

A discusión

DEFINING POVERTY LINES AS A FRACTION OF CENTRAL TENDENCY*

Christophe Muller**

WP-AD 2005-13

Editor: Instituto Valenciano de Investigaciones Económicas, S.A.
Primera Edición Marzo 2005
Depósito Legal: V-1416-2005

IVIE working papers offer in advance the results of economic research under way in order to encourage a discussion process before sending them to scientific journals for their final publication.

* This research was carried out during my visit to the Department of Agricultural Economics at the University of California at Berkeley. I am grateful to the British Academy and to the International Research Committee of the University of Nottingham for their financial support. I would like to thank the participants of a seminar in Nottingham University. I am also grateful for the financial support by Spanish Ministry of Sciences and Technology. Project No. BEC2002-03097 and by the Instituto Valenciano de Investigaciones Económicas. Usual disclaimers apply.

** Departamento de Fundamentos del Análisis Económico, Universidad de Alicante, Campus de San Vicente, 03080 Alicante, Spain. E-mail: cmuller@merlin.fae.ua.es.

DEFINING POVERTY LINES AS A FRACTION OF CENTRAL TENDENCY

Christophe Muller

ABSTRACT

We show under lognormality that, when the Gini coefficient is stable over time, defining the poverty line as a fraction of a central tendency of the living standard distribution restricts the evolution of the poverty measures to be stable. That is, poverty does not change if the Gini coefficient does not change. Moreover, when the Gini coefficient slightly changes, most of the poverty change can be considered a change in inequality. Then, the consequences of using different poverty lines are analysed. Thus, important features in studies of poverty change based on these lines may result from methodological choices rather than from economic mechanisms.

Keywords: Measurement and Analysis of Poverty, Income Distribution, Personal Income Distribution.

JEL Classification: I32, O15, D31.

1. Introduction

For many years the relative notions of poverty have been important. These notions account for the evolution of perceptions of basic needs evolving in society¹. Being poor amongst a population of poor people can be considered very differently from being poor in a wealthy environment. This concern is often met by updating the poverty line across time in relation to the distribution of living standards. In these conditions, are the evolution patterns of poverty measures a real economic phenomena or only hidden consequences of methodological choices²? We deal with this question in this paper.

The literature on poverty lines is extensive³ and varied. In particular, fractions of the median or the mean of the living standard distribution have been used to update poverty lines, notably for dynamic poverty analyses by national and international administrations⁴. Example of major countries where administrations use a fraction of the median of income as a component of poverty threshold are the United Kingdom (Oxley, 1998), and the U.S. probably in the future as it is recommended in Citro and Michael (1998, 2002), although using this approach is less familiar in the latter country⁵.

Other updating procedures exist such as poverty lines anchored on the mean living standard of households whose living standards are close to the desired poverty line (Ravallion, 1998), or poverty lines relying on subjective perceptions

¹Sen (1983), Foster (1998).

²Smeeding (1979) and Browning (1979) discuss other methodological issues affecting measurement of inequality and poverty.

³van Praag, Goedhart and Kapteyn (1978), Hagenaars and van Praag (1985), Callan and Nolan (1991), Citro and Michael (1995), Short, Garner, Johnson and Shea (1998), Ravallion (1998) and Madden (2000).

⁴Fuchs (1969), Plotnick and Skidmore (1975), Fiegehen, Lensley and Smith (1977), O'Higgins and Jenkins (1990), Central Statistical Authority (1997), Oxley (1998), Chambaz and Maurin (1998) and Stewart (1998). See Zheng (2001) for other references.

⁵In Citro and Michael (1995), page 5: 'We propose that the poverty-level budget for the reference family start with a dollar amount for the sum of three broad categories of basic goods and services - food, clothing, and shelter (including utilities). The amount should be determined from actual Consumer Expenditure Survey (CEX) data as a percentage of median expenditure on food, clothing, and shelter by two-adult/two-child families.' In Betson et al. (2000), nine alternative thresholds are proposed and calculated for poverty measurement in the U.S. Official Statistics in 1992. Among them are: (1) One-half average expenditures of four-person consumer units; (2) One-half median after-tax income of four-person families. Since these are official recommendations, they should be at least partly followed in the future.

of poverty by individuals⁶. This paper does not cover these procedures.

An index of poverty is a real valued function P , which given a poverty line z , associates to each income profile $y \in R_+^n$, a value $P(y, z)$ indicating its associated level of poverty. For example, using a household consumption survey, an estimation of a poverty measure provides an indicator of the amount of poverty in the country. The results can be used to guide economic and social policies. We consider in this paper a large class of poverty measures under lognormality of the living standard distribution. This class covers all the poverty measures used in applied work. However, we also stress two major poverty measures for which we have explicit parametric results: (1) the Watts measure⁷, one of the most popular axiomatically sound poverty measure; (2) the head-count index, which is the most used poverty measure.

The aim of the paper is to show that using a fraction of a central tendency as the poverty line restricts the evolution of poverty statistics to be stable when the inequality is stable. This situation may occur in particular for proportional taxation, uniform VAT and fixed rate sharecropping arrangements. Therefore, for null or low levels of inequality changes – the usual case – using such popular updating procedure leads to confuse the evolution of poverty over years with the evolution of inequality described by using the Gini coefficient. This is important for policy because this procedure is frequently implemented in poverty studies, which generates pictures of limited changes in poverty. Browning (1989) shows that it is crucial for government policy to distinguish inequality and poverty. Indeed, ‘while helping the truly needed is favoured, extending that role to permit redistribution is often counterproductive’. Section 2 describes the properties of poverty measures when poverty lines are updated by a fraction of central tendency. The consequences of using different relative poverty lines are also compared. Section 3 concludes our research followed by the proofs in the appendix.

2. Poverty Lines and Poverty Change

2.1. The setting

The results are largely based on the assumption of lognormality of the distribution of living standards. The lognormal approximation has often been used in applied

⁶van Praag, Goedhart and Kapteyn (1978), Hagenaars and van Praag (1985), Pradhan and Ravallion (1998).

⁷Watts (1968), Zheng (1993).

analysis of living standards⁸. Although it has sometimes been found statistically consistent with income data (e.g. van Praag, Hagenars and van Eck, 1983), other distribution models for living standards or incomes may be statistically closer to the data. Using US data, Cramer (1980) finds the lognormal distribution is no longer dominated by other distribution models if measurement errors are incorporated.

What is wanted in this paper is: (1) to obtain simplifications in calculus while simultaneously considering the three major central tendencies of a distribution (mean, median and mode); (2) to simultaneously obtain a simple parametric expression of the Watts measure, the head-count index and the Gini coefficient of inequality. This is generally not possible with non-lognormal distributions. Then, the goodness-of-fit of the distribution model is of rather secondary interest. The lognormal model is used as a simple way of illustrating a general argument that could be extended to more flexible specifications of the income distribution. In this paper, a more statistically adequate distribution model would not allow us to present the point more clearly, or exploit the availability of parameter estimates for the lognormal distribution in the US. However, much of the qualitative intuition of the results should work with other usual income distributions.

The variance of the logarithms, denoted σ^2 , is a well-known inequality measure, not always consistent with the Lorenz ordering (Foster and Ok, 1999). This is not the case under lognormality. Then, under lognormality, the Gini coefficient is

$$G = 2\Phi(\sigma/\sqrt{2}) - 1,$$

where Φ is the cdf of the standard normal law and the Theil coefficient is $\sigma/2$. σ corresponds one-to-one with the Gini coefficient and Theil coefficient. This paper only mentions one of these inequality measures in the qualitative statements.

When updating the poverty line, by defining it as a fraction of the median (mean or mode), measured aggregate poverty is conserved under lognormality when σ is constant. Let us recall that the median of a lognormal distribution $LN(m, \sigma^2)$ is e^m , the mode is $e^{m-\sigma^2}$ and the mean is $e^{m+\sigma^2/2}$. Then, for example, a poverty line defined as a fraction of the median has a formula: $z = K e^m$, with K a given number between 0 and 1. In practice, parameters m and σ are not perfectly known, but are estimated instead. To avoid mixing too many questions we do not discuss estimation errors in this paper. However, there are sampling

⁸ Alaiz and Victoria-Feser, 1990, Slesnick, 1993. Atchison and Brown (1957) and Cowell (1983) indicate that the lognormality is often found appropriate for populations of workers in specific sectors.

confidence intervals for poverty indicators in the application. And now, in the theoretical part, it can be assumed that m and σ are known.

The first part starts with a very general class of additive poverty measures of the form

$$P = \int_0^z k(y, z) d\mu(y),$$

where y is the income variable, μ is the cdf of $LN(m, \sigma^2)$ and z is the poverty line. P can be rewritten after a change in the variable:

$P = \int_{-\infty}^{Z \equiv \frac{\ln z - m}{\sigma}} k(e^{\sigma t + m}, e^{\sigma Z + m}) \phi(t) dt$ where ϕ is the pdf of the standard normal law. Therefore, P only depends on parameters $Z (\equiv \frac{\ln z - m}{\sigma})$, σ and m . Note that the level of m cannot be described as merely the scale of the incomes. In particular, when m rises with a given σ , the variance of the incomes also rises. Now, if the poverty measure can be written as

$$P = \int_0^z k\left(\frac{y}{z}\right) d\mu(y),$$

which is always the case for measures employed in applied work, then it is apparent that it does not depend on m , the location parameter, once Z and σ are given. Indeed, $P = \int_{-\infty}^Z k\left(\frac{e^{\sigma t + m}}{e^{\sigma Z + m}}\right) \phi(t) dt = \int_{-\infty}^Z k(e^{\sigma(t-Z)}) \phi(t) dt$ can be rewritten as

$$F\left(\frac{\ln z - m}{\sigma}, \sigma\right),$$

a parameterised form of most poverty measures used in practice. Therefore, for all poverty lines that Z does not depend on m , the considered poverty measures also do not depend on m . These poverty lines are presented in the next subsection.

2.2. Results with constant Gini coefficient

The previous discussion leads to a consideration of the general class of poverty measures that can be written as $F\left(\frac{\ln z - m}{\sigma}, \sigma\right)$ under lognormality.

The variations of the Gini coefficient have often been observed as small. A case where the Gini does not change, is of a proportional taxation. In this case, each person pays a fixed proportion $0 \leq t < 1$ of its income y , leaving it with

$(1 - t)y$. Clearly, in this situation, the Lorenz curve and, therefore, the Gini coefficient remain fixed. Naturally, poverty when measured with a fixed poverty line becomes worse by a proportional taxation. Some non-poor people cross the poverty threshold downwards, and those with low incomes who remain poor fall, raising the severity in poverty.

Proportional taxation has always been attractive to fiscal administrations because of its simplicity. Historically, some have also defended proportional taxation on the grounds of social justice. Thus, John Stuart Mill's formula of the 'ability to pay' doctrine in the nineteenth century calls for a proportional tax on income above subsistence (See Musgrave, 1988, p. 18). When subsistence needs are small, one obtain what boils down to a proportional income tax. Besides, that was the format of Pitt's proportional income tax of 3 percent in 1840.

Actual tax systems are very complicated at the present moment, combining elementary taxes that may be progressive, proportional or regressive. However, it is unlikely the whole tax system will be exactly proportional, but individual taxes of interest may be. For example, medieval populations of poor peasants in many European countries were subject to a fixed proportion of the peasant's crop income. Meanwhile, recommendations for Value Added Tax (VAT) often favor a unique tax rate for all goods, in order to eliminate the distorting effect of the tax on relative prices. In that case, if consumption is used as a base for the definition of individual living standards, a uniform VAT would not change the income Lorenz curve or associated inequality measures that are scale invariant. Also, if one is interested in a population of non-tenant peasants subject to a fixed share-cropping rate, the impact of a change in the share-cropping arrangement on poverty can be studied by assuming unchanged inequality measured by the Gini coefficient. Indeed, all crop incomes are affected proportionally and one can assume there is no other important income.

It has often been observed that σ and other inequality measures vary less than usual poverty measures between years. For example, the estimates in Datt and Ravallion (1992) for India and Brazil in the 1980's show a smaller temporal relative variation for the Gini coefficient than the head-count index. Then, in a first approximation and in many contexts, G may change slightly when compared to changes in poverty measures. When G is considered fixed, we obtain the following results.

Proposition 2.1.

Under lognormality when the Gini coefficient of inequality is constant, using a fraction of the median (mean or mode) of the income distribution to update the

poverty line as the distribution varies yields a fixed estimate of poverty measured by any poverty measure of the form $P = \int_0^z k(y/z) d\mu(y)$, where μ is the cdf of $LN(m, \sigma^2)$ and z is the poverty line.

This is also the case for all poverty measures that can be parametrically written as $F(\frac{\ln z - m}{\sigma}, \sigma)$.

Proof: If a poverty measure of the form $F(\frac{\ln z - m}{\sigma}, \sigma) = F(Z, \sigma)$ with $Z \equiv \frac{\ln z - m}{\sigma}$, then
 $dF = \frac{\partial F}{\partial Z} dZ + \frac{\partial F}{\partial \sigma} d\sigma$ and $dZ = \frac{1}{z\sigma} dz - \frac{1}{\sigma} dm - \frac{\ln z - m}{\sigma^2} d\sigma$. This results as

$$dF = \frac{1}{\sigma} \frac{\partial F}{\partial Z} \left(\frac{dz}{z} - dm \right) + \left(\frac{\partial F}{\partial \sigma} - \frac{\partial F}{\partial Z} \frac{\ln z - m}{\sigma^2} \right) d\sigma.$$

Therefore, if σ is constant, $dF = 0$ is equivalent to $\frac{dz}{z} - dm = 0$. One exception exists in the case where $\frac{\partial F}{\partial Z} = 0$, which is generically negligible. By integrating the formulas, one obtains: $z = K(\sigma)e^m$, where $K(\sigma)$ is a function of σ only.

Under lognormality, if $K(\sigma) = 1/p$ with $0 < p < 1$, then $z = \frac{e^m}{p}$ is the p^{th} fraction of the median. If $K(\sigma) = e^{\sigma^2/2}/p$, then $z = \frac{e^{m+\sigma^2/2}}{p}$ is the p^{th} fraction of the mean. If $K(\sigma) = e^{-\sigma^2}/p$, then $z = \frac{e^{m-\sigma^2}}{p}$ is the p^{th} fraction of the mode. QED.

It is easy to check that with the chosen relative poverty lines all poverty measures of the parametric form $F(\frac{\ln z - m}{\sigma}, \sigma)$ are scale invariant, i.e. they are not changed by multiplying all incomes by the same positive factor. Note that these measures do not cover all the scale invariant measures. The latter ones can be written as $K(m, \sigma, \ln z)$ and must satisfy $\frac{\partial K}{\partial m} + \frac{\partial K}{\partial \ln z} = 0$. The fact that the measures $F(\frac{\ln z - m}{\sigma}, \sigma)$ do not change when incomes arbitrarily change, even if the Gini coefficient is kept constant, is more surprising. The scale change of all incomes would result in unchanged poverty as soon as the poverty line is proportionally updated. But the particular result of interest is that the same invariance applies for any changes in incomes which leave a summary measure of inequality unchanged, provided income is lognormal. This is the specific shape of the relative poverty line that exactly offsets the effect of change in m for poverty measurement⁹.

⁹It is wrong to believe that fixing σ is enough to fix everything except the scale of incomes. For example, the variance of incomes is equal to $e^{2m+\sigma^2}(e^{\sigma^2} - 1)$ and still varies with m even when σ is fixed. Moreover, the population of the poor also varies with the level of m .

In the strict conditions of Proposition 2.1, or when G slightly changes, the consequence of using fractions of central tendencies as simplified updating rules for the poverty line is plain. Such methods restrict one to obtain only stable measures of poverty evolution, at least under lognormality, and by extension for income distributions not too far from the lognormality hypothesis. This may have damaging implications for poverty policies if alternative and better poverty lines show different poverty evolution, for example soaring poverty. In such a situation, crucial interventions to alleviate a living standard crisis may not be carried out because the used poverty indicators are faulty. We now turn to the cases where the changes in σ are small instead of being strictly nullified.

2.3. Results with Gini non constant

When σ slightly changes across periods, as often observed in the data at country level, the proof of Proposition 2.1 indicates that most of the change in poverty can be considered proportional to a change in inequality, as measured by the variance of logarithms. As shown, at the first order we have with the above relative poverty lines:

$dF = \left(\frac{\partial F}{\partial \sigma} - \frac{\partial F}{\partial Z} \left(\frac{\ln z - m}{\sigma} \right) \right) d\sigma = A d\sigma$, where A is the value of the term in parentheses. Then, when inequality changes moderately and under the approximation of lognormality, poverty measures that can be written as $P = \int_0^z k(y/z) d\mu(y)$, mostly reflect this change rather than that which can be specific in poverty evolution.

It is possible to refine the analysis by distinguishing different relative poverty lines. Under lognormality one can define the relative poverty lines by denoting $z = e^{m+\alpha\sigma^2}/p$ with $\alpha = 0$ when the median is used as the central tendency, $\alpha = 1/2$ for the mean and $\alpha = -1$ for the mode. Then, $\ln z = -\ln p + m + \alpha\sigma^2$. As the proof shows, the results of Proposition 2.1 are also valid for any poverty line of the form $K(\sigma)e^m$, although we do not develop cases which have not been used in practice. One can learn by examining how the poverty measures vary with the values of σ and p , for example in the next proposition.

Proposition 2.2. *For all poverty measures of the parametric type $F(Z, \sigma)$ twice differentiable, where $Z = \frac{\ln z - m}{\sigma}$ and z is the poverty line, and where m and σ^2 are the parameters of the lognormal income distribution (therefore in particular of the form $P = \int_0^z k(y/z) d\mu(y)$, where μ is the cdf of $LN(m, \sigma^2)$), we obtain with the relative poverty line $z = e^{m+\alpha\sigma^2}/p$:*

$$dF = \left[\frac{\partial F}{\partial Z} \left(\frac{\ln p}{\sigma^2} + \alpha \right) + \frac{\partial F}{\partial \sigma} \right] d\sigma - \frac{1}{p\sigma} \frac{\partial F}{\partial Z} dp.$$

Proof:

The results are obtained from direct differential calculus, noting that $Z = -\ln p/\sigma + \alpha\sigma$, $\frac{\partial Z}{\partial p} = -\frac{1}{\sigma p}$, $\frac{\partial Z}{\partial \sigma} = \ln p/\sigma^2 + \alpha$. The determination in the signs of the coefficients of differential terms of dF is straightforward as soon as one notices that $\ln p/\sigma^2 + \alpha \geq 0$ for $p \geq 1$ and the mean or median are used as the central tendency. QED.

The sign of dF shows that poverty rises or falls with a change in σ . The term in dp in dF is interesting in order to understand the impact of choosing different fractions of a central tendency for defining the poverty line. These results characterize the evolution of measured poverty as the consequence of a methodological choice rather than an autonomous economic phenomenon. Naturally, one must be cautious with such interpretations because differences in these parameters for the compared situations are not necessarily small, although the differential of F provides insight on typical variations. One expects that the poverty measure is an increasing function of Z that increases with the poverty line ($\frac{\partial F}{\partial Z} \geq 0$). The assumption that $\frac{\partial F}{\partial \sigma} \geq 0$ may seem plausible, at least for poverty measures giving a large importance to poverty severity, because the inequality among the poor contributes to this severity is part of global inequality.

The first term on the right-hand-side of the dF equation describes the poverty change that accompanies the change in income distribution and is proportional to the change in inequality measured by σ . The sign of the coefficient of $d\sigma$ is generally ambiguous, although it can be argued as positive in most situations, which corresponds to $\frac{\partial F}{\partial Z} \geq 0$, $\frac{\partial F}{\partial \sigma} \geq 0$, $p > 1$ and $\alpha = 0$ or $\alpha = 1/2$ (i.e. the median or mean are used as central tendency for the relative poverty line). We denote from now the latter conditions on p and α : ‘usual values of p and α .’ Then, in these conditions the poverty measure varies in the same direction than the inequality measure. The second term on the right-hand-side of the dF equation describes the first-order differences in the measured poverty changes when measured with different poverty lines, here characterised by different fractions of the central tendency. Assuming $\frac{\partial F}{\partial Z} \geq 0$, the lower the poverty line is (the higher p is), the less the absolute poverty changes. This is consistent with smaller values of the poverty measure when the population of the poor is smaller. The same result holds true for finite variations of p .

Note that selecting one given central tendency (the mean, median or mode) is equivalent to fixing the median as the used central tendency, and choosing an adjusted level of the fraction parameter p . Indeed, there exists p' and p'' such that $\frac{1}{p}e^{m-\sigma^2} = \frac{1}{p'}e^m$ and $\frac{1}{p}e^{m+\sigma^2/2} = \frac{1}{p''}e^m$. This justifies that the terms in $d\alpha$ are not developed in the study of the differential of F . Nevertheless, one can recall that the mode may differ from the median and mean in that with the usual fractions defining the poverty line, the sign of the coefficients of $d\sigma$ in dF can be negative. The next part describes more explicit results based on the head-count index and the Watts measure.

2.4. The Head-count index and the Watts poverty measure

The head-count index, the most popular poverty indicator, is the proportion of poor people in the whole population,

$$P_0 \equiv \int_0^z d\mu(y),$$

where μ is the cdf of living standards y and z is the poverty line. The Watts poverty measure is defined as

$$W = \int_0^z -\ln(y/z) d\mu(y).$$

The Watts measure satisfies the focus, monotonicity, transfer and transfer sensitivity axioms. It is also continuous and sub-group consistent. Focus axiom: The poverty index $P(y, z)$ is independent of the income distribution above z . Monotonicity: $P(y, z)$ is increasing if one poor person experiences a decrease in income. Transfer: $P(y, z)$ increases if income is transferred from a poor person to someone richer. Transfer-sensitivity: The increase in $P(y, z)$ in the previous Transfer axiom is inversely related to the income level of the donator. Sub-group consistency: If an income distribution is partitioned in two sub-groups y' and y'' , then an increase in $P(y'', z)$ with $P(y', z)$ constant, increases $P(y, z)$. Because of its axiomatic properties, it is often a better representation of poverty than other used poverty indicators. If the living standard y follows a lognormal distribution in that $\ln(y) \sim N(m, \sigma^2)$, then the Watts poverty measure is equal to $W = (\ln z - m) \Phi\left(\frac{\ln z - m}{\sigma}\right) + \sigma \phi\left(\frac{\ln z - m}{\sigma}\right)$, where ϕ and Φ are respectively the pdf and cdf of the standard normal distribution (Muller, 2001). The formula for the head-count index under lognormality is $P_0 = \Phi\left(\frac{\ln z - m}{\sigma}\right)$. Using Proposition 2.2

and by noting that: $\frac{\partial P_0}{\partial Z} = \phi(Z)$; $\frac{\partial W}{\partial Z} = \sigma\Phi(Z) + \sigma Z\phi(Z) + \sigma\phi'(Z) = \sigma\Phi(Z)$; $\frac{\partial P_0}{\partial \sigma} = \frac{\partial P_0}{\partial \sigma} = 0$; $\frac{\partial W}{\partial \sigma} = Z\Phi(Z) + \phi(Z)$, we obtain

$$dP_0 = \left(\frac{\ln p}{\sigma^2} + \alpha \right) \phi(Z) d\sigma - \frac{1}{\sigma p} \phi(Z) dp$$

and

$$dW = [2\alpha\sigma\Phi(Z) + \phi(Z)] d\sigma - \frac{1}{p} \Phi(Z) dp.$$

A few differences in the variations of P_0 and W become evident with the formula. Some of the first-order variations of the Watts measure appear proportionally to the proportion of poor people in the population, $\Phi(Z)$, while that is never the case for the head-count index for which all the first-order variation terms are proportional to $\phi(Z)$. Examining the calculus shows that the components proportional to $\phi(Z)$ in the formula of dW can identify the variations stemming from a change in the population of the poor, while the component proportional to $\Phi(Z)$ can identify those coming from the change in poverty severity. Secondly, divisions by σ occur for terms in the differentials of P_0 , but not for that of W . The meaning of all these differences may be unclear, but they suggest that the variation profiles of the two measures are not strongly related.

However, there are also important similarities between the variations of both measures. At the first order of the approximation, for the usual values of p and α , the poverty evolution related to changes in the income distribution (with σ) goes in the same direction as P_0 and W . In both cases the coefficient of $d\sigma$ in dF is positive, which indicates that poverty measured by both indicators increases with inequality, at the first order. Meanwhile, for poverty line z below the median of the income distribution, the choice of the fraction for defining the poverty line similarly affects both measures since the coefficients of dp in dF have the same negative sign for both measures.

Other possible parametric approaches depend less on the lognormality assumption, but deliver less tractable formulae. For example, Datt and Ravallion (1992) derive parametric formulae for Foster-Greer-Thorbecke poverty indices P_0 , P_1 and P_2 , under the assumptions of parameterized Lorenz curves of types Beta and Generalised Quadratic. However, these are only implicit formulae and the poverty measures must be extrapolated using roots of complicated equations. In such a case, an explicit analysis of the variations using these measures is ruled out. Meanwhile, the parameters intervening in these Lorenz curves are not easily interpreted and cannot be assimilated to inequality measures. Therefore, we

chose not to follow this approach, but rather relied on an approximate lognormal representation that can be seen as a further simplification.

3. Conclusion

Are the evolution patterns of poverty measures a real economic phenomena or only hidden consequences of methodological choices? This paper analyses the consequences of updating poverty lines by using fractions of central tendencies of the living standard distribution. It is shown for general poverty measures that under lognormal approximation and if the Gini coefficient of inequality does not change very much, the measured evolution of poverty is restricted to be stable with these updating rules. This situation may occur particularly when studying proportional taxation, uniform VAT, fixed rate share-cropping arrangements, but also for usual situations when the Gini coefficient changes moderately. In these cases, most of the changes in poverty can be considered as a change in inequality, rather than as a specific poverty phenomenon. Finally, we discussed the consequences of using different relative poverty lines or different poverty indicators. An illustration based on U.S. data confirms the theoretical results and shows the impact caused by the choice of a particular poverty line. This choice determines many features of the apparent evolution of poverty.

Therefore, using the considered relative poverty lines restricts what one could expect from studying the evolution of poverty. Other notions of poverty lines may allow clearer separation of poverty changes and small inequality changes. Furthermore, past studies of poverty change that employed these methods could be reexamined with different updating procedures for the poverty line.

The different types of poverty line updating used in the literature each have their advantages and disadvantages, and it is not always clear what is the best approach (see the surveys by Callan and Nolan, 1991, and Ravallion, 1998). In particular, it is not clear if the absence of sensitivity of the poverty line to inequality is a systematically desirable property. Indeed, “absolute poverty lines” that are not updated and do not depend on inequality, have their weaknesses. They do not account for the evolution of individual expectations in society, while many economists think that updating is desirable.

Some changes in the income distribution are likely to be simultaneously associated to changes in poverty and inequality. However, not all changes in inequality will lead to changes in poverty, as opposed to what happens with the considered

relative poverty lines. What is needed to know is what type of change in inequality should impact on the poverty line? For example, this could be investigated through psychological experiments.

In conclusion, we devote a few words to the importance of the lognormality assumption. On one side, it is hard to believe that the bulk of our story linking poverty and inequality with relative poverty lines is not captured by the general shape of the lognormal distributions. One expects qualitatively to obtain similar results with other distributions. On the other side, it would be interesting to know what restrictions the lognormality assumption brings.

BIBLIOGRAPHY

ALAIZ, M.P. and M.-P. VICTORIA-FESER, 1996, "Modelling Income Distribution in Spain: A Robust Parametric Approach," Distributional Analysis research Programme, Working Paper no 20, LSE-STICERD, June.

ATCHISON, J. and J.A.C. BROWN, 1957, "*The lognormal distribution: with special references to its uses in economics*," Cambridge University Press, Cambridge.

BROWNING, E.K., 1979, "On the Distribution of Net Income: Reply," *Southern Economic Journal*, January, Vol. 45, Iss. 3, pg. 945.

BROWNING, E.K., 1989, "Inequality and Poverty," *Southern Economic Journal*, April, Vol. 55, Iss. 4, pg. 819-830.

CALLAN, T. and B. NOLAN, 1991, "Concepts of Poverty and the Poverty Line," *Journal of Economic Surveys*, Vol. 5, No. 3.

CENTRAL STATISTICAL AUTHORITY, 1997, "*Poverty Situation in Ethiopia*," Ministry of Economic Development and Cooperation, Addis Abeba.

CHAMBAZ, C. and E. MAURIN, 1998, "Atkinson and Bourguignon's Dominance Criteria: Extended and Applied to the Measurement of Poverty in France," *Review of Income and Wealth*, series 44, No. 4, 497-513, December.

CITRO, C.F. and M.R.T. MICHAEL (eds), 1995, "*Measuring Poverty: A New Approach*," Washington D.C., National Academy Press.

COWELL, F.A., 1993, "*Measuring Inequality*," 2nd edition, Cambridge University Press.

CRAMER, J.S., 1980, "Errors and disturbances and the performance of some common income distribution functions," mimeo University of Amsterdam.

DATT, G. and M. RAVALLION, 1992, "Growth and redistribution components of changes in poverty measures," *Journal of Development Economics*, 38, 275-295.

FIEGEHEN, G.C., P.S. LANSLEY and A.D. SMITH, 1977, "*Poverty and Progress in Britain 1953-73*," Cambridge University Press.

FOSTER, J.E., 1998, "Absolute versus Relative Poverty," *American Economic Association Papers and Proceedings*, 335-341, May.

FOSTER, J.E. and E.A. OK, 1999, "Lorenz Dominance and the Variance of Logarithms," *Econometrica*, Vol. 67, No. 4, 901-907, July.

FUCHS, V., 1969, "Comment on Measuring the Size of the Low-Income Population" in Lee Soltow, ed., "Six papers on the size distribution of wealth and income," New York, National Bureau of Economic Research, 198-202.

HAGENAARS, A.J.H. and B.M.S. VAN PRAAG, 1985, "A Synthesis of Poverty Line Definitions," *Review of Income and Wealth*, Serie 31, No. 1-4.

MADDEN, D., 2000, "Relative or Absolute Poverty Lines: a New Approach," *Review of Income and Wealth*, Serie 46, No. 2, June.

McDONALD, J.B. and M.R. RANSOM, 1979, "Functional Forms, Estimation Techniques and the Distribution of Income," *Econometrica*, Vol. 47, No. 6, November.

MULLER, C., 2001, "The Properties of the Watts Poverty Index under Log-normality," *Economics Bulletin*, Vol. 9, No.1, August, pp1-9.

MUSGRAVE, R.A., 1985, "A Brief History of Fiscal Doctrine," Chapter 1 in A.J. Auerbach and M. Feldstein, "Handbook of Public Economics, Vol. I", Elsevier S.P.B.V.

O'HIGGINS, M. and S. JENKINS, 1990, "Poverty in the EC: Estimates for 1975, 1980 and 1985" in R. Teekens and B. M.S. van Praag (eds.), "*Analysing poverty in the European Community: Policy issues, research options, and data sources*," Luxembourg, Office of Official Publications of the European Communities, 187-212.

OXLEY, H., 1998, "Income dynamics: inter-generational evidence" in "*Persistent Poverty and Lifetime Inequality: The Evidence*," Proceedings from a workshop held at H M Treasury, London, November.

PLOTNICK, G. and R. SKIDMORE, 1975, "*Progress Against Poverty. A Review of the 1964-74 Decade*," Academic Press.

PRADHAN, M. and M. RAVALLION, 1998, "Measuring Poverty Using Qualitative Perceptions of Welfare," mimeo The World Bank, August.

RAVALLION, M., 1998, "Poverty Lines in Theory and Practice," Working Paper World Bank, March.

SEN, 1983, "Poor, Relatively Speaking," *Oxford Economic Papers*, 35, 153-169.

SHORT, K., T.I. GARNER, D.S. JOHNSON, and M. SHEA, 1998, "Redefining Poverty Measurement in the U.S.: Examining the Impact on Inequality and Poverty," mimeo U.S. Bureau of the Census, August.

SLESNICK, D.T., 1993, "Gaining Ground: Poverty in the Postwar United States," *Journal of Political Economy*, vol. 101, No 1.

SMEEDING, T.M., 1979, "On the Distribution of Net Income: Comment," *Southern Economic Journal*, January, Vol. 45, Iss. 3, pg. 932.

STEWART, M., 1998, "Low pay, no pay dynamics" in "*Persistent Poverty and Lifetime Inequality: The Evidence*," Proceedings from a workshop held at H M Treasury, London, November.

VAN PRAAG, B., T. GOEDHART, and A. KAPTEYN, 1978, "The Poverty Line - A Pilot Survey in Europe," *The Review of Economics and Statistics*, 461-465.

VAN PRAAG, B., A. HAGENAARS, and W. VAN ECK, 1983, "The Influence of Classification and Observation Errors on the Measurement of Income Inequality," *Econometrica*, Vol. 51, No. 4, July.

WATTS, H.W., 1968, "An Economic Definition of Poverty" in D.P. Moynihan (Ed.), "*On Understanding Poverty*," 316-329, Basic Book, New York.

ZHENG, B., 1993, "An Axiomatic Characterization of the Watts Poverty Index," *Economic Letters*, 42, 81-86.

ZHENG, B., 2001, "Statistical inference for poverty measures with relative poverty lines," *Journal of Econometrics*, 101, 337-356.