A Bootstrap Analysis of Poverty and Inequality Using the PACO Data Base

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1. Introduction

In this paper, we will analyse poverty and inequality among pensioners in Hungary, Luxembourg and the United Kingdom. We will compare the results we obtain for households headed by a retired person to the results obtained for households headed by an economically active person and we will discuss changes in poverty and inequality over time.

In Hungary, Luxembourg and the United Kingdom, public pensions are provided on a pay-as-you-go (PAYG) basis. In addition to providing income insurance in old age, these programs have the unique power to transfer income from the lifetime rich to the lifetime poor. The World Bank [(1994), page 101] argues that “This is their big advantage over other financing arrangements for old age security, and their success in achieving this poverty alleviation objective may be taken as the litmus test of a well-functioning public plan”.

The problem of poverty in old age is exacerbated by demographic ageing: as the number of elderly and retired people in society grows, there will be an increasing pressure on scarce resources for social security and social assistance. Demographic ageing, early retirement and generous pension benefits are deteriorating the financial position of public old age pension systems. In the medium to long term, demographic and system dependency ratios will rise. Pension expenditures relative to GDP will increase and there will be considerable pressure on public finances.

To guarantee the solvency of the public PAYG schemes, governments are facing up to difficult and often unpopular choices. In order to offset an increase in the system dependency ratios, one or a combination of the following adjustments must take place: increasing contributions to the system by raising payroll tax rates or paying lower pensions in the future or increasing the labour force participation rates of older workers by raising the retirement age or increasing the number of contributors to the system by raising the labour force participation rates of the young and of women.

The first three alternatives are hardly popular policies that are also unlikely to gather enough political support to ensure that they can be implemented. The last policy alternative is also difficult to implement as the scale of the problem is calling for very large increases in the number of contributors relative to the number of beneficiaries. Consequently, a fundamental overhaul of old-age income insurance appears

inevitable and the pensions issue figures prominently in the current political debates in Hungary, Luxembourg and the United Kingdom.

Given the impossibility to explicitly cut pension benefits, cost containment is also achieved by allowing inflation to erode the real value of the pension benefits. This remark appears to be particularly relevant in the case of Hungary during the early stages of transition[1]. Most observers also agree that the relatively low level at which the UK's implicit pension debt stands is due to the fact that since 1980, benefits have been indexed to price inflation rather than to wages.

As plans to reform the public pension schemes have potentially negative effects on the welfare of pensioners, these plans should be preceded by a careful analysis of the living standards of the retired. Information on how current policies affect the welfare of pensioners should also offer guidance to policymakers involved in shaping the institutions and design features of the future old-age income insurance.

In the field of poverty analysis, most of the attention focuses on the identification and aggregation problems [Sen (1976), page 219]. Statistical inference for poverty and inequality measures, on the other hand, is widely ignored.

Conclusions about poverty and the distribution of incomes, however, are typically based on information obtained from sample surveys. These sample surveys are subject to sampling and non-sampling errors. Sampling errors are those errors that are due to the fact that we observe only a sub-set of the total population. Statistical inference deals with sampling errors and allows us to determine whether the estimated poverty and inequality measures represent the true population parameters.

The problem can be formulated as follows. We have obtained a random sample $X = (x_1, x_2, \ldots, x_n)$ from an unknown probability distribution F and we want to estimate a parameter (e.g., a headcount poverty index) $q = t(F)$ on the basis of X. We calculate an estimate $\hat{\theta} = s(X)$ using X. The question we are examining in this paper is: How accurate is $\hat{\theta}$?

Furthermore, we are often interested in analysing poverty and inequality in a dynamic or a cross-country context in order to find answers to questions like: Have poverty and inequality increased in country A over time? or Does country B have a higher incidence of poverty than country C? Thus, we would like to determine the statistical significance of changes in poverty or income distribution indices: $DIFF = P_1 - P_2$. Hypotheses tests conducted on the test statistic *DIFF* involves comparing the means from two distributions. In the literature, this is known as the *Fisher-Behrens* problem. Notice that within the classical hypothesis testing framework, there is no straightforward solution to this problem.

[1] See e.g., Hancock and Pudney [1996].

In this paper, we will demonstrate the usefulness of bootstrapping techniques for carrying out statistical inference for poverty and inequality measures. We will use data from the Panel Comparability Project (PACO) to analyse poverty and inequality in Hungary, Luxembourg and the United Kingdom. Section 2 of the paper discusses methodological issues related to poverty analysis. In section 3, we stress the need for performing statistical inference for poverty and income inequality measures. In section 4, the bootstrap method is described. Section 5 we performs cross-national comparisons of poverty and inequality using 1992 cross-sectional data. In section 6, the PACO data are used to compare changes in poverty and inequality over time. Finally, section 7 concludes.

2. Poverty analysis and the identification problem

Following Sen [1976], poverty analysis can be broken down into two stages: identifying the poor in the population and summarising this information in a poverty index. The traditional approach to the identification problem involves the use of poverty lines and equivalence scales. Unfortunately, there exists no consensus among researchers as to what constitutes the appropriate poverty line or equivalence scale.

A poverty line is a pre-defined cut-off point for income. Households with income equal to or above the poverty line are non-poor while households with income below the poverty line are poor. Callan and Nolan [1991] present a comprehensive survey of operative poverty lines and outline the advantages and disadvantages of each method.

Following Goedhart et al. [1977], there are four general types of poverty lines: *absolute* poverty lines, *official* poverty lines, *subjective* poverty lines and *relative* poverty lines. Using an absolute poverty line, we identify a group of commodities necessary for the subsistence of the individual. The poverty line is then defined as the minimal amount of money that enables the individual to purchase this commodity bundle. The poverty line may also be defined in relation to a government transfer aimed at income maintenance payment (e.g., an unemployment benefit, a minimum pension benefit). This type of poverty line is called an official poverty line[2]. In the case of a subjective poverty line, individuals are asked directly to identify the minimum level of resources necessary to reach a certain standard of living. The poverty line is then constructed using this information on the expressed preferences

[2] Notice that the use of an official poverty line can give rise to anomalies. Callan and Nolan [(1991), page 250] argue that: “One major conceptual problem is highlighted by the fact that while rising the minimum level of social security payments tends to raise the incomes of the poorest groups in society: it will tend to lead to a rise in measured poverty on this definition. The importance of this problem can be most clearly demonstrated by a *reductio ad absurdum*: the numbers in poverty could be almost eliminated by reducing the minimum level of official income support towards zero”.

of the respondents. Finally, the relativist approach to poverty measurement defines the poverty line as a fraction of the median or mean welfare of society.
For the purposes of this paper, we are using the latter concept i.e., a relative poverty line. Relative poverty lines are widely accepted as a tool of analysis for poverty in developed economies. We have chosen 50 percent of the median income per equivalent adult as the cut-off point. This poverty line is widely used in empirical work [see e.g., Blackburn (1994)]. Following Callan and Nolan [(1991), page 253], "The general rationale [for the use of a relative poverty line] is that those falling more than a certain 'distance' below the average or normal income level in the society are unlikely to be able to participate fully in the life of the community".

The distinction between absolute and relative poverty is particularly relevant from a policy point of view: Are we primarily concerned with the standard of living of those who receive low incomes or are we concerned with the unequal distribution of these incomes? Absolute poverty is eliminated by making everybody better off i.e., by shifting the income distribution upwards. Relative poverty, on the other hand, is eliminated by redistributing income from the rich to the poor.

The second choice pertains to the choice of an equivalence scale. Households are differing according to their socio-demographic characteristics e.g., size, composition by age, number of dependants, place of residence. The needs of the household members are also likely to vary with these characteristics: children and adults have different needs, women have different needs than men and the cost of living is usually higher in urban areas than in rural areas. If we do not take these differences into account, our poverty estimates are likely to be biased.

A simple headcount measure also ignores economies of scale in consumption. This is obvious for commodities like rent or heating but economies of scale may also exist for other commodities like e.g., food or clothing. If economies of scale in consumption exist, the marginal cost of an additional household member is not constant but decreasing. The approach commonly used to take into account differences in needs and economies of scale is to standardise the income data by using an equivalence scale factor.

Following Deaton and Muellbauer [1980], the equivalence scale m_k is defined by:

$$m_k = m\left(P, u, A, A_k\right) = \frac{C\left(P, u, A_k\right)}{C\left(P, u, A_r\right)}$$

where P is a vector of prices, u is the utility level, A_t is a vector of demographic attributes of household t and C is a cost function. Thus, the equivalence scale is the ratio of the costs required to achieve a given utility level for households of differing compositions.

Equivalence scales used in applied work and for policy purposes are extremely varied in how they allow for differences in family composition. There is no

consensus as to what scale should be used and equivalisation is often criticised for of its *ad hoc* nature [see Nelson (1993)]. Following Buhman et al. [(1988), page 119], these differences are summarised by a single parameter: the family -or household- size elasticity of needs. Household incomes are standardised as follows:

$EI = D/S^e$

where *EI* is the equivalent income per household member, *D* is the household disposable income, *S* is the household size and *e* is the elasticity of the scale which varies between 0 and 1. If *e = 0*, there are perfect economies of scale i.e., the cost for a household of two to achieve a given utility level is the same as the cost for a single-person household. If *e = 1*, there are no economies of scale i.e., a household of two needs twice as much income to achieve a given utility level than a single-person household.

The equivalence scale used in this paper is referred to in the literature as the "international experts' scale" [see Burkhauser et al. (1997)] and uses an elasticity scale factor *e = 0.5*.

This approach to poverty measurement is arguably a simplistic one. Pryke [1995] provides a comprehensive critique of the poverty line and equivalence scale approach to poverty analysis. However, we shall adopt Sen's [(1973), page 78] dictum and avoid "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". Notwithstanding, we do believe that it is very important to state these limiting assumptions explicitly and to take them into account when analysing and discussing our results.

3. Statistical inference for poverty and inequality indices

The interest of this paper centres on properties of the distribution of incomes in three countries: Hungary, Luxembourg and the United Kingdom. The respective probability distributions of the populations are unknown but we have obtained cross-sectional samples with observations drawn from these distributions.

Based on the information contained in the samples, our objective is to draw inferences about the properties of the distribution of incomes at the population level. This is a standard problem of statistical analysis. The sample mean and sample standard deviation are used to construct a point estimate and a confidence interval for the unknown population mean i.e., $\hat{m} = \bar{x}$ and $\left[\bar{x} - 1.96\,s\,; \bar{x} + 1.96\,s\right]$ for a 95 percent confidence interval.

This is where the problems with classical statistical inference begin. Classical inference assumes a normal distribution and a simple function of interest (e.g., the population mean μ), so that the form of the confidence interval is known.

However, in the present context, we do not want to assume normality of the distribution. In addition, the functions of interest - poverty and income distribution indices - are non-linear functions of income with the added complication that they are usually bounded. Thus, the form of the confidence interval is unknown.

There are three general types of solutions to this problem. The first solution is simply not to compute sampling variances and confidence intervals, assuming they will be small. However, Maasoumi [(1994), page 14][3] argues:

"[the argument that] in this area we often deal with large samples which do not justify too much concern for precision (sampling variance) … is occasionally contradicted by large standard errors, and it may be turned around in order to justify reporting even more statistical measures of precision and tests. This is because almost all of the useful statistical theory in this area is based on asymptotic approximations which are supposed to do well with large samples."

The second solution is to take advantage of the fact that we are working with large samples and to calculate asymptotic variances and confidence intervals. The asymptotic distribution provides an approximation to the true distribution. Asymptotic theory essentially assumes normality. Bishop et al. [1997], Rongve [1997], Bishop et al. [1995] and Kakwani [1993] have all used asymptotic methods to obtain consistent estimates of the variance-covariance structure of poverty measures in order to carry out statistical inference on the resulting estimates.

However, Mills and Zandvakili [(1997), page 134] point out:

"…the interval estimates available from asymptotic theory may not be accurate and the small sample properties of these intervals are not known. Further, all the decomposable inequality measures used in the literature are bounded (e.g., the Gini coefficient lies in the [0,1] interval], so the application of standard asymptotic results may lead to estimate intervals that extend beyond the theoretical bounds of a particular measure (e.g., a negative lower bound for Gini)".

The third solution to the problem is to carry out distribution-free inference. We have argued that classical inference assumes a normal distribution. As we do not possess any information about the distribution of the population, we would feel at best uneasy if we assumed normality. Distribution-free inference has the advantage that no prior knowledge about the distribution function of the population is required.

One such distribution-free method is bootstrapping and this is the method that we will use in this paper. The bootstrap is a computer-intensive method for estimating the standard error of a parameter. It will be described in greater detail in the next section. Following Sitter [(1992), page 136]: "Bootstrap methods reutilize the existing estimation system repeatedly, using computing power to avoid theoretical

[3] Quoted by Mills and Zandvakili [(1997), page 133].

work". Mills and Zandvakili [1997] are using the bootstrap to carry out statistical inference for inequality measures.

Notice that when comparisons are the major focus of the analysis, we may reach valid conclusions about the direction of change in poverty and inequality by comparing the two distributions directly. Atkinson [1987] and Foster and Shorrocks [1988] have pioneered this approach. They advocate the use of dominance conditions in order to make inferences about changes in poverty over time or across countries.

The basic idea underlying the argument is that there is no widespread agreement as to what is the appropriate level for the poverty line. Thus, the poverty line may vary over a range $[z^-;z^+]$. First-order stochastic-dominance comparisons of income distributions over time or across countries then involves setting multiple poverty lines z in the range $[z^-; z^+]$ in order to determine whether we obtain the same poverty rankings for all the z's.

Examples of this kind of statistical inference are Blackburn [1994] for cross-country comparisons and Zheng et al. [1995] for inter-temporal comparisons. Anderson [1996] extends the theoretical literature in this field by proposing a non-parametric test of stochastic dominance in income distributions.

4. The bootstrap principle

Bootstrapping is based on re-sampling with replacement. Each bootstrap sample is an independent random sample of size n from the empirical distribution $\hat{F}$. The elements of the bootstrap sample are the same than those of the original data set. Some may appear only once in the bootstrap sample, some two or more times while some others may appear zero times. To each bootstrap sample corresponds a bootstrap replication of $\hat{\theta}$:

$$\hat{q}^* = s(x^*)$$

The bootstrap replication is the result of applying the same function $s(.)$ to x^* as was applied to x. Following Efron and Tibshiriani [(1993), page 47] the bootstrap algorithm for estimating the standard error of a parameter is summarised by the following three steps:

Step 1: Select B independent bootstrap samples $x^{*1}, x^{*2},\ldots,x^{*B}$, each consisting of n data values drawn with replacement from x.

Step 2: Evaluate the bootstrap replication corresponding to each bootstrap sample,

$$\hat{q}^*(b) = s\left(x^{*b}\right) \qquad b = 1,2,\ldots,B.$$

Step 3: Estimate the standard error by the sample standard deviation of the B replications,

$$\hat{se}_B = \left\{ \sum_{b=1}^{B} \left[\hat{\theta}^*(b) - \hat{\theta}^*(.) \right]^2 / (B-1) \right\}^{1/2},$$

$$where \quad \hat{\theta}^*(.) = \sum_{b=1}^{B} \hat{\theta}^*(b) / B.$$

It can be shown that the following result holds:

$$\lim_{B \to \infty} \hat{se}_B = se_{\hat{F}} = se_{\hat{F}}(\hat{\theta}^*)$$

i.e., the empirical standard deviation approaches the population standard deviation as the number of bootstrap replications grows large.

How many bootstrap replications are necessary in order to obtain a robust estimate of the standard error? There is a total of $\binom{2n-1}{n}$ distinct bootstrap samples on which the function *s(.)* can be evaluated. When we are dealing with very small samples, we may be able to compute *s(.)* for all the distinct bootstrap samples. Notice however that a sample as small as *n = 10* already yields 92,378 distinct bootstrap samples. For samples of the sizes with which we are working here, the total number of distinct bootstrap samples is very large indeed.

In fact, the real constraint on the number *B* of bootstrap replications is computer time, which increases linearly with *B*. Based on their experience, Efron and Tibshiriani [1993] propose the following set of rules of thumb: even a small number of bootstrap replications *(B = 25)* is usually informative. *B = 50* is often enough to yield a good estimate of $se_F(\hat{q})$. Very rarely are more than *B = 200* replications necessary.

However, much bigger values *(B > 1000)* are required if we want to obtain bootstrap confidence intervals. For the purposes of this paper, we are using *B = 2000*.

Like asymptotic methods, bootstrapping is also an approximate method. However, and unlike asymptotic methods, bootstrapping attempts to obtain small sample results. In practice, bootstrapping seems to work very well i.e., it yields a correct confidence interval. However, theory is in its infancy and the justification for the good performance of the bootstrap is asymptotic.

Notice that independence of observations is a *sine qua non* condition for the bootstrap to be valid. If this condition is violated, difficulties arise. This precludes the use of the simple bootstrap for statistical inference using small samples and

complex survey data. Variants of the bootstrap method may be used in those cases. The Rescaling Method, the Mirror-Match Method and the Without-Replacement Bootstrap (BWO) are discussed by Sitter [1992] who also proposes extensions of the BWO method which makes the method applicable to data obtained through stratified sampling, two-stage cluster sampling and unequal-probability sampling.

Finally, the bootstrap can be used for hypothesis testing. In fact, it turns out to be a rather powerful tool of analysis in that respect. As Mills and Zandvakili [(1997), page 134] point out: “Further, since bootstrap intervals computed using the percentile method have a clear Bayesian interpretation, they provide a straightforward solution to the Behrens-Fisher problem of comparing means from two distributions”.

The bootstrap confidence intervals reported in this paper were computed using the percentile method. As the name suggests, this procedure is based on the percentiles of the histogram of bootstrap replications. A more detailed exposition of the percentile method is provided in appendix A1.

5. A cross-country bootstrapping analysis of poverty and inequality

In this section, we will analyse poverty and income inequality in Hungary, Luxembourg and the United Kingdom in 1992. We will use cross-sectional household files from the Panel Comparability Project (PACO). The PACO is a comparative cross-national and longitudinal data base. It contains harmonised and consistent variables and identical data structures for each country included.

Poverty and income distributions are analysed at the household level. A household is defined to be all persons living under the same roof, sharing income and expenditures. We have chosen two types of households for this study: households with a head who is retired and household with a head who is working.

Poverty is measured in terms of disposable income per equivalent adult household member[4]. Much has been written on the question whether poverty is best comprehended in terms of income or consumption. The arguments in this debate are of a philosophical rather than an economic nature. Is poverty, for instance, the result of inequality in opportunities or inequalities in outcomes? In the former case income is a more appropriate proxy of welfare while in the latter case, consumption should be used.

The criterion which made us chose income rather than consumption to approximate the standard of living of households was a pragmatic one: information on household consumption is not available in the PACO data base.

[4] The particular income concept retained is the PACO variable hxx053 (total gross household income), after suitable standardisation using equivalence scales.

In Tables 1-3, we report bootstrap standard errors and confidence intervals for poverty and inequality indices for Hungary, Luxembourg and the United Kingdom.

Sachs [(1984), page 273] argues that: “A comparison of two parameters is possible in terms of their confidence intervals: (1) If the confidence intervals intersect, it does not necessarily follow that the parameters do not differ significantly. (2) If the confidence intervals do not intersect, there is at the given significance level a genuine difference between the parameters”.

But the bootstrap procedure also allows us to obtain tail probability values for hypothesis tests directly from the bootstrap distribution. In particular, our interest focuses on cross-country and inter-temporal comparisons of poverty and inequality. In Tables 4-6, we provide bootstrap estimates of the standard errors of the observed cross-country differences for the year 1992. We also compute probability values for the hypothesis that the differences in poverty and inequality indices are significantly different from zero.

As we are using a relative poverty line as the low-income cut-off point, income inequality and poverty are intrinsically linked. For instance, in the case of an highly unequal distribution of incomes, outliers at the top end of the income distribution will exert upward pressure on the mean income and henceforth push more people into poverty, relatively speaking. More generally, a generalised improvement in living conditions that is shared equally by all income groups leaves poverty unchanged. Likewise, a general decline in living standards does not lead to additional poverty if the relative income positions remain unaffected. Hence, we will also report inequality of incomes indices in our result tables. The formulas used to compute the poverty and inequality indices are summarised in appendix A2.

Furthermore, poverty indices are very sensitive to the choice of a particular poverty line. In appendix A3, we provide a sensitivity analysis for point estimates for the headcount and FGT poverty indices using a wide range of poverty lines. In the core of the paper, however, we will focus on the results obtained for the 50 percent of median income poverty line.

The results from our cross-country analysis of relative income positions in 1992 reveal a very high incidence of relative poverty among retirees’ households in the UK relative to Hungary and Luxembourg. The 95 percent confidence interval for the headcount index has a lower bound of 37.2 percent and an upper bound of 42.9 percent (Table 3). This is much higher than the corresponding rates for Luxembourg and the transition economy Hungary. In fact, point estimates for Hungary and Luxembourg are very close to 10 percent (Tables 1 and 2). The cross-country differences, of the order of 30 percent, are also obviously statistically significant from zero (Tables 5 and 6).

The high incidence of poverty among pensioners’ households in the UK is confirmed by the FGT index which takes into account not only the number of poor people but also the average shortfall from the poverty line. The size of the parameter estimate

suggests not only that the actual number of poor households is very large but also that their average shortfall from the poverty line is very large.

The comparison between Hungary and Luxembourg also yields interesting results. We have said that the point estimates of the headcount index are very similar (10 percent). In addition, the 95 percent confidence intervals overlap substantially. Yet, a hypothesis test on the difference between the two indices shows that we reject the hypothesis of no difference at the 5 percent level (Table 4).

However, the FGT index for Hungary is much higher than the FGT index for Luxembourg (Tables 1 and 2). The 95 percent confidence intervals do not overlap for these two indices and a hypothesis test shows that we can safely reject the hypothesis of no difference (Table 4). Thus, while incidence rates of poverty, as measured by the headcount index, are similar, poverty among pensioners' households, when it occurs, is much "deeper" in Hungary i.e., the poor are poorer in Hungary.

When we are looking at the distribution of incomes rather than at relative poverty, we see that the UK does not only exhibit a higher incidence of poverty among its pensioners' households but that the distribution of incomes is also much more unequal (Tables 1-3). The 95 percent confidence intervals for the Gini coefficient and the relative mean deviation do not overlap and the hypotheses tests confirm that we can reject the hypothesis of no difference in inequality between the UK and Hungary and Luxembourg (Tables 5 and 6).

For Hungary and Luxembourg, inequality indices are again very close to each other (0.24 for the Gini coefficient and 0.17 for the relative mean deviation, Tables 1 and 2) and confidence intervals overlap substantially. We reject the hypothesis of no difference for the Gini coefficient but do not reject the hypothesis of no difference in the case of the standard mean deviation (Table 4).

Notice that the relative mean deviation of incomes has a straightforward interpretation in economic terms. It represents the income transfer from households above the mean income to households below the mean income necessary to achieve perfect equality of incomes. In Luxembourg and Hungary this transfer amounts to 17 percent of pensioners' incomes while in the UK, this transfer actually amounts to 26 percent.

Rather different conclusions about poverty - yet not about inequality - emerge when we analyse the relative income positions poverty of households headed by a head who is working. Poverty rates, as measured by the headcount index, are very low in all three countries. As in the case of pensioners' households, the United Kingdom exhibits a higher incidence of poverty but the welfare gap between UK households and households in the other two countries is much smaller than for households with a retired head. This offers a very stark contrast to the situation of pensioners' households in the United Kingdom.

When we take into account "depth" of poverty by looking at the FGT index, we see that Luxembourg not only has fewer poor households but that the poor households are significantly better off than those in Hungary and the UK. Interestingly, the comparison between Hungary and the UK shows that the headcount index for Hungary is significantly smaller than the UK headcount index. However, a hypothesis test on the significance of the difference between FGT indices suggests that we cannot reject the hypothesis of no difference (Table 5). This, in turn, suggests that poverty among households with a working head is much more deeply rooted in Hungary than it is in the UK and henceforth much harder to escape.

Direct welfare comparisons between households with a retired and households with a working head show that, in all three countries, households with a retired head are always worse off than households with a working head (appendix A-4). This is not a surprising result as replacement rates for retirement are typically below 100 percent. In 1992 in Luxembourg, the social security replacement rate based on a final salary of $20,000 and $50,000 was 82 percent and 57 percent respectively. The corresponding figures for the United Kingdom were 50 percent and 26 percent[5] [Davis (1997), Table 1-1].

Tullock [(1984), page 121] explains why the retired receive lower incomes: "If we go back to the period before social security and before the significant drive on the part of the government to get retirement ages down, we find that people tended to have declining incomes towards the end of their lives. Those who had some source of income other than work […] eventually reach the point where their preferred that other source of income, together with leisure, to working. Thus, as a general rule, people retired, their income went down, and they chose retirement at a lower income than their final working income because they preferred leisure. Thus, the custom that older people had lower incomes than people in the active phase of their lives became well established. There does not, however, seem to be any other reason for it". Thus, one may be led to wonder whether the observed differences between retired and active households reflect actual differences in their standards of living or whether they simply reflect differences in their respective demands for leisure[6].

Comparisons of income distributions between households with a retired and households with a working head yield no clear-cut results. In Hungary, retirees'

[5] For he United Kingdom, State Earnings Related Pension Scheme (SERPS) only. Comparable data for Hungary is not available.

[6] Retired persons have more leisure at their disposal and a purely monetary welfare proxy does not take into account the value of leisure. However, a one-to-one relationship between income foregone and additional leisure can only be established in the case where retirement is based on a voluntary decision. As the retirement decision typically entails a discontinuous reduction of hours worked to zero -rather than a gradual reduction of hours- it is very difficult to know how much of the additional leisure is voluntary and how much is not.

households exhibit a more equal distribution of incomes than households with a head who is working. The opposite is true in the United Kingdom. In the case of Luxembourg, point estimates also suggest that incomes are distributed more equally among retirees' households than among working households. However, direct hypotheses tests performed on the statistical significance of the difference between point estimates suggest than we cannot unequivocally reject the null hypothesis of no difference (appendix A 4).

From a theoretical perspective, the use of progressive benefit formulas, the existence of minimum and maximum pensions as well as the existence of floors and ceilings on pension contributions would suggest that the distribution of incomes of retirees' households is more compressed and hence more equal than that of households with a working head. The fact that, in the case of the United Kingdom, this is not borne out by the figures warrants some further investigation.

One of the possible explanations is that private or occupational pensions are much more commonplace in the UK than in Hungary or in Luxembourg. The Department of Social Security (DSS)[7] argues that: "As a group, today's pensioners are increasingly benefiting from improvements in funded and occupational pension schemes and the State Earnings Related Pension Scheme during their working lives. And it is largely as a result of this additional 'second tier' provision that the average incomes of the richest pensioners are growing faster than those of the less well-off. For better-off pensioners the Retirement Pension is becoming less important as a source of income. Other pensioners who rely more heavily on social security have not experienced the same rise in living standards". Thus, occupational and private pensions boost the incomes of the recipients and cause a shift in the overall distribution of incomes.

6. Bootstrapping poverty and inequality indices: inter-temporal comparisons

In this section, we will examine changes over time in poverty and inequality against the background of the general macroeconomic climate in Hungary, Luxembourg and the United Kingdom at the time.

In Tables 7-9, we report bootstrap standard errors for changes in poverty and inequality over time results. We also provide p-values for the hypothesis that these changes over time are significantly different from zero.

[7] *Welfare Reform Focus File 06: Pensioners' Incomes*, page 1, Department of Social Security, London, 1998

a. Hungary (1992-1994)

In the early 1990's, Hungary's economy was undergoing fundamental change. The transition to the market was accompanied by four successive years of falling real GDP. Growth resumed in 1994, the last year available in the PACO database.

The outlook for Hungary's pension public system is bleak: pension spending currently exceeds contribution revenues to the pension system by approximately 2 percent of GDP. Increases in the payroll tax for social security are unlikely to generate additional revenues as the tax is very high already - it exceeds 30 percent - and further increases would in all likelihood lead to more tax evasion and displacement of economic activity to the informal sector.

Hungary's demographic dependency ratio was 36 percent in 1995. However, as a result of the low legal retirement age and the soft eligibility criteria for disability pensions, its system dependency ratio was, at 74.8 percent, more than twice that figure. In 1995, the ratio of pensioners to the pension age population was 130 percent[8]. The situation is likely to worsen as demographic ageing sets in after 1998.

Between 1992 and 1993, poverty -measured by the headcount index- among retirees' households fell by nearly 2.5 percent. Poverty was on the rise again between 1993 and 1994 but remained significantly lower in 1994 than it was in 1992 (Tables 1 and 7). While this data hints at an improvement in the living conditions of the retired between 1992 and 1994, this trend is not confirmed by the FGT index: the initial large fall between 1992 and 1993 is fully offset by the increase between 1993 and 1994. A hypothesis test performed on the difference between the 1992 and 1994 estimates shows that we cannot reject the hypothesis of no difference. Roughly speaking, this suggests that the same "amount" of total poverty is now shared between fewer people i.e., that the poor have become poorer. During the same period, headcount and FGT indices for households headed by a working head increase without interruption.

Thus, despite the resumption of economic growth in 1994, it appears that poverty among retired and economically active households has increased between 1992 and 1994. Furthermore, we find evidence that suggests that during this period, the poor have become poorer. This, in turn, suggests not only that poverty spells lengthen but it also suggests that the social security system fails its function as a safety net[9].

[8] Data taken from Rocha and Palacios [1996].

[9] See also OECD (1995), page 191.

Changes over time in income inequality are similar for households headed by retired and working heads. Income inequality is reduced between 1992 and 1993[10]. It increases between 1993 and 1994. Over the whole period 1992-1994, income inequality increases significantly (Tables 1 and 7).

The widening income inequalities among households headed by working heads and the ensuing increase in poverty are most likely to be the result of transition-induced increases in the returns to job skills and education. Trends in pensioners' poverty and inequality, however, are more difficult to account for.

It is important to distinguish between pension rights already accrued and the pensions of new entrants into retirement. With respect to accrued pension rights, Hancock and Pudney [(1996), page 16] argue that: "Provisions for the inflation-linked increases of pensions once in payment are essentially *ad hoc* and have often been highly complex". Furthermore, they maintain (pages 17-18) that: "Rates of pension increase have always favoured low pensions […]. The result is a bunching of pensions in payment towards the legal minimum […]". Thus, the indexation mechanism for public pensions leads to a compression of the distribution of pensions already in payment. The income distribution for those already pensioned becomes more equal while overall poverty probably increases or, at the very least, does not decrease.

At the same time, the indexation mechanism is also used to erode the value of new pensions. Following Rocha and Palacios [(1996), pages 11-12], the indexation parameters were manipulated in order to achieve a reduction in the average replacement ratio: "First, the lack of full actualization of past contributions in the benefit formula resulted in an erosion of real entry pensions. Second, wage brackets in the redistributive benefit formula were not fully adjusted for wage growth, leading to a 'reverse bracket creeping' effect. These two factors resulted in a sharp drop of entry level pensions, both in real terms and in relation to the average wage in the economy".

Thus, in an effort to control the spiralling costs of its public pension system, the Hungarian government has relied extensively on the indexation mechanism to reduce the real value of pension benefits. However, such cost-cutting efforts are non-transparent, highly inequitable and counteract the fundamental goal of public pensions, which is to provide income insurance in old-age.

b. Luxembourg (1990-1992)

In the 1980's, Luxembourg experienced a decade of strong, uninterrupted growth. Over the period 1983-1988, GDP growth averaged 4.5 percent per annum[11]. This growth somewhat slackened in the early 1990's but GDP growth rates remained

[10] In the case of households headed by a working head, the difference between the 1992 and 1993 Gini coefficients is statistically significant only at the 10 percent level.

[11] See OECD (1991).

above 2 percent per annum during 1990-1992. Overall, the macroeconomic performance remained very impressive considering the economic problems affecting Luxembourg's neighbouring countries in the early 1990's.

Luxembourg's welfare system is inspired by German law and it is largely based on the principle of solidarity between socio-economic groups and workers and the retired. The pensions system is extremely generous but nonetheless affordable, at least in the short to medium run.

However, Luxembourg's population is growing older over the next decades and economic prosperity increasingly triggers demands for earlier retirement. In spite of the favourable economic climate current levels of contribution rates in the public pension employees scheme will not be sufficient in the long run to cover the rising expenditures due to ageing and early retirement.

The headcount measure of poverty among households headed by a retired head increases between 1990 and 1991 and then again between 1991 and 1992. Both increases are statistically significant (Tables 2 and 8). The reduction of the FGT index between 1990 and 1991 appears remarkable against the backdrop of the observed increase in the headcount index. It suggests that the poverty gap has been reduced significantly and that the poor have been made better off. A possible explanation for this puzzle may lie in the hybrid pension indexation mechanism.

Pensions are indexed for price inflation by a variable-lag system: whenever prices increase by at least 2.5 percent, pension benefits - and wages - increase by an equal amount. There is also a semi-automatic mechanism in place which indexes pension benefits to real wage growth. In practice, pensions are adjusted every two years to take into account the effect of increasing real wages.

In such a system of price and wage indexation, periods of economic growth will generally be accompanied by an increase in the number of retirees' households receiving incomes below the poverty line as the poverty line increases faster than pension benefits. This effect is partially offset in years when pension benefits are adjusted for past real wage growth and at the same time, the wage indexation will contribute towards closing the poverty gap.

In January 1991, all pensions were increased by 5.07 percent[12] in order to compensate pensioners for real wage growth taking place during 1986-1989. We believe that this adjustment in pension benefits goes some way towards explaining the puzzle that we have encountered above.

Notice that the Gini coefficient and the relative mean deviation of incomes for households headed by retired heads are falling between 1990 and 1991 and again

[12] See IGSS (1996), page 48.

between 1991 and 1992, an indication that the distribution of retirees' incomes has become more equal.

The headcount and FGT poverty indices for households headed by working heads are increasing between 1990 and 1991 and then falling again between 1991 and 1992. All changes are statistically significant and poverty is also significantly higher in 1992 than it was in 1990 (Tables 2 and 8). However, poverty rates are typically very low and small increases in poverty at these very low levels of poverty are not a major concern.

The inequality of incomes indices for active households increase between 1990 and 1991 but decrease between 1991 and 1992. A hypothesis test performed on the difference between the 1990 and 1992 inequality indices shows that we cannot reject the null hypothesis of no difference (Table 8).

Overall, the conclusion with respect to changes in poverty and inequality in Luxembourg between 1990 and 1992 is that the *status quo* largely prevailed. Our estimates suggest that poverty has been increasing over time. However, poverty levels are still very low and there are signs that the distribution of incomes is becoming more equal.

c. United Kingdom (1991-1993)

In the early 1990's, the UK economy experienced the longest recession in post-war history. Starting with the second quarter of 1990, GDP contracted for eight successive quarters. GDP at market prices fell by 2.2 percent in 1991 and by 0.6 percent in 1992. It grew by 1.9 percent in 1993[13].

There are major differences between the pension system in the UK and those in Hungary and Luxembourg. Private pension funding, which has been developed as a complement to public old-age pension schemes, assumes a much more significant part in old-age income insurance in the UK than in the other two countries. In the United Kingdom, 75 percent of the labour force are covered by a private pension plan while in Luxembourg, the corresponding figure is 30 percent. In 1994, pension fund assets represented 68 percent of GDP in he UK but only 3 percent in Luxembourg[14]. In Hungary, private pensions are still very much in their infancy, mainly because of the absence of a clear regulatory framework[15].

[13] See OECD (1994), page 13.

[14] See Davis [(1997), page 36].

[15] See also World Bank (1995): "The first concrete step towards a third-pillar scheme was taken in November 1993 with the passage of the *Act on the Voluntary Mutual Benefit Funds*. The intention was to provide a true third pillar, that is, a regulated vehicle for optional retirement savings, for an additional contribution cost of course, beyond the mandatory national PAYG scheme".

The long term prospects for the public pension scheme in the UK are also much more favourable. The UK's implicit pension debt, defined as the present value of the pension rights that have already been earned by workers and pensioners in the system, is estimated to amount to 68 percent of 1990 GDP. Luxembourg's implicit pension debt is estimated at 156 percent of 1990 GDP[16]. Finally, the World Bank [(1995), page 36] estimates an implicit pension debt for Hungary amounting to 263 percent of 1994 GDP.

However, it is largely acknowledged that the UK's relatively low implicit pension debt owes much to a system of indexation which updates benefits in line with inflation rather than with prices. Indexation of benefits to prices rather than to wages does not allow pensioners to share in productivity growth that occurs after they have retired. Pension benefits fall relative to earnings and pensioners are made wore off in the long run.

The headcount and FGT poverty indices for households with a retired head decrease between 1991 and 1992 and then increase again between 1992 and 1993. The latter change is not statistically significant for the headcount index but it is significant for the FGT index (Tables 3 and 9). The results suggest that fewer pensioners are poor in 1993 compared to 1991 but that the poor have become even less well-off.

The drop in relative poverty between 1991 and 1992 is of particular interest to us. We have seen previously that the UK economy was in recession in 1991 and 1992. We have also seen that since 1980, the state pension is indexed to prices. Many observers argue that the policy of indexation to prices has led to a substantial increase in relative poverty among the retired since 1980. It is therefore worthwhile noticing that, when benefits are indexed to prices, relative poverty can be decreased if real incomes are falling. In fact, when real incomes are falling, inflation - and therefore pensions - are rising faster than the poverty line, thus pulling some people out of poverty who receive incomes that are indexed to prices.

The headcount poverty index for households headed by a working head remains stable between 1991 and 1993. An initial small decrease in poverty is completely offset by an increase in the following period. We do not reject the hypothesis of no difference between the 1991 and the 1993 headcount indices. The FGT index, however, increases significantly between 1991 and 1993 (Tables 3 and 9). Again, this suggests that the poor have become poorer as a larger poverty gap is shared by the same amount of poor people.

While poverty among retirees' households has decreased according to one index and increased according to another, there is a clear trend in retirees' income

[16] See Davis [(1997), Table 4.5].

inequality: it has increased substantially. We also observe that all the changes are significantly different from zero, at least at the 5 percent level (Table 9).

This contrasts with the experience of households headed by a working head for whom we observe a large reduction in income inequality between 1991 and 1992, followed by a small increase in inequalities between 1992 and 1993. The hypotheses tests confirm that inequality has gone down significantly between 1991 and 1993 (Tables 3 and 9).

7. Conclusions and policy implications

Panel Comparability Project (PACO) data is used in a comparative analysis of the relative income positions of retired persons' households in Hungary, Luxembourg and the United Kingdom. We compute bootstrap standard errors and confidence intervals for poverty and inequality measures. We also perform bootstrap hypothesis tests in order to establish the statistical significance of the observed cross-country and inter-temporal differences in poverty and inequality.

In a first application, we examine poverty and inequality in 1992 in Hungary, Luxembourg and the United Kingdom. The results indicate that the welfare state in the UK fails to provide adequate protection against poverty in old-age. Over 40 percent of households headed by a retired head receive incomes below the poverty line. This offers a stark contrast to the experience of Hungary and Luxembourg, where approximately one in ten households headed by a retired person lives in poverty.

While poverty is relatively shallow in Luxembourg - the average shortfall from the poverty line is small - poverty is much more deeply rooted in Hungary and the United Kingdom. This is an important consideration as it makes it much harder to escape from poverty and poverty spells are therefore much longer.

Poverty rates are reduced dramatically for households headed by a working person. They are typically below 5 percent and the results suggest that the best way to escape from poverty is through an active involvement in the labour market. However, this result is of little benefit to the retired whose active involvement in the labour market has, by definition, ceased. The retired as a group are disproportionately exposed to the risk of poverty.

In our second application, we carry out dynamic comparisons of poverty and inequality in Hungary, Luxembourg and the United Kingdom.

Three successive years of GDP growth between 1990 and 1992 have left relative income positions in Luxembourg more or less undisturbed. Albeit slightly on the rise, poverty still remains very low and income inequality, if anything, is reduced.

Both the United Kingdom and Hungary emerged from recessions in 1993 and 1994 respectively. The recession in Hungary was much longer and deeper than that in the United Kingdom. It is important to bear in mind that the fact that relative poverty in Hungary is considerably lower than in the UK is a legacy from the pre-transition era when incomes were distributed much more equally. There is still a considerable gap in per capita incomes between the two countries and the observed differences in relative poverty rates can in no way be related to differences in absolute standards of living.

In Hungary and the UK, the proportion of pensioners' households living in poverty decreases over time. However, the data also indicates that the average shortfall from the poverty line increases i.e., that the poor households become poorer.

We also find evidence that the distribution of pensioners' incomes becomes more unequal over time in Hungary and the UK. In Hungary, this increase in inequality may be related to the unequal treatment of "old" and "new" pensioners. In the UK, high and rising levels of income inequality among pensioners' households can be attributed to the unequal treatment of pensioners relying exclusively on the state pension scheme and those receiving supplements through participation in occupational and private pension schemes.

Most proposals for reforms to the existing PAYG pensions systems recommend to separate the redistribution function of pensions from their income insurance function [e.g., World Bank (1994)] through the introduction of a multi-tiered system. Such a shift will have to be operated with great care. As the UK example suggests, the separation of the redistribution and insurance function in a multi-tiered system may lead to a polarisation of relative income positions and this, in turn, is likely to erode public support for such a system.

We have also repeatedly referred to the indexation mechanism of pensions in relation to changes in relative income positions among the retired. We have argued that indexation of pension benefits to prices is counter-cyclical: relative poverty among pensioners tends to fall during recessions. However, during periods of economic growth, pensioners are not allowed to share in the benefits of growth. As the Hungarian case illustrates, the lack of a clear policy on pensions indexation and the use of the indexation mechanism as a cost-reducing device also leads to the differential treatment of people in similar circumstances and is therefore highly inequitable.

Appendix A1: Confidence intervals based on the bootstrap percentiles

In this appendix, we briefly describe how confidence intervals based on the bootstrap percentiles are computed. The appendix is drawing on Efron and Tibshiriani [(1993), chapter 13].

Consider $\hat{\theta}$, an estimate of the parameter q and $\hat{se}$ is the estimated standard error. The standard normal confidence interval is given by:

$$\left[\hat{\theta} - z^{(1-\alpha)}\hat{se}; \hat{\theta} - z^{(\alpha)}\hat{se}\right]$$

If $\hat{\theta}^*$ is a random variable drawn from a normal distribution, the endpoints of the confidence interval can also be described as follows:

$\hat{\theta}_{lower} = \hat{\theta}^{*(a)}$ = *100 a^{th} percentile of* $\hat{\theta}^*$*'s distribution*
$\hat{\theta}_{upper} = \hat{\theta}^{*(1-a)}$ = *100 (1-a)th percentile of* $\hat{\theta}^*$*'s distribution*

Assume that the bootstrap data set x^* is generated according to $\hat{F} \rightarrow x^*$ and that the bootstrap replications $\hat{\theta}^* = s(x^*)$ are computed. Let $\hat{G}$ be the cumulative distribution function of $\hat{\theta}^*$. The *(1-2a)* percentile interval is defined by the *a* and *1-a* percentiles of $\hat{G}$:

$$\left[\hat{\theta}_{\%lo}; \hat{\theta}_{\%up}\right] = \left[\hat{G}^{-1}(\alpha); \hat{G}^{-1}(1-\alpha)\right]$$

By definition, $\hat{G}^{-1}(\alpha) = \hat{\theta}^{*(\alpha)}$, the *100 a^{th}* percentile of the bootstrap distribution. Thus:

$$\left[\hat{\theta}_{\%lo}; \hat{\theta}_{\%up}\right] = \left[\hat{\theta}^{*(\alpha)}; \hat{\theta}^{*(1-\alpha)}\right]$$

This confidence interval refers to the ideal bootstrap situation i.e., *B* = ¥. The approximate *(1-2a)* percentile confidence interval is:

$$\left[\hat{\theta}_{\%lo}; \hat{\theta}_{\%up}\right] \approx \left[\hat{\theta}_B^{*(\alpha)}; \hat{\theta}_B^{*(1-\alpha)}\right]$$

The central limit theorem tells us that as *B* ® ¥, the bootstrap histogram will become normally shaped.

Appendix A2: Poverty and inequality indices

The poverty and inequality indices used in this paper are widely used in the literature. In this appendix, we just present the formulas that we have used to compute them.

a. Poverty indices

The *headcount index* simply gives the proportion of poor people in the total population. It is defined as follows:

$$HC = \frac{p}{n}$$

where *p* is the number of poor and *n* is the number of persons in the population.

The headcount index lies between 0 and 1. It is equal to 0 if every household has income greater than the poverty line. It is equal to 1 if all households have incomes below the poverty line.

The index proposed by *Foster, Greer and Thorbecke* [1984] takes into account the number of poor people in the total population as well as their average shortfall from the poverty line. The Foster-Greer-Thorbecke *(FGT)* index is defined as follows:

$$FGT = \frac{1}{n}\sum_{i=1}^{p}\left(\frac{z - y_i}{z}\right)^e$$

where z is the poverty line, y_i is the income of poor household i and e is a poverty aversion parameter. In our calculations, we use the value $e = 2$ suggested by Foster et al. [1984]. As the FGT index is typically a small number, we have multiplied our estimates by 10.

b. Inequality measures

The *Gini coefficient* is based on the Lorenz curve of income distribution. It can be interpreted as the expected income gap between two individuals randomly selected from the population:

$$Gini = \frac{2}{n^2 \bar{y}}\sum_{i=1}^{n} i\left(y_i - \bar{y}\right)$$

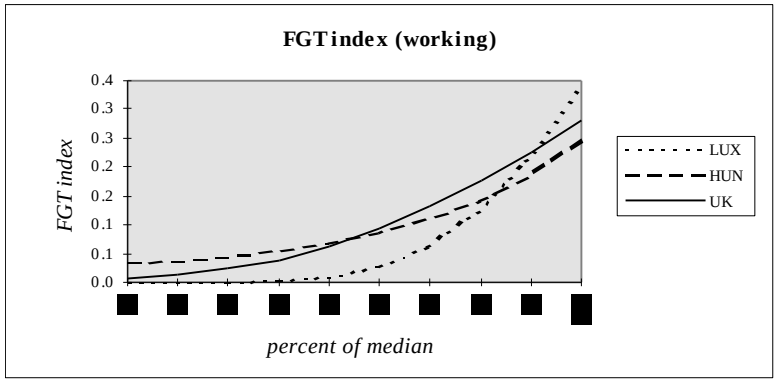
where n is the population size and $\bar{y}$ is the mean income. The incomes y_i are ordered in ascending order. The index varies between 0 (perfect equality) and 1 (perfect inequality).

The *relative mean deviation of incomes* is defined as follows:

$$RMD = \frac{\sum_{i=1}^{n} |y_i - \bar{y}|}{2n\bar{y}}$$

A higher value of the index implies greater inequality. The index can be interpreted as the average percentage income transfer from those above the mean to those below the mean necessary to achieve perfect equality.

Appendix A3: Sensitivity of the headcount poverty index to changes in the poverty line (1992, point estimates only)



Appendix A4: Bootstrap hypotheses tests for poverty and income distribution measures, within-cour households with a retired and households with a working head (1992)

		HUNGARY	LUXEMBOURG	UNITED KINGDO
Headcount index	*DIFF*	-0.069	-0.078	-0.35
	Standard	0.006	0.007	0.01
	deviation	0.000	0.000	0.00
	p-value			
FGT index	*DIFF*	-0.055	-0.021	-0.36
	Standard	0.009	0.005	0.02
	deviation	0.000	0.000	0.00
	p-value			
Gini coefficient	*DIFF*	0.021	0.002	-0.04
	Standard	0.002	0.001	0.00
	deviation	0.000	0.020	0.00
	p-value			
Relative mean deviation	*DIFF*	0.013	0.001	-0.04
	Standard	0.001	0.001	0.00
	deviation	0.000	0.255	0.00
	p-value			

NOTE: if *DIFF<0*, poverty/inequality are higher among households with a retired head than among househ

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Table 1: Bootstrap standard errors and confidence intervals for poverty and inequality indices, Hungary 1992-1994

	RETIRED			WORKING		
	1992	**1993**	**1994**	**1992**	**1993**	**1994**
Headcount index	0.097	0.075	0.085	0.028	0.040	0.046
Standard deviation	0.011	0.010	0.013	0.006	0.007	0.008
95% $_{lower}$	0.076	0.056	0.064	0.018	0.026	0.031
95% $_{upper}$	0.120	0.095	0.105	0.039	0.053	0.062
FGT index	0.124	0.072	0.122	0.069	0.079	0.092
Standard deviation	0.032	0.021	0.032	0.023	0.026	0.027
95% $_{lower}$	0.067	0.035	0.066	0.029	0.034	0.043
95% $_{upper}$	0.191	0.119	0.191	0.119	0.137	0.150
Gini coefficient	0.244	0.236	0.267	0.265	0.264	0.274
Standard deviation	0.008	0.008	0.011	0.010	0.010	0.009
95% $_{lower}$	0.228	0.220	0.245	0.246	0.245	0.257
95% $_{upper}$	0.260	0.251	0.289	0.285	0.284	0.292
Rel. mean dev.	0.172	0.164	0.187	0.184	0.183	0.193
Standard deviation	0.006	0.006	0.008	0.007	0.007	0.006
95% $_{lower}$	0.159	0.152	0.173	0.172	0.169	0.181
95% $_{upper}$	0.184	0.177	0.202	0.198	0.197	0.206

Table 2: Bootstrap standard errors and confidence intervals for poverty and inequality indices, Luxembourg 1990-1992

	RETIRED			WORKING		
	1990	**1991**	**1992**	**1990**	**1991**	**1992**
Headcount index	0.089	0.092	0.099	0.015	0.025	0.021
Standard deviation	0.012	0.012	0.011	0.004	0.005	0.004
95% $_{lower}$	0.066	0.071	0.078	0.008	0.016	0.013
95% $_{upper}$	0.111	0.117	0.123	0.022	0.035	0.029
FGT index	0.035	0.027	0.032	0.002	0.015	0.011
Standard deviation	0.009	0.007	0.009	0.001	0.005	0.004
95% $_{lower}$	0.019	0.015	0.016	0.000	0.007	0.004
95% $_{upper}$	0.054	0.041	0.052	0.004	0.025	0.019
Gini coefficient	0.256	0.252	0.243	0.244	0.247	0.245
Standard deviation	0.010	0.011	0.008	0.009	0.007	0.007
95% $_{lower}$	0.237	0.232	0.227	0.228	0.233	0.232
95% $_{upper}$	0.276	0.275	0.259	0.264	0.263	0.259
Rel. mean dev.	0.181	0.180	0.172	0.171	0.174	0.173
Standard deviation	0.007	0.008	0.006	0.006	0.005	0.005
95% $_{lower}$	0.168	0.166	0.161	0.160	0.165	0.164
95% $_{upper}$	0.196	0.196	0.183	0.185	0.185	0.182

Table 3: Bootstrap standard errors and confidence intervals for poverty and inequality indices, United Kingdom 1991-1993

	RETIRED			WORKING		
	1991	**1992**	**1993**	**1991**	**1992**	**1993**
Headcount index	0.413	0.400	0.401	0.047	0.045	0.048
Standard deviation	0.014	0.014	0.015	0.004	0.004	0.004
95% $_{lower}$	0.385	0.372	0.371	0.039	0.037	0.039
95% $_{upper}$	0.441	0.429	0.429	0.055	0.053	0.056
FGT index	0.446	0.429	0.477	0.071	0.062	0.095
Standard deviation	0.035	0.036	0.040	0.010	0.010	0.014
95% $_{lower}$	0.378	0.361	0.401	0.051	0.043	0.069
95% $_{upper}$	0.517	0.503	0.560	0.092	0.082	0.122
Gini coefficient	0.324	0.356	0.359	0.317	0.307	0.311
Standard deviation	0.008	0.012	0.011	0.005	0.005	0.005
95% $_{lower}$	0.309	0.335	0.338	0.307	0.298	0.302
95% $_{upper}$	0.340	0.380	0.380	0.328	0.317	0.321
Rel. mean dev.	0.236	0.260	0.258	0.223	0.217	0.220
Standard deviation	0.006	0.009	0.008	0.004	0.003	0.004
95% $_{lower}$	0.224	0.244	0.243	0.216	0.211	0.213
95% $_{upper}$	0.247	0.278	0.274	0.231	0.224	0.227

Table 4: Bootstrap hypotheses tests, Luxembourg and Hungary, 1992

		RETIRED	WORKING
Headcount index	*DIFF*	0.002	-0.007
	standard deviation	0.001	0.001
	p-value	0.010	0.000
FGT index	*DIFF*	-0.092	-0.058
	standard deviation	0.023	0.019
	p-value	0.000	0.000
Gini coefficient	*DIFF*	-0.001	-0.020
	standard deviation	0.000	0.003
	p-value	0.012	0.000
Rel. mean deviation	*DIFF*	0.001	-0.012
	standard deviation	0.001	0.002
	p-value	0.188	0.000

NOTE: if *DIFF<0*, poverty/inequality are higher in Hungary than in Luxembourg

Table 5: Bootstrap hypotheses tests, Hungary and the United Kingdom, 1992

		RETIRED	WORKING
Headcount index	*DIFF*	-0.304	-0.017
	standard deviation	0.006	0.002
	p-value	0.000	0.000
FGT index	*DIFF*	-0.306	0.007
	standard deviation	0.005	0.013
	p-value	0.000	0.295
Gini coefficient	*DIFF*	-0.112	-0.042
	standard deviation	0.004	0.005
	p-value	0.000	0.000
Rel. mean deviation	*DIFF*	-0.088	-0.033
	standard deviation	0.003	0.003
	p-value	0.000	0.000

NOTE: if *DIFF<0*, poverty/inequality are higher in the United Kingdom than in Hungary

Table 6: Bootstrap hypotheses tests, Luxembourg and the United Kingdom, 1992

		RETIRED	WORKING
Headcount index	*DIFF*	-0.301	-0.024
	standard deviation	0.003	0.000
	p-value	0.000	0.000
FGT index	*DIFF*	-0.398	-0.051
	standard deviation	0.027	0.006
	p-value	0.000	0.000
Gini coefficient	*DIFF*	-0.113	-0.062
	standard deviation	0.004	0.002
	p-value	0.000	0.000
Rel. mean deviation	*DIFF*	-0.087	-0.045
	standard deviation	0.003	0.001
	p-value	0.000	0.000

NOTE: if *DIFF<0*, poverty/inequality are higher in the United Kingdom than in Luxembourg

Table 7: Bootstrap hypotheses tests for poverty and income distribution measures, inter-temporal co 1992

		RETIRED			WORKING	
		1990-1991	1991-1992	1990-1992	1990-1991	1991-199
Headcount index	DIFF	0.003	0.007	0.010	0.010	-0.00
	Standard deviation	0.001	0.001	0.001	0.001	0.00
	p-value	0.000	0.000	0.000	0.000	0.00
FGT index	DIFF	-0.008	0.005	-0.003	0.013	-0.00
	Standard deviation	0.003	0.003	0.000	0.004	0.00
	p-value	0.000	0.010	0.000	0.000	0.00
Gini coefficient	DIFF	-0.003	-0.010	-0.013	0.003	-0.00
	Standard deviation	0.001	0.003	0.002	0.002	0.00
	p-value	0.020	0.000	0.000	0.095	0.00
Relative mean deviation	DIFF	-0.002	-0.007	-0.009	0.003	-0.00
	Standard deviation	0.001	0.002	0.002	0.002	0.00
	p-value	0.026	0.000	0.000	0.036	0.00

NOTE: if *DIFF<0*, poverty/inequality is decreasing over time

Table 8: Bootstrap hypotheses tests for poverty and income distribution measures, inter-temporal co 1991-1993

		RETIRED			WORKING	
		1991-1992	**1992-1993**	**1991-1993**	**1991-1992**	**1992-199**
Headcount index	*DIFF*	-0.013	0.000	-0.012	-0.003	0.00
	Standard deviation	0.001	0.001	0.001	0.000	0.00
	p-value	0.000	0.293	0.000	0.000	0.00
FGT index	*DIFF*	0.016	0.048	0.031	-0.009	0.03
	Standard deviation	0.002	0.004	0.005	0.001	0.00
	p-value	0.000	0.000	0.000	0.000	0.00
Gini coefficient	*DIFF*	0.032	0.003	0.034	-0.010	0.00
	Standard deviation	0.004	0.001	0.003	0.000	0.00
	p-value	0.000	0.039	0.000	0.000	0.00
Relative mean deviation	*DIFF*	0.024	-0.001	0.023	-0.006	0.00
	Standard deviation	0.003	0.001	0.002	0.000	0.00
	p-value	0.000	0.000	0.000	0.000	0.00

NOTE: if *DIFF<0*, poverty/inequality is decreasing over time

Table 9: Bootstrap hypotheses tests for poverty and income distribution measures, inter-temporal co

		RETIRED			WORKING	
		1992-1993	**1993-1994**	**1992-1994**	**1992-1993**	**1993-199**
Headcount index	DIFF	-0.022	0.010	-0.011	0.012	0.00
	Standard deviation	0.001	0.001	0.001	0.001	0.00
	p-value	0.000	0.000	0.000	0.000	0.00
FGT index	DIFF	-0.052	0.051	-0.001	0.010	0.01
	Standard deviation	0.010	0.011	0.001	0.003	0.00
	p-value	0.000	0.000	0.161	0.001	0.00
Gini coefficient	DIFF	-0.008	0.031	0.023	-0.002	0.01
	Standard deviation	0.000	0.003	0.003	0.001	0.00
	p-value	0.000	0.000	0.000	0.009	0.00
Relative mean deviation	DIFF	-0.007	0.022	0.015	-0.002	0.01
	Standard deviation	0.000	0.002	0.001	0.000	0.00
	p-value	0.000	0.000	0.000	0.003	0.00

NOTE: if *DIFF<0*, poverty/inequality is decreasing over time