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TIPs FOR POVERTY ANALYSIS. THE CASE OF SPAIN, 1980-81 TO 1990-91

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Abstract

In this paper, we apply the methodology developed by Jenkins and Lambert (1996) to the study of the evolution of poverty in Spain during the 1980's. The main advantage of this approach lies in the fact that it provides poverty orderings consitent with a wide subset of generalized poverty gap poverty indices, while allowing different poverty lines for each of the distributions being compared. Our contribution focuses on two aspects. (i) We estimate poverty trends for homogeneous subgroups of households of the same size. For the heterogeneous population as a whole, we study the robustness of our results to the choice of the equivalence scale. (ii) We extend to our procedures of statistical inference which are already used in the inequality literature. The main conclusion is the unambrigous fall in poverty levels, both in the population as a whole as well as in all subgroups in the partition by household size.

Key Words
Poverty dominance; Equivalence scales; Statistical inference.

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TIPs for Poverty Analysis.
The case of Spain, 1980-81 to 1990-91*.

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ABSTRACT

In this paper, we apply the methodology developed by Jenkins and Lambert (1996) to the study of the evolution of poverty in Spain during the 1980's. The main advantage of this approach lies in the fact that it provides poverty orderings consistent with a wide subset of generalized poverty gap poverty indices, while allowing different poverty lines for each of the distributions being compared. Our contribution focuses on two aspects. (i) We estimate poverty trends for homogeneous subgroups of households of the same size. For the heterogeneous population as a whole, we study the robustness of our results to the choice of the equivalence scale. (ii) We extend to our case procedures of statistical inference which are already used in the inequality literature. The main conclusion is the unambigous fall in poverty levels, both in the population as a whole as well as in all subgroups in the partition by household size.

RESUMEN

En este trabajo utilizamos la metodología desarrollada por Jenkins y Lambert (1996) para analizar la evolución de la pobreza en España durante la década de los 80. La principal ventaja de este enfoque es que proporciona órdenes de pobreza consistentes con un amplio subconjunto de índices de pobreza del gap de pobreza generalizado, a la vez que permite la utilización de líneas de pobreza diferentes en cada una de las distribuciones que se pretenden comparar. Nuestra contribución se centra en dos aspectos. (i) Estimamos los niveles de pobreza en subgrupos homogéneos constituidos por hogares con el mismo tamaño. En el caso de la población total estudiamos la robustez de los resultados ante diferentes escalas de equivalencia. (ii) Extendemos a esta metodología los procedimientos de inferencia estadística ya existentes en la literatura de desigualdad. La principal conclusión es el descenso unánime en los niveles de pobreza tanto en el conjunto de la población como en todos los subgrupos de la partición por tamaño del hogar.

INTRODUCTION

Sen (1976)'s seminal article on poverty measurement distinguished between the identification problem concerned with setting the poverty standard, and the aggregation problem of constructing a suitable overall index of poverty. Following Sen's influential recommendation that poverty measures should incorporate Intensity and Inequality considerations as well as Incidence ones, a host of indices with these characteristics have been proposed (See Foster (1984) for a review of the early literature).

Notice that there are two different sources of ambiguity. Given a poverty line, any evidence that points to, say, distribution **y** having less poverty than distribution **x** according to index P would have little significance if the ranking is reversed for index P'. Or, given a poverty measure, the inconclusiveness may arise if we obtain different rankings for different poverty lines. Consequently, a careful applied paper in this area may consist of poverty comparisons according to several interesting poverty measures and alternative poverty lines. This is indeed the case of some recent work in Spain, using the Encuestas de Presupuestos Familiares (EPF for short) of 1973-74, 1980-81 and 1990-91. (See Ruiz-Huerta and Martínez (1994) and INE (1996)).

However, recent theoretical results open up a more definite way of approaching the double source of ambiguity just described. These results seek to characterize situations in which income distributions may be unambigously ranked while nonetheless taking into account a potential diversity of judgements about the form of the aggregate poverty index and the appropiate choice of the poverty line in the distibutions to be compared. In this paper, we apply this novel approach to the study of poverty trends in Spain during the 80's using the two latest EPF's.

We use a graphical device -the "Three I's of Poverty" (TIP) curve- due to Jenkins and Lambert (1996), or JL for short. TIP curves play a very important dual role in poverty analysis. On the one hand, they receive their name because of their ability to succintly and simultaneously portray the Incidence, Intensity, and Inequality dimensions of aggregate poverty which constitute the core of poverty analysis since Sen (1976). On the other hand, orderings of distributions by non-intersecting TIP curves correspond to unanimous poverty orderings according to a wide class of poverty indices which contain most of the measures actually used in applied work.

JL methods apply to the case in which two income distributions are being compared for all common poverty lines at or below the poverty line used to define the poverty gaps. The major novelty, however, comes when poverty lines are allowed to differ, a situation which presents itself in many practical applications in international and intertemporal comparisons. In our context, two poverty lines are defined relative to the 1980-81 and 1990-91 standards of living in Spain. An appropiate TIP test allows us to conclude that poverty has decreased according to, not only a handful, but all members of a rich class of admissible poverty measures. Furthermore, JL methods allow us to answer the following question: by how much can we reduce the 1980-81 poverty line, mantaining constant the corresponding to 1990-91, while preserving the unambigous poverty dominance conclusion?

As far as our own contribution in this paper, we extend JL empirical analysis for the UK in two directions.

1. In every empirical application, one must confront the heterogeneity of the population which precludes direct income comparisons for households with different non-income characteristics. We study the robustness of poverty comparisons to changes in the equivalence scale, using the model originally suggested by Buhmann et al (1988) and Coulter et al (1992a, b), in which the only household characteristic entering the scales is household size. First, we investigate the robustness of our conclusions for the population as a whole to changes in the parameter which captures the generosity of the scale. Second, we study separately poverty trends during this period for each subgroup in the basic partition by household size. This is potentially important because it is well known that both the measurement of aggregate poverty and the composition of the poor are very sensitive to the scale used [(1)].

2. JL only provide numerical comparisons of TIP curves, but it has been known for some time that such comparisons might be affected by sampling variability. To account for that, we construct confidence intervals for the TIP curves in order to follow proper statistical inference procedures to test for equality, noncomparability or dominance in pair-wise TIP comparisons. For that purpose, we show that existing results in the context of Generalized Lorenz curves are readily applicable to our case.

The plan of the paper is as follows. Section I presents the TIP curve concept and the theoretical results which make it possible to associate the dominance relationships between these curves with the indices belonging to the class of GPG indices. In Section II we use the approximations in large samples of the ordinates of the TIP curves to develop statistical inference procedures for poverty partial orders. In Section III, we take a brief look at our data and certain methodological issues, and proceed to apply these techniques in Section IV to the comparison of poverty levels in Spain during the 80's. We do this both for the population as a whole and each of the subgroups in the partition by household size. Section V provides some concluding comments. A brief Appendix contains the results regarding other partitions of the population.

I. THE JENKINS-LAMBERT APPROACH

I.1. TIP curves and GPG poverty measures

Let there be a set of individuals $N=\{1,\ldots,n\}$, each of which characterized by a real number, x_i, which we will call income. Let $\mathbf{x}=(x_1,\ldots,x_n)$ be the income distribution once incomes have been arranged in ascending order, so that $0<x_1\leq\ldots\leq x_n$; and let z be a critical economic level, known as the poverty line, which implicitly defines the set of poor people, $T(\cdot)$, comprising all individuals whose income does not reach this level; i.e.

$$T(\mathbf{x},z) = \{i\in N: x_i<z\}.$$

Let q be the number of poor people. Let $\mathbf{g}_x$ be the vector of poverty gaps associated with distribution $\mathbf{x}$ and the poverty line z, where

$$g_{x_i} = \max\{z-x_i, 0\}.$$

Many familiar poverty indices may be defined as functions of the vector $\mathbf{g}_x$. For later reference, let $\mathbf{P}$ be the class of replication invariant, increasing and Schurr-convex functions of poverty gap vectors. In fact, many poverty indices can be expressed solely in terms of the vector of normalized poverty gaps, $\mathbf{\Gamma}_x$, where each of its element is defined by:

$$\Gamma_{x_i} = \frac{g_{x_i}}{z} = \max\{\frac{z-x_i}{z}, 0\}.$$

Let **Q** be the class of replication invariant, increasing and Schurr-convex functions of normalized poverty gap vectors. Clearly, $\mathbf{Q} \subseteq \mathbf{P}$ [(2)].

The TIP curve of poverty gaps, denoted by TIP(g;p) where $0 \leq p \leq 1$, plots against p the sum of the first 100·p percent of g-values divided by the total number of receiving units. Thus TIP(g;0)=0 and

$$TIP(g;k/n) = \frac{\sum_{i=1}^{k} g_i}{n},$$

for integer values k, $k \leq n$ [(3)]. Figure 1 from JL illustrates some of the TIP's good properties. The Incidence aspect of poverty is summarized by the length of the TIP curve's non-horizontal section. The headcount ratio is that $p=q/n$ at which the curve becomes horizontal. The Intensity is summarized by the TIP curve's height, since the vertical intercept at $p=1$ is the aggregate poverty gap averaged across all households. The Inequality aspect is summarised by the degree of concavity of the non-horizontal section of the TIP curve. If all the households' poverty gaps were equal, this section would be a straight line with slope equal to $(z-x_i)$.

Figure 1 around here.

The TIP curve for normalized poverty gaps, denoted TIP(Γ,p), has the same shape properties and thus also shows the Incidence, Intensity and Inequality dimensions of aggregate poverty [(4)].

I.2. Poverty Dominance Results

Given two income distributions, **x** and **y**, and any two poverty lines, z_x and z_y, we may calculate the TIP curves associated with each distribution of poverty gaps, TIP_{g_x} and TIP_{g_y}. We say that the distribution g_x dominates in the TIP sense to the distribution g_y, when the TIP_{g_x} curve does not lie below the TIP_{g_y} curve at any point.

The first result is that dominance of un-normalised poverty gaps is equivalent to a unanimous poverty ordering by all indices in **P** for all common poverty lines set at z or lower: Given any two income distributions x and y and a common poverty line z, TIP dominance of g_x over g_y is necessary and sufficient to ensure $P(y|z') \leq P(x|z')$ for all common poverty lines $z' \leq z$, and for all poverty indices $P \in \mathbf{P}$ [(5)].

However, this result is not as definitive as it may seem at first glance. The common poverty line used so far provides an absolute view which does not allow for different poverty standards in the distributions being compared. The fact that one distribution presents an improvement over another for any common poverty line, does not imply that this result will be maintained for different lines. The use of different poverty lines is particularly interesting when we want to compare poverty levels in different countries or at different points in time for the same country. This is indeed the main argument in defense of relative poverty lines.

Fortunately, in the case of different poverty lines TIP dominance of normalized poverty gaps ensures that, for all poverty indices in **Q**, not only one income distribution has less poverty than another for these two poverty lines, but also that the result extends to all pairs of poverty lines with the same relative relationship as the initial ones [(6)].

Furthemore, given two poverty lines z_x and z_y, if TIP dominance of $\mathbf{\Gamma}_x$ over $\mathbf{\Gamma}_y$ obtains and is found to be 'strong', then there may be room to rescale upwards the incomes in **x**, the poorer distribution, while preserving the poverty ranking between **x** and **y** for the subclass **Q**. Or, equivalently, there might be room to lower the poverty line for distribution **x** alone, all the while preserving the poverty ordering for the subclass **Q** [(7)]. The interesting point is that the extent to which this may be done is revealed by the poverty gap data themselves. The intuition is that when the TIP curve for **x** lies everywhere above that for **y**, there is scope for lowering $TIP(\mathbf{\Gamma}_x,p)$ while mantaining non-intersecting TIP curves of normalized poverty gaps and the ordering for the subclass **Q**.

II. STATISTICAL METHODS

As we have seen, the comparison of TIP curves is a valuable device to test for the presence of robust poverty orderings. Unfortunately, as with the Lorenz curves, the TIP dominance relation is only a partial ordering of distributions of poverty gaps. Thus, there are three possible results: dominance, equality and non-comparability. Current experience with Lorenz curves indicates that many of the crossovers observed in practice are only the result of sampling variability, and do not reflect the true characteristics of the population involved [(8)]. For this reason, we propose using statistical procedures which allow for a distinction between dominance, equality and non-comparability, overcoming the shortcomings of mere numerical comparisons.

Let X be a random income variable, and let F_x be the population cumulative distribution function which is assumed continuous and twice differentiable. A quantile of income, ζ_p, corresponding to the proportion of individuals p ($0 \leq p \leq 1$) is implicitly defined by $F_x(\zeta_p)=p$ (on the assumption that F_x is strictly monotonic). Thus, corresponding to a set of K-abscissae, $p_1<p_2<\ldots<p_K$, we have a set of K population income quantiles $\zeta_1<\zeta_2<\ldots<\zeta_K$, and a set of K population Generalized Lorenz (GL for short) curve ordinates, $\phi(\zeta_1)<\phi(\zeta_2)<\ldots<\phi(\zeta_K)$, defined as:

$$\phi(\zeta_k) = \int_0^{\zeta_k} x\,dF_x(x) = p_k \gamma_k,$$

where $\gamma_k=E(X|X\leq\zeta_k)$ is the conditional mean of incomes less than or equal to ζ_k.

Let V be the variable obtained from X by the transformation:

$$V = \max\{(z-X), 0\},$$

where $z \in R^+$ is a fixed value. We know that, by definition, V is the variable used to construct the TIP curve. To make the analogies between both curves even more obvious, let us define a new variable, which we shall call W, defined as:

$$W = -V = \min\{(X-z), 0\}.$$

The density function of W, f_w, is a translation of the density function of the original variable, f_x, with the peculiarity that it is censored in W=0, where the density corresponding to all values of $X \geq z$ is accumulated (see Figures 2 and 3).

Figures 2 and 3 around here

Let $\zeta^* = (\zeta^*_1, \ldots, \zeta^*_K)$ be the vector of population quantiles for W, and let us define the corresponding GL ordinates by

$$\phi(\zeta^*_k) = \int_0^{\zeta^*_k} w dF_w(w) = p_k \gamma^*_k,$$

where $\gamma^*_k = E(W \mid W \leq \zeta^*_k)$. Let us consider a random sample of size n. The sample estimate of the GL ordinates are computed as

$$\hat{\phi}(\hat{\zeta}^*_k) = \sum_{i=1}^{r_k} \frac{w_i}{n} = p_k \hat{\gamma}^*_k,$$

where $\hat{\gamma}^*_k = \sum_{i=1}^{r_k} \frac{w_i}{r_k}$ and $r_k = [n \cdot p_k]$.

In order to perform statistical inference with the vector of GL sample ordinates, it is necessary to know the asymptotic distribution of $\hat{\phi}$. Beach and Davidson (1983) show that if the population has finite mean and variance and the cumulative distribution function is strictly monotonic and twice differentiable, then the sample ordinates are asymptotically normal:

$$\sqrt{n}(\hat{\phi} - \phi) \xrightarrow{d} N_K(0, \Pi).$$

Π is the covariance matrix with

$$\pi_{k,l} = p_k [\lambda_k^2 + (1-p_l)(\zeta_k-\gamma_k)(\zeta_l-\gamma_l) + (\zeta_k-\gamma_k)(\gamma_l-\gamma_k)],$$

for $k \leq l$, where λ_k^2 is defined as the variance of X conditional on $X \leq \zeta_k$. In the empirical analysis, consistent sample estimates of λ_k^2, ζ_k y γ_k can be calculated and substituted in the previous expression.

Although W has a censored density function in the upper tail, there is no need to modify the theorem because the distribution function, F_w, is differentiable in the interval $(-\infty,0)$ (9). To obtain confidence intervals for the ordinates associated with each abscisa, only the behaviour of the distribution up to each abscisa is relevant. This is true since the conditional means and variances of the quantiles associated with values of $W<0$ would exactly coincide with those belonging to a hypothetical variable W' defined (with no censoring) as, W'=(X-z). Therefore, we propose using the asymptotic result in the ordinates corresponding to values of $W<0$, and the results regarding the population mean for the ordinates including values of $W=0$.

Once the difficulties involved in working with a censored distribution are overcome, we only have to relate the GL curve of the variable W to the TIP curve of the variable V. But both curves are symmetrical, and so the application of the above results is immediate.

Figure 4 around here.

We are, then, in a position to use asymptotically distribution-free inference procedures developed by Bishop et al (1989) and Bishop et al (1994) to test equality of GL curves. Unlike the classical tests (10), which only provide a partition of the sample space into two regions (acceptance and rejection regions), the procedures used by these authors, based on the union-intersection principle (11), make it possible to distinguish between three differentiated regions associated with dominance, equality and noncomparability between the two curves under comparison.

In poverty measuring, only the situation of the poor needs to be taken into account. The consequence for the TIP test is that, unlike the comparison of Lorenz curves, in the overall null hypothesis we should only include the TIP ordinates corresponding to values of $W<0$ (or

V>0), together with the ordinate associated with the last quantile [12]. To consider all the quantiles would increase the width of the confidence intervals for the same significance level.

Although the original analysis was presented in terms of a sample of i.i.d. observations, Beach and Kaliski (1986) have extended this methodology to samples which involve weighted observations. This extension is important in our case because the Spanish data come from a sample in which, in an attempt to reflect the socio-demographic structure of the country, households are weighted differently. Beach and Kaliski demonstrate that the central results are mantained, so that a suitable redefinition of the quantiles and conditional sample means and variances is the only operation we must perform in order to include the information refering to each sample observation.

III. DATA AND EQUIVALENCE SCALES

III.1. Data

Our data comes from two large budget surveys, the EPF's for 1980-81 and 1990-91. They consist of 23,972 and 21,155 observations, representative of a population of approximately 10 and 11 million households, respectively, occupying residential housing in all of Spain including the northern African cities of Ceuta and Melilla. The use of the EPF's in studying poverty presents advantages as well as a number of disadvantages, as several authors have pointed out recently [13]. To the classic problems regarding the lack of response or the underestimation of reported income by certain segments of the population, it is necessary to add those shortcomings which are particularly relevant when dealing with poverty. We are referring to the exclusion in the sample of some of the more marginal strata of the population: the homeless and people who reside in accommodation not covered in the sample, e.g. residences for the aged, prisons, hospices, boarding houses, etc. The EPF's, however, are the only large and comparable micro surveys in Spain where data on household expenditure and income is complemented by detailed information on the demographic, geographic and socioeconomic household characteristics. In this paper we use the EPF's despite being aware that the results obtained should be completed with data from other sources directly involving the population not covered by them.

We agree with Slesnick (1991, 1993) that, ideally, we should identify the standard of living with commodity consumption. Lacking information on leisure and public goods consumption, our starting point must be household total expenditures as an approximation to household consumption of private goods and services. The EPF has a rather wide concept of total expenditure, including expenditures on items not covered by the Consumer Price Index (like funeral articles; contributions to non-profit institutions; gambling expenditures; fines; hunting, fishing and other fees), as well as a number of imputations for home production, wages in kind and subsidized meals at work. To avoid double counting, transfers to other households or to household members absent from home are excluded.

Recently, bulk purchases of food and drinks for home consumption have been gaining popularity among certain strata from the more urbanized population. This might not cause a major problem in 1980-81 but, concerned with the gradual extent of this practice during the 80's, the INE collected partial but valuable information on bulk purchases for the 1990-91 EPF. However, this information is not taken into account in the estimates of annual food expenditures contained in the public use tape constructed by the Institute. Fortunately, Peña and Ruiz-Castillo (1995) have studied this issue in some detail, and have produced improved estimates of food and drinks annual expenditures using all the available information on bulk purchases. These estimates have been incorporated in our household total expenditures measure.

Our experience with the 1980-81 EPF indicates that discontinuous household expenditures on some durables, whose occurrence may distort heavily the total, are best considered investment rather than consumption. These refer to current acquisitions of cars, motorcycles and other means of private transportation, as well as house repairs financed by either tenants or owner-occupiers. Life and housing insurance premiums are excluded on the same grounds. Thus, our estimate of household current consumption equals total household expenditures, net of these investment items.

Ideally, the elimination of current expenditures on the acquisition of those durables should be accompanied by the inclusion of an estimate of the consumption services currently provided by these investment flows as well as by the stock of household durables acquired in the past. We do this only for housing -without doubt the more important household durable- since the INE includes a market rental value for both owner-occupied housing and the rest of the stock which is neither rented nor owned by the household occupying it. Such rental values are the estimates reported by the owner or the occupying household, respectively [(14)].

We express household expenditure at constant prices of the Winter of 1991 by means of household specific statistical price indices. These have been constructed in Sastre and Ruiz-Castillo (1997) using the official price index system with 1983 as the base year.

To make clear the difficulties which may arise in comparing our results and those obtained in previous studies, it is important to point out that Ruiz-Huerta and Martínez (1994) and INE (1996) use a definition of household total expenditures considerably different from ours. Moreover, in order to make comparisons in real terms, both studies use a common inflation rate for all 1980-81 households. This practice eliminates from the picture the effect of changes in relative prices. On the other hand, both studies provide interesting evidence on the paradoxes which result from using the EPF data on household income along with a measure of total expenditure.

III.2. Equivalence scales

Each household is characterized by its total expenditures defined above, x_i, and a vector of characteristics which gives rise to differences in "needs". The usual procedure is to define an equivalence scale in terms of some demographic characteristics, which is then used in adjusting the original variable for these differential needs [(15)]. However, as Coulter et al (1992a) conclude in their review of the literature, there is no single "correct" equivalence scale for adjusting incomes. Thus, a range of scale relativities is both justifiable and inevitable. The problem, of course, is that poverty measurement is known to be sensitive to scale choice.

To make the analysis tractable we suppose that equivalence scales depend only on the number of persons in the household. Households of the same size are assumed to have the same needs and, therefore, their incomes will be directly comparable. Larger households have greater needs, but also greater opportunities to achieve economies of scale in consumption. Assume that there are $s = 1,\ldots,S$ household sizes. Following Buhmann et al (1988) and Coulter et al (1992a, 1992b), for each household i of size s we define adjusted income by

$$u_i(\theta) = \frac{x_i}{(s_i)^{\theta}}, \quad i=1,...,n \ \ and \ \ \theta \in [0,1].$$

When $\theta = 0$, adjusted income coincides with unadjusted household income, while if $\theta = 1$, it becomes per capita household income. Taking a single adult as the reference type, the expression s^θ can be interpreted as the number of equivalent adults in a household of size s. Thus, the greater θ is, the smaller are the economies of scale in consumption within the household or, in other words, the larger is the number of equivalent adults.

We suggest to proceed in two parts. In the first place, we compare poverty within each of the ethically homogeneous subgroups of the partition by household size. The poverty line for households of size s, z_s, is taken to be some fraction ϕ (16) of the mean original income of all households of that size, denoted by $m(\mathbf{x}_s)$. That is, $z_s = \phi \cdot m(\mathbf{x}_s)$. In the second place, with regard to the population as a whole, we consider the following values for the equivalence scales parameter θ: 0, 0.2, 0.4, 0.7, and 1.0. This procedure permits to study the robustness of our conclusions to changes in the generosity of the scale which capture very different assumptions about the importance of economies of scale. It is easy to check that the poverty line, $z(\theta) = \phi \cdot m(\mathbf{u}(\theta))$, is the sum of the poverty lines of the basic partition, weighted by the importance of each group in the population, p_s, and by the inverse of the household size raised to the power θ:

$$z(\theta) = \sum_{s=1}^{S} z_s p_s \left(\frac{1}{s^{\theta}}\right).$$

Therefore, the larger the size the smaller the importance of this subgroup poverty line in the definition of the overall poverty line. This feature becomes more pronounced as θ increases from 0 to 1.

IV. POVERTY TRENDS IN SPAIN

IV.1. A common poverty line

For many people, a constant absolute common poverty line provides an adequate reference point for analysis of trends in living standards. This could be particularly justified in a situation like ours in which household specific price indices have been used to express both distributions at constant prices. Therefore, let us begin by setting a poverty line equal to half the 1980-81 average household expenditures for both the 1980-81 and the 1990-91 distributions expressed at winter of 1991 prices. Table 1 presents some basic statistics for different values of the parameter θ. The first two columns are for average expenditures; the next two present the headcount ratio; the fifth expresses the poverty change by the percentage change in headcount ratios from 1980-81 to 1990-91; the last two columns provide the average poverty gap in both years. Poverty lines are set at 50% of 1980-81 average expenditure (in thousands pesetas).

Table 1 around here

The first thing to notice is that, for this particular absolute poverty line, both the Incidence and the Intensity of poverty (measured by the proportion of people in poverty and the average poverty gap, respectively), have decreased in Spain during this period for all values of θ. However, notice the impact of the equivalence scale parameter on the headcount ratio and the average poverty gap. As Coulter et al (1992b) and Mercader (1993) point out, increasing the value of the parameter θ means, on the one hand, lowering the expenditure for all households with the exception of single person ones. This tends to cause an increase in the number of poor people. But on the other hand, this also lowers the mean, which reduces both the poverty line and the number of poor people. The fact that the proportion of poor people is U-shaped in both distributions indicates that, for small parameter values, the second effect is larger and the number of poor people decreases. As we approach the intermediate values, the reduction of the poverty line effect is offset by the increasing number of people which become poor. The reason for this is that the density around the poverty line is far greater than at the beginning. The last two columns of Table 1 show that the average poverty gap decreases with θ as the differences between the household expenditures and the poverty line become lower and lower.

It is not only that poverty measurement depends on the equivalence scale one uses. More importantly, the composition of the poor is known to be very sensitive to this choice. Tables 2a and 2b present the distribution of the poor by household size as a function of θ. In most cases the proportion of the poor in smaller households (1 and 2 members) is higher than in the total population. This difference decreases when θ rises, until we reach $\theta=1$ where the percentage of poor people among the larger households is greater than their demographic weight.

Tables 2a and 2b around here.

The next question, of course, is the robustness of poverty trends to the change in θ. In Del Río and Ruiz-Castillo (1996), we found that the 1990-91 distribution dominated in the Lorenz sense the 1980-81 distribution for every θ. Therefore, inequality at 1991 Winter prices went down for every Lorenz consistent inequality index. In addition, it turns out that mean household expenditure went up by 24 per cent to 34 per cent, as θ varies from 0 to 1. Consequently, the 1990-91 distribution dominates the 1980-81 distribution in the Generalized Lorenz sense for every θ. By the same token, the 1980-81 TIP curve of un-normalized poverty gaps dominates the 1990-91 one for every value of θ (17). The implication, of course, is that for all possible common poverty lines, and for all θ, poverty has diminished during the 80's for all poverty measures in the class **P**. For illustrative purposes, we show in Figure 5 the TIP curves of un-normalized poverty gaps for an intermediate value of $\theta = 0.4$.

Figure 5 around here.

IV.2. Different poverty lines

Even if the household specific price indices we have used do a good job in allowing us to make comparisons in real terms which take into account the distributional role of changes in relative prices, many people would insist that poverty comparisons should be made recognizing the differences in the standard of living in the two situations. As a matter of fact, JL provide an illuminating example in which one distribution has less poverty than another for all common absolute poverty lines. However, after allowing for the fact that the first distribution enjoys a higher standard of living, the conclusion is reversed.

We begin the analysis of the relative case by fixing both poverty lines at half their own average household expenditures. Table 3 presents the poverty lines in both situations, the headcount ratios, the poverty change measured by the reduction of headcount ratios during the decade in percentage terms, and the average normalized poverty gaps.

Table 3 around here.

Notice that, since the poverty line in 1990-91 is now higher than before, reflecting the higher standard of living of this distribution, the headcount ratios have increased relative to the values in column four of Table 1. However, for all θ the Incidence and the Intensity of poverty is still smaller than in 1980-81. Following JL's methodology one can ask: can this conclusion be maintained for the class **Q** of poverty measures which, in addition, reflect Inequality considerations among the poor? To answer this question we compare the TIP curves for the normalized poverty gaps in both years. The result is that the 1980-81 TIP curve dominates the 1990-91 TIP curve, in a statistically significant way, for all values of θ. Figure 6 illustrates the case for $\theta = 0.4$.

Figure 6 around here.

Therefore, we can state that poverty has declined in Spain for all poverty measures in **Q** and all poverty lines maintaining the initial relativity -i.e., in the case $\theta = 0.4$ for example, for all poverty lines $(z_{1980\text{-}81};z_{1990\text{-}91})=(r\cdot 582;\ r\cdot 737)$, with $r\in(0,1]$.

Looking at Figure 6, one can ask a very probing question: mantaining the poverty line for 1990-91 at half its average household expenditure, how far could we lower the poverty line for 1980-81 and still conclude that its TIP curve for normalized poverty gaps dominates the 1990-91 one in a statistically significant sense? The results are summarized in the second and third columns of Table 4. The second column provides the lowest 1980-81 poverty line which implies the above result, while the third column indicates which percentage of the 1980-81 average household expenditure this value represents.

Table 4 around here.

We observe that the lowest 1980-81 poverty line which ensures a poverty improvement over the decade, represents a practically fixed proportion of the mean (46 per cent) regardless of the equivalence scale used. This is a rather robust result, in contrast with the greater variability of the poverty improvement measured by the percentage change in the headcount ratio (see column 5 of Table 3). On the other hand, the last two columns of Table 4 present the information on the lowest 1980-81 poverty lines computed by numerical methods. We observe that the statistical methods lead to larger intervals than the numerical ones.

The last question we may ask is: how do these results change when we vary the definition of the 1990-91 poverty line? Although the results are not shown, we have compared the TIP curves for the normalized poverty gaps when the poverty lines are defined as fractions different from one half of the respective means. The order of magnitude is practically the same. When the 1990-91 poverty line is fixed at 60 (40) per cent of the mean, the 1980-81 poverty line can be fixed between the 56 and the 60 (36 to 40) per cent of its own mean.

IV.3. The basic partition

In this paper we assume that the only characteristic which gives rise to differences in socially relevant needs is household size. Thus, only the expenditures of households of the same size are directly comparable. Equivalence scales are only a device to implement welfare comparisons between households of different size. Because different people may have different views about the appropiate type of economies of scale, in the previous section we have studied poverty trends for the population as a whole as a function of the parameter Q. However, the study of the robustness of our conclusions to changes in does not end the list of important questions. To complete our work we must study the poverty trends for each of the ethically homogeneous subgroups in the partition by household size. Table 5 shows the demographic weight, the poverty lines and the proportion of poor people in the partition by household size, calculated as 50 per cent of the average household expenditure in each group.

Table 5 around here

The most important result is the reduction in poverty levels troughout the 1980's in almost all subgroups, both in absolute and relative terms. Column 9 of Table 5 shows that this improvement in relative terms is maintained when the poverty line for 1980-81 falls from 50 per cent to 40-47 per cent, depending on the case. Leaving aside the case of households with 7 members [18], the groups which allow for a greater margin in reducing the line for 1980-81 are the single person and 3 person households. Households with 4 members exhibit a relative improvement but allow a smaller range in the definition of the poverty line for 1980-81: we cannot order both distributions below 47 per cent of the average for 1980-81 in terms of the TIP curves. Interestingly enough, the decrease in poverty for 4 person households for all poverty measures in the class **Q** can be established in spite of the fact that the headcount for this group increases during this period. The other subgroups present a stronger poverty reduction as well as a headcount decrease.

Finally, the Appendix includes the results of a brief analysis using others partitions. We compare TIP curves for 1980-81 and 1990-91 constructed from poverty lines at 50 per cent of the adjusted average expenditures for each group. Statistical inference procedures have not been used due to the low number of observations in many of the subgroups [19]. The groups marked with the symbol (*) represent situations in which the TIP curve for 1990-91 lies above that of 1980-81, reflecting an increase in poverty levels during the period. Examples of this are the Extremadura and La Rioja in the partition by Autonomous Community, and the households whose main income earner has attained an educational level beyond a three year-College degree or belongs to the Upper classes [20]. When TIP curves cross, no conclusion can be reached. This is the case of the País Vasco and Cataluña (whose headcount increased by 15.1 per cent), municipalities of more than 500,000 inhabitants, and households headed by unclassifiable occupied persons. The groups which most stand out for their poverty reduction are: municipalities of less than 10,000 inhabitants; Asturias, Andalucía, Navarra, Baleares and the two Castillas; and households headed by an illiterate or a self-employed person [21].

V. CONCLUSIONS

In a heterogeneous world where household characteristics give rise to different household needs, income is usually adjusted by some appropiate equivalence scale in order to make inter-household welfare comparisons across households with different needs. Both aggregate poverty measurement and the characteristics of the poor depend on the equivalence scale used. In this paper we have studied the robustness of poverty comparisons in Spain between 1980-81 and 1990-91 to the choice of equivalence scale. For this purpose, we have adopted a well known model where equivalence scales depend only on household size through a single parameter θ capturing the importance we want to give to economies of scale in consumption within the household.

In Del Río and Ruiz-Castillo (1996) we found that, when both distributions are expressed at Winter of 1991 prices, the 1990-91 distribution of household total expenditure, net of the acquisition of some durables, dominates the 1980-81 distribution in the Generalized Lorenz sense for all values of the parameter θ. This means that, independent of the equivalence scale used, for all absolute poverty lines common to both situations, poverty in 1990-91 is unambigously smaller than in 1980-81 for all members of the class **P** of generalized poverty gaps poverty measures [(22)].

Many people would argue that poverty lines should take into account the relative standard of living of the two situations. To appreciate the advantages of the approach advocated in this paper, let us compare it with the one followed by INE (1996). Given a particular equivalence scale, this study computes poverty estimates for 1980-81 and 1990-91 according to six poverty indices and 3 types of poverty lines. Therefore, to establish its global conclusion about poverty trends INE (1996) must test the statistical significance of 18 poverty comparisons. In our case, by comparing a single pair of TIP curves of normalized poverty gaps we establish that poverty has gone down according not only the six poverty measures used in INE (1996), but all the other members of the class **Q**; and not only for a few poverty lines, but for all poverty lines which maintain the relativity determined by the difference in living standards between the two distributions.

If one desires a quantitative expression of the extent of the poverty reduction, JL methods allow the data themselves to reveal by how much can we reduce the poverty line for 1980-81 and still maintain that the 1980-81 TIP curve for the normalized poverty gaps dominates the 1990-91 TIP curve. We have found that, for all values of θ, when the poverty line for 1990-91 is set at 60, 50, or 40 per cent of the average household expenditures, the poverty line for

1980-81 can always be set 4 percentage points lower at 56, 46, and 36 per cent, respectively, of the average of the 1980-81 distribution. When we compare TIP curves using only numerical methods, this margin is reduced.

In brief, regardless of where we set the poverty line for 1990-91, the amplitude of the range of poverty lines for 1980-81 which captures the strength of the decline of poverty in Spain during the 80's, is independent of the equivalence scale used. However, this margin varies for different subgroups in the partition by household size. When we set the 1990-91 poverty line at 50 per cent of the average of the corresponding distribution, for single person and three person households the margin is approximately 8 per cent, while for the large group of four person households the margin is only 3 per cent.

In an Appendix, we offer the results of similar computations for the partitions by the Autonomous Community and the municipality size of residence, as well as the the household head's educational level and socioeconomic category.

APPENDIX

OTHER PARTITIONS

Definition of the socioeconomic (SOCIO) and educational (EDC) variables.

EDC:

1. Illiterate,
2. Without formal studies,
3. Grade school,
4. Primary school,
5. Secondary school,
6. Vocational school,
7. Three-year College degree,
8. More than three-year College degree.

SOCIO:

1. Self employed, agricultural,
2. Workers, agricultural,
3. Workers,
4. Self employed,
5. Supervisors, Armed Forces,
6. Upper classes,
7. Unclassifiable occupied persons,
8. Retired,
9. Living off property income,
10. Other persons outside of the labor force.

RESULTS IN OTHER PARTITIONS

Tables 6, 7, 8 and 9 around here.

NOTES

(1) For a recent analysis of this problem, see Lanjouw and Ravaillon (1995).

(2) See Table 1 in JL for examples of well known poverty indices in the classes **P** and **Q**.

(3) In previous versions of the paper, JL labelled this curve the Inversed Generalized Lorenz curve, following the terminology introduced by Jenkins (1991, 1994) who used the device for wage discrimination measurement. See JL's note 1 for other uses and names of the same curve in Yitzhaki (1991), Hannah and Kay (1977) and Shorrocks (1993, 1994).

(4) See JL for the relation between the TIP($\mathbf{\Gamma}$,p) and Shorrocks (1995) modified-Sen poverty index.

(5) This is Theorem 1 in Jenkins and Lambert (1996). See also Theorem 2 and the discussion that follows for the connection between the poverty orderings revealed by TIP dominance and those revealed by Generalized Lorenz dominance, as well as the connection between these two theorems and the previous results in Atkinson (1987) and Foster and Shorrocks (1988a, 1988b).

(6) This is Theorem 3 in Jenkins and Lambert (1995).

(7) This is Theorem 3 in Jenkins and Lambert (1996).

(8) Bishop, Formy and Thistle (1989) provide evidence in this sense. In the case of Spain, this has been corroborated in Del Río and Ruiz-Castillo (1996).

(9) Although, as was already suggested by Beach and Davidson (1983), the assumptions of the theorem may be relaxed in order to obtain a more general result to include another kind of functions.

(10) Beach and Davidson (1983), Gail and Gastwirth (1978) and Gastwirth and Gail (1985) provide different classical tests for comparing the equality of Lorenz curves.

(11) Richmond (1982) presents the methodology used to construct joint confidence intervals.

(12) The inclusion of the last ordinate allows us to test the equality of average poverty gaps.

(13) See Mercader (1993), Ruiz-Huerta and Martínez (1994) and INE (1996).

(14) Unfortunately, we do not have information to impute a money value to the flow of services yielded by other household durables.

(15) This is the procedure followed by JL who, like many other authors in the UK, use the official McClements equivalence scales to obtain equivalent or adjusted income.

(16) In empirical applications ϕ is usually taken to be in the interval (0.4, 0.6).

(17) All the results in this paragraph are statistically significant according to the methods discussed in Section II.

(18) Households with 7 members are represented by 842 and 471 observations in the EPF for 1980-81 and 1990-91, respectively. Although TIP curve estimates have only been made on deciles, the size of the sample is too small to be able to apply statistical inference procedures to the first one.

(19) It is important to recall that these are asyntotic tests which must be applied to each of the quantiles where the TIP curve is estimated as being below the poverty line.

(20) See the Appendix for a description of the variables SOCIO and EDC, refering to the socioeconomic category and the educational level, respectively, of the household head.

(21) Both Ruiz-Huerta and Martínez (1994) and INE (1996) are interested in the contribution of individual subgroups to the overall poverty rate. Correspondingly, they apply the overall poverty line to all subgroups within each partition. Therefore, our results on poverty trends, where each subgroup's poverty line is fixed in terms of its own average household expenditures, should be seen as complementary of those obtained by those authors.

(22) Using appropiate methods of statistical inference, INE (1996) also finds that the 1990-91 distribution dominates the 1980-81 one in the Generalized Lorenz sense. Applying Shorrocks (1983) results, this study concludes that social welfare has increased during the 80's. However, it does not extract the pertinent implications for poverty trends in the case of a common poverty line.

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FIGURES AND TABLES

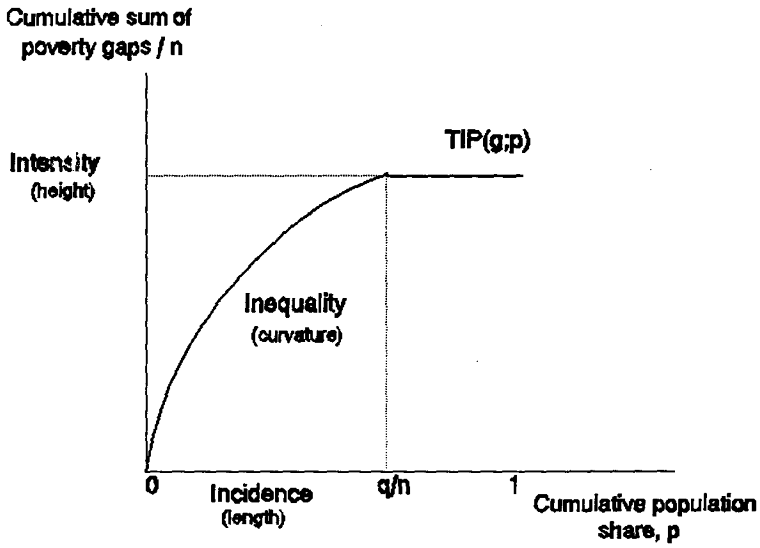

Figure 1
Properties of TIP curve

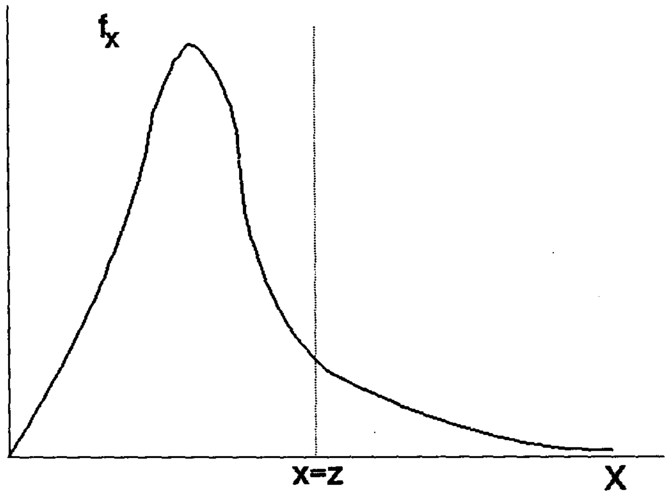

Figure 2
. Density function of income

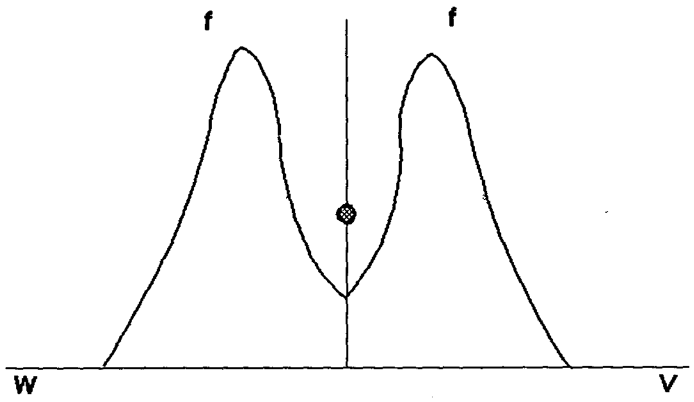

Figure 3
Density functions of W and V

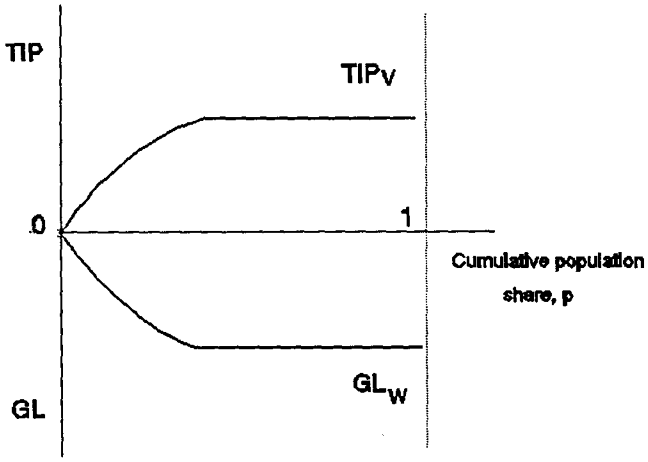

Figure 4
GL curve of W and TIP curve of V

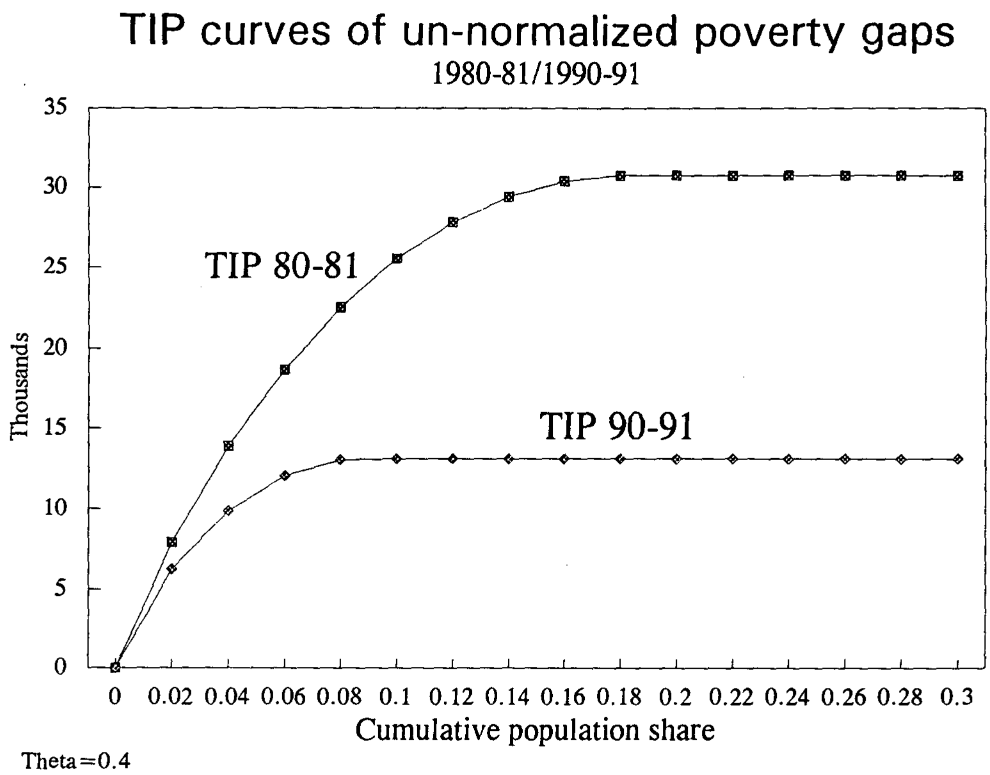
TIP curves of un-normalized poverty gaps
1980-81/1990-91
35
30
25
20
15
10
5
0
Thousands
TIP 80-81
TIP 90-91
0 0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16 0.18 0.2 0.22 0.24 0.26 0.28 0.3
Cumulative population share
Theta=0.4

Figure 5

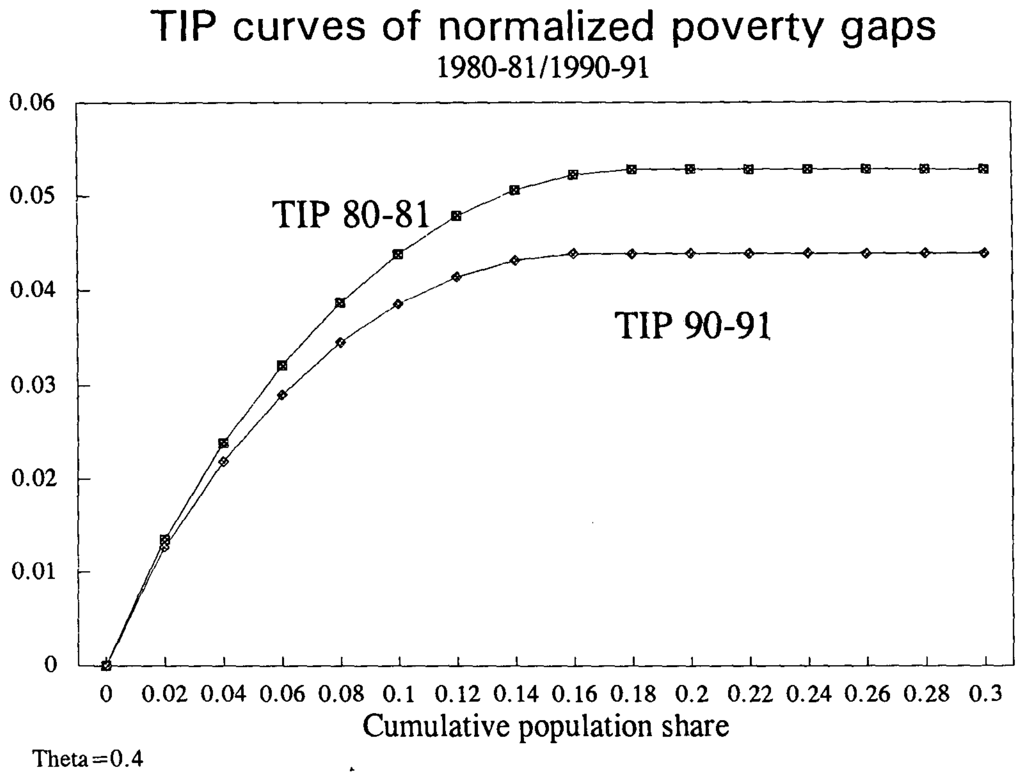
TIP curves of normalized poverty gaps
1980-81/1990-91
0.06
0.05
0.04
0.03
0.02
0.01
0
TIP 80-81
TIP 90-91
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
0.22
0.24
0.26
0.28
0.3
Cumulative population share
Theta=0.4

Figure 6

Table 1. Poverty lines equal to 50% of 1980-81 average expenditure (in thousands pesetas)

	Average Expenditures		Headcount ratio (%)		Headcount ratio (*) change(%)	Average poverty gap	
	1980-81	1990-91	1980-81	1990-91		1980-81	1990-91
θ=0.0	1,949	2,391	22.0	14.0	-36.4	75.4	43.4
θ=0.2	1,499	1,869	19.9	11.3	-43.2	47.6	23.7
θ=0.4	1,164	1,473	18.2	8.8	-51.6	30.8	13.1
θ=0.7	811	1,050	17.3	6.8	-60.7	18.4	6.3
θ=1.0	578	766	18.8	7.0	-62.8	14.2	4.4

(*) $$\textit{Headcount ratio change} = \frac{((1990\text{-}91) - (1980\text{-}81))\ \textit{headcount ratios}}{(1980\text{-}81)\ \textit{headcount ratio}} \cdot 100$$

Table 2a. Distribution of the poor by household size as function of θ in 1980-81

Household size	Parameter of Equivalence Scale					Distribution by Household size
	θ=0.0	θ=0.2	θ=0.4	θ=0.7	θ=1.0	
H=1	26.4	24.7	21.6	13.9	6.9	7.8
H=2	41.6	38.5	34.2	26.1	17.6	21.1
H=3	15.4	15.5	15.3	14.9	13.5	18.6
H=4	8.5	9.8	11.7	14.9	17.2	23.6
H=5	4.8	6.5	8.7	12.8	18.3	14.9
H=6	1.7	2.5	4.0	8.1	12.2	7.8
H=7	1.5	2.5	4.3	9.3	14.3	6.3

Table 2b. Distribution of the poor by household size as function of θ in 1990-91

Household size	Parameter of Equivalence Scale					Distribution by Household size
	$\theta=0.0$	$\theta=0.2$	$\theta=0.4$	$\theta=0.7$	$\theta=1.0$	
H=1	32.5	29.8	26.0	15.5	6.7	10.0
H=2	42.4	39.5	35.4	28.3	19.7	22.3
H=3	13.6	14.5	15.3	15.8	15.0	20.8
H=4	7.0	9.0	11.6	16.7	21.5	25.0
H=5	2.9	4.5	6.7	12.2	17.9	13.2
H=6	0.9	1.6	2.9	5.9	10.2	5.4
H=7	0.6	1.1	2.1	5.6	9.0	3.3

Table 3. Poverty lines equal to 50% of contemporary average expenditure (in thousands pesetas)

	Poverty lines		Headcount ratio (%)		Headcount ratio (*) change(%)	Average poverty gap	
	1980-81	1990-91	1980-81	1990-91		1980-81	1990-91
$\theta=0.0$	974	1,196	22.0	20.8	-5.4	0.077	0.069
$\theta=0.2$	750	934	19.9	18.4	-7.5	0.063	0.054
$\theta=0.4$	582	737	18.2	16.5	-9.3	0.053	0.044
$\theta=0.7$	405	525	17.3	15.4	-11.0	0.045	0.036
$\theta=1.0$	289	383	18.8	17.0	-9.6	0.049	0.040

(*) $$\textit{Headcount ratio change} = \frac{((1990\text{-}91) - (1980\text{-}81))\ \textit{headcount ratios}}{(1980\text{-}81)\ \textit{headcount ratio}} \cdot 100$$

Table 4. Poverty lines for 1980-81 thats implies TIP dominance

	Poverty line located at 50% of 1980-81 average expenditure	Lowest poverty lines 1980-81		Lowest numerical poverty lines 1980-81	
		Value	% Average	Value	% Average
$\theta=0.0$	974	896	46.0	916	47.0
$\theta=0.2$	750	690	46.0	705	47.0
$\theta=0.4$	582	524	45.0	547	47.0
$\theta=0.7$	405	373	46.0	381	47.0
$\theta=1.0$	289	266	46.0	272	47.0

Table 5. Poverty lines and poverty measurement within the partition by household size

Household size	Population ratio (%)		Poverty lines		Headcount ratio (%)		Headcount ratio (*) change(%)	Lowest poverty lines 1980	
	1980-81	1990-91	1980-81	1990-91	1980-81	1990-91		Value	% Average
1 person	7.8	10.0	402	544	30.4	25.6	-15.8	337	42.0
2 persons	21.1	22.3	673	839	22.3	18.8	-15.7	579	43.0
3 persons	18.6	20.8	933	1,182	16.5	13.3	-19.4	767	41.1
4 persons	23.6	25.0	1,105	1,451	12.1	12.3	1.6	1,039	47.0
5 persons	14.9	13.2	1,197	1,525	13.7	11.4	-16.8	1,029	43.0
6 persons	7.7	5.4	1,267	1,622	12.2	11.6	-4.9	1,115	44.0
7 persons	3.6	2.2	1,399	1,636	14.3	13.1	-8.4	1,119	40.0

$$(*)\ \textit{Headcount ratio change} = \frac{((1990\text{-}91) - (1980\text{-}81))\ \textit{headcount ratios}}{(1980\text{-}81)\ \textit{headcount ratio}} \cdot 100$$

Table 6. Poverty lines within the partition by Educational level with $\theta=0.4$

Educational level	Population ratio (%)		Poverty lines		Headcount ratio (%)		Headcount ratio (*) change(%)	Lowest poverty lines 1980	
	1980-81	1990-91	1980-81	1990-91	1980-81	1990-91		Value	% Average
1	7.3	4.4	326	416	20.2	17.2	-14.8	297	45.5
2	24.9	21.4	433	538	15.5	14.5	-6.4	425	49.1
3	47.7	38.3	569	680	12.0	11.6	-3.3	558	49.0
4	6.7	14.0	739	784	9.9	9.4	-5.0	724	49.0
5	4.9	7.4	900	981	10.4	11.7	12.5	882	49.0
6	1.5	5.2	778	880	8.5	8.6	1.2	778	50.0
7	3.4	4.6	944	1,076	9.9	8.9	-10.1	888	47.0
8*	3.5	4.6	1,159	1,400	11.3	13.1	15.9	90 IGL_u 80	49.9

$$(*)\ \textit{Headcount ratio change} = \frac{((1990\text{-}91) - (1980\text{-}81))\ \textit{headcount ratios}}{(1980\text{-}81)\ \textit{headcount ratio}} \cdot 100$$

Table 7. Poverty lines within the partition by Socioeconomic category with $\theta=0.4$

Socioeconomic category	Population ratio (%)		Poverty lines		Headcount ratio (%)		Headcount ratio (*) change(%)	Lowest poverty lines 1980	
	1980-81	1990-91	1980-81	1990-91	1980-81	1990-91		Value	% Average
1	6.0	2.8	442	599	14.5	12.3	-15.2	425	48.1
2	5.6	3.6	398	555	15.8	11.6	-26.6	382	48.0
3	31.9	37.4	566	771	8.5	9.0	5.9	566	50.0
4	7.3	6.8	606	785	12.9	10.9	-15.5	533	44.0
5	16.3	8.9	789	1,117	9.5	9.8	3.2	773	49.0
6*	6.2	3.6	1,068	1,189	13.4	16.2	20.9	90 IGL_d 80	49.3
7	0.4	0.9	580	648	18.4	21.0	14.1	crossing	crossing
8	23.4	33.6	410	585	19.3	17.8	-7.8	394	48.0
9	0.9	0.2	630	855	34.8	25.4	-27.0	536	42.5
10	2.0	2.2	479	545	24.2	24.3	0.4	450	47.0

$$(*) \quad \textit{Headcount ratio change} = \frac{((1990\text{-}91) - (1980\text{-}81))\ \textit{headcount ratios}}{(1980\text{-}81)\ \textit{headcount ratio}} \cdot 100$$

Table 8. Poverty lines within the partition by Autonomous Community with $\theta=0.4$

Autonomous Community	Population ratio (%)		Poverty lines		Headcount ratio (%)		Headcount ratio (*) change(%)	Lowest poverty lines 1980	
	1980-81	1990-91	1980-81	1990-91	1980-81	1990-91		Value	% Average
Andalucia	16.0	16.6	495	634	19.5	14.2	-27.2	426	43.0
Aragón	3.5	3.4	568	658	17.3	16.5	-4.6	546	48.1
Asturias	3.2	3.0	559	742	18.2	13.3	-26.9	432	38.6
Baleares	2.0	1.9	599	782	19.5	12.0	-38.5	539	45.0
Canarias	3.2	3.5	534	692	15.7	15.6	-0.6	513	48.0
Cantabria	1.4	1.3	673	717	14.5	10.0	-31.0	633	47.0
Castilla-L	7.3	7.1	518	647	20.1	18.0	-10.4	477	46.0
Castilla-M	4.5	4.5	425	601	19.5	16.5	-15.4	391	46.0
Cataluña	16.2	16.0	643	864	13.2	15.2	15.1	crossing	crossing
Valencia	10.0	10.1	567	647	15.9	15.2	-4.4	533	47.0
Extremadura*	2.8	2.9	388	519	18.9	18.2	-3.7	90 IGL_u 80	49.0
Galicia	7.2	6.9	557	667	17.3	14.6	-15.6	525	47.1
Madrid	12.2	12.6	744	966	15.2	12.0	-21.0	727	48.9
Murcia	2.5	2.5	531	644	16.2	13.2	-18.5	510	48.0
Navarra	1.3	1.3	701	893	14.0	11.7	-16.4	617	44.0
Pais Vasco	5.5	5.4	692	831	12.8	11.0	-14.1	crossing	crossing
La Rioja*	0.7	0.7	563	698	10.8	10.5	-2.8	90 IGL_u 80	47.6
C and M	0.3	0.3	536	561	15.1	15.0	-0.7	536	50.0

$$(*)\quad \textit{Headcount ratio change} = \frac{((1990\text{-}91) - (1980\text{-}81))\ \textit{headcount ratios}}{(1980\text{-}81)\ \textit{headcount ratio}} \cdot 100$$

Table 9. Poverty lines within the partition by municipality size with $\theta=0.4$

Municipality size	Population ratio (%)		Poverty lines		Headcount ratio (%)		Headcount ratio (*) change(%)	Lowest poverty lines 1980	
	1980-81	1990-91	1980-81	1990-91	1980-81	1990-91		Value	% Average
< 2,000 inh.	11.2	7.3	447	537	20.6	18.7	-9.2	411	46.0
2,000-10,000	19.0	19.4	464	608	18.2	15.5	-14.8	427	46.0
10,000-50,000	21.1	22.0	535	682	15.3	14.7	-3.9	514	48.0
50,000-500,000	29.2	31.8	640	772	14.6	13.1	-10.3	602	47.0
> 500,000	19.5	19.5	738	942	16.1	14.9	-7.4	crossing	crossing

$$(*)\quad \textit{Headcount ratio change} = \frac{((1990\text{-}91) - (1980\text{-}81))\ \textit{headcount ratios}}{(1980\text{-}81)\ \textit{headcount ratio}} \cdot 100$$