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Abstract: The relatively widespread use of poverty measures is analysed and their properties compared with other definitions of welfare. Using a synthetic data set but one which shares some properties of the Irish income distribution of 1987, a number of changes in incomes are simulated and their impact upon a variety of poverty and welfare measures is analysed. It is argued that abbreviated welfare measures may summarise better what it is that concerns economists about poverty than do conventional poverty measures.

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A Comparison of Poverty and Welfare Measures

1. Introduction

The measurement and analysis of poverty has become one of the most important areas of public policy in Ireland in recent years.[1] The extent of resources being devoted to the subject in Ireland renders even more important the proper measurement of poverty. As Sen (1976) pointed out in his seminal article, the measurement of poverty essentially involves two issues: the identification of those who are poor, which essentially involves the choice of a poverty line (below which families are defined as being "poor"), and secondly, the construction of a measure of poverty given the identification of the poor (we can refer to this as the aggregation issue). This paper covers both issues. It reviews current measures of poverty and suggests that they may be deficient under both of Sen's headings and proposes a broader measure of welfare which may be preferable. The paper also illustrates the danger of automatically equating higher measured poverty with lower welfare.

The layout of this paper is as follows: in section 2 we briefly review some of the more popular poverty measures and indicate their shortcomings. In section 3 we discuss a broader measure of welfare and in section 4 we examine the empirical performances of the poverty and welfare measures under a number of different scenarios. Section 5 presents concluding remarks.

2. Poverty Measures

This section of the paper briefly reviews some of the more popular poverty measures and indicates their shortcomings. This is not intended to be a comprehensive

[1] See for example the recent volumes by Callan et. al (1996) , Nolan and Whelan (1996) and Nolan and Callan (eds., 1994).

review of poverty measures. For that the reader should look elsewhere.[2] Nevertheless, we will briefly address the two issues raised by Sen: identification and aggregation.

The identification issue is typically concerned with the identification of a poverty line. Households with incomes below the poverty line are deemed to be poor and those above the poverty line are not poor.[3] Perhaps the most important decision with regard to choice of a poverty line is that between an absolute or a relative poverty line. An absolute poverty line may be defined with respect to the cost of purchasing a minimum basket of necessities and, as its name suggests, this basket may remain unchanged even though incomes as a whole in the population in question may be increasing. Examples of such lines are the official poverty line in the US. Note that while such poverty lines may be updated occasionally (as is the case with the US), they are still absolute in the sense that they are not defined relative to any summary measure of income for the population as a whole.

As outlined above, even absolute poverty lines are rarely cast in stone in the sense that they are absolutely unchanging over time. Poverty lines may be updated to reflect changes in the overall standard of living and expectations in society. Many people view it as unreasonable that what was accepted as a minimum standard of living fifty years ago should also be accepted today. Thus in some sense even absolute measures of the poverty line can be relative in that they may change over time. A *purely* relative measure is one that is defined as a certain fraction of some central summary statistic, e.g. the mean, of population incomes.[4] Thus the poverty line may be set at, say, 50% of average income.

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[2] For example, Sen (1997), Callan et al. (1996), Myles (1995), Callan and Nolan (1991) and all the references therein.

[3] The incidence of poverty may also be identified via other non-income indicators such as lifestyle indicators. See Nolan and Whelan (1996) who point out that the poor as identified by income may be different from the poor as identified by lifestyle.

[4] Note that the adoption of this approach implies that when making cross-country comparisons of poverty we are setting the poverty line for rich countries higher than for poor countries, a position with which some people may be uncomfortable. This issue is rarely pointed out, perhaps because different national accounts

Alternatively, given that income is rarely distributed symmetrically, we may define the poverty line as a fraction of median income. This approach implicitly takes some account of the degree of inequality in the distribution of income in its calculation of the poverty line.

The relative merits and demerits of these approaches to calculating poverty lines are discussed in the aforementioned references. Two issues which are of relevance to this paper deserve mention however. First, while purely relative poverty lines have their attractions, they also have the property that poverty measures based on them are homogenous of degree zero in incomes. Thus even if everyone's income (and presumably living standards) were to double overnight, measured poverty would remain unchanged. Also, should average incomes *fall*, then even though living standards have dropped, measured poverty may decrease.

Secondly, the approach of identifying the poor solely as those below the poverty line awards an importance to the choice of poverty line which may not be warranted. For example, in many respects, the standard of living of a household just below the poverty line and that of one just above the poverty line may be indistinguishable. Yet the first household is "poor" while the second is not. Many commentators have suggested that poverty is not a discontinuous phenomenon which ceases as soon as a household's income goes above the poverty line. As Watts puts it: "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" (Watts, 1968, p. 325). Rather there may be a continuum from wealth to poverty.[5] The choice of a discrete line ignores this as well as increasing the importance of measurement errors for incomes near the poverty line.

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conventions with regard to definitions of income means that cross-country poverty comparisons are fraught with difficulties.

[5] Sen (1997) has suggested that this problem may be overcome by replacing all incomes above the poverty line by the exact poverty-line income.

Before discussing the issue of aggregation for a given poverty line, we should note the contributions of Atkinson (1987) and Shorrocks (1995). Their approach to measuring poverty and to comparing the degree of poverty across two income distributions is similar to the use of the generalised Lorenz criterion when examining inequality (see Shorrocks, 1983). In other words, rather than comparing specific poverty measures for the two distributions, they examine whether *dominance* relations hold in the sense that one distribution would be ranked as having more poverty than another distribution for all poverty measures satisfying certain properties (this approach can encompass both the issue of the poverty line and the method of aggregation). Of course, when dominance relations *do not* hold, then it is always possible to find different poverty measures which will rank the two distributions differently, and the choice of poverty measure becomes crucial again.

We will now discuss some specific poverty measures which are commonly employed. First, we introduce some notation. Let **y** be the vector of personal incomes for the community as a whole, assuming we have adjusted incomes for family size and composition etc., and let z be the poverty-line income.[6] The number of people with incomes less than or equal to z is given by $q = q(y; z)$. If the total number of people in the community is $n = n(y)$, then we have our first poverty measure known as the *Headcount Ratio, H,* where $H = \frac{q}{n}$. The deficiencies of *H* as a poverty measure have been well documented. It takes no account of the depth of poverty i.e. someone just below the poverty line has the same weight as the very poorest of the poor. It is also fails to obey the *principle of transfers* i.e. a transfer of income from a poor person to a rich person does not increase *H*. Indeed, if the recipient of the transfer is just below the poverty line and the

[6] We will use the terms "family" and "person" interchangeably here even though this ignores issues regarding poverty *within* families and family size. The issues we wish to highlight in this paper arise regardless of these considerations.

transfer raises him just above the poverty line, then the transfer will have *reduced* poverty. This gives rise to the situation where the most effective means of reducing measured poverty is to target the comparatively best-off of the poor. Despite these drawbacks, the headcount ratio is still perhaps the most widely quoted poverty measure.

If we wish to take account of the depth of a poor person's poverty then we can examine their income gap $g_h = z - y_h$. Then the overall distance of the incomes of the poor can be measured by an aggregate gap measure. Thus if μ_p is the mean income of the poor population, the income-gap ratio $I = \frac{z - \mu_p}{z}$ reflects the average shortfall of the incomes of the poor expressed as a share of the poverty-line income z. While *I* does take account of the depth of poverty, it does not tell us how many people are poor and since it also does not obey the principle of transfers, it does not take account of the distribution of income amongst the poor.

The problems associated with H and I led to the development of distribution-sensitive measures of poverty. In this very brief review we will mention only two such measures, that of Sen (1976) and the P_α measures of Foster, Greer and Thorbecke (FGT, 1983). Sen proposed that a poverty measure should in general take the form of a multiple of a weighted sum of income gaps. Thus $S(y;z) = A(y;z)\sum_{h\in\Gamma} g_h(y;z)v_h(y;z)$ where Γ is the set of poor households, v_h is the weight for household h and A is a normalisation factor. Sen proposed that v_h be given by a household's *rank* amongst the poor. He then chose A so that when all poor households have the same incomes the poverty measure is given by the product of H and I. If the number of poor households is sufficiently large, then Sen's measure can be expressed as $S = HI + (1-I)G_p$ where G_p is the Gini coefficient amongst the poor.

While Sen's measure obeys the principle of transfers, it is not *transfer-sensitive*, i.e. the effect of the transfer is independent of the incomes of those involved in the transfer. If the transfer from poor to less poor is to have a greater impact upon poverty the *poorer* are the households involved, then transfer-sensitivity holds. FGT (1984) proposed that the weight on a poor household's income gap should be given not by their rank amongst the poor but by their actual income. They then proposed a class of poverty measures whereby poverty is given by a power of the normalised income gaps. Thus $P_\alpha = \frac{1}{n}\sum_{h=1}^{q} g_h^\alpha$. Thus when α=0, P_α=H, the headcount ratio, while if α=1 we have P_α=HI, the per capita income-gap. When α>1, then P_α obeys the principle of transfers, while if α>2 then it is transfer sensitive. Probably the most popular version of the P_α measure is where α=2, in which case $P_2 = H[I^2 + (1-I)^2 C_p^2]$ where C_p^2 is the coefficient of variation of income amongst the poor.

This concludes our brief review of poverty measures. We will now investigate an alternative to these measures, which may be preferable in the sense that it avoids some of the problems outlined above.

3. An Alternative to Conventional Poverty Measures

In section 2 we saw that there are few, if any, conventional poverty measures that do not have some unattractive feature. Perhaps two of the most pressing problems concern the discontinuity involved in identifying the poor as those below a poverty line, and the fact that a purely relative poverty line is homogenous of degree zero in incomes. As an alternative to poverty measures, it may be best to turn our attention back towards more direct measures of welfare. This can be justified on the basis that such measures may avoid the two problems referred to above. It can also be justified if we examine more closely

exactly why people are concerned about poverty. It seems reasonable to suggest that people are concerned about poverty because its existence causes the welfare of society to be lower than would be the case if it did not exist. If our concern about poverty is motivated by its effect on welfare, then why not try to measure welfare itself more directly? In this section we examine a measure of welfare which we believe addresses the main issues which people are concerned about when analysing poverty but which also avoids some of the problems which conventional poverty measures face.

The class of welfare measures which we propose as an alternative to poverty measures are what Lambert (1993) calls *abbreviated welfare measures.* An abbreviated welfare measure is one which is defined solely over income and some summary measure of inequality. Thus $W = w(y, G)$ where in this case the inequality measure adopted is the Gini coefficient. As Lambert outlines such an abbreviated welfare measure cannot be derived from an individualistic social welfare function (i.e. one where my utility is dependent on my own income and independent of the incomes of others). However, if the underlying social welfare function is non-individualistic (i.e. other peoples'incomes enter as arguments into my utility function) then it is possible to derive the above form of abbreviated welfare function. In terms of intuition, a non-individualistic social welfare function can be motivated along the lines of either envy (there is a strong deprivation effect if my income is lower than the rest) or altruism (my conscience is affected if my income is above that of the rest of society)![7] As Lambert shows we can then use a simple abbreviated welfare function of the form $W = \mu_y(1 - G)$, where μ_y is average income.

In this paper we concentrate on the above form of abbreviated welfare function, except that we use Yitzhaki's extended Gini as opposed to the conventional Gini (Yitzhaki,

[7] For envy see Runciman (1966) and for altruism see Layard (1980).

1983). Thus our abbreviated welfare function is $W(\gamma) = \mu_y[1 - G(\gamma)]$ where γ is a parameter which influences the weight attached to the lower parts of the income distribution.[8] A higher value of γ implies a higher weight on the lower part of the income distribution and thus a greater degree of inequality aversion.

We believe this measure may be preferable to conventional poverty measures. Take the problem with the discrete nature of the poverty line. A family just below the poverty line will have a weighting in the poverty measure but a family just above the poverty line will have no weighting, even though its standard of living may be virtually indistinguishable from the poor family. Using an abbreviated welfare measure, the poor family will have a relatively high weight (depending upon the value of γ) and the family just above the poverty line will also have a relatively high weight. Their weight will be less than the poor family, but obviously greater than that of a family which is well above the poverty line. Depending upon the value of γ chosen, the weight of relatively rich families in abbreviated welfare will be very low, and the problem of the discontinuity of the poverty line will be avoided.

The abbreviated welfare approach also avoids the homogeneity of degree zero property of purely relative poverty measures. Given that the use of a purely relative approach implies that a doubling of living standards for everyone has no impact upon poverty, the corollary of this is that changes in measured poverty can *only* come about via changes in the income distribution. In that case it may be preferable to use a measure which explicitly takes account of the income distribution, rather than a relative poverty measure where the impact of the income distribution is less transparent. Using an

[8] More formally, if F is the cumulative distribution of income, then $G(\gamma) = -\gamma \operatorname{cov}[y, (1-F)^{\gamma-1}] / \mu_y$. When γ=2 we have the conventional Gini.

abbreviated welfare measure, welfare can increase via improvements in the overall standard of living *and* via less inequality in the income distribution.

4. Empirical Evidence on Poverty and Welfare Measures

We have outlined above reasons why we believe that abbreviated welfare measures may be preferable to conventional poverty measures. We now present some empirical evidence using the Irish Household Budget Surveys (HBS) of 1987 and 1994. These are nationally representative surveys carried out every seven years and collect a variety of information concerning the consumption patterns, income and demographic characteristics of in excess of 7000 households. Before proceeding with the analysis we must first decide upon our definition of "income" or more particularly whether to use income or expenditure. [9] Broadly the issues are as follows[10]: certain components of income are difficult to measure e.g. income from self-employment. Perhaps more importantly cross-section studies typically provide income measures which are snapshots in time and thus take no account of the difference between transitory and permanent income. Since consumption/expenditure decision are usually made with reference to permanent income then expenditure measures may be preferable. However, such measures also have drawbacks. Expenditure on items such as alcohol and tobacco are typically under-reported. Also, as mentioned above, expenditure over a two-week period may not be a reliable measure of consumption, particularly for mature households who may have a large stock of durables from which they derive services.

However a further problem specific to the HBS is that income observations are "top-coded" i.e. values of income in excess of £800 per week are simply entered as £800 per

[9] For a recent discussion of poverty and inequality in Ireland which looks at measures of both income and consumption see O'Neill and Sweetman (1998).

week. Thus the distribution of income is censored on the right hand side at a value of £800. This causes problems both when estimating income elasticities and also when calculating a poverty line which is a certain percentage of mean income (it does not arise when using median income). One way around this problem is to find an appropriate instrument for income and then use predicted income rather than actual income for the calculation of income elasticities (the problem does not arise for expenditure). Thus given appropriate instruments for income we can carry out a Tobit regression of income on these variables (reflecting the censoring of income) and then use predicted income from this Tobit. This approach was adopted but the results were not satisfactory and so it was decided to use expenditure as the basis for calculating elasticities and the poverty line.[11] Our expenditure measure is total expenditure excluding repayments of loans other than house purchase mortgages, savings and taxes. It includes the value of home grown food consumed.

Since we are examining expenditure decisions across families of differing sizes and composition it is necessary to adjust our measures of expenditure by the appropriate equivalence scale. There is an extensive literature on the appropriate choice of equivalence scale.[12] Here we use a scale which has been widely used in poverty studies in the EU. It is the same as scale "C" used by Callan et al (1996) and is also used by O'Neill and Sweetman (1998). The weights are 1 for the first adult in the household, 0.7 for additional people aged over 14 and 0.5 for people aged less than 14.

[10] For a detailed discussion see Blundell and Preston (1998).
[11] However to facilitate comparison with the Callan et al study we also present results based on disposable income.
[12] See Deaton and Muellbauer (1980) for a discussion.

5. Conclusion.

This paper has discussed the usefulness of conventional poverty measures and suggests that abbreviated welfare measures may be preferable. The drawbacks of conventional poverty measures were briefly discussed and their empirical properties were compared with those of abbreviated welfare measures. The results suggest that while poverty and welfare measures may rank different distributions similarly, they do not always indicate the same direction of change. The results also show the dangers of automatically equating higher measured poverty with lower welfare and suggest that conventional poverty measures should always be accompanied by some broader measure of welfare. It is hoped in future work to examine these same issues using actual rather than synthetic data.

Table 1: Simulated Income Changes

Quintile	y	y_0	y_1	y_2	y_3	y_4	y_5
0-5%	-	+25%	0%	-5%	+10%	+35%	+75%
5-10%	-	+25%	0%	-5%	+10%	+35%	+50%
10-15%	-	+25%	+10%	+5%	+15%	+30%	+50%
15-20%	-	+25%	+10%	+5%	+15%	+30%	+50%
20-25%	-	+25%	+10%	+5%	+20%	+30%	+15%
25-30%	-	+25%	+10%	+15%	+20%	+30%	+15%
30-35%	-	+25%	+20%	+15%	+20%	+25%	+15%
35-40%	-	+25%	+20%	+15%	+20%	+25%	+15%
40-45%	-	+25%	+20%	+15%	+20%	+25%	+15%
45-50%	-	+25%	+20%	+15%	+25%	+25%	+15%
50-55%	-	+25%	+30%	+15%	+25%	+20%	+15%
55-60%	-	+25%	+30%	+15%	+25%	+20%	+15%
60-65%	-	+25%	+30%	+15%	+25%	+20%	+15%
65-70%	-	+25%	+30%	+15%	+25%	+20%	+15%
70-75%	-	+25%	+40%	+15%	+30%	+15%	+15%
75-80%	-	+25%	+40%	+15%	+30%	+15%	+15%
80-85%	-	+25%	+40%	+50%	+30%	+15%	+5%
85-90%	-	+25%	+40%	+50%	+30%	+15%	+5%
90-95%	-	+25%	+50%	+50%	+30%	+10%	+5%
95-100%	-	+25%	+50%	+75%	+35%	+10%	-5%

Table 2: Selected Poverty Measures

	y	y_0	y_1	y_2	y_3	y_4	y_5
HC_{40}	0.060	0.060	0.115	0.123	0.088	0.037	0.007
HC_{50}	0.127	0.127	0.230	0.200	0.154	0.084	0.023
HC_{60}	0.229	0.229	0.300	0.312	0.270	0.174	0.116
IG_{40}	0.184	0.184	0.265	0.239	0.209	0.164	0.146
IG_{50}	0.216	0.216	0.252	0.293	0.259	0.195	0.176
IG_{60}	0.227	0.227	0.365	0.292	0.254	0.203	0.106
S_{40}	0.087	0.087	0.117	0.127	0.108	0.078	0.068
S_{50}	0.112	0.112	0.163	0.152	0.131	0.098	0.067
S_{60}	0.144	0.144	0.201	0.203	0.171	0.120	0.072
FGT_{40}	0.003	0.003	0.011	0.011	0.006	0.002	0.000
FGT_{50}	0.009	0.009	0.023	0.023	0.014	0.005	0.001
FGT_{60}	0.018	0.018	0.039	0.038	0.026	0.011	0.003
W(2)	73.97	92.46	89.92	85.58	90.93	91.97	90.63
W(3)	63.12	78.90	73.11	70.37	76.06	80.18	80.78
W(5)	53.10	66.38	58.63	57.45	62.64	69.01	72.34

Table 3: % change in poverty and welfare measures

	y_0	y_1	y_2	y_3	y_4	y_5
HC_{40}	0	+91.7	+105.0	+46.6	-38.3	-88.3
HC_{50}	0	+81.1	+57.5	+21.2	-33.8	-81.9
HC_{60}	0	+31.0	+36.2	+17.9	-24.0	-49.3
IG_{40}	0	+44.0	+29.9	+13.6	-10.9	-20.6
IG_{50}	0	+16.7	+35.6	+19.9	-9.7	-18.5
IG_{60}	0	+60.8	+28.6	+11.9	-10.6	-53.3
S_{40}	0	+34.5	+46.0	+24.1	-10.3	-21.8
S_{50}	0	+45.5	+35.7	+17.0	-12.5	-40.2
S_{60}	0	+39.6	+41.0	+18.8	-16.7	-50.0
FGT_{40}	0	+240.3	+239.6	+90.3	-48.2	-91.9
FGT_{50}	0	+157.7	+159.5	+63.2	-42.9	-88.2
FGT_{60}	0	+117.6	+113.7	+46.5	-37.5	-82.8
W(2)	+25	+21.6	+15.7	+22.9	+24.3	+22.5
W(3)	+25	+15.8	+11.5	+20.5	+27.0	+28.0
W(5)	+25	+10.4	+8.2	+18.0	+30.0	+36.2

Table 4: Rank Correlation Coefficients

H_{40}	1.0															
H_{50}	0.8	1.0														
H_{60}	1.0	0.8	1.0													
I_{40}	0.9	0.9	0.9	1.0												
I_{50}	0.9	0.5	0.9	0.7	1.0											
I_{60}	0.9	0.9	0.9	1.0	0.7	1.0										
S_{40}	1.0	0.8	1.0	0.9	0.9	0.9	1.0									
S_{50}	0.9	0.9	0.9	1.0	0.7	1.0	0.9	1.0								
S_{60}	1.0	0.8	1.0	0.9	0.9	0.9	1.0	0.9	1.0							
F_{40}	0.9	0.9	0.9	1.0	0.7	1.0	0.9	1.0	0.9	1.0						
F_{50}	0.9	0.9	0.9	1.0	0.7	1.0	0.9	1.0	0.9	1.0	1.0					
F_{60}	0.9	0.9	0.9	1.0	0.7	1.0	0.9	1.0	0.9	1.0	1.0	1.0				
W_2	0.9	0.6	0.9	0.8	0.8	0.8	0.9	0.8	0.9	0.8	0.8	0.8	1.0			
W_3	1.0	0.8	1.0	0.9	0.9	0.9	1.0	0.9	1.0	0.9	0.9	0.9	1.0	1.0		
W_5	1.0	0.8	1.0	0.9	0.9	0.9	1.0	0.9	1.0	0.9	0.9	0.9	0.9	1.0	1.0	
Y	-0.9	-0.9	-0.9	-1.0	-0.7	-1.0	-0.9	-1.0	-0.9	-1.0	-1.0	-1.0	-0.8	-0.9	-0.9	1.0
	H_{40}	H_{50}	H_{60}	I_{40}	I_{50}	I_{60}	S_{40}	S_{50}	S_{60}	F_{40}	F_{50}	F_{60}	W_2	W_3	W_5	Y

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