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ON THE MEASUREMENT OF POVERTY

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Official statistics in the United States and the United Kingdom show a rise in poverty between the 1970's and the 1980's but scepticism has been expressed with regard to these findings. In particular, the methods employed in the measurement of poverty have been the subject of criticism. This paper re-examines three basic issues in measuring poverty: the choice of the poverty line, the index of poverty, and the relation between poverty and inequality. One general theme running through the paper is that there is a diversity of judgments which enter the measurement of poverty and that it is necessary to recognize these explicitly in the procedures adopted.

There is likely to be disagreement about the choice of poverty line, affecting both its level and its structure. In this situation, we may only be able to make comparisons and not to measure differences, and the comparisons may lead only to a partial rather than a complete ordering. The first section of the paper discusses the stochastic dominance conditions which allow such comparisons, illustrating their application by reference to data for the United States.

The choice of poverty measure has been the subject of an extensive literature and a variety of measures have been proposed. In the second section of the paper a different approach is suggested, considering a class of measures satisfying certain general properties and seeking conditions under which all members of the class (which includes many of those proposed) give the same ranking.

Those sceptical about measures of poverty often assert that poverty and inequality are being confounded. The third section of the paper distinguishes four different viewpoints and relates them to theories of justice and views of social welfare.

KEYWORDS: Poverty, inequality, standard of living.

INTRODUCTION

THE SUBJECT WHICH I HAVE CHOSEN for this lecture is undoubtedly more appropriate for Bowley than for Walras. Sir Arthur Bowley was a pioneer in the measurement of poverty in Britain, notably in bringing statistical rigor to bear on this important but emotive topic. Seventy years ago he produced, with Burnett-Hurst, a book *Livelihood and Poverty* (1915), which studied the incidence of poverty in five English towns. Ten years later, with Hogg, he produced a sequel called *Has Poverty Diminished*? (1925), examining the changes which had taken place in the intervening period.

The changing extent of poverty is a subject of importance today. Many people are concerned that recession, and conservative government policy, have led to an increase in poverty; and the official statistics provide grounds for this fear. In Britain, government figures (Department of Health and Social Security, 1983) show that the proportion of families with incomes below the supplementary benefit level increased by around a quarter between 1979 and 1981, the most recent year available. In the United States, the official estimates (U.S. Bureau of the Census, 1985) show 14.4 per cent of the population to be in poverty in 1984, compared with 11.2 per cent in 1974. On the other hand, there are those, especially defenders of the government record, who are sceptical about the claim that

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poverty has increased. The sceptics point to the unsatisfactory nature of the measures used and the need for reconsideration of basic concepts.

For this reason, I was tempted to echo Bowley and title this Lecture *Has Poverty Increased*? However, I have not done so, since the content is methodological rather than substantive. It does not seek to provide a definitive answer to the question as to whether poverty has increased; rather it explores some of the problems which arise in trying to provide such an answer. There are many more such problems than can be considered in the space available, and I concentrate on three. (In Atkinson (1985) I have discussed some of the other issues which arise, including the dynamic aspects of poverty and the choice of unit of analysis—individual, family, or household).

First, there is the choice of poverty line—clearly an essential ingredient. It has been recognized since the early days that there is room for differences of view as to the drawing of the line. Those sceptical as to the conclusion that poverty has increased may therefore argue that the choice of a different standard could lead to a reversal of the conclusion.

Secondly, there is the choice of poverty measure. I have simply referred to the proportion of the population in poverty, commonly known as the head count, but there has been an extensive recent literature on alternative poverty measures. Could different views about the choice of poverty measure lead us to reach different conclusions about what has happened?

Thirdly, sceptics have been heard to complain that those concerned about poverty are really confusing poverty and inequality. Are the numbers quoted for the U.K. and the U.S. just an alternative measure of income inequality? Here, the sceptics are touching on a raw nerve, since in my view the literature on the measurement of poverty has done little to illuminate the relationship between the two concepts.

Before considering these questions, I should draw attention to one theme that recurs throughout the lecture: that there is likely to be a diversity of judgments affecting all aspects of measuring poverty and that we should recognize this explicitly in the procedures we adopt. This will lead to less all-embracing answers. We may only be able to make comparisons and not to measure differences; and our comparisons may lead only to a partial rather than a complete ordering. But such partial answers are better than no answers. In this, and other aspects, I should acknowledge the influence of the work of Amartya Sen. In particular, he has stressed "the danger of falling prey to a kind of nihilism [which] takes the form of noting, quite legitimately, a difficulty of some sort, and then constructing from it a picture of total disaster" (1973, p. 78). So that while I shall be taking seriously the objections raised by the sceptics, my emphasis will be on what we *can* say.

1. LEVEL OF THE POVERTY LINE

Beginning with the first question, it is evident that the choice of the poverty line, denoted here by Z, is a matter about which views may differ. Of this, early investigators such as Bowley were well aware. He referred to his poverty line as "arbitrary, but intelligible" (1925, p. 14), recognizing that others might disagree, as illustrated by the famous occasion in 1920 when he was being cross-examined by Ernest Bevin, the well-known union leader (later Foreign Secretary) during the inquiry into dock workers' pay. Bowley had given evidence for the employers as to what constituted a minimum basket of goods. Bevin in turn had gone out and bought the recommended diet and came into court with a plate bearing a few scraps of bacon, fish, and bread. In a devastating piece of cross-examination, he asked Bowley whether he thought that this was sufficient breakfast for a man who had to carry heavy bags of grain all day.[2]

In terms of the measurement of poverty there is a straightforward procedure, which has been used implicitly for a long time. If we suppose that the poverty line may vary over a certain range $[Z^-, Z^+]$, denoted by Z^*, then we can examine whether or not we obtain the same ranking for all Z in the range Z^*. For the head count measure, this means comparing over the range Z^* the cumulative distribution, denoted by $F(Y)$, where Y may refer to income or standard of living (for simplicity, I refer to income).

To make this more precise, let us assume that the population is fixed in size, and that $F(Y_1)=0$ and $F(Y_2)=1$ for some finite Y_1 and Y_2; for ease of exposition, I take $Y_1=0$ and $Y_2=A$. The corresponding density function is denoted by $f(Y)$. We are interested in comparing two distributions, F and F^1, denoting the difference by $\Delta F \equiv F-F^1$. The difference in the corresponding densities is denoted by Δb. Then we require a *restricted* form of first-degree stochastic dominance condition:

CONDITION I: *For there to be for all $Z \in Z^*$ a reduction, or no increase, in poverty, as measured by the headcount, on moving from the distribution F^1 to F:*

(I) $\Delta F(Z) \leq 0$ *for all* $Z \in [Z^-, Z^+]$.

The application of this simple condition is illustrated in Figure 1, which shows the curves for the U.S. in 1974, 1979, and 1982,[3] taking the range from 50 per cent (75 per cent for 1974) of the official poverty standard to 150 per cent. In the case of the comparison of 1982 with either of the years in the 1970's, the curves do not intersect. This means that we may not be able to say that poverty has gone up by x per cent, since the shift is not uniform, but we can agree about the direction of the change: poverty increased between 1979 and 1982. On the other hand, it is possible that we cannot reach agreement, as when comparing 1974 and 1979, where the curves intersect. We cannot rank 1974 and 1979 if the

[2] In fact the Bowley family of 5 had been living on the food budget for the previous three weeks. The *Daily News* carried pictures including one of his ten year old daughter with the caption "The Professor's 47 shillings a week does not prevent her keeping guinea pigs." I am grateful to John Creedy for drawing my attention to Bowley (1972).

[3] In constructing this diagram, it has been assumed that the poverty lines in different years are comparable. The issue of the adjustment of the poverty line over time is discussed in Atkinson (1985). No account is taken here of changes in the population size.

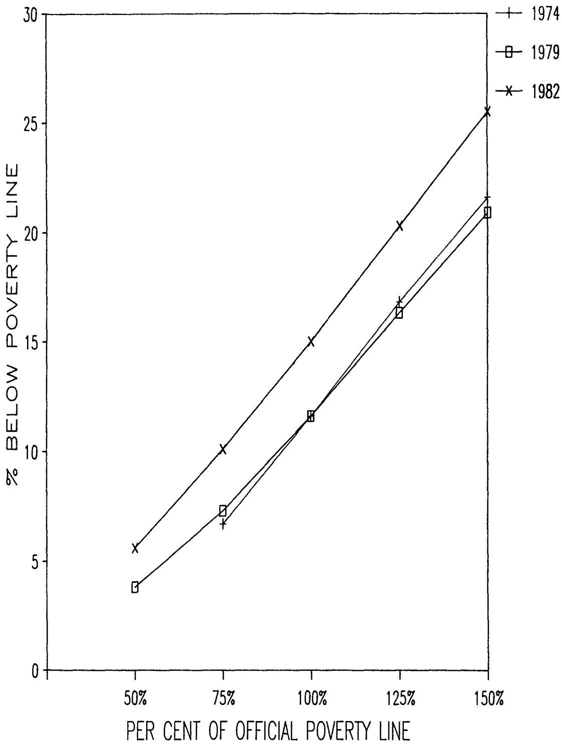

FIGURE 1—Cumulative percentage below different poverty levels (expressed as per cent of official poverty line) in the U.S. for 1974, 1979, and 1982.

SOURCES: 1974 from U.S. Department of Health, Education, and Welfare (1976), Table 17; 1979 from U.S. Bureau of the Census (1981), Table 7; 1982 from U.S. Bureau of the Census (1984), Table 7. The 1974 figures are before the introduction of the revised methodology.

range of permissible poverty lines extends both above and below the official poverty line (which is the point of intersection in this case).

The same can be done for other poverty measures, such as the poverty deficit, normalized by the poverty line. This is the measure D in Table I, which shows a variety of different poverty measures. Again let us suppose that there is a range Z^* over which Z may vary. What we then require for agreement that poverty has decreased, or is not higher, is that D be everywhere no higher for all Z in the range Z^*. As noted by Foster and Shorrocks (1984), this is equivalent to a second-degree stochastic dominance condition, although it is important to specify the range over which it must hold. It is a *restricted* second-degree dominance conditions: [4]

[4] The significance of the restriction may be seen from the fact that the global first-degree condition ($\Delta F(Z) \leq 0$ for all Z) implies the global second-degree condition but that Condition I does not imply Condition II. Suppose that $Z^- = Z^+$ and that $\Delta F(Z) > 0$ for $Z < Z^+$, $\Delta F(Z^+) = 0$. Then Condition I is satisfied, but Condition II is not satisfied.

CONDITION II: *For there to be for all $Z \in Z^*$ a reduction, or no increase, in poverty, as measured by the poverty deficit, on moving from the distribution F^1 to F:*

$$(II) \qquad \Delta\Phi(Z) \equiv \int_0^Z \Delta F(Y)\, dY \leq 0 \quad \textit{for all} \quad Z \in [Z^-, Z^+].$$

This result follows from the fact that, integrating by parts,

$$(1) \qquad \Delta\Phi(Z) = \int_0^Z [Z - Y]\Delta f(Y)\, dY.$$

The application of this second-degree condition may be illustrated by the U.S. data for 1974 and 1979. In Figure 1, the cumulative frequency is lower in 1974 at income levels below the poverty line, at least in the range shown, which suggests that "serious" poverty is more severe in 1979 and that this would be reflected in the poverty deficit. This is in fact the case. Whereas the headcount measured at the official poverty line is identical in the two years, the poverty deficit per head of the U.S. population, normalized by the poverty line, increased between 1974 and 1979 (derived from U.S. Bureau of the Census, 1981, Table 6). If we take F^1 as the distribution in 1979 and F as that in 1974, then $\Delta\Phi(Z)$ is negative at the official poverty line. As we take values of Z above the official poverty line, then the value of $\Delta\Phi(Z)$ is rising, since ΔF is positive, but there will be a range of Z above and below the official line such that we can reach the definite conclusion for the poverty deficit that poverty increased between 1974 and 1979. A change in the poverty measure has therefore widened the range of possible comparisons.

Before going on to the choice of poverty measure, it should be noted that in Condition I and II families have been assumed to be identical in their needs and the poverty line has been taken as the same for all. In practice, the poverty line is different for families of different size and differing in other respects. There is therefore scope for disagreement not just about the *level* of the poverty line but also about its *structure.* The sceptic may point to the widely varying equivalence scales which are employed and to the possibility that these may give conflicting results. Moreover, differing weights are used in combining the poverty indices for different groups to arrive at an aggregate measure. Sometimes the total number of *families* is counted; in other cases it is the total number of *people* in poverty. However, all is not lost, since again we may seek a partial ordering. Suppose that we can agree on a ranking of the "needs" of different types of family such that the poverty line is at least no lower as we move up the ranking: couples should get no less than single persons, couples with 1 child no less than couples without children, and so on. Suppose that the same applies to the weights in the aggregate poverty index. Families then differ in two dimensions—income and "needs"—and we can use the results for bi-variate stochastic dominance, applied to income inequality measurement in Atkinson and Bourguignon (1984). In the case of the poverty deficit, this leads to conditions for dominance which are quite demanding but which are easy to check. In effect, they involve cumulating not just over incomes but also in the second direction of differences in "needs" (Atkinson, 1987). And where there is only incomplete agreement on the ranking of "needs," the conditions may be applied for the alternative rankings.

2. DIFFERENT MEASURES OF POVERTY

The head count measure, H, used at the outset has been under severe attack. Some twenty years ago, Watts noted that it had "little but its simplicity to recommend it" (1968, p. 326). In his influential work, Sen has remarked that the degree of support commanded by this measure is "quite astonishing" (1979, p. 295) and criticized Bowley for his identification of the measurement of poverty with the use of H. Watts, Sen, and a variety of subsequent authors, have therefore proposed alternatives (see Foster, 1984, for a valuable survey), opening the door for the sceptic to claim that these can lead to conflicting conclusions.

In order to explore the properties of different measures, let us consider the class of additively separable poverty measures, P, such that there is a monotonic transformation, $G(P)$, which can be written in the form of the integral of a function $p(Y, Z)$ over the full range of the distribution of incomes, with $p(Y, Z) = 0$ for $Y \geqslant Z$, but where we express poverty negatively, in that the function G is decreasing in the poverty index, P:

$$G(P) = \int_0^A p(Y, Z) f(Y)\, dY \tag{2}$$

where

$$p(Y, Z) = 0 \quad \text{for} \quad Y \geqslant Z \quad \text{and } G \text{ is a decreasing function.}$$

We assume that p is nondecreasing in Y, which implies that $p(Y, Z)$ is nonpositive. Writing the objective in this way puts it in a form similar to a social welfare function—an aspect developed in the final section of the lecture—and means that an *increase* in G is preferred. Of course, the assumption that the index may be written in this way is restrictive; it excludes for example the index proposed by Sen (1976a). It does however encompass a variety of measures, including all of those shown in Table I, as is illustrated in Figure 2, where the form of $p(Y, Z)$ is sketched as a function of Y for these different measures.

The objection of Watts to the headcount is that "poverty is not really a discrete condition. One does not immediately acquire or shed the afflictions we associate with the notion of poverty by crossing any particular income line" (1968, p. 325). In terms of the representation (2), for the headcount the function p is discontinuous at $Y = Z$, taking the value -1 for $Y < Z$, and 0 for $Y \geqslant Z$. This is illustrated in Figure 2 by the heavy line. Here, there is room for difference of opinion. On the one hand, there are those who agree with Watts that there is a continuous gradation as one crosses the poverty line. On the other hand, there are people who see poverty as an either/or condition. A minimum income may be seen as a basic right, in which case the headcount may be quite acceptable as a measure

TABLE I
EXAMPLES OF POVERTY MEASURES

Head count: $H=\int_0^Z f(Y)\,dY.$

Normalized Deficit: $D=\int_0^Z [1-Y/Z]f(Y)\,dY.$

Watts Measure: $W=-\int_0^Z \log_e (Y/Z)f(Y)\,dY.$

Clark et al. (Second) Measure: $1/c[1-(1-P^*)^c]=1/c\int_0^Z (1-(Y/Z)^c)f(Y)\,dY,$ where $c\leq 1.$

Foster et al: $P_a=\int_0^Z (1-Y/Z)^a f(Y)\,dY,$ where $a\geq 0.$

of the number deprived of that right. The same position may be taken if the income level Z is interpreted as that necessary for survival, although if the probability of survival varies continuously with income we may be back with the position of Watts.

For those who reject the headcount, and require that the function $p(Y, Z)$ be continuous, there are several possible ways in which one could arrive at a replacement for the head count. One can simply propose measures which look better. Watts himself suggested two, and these are shown in Figure 2. First, there is the normalized poverty deficit which replaces the discontinuous p function by a continuous function. The second proposal is more sophisticated, and is designed to allow for the fact that "poverty becomes more severe at an increasing rate" (1968, p. 326), taking the p function $\log(Y/Z)$, where $Y<Z$. This in turn may be seen as a subcase of the second class of measures suggested in Clark et al. (1981), governed by the parameter c, varying between 1 and $-\infty$, with the Watts case being obtained as c tends to zero. There are other possibilities, such as the class of measures proposed by Foster et al. (1984) and shown in Figure 2, based on a power of the (normalized) poverty gap.

Sen, on the other hand, took an axiomatic approach and this has been followed in a number of subsequent articles. In the construction of his index, the key axiom is one which rejects the equal weighting of poverty gaps implied by the poverty deficit (the linearity of the p function), on the grounds that this is insensitive to the distribution of income amongst the poor, and proposes that the poverty gap be weighted by the person's rank in the ordering of the poor. Sen refers to the classic use by Borda of such an equidistance cardinalization of an ordering and to a subjective concern of the poor for their relative position. In my own judgment, the arguments about relative position and ranking are more persuasive for inequality measurement (as in Sen, 1974) than for poverty measurement—a point to which I return.

There is yet another approach which has not been much followed in the literature (the closest that I have seen is Gourieroux, 1980). This approach

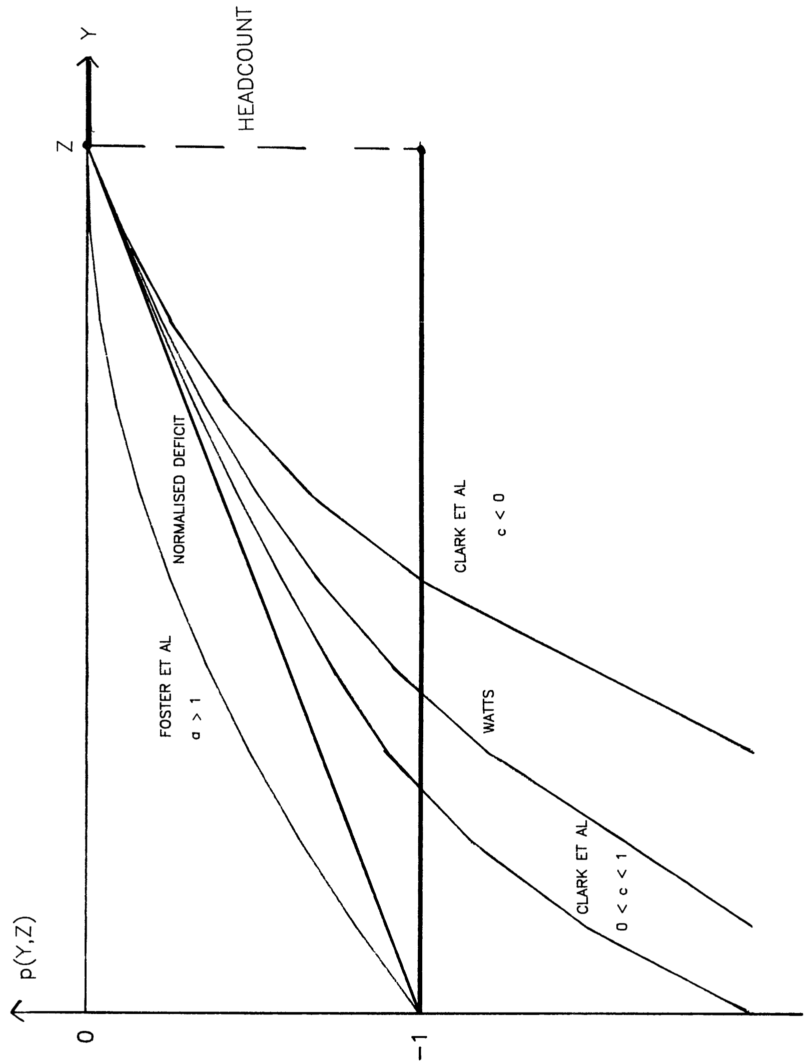

FIGURE 2.—Form of the function $p(Y, Z)$ for different poverty measures.

considers a class of poverty measures satisfying certain general properties and seeks conditions under which all members of that class will give the same ranking. It tries to establish common ground, so that we may be able to say that poverty has increased, or decreased, for all poverty measures in a class.

To this end, let us consider the difference in poverty as measured by the class of poverty measures which can be written in the form (2), where p is now assumed to be a continuous function. Poverty is lower, or no higher, if $\Delta G \geqslant 0$, where

$$(3) \qquad \Delta G = \int_0^A p(Y, Z)\, \Delta f(Y)\, dY = \int_0^Z p(Y, Z)\, \Delta f(Y)\, dY.$$

Then we have the following condition.

CONDITION IA: *A necessary and sufficient condition for there to be for all $Z \in Z^*$ a reduction, or no increase, in poverty for all measures in the class* (2), *where p is continuous and nondecreasing in Y, on moving from the distribution F^1 to F is that*:

$$(\text{IA}) \qquad \Delta F(Z) \leqslant 0 \quad \textit{for all} \quad Z \in [0, Z^+].$$

The sufficiency of this condition may be seen by integrating ΔG by parts (and using the fact that $p(Z, Z) = 0$):[5]

$$(4) \qquad \Delta G = -\int_0^Z p_Y\, \Delta F(Y)\, dY.$$

The nonnegativity of ΔG then follows from $p_Y \geqslant 0$. The necessity may be seen by considering an interval $[Y_0, Y_0 + \varepsilon]$ where $\Delta F(Z) > 0$, and constructing a function p taking the value $-\varepsilon$ for $Y \leqslant Y_0$, $-(\varepsilon - (Y - Y_0))$ for Y in the interval, and 0 for $Y \geqslant Y_0 + \varepsilon$. It may be noted that Condition IA is stronger than Condition I and that even though the range of permissible poverty lines is $[Z^-, Z^+]$, rather than $[0, Z^+]$, the condition cannot be weakened where $Z^- > 0$. In the limiting case where we are agreed on the poverty line ($Z^- = Z^+$), we still require $\Delta F(Z) \leqslant 0$ for all income levels below Z^+.

Suppose that we now make the further assumption that the function $p(Y, Z)$ is (weakly) concave in Y: i.e. where p is differentiable, $p_{YY} \leqslant 0$. This further assumption is restrictive, as discussed below, but it allows us to make use of a result suggested by a theorem of Fishburn (1977) in the portfolio literature. In that literature, "poverty" corresponds to below-target returns. The head count corresponds to the safety first principle of Roy (1952), the poverty deficit to the

[5] For discussion of the validity of integration by parts, see the stochastic dominance literature: for example, Tesfatsion (1976) and Le Breton (1986).

Domar Musgrave (1944) measure of risk, and the Foster et al. measures to the $\alpha - t$ model of risk analyzed by Fishburn. The result is given in Condition IIA.

CONDITION IIA: *A necessary and sufficient condition for there to be for all $Z \in Z^*$ a reduction, or no increase, in poverty for all measures in the class* (2), *where p is continuous, nondecreasing and* (*weakly*) *concave in Y, on moving from the distribution F^1 to F is that*:

$$\text{(IIA)} \qquad \Delta\Phi(Z) = \int_0^Z \Delta F(Y)\, dY \leq 0 \quad \textit{for all} \quad Z \in [0, Z^+].$$

In terms of a diagram, we require that the "poverty deficit curve", $\Phi(Z)$, lie below (or not above) for all poverty lines less than or equal to Z^+.[6]

The sufficiency of Condition IIA in the case where p is everywhere differentiable on $[0, Z]$ may be seen by integrating the right side of (4) by parts:

$$(5) \qquad \Delta G = -p_Y(Z, Z)\, \Delta\Phi(Z) + \int_0^Z p_{YY}(Y, Z)\, \Delta\Phi(Y)\, dY.$$

More generally, sufficiency may be seen by building on the observation of Hardy et al. (1929) that a concave function may be approximated uniformly by the sum of an increasing linear function and a finite number of positive multiples of "angles", the latter taking the value $-(B - Y)$ for $Y \leq B$, zero otherwise, where B is some arbitrary constant. These angles are minus the deficit from an arbitrary line B (and in the present case $B \leq Z$). The same angles may be used to show necessity, since the deficit from an arbitrary line B, where $B \leq Z$, is a permissible poverty measure.[7]

The statement of Condition IIA takes account of the fact that narrowing of the range of permissible poverty lines to $[Z^-, Z^+]$ does not allow the condition of $\Delta\Phi(Z)$ to be weakened. In order to encompass all nondecreasing and concave functions p, we require that the poverty deficit be no greater at all values of Z below Z^+. Suppose, for example, that we take the measure of Foster et al., with the parameter $a = 2$. Then $p_Y(Z, Z) = 0$ and $p_{YY}(Y, Z) = -2/Z^2$. Therefore, from (5), $\Delta G \geq 0$ if

$$(6) \qquad \int_0^Z \Delta\Phi(Y)\, dY \leq 0 \quad \text{for all} \quad Z \in Z^*.$$

[6] As is noted by Foster and Shorrocks (1984), this is equivalent to requiring that the generalized Lorenz curves do not intersect, although this is a less natural way to state the condition in the present context, since the comparison is made up to a common value of Z, not a common value of F.

[7] This method of proof follows that of Karamata (1932). I am grateful to Michel Le Breton for this reference.

It is clearly not sufficient that $\Delta\Phi(Z) \leq 0$ for all $Z \in Z^*$. On the other hand, we now have an unambiguous relation between the first-degree and second-degree dominance conditions. Condition IIA is implied by, but does not imply, Condition IA, so that the second-degree condition is clearly weaker.

As we have seen, a second-degree dominance condition is not strong enough to ensure the same ranking by the headcount. What makes the second-degree condition sufficient is that we are willing to assume that p is concave in income; in other words that it satisfies the Dalton transfer principle. The discontinuous p function with the head count measure does not satisfy this condition. A disequalizing transfer from a poor person to someone richer may reduce the headcount (where the recipient was previously below the poverty line and is raised above by the transfer). Nor is the Dalton transfer principle required by the authors of certain other measures, including that proposed by Sen where the weights on the individual poverty gaps change with the number of poor people. Again a disequalizing transfer from a poor person may reduce measured poverty where the number of poor falls and hence changes the weights.[8]

Do we wish to impose the Dalton transfer principle? Here views may differ. For those who see a minimum income as a basic right, the criticizms of the headcount may not be germane and the transfer principle—at least in its unqualified form—may be irrelevant. On the other hand, those viewing poverty in terms of a continuous gradation may find the transfer principle quite acceptable. It should be stressed that it is quite consistent with giving a specific role to the poverty line. The index may be sensitive to transfers affecting those below the poverty line but neutral with regard to the impact above Z: i.e. the second derivative of p with respect to Y may be strictly negative below Z and zero above Z.[9]

The advantage of assuming the Dalton transfer principle to hold is that we may use Condition IIA, in which case the implications that can be drawn from the poverty deficit curve are much more far-reaching than at first appeared. If the curves do not cross before Z^+, then all of the measures in the Foster et al. class with $a \geq 1$, including of course the poverty gap itself, will give the same ranking, as will all measures in the class proposed by Clark et al. What is more, the result can be strengthened to include measures which are s-concave but not necessarily additively separable, such as the variation on the Sen index proposed by Thon (1979), where the weight attached to the poverty gaps is the ranking in the *whole* population and not just that among the poor. The result may be extended to third (and higher) degrees of stochastic dominance.

The choice of poverty line and the choice of poverty measure have been discussed separately, but it is evident from consideration of Conditions I, IA,

8 The measure does satisfy Sen's "weak transfer axiom": a transfer of income from a person below the poverty line to anyone richer which leaves the number below the poverty line unaffected must increase the poverty measure (see, for example, Sen, 1979, p. 302).

9 Kundu and Smith (1983) have shown that the transfer principle cannot hold simultaneously with two population monotonicity axioms governing comparisons of populations of different sizes. (The same conflict does not arise with the weak transfer axiom.) However, as is noted by Sen, these axioms are "really very demanding" (1981, p. 193n).

and Conditions II, IIA that these issues are intimately related. Agreement on the use of the poverty deficit from among the class of nondecreasing, concave p functions avails us nothing if the poverty line could lie anywhere in the range $(0, Z^+]$. It allows us to apply II rather than IIA, but where $Z^- = 0$ these are identical. Similarly, agreement that the poverty line is Z^+ avails us nothing if the choice of poverty index can give zero weight to those with income Y in some range $Y_0 \leq Y \leq Z^+$. Put more positively, Condition IA and IIA allow for differences of view with regard to the choice of both poverty line and poverty measure, and as such these dominance conditions are powerful tools.

3. POVERTY AND INEQUALITY

At least four schools of thought about the relation between poverty and inequality can be distinguished. These are summarized below, where we denote by I the "cost" of inequality to be deducted from mean income $\bar{Y}$: the "equally distributed equivalent income" (Atkinson, 1970; Sen, 1976b) is $\bar{Y} - I$. P similarly denotes the "cost" of poverty to be subtracted:

(A) No specific weight to poverty: maximize $\bar{Y} - I$.

(B) Lexicographic approach: maximize $-P$, then $\bar{Y} - I$ where ranking on P identical,

(C) Concern only for poverty: maximize $\bar{Y} - P$.

(D) Trade-off between poverty and inequality: maximize $\bar{Y} - I - P$.

The first view, (A), is that of people who attach no specific weight to poverty, being concerned solely with inequality. If poverty is singled out, then it is simply as a component of social welfare assessment. So that one could adopt a logarithmic social welfare function and decompose the inequality into that due to people having incomes below Z and other components. In this way, the Watts measure of poverty would enter, but only as an interpretation of part of the measured inequality. Such a decomposition into a "poverty effect" and an "affluence effect" was indeed discussed by Watts (1968), and is explored by Pyatt (1984), who provides an interesting geometric representation in the case of the Gini coefficient. It should be observed that in such a decompostion the functional form for the poverty component is the same as that for the inequality index.

If, on view (A) the measurement of inequality were to be based on the Rawlsian difference principle (Rawls, 1971), then this might appear to focus attention on the poor. We have however to be careful. The Rawlsian difference principle has usually been presented by economists, myself included, as maximizing the welfare of the least advantaged individual; and this objective is in no way related to a particular income level. Poverty as such has no role. It would be of no significance that people had more or less than Z. All that would matter would be their rank order.

There is, however, more to a Rawlsian theory of poverty than this, although Rawl's own discussion is not explicit (and, incidentally, the word "poverty" does not appear in his extensive index). To begin with, the popular interpretation in terms of literally the worst off person is not that which Rawls advocates. He sees his difference principle as concerned with a least fortunate *group*, which in his brief discussion he suggests might be unskilled workers or, alternatively, those "with less than half of the median income and wealth" (1971, p. 98). Some degree of aggregation over individuals is involved, and the definition of this group may give a role to the poverty line (like half of median income).

Perhaps more importantly, we have to remember that the difference principle is the second of Rawls' two principles, and that concern for poverty may enter through the first of his principles, that which gives priority to basic liberties. It can be argued that these liberties, which include participation in society, are dependent on a specified level of income. This is an approach which has been developed by Barry in terms of "effective liberty", the idea being that liberty cannot be enjoyed "unless people reach some necessary level of wealth" (1973, p. 77). This provides one justification for the second view, (B), of the relation between poverty and inequality. This is that we have a *lexicographic approach*, where avoiding poverty has priority in assuring effective liberty, but inequality enters the assessment as a second concern. In this case, there is no reason why the functional form of P should be related to that of I. It would be quite consistent to use the head count for P and a measure satisfying the transfer principle for I.

In considering the remaining two approaches, it may be useful to think of the assessment of social welfare as involving two stages. First, there is the identification of a particular level of income as being below the poverty line and the evaluation of the costs associated with this deprivation. Second, there is the aggregation across individuals to arrive at an overall social judgment. Again it may be helpful to draw on the analogy with risk analysis. In the work cited earlier, Fishburn (1977) has shown that the mean-risk model is congruent with expected utility maximization if the utility function takes the value Y for $Y \geq Z$ but the value $T(Y)$ for $Y < Z$ where $T(Y)$ is less than Y and takes account of the cost of a below-target return. This transformation $T(Y)$ is the first of the two stages. The second stage, of aggregation, is linear in the Fishburn case. This leads to a maximand which subtracts the risk measure from the mean; and in the present context this would give a measure in which social welfare is represented by mean income less the "cost" of poverty: $\bar{Y} - P$.

This situation corresponds to that of concern only for poverty, or the view (C). If the aggregation at the second stage involves social weights, derived from some principle of justice, then we may have a trade-off between poverty and inequality, or view (D). Concern about poverty enters at the first stage and notions of justice come into the second stage. We may for example believe that the cost of poverty is best measured by the poverty gap, but be convinced by Sen that distributive justice is best captured by rank order weights, which enter at the second stage. Indeed, the notion of relative position embodied in rank order weights appears much more relevant at this second stage, where the whole income distribution is being considered. The measure obtained by combining these two elements involves subtracting from mean income the cost of inequality as measured by the Gini coefficient (times the mean) and the cost of poverty as measured by the Thon version of the Sen index. This is an example of the trade-off approach, in that an improvement in the value of the Thon index might be held to justify a worsening of the overall Gini coefficient.

CONCLUDING REFLECTIONS

Throughout this lecture, I have tried to show how different views about poverty can be encompassed within a common framework. The aim is to reach some degree of agreement even where judgments differ—whether as to the level of poverty line, the choice of poverty measure, or the relationship between poverty and inequality. To this end, I have in particular argued that dominance conditions may provide tools which are both powerful and easy to apply in empirical research. At the same time, they have not to my knowledge been used in this way. As we have seen, the value of the poverty deficit at different poverty lines (say, from 10 per cent to 200 per cent of the official poverty line) provides a lot of information, yet the necessary table is not among the more than 200 published by the U.S. Census Bureau. The sceptics are right in suggesting the need for reconsideration of the basic approach, even if the conclusions reached from such a re-examination may not be palatable to them.

I should like to end with three concluding reflections, prompted in part by reading Bowley's earlier work to which I referred at the outset. First, Bowley asked the question—has poverty diminished?—and concluded that in general it had. I have not attempted to present substantive results here, but the substantive question is an important one and it is a sad commentary on events that the possibility of poverty *increasing* is one that has to be taken seriously.

The second reflection concerns the presentation of results. I referred earlier to Bowley's encounter with Ernest Bevin. Bevin's biographer comments that "Photographs of the meagre portions of food appeared in half a dozen newspapers over the caption 'A Docker's Breakfast'. They were worth volumes of statistics in their effect on public opinion" (Bullock, 1960, p. 128). It seems to me that there are lessons here. In this field in particular, economists have remained wedded to volumes of statistics as a means of presenting results and have not been very creative in seeking alternatives. Indeed, since most of the work on poverty is now secondary analysis, we do not even have the case studies which increased the impact of the early research of Bowley and others.

What could we do to enliven the material and improve the effectiveness of communication? One suggestion being pursued at the L.S.E. is to exploit the capacities of micro-computers not just in carrying out research but also in its presentation. Rather than supplying the users with tables, what can be done in this and other fields (such as tax reform analysis) is to supply a disk with data and programs for analysis. These programs contain quite a lot of structure, for example making use of dominance results where appropriate, but they also have the great merit of allowing user participation in the design of the results. The users can specify their own poverty standards, choose their own poverty measures, and look at the position of individual families (suitably anonymized). In this way, the analysis is both more flexible and more immediate.

Finally, I cannot help reflecting that the questions discussed in this Walras-Bowley Lecture are ones which did not apparently greatly concern Bowley himself, or other pioneers in the field. In retrospect, this was unfortunate, since important conceptual issues in the measurement of poverty remained undiscussed for too long. What was needed was a greater degree of vertical integration between the statistical measurement of poverty on the one hand and welfare economics on the other. One of the great merits of the Econometric Society is that it brings together these two concerns and I hope that the present lecture too has made a contribution to such integration.

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