no poor in the population under consideration. If all incomes (or expenditures) are equal to zero so that the relative poverty gaps are all equal to one, the TIP curve would be a straight line from the origin with a vertical intercept equal to 1 at  $p=1$ .

Table 3.4: Poverty in Guinea by Area of Residence

Poverty Measure	Conakry	Other Urban	Rural	Guinea
$P_0$	0.07	0.24	0.53	0.40
$P_1$	0.01	0.07	0.18	0.13
$P_2$	0.00	0.03	0.08	0.06

Source: Computed

The program in Box 3.1 was used to produce figure 3.1. It requires the user to fill in the values of three arguments. The WORKFILE containing the relevant data, a GROUP containing three series (total expenditure, the household size and the household weight), and a SCALAR equal to the poverty line. The program can be easily edited to include formulae

for the three members of the FGT family discussed above. In the case of Guinea, we obtained the following results by area of residence.

The results presented in table 3.4 reveal that, poverty in Guinea (as measured by the FGT class of indices) is essentially a rural phenomenon. About 53 percent of the rural population lived in poverty in 1994. The next poorest area consists of the urban centers outside of the capital city, where poverty incidence is estimated at 24 percent. Income poverty is lowest in the capital city of Conakry where incidence stood at 7 percent.

### *Sen's Measure of Poverty*

The FGT family of poverty indices relies on the coefficient of variation in order to account for inequality among the poor. This dimension of poverty may be implemented by combining truncation with the weighing scheme expressed by (2.4). If  $G_p$  represents the Gini coefficient of the distribution of the living standard among the poor, according to Sen (1997:173), the following expression is an indicator of welfare among the poor:

$$(3.17) \quad w_p = \mu_p (1 - G_p)$$

It represents the level of *per capita* level of living, which, if enjoyed equally by every poor person, would provide the same level of social well-being among the poor as the current distribution.

Table 3.5. Guinea 1994: Inequality by Poverty Status

Aversion	Sen	Gini for Poor	Gini for Non-Poor	Overall Gini
1.00	0.13	0.00	0.00	0.00
1.50	0.16	0.10	0.23	0.28
2.00	0.18	0.16	0.32	0.40
2.50	0.19	0.21	0.37	0.47
3.00	0.20	0.25	0.40	0.52
3.50	0.21	0.27	0.42	0.55
4.00	0.21	0.30	0.44	0.58
4.50	0.22	0.32	0.45	0.60
5.00	0.22	0.34	0.46	0.61
5.50	0.23	0.35	0.47	0.63
6.00	0.23	0.36	0.48	0.64

Source: Computed

Sen (1997:173) proposes a poverty index that is analogous to the poverty gap indicator of the FGT family. The only difference between the two is that Sen uses  $w_p$  in lieu of  $\mu_p$ . Hence the expression:

$$(3.18) \quad S = P_0 \left( 1 - \frac{w_p}{z} \right)$$



It is useful to recall the axioms underpinning Sen's poverty index: (1) *focus*; (2) *monotonicity*; (3) *weak transfer*; (4) symmetry, (5) scale invariance. Focus requires that the poverty measure depend only on the situation of the poor. The living conditions of the non-poor are irrelevant. Monotonicity requires an increase in the poverty measure whenever the well-being of the poor decreases. The weak transfer axiom makes the measure sensitive to changes in the distribution of living conditions among the very poor. Thus, if resources are transferred from one poor person to a relatively poorer one, the weak transfer axiom implies that the poverty measure should decrease.

The extended Gini coefficient may be used in expression (3.18) to obtain an extended version of Sen's poverty indicator written as follows.

$$(3.19) \quad S(v) = P_0 \left[ 1 - \frac{\mu_p [1 - G_p(v)]}{z} \right]$$

Note that the generalized Sen index of poverty is analogous to the poverty gap ratio defined by (3.14). In fact both indices are equivalent when the aversion parameter  $v=1$ . The results presented in tables 3.4 and 3.5 confirm this fact for the case of the distribution of household expenditures in Guinea in 1994. We note that  $S(1)=P_1=0.13$ . This observation suggests another way of extending the Sen index of poverty. Instead of using the extended Gini to measure inequality among the poor, one could use another index such as the Atkinson index of inequality<sup>11</sup>.

Table 3.5 shows values of extended Sen index along with estimates for the extended Gini coefficient for values of the aversion parameter ranging from 1 to 6. All indices increase monotonically with  $v$ . The results also reveal that inequality is higher among the non-poor than among the poor.

### ***How Desirable is Truncation?***

To be sure, both the FGT and Sen approaches to poverty analysis are consistent with the maximin approach discussed in Section 2. Within that framework, social weights are assigned to individuals on the basis of some notion of social desert. The more deserving the individual the higher the social weight assigned to her/his situation. The Gini family of indices implements this idea as follows. First, individuals are ranked in decreasing order of social desert. Second, social weights are assigned according to (2.4) which describes each weight as a function of the relative rank of the individual and the degree of inequality aversion. As revealed by figure 2.1, the level of aversion for inequality implies a cut-off rank such that people before it receive higher social weights than people after the cut-off

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<sup>11</sup> The Atkinson index of inequality is also based on the concept of equally distributed equivalent (EDE) welfare applied to a specific social welfare function. In this framework, the difference between average welfare and the EDE welfare is considered as the per capita social cost of inequality. The Atkinson index is equal to the per capita social cost divided by average welfare (See Lambert 1993b:131-138) for analytical details.

point. Our interpretation of expression (3.12) indicates that the FGT method does something very similar subject to the following adjustments. First, the social weights are now a function of the relative poverty gap. Second, *the cut-off point is no longer tied to the choice of the aversion parameter, it is imposed exogenously by the poverty line.* Third, everybody after the cut-off point now receives a weight of zero, regardless of her/his welfare level. Similar considerations apply to Sen's index of poverty. We argue that the problem here is not so much with the use of the poverty line as it is with ignoring every person beyond the cut-off point.

It is evident that truncation implements Sen's interpretation of the focus assumption. As mentioned above, this interpretation renders the living standard of the non-poor irrelevant for the purpose of social evaluation. As argued in the beginning of Section 2 of this paper, social evaluation is a critical input into public policy formulation and implementation. Indeed any policy recommendation is constrained by such an evaluative input, the reliability of which is determined by the organizing framework (view of the world) and the quality of the data set to which the framework applies.

There are two basic approaches to policymaking that shape the informational needs of the exercise. The *normative* approach seeks to maximize a social welfare function subject to the economy's resource, technology and institutional constraints. In the classical version, the resulting optimal program is supposed to be implemented by a set of competitive and complete markets given the prevailing ownership of resources (Dixit 1996: 4-5). In the context of the *positive* approach, policymaking is viewed as involving strategic interactions among various socioeconomic agents subject to potential *conflict* and *cooperation*. In this context, Aristotle is reported to have stated that "*It is when equal have or are assigned unequal shares, or people who are not equal, equal shares, that quarrels and complaints break out.*" (Young 1994:64).

In the positive perspective, a policy may be viewed as a social contract among participants which is enforceable within a given governance structure. Governance structure involves three basic elements:(1) abstract and universal rules of the social game; (2) enforcement institutions; and (3) mechanisms for the resolution of conflicts over both the rules and their enforcement (Fristchtak 1994)<sup>12</sup>. Any policy choice entails a distribution of burdens and advantages that creates winners and losers. Governance capacity is therefore the ability to coordinate the aggregation of these diverging private interests into an outcome that can credibly be taken to represent public interest. This is a key consideration in the investigation of political feasibility<sup>13</sup> of public policy. Such an investigation pertains to the way gainers and losers form coalitions and use the political system to their advantage. As Kanbur (1994:8) explains it, the outcome hinges crucially on the threshold at which a gain or a loss becomes so significant that an individual or a group

---

<sup>12</sup> This author further explains that governance capacity in a modern state may be assessed in terms of the mere existence of such rules, institutions and mechanisms, and the degree to which they are universal and predictable. Governance capacity is also determined by the extent to which the state is autonomous vis-à-vis private interests in society.

<sup>13</sup> Thus Kanbur (1994:4) explains that desirability is determined by welfare economics while feasibility stems from political economy.

feels compelled to organize and fight. *At this point it may be worth distributing real or symbolic pay-offs to the losers in order to buy social peace.*

The above political economy considerations suggest that truncation may be too drastic an approach to poverty-focused evaluation. Such considerations imply that we must not ignore the non-poor totally in our social calculus. The Dalton principle and its implementation by the Gini family of indices offer a way out of drastic truncation. This framework is consistent with a milder interpretation of the focus assumption which now requires only that we assign higher weights to the welfare interest of the poor relative to that of the non-poor. The particular range of social weights selection in the evaluation is an outcome of the governing political process.

#### ***4. Impact Analysis***

We view distributional impact as a comparison of social states based on the associated distributions of pay-offs from socioeconomic interaction. In this Section, we focus on the welfare impact of public policy. One particular state, known as the *counterfactual*, plays a crucial role in the assessment of the impact of policy. By definition, the counterfactual describes the state of the world that would have prevailed had the policy in question not been implemented. Thus impact assessment involves the comparison of two states of affairs: one *with* and the other *without* the policy. This comparison will be based on the welfare criterion defined by (2.1). The discussion is organized around three points: (1) social desirability of feasible policy reforms; (2) unambiguous welfare comparisons; and (3) the use of abbreviated social welfare functions.

#### ***Social Desirability of Feasible Policy Options***

Policy design and evaluation involve a determination of *desirable* actions within a *feasible* set. Considering the public budget as the policy instrument *par excellence*, the set of feasible collective actions must be viewed as determined by the budgetary process in the broadest sense of the term in order to capture the political economy dimension of feasibility. To be concrete, we focus on commodity taxation and assume *revenue neutrality*. Yitzhaki and Lewis (1996:543) argue that this assumption allows one to ignore the issue of the optimal size of government activity. Social desirability of a feasible action depends on the chosen social evaluation criterion or social welfare function.

In general, the impact of a policy change on the welfare of individual **h**, may be analyzed within the standard model of consumer behavior. The consumer is assumed to choose the best bundle of commodity that she can afford. At the optimum, this behavior can be characterized by the *indirect utility function* defined as follows:

$$(4.1) \quad v^h(q, y^h) = \max \{u^h(x^h) \quad s.t. \quad q \cdot x^h = y^h\}$$

where  $\mathbf{q}$  is a vector of consumer prices and  $y^h$  is the income of consumer  $\mathbf{h}$ . One can invoke Roy's identity (Varian 1992: 106) to compute the impact of the policy on the welfare of individual  $\mathbf{h}$  as:

$$(4.2) \quad dv^h = -\theta^h \left( \sum_{j=1}^m x_j^h dq_j \right) + dy^h$$

Expression (4.2) above implies that the marginal impact, in terms of income, of a unit increase in the tax on commodity  $\mathbf{j}$  (assumed to be a private good) is given by the following expression:

$$(4.3) \quad mv_j^h = \frac{\partial v^h / \partial t_j}{\theta^h} = -x_j^h$$

In the case of a tax increase, expression (4.3) measures the loss imposed on consumer  $\mathbf{h}$  as the consumption rate of commodity  $\mathbf{j}$ . The total impact of a change in all commodity taxes may now be expressed as:

$$(4.4) \quad dv^h = \sum_{j=1}^m mv_j^h dt_j = -\sum_{j=1}^m x_j^h dq_j$$

The social impact of such a reform may be written as:

$$(4.5) \quad dW = \sum_{h=1}^n \beta^h dv^h = -\sum_{h=1}^n \beta^h \sum_{j=1}^m x_j^h dq_j$$

where  $\beta^h$  is now the marginal social weight of the income of individual  $\mathbf{h}$ . This coefficient is defined as  $\beta^h = \left( \frac{\partial W}{\partial v^h} \right) \left( \frac{\partial v^h}{\partial y^h} \right)$ .

The change in social welfare induced by the tax reform may be transformed as follows. First, we change the order of summation in (4.5), then we multiply by the neutral element ( $x_j/x_j$ ) where  $x_j = \sum_{h=1}^n x_j^h$  is the aggregate *base* of the tax on commodity  $\mathbf{j}$ .

This transformation leads to the following expression:

$$(4.6) \quad dW = -\sum_j x_j \sum_{h=1}^n \frac{\beta^h x_j^h}{x_j} dq_j$$

To further apprehend the structure of the change in social welfare, we need to consider the impact of the tax reform on the public budget. Government revenue is equal to:

$$(4.7) \quad B = \sum_{j=1}^m t_j x_j(q, y)$$

where  $x_j(q, y)$  is the demand for commodity  $j$  (the tax base) as a function of prices and incomes. A small change in all taxes leads to the following change in government revenue.

$$(4.8) \quad dB = \sum_{j=1}^m \left( \frac{\partial B}{\partial t_j} \right) dt_j = \sum_{j=1}^m r_j dt_j = \sum_{j=1}^m \delta_j$$

Where  $r_j$  is the marginal revenue associated with a change in the  $j^{\text{th}}$  tax. The marginal tax reform may be characterized by a vector of tax changes  $dt$ , or by a vector of tax revenues  $\delta$ .

Revenue-neutrality implies that  $dB=0$ . Given that  $q$  is the vector of consumer prices, we have  $dt=dq$ . According to (4.8), we may write  $dq_j = \frac{\delta_j}{r_j}$ . This implies the following expression for the change in social welfare:

$$(4.9) \quad dW = - \sum_{j=1}^m \frac{x_j}{r_j} \left( \frac{\sum_{h=1}^n \beta^h x_j^h}{x_j} \right) \delta_j$$

Three important parameters are embedded in the above expression. The *first* one reveals the *distributional characteristic of commodity j*. The parameter is defined as (Mayshar and Yitzhaki 1995:795):

$$(4.10) \quad DC_j = \left( \frac{\sum_{h=1}^n \beta^h x_j^h}{x_j} \right) \geq 0$$

The *second* parameter is the marginal efficiency cost of funds collected through taxation of commodity  $j$ . It is defined as:

$$(4.11) \quad MECF_j = \frac{x_j}{r_j} = \frac{1}{1 + \frac{1}{x_j} \sum_{k=1}^m t_k \frac{\partial x_k}{\partial t_j}} = \frac{1}{\alpha_j}$$

Slemrod and Yitzhaki (2001:6) explain that this parameter is an indicator of the extent of leakage from the tax base (hence efficiency cost) associated with adjustment in behavior by the taxpayer in response to the change in tax burden. This may be thought of as an

incentive effect of the tax on  $j$ . The marginal efficiency cost is equal to the ratio of the cost of funds to the taxpayers to the value of the funds going to the public treasury.

The *third* parameter is the marginal social cost of funds defined as follows:

$$(4.12) \quad MSCF_j = -\frac{\sum_{h=1}^n \beta^h m v_j^h}{r_j} = \frac{\sum_{h=1}^n \beta^h x_j^h}{r_j} = \left( \frac{\sum_{h=1}^n \beta^h x_j^h}{x_j} \right) \left( \frac{x_j}{r_j} \right)$$

The above expression reveals that the marginal social cost of funds is equal to the distributional factor times the marginal efficiency cost of raising funds through a tax on commodity  $j$ .

It is instructive to note that the distributive component may also be written as follows:

$$(4.13) \quad DC_j = \frac{\sum_{h=1}^n \beta^h x_j}{x_j} = \frac{1/n \sum_{h=1}^n \beta^h x_j^h}{\mu_j} = \left[ \mu_\beta + \frac{\text{cov}(x_j, \beta)}{\mu_j} \right]$$

When social weights are chosen according to (2.4), then we know that  $\mu_\beta=1$  and the second term within the brackets is equal to minus the extended concentration coefficient of commodity  $j$ . Therefore, the marginal social cost of funds for this commodity is equal to:

$$(4.14) \quad MSCF_j = MECF_j[1 - C_j(v)] = MECF_j[1 - \eta_j(v)G_x(v)]$$

The impact of the tax change on social welfare is thus equal to:

$$(4.15) \quad dW = -\sum_{j=1}^m MSCF_j \delta_j$$

The policy option is feasible if  $dB = \sum_{j=1}^m \delta_j \geq 0$  has a nontrivial solution. It is socially

desirable if  $dW \geq 0$ . The final determination rests on the specification of the social weights  $\beta^h$ . If we impose only minimal restrictions on social weights, then a wide class of social welfare functions would agree on the characterization of the policy option. This situation corresponds to dominance ranking. However, the selection of a unique set of weights allows one to assess all policy options on the basis of the implied criterion.

### ***Unambiguous Welfare Comparisons***

As noted above, social desirability depends on the value judgments underpinning the social welfare function. Such judgments can take the form of restrictions placed on

the social weights  $\beta^h$ . Suppose that we adopt an individualistic welfare function of the type defined by (2.1) subject to the restriction that  $\beta^h \geq 0$  for each  $h$ . A Pareto-improving tax reform would have to improve the welfare of at least one individual without hurting any. This could be characterized in terms of (4.4) using the implication of (4.8) that  $dq_j = \frac{\delta_j}{r_j}$ . A Pareto-improving marginal tax reform must satisfy the following  $(n+1)$

linear restrictions:

$$(4.16) \quad dB = \sum_{j=1}^m \delta_j \geq 0; \quad dv^h = -\sum_{j=1}^m (x_j^h / x_j) MECF_j \delta_j \geq 0 \quad \forall h$$

The above expression reveals that the marginal impact of the reform on consumer  $h$  is equal to minus the weighted sum of modified consumption shares. The weights are the marginal tax receipts  $\delta_j$ , while the modified consumption share of each commodity are obtained by multiplying each share by the corresponding marginal efficiency cost of funds.

As noted in Section 2, the Dalton principle may be built in the social welfare function by first ranking individuals according to some criterion of social desert, then assigning social weights in such a way that of any two individuals the more deserving receives a higher weight. To see clearly what is involved, consider a society of three individuals ranked from the poorest to the richest. Under the Dalton principle, the pattern of social weights is  $\beta_1 \geq \beta_2 \geq \beta_3$ . Given that social weights are now chosen such that each is nonnegative and adjacent ones satisfy  $(\beta^{h-1} - \beta^h) \geq 0$  it is desirable to express the welfare improving condition in a way that is consistent with this restriction. Mayshar and Yitzhaki (1995:797) show that a *Dalton-improving policy* may be characterized in terms of cumulative marginal impact.

The cumulative marginal impact is defined as:

$$(4.17) \quad cmv^h = \sum_{i=1}^h dv^i; \quad i = 1, 2, 3.$$

By definition,  $dv^h = cmv^h - cmv^{h-1}$ . The change in social welfare due to a marginal tax reform is thus equal to:

$$(4.18) \quad dW = \sum_{h=1}^3 \beta^h dv^h = (\beta^1 - \beta^2) cmv^1 + (\beta^2 - \beta^3) cmv^2 + \beta^3 cmv^3$$

Expression (4.18) is a sum of cross products. The first term of each product is known to be nonnegative. It is therefore clear that if the second term is also nonnegative the whole sum will be nonnegative as well. The reform will be welfare improving (i.e.  $dW \geq 0$ ) if each  $cmv^h \geq 0$ . The condition for Dalton-improvement may thus be stated generally as:

$$(4.19) \quad dB = \sum_{j=1}^m \delta_j \geq 0; \quad cmv^h \geq 0 \quad \forall h$$

The condition for Pareto-improvement implies that for a Dalton-improvement, but not the other way around. Mayshar and Yitzhaki(1995:798) emphasize that, within this framework, *the social ranking is exogenous and need not be based on income*. They further note that when the ranking is based on income, the Dalton criterion is equivalent to the second degree dominance criterion based on the generalized Lorenz curve.

To further expose the structure of the Dalton criterion, on the basis of (4.9) we write the cumulative marginal impact as follows.

$$(4.20) \quad cmv^h = \sum_{i=1}^h dv^i = - \sum_{j=1}^m \delta_j \sum_{i=1}^h (x_j^i / x_j) MECF_j$$

In the above expression, the term  $\sum_{i=1}^h (x_j^i / x_j) MECF_j$  represents a point on the concentration curve of commodity **j** scaled by that commodity marginal efficiency cost of funds. Thus (4.20) shows that the design of a Dalton-improving indirect tax reform is equivalent to searching for a vector  $\delta$  such that  $\sum_j \delta_j \geq 0$  and the  $\delta$ -weighted sum of scaled concentration curves for the commodities is everywhere non-positive<sup>14</sup>.

Let's now focus on the simple two-commodity case where commodity **k** is taxed in order to subsidize the consumption of commodity **s** while keeping the public budget balanced. The revenue neutrality constraint implies that  $(\delta_s + \delta_k) = 0$ . The condition for Dalton-improvement may thus be written as:

$$(4.21) \quad - \left[ \sum_{i=1}^h (x_s^i / x_s) MECF_s - \sum_{i=1}^h (x_k^i / x_k) MECF_k \right] \delta_s \geq 0 \quad \forall h$$

Since  $\delta_s$  is negative by assumption, the reform will be Dalton-improving if the modified concentration curve for commodity **s** lies nowhere below that for commodity **k**. We may say that commodity **s** Dalton dominates commodity **k**. If the two commodities happen to have identical positive MECFs<sup>15</sup>, then we need only compare the ordinary concentration curves. It is in fact the relative magnitudes of the MECFs that determine whether to use

<sup>14</sup> Mayshar and Yitzhaki(1995: 800) propose the following algorithm in the case of strict revenue-neutrality.  $\min_{\delta} \sum_{h=1}^n \left[ \max(-cmv^h(\delta), 0) \right]^2$  s.t.  $\sum_{j=1}^m \delta_j = 0; \delta_1 \neq 0$ . A solution is achieved when the

objective function is equal to zero for nontrivial values of the vector  $\delta$ . In fact the constraint that  $\delta_1 \neq 0$  is meant to avoid trivial solutions. The authors further explain that one must compute two sets of solutions for positive and negative values of  $\delta_1$ . Since the scale of the reform can be set arbitrarily, this implies checking solutions for  $\delta_1=1$  and for  $\delta_1=-1$ . Finding a solution for these two values means that there exists a Dalton-improving tax reform that does not involve a change in the tax rate of commodity 1.

<sup>15</sup> Estimates of MECFs are known to be sensitive to changes in the structure of preferences (Mayshar and Yitzhaki 1995:803).



the ordinary concentration curves or the modified ones. It is instructive to note that, if the concentration curve of commodity  $s$  lies nowhere below the Lorenz curve of total expenditure (or income), then a subsidy on this commodity financed by a proportional income tax would increase welfare (Yitzhaki and Slemrod 1991: 486). In the same spirit, Yitzhaki and Thirsk 1990:14) explain that a tax on wages may be interpreted as *a tax on all expenditures made by workers*.

Finally, to focus only on efficiency considerations, we look at  $cmv^n$ . In the case of a revenue neutral reform involving two commodities, expression (4.20) implies that:

$$(4.22) \quad cmv^n = \sum_{h=1}^n dv^h = -(MECF_s - MECF_k)\delta_s \geq 0$$

This expression reveals that the neutral tax reform involving a subsidy for commodity  $s$  will reduce deadweight loss if  $MECF_s > MECF_k$ .

*There is a necessary condition for Dalton improvement based on Gini elasticities of the two commodities involved.* Recall that if commodity  $s$  dominates commodity  $k$  in terms of expression (4.21), then it must be true that the area of concentration of  $s$  multiplied by the marginal efficiency cost of  $s$  must be less than the area of concentration of commodity  $k$  times its marginal efficiency cost. This condition may be stated in terms of concentration indices as follows.

$$(4.23) \quad -[C_s(v)MECF_s - C_k(v)MECF_k] \geq 0$$

Based on definition (4.11), we write the ratio of the marginal efficiency coefficients as

$$\alpha_{sk} = \frac{MECF_k}{MECF_s}. \text{ Using the definition of the Gini Engel elasticity, the necessary condition}$$

for Dalton improvement can be expressed as:

$$(4.24) \quad -[\eta_s(v) - \alpha_{sk}\eta_k(v)]G_x(v) \geq 0$$

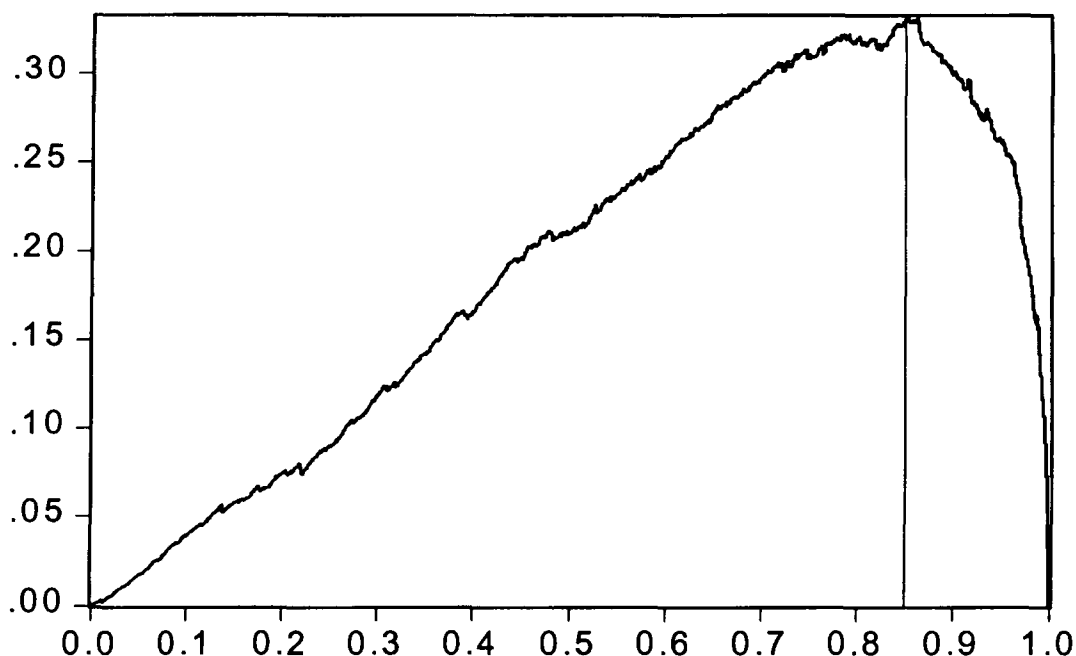
This condition can be used to narrow down the set of commodities on which to perform pairwise comparisons of modified concentration curves (Yitzhaki and Thirsk 1990:9). When both commodities have identical MECFs, then the necessary condition for Dalton improvement presented in (4.22) reduces to the following inequality:  $\eta_s(v) \leq \eta_k(v)$ .

Condition (4.21) can be verified graphically by plotting on the horizontal axis the cumulative proportions of individuals in the income distribution, and on the vertical axis the difference between the concentration curve of commodity  $s$  and the concentration curve of commodity  $k$ , multiplied by  $\alpha_{sk}$ . Yitzhaki and Slemrod(1991) call this the **DCC(p)** curve (the “difference in concentration curves” curve). This curve starts at  $(0,0)$  and ends at  $(1, 1 - \alpha_{sk})$ . If it lies everywhere above the horizontal axis, commodity  $s$  dominates commodity  $k$ ; if it is located entirely below the horizontal axis, then commodity  $k$  dominates  $s$ . If the curve crosses the horizontal line, there is no dominance to speak of.

The  $DCC(p)$  curve allows a combined presentation of both the efficiency gain from the reform and its distribution among income groups. If the curve is increasing at  $p$ , then individuals located at that percentile gain from the policy. If the curve is decreasing then they are losing from the reform.  $DCC(1)=(1-\alpha_{sk})$  provides an indication of whether the cumulative gain for the whole society is positive, zero or negative. The outcome hinges on how  $\alpha_{sk}$  compares to 1. When this ratio is equal to one, the policy reform is neutral with respect to efficiency (no efficiency gain, nor loss). However, if the  $DCC(p)$  curve lies above the horizontal axis for all other values of  $p$ , we conclude that the policy is welfare improving (in the sense of Dalton) on account of distribution. When  $DCC(1)<0$  (implying that  $\alpha_{sk}>1$ ) condition (4.21) cannot hold for all  $h$ , since it fails to hold for  $h=n$ .

It is useful to note that the same methodology can help analyze the case where a *subsidy is financed by a proportional income tax*. In this case, we have to compare the concentration curve for commodity  $s$  to the Lorenz curve of the income distribution.

Figure 4.1. Difference in Concentration Curves for Cereals and Beverages in Guinea 1994



To illustrate the point, we compare the distributional characteristics of two commodities, cereals and beverages, using data from the 1994 integrated household survey from Guinea. Figure 2.2 shows the concentration curves of the two commodities along with the Lorenz distribution of total household expenditure. It is evident from that figure that the consumption of cereals in Guinea is more equally distributed than total consumption and the consumption of beverages. Not having estimates for relative efficiency costs, we proceed as if  $\alpha_{sk}$  were equal to one (the case of neutrality vis-à-vis efficiency). Under this assumption, we would expect welfare dominance to the extent that the concentration curve for cereals lies totally above the concentration curve for

beverages over the entire range of the cumulative distribution of per capita expenditure. Figure 4.1 confirms this view. It plots the difference between the concentration of the consumption of cereals and that of beverages. The **DCC** curve lies entirely above the horizontal axis, thus it would be socially desirable to implement a commodity tax reform that would shift the tax burden away from cereals and towards beverages while keeping the public budget balanced. In addition, figure 4.1 reveals that at least 85 percent of the population would benefit from such a move.

It is useful to note the concept of TIP dominance in the context of truncated analysis. Given a poverty line  $z$ , if a TIP curve  $a$  lies entirely over another TIP curve  $b$ , we say that  $a$  TIP-dominates  $b$ . In other words, there is more poverty in situation  $a$  than in situation  $b$ , regardless of the dimension we choose to focus on: *incidence*, *intensity* or *inequality* among the poor, and for all poverty lines less than or equal to  $z$ .

Figure 4.2. A TIP Comparison of Poverty in Guinea by Area of Residence  
(Data Source: 1994 Integrated Household Survey)

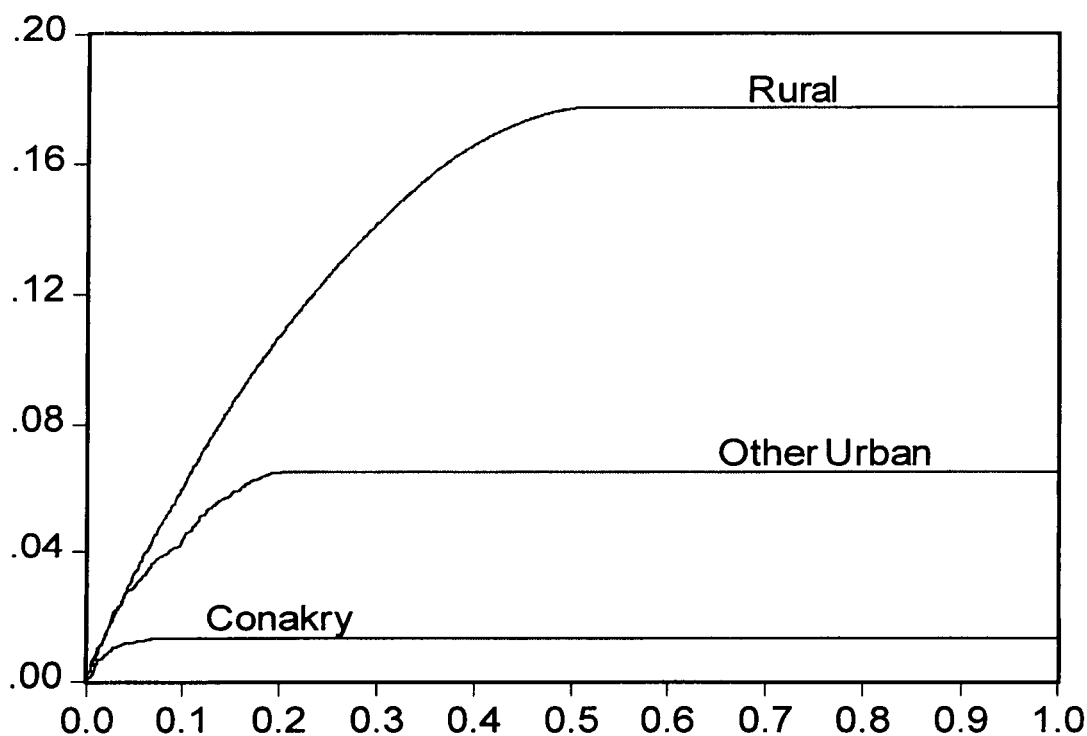


Figure 4.2 illustrates the point with three TIP curves for three population sub-groups in Guinea based on the area of residence of the household in 1994: (1) Conakry, the capital city; (2) other urban centers and (3) the rural area. The dominance relation among these curves reveals that, regardless of the dimension considered, poverty in Guinea (as measured by the FGT class of indices) is essentially a rural phenomenon. About 53 percent of the rural population lived in poverty in 1994. The next poorest area consists of the urban centers outside of the capital city, where poverty incidence is estimated at 24 percent. Income poverty is lowest in the capital city of Conakry where incidence stood at 7 percent.

Our discussion of TIP curves focuses on the FGT class of poverty indices. However it is worth noting that Jenkins and Lambert's (1997) results are more general. Consider the class of Generalized Poverty Gap (GPG) poverty indices. The members of this class are increasing Schur-convex<sup>16</sup> functions of absolute poverty gaps given the poverty line. In addition, these indices are replication invariant. A sub-class of these indices, GNPG, is defined on normalized poverty gaps (e.g. FGT). As it turns out, TIP dominance based on absolute poverty gaps is equivalent to a unanimous poverty ordering by all members of the GPG class, and for all poverty lines that are at most equal to the chosen one<sup>17</sup>.

### *Use of Abbreviated Social Welfare Functions*

Dominance criteria provide a general framework for identifying unambiguous rankings of social states in terms of the distribution of the living standard. However, the relation of dominance is a *partial ordering* in the sense that it could fail to rank two situations. For instance when two concentration (or Lorenz) curves intersect, we lose the ability to draw unambiguous conclusions about the inequality or welfare content of the distributions under comparison.

Sen (1989: 18) explains that the dominance approach to social evaluation provides a *minimal partial order* on the focal space. The Pareto improvement test discussed above (based on the social welfare function defined by 2.1) is an example of such a minimal ordering to the extent that it requires only non-negative social weights. Sen (1989) also explains that it is possible to go beyond the scope of this minimal order by further restricting social weights to lie within a particular range. The Dalton criterion, for instance further restricts the admissible range associated with the Pareto criterion. The narrower the range, the more extensive the overall ranking will be in comparison to minimal dominance. A social evaluation function based on a unique set of weights (e.g. 2.5) would induce a complete ordering of socioeconomic states. The weights in question are a reflection of the underlying *value judgments*. These value judgments determine the structure of *index numbers* used to assess the inequality and social welfare effects of a policy based on induced distributional changes. In the end, the selection of evaluative weights boils down to *priority* setting among the different dimensions of the quality of life (e.g. components of consumption) and among diverse individuals or groups (within resource and institutional *constraints*). In this subsection we focus on index numbers based on the *maximin* principle, and on *normalized poverty gaps*.

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<sup>16</sup> By analogy to Schur-concavity in the case of inequality and welfare which ensures that inequality falls and welfare increased when the distribution of resources is "smoothed" by equalizing transfers, Schur-convexity require that poverty fall when poverty gaps are smoothed (Jenkins and Lambert 1997).

<sup>17</sup> Jenkins and Lambert(1997) also reveal a close link between the poverty orderings based on TIP dominance and those associated with generalized Lorenz dominance. They show that distribution **a** dominates distribution **b** on the basis of the generalized Lorenz curve if and only if the TIP curve for **b** lies nowhere below that of **a**, for all common poverty lines **z**. The generalized Lorenz curve is equal to the ordinary Lorenz curve times the mean of the corresponding distribution.

### Changes in the Abbreviated Social Welfare Function

When an economy undergoes a shock (exogenous or policy), its structure and the implied distribution of welfare may change significantly. In the particular case of policy reform, the desirability and feasibility of a policy proposal depend essentially on the implications of the proposal for efficiency and equity. We may use the abbreviated social welfare function defined by (2.5) to track the effects of a policy. To simplify matters, we focus the analysis at the margin. Consider therefore the enactment of a policy that leads to marginal changes ( $dx^h$ ) in the living standard of the population involved. The logic behind expression (2.5) leads us to the following assessment of the induced welfare impact.

$$(4.25) \quad dV(v) = \frac{1}{n} \sum_{h=1}^n w^h(v) dx^h = \mu_a + v \text{cov}[a, (1-p)^{v-1}]$$

where  $\mathbf{a}$  stands for the distribution of marginal benefits induced by the reform. The above expression is equivalent to the following<sup>18</sup>:

$$(4.26) \quad dV(v) = \mu_a [1 - C_a(v)] = \mu_a [1 - \eta_a(v) G_x(v)]$$

where  $\eta_a(v) = \frac{C_a(v)}{G_x(v)}$  is the ratio of the concentration of marginal benefits to the overall Gini index of inequality in the distribution of the living standard prior to the reform.

Expression (4.26) shows that a first-order assessment of the welfare impact of a policy reform within the maximin framework can be based on three parameters: (1) the average marginal benefit of the reform ( $\mu_a$ ), (2) the overall Gini index of inequality  $G_x(v)$  and (3) the Gini Engel elasticity of the marginal benefit of the reform  $\eta_a(v)$ . A Gini Engel elasticity greater than one means that the distribution of marginal benefits is more unequal than the initial distribution of the living standard. Therefore the reform is inducing more inequality. This distributional effect will lower welfare. The overall impact depends on the sign and size of the average benefit.

When the living standard is composed of different components, we may be interested in welfare changes due to a change in one component. Kakwani(1995:5) provides a way of computing the elasticity of  $V(v)$  with respect to the mean of the  $j^{\text{th}}$  component.

$$(4.27) \quad \theta_j^K(v) = \frac{\mu_j [1 - G(v)] + \mu_j [G(v) - C_j(v)]}{\mu [1 - G(v)]} = \lambda_j \left[ 1 + \frac{G(v) - C_j(v)}{1 - G(v)} \right] = \lambda_j [1 + P_j^K(v)]$$

According to Kakwani(1995:5) this elasticity, which measures the effect of a change in the  $j^{\text{th}}$  income component on total welfare and may be interpreted as the sum of the “income” and the inequality effect. The income effect is equal to the share of the component in total expenditure (or income)  $\lambda_j$ , while the inequality effect is equal to this share times a

<sup>18</sup> The expression is obtained by factoring out  $\mu_a$  and multiplying the resulting concentration coefficient by the neutral element  $[G_x(v)/G_x(v)]$ . Also note the analogy between this expression and that of the marginal social cost of funds (4.14).

progressivity index denoted by  $P_j^K(\nu)$ . A positive value of this index means that the change in the  $j^{\text{th}}$  component is progressive in the sense that it favors the poor more than the rich. A negative value implies regressivity. If the change in the  $j^{\text{th}}$  income component is distributed in proportion to total income, its concentration index will be equal to the Gini index and the progressivity index will be zero. In this case neither the rich nor the poor are favored. This progressivity index may guide the design of an optimum tax (or expenditure) policy. The methodology described here may also be used to evaluate the effect of price changes on total welfare<sup>19</sup>.

### *Poverty Impact*

One may be interested in analyzing the poverty impact of policies and shocks based on poverty indices such as those of the FGT family. As a general rule, the poverty impact of a policy depends on the degree of targeting. Options range from perfect targeting to no targeting at all. In the extreme case of no targeting, any effect of policy on the poor is linked to the “trickle down mechanism”. However, policy makers may resort to a coarser approach to targeting based on a broad definition of population subgroups (Kanbur 1987a:72). Such policies will affect both the poor and the non-poor within the targeted socioeconomic group. For instance, price support for a particular crop will affect both poor and non-poor farmers engaged in the cultivation of the crop. A subsidy on a particular food item will affect all those who are consuming it. At the margin, such an analysis relies on the derivatives of the poverty indices used with respect to changes in the welfare indicator. For the FGT family of indices, the first derivative of the poverty gap with respect to the welfare indicator is equal to:

$$(4.28) \quad \frac{\partial \psi_{FGT}}{\partial x^h} = \min \left\{ -\frac{\alpha}{z} (1 - x^h / z)^{\alpha-1}, 0 \right\}$$

and the second derivative is:

$$(4.29) \quad \frac{\partial^2 \psi_{FGT}}{\partial (x^h)^2} = \max \left\{ -\frac{\alpha(\alpha-1)}{z^2} (1 - x^h / z)^{\alpha-1}, 0 \right\}, \quad \alpha > 1.$$

For positive values of the aversion parameter, these derivatives indicate that members of the FGT family of indicators are *non-decreasing convex* functions of the welfare indicator.

Kanbur(1987a:73) notes that a policy may have either an additive or a multiplicative effect on the level of individual welfare. Consider first the additive case. Policy implementation changes all levels of welfare to  $(x^h+t)$ , so that individual poverty

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<sup>19</sup> See Kakwani (1995:5-7) for details

gaps are now equal to:  $\psi_{FGT}(z, x^h, \alpha) = \max\{(1 - (x^h + t)/z)^\alpha, 0\}$ . This implies the derivative of the poverty gap with respect to  $t$  is equal to:

$$\frac{d\psi_{FGT}}{dt} = \min\left\{-\frac{\alpha}{z}(1 - (x^h + t)/z)^{\alpha-1}, 0\right\}.$$

This suggests that the derivative of the average poverty gap with respect to  $t$  is equal to:

$$(4.30) \quad \frac{dP_\alpha}{dt} = -\frac{\alpha}{z} \left( \frac{1}{n} \sum_{h=1}^n \max[(1 - (x^h + t)/z), 0] \right) = -\frac{\alpha}{z} P_{\alpha-1}$$

Kanbur interprets this expression as the shadow price of budgetary expenditure when one is seeking to minimize  $P_\alpha$  subject to a budgetary constraint. When  $\alpha=1$ , the amount by which poverty intensity changes when the welfare indicator increases marginally is proportional to the head count ratio, i.e.  $P_0$ .

If policy implementation has a multiplicative effect such that post policy welfare is equal to  $(1+t)x^h$ , then it can be shown that the derivative of the average poverty gap is equal to:

$$(4.31) \quad \frac{dP_\alpha}{dt} = -\frac{\alpha}{1+t} (P_{\alpha-1} - P_\alpha) < 0$$

This expression makes the shadow price of budgetary expenditure proportional to the difference between  $P_{\alpha-1}$  and  $P_\alpha$ .

Another interesting aspect of poverty impact analysis relates to the responsiveness of poverty to growth and changes in inequality. Given that poverty indices are computed on the basis of a distribution of living standards, which is fully characterized by the *mean* and the degree of *inequality*, it is reasonable to think of a poverty index as a function of these two factors. Indeed, procedures have been developed for the decomposition of changes in poverty into *growth* and *inequality* components (Ravallion and Datt, 1992).

For small changes and under the assumption that the Lorenz curve shifts proportionately over the whole range of income distribution, Kakwani (1990) shows that the total percentage change in a poverty index is equal to the *growth elasticity of the index* times the percentage change in the mean income plus the *elasticity of the index with respect to the Gini* times the percentage change in the Gini coefficient. He further shows that the growth elasticity of the head-count index is equal to:

$$(4.32) \quad \eta_H = -\frac{zf'(z)}{H} < 0$$

Where  $f(z)$  is the density function of the welfare indicator evaluated at the poverty line. The elasticity with respect to Gini is:

$$(4.33) \quad \varepsilon_H = -\frac{(\mu - z)}{z} \eta_H$$

For the general class of additively separable poverty measures, the growth elasticity is given by the following expression.

$$(4.34) \quad \eta_P = \frac{1}{P} \sum_{h=1}^m w_h x_h \left( \frac{\partial \psi}{\partial x_h} \right)$$

The elasticity with respect to Gini is:

$$(4.35) \quad \varepsilon_P = \eta_P - \frac{\mu}{P} \sum_{h=1}^m w_h \left( \frac{\partial \psi}{\partial x_h} \right)$$

These elasticities may be used to evaluate the *potential for poverty reduction*. Indeed, a higher growth elasticity means a greater potential for poverty reduction. Focusing in particular on poverty incidence, it can be seen from (4.32) that the responsiveness of the head-count index to growth depends essentially on the *initial value* of the index and the slope of the distribution function at the poverty line. The higher the initial head-count, the lower the elasticity and the higher the actual rate of growth required to further reduce poverty (other things being equal).

In the particular case of the FGT family of indices, these elasticities are equal to:

$$(4.36) \quad \eta_{FGT} = -\frac{\alpha[P_{\alpha-1} - P_\alpha]}{P_\alpha}; \quad \varepsilon_{FGT} = \eta_{FGT} + \frac{\alpha\mu P_{\alpha-1}}{zP_\alpha}; \quad \alpha > 0.$$

On the basis of expressions (4.35) and (4.36) the total impact of growth and redistribution on income poverty may be written as:

$$(4.37) \quad \frac{dP}{P} = \eta_P \frac{d\mu}{\mu} + \varepsilon_P \frac{dG}{G}$$

Ravallion (1994b) argues that the above decomposition may lead to large errors in the case of big discrete changes. A different approach is therefore required. Instead of summarizing inequality by the Gini index, one may use a parameterized Lorenz curve along with the mean income to decompose changes in poverty into growth and inequality components, and a residual<sup>20</sup>.

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<sup>20</sup> Ravallion and Datt (1992) note that the existence of this residual depends on whether or not the poverty index is additively separable between the mean and the Lorenz curve. The residual would vanish if the mean income or the Lorenz curve remained constant over the decomposition period.



The *growth-inequality* relationship thus seems fundamental in analyzing the dynamics of poverty. If growth is distributionally neutral, poverty is expected to be reduced on such a path<sup>21</sup>. If one drops the neutrality assumption, then the outcome becomes ambiguous. In this case the distributional impact and the poverty implications depend essentially on the initial structure of the economy and the profile of the adjustment process.

## 5. Conclusion

This paper sought to demonstrate how one might perform distributional impact analysis within a *poverty-focused* evaluative framework. The approach is illustrated with household level data from Guinea, using EViews as a computing platform. The focus on poverty is important for at least two reasons. Widespread poverty in the developing world remains a serious challenge for the development community. Furthermore, the ethics of *empowerment* which underpins current development thought entails the expansion and the distribution of socioeconomic opportunities with implications for individual and collective well-being. These considerations have prompted the development community to make poverty reduction a fundamental objective of socioeconomic development, and a benchmark measure of the performance of various social arrangements. In this context, poverty is seen as the deprivation of basic capabilities to lead the type of life one has legitimate reasons to value.

Any evaluation is characterized by the underlying *criterion*. The object of social evaluation is the determination of the extent to which prevailing social arrangements promote individual and collective well-being. This requires identification of the objects of value, and an aggregation rule for the comparison of social states. The need for aggregation raises the fundamental issue of weights to attach to each constituent of the aggregate. The choice of social weights is based on *value judgments*. If one believes that an incentive-preserving transfer of resources from rich to poor would increase collective well-being, then the *maximin principle* provides an adequate foundation to a poverty-focused evaluation. When implemented in the context of additively separable social welfare functions, the principle leads to social evaluation functions that are decomposable into two components revealing both the average living standard and its distribution among the population. The distribution component is equal to the covariance between the living standard and the social weights. Thus, the maximin approach to social evaluation offers a way of combining both efficiency and equity considerations in social evaluation. In addition, the linearity of the covariance operator allows a factor decomposition of the inequality components on the basis of the constituents of the living standard.

Further specification of social weights is needed to determine the extent of poverty focus of the evaluation. The Gini family of indices provides a weighing scheme based on relative ranks of individuals (according to some criterion of social desert), and on a focal parameter indicating the degree of aversion to inequality. This aversion

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<sup>21</sup> The time frame is important in this context as we should distinguish between short and long-run impacts associated respectively with fluctuations in output, and steady-state growth in capacity output.

parameter also determines a cut-off rank such that people below the cut-off point receives higher weights than people above it. In that sense, the standard approach to poverty analysis based on the truncation of the distribution of the living standard by a poverty line is quite consistent with the maximin approach. However, this truncation appears undesirable on political economy grounds.

The criterion presented in this paper can guide the identification of desirable policy options. This entails a ranking of social states on the basis of the values assumed by the criterion in each state. The scope of the ranking depends on the acceptable range assigned to social weights. This range is a reflection of the extent of the restrictions placed on the social weights. The milder the restrictions, the more *robust* the implied comparisons. This is the essence of the dominance approach to evaluation based on the comparison of distribution functions. When dominance fails, one can resort to abbreviated social welfare functions. Such functions usually translate the concept of equally distributed equivalent (EDE) welfare. Gini-based evaluation functions incorporate a focal parameter that summarizes the underlying value judgments. This parameter can be used in sensitivity analysis.

In the end, the selection of evaluative weights boils down to priority setting among the different dimensions of the quality of life and among diverse individuals or groups (within resource and institutional constraints). The maximin approach illustrates the link between social weights and the underlying value judgments. *It is important to note that in the selection of evaluative weights, one has a choice between a technocratic and a democratic approach* (Sen 1999). The ethics of empowerment imply a determination of explicit evaluative weights from a participatory approach based on open public debate involving all concerned. This seems to be one of the sure ways to detect the value system that commands respect among the participants in the relevant social arrangement.

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