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ON INDICES FOR THE MEASUREMENT OF POVERTY*

When discussing the state of research on poverty and social security in Britain Atkinson (1977) pointed out that, in measuring the prevalence of poverty, attention has been focused upon the proportion of the population with an income below the poverty line. It is well known that as an index of poverty this has serious shortcomings – in particular, it is insensitive to how far below the poverty line the incomes of the poor fall. Alternative indices have been proposed: the United States Social Security Administration introduced the notion of poverty gaps (see Batchelder (1971)), that is, the aggregate value of the difference between the incomes of the poor and the poverty line, while Sen (1976) has suggested that income inequality among the poor is also an important dimension of poverty. Atkinson (1977) therefore proposed that researchers experiment with a range of indices which incorporate such aspects of poverty, given the possibility that the measurement of poverty may be sensitive to the precise index employed. Beckerman (1979) has shown that the information content of poverty gaps very usefully supplements that provided by the aggregate incidence approach. However, to our knowledge, there has been no attempt in Britain to compute indices which take account of inequality among the poor. In this paper we hope to correct this omission, and in doing so comments will be offered on some proposed methods of incorporating such a consideration. A close examination of these has prompted us to propose two further indices which, although relying on the setting up of an alternative structure for analysing this problem, are firmly based on the approaches favoured in the existing literature.

I

As pointed out above, in British studies the proportion of the population with incomes below the poverty line has proved to be a popular index of poverty (see Abel-Smith and Townsend (1965), Atkinson (1969) and Fiegehen, Lansley and Smith (1977)). This index, known as the *head count ratio*, will be written

$$H = q/n \tag{1}$$

where q is the number of poor and n the total population. Assuming that the poor can be viewed as homogeneous individual units, to be referred to as individuals, implying a common poverty line, z, the poverty gap of a poor individual i is given by

$$g_i = z - y_i \geqslant 0, \tag{2}$$

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where y_i is the income of individual i.[1] To incorporate poverty gaps into an index of poverty it is usual to express the aggregate gap of the poor as a proportion of GDP or the aggregate income of the poor, when each poor individual receives an income equal to the poverty line. While Beckerman (1979) adopts the former approach for the purposes of this paper it will prove more convenient to use the latter. Therefore define the *poverty gap ratio*

$$I = \sum_i g_i / qz, \quad g_i \geqslant 0, \quad i = 1 \ldots q. \tag{3}$$

Sen (1976) shows that both of these indices violate one or both of the following appealing axioms:

(*a*) the monotonicity axiom – all other things being equal, a reduction in the income of a person below the poverty line must increase the poverty index;

(*b*) the transfer axiom – all other things being equal, a pure transfer from a person below the poverty line to someone who is richer, but may still be poor, must increase the poverty index.

H violates both the monotonicity and transfer axioms while I violates the transfer axiom in the case of transfers among the poor. Sen attaches considerable importance to the transfer axiom and therefore sees the need for an alternative poverty index. This he attempts to provide using an ordinal approach to welfare comparisons of states of the poor.

The transfer axiom can be interpreted as saying that for a given ordered vector of weighted poverty gaps $(\phi_1 g_1, \ldots \phi_j g_j, \ldots \phi_k g_k, \ldots \phi_q g_q)$ where $g_1 < g_j < g_k < g_q$, a poverty index which depends upon the elements of this vector will attach weights to each poverty gap such that $\phi_1 < \phi_j < \phi_k < \phi_q$. A transfer of the type outlined in the transfer axiom, say from individual k to individual j, given that the weighting system implies that individual j's poverty gap is attached less weight in determining the index of poverty than individual k's, will satisfy the axiom. Now Sen's interpretation of the distinction between H and I and the class of indices he would like to see used is that while the former reflect either the proportion of the population which is poor or average deprivation, both of which Sen thinks are important, the latter would reflect, in addition, relative deprivation.

The Sen notion of relative deprivation reflects the implications of some poor individuals having incomes which deviate from the poverty line by more than is the case with other poor individuals. On realising this all those who can observe someone less poor than themselves, but still poor, will feel a heightened sense of deprivation. Conversely, individuals who realise that the extent of their poverty is relatively minor will have their senses of deprivation muted. Hence the ease with which the concept can be motivated in terms of income transfers among the poor becomes apparent. A transfer of income between two poor individuals increases the poverty gap of one individual by exactly the same amount as it reduces that of the other. The unweighted aggregate poverty gap remains unaffected. However, the gaps of these two individuals either move closer together or further apart, and there is an appealing sense in which relative

[1] In this paper the problem of how the poverty line is determined is not discussed. The major concern is with constructing poverty indices for a given poverty line.

deprivation is reduced in the first case and increased in the second. The weighting of individual poverty gaps allows this possibility to be taken into account when measuring poverty.

If this concept of relative deprivation is to be reflected in a poverty index, in addition to the other aspects discussed above, then a set of poverty gap weights has to be decided upon. Sen derives an appropriate weighting system from three axioms which taken together imply

(*c*) the ranked relative deprivation axiom – the weight ϕ_i attached to poverty gap g_i should correspond to the rank order of individual i in the coincident interpersonal welfare and income rankings of the poor (i.e. $\phi_1 = 1$, $\phi_2 = 2$, etc.). The title of this composite axiom is taken from Sen (1979). When combined with a fourth

(*d*) normalisation axiom – when all the poor have identical incomes the poverty index should equal the product of H and I, a unique poverty index is defined. This *Sen index* is given by

$$S = H(1-(1-I)\{1-G[q/(1+q)]\})$$
$$\rightarrow H[I+(1-I)G] \quad \text{as} \quad q \rightarrow \infty \tag{4}$$

where G is the Gini index of the distribution of income among the poor.[1] S exhibits the following properties:

(S1) it satisfies the monotonicity and transfer axioms;

(S2) it is increasing in H, I and G;

(S3) it lies in the closed interval (0,1), the limits being defined when there are no poor and when all individuals have zero incomes.

Although the Sen index captures much that is of interest in attempting to measure poverty it is not without its weaknesses. There are two major ones, the first technical and the second conceptual. These will be discussed, and some attempts at amelioration outlined, in the next two sections.

II

While the Sen index satisfies the transfer axiom it is a feature of a system of rank order weights that the impact of an income transfer between two individuals depends only upon the difference in the rankings of the two individuals concerned. This implies that a fixed equidistant transfer, in terms of the income difference between the donor and recipient, over equal numbers of units will reveal the Gini index to be equally sensitive no matter where in the distribution these occur (see Sen (1973)). It has recently been suggested by Kakwani (1980) that if each weight ϕ_i is raised to some power $k > 1$ the Sen index will become more sensitive to transfers among those with large poverty gaps. In fact, this is true for any value of $k > 1$ in the above case.

However, fixed equidistant transfers will have a much larger impact in the

[1] The Gini index is a function of the rank order weighted sum of individual income shares (see Sen (1973)). Given that S is derived from the ranked relative deprivation axiom it should not appear too surprising to find S depending on G.

region of the modal income class of a distribution since many more individuals are by-passed when such a transfer occurs. This is exactly the problem that arises in using the Gini index to measure inequality in the distribution of incomes in society as a whole, where transfers of the type described above will have a much larger impact around the centre of the distribution (see Atkinson (1970)). In the case of the distribution of income among the poor it is typically the top of the distribution that is most densely populated (i.e. close to the poverty line) and therefore where transfer sensitivity will be at its greatest. Now if, following Kakwani, it is required that transfer sensitivity should be greater at the bottom than the top of the distribution it is clear that an arbitrary value of $k > 1$ cannot guarantee the required sensitivity. Nevertheless, it is equally clear that for a given distribution of income a value of k can be found which will achieve this. Of course, the need to have to search for a sufficiently large value does not particularly endear one to this method of achieving the desired degree of transfer sensitivity. Moreover, there is an additional argument in favour of rejecting this approach. Kakwani suggests that k should be chosen according to social preferences regarding transfer sensitivity at different levels of income. There are strong grounds for believing that such preferences should be independent of the particular distribution being considered. The parameter k does not have this property.

The problem that has been discussed above can be viewed as one related to the group social welfare function underlying the Gini index. This is the rank order weighted sum of individual income shares (see Sen (1973)). Agreeing with Kakwani's view about relative transfer sensitivity, and believing this to accord with widely held social values, it is clear that the Gini index is not a suitable index of inequality for capturing this particular value judgement. An appealing approach to constructing an inequality index with exactly the required properties is to first specify the group social welfare function to be used in comparing distributions, and then from that derive an appropriate inequality index. Such an approach was popularised by Atkinson (1970).

In adopting the welfare-based approach to inequality measurement the first problem is to specify the group social welfare function. Now clearly there are many from which to choose but, as Atkinson (1970) points out, if attention is focused on ordinal rather than cardinal comparisons there is a far lesser need for agreement about the precise form of the function. The group social welfare function employed will be additively separable in individual welfares. In specifying this function further an attempt is going to be made to embody directly into it the Sen notion of relative deprivation.

Although the foregoing discussion has been in terms of income inequality, and it is the Gini index of the distribution of incomes among the poor that appears in the Sen index, it is comparisons of poverty gaps that are central to the Sen notion of relative deprivation. Indeed it can be demonstrated that this is exactly what is being reflected in the Sen index. From (4) the Sen index can be rewritten

$$S = HI[1 + (1 - I)G/I] \tag{5}$$

and it is well known that the Gini index is equal to one-half the relative mean difference; that is

$$G = (2q^2\bar{y}_p)^{-1}\sum_i \sum_j |y_i - y_j| \quad i,j = 1 \ldots q, \tag{6}$$

where $\bar{y}_p$ is the mean income of the poor (see Sen (1973)). Now from (2) and (3) $(1-I)/I = \bar{y}_p/\bar{g}$, where $\bar{g}$ is the mean poverty gap, and $|y_i - y_j| = |g_j - g_i|$ for all i and j. It follows that

$$(1-I)G/I = (2q^2\bar{g})^{-1} \sum_i \sum_j |g_j - g_i| \quad i,j = 1 \ldots q, \tag{7}$$

which is just the Gini index of the distribution of poverty gaps. Denoting this G^* the Sen index becomes

$$S = HI(1+G^*) \tag{8}$$

and is seen to be the product of the head count ratio, the poverty gap ratio and one plus the Gini index of the distribution of poverty gaps, the latter a measure of relative deprivation in aggregate. Establishing this result leads fairly naturally to a specification of a group social welfare function reflecting directly the Sen notion of relative deprivation. In particular, it will be represented employing what can be called deprivation functions, which are social evaluation functions for individual poverty gaps, and the inequality in poverty gaps will reflect relative deprivation in aggregate.

Therefore assume that identical individual deprivation functions take the form

$$d(g_i) = (1/\alpha)g_i^\alpha, \tag{9}$$

where the inequality aversion parameter $\alpha \geqslant 1$ for concavity in *income*. The group social welfare function is assumed to be decreasing, symmetric and additive and can therefore be written

$$-w(\mathbf{g}, \alpha) = \sum_i d(g_i) \quad i = 1 \ldots q, \tag{10}$$

where $\mathbf{g}$ is a vector of non-negative poverty gaps. The welfare of the poor is assumed to be separable from that of the non-poor. The inequality aversion parameter determines the relative sensitivity of $-w(..)$ to gaps of different sizes. If $\alpha = 1$ the welfare of the poor depends only on the aggregate poverty gap: when $\alpha > 1$ more weight is placed on large gaps (small incomes) in determining $-w(..)$ and in the limit, as $\alpha \to \infty$, only the largest gap matters and $-w(..)$ becomes maximin with respect to income.

To measure inequality in the distribution of poverty gaps first define the 'equally distributed equivalent poverty gap' as that poverty gap which, if shared by all the poor, would be regarded as yielding the same level of welfare as the existing level and distribution of gaps. This is given by

$$g^* = [(1/q) \sum_i g_i^\alpha]^{1/\alpha} \quad i = 1 \ldots q. \tag{11}$$

Poverty can then be measured using the following index, directly analogous to the Sen index:

$$P = HI(g^*/\bar{g}). \tag{12}$$

Noting that $P = qg^*/nz$ the index can be seen to have the following interpretation – it is that aggregate gap of the poor which, if equally shared, would yield the same level of welfare of the poor as the actual aggregate gap distributed as it is, expressed as a proportion of the aggregate gap when each member of the population has a zero income.

The poverty index P has the following properties:

(P1) it is increasing in H, I and $(g^*/\bar{g})$, the relative deprivation measure;

(P2) it is increasing in α;

(P3) it lies in the closed interval (0, 1) – while it is clear that $g^*/\bar{g} > 1$ it is always the case that $g^* < z$;

(P4) it satisfies the monotonicity axiom;

(P5) $P = HI$ when $\alpha = 1$;

(P6) when $\alpha > 1$ P embodies a group social welfare function which is strictly concave in income and the transfer axiom is satisfied.[1] The sensitivity of P to fixed equidistant transfers depends upon the difference in the marginal social valuations of the poverty gaps of the individuals concerned – this is determined by the ratio (g_j/g_k) which is decreasing in income. P becomes more sensitive to all transfers the larger is α.

III

Another shortcoming of the Sen approach, suggested by Takayama (1979), concerns the way in which relative deprivation enters his index. In particular, having the poor compare their *poverty gaps* with those of other poor individuals provides an inadequate representation of relative deprivation. Takayama argues that relative deprivation is more normally a reflection of the depression felt by individuals who compare their *incomes* with those of the rest of society. While the relevant income is that actually received when comparison is with other poor individuals, this is not the case when comparison is with the non-poor. The important point about the non-poor is that they have incomes at least equal to the level against which poor individuals assess their deprivation, namely the poverty line. For a given poverty line the actual incomes of the non-poor should not affect feelings of deprivation.[2]

In order to accommodate deprivation relative to individuals above the poverty line Takayama (1979) defines the censored income distribution as one where all incomes above the poverty line are set equal to the poverty line, and then uses the Gini index of the censored distribution as an index of poverty. The *Takayama index* can be shown to be given by

$$T = H[(1-\xi)I + \xi G], \quad \xi = 1-(1-H)z/\bar{y}, \tag{13}$$

[1] Strict concavity of the group social welfare function guarantees that the transfer axiom is satisfied. However, a much weaker concavity condition would suffice. For example, the Gini index is not strictly concave but the Sen index satisfies the transfer axiom (see Sen (1973)).

[2] Of course, it may well be argued that the levels of incomes of all individuals should be taken into account in determining the poverty line, and hence indirectly feelings of deprivation. Our approach admits this possibility, but it is not considered explicitly.

where $\bar{y}$ is the mean of the censored income distribution and G is still the Gini index of the distribution of income among the poor.[1] The properties of T differ slightly from those of S being:

(T1) it satisfies the transfer axiom in all but the cases of those transfers from the poor to the non-poor where it violates the monotonicity axiom. This can occur when the richest poor are among the relatively rich in the censored income distribution;

(T2) it is increasing in I, G and H when $H < 1/2$;

(T3) when n is large T lies in the closed interval (0, 1) the upper limit defined where one individual receives all the income, T being an inequality index;

(T4) when all the poor have identical incomes $T = HI(1-\xi)$.

In the last section a Sen-type measure with explicit welfare significance, P, was outlined. Although fairly appealing this measure does have a weakness. To derive P the normalisation axiom has been used, but this endows the index with the property that it is independent of α when all the poor have the same income. Independently of how low the incomes of the poor are the poverty index is unaffected by changes in the value of the inequality aversion parameter. Of course, this is no more than a different way of presenting the Takayama point concerning the rather limited concept of relative deprivation used by Sen. Indeed Takayama himself suggests that the normalisation axiom is arbitrary and his index does not satisfy it. While this is undoubtedly true it is not at all clear that it constitutes a serious criticism of Sen's approach. The axiom appears to be quite consistent with the rather limited notion of relative deprivation used by Sen, and hence in the derivation of P. If there is an arbitrary element to the analysis it is to be found in the relative deprivation concept alone. It will now be shown that the above problem is overcome when the Takayama concept of relative deprivation is embodied in a group social welfare function.

Assume that the social evaluation function for individual incomes can be written

$$u(y_i) = (1/\beta)\,[\min\,(z, y_i)]^\beta, \quad \beta \leqslant 1, \tag{14}$$

where the inequality aversion parameter $\beta \leqslant 1$ for concavity in income. The group social welfare function, which is increasing, symmetric and additive, can be written

$$\begin{aligned} w(\mathbf{y}_p, z, \beta) &= \sum_i u(y_i) \quad i = 1 \ldots n \\ &= (1/\beta)\sum_i y_i^\beta + [(n-q)/\beta]z^\beta \quad i = 1 \ldots q \end{aligned} \tag{15}$$

where $\mathbf{y}_p$ is the vector of incomes of the poor. If y^* is the 'equally distributed equivalent income' for the whole population, given a censored income distribution, then, by definition,

$$(n/\beta)y^{*\beta} = (q/\beta)y_p^{*\beta} + [(n-q)/\beta]z^\beta,$$

[1] The essential difference between S and T should be that T gives relatively more weight to I than G, when compared with S. That is, $(1-\xi)/\xi > 1/(1-I)$. This can be shown to be the case if $H < 1/2$.

where y^*_p is the 'equally distributed equivalent income' for the poor alone. It follows that

$$y^* = \{H[(1-A)\bar{y}_p]^\beta + z^\beta(1-H)\}^{1/\beta}, \tag{16}$$

where $A = 1-(y^*_p/\bar{y}_p)$ is the well-known Atkinson inequality index for the distribution of income among the poor.

The poverty index to be used is

$$\begin{aligned} P^* &= 1-(y^*/z) \\ &= 1-\{H[(1-A)(1-I)]^\beta + (1-H)\}^{1/\beta}. \end{aligned} \tag{17}$$

The rationale for dividing y^* by z is that a situation of no poverty is defined by all incomes in the censored income distribution being equal to z. P^* therefore measures the proportionate welfare loss in having individuals with incomes below this, in terms of the proportion of the population which is so affected, the average deviation of their incomes from the poverty line and the inequality in their incomes.

The poverty index P^* has the following properties:

(P*1) it is increasing in H, I and A;
(P*2) it is decreasing in β;
(P*3) it lies in the closed interval (0, 1);
(P*4) it satisfies the monotonicity axiom;
(P*5) $P^* = HI$ when $\beta = 1$;
(P*6) when all the poor have the same incomes

$$P^* = 1-[H(1-I)^\beta + (1-H)]^{1/\beta},$$

which indicates that the greater the degree of inequality aversion the greater is P^*. Note also that as this shared income approaches zero

$$P^* \to \begin{cases} 1-(1-H)^{1/\beta} > H & 0 < \beta < 1 \\ 1 & \beta \leqslant 0. \end{cases}$$

Now it is clear that S, P and T cannot exceed H when all the poor have the same income. P^* can be, and in the case where $\beta \leqslant 0$ it is equal to unity independently of the value taken by H. This is simply a reflection of how serious low incomes are, in welfare terms, given the above specification of the welfare function and the way poverty is being measured. Indeed, in common with the Atkinson index, as any *one* income tends to zero $P^* \to 1$, $\beta \leqslant 0$. This property does not carry over to any of the other indices. It is therefore to be expected that P^* will be relatively sensitive to large poverty gaps.

(P*7) when $\beta < 1$ P^* is derived from a group social welfare function which is strictly concave in incomes and the transfer axiom holds. The transfer sensitivity properties of P with $\alpha > 1$ all go through for P^* when $\beta < 1$.

(P*8) P^* is a fairly natural translation of an inequality index into a poverty index although less so than T, which measures poverty using an inequality index. The equivalent procedure with the welfare-based approach would yield a poverty index

$$P^{**} = 1 - (y^*/\bar{y}).$$

As was pointed out earlier T may not satisfy the monotonicity axiom. The same is true of P^{**};

(P*9) P^* is increasing in z.[1]

IV

In this section estimates of all the indices discussed above are to be presented. These will describe poverty among households of differing composition and will be based upon data from the Family Expenditure Survey (F.E.S.) for 1975.

The method of collecting F.E.S. data, sampling procedures and possible errors are fully reviewed in Kemsley (1969), while the form in which they are employed in this paper will be discussed in considerable detail in Beckerman and Clark (in preparation). However, a couple of comments are worth making before proceeding further with this analysis.[2]

Estimates reported below are based upon normal net disposable weekly income, which is personal disposable income defined in the familiar way minus actual rates and rent, net of any rebates, and work expenses. Normal income is distinguished from the alternative income concept used in the F.E.S., last week's income, by the way in which employment income and short-term social security benefits are treated. When earnings during the survey period are affected by irregular bonuses or short hours the employee's assessment of normal income is used. When an individual has been away from work for thirteen weeks or less normal income when last employed is used in place of the short-term benefit actually received.

In common with most British studies the poverty line is set equal to the Supplementary Benefit (S.B.) scale rate in force for households of differing composition. Since S.B. scale rates are not adjusted to compensate for the impact of inflation an allowance for this has been made. The procedure used in this paper follows that suggested by Beckerman and Clark, and movements in prices between the last uprating and the date of interview have been used to inflate the S.B. scale rates and hence the poverty line.

Turning now to the estimates of the poverty indices, these are contained in Table 1. The elements of the table are the precise value taken by each index with, in brackets beside it, the poverty rank of each household type from the poorest (1) to the least poor (8). Moving across the table from left to right the

[1] This property is unique to P^*. While it is fairly easy to show that H cannot fall and I, S, P and T can all fall when z is increased it is more difficult to see that P^* always increases. Some of the other properties of P^* are also less obvious than is the case with the alternative indices. A paper has therefore been written describing in more detail the construction and properties of P^*. This is available on request from the Institute for Fiscal Studies.

[2] Although the numerical results are supposed to be no more than illustrative we view it as inevitable that people will comment on them in more detail than we intend. Hence the need to make the following points. However, we do urge readers to refer to Beckerman and Clark before arriving at too many conclusions based upon the estimates presented.

Table 1

Poverty Indices by Household Type, 1975

Household type	H	I	S	$P(\alpha = 1{\cdot}5)$	$P(\alpha = 2)$	$P(\alpha = 2{\cdot}5)$	T	$P^*(\beta = 0{\cdot}5)$	$P^*(\beta = -0{\cdot}5)$	$P^*(\beta = -1)$
Single pensioners	0·361 (1)	0·098 (7)	0·061 (1)	0·044 (2)	0·053 (2)	0·064 (2)	0·033 (1=)	0·039 (2)	0·043 (2)	0·051 (2)
Pensioner couples	0·163 (2)	0·093 (8)	0·023 (3)	0·018 (3)	0·022 (4)	0·025 (4)	0·014 (3)	0·016 (3)	0·019 (3)	0·020 (3)
Single non-pensioners	0·060 (4)	0·204 (5)	0·017 (4)	0·017 (4)	0·023 (3)	0·028 (3)	0·012 (4)	0·013 (4)	0·015 (4)	0·017 (5)
Non-pensioner couples	0·018 (8)	0·270 (3)	0·007 (7)	0·006 (7)	0·006 (7)	0·007 (7)	0·005 (7)	0·003 (7=)	0·008 (7)	0·009 (7)
Couples (1–2 children)	0·022 (6)	0·297 (1)	0·009 (6)	0·008 (6)	0·009 (6)	0·010 (6)	0·006 (6)	0·008 (6)	0·012 (5=)	0·019 (4)
Couples (3+ children)	0·028 (5)	0·280 (2)	0·010 (5)	0·010 (5)	0·012 (5)	0·013 (5)	0·008 (5)	0·009 (5)	0·012 (5=)	0·013 (6)
Lone parents	0·134 (3)	0·253 (4)	0·052 (2)	0·047 (1)	0·060 (1)	0·072 (1)	0·033 (1=)	0·046 (1)	0·057 (1)	0·068 (1)
Others	0·019 (7)	0·143 (6)	0·004 (8)	0·003 (8)	0·003 (8)	0·004 (8)	0·003 (8)	0·003 (7=)	0·004 (8)	0·005 (8)

first point to note is the difference in rankings between the head count ratio, H, and the poverty gap ratio, I. For example, a large proportion of single pensioners are poor yet their average gap is low. This situation can be compared with that of couples with 1–2 children, among whom poverty incidence is low but the average poverty gap is high.

The ranking of household types according to the Sen index, S, can be seen to be very similar to that by H, and the ranking by P looks much like that by S. However, there is an unambiguous ranking reversal as the inequality aversion parameter, α, is increased. Again, the ranking by the Takayama index is more or less identical to that by S. A similar pattern also emerges with P^*, although as the inequality aversion parameter, β, is reduced the variation is somewhat greater than with P. In particular the rank of couples with 1–2 children rises two places which, by the standards of what has preceded, is quite marked. This is mentioned because it is consistent with an expected property of P^*. It was pointed out above that when $\beta \leqslant 0$, as any one income tends to zero P^* tends to unity. Thus the major difference that should emerge when P^* rather than one of the other distribution-dependent indices is used should show up when a household type has a low H but a high I. This is shown to be true of couples with 1–2 children, and the change in P^* as β falls bears out this expectation.

It was stated at the outset of this paper that one of its aims was to see whether the way in which poverty was measured really matters. The empirical evidence suggests that it does – this is particularly marked when considering the choice between H and I, but less so when choosing between the distribution-dependent indices, even at various levels of inequality aversion. Nevertheless differences do emerge. P^* looks as though it does capture some aspects of poverty that the other indices do not – in particular it is less dominated by H, giving more weight to I and A. As the inequality aversion parameter is changed the indices with an explicit welfare base do display some ranking changes.

V

Sen (1979) concluded his paper by noting that pluralism was inherent in the exercise of poverty index construction. We have taken advantage of this and offered two further types of index. The Sen and Takayama concepts of relative deprivation have been incorporated into an explicit social welfare framework to yield the new indices. Such an approach has allowed us to endow the new indices with desirable properties not shared by the original Sen and Takayama indices. The empirical estimates tentatively suggest that these new indices respond to aspects of poverty given little weight in the composite indices already suggested. They are therefore worth exploring with alternative data sets. However, in the area of poverty index construction the room for pluralism still remains and we, and no doubt others, will take further advantage of it.

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References

Abel-Smith, B. and Townsend, P. (1965). *The Poor and the Poorest*, Occasional Paper on Social Administration, no. 17. London: Bell and Sons.

Atkinson, A. B. (1969). *Poverty in Britain and the Reform of Social Security*, London: Cambridge University Press.

—— (1970). 'On the measurement of inequality.' *Journal of Economic Theory*, vol. 2, pp. 244–63.

—— (1977). 'Poverty and social security research: an agenda,' in *Social Security Research*, Papers presented at a D.H.S.S. Seminar, H.M.S.O., London.

Batchelder, A. B. (1971). *The Economics of Poverty*. New York: Wiley.

Beckerman, W. (1979). 'The impact of income maintenance payments on poverty, 1975.' Economic Journal, vol. 86, pp. 261–79.

—— and Clark, S. (in preparation). The Impact of Social Security Programmes on Poverty (provisional title). Institute for Fiscal Studies, London.

Fiegehen, G., Lansley, P. S. and Smith, A. D. (1977). *Poverty and Progress in Britain, 1953–73*. London: Cambridge University Press for the National Institute of Economic and Social Research.

Kakwani, N. (1980). 'On a class of poverty measures.' *Econometrica*, vol. 48, pp. 437–46.

Kemsley, W. F. F. (1969). *Family Expenditure Survey: Handbook on the Sample, Fieldwork and Coding Procedures*. London: H.M.S.O.

Sen, A. K. (1973). *On Economic Inequality*. Oxford: Clarendon Press.

—— (1976). 'Poverty: an ordinal approach to measurement.' *Econometrica*, vol. 44, pp. 219–31.

—— (1979). 'Issues in the measurement of poverty.' *Scandinavian Journal of Economics*, vol. 91, pp. 285–307.

Takayama, N. (1979). 'Poverty, income inequality and their measures: Professor Sen's axiomatic approach reconsidered.' *Econometrica*, vol. 47, pp. 747–59.