Income Inequality Comparisons with Dirty Data: The UK and Spain during the 1980s

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Abstract

Inequality comparisons between countries and over time should take into account problems of data imperfection. We examine the contrasting experience of the UK and Spain during the 1980s in terms of the distribution of disposable income. We consider whether the apparent divergence in inequality could be attributable to deficiencies in income data including under-reporting.

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JEL Classification: C13, D63.

1. Introduction and Motivation

The relatively recent availability of comprehensive micro-data on incomes has opened up new possibilities for distributional comparisons over time and across countries. Statistical indices and graphical devices for summarising the income distribution can be applied to entire samples or key subsamples for different societies at different moments in time, and standard tests can be implemented. A small but growing literature has demonstrated the usefulness of such detailed data in estimating levels of inequality, understanding inequality trends over time and comparing inequality across societies.[1] However the practice of using micro-data for distributional comparisons has focused attention upon a number of new methodological issues that have captured the attention of researchers in this field. One of these issues concerns the quality of the income micro-data used in these analyses and on how far cross-country comparisons (or income inequality trends) are affected by the likely problems with data quality. This paper focuses upon the issue of "dirty data" in the context of a particularly interesting recent historical comparison: what happened to inequality in Spain and the UK during the 1980s.

The problem of dirty income data might be attributable to a number of factors. Generally, income micro data derived from sample surveys inevitably includes gross errors, such as those arising from coding or transcribing mistakes or observations that do not really belong to the income data-set. There is also a well-documented problem of poor reliability of the income data for some component income sources, mainly self-employment income and income from capital. In a cross-country perspective, the way in which these (and other) sources of error are likely to affect inequality comparison depends on the nature of the dirt in each country's income data and on how the dirtiness of the data changes over time.

A number of studies have considered the problem of data deficiencies in this context. For example Gottschalk and Smeeding (1998) use a simple model to discuss how dirty data may affect the comparative conclusions drawn from international comparisons based on the quantile ratios[2] and Cowell and Victoria-Feser (1996b, 1998) have addressed the issue in the context of robust statistics. So what can be said from a given inequality comparison across countries or over time in the presence of dirty data? Following the Gottschalk-Smeeding approach one might try to guess the direction of the bias that the different sorts of error could cause. Alternatively, following Cowell and Victoria-Feser's suggestions for systematically trimming distributions, one might try to implement distributional dominance criteria to a variety of modified empirical distributions.

The aim of the present paper is to compare relative income inequality in Spain and the UK over the decade of the 1980's using the cross-sectional micro-economic evidence of the two countries. Our focus is on relative inequality concepts, that is "standard" Lorenz curves and associated mean-independent inequality measures. The received wisdom is that trends in income inequality in the two countries went in opposite directions during the 1980's: while income inequality substantially increased

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[1] See for instance Atkinson *et al.* (1995) or Eurostat (1997).

[2] They show that comparative conclusions are robust to some types of measurement errors. In particular they show that: (i) measurement error that is independent of decile rank affects neither level nor trend in inequality in a single country, nor in cross-national comparisons of inequality; (ii) measurement error that is common across countries does not affect cross-national comparisons of levels or trends; (iii) cross-national comparisons of trends in decile ratios are not affected by measurement error that is either time-invariant or is time varying but common across countries.

in the UK, there was a slight decrease in Spain.[3] However, given these contrasting inequality trends, has the ranking of the two countries been reversed? The comparative evidence for the 1980s suggests that around 1980 Spain was more unequal than the UK and that the ranking between the two countries remained unchanged until the middle of the decade. During the second half of the 1980s the ranking appears to have changed. However, one might wonder whether these strong comparative results are robust. Or are they - at least in part - artefacts of the data-quality problems that are known to afflict certain parts of the income distribution? Would the sharply contrasting distributional history of Spain and the UK disappear if the data were treated appropriately to allow for data contamination or measurement error? Our comparative analysis focuses on these issues concerning Spanish-UK distributional comparisons using a number of techniques for treating dirty data, including the methodology suggested by Cowell and Victoria-Feser (1998).

The paper is organised as follows. Section 2 addresses the issues of distributional comparison in the presence of dirty data. Section 3 introduces the data and definitions used in this study while Section 4 discusses methodological issues. Our results are presented in Sections 5 and 6: Section 5 focuses on the UK-Spanish comparative analysis using the whole distribution in both countries and Section 6 studies the robustness of the comparative results to trimming. Finally, Section 7 concludes.

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[3] See the revision of the empirical evidence in Section 5 below.

2. Distributional Comparisons and Dirty Data

A practically minded approach to comparisons of income distribution should take into account the possibility that there are imperfections in the data. Apart from standard issues of sampling variability we should allow for the possibility that simple things can go wrong in the best conducted survey procedures: for example data may be misreported, misrecorded or just missing. This unfortunate fact of life raises three separate but related questions:

- How do standard tools of distributional analysis behave in the presence of certain types of data imperfection?
- What can we deduce about the "true" income distribution on the assumption that the data imperfections take some specific form?
- What practical steps could be taken to mitigate the effects of data imperfection on the conclusions to be drawn from comparative studies of income distribution?

We can usefully model imperfections in the data in one of two complementary approaches: data contamination or measurement error (Cowell, 1998). In order to understand the basic elements of these two approaches we introduce some simple notation. Denote the income variable by x and let it be distributed in the population according to a distribution function F; this means that for any valid income level x_0 the value $F(x_0)$ denotes the proportion of the population that has income $x \leq x_0$. By definition $F(x)$ is non-decreasing in x and $0 \leq F(x) \leq 1$.

2.1. Data Contamination

Assume that the "true" distribution of income F is not directly observable, but instead one observes a mixture distribution

$$F_{\delta} := [1-\delta]F + \delta H \quad \textbf{(1)}$$

where H is an "alien" contamination distribution and δ indicates the importance of the contamination. In principle the distribution H can be arbitrarily specified; a typical example is where H consists of a series of point masses, like "spots" on the true distribution.

It is known that some tools for the measurement of inequality or for ranking distributions are catastrophically sensitive to some types of data contamination. This means that for infinitesimal contamination - for arbitrarily small values of δ - the performance of the tool is entirely dominated by the properties of the contamination rather than the true distribution. As a simple example, consider the behaviour of the coefficient of variation: it is well known that this index is very sensitive to high incomes (Champernowne and Cowell 1998, Cowell 1995, Sen and Foster 1997). Accordingly it is not surprising to find that, even in quite large samples, one or two very large income observations can "drive" the estimate of the coefficient of variation. However, this behaviour is not confined to one or two idiosyncratic inequality measures; it is a widespread problem associated with inequality indices and ranking tools (Cowell and Victoria-Feser, 1996a).

2.2. Measurement Error

As an alternative approach, suppose that it is impossible to measure an individual's "true" income x without error, but rather one finds measured income given by

$$y = x + \upsilon \quad \textbf{(2)}$$

where υ is a random variable. Rather than the true distribution, it is the distribution of y that is actually observed. This type of model is appropriate for data problems such as systematic under-reporting because of fraud: in this case it is reasonable to suppose that υ may be correlated with x. This formulation may also be appropriate for modelling other phenomena that are relevant to the analysis of income distributions. For example a routine practical difficulty with which the applied researcher must deal is that of income variability and the arbitrary choice of time period over which income is defined. In some cases (such as the UK data discussed below) weekly income is used as a proxy for annual income and this gives rise naturally to a "measurement - error" model of income where – in equation (2) – x plays the role of "permanent" income and υ is a transitory component.

2.3. Methods for Treatment

The approaches mentioned in subsections 2.1 and 2.2 are complementary and may lead to similar insights on the treatment of problems of data imperfection. From each approach one can derive a number of procedures which may lead to more satisfactory results on inequality ranking and estimates of inequality indices.

Inequality Components

The point contamination model in subsection 2.1 suggests the following approach in terms of inequality analysis. Let $I(F)$ denote the inequality of a particular income distribution F according to some specified inequality index I. Then it may be possible to carry out a decomposition of observed inequality into true and contamination components of the form

$$I\left(F_{\delta}\right) := w_1 I(F) + w_2 I(H) + I_{\mathrm{B}} \quad \textbf{(3)}$$

where w_1 and w_2 are weights which depend upon δ, and I_{B} represents a "between-group" or "between-distribution" inequality component and depends upon δ and the means of F and H. There is a fairly large class of inequality measures which will permit an exact decomposition of the sort implied by (3), or by simple transformation of (3); even so, this broad class would exclude some popular measures such as the Gini coefficient and ranking tools such as the Lorenz criterion.

The approach of section 2.2 suggests a complementary treatment of the components of inequality. In this case one breaks down the structure of inequality as follows

$$I\left(F^{(y)}\right) = \omega_1 I\left(F^{(x)}\right) + \omega_2 I\left(F^{(\upsilon)}\right) + \omega_3 \operatorname{cov}(x, \upsilon) \quad \textbf{(4)}$$

where ω_1, ... ,ω_3. are weights which depend upon the means of x and υ, and "cov" denotes the covariance of "true" income and its error component. The difficulty with the appealingly simple specification (4) is that very few inequality measures are capable of being decomposed in this way,[4] so that its value as a practical tool, rather than as an illustrative device, is decidedly limited.

Trimming

Consider the problem of whether the distribution for country A really Lorenz-dominates that for country B in a case where we suspect that there may be some contamination in one or other country's data. One of the difficulties of working with data that are suspected of contamination is that we may have little or no information about the form of, say, the distribution in equation (1). However we may be able to say something (a) about the validity of distributional comparisons under certain hypothesised types of contamination, and (b) about the parts of the distribution where distributional comparisons are likely to be particularly sensitive to a small amount of contamination from an arbitrary distribution. Point (b) can be easily addressed: intuitive reasoning suggests, and formal analysis confirms, that random "spots" of contamination have a relatively high probability of changing the outcome of a distributional comparison if the spots occur in either of the tails of the distribution rather than elsewhere. Accordingly, in the absence of any other specific information about the contamination distribution it is appropriate to examine comparisons of A and B under a "balanced trim" of the distributions: will the A-versus-B Lorenz comparison be altered by the removal of 0.5%, 1%, … of observations from each tail of the distribution?

Alternatively – point (a) above – it may be that one has good reason to suppose that the contamination is generated by an economic phenomenon that is much more likely to affect only one tail of the distribution. For example small or medium-sized incomes may be systematically misreported as zero because of fraud, while certain types of income, such as property income which is more important in upper income groups, may be under-reported. In these cases an "unbalanced" trimming of the distributions may be appropriate. Will the A-versus-B Lorenz comparison be altered by the removal of 0.5%, 1%, … of observations from the lower tail of each

[4] In effect one is limited to the GE(2) index (used below) and ordinally equivalent indices such as the coefficient of variation.

distribution?

Collateral Information

One of the advantages of micro-data sets is that it is possible to use information other than income to throw some light on the picture of distribution in cases where one suspects that the income data are unreliable. This collateral information may be about personal characteristics or about economic choices made by the income receiver. A classic example of this is the treatment of the self-employed. Given that there is a strong presumption that self-employment provides the opportunity for tax evasion and consequent misreporting of income, there is a good case for using an indicator of self-employment activity as a tool for screening the data, and for treating subsamples of the self-employed separately.

2.4. Distributional Comparisons

Given that we have some potentially useful ways of dealing with data sets that may have been affected by contamination and measurement error, what issues may arise when applying them to distributional comparisons over time and between countries? Clearly we have to take account of country-specific problems - are both A and B affected by data imperfection? Are they both affected by data imperfection in the same way? – and time-specific component errors. One approach is to make a number of alternative extreme assumptions in order to set bounds on the conclusions that may be drawn from the imperfect data sets.

3. Data issues

Our analysis is based on household micro-data from national surveys that took place at the beginning of the 1980s and 1990s.

Spain

The Spanish surveys used are the *Encuesta de Presupuestos Familiares* (EPF) for the years 1980-81 and 1990-91. The EPF survey is carried out periodically by the Spanish statistical office INE (*Instituto Nacional de Estadística*) and its primary purpose is to collect expenditure information for constructing the weights for the Retail Price Index. However, it also collects data on a number of sources of income, both in cash and in kind, as well as some other information on household socio-economic characteristics. The sample in each of these surveys represents the total private household population in Spain[5] in the respective years, and it contains around 24,000 households representing 10 million private households in 1980-81 and over 21,000 households representing over 11 million private households in 1990-91. Grossing up weights are provided by INE for both surveys to ensure that the sample results are statistically representative of the population.

The UK

The UK surveys are those of *Households Below Average Income* (HBAI) for years 1979 and 1990-91. The HBAI series is a useful hybrid for distributional analysis in the UK. The data are specially constructed using the *Family Expenditure Survey* as a base, adjusting where appropriate using information from the *Survey of Personal Incomes,* conducted by the Inland Revenue, to correct for under-reporting of incomes at the upper end of the income distribution. The sample size in 1979 is approximately

[5] The survey covers both mainland Spain and its islands. The cities of Ceuta and Melilla are excluded in this analysis.

18,000 individuals, and the pooled sample for 1990/91 is 30,000 individuals. Data are available on household size and composition, demographics, employment status, housing ownership and housing costs, receipt of different state transfers, both in cash and in kind, and different sources of income, both in cash and in kind. Grossing up weights derived from Census data ensure the each survey is representative of the population in each year.

Problems of comparison

Differences in the way income data are collected may have a direct impact upon apparent differences in inequality between the two countries. Four types of difference are relevant here.

The first concerns the period over which income data are collected. In the Spanish survey, the data is collected on an annual basis, whereas in the UK income amounts are weekly. As we noted earlier, we would expect higher income variability the shorter the income measurement period.

A second, related, source of error refers to the accuracy of individual responses. As noted by Mercader (1995), respondents in the Spanish survey are asked (over an interview period of a week) about the income received during the last 12 months. As a result the answer may be inaccurate — people may forget that they have done occasional work and under-record the true earned income. Evidence of this is the fact that income data show a much higher frequency at the rounded quantities (millions or hundreds of thousands of pesetas) than at other income values. This source of bias might be less important in the UK case, where the interview period and the time period coincide.

Thirdly, the detail of the income questionnaires may also differ across countries. In general, the income questionnaires are much more detailed in the UK than in Spain. The Spanish 1980 survey contains one main table that is used to record the eight different sources of income for up to four household members, extended to twenty-one income sources in the 1990-91 survey. In the UK, (following Atkinson *et al*, (1983), referring to the FES), the Income Schedule for each person had 81 questions specifically about income. Both Spanish surveys have a similar interview structure although the 1990-91 survey notably extends the income questionnaire (see the Appendix for more detail).

Finally, it is also known that systematic under-reporting, particularly among self-employed, and of capital income is important in both countries. In the UK case under-reporting in the *Family Expenditure Survey* is largely overcome through the use of upper income data from the *Survey of Personal Incomes*, collected by the Inland Revenue[6]. The Spanish survey data does however show some larger discrepancies with national accounts data. For example the coverage of wages and salaries by the EPF is around 70-80% of the NA figures, in each of the two years. Wider gaps occur for self-employment income, property income and some forms of government transfers[7].

4. Methodological Issues

Our analysis is based on equivalised household disposable income, but the income-

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[6] See DSS (1993) for more details.

[7] For a more detailed description of the divergences between income aggregates in the EPF and in the National Accounts see Mercader-Prats (1995), Sanz (1996) and Oliver-Alonso (1997).

receiving unit is the individual. This method is appropriate for an individualistic, welfare-consistent approach to the analysis of income distributions. It requires both an adjustment to income (equivalisation) and weighting of each household. To take account of the economies of scale within the household we use a simple equivalence scale: household income is adjusted by the square root of household size.[8] The choice of equivalence scale can lead to differing estimates of income inequality, and so different rankings, because of different demographic characteristics between countries or across time[9]. Estimates are computed weighting each individual in the household equally, assuming an equal income pooling among the different household members.

The definition of income used in our analysis includes the main components of income: net earnings from employment, net profit from self-employment, private and state pensions and benefits and investment income, as well as the cash value of certain forms of income in kind. From these are deducted income tax and social security contributions. This income definition is known as “Income Before Housing Costs” in the UK as expenditure on housing is not deducted. This is similar to the income concept provided by the Spanish survey data. See the Appendix for details.

5. Inequality Comparisons

This section provides a comparative perspective of inequality trends in the UK and Spain during the 1980s. National studies on income inequality trends show that inequality in Spain fell during the 1980s whereas UK income inequality rose. Del Río

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[8] This equivalence scale corresponds to s=0.5 for the Buhmann et al parametric form - Buhmann *et al.* (1988), Coulter *et al* (1992). This equivalence scale has been recently used as the basis for international comparisons -Atkinson *et al.* (1995).

[9] See Burkhauser, Smeeding and Mertz (1996), Cowell and Mercader-Prats (1998) and Garner, Ruiz-Castillo and Sastre (1998) on the sensitivity of international comparisons of income inequality to choice of equivalence scales.

and Ruiz-Castillo (1996) provide a robust analysis of the evolution of relative and absolute inequality and social welfare in Spain over the period. Inequality trends in Spain are also studied in INE (1996) and Mercader (1997). For detailed studies of UK income inequality see Cowell, Jenkins and Litchfield (1996), Goodman and Webb (1994), Hills (1994, 1998) and Jenkins (1994) among many others.

Comparative work including both countries has also appeared in a number of recent studies: see Ayala *et al* (1993), Zaidi and de Vos (1998), Smeeding and Gottschalk (1995), and Gottschalk and Smeeding (1998) amongst others[10]. Each of these studies show that inequality in the UK and Spain over the 1980s moved in opposite directions, although it is less clear how this has affected the ranking of the two countries. According to all of these works, inequality in Spain in 1980 was higher than in the UK. Evidence of a change in ranking appears late in the decade: Ayala *et al* (1993) find inequality in 1986 in the UK to be still lower than inequality in 1990 in Spain, but Zaidi and de Vos (1998) find inequality higher in the UK in 1988 than in Spain in 1990[11]. Finally, estimates produced by Gottschalk and Smeeding (1998) suggest a Gini coefficient in 1990 for Spain that was slightly lower than the one for the UK in 1991[12].

We begin with a comparison of trends over time using standard Lorenz curves. We then present a set of summary measures of inequality paying particular attention to the presence of zero and low incomes in each survey, and the role of the trends in self-

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[10] Ayala *et al* (1993) use data from the Luxembourg Income Study which uses the EPF for Spain and the FES for the UK. Zaidi and de Vos (1998)) estimates are based on expenditure.

[11] According to Zaidi and de Vos (1998) the Spanish and UK Lorenz curves coincide at the first decile in the two countries. Ayala *et al* (1993) find that the UK 1986 curve Lorenz-dominates the one for Spain 1990.

[12] These latter estimates are based on incomes that are bottom (1%) coded at mean disposable income

employed income.

5.1. An Overview

At the beginning of the 1980s the Spanish income distribution appeared to be worse - in terms of inequality - than that of the UK, but the deterioration in the UK distribution over the 1980s was sufficient to reverse the two countries relative positions. This is demonstrated by plotting Lorenz curves for each country in each year, as shown in Figure 1 below.

The graph shows that the Lorenz curve for Spain shifted inwards slightly between 1980 and 1990, whereas the UK Lorenz curve shifted outwards, resulting in a re-ranking of the two countries. The UK distribution Lorenz-dominates the Spanish distribution at the beginning of the period, showing that UK inequality was unambiguously lower than Spanish inequality. By the end of the period the situation was reversed with income inequality in the UK being unambiguously higher than in Spain. Hence our initial analysis supports the evidence of other studies described in Section 5 above.

Our estimates suggest therefore that the clear worsening of the UK distribution by the late 1980's would have caused a re-ranking of the two countries, a re-ranking that would not have been evident by the mid-80's. Our objective in what follows is to test how robust our conclusions on the comparative results are to the presence of the type of dirty data described above. We begin with the problem of zero incomes.

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and top (1%) coded at 10 times median disposable income.

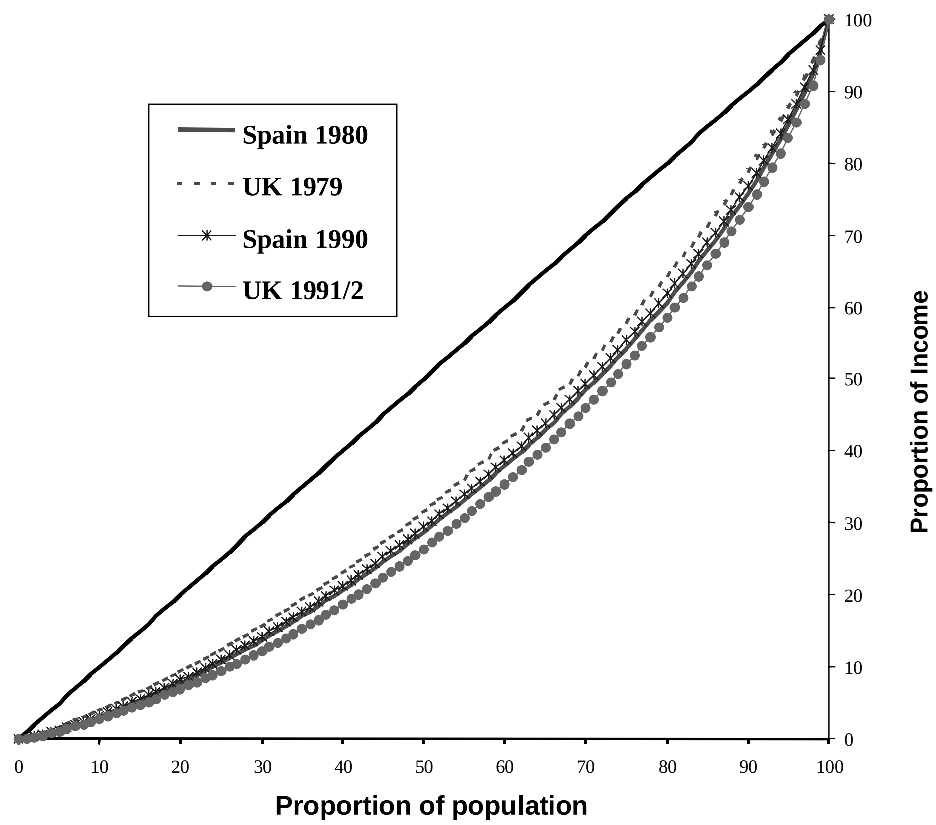

Figure 1: Lorenz curves for Spain and the UK, beginning and end of the 1980s.

5.2. Zero incomes

Zero incomes pose a number of problems for researchers in the field of income distribution. First, do they have any meaning, in principle? The answer to this question depends largely on the meaning attributed to “income” in a particular survey or study. Some definitions of income might imply that a non-positive value is meaningless in that it is supposed to be a comprehensive measure of individual welfare and a zero income value would imply starvation. In other cases it is acknowledged that there may be some sources of income that for some reason are not covered by the study, so that recorded income may quite reasonably be zero. Second, zero incomes cause a technical problem for inequality measurement since some summary measures automatically assume their maximum values (or are unbounded) in the presence of one or more zero income values. For example, the Generalised Entropy measure with parameter $\alpha=0$ and the Atkinson measure with parameter $\varepsilon=1$ attain their maximum value in the presence of zero incomes.

How is one to proceed when zero incomes are present? Firstly it is possible that these incomes are merely errors, particularly when the reporting period in a survey is a whole year, as in the Spanish data. Zero incomes are more plausible in the UK data since the reporting period is only a week.

In our data the number of zero incomes is relatively small and, as expected, it is higher for the UK than for Spain: 0.2 and 0.1 per cent of the household population in the Spanish 1980 and 1990 surveys respectively, and 0.2% in 1979 and 0.4% in 1990/91 in the UK surveys. In order to study the effect of zero incomes on our inequality estimates, we treat households which report zero incomes in three alternative ways: first their incomes are left unchanged in the inequality estimates, which causes some measures to become effectively meaningless; secondly these households are dropped from the analysis; as a third alternative they are assigned a low income value, one quarter of the contemporaneous mean. Table 1 below shows a set of summary measures for each country in each year for each of these three procedures.

Table 1: Inequality in Spain and the UK during the 1980s.						
	1980			***1990***		
	All cases[1]	*Zero incomes dropped*	*Zero incomes imputed*[2]	*All cases*[1]	*Zero incomes dropped*	*Zero incomes imputed*[2]
			Spain			
Gini	0.3134	0.3127	0.3130	0.2998	0.2994	0.2996
GE0	∞*	0.1700	0.1705	∞*	0.1554	0.1556
GE1	0.1760	0.1749	0.1753	0.1580	0.1575	0.1577
GE2	0.7368	0.7356	0.7362	0.6705	0.6700	0.6703
ATK0.5	0.0825	0.0815	0.0817	0.0748	0.0743	0.0744
ATK1.0	1.0000*	0.1563	0.1567	1.0000*	0.1439	0.1441
ATK1.5	1.0000*	0.2305	0.2311	1.0000*	0.2150	0.2153
			United Kingdom			
Gini	0.2660	0.2646	0.2654	0.3466	0.3443	0.3466
GE0	∞*	0.1174	0.1183	∞*	0.2073	0.2243
GE1	0.1172	0.1153	0.1160	0.2134	0.2098	0.2133
GE2	0.1617	0.1605	0.1305	0.4069	0.4039	0.4069
ATK0.5	0.0580	0.0563	0.0567	0.1012	0.0979	0.1008
ATK1.0	1.0000*	0.1107	0.1116	1.0000*	0.1872	0.2009
ATK1.5	1.0000*	0.1659	0.1674	1.0000*	0.2997	0.3682

Note 1: * Inequality measure takes its maximum value in the presence of zero incomes.

Note 2: Individuals with zero incomes in Spain and the UK were imputed a real income of 25% of mean income.

As suggested by our Lorenz curves, the two countries experienced different trends in inequality over the period. Inequality as measured by all indices, and regardless of the method used for dealing with zero incomes, fell slightly in Spain between 1980 and 1990, and rose dramatically between 1979 and 1990/91 in the UK. The ranking by these measures of the two countries also changed, with inequality in Spain being higher than in the UK at the beginning of the 1980s, but lower by 1990. This is true for all measures and for each of the methods adopted for the treatment of zero incomes, with the exception of that indicated by GE2 (recall that GE2 is especially sensitive to incomes in the upper tail of the distribution).

5.3. Low Incomes

If there is a case for looking critically at incomes recorded at zero there is probably a reasonable case for also looking at other low incomes. But what are “low” incomes? For some cross-country comparisons it might be interesting to use the poverty line as a reference point, but there is no official poverty line in either the UK or Spain. However it has become common practice to interpret “low income” as some proportion of mean income (DSS, 1993, Eurostat, 1997). In Figures 2 and 3 we can see the distribution of low incomes in the UK and Spain in the two years, where "low income” is interpreted as being below 25% of the contemporary mean income[13]. We plotted the histogram for each year for incomes below 25% of the contemporary mean: £40 per week (roughly £2000 p.a.) for the UK and 250,000 pesetas for Spain. The two graphs are strikingly different: that for the UK consists of a spike in the neighbourhood of zero which does not appear in the Spanish distribution. This is almost certainly due to the different reference periods, which make zero incomes a more plausible possibility for a one week period, but less so for Spain where the reference period is the whole year.

[13] We also examined the impact of a number of possible specifications of this imputed low income: see the discussion in the Appendix.

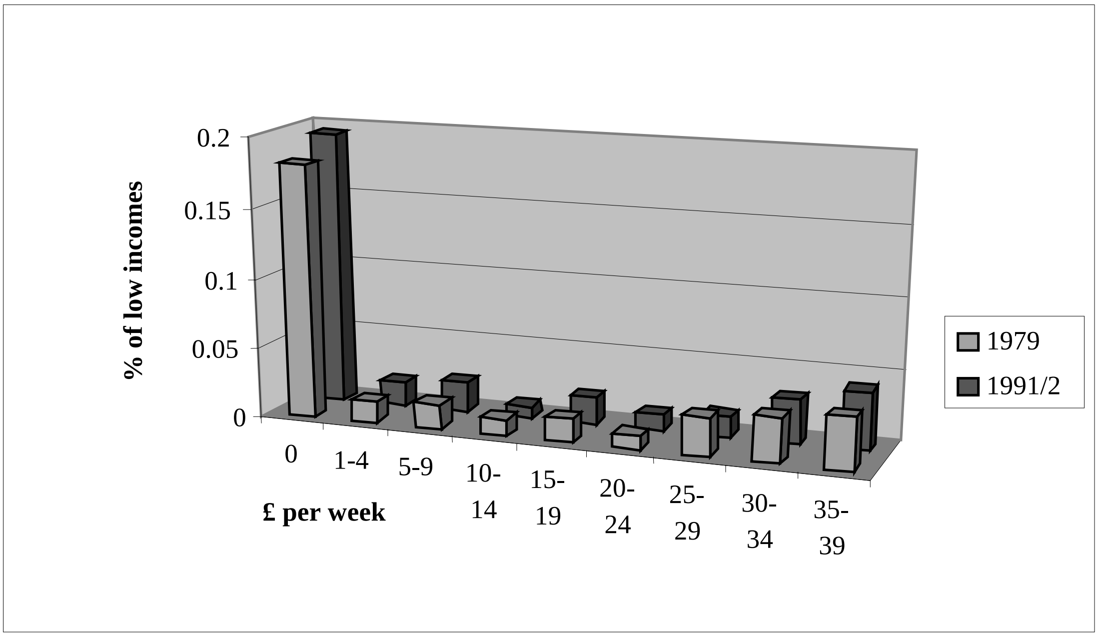

Figure 2: Low Incomes in the UK

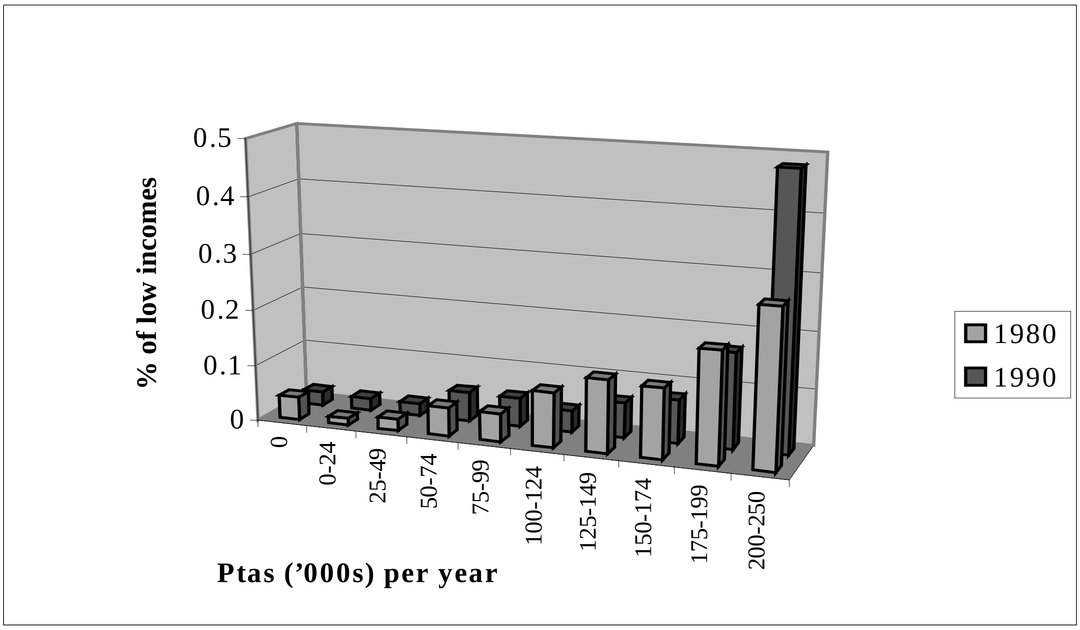

Figure 3: Low Incomes in Spain

Table 2 shows the effect on inequality of imputing low incomes at a value equal to the poverty line. This is equivalent to the practice of "bottom coding" at the lower-bound income implied by the poverty line.

Table 2: Effect of imputing low incomes to the "poverty line"

	UK		Spain	
	1979	**1990/91**	**1980**	**1990**
Gini	0.2646	0.3427	0.3107	0.2977
GE(0)	0.1143	0.1953	0.1617	0.1478
GE(1)	0.1147	0.2069	0.1720	0.1549
GE(2)	0.1298	0.2816	0.7330	0.6675
ATK(0.5)	0.0556	0.0954	0.0793	0.0723
ATK(1)	0.1080	0.1774	0.1493	0.1374
ATK(1.5)	0.1574	0.2487	0.2129	0.1973

Notes:

1 Assumed "poverty line" income is 25% mean income

2 "Low incomes" means all those below the "poverty line".

5.4. Misreporting of self-employment income

Dirty data, however, do not only occur at low income levels. Under-reporting of certain types of income, such as self-employment incomes, the imputed value of consumption of own production and income from capital, means that it is not only zero and low incomes that need to be accounted for. Section 6 below addresses the problem of data contamination in both tails of the income distribution and tests the robustness of the results to trimming. Here we complement this information by studying inequality by sub-populations, namely the self and non-self employed households. Table 3 shows some simple statistics and some inequality measures for these two populations. A household is considered to be self-employed if the head and/or the spouse are classified as self-employed in the respective surveys[14]. The percentage of households that are self-employed is higher in Spain than in the UK although the relative weight of this population increases in the UK and decreases in Spain over time. In both countries, the self-employed appear to have an average income above that for the non-self-employed. In the UK the self-employed are over–represented in the zero income population (in 1979 53% of the zero income cases are self-employed and 66% in 1990), whereas in Spain these percentages are 0 in both years.

If we drop the self-employed from the samples in each year and in each country we can examine trends in inequality amongst the remainder of the population, which, it may be argued, report their income more reliably. The trends in inequality among the non self-employed for each country remain the same, that is, inequality fell in Spain during the 1980s but rose in the UK. Furthermore the ranking of the two countries remains almost unchanged with the Spanish income distribution being more unequal than the UK one at the beginning of the decade and less unequal at the end. As in the analysis above of the whole population the only measure which does not support this pattern is GE(2).

[14] In the Spanish 1980 survey the self-employment status of the head only is known, whereas the 1990-91 survey records the status of all individuals. In the UK surveys the head and spouse record their status.

Table 3: Inequality and the Self-Employed – Spain and the UK

Spain	**1980**		**1990/91**	
	Self-employed	*Not Self-employed*	*Self-employed*	*Not Self-employed*
Pop share	16.9	83.1	12.4	87.6
Mean income	369,497	357,691	1,136,955	1,004,549
Gini	0.3331	0.3092	0.3071	0.2977
GE(1)	0.1952	0.1719	0.1719	0.1542
GE(2)	0.7181	0.7411	0.7025	0.6607
ATK(0.5)	0.0908	0.0798	0.0797	0.0728
UK	**1979**		**1990/91**	
	Self-employed	*Not Self-employed*	*Self-employed*	*Not Self-employed*
Pop share	6%	94%	10%	90%
Mean	159	140	219	183
Gini	0.3294	0.2606	0.4242	0.3347
GE(1)	0.1842	0.1115	0.3313	0.1950
GE(2)	0.2076	0.1237	0.4462	0.2555
ATK(0.5)	0.0954	0.0551	0.1639	0.0922

6. Robustness to trimming

We saw in section 5 that the ranking of the two countries was reversed during the 1980s, and that this result was generally robust to the treatment of zero incomes, low incomes and the separate treatment of the self-employed. In this section, we investigate the use of trimming to remove potential contamination from mis- or under-reporting of incomes, for example of capital income, in the tails of the distribution. Two trimming factors are used: 1% and 5% in both one-tailed and two-tailed exercises. Table 4 below shows the possible combinations.

Table 4: Trimming the tails of the income distribution.

	Upper Tail		
Lower Tail	**0%**	**1%**	**5%**
0%	No trimming	Single tailed trimming	Single tailed trimming
1%	Single tailed trimming	Two tailed trimming	
5%	Single tailed trimming		Two tailed trimming

The "No trimming" results are those presented in Section 5 above: regardless of how we treat zero incomes, the result holds that at the beginning of the 1980s the UK Lorenz-dominated Spain (i.e. inequality in Spain was higher) but that by the end of the decade the situation was reversed.

When the distribution is trimmed equally at both ends we refer to this as balanced trimming (a 1 percent balanced trim means that 1 percent is removed from each tail of the distribution: 2% overall). Unbalanced trimming means that only one end is trimmed: either the top or the bottom. We present decile-level Lorenz co-ordinates for all possible trimming levels - see Tables 5 and 6 below[15]. The tables show that whatever trimming factor we use and whether we trim both tails or just one, the ranking results of section 5 hold. That is, inequality was lower in the UK than in

[15] Inspection of percentile-level cumulative income shares confirms the picture.

Spain at the beginning of the 1980s, but the ranking switched during the period to leave inequality in the UK higher than in Spain.

Table 5. Spain and the UK at the beginning of the 1980s: Cumulative income shares

	Whole Distribution	*Trimming: α=1%*			*Trimming: α=5%*		
		Both tails	*Lower tail*	*Upper tail*	*Both tails*	*Lower tail*	*Upper tail*
				Spain			
10	2.99	3.39	3.27	3.10	4.28	3.88	3.27
20	7.74	8.37	8.08	8.02	9.81	8.93	8.46
30	13.66	14.52	14.02	14.14	16.44	15.02	14.89
40	20.66	21.76	21.03	21.37	24.08	22.07	22.47
50	28.71	30.07	29.07	29.70	32.76	30.11	31.18
60	37.91	39.53	38.23	39.19	42.52	39.20	41.05
70	48.43	50.32	48.71	50.01	53.53	49.56	52.25
80	60.70	62.85	60.93	62.61	66.10	61.62	65.10
90	75.84	78.17	75.98	78.02	81.02	76.43	80.37
100	100.00	100.00	100.00	100.00	100.00	100.00	100.00
				UK			
10	3.86	4.26	4.17	3.94	4.95	4.60	4.13
20	9.20	9.76	9.55	9.40	10.92	10.20	9.82
30	15.60	16.31	15.97	15.93	17.87	16.74	16.61
40	23.00	23.85	23.37	23.47	25.76	24.19	24.43
50	31.43	32.42	31.79	32.05	34.62	32.63	33.29
60	41.03	42.15	41.35	41.81	44.59	42.16	43.33
70	51.89	53.14	52.18	52.85	55.73	52.90	54.63
80	64.39	65.74	64.61	65.51	68.32	65.18	67.45
90	79.07	80.44	79.20	80.31	82.72	79.55	82.20
100	100.00	100.00	100.00	100.00	100.00	100.00	100.00

	Whole Distribution	Trimming: α=1%			Trimming: α=5%		
		Both tails	*Lower tail*	*Upper tail*	*Both tails*	*Lower tail*	*Upper tail*
				Spain			
10	3.22	3.61	3.50	3.32	4.50	4.12	3.49
20	8.18	8.78	8.51	8.43	10.16	9.34	8.86
30	14.22	15.01	14.57	14.65	16.86	15.53	15.38
40	21.30	22.33	21.67	21.95	24.54	22.68	22.99
50	29.44	30.68	29.80	30.32	33.22	30.77	31.71
60	38.72	40.19	39.05	39.85	42.99	39.99	41.58
70	49.40	51.08	49.69	50.79	54.07	50.52	52.81
80	61.82	63.72	62.05	63.49	66.72	62.71	65.71
90	76.81	78.84	76.95	78.70	81.47	77.39	80.87
100	100.00	100.00	100.00	100.00	100.00	100.00	100.00
				UK			
10	2.75	3.20	3.05	2.88	3.97	3.51	3.07
20	6.93	7.61	7.27	7.25	8.89	7.92	7.75
30	12.17	13.12	12.55	12.72	14.94	13.39	13.53
40	18.64	19.90	19.04	19.47	22.21	20.00	20.64
50	26.37	27.96	26.77	27.54	30.72	27.76	29.12
60	35.42	37.35	35.78	36.96	40.51	36.74	38.99
70	46.00	48.30	46.32	47.96	51.78	47.19	50.41
80	58.54	61.23	58.80	60.96	64.85	59.51	63.75
90	73.88	76.92	74.05	76.75	80.33	74.50	79.65
100	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 6. Spain and the UK at the end of the 1980s:

Cumulative income shares

7. Conclusion

This paper has compared the evolution of income inequality in Spain and the UK during the 1980s and has examined the robustness of distributional comparisons in the presence of potentially dirty data.

There is much evidence to suggest that income inequality in Spain at the beginning of the decade was higher than in the UK, but that by 1990 the combination of a fall in inequality in Spain and a rise in inequality in the UK led to a re-ranking of the two countries.

Because survey data - especially data on incomes - is often contaminated with errors arising from mismeasurement, misreporting or misrecording, comparisons between countries and over time are made particularly difficult. We investigated the possible impact of four types of dirty data on the comparison of inequality trends in the two countries: the recording of zero incomes, the under-reporting of incomes in the lower tail, misreporting of income by the self-employed and the misreporting of incomes in both the tails. There are a number of ways these problems can be overcome, by using extra information in the data set or by the controlled trimming of the distribution. We applied both techniques: imputing extra income to those households which reported zero or very low incomes (25% of the contemporary mean); splitting the sample into the self-employed and the non-self-employed population and systematically trimming the extremes of the distribution.

Whatever reasonable steps are taken to allow for the "dirty data problem" the conclusion is inescapable: inequality in the UK rose so much during the 1980s that the ranking of the two countries was unambiguously reversed. This conclusion cannot be dismissed as an artefact of methods of data collection or data treatment in either country.

8. References

Atkinson, A.B. and Micklewright, J. (1983) "On the reliability of income data in the family expenditure survey 1970-1977", *Journal of the Royal Statistical Society,* Series A, vol 146, pp. 33-61.

Atkinson, A. B., Rainwater, L., and Smeeding, T. M. (1995), *Income Distribution in OECD countries*, Social Policy Studies, nº18, OECD.

Ayala, L, Martínez, R. and Ruiz-Huerta, J. (1993), “La distribución de la renta en España: Una perspectiva comparada.” *Actas del I Simposio sobre Igualdad y distribución de la Renta y la Riqueza*, Vol.II, Fundación Argentaria, Madrid.

Buhmann, B., Rainwater, L., Schmaus, G. and Smeeding, T. M. (1988), “Equivalence scales, well-being, inequality and poverty: Sensitivity estimates across ten countries using the Luxembourg Income Study (LIS) database”, *The Review of Income and Wealth*, **34**, 115-142

Burkhauser, R.V., Smeeding, T. and Merz, J. (1996) “Relative Inequality and Poverty in Germany and the United States using Alternative Equivalence Scales” *The Review of Income and Wealth* **42** 381-400.

Champernowne, D. G. and Cowell, F. A. (1998), *Inequality and Income Distribution*, Cambridge University Press, Cambridge.

Coulter, F. A. E., Cowell, F. A. and Jenkins, S. P. (1992), “Equivalence scale relativities and the extent of inequality and poverty”, *Economic Journal*, **102**, 1067-1082.

Cowell, F. A. (1995), *Measuring Inequality*, Harvester Wheatsheaf, Hemel Hempstead (2nd edn).

Cowell, F. A. (1998), “Measurement of Inequality” , *in* Atkinson, A. B. and Bourguignon, F. (eds), *Handbook of Income Distribution*, North Holland, Amsterdam, chapter 2.

Cowell, F. A., Jenkins, S. P. and Litchfield, J. A. (1996) , “The changing shape of the UK income distribution: kernel density estimates”, in Hills, J. (ed) *New Inequalities: The changing distribution of income and wealth in the United Kingdom.* CUP, Cambridge.

Cowell, F.A. and Mercader-Prats, M. (1998) “Equivalence Scales and Inequality” *Distributional Analysis Discussion Paper*, No 27 STICERD, London School of Economics, London WC2A 2AE.

Cowell, F. A. and Victoria-Feser, M.-P. (1996a), “Robustness Properties of Inequality Measures”, *Econometrica*, **64**, 77-101.

Cowell, F. A. and Victoria-Feser, M.-P. (1996b), “Welfare judgements in the presence of contaminated data”, *Distributional Analysis Discussion Paper* No. 13, STICERD, London School of Economics, London WC2A 2AE.

Cowell, F. A. and Victoria-Feser, M.-P. (1998), “Distributional Dominance with Dirty Data”, *Working Paper*, STICERD, London School of Economics, London WC2A 2AE.

Del Río, C. and Ruiz-Castillo, J. (1996), "La desigualdad de los recursos", in *La Desigualdad de los Recursos, II Simposio sobre Igualdad y Distribución de la Renta y la Riqueza*, Vol.6.

DSS (1993), *Households Below Average Income: A Statistical Analysis 1979-1990/91.* London HMSO

EUROSTAT (1997), “Income distribution and poverty in EU12-1993”, *Statistics in Focus. Population and Social Conditions*, no 6.

Garner, T., Ruiz-Castillo, J. and Sastre, S. (1998) “The Influence of Demographics and

Household Specific Price Indices on Expenditure-based Inequality and Welfare”, *mimeo*.

Goodman A. and Webb, S. (1994), “For Richer and Poorer: The changing distribution of income in the United Kingdom 1961-91”, IFS Commentary No. 42. London: IFS.

Gottschalk, P. and Smeeding, T. M. (1998), “Empirical Evidence on Income Inequality in Industrialized Countries", *in* Atkinson, A. B. and Bourguignon, F. (eds), *Handbook of Income Distribution*, North Holland, Amsterdam, chapter 3.

Hills, J. (1994), *New Inequalities: the changing distribution of income and wealth in the UK* Cambridge: CUP.

Hills, J. (1998), *Income and Wealth: the Latest Evidence*, Joseph Rowntree Foundation, York.

INE (1996), *Encuesta de Presupuestos Familiares, Desigualdad y Pobreza en España*, Estudio basado en las Encuestas de Presupuestos Familiares, 1973-74, 1980-81 and 1990-91.

Jenkins, S. P. (1994), “Winners and Losers: A portrait of the UK income distribution during the 1980s”, University College of Swansea, Department of Economics Discussion Paper 94-07. Swansea: University College of Swansea.

Mercader-Prats, M. (1995), *Peut-on Mesurer la Pauvreté? Aspects méthodologiques et conceptuels de la mesure de la pauvreté : l'Espagne dans le context Européen*, PhD disertation, DELTA, EHESS.

Mercader-Prats, M. (1997) “Sobre la Desigualdad Territorial y Personal en España y su Evolución Reciente” *Hacienda Pública Española*, **141/142, 2-3** 351-64.

Oliver-Alonso, J. (1997) "Ingreso, Consumo y Ahorro de las Familias: Propuesta de una Metodología para la Explotación de la Encuesta de Presupuestos Familiares", Documentos de Trabajo, Fundación FIES, nº 132.

Sanz, B. (1996) "La Articulación Micro-Macro en el Sector Hogares: De la Encuesta de Presupuestos Familiares a la Contabilidad Nacional", in La Desigualdad de los Recursos, II Simposio sobre Igualdad y Distribución de la Renta y la Riqueza, Vol.6.

Sen, A. K. and Foster, J. E. (1997), *On Economic Inequality*, Clarendon Press, Oxford (2nd edn).

Smeeding, T. M. and Gottschalk, P. (1995) "The International Evidence on Income Distribution in Modern Economies: Where Do We Stand?", Working Paper 137, Luxembourg Income Study, CEPS/INSTEAD.

Zaidi, M.A. and Vos, K. de, (1998), "Trends in Consumption-based Poverty and Inequality in the Member States of the European Union during the 1980s", Discussion Paper, Economics Institute, Tilburg.

Appendix

This Appendix provides an overview of the principal characteristics of the datasets and some of the procedures used in the text.

A.1 Data characteristics: Spain and the UK

The income definition adopted in the Spanish survey includes:

- Net earnings from employment
- net profit from self-employment
- investment income
- social security income
- maintenance payments
- income from maintenance grants and scholarships
- cash value of certain forms of income in kind, mainly home-production, self-consumption and wage in kind, such as subsidized meals at work..

The concept is net of income-tax payments and National Insurance contributions, and it excludes income from capital gains. Also there is no allowance for outright owner-occupiers' imputed rent. The scope of the income schedule of the survey widened between 1980 and 1990 to cover more disaggregated income sources for more members. In 1980 up to 4 members could record their income, while in 1990 this was extended to eight.

The income concept in the UK survey (Income BHC) is defined as the sum of:

- Net usual earnings from employment
- net profit from self-employment
- investment income

- social security income
- income from occupational pensions, plus
- maintenance payments
- income from maintenance grants and scholarships
- cash value of certain forms of income in kind[16]

The concept is net of PAYE income-tax payments, National Insurance contributions, contributions to occupational pension schemes, domestic rates community charge, council tax and of repayments to social funds loans. The concept excludes home production and capital gains. Also there is no allowance for outright owner-occupiers' imputed rent.

A.2 Imputations for low income observations.

Here we present results obtained by applying different income values to those households with low incomes. Defining low incomes is a complex issue, and the cut-off point is subject to much debate with results potentially varying with the choice of cut-off. Above we presented the results of simply imputing 25% of mean income to all those with incomes below this level. Here we extend the analysis to include 50% of mean income plus 25% and 50% of median income[17].

The results for the UK show a rise in inequality over the decade for all measures and for all levels of imputed income.

[16] Luncheon Vouchers, free meals or food (until 1989), coal or coke, free school meals, free welfare meals, and school meals.

[17] Mean income in the UK was £141 and £187 per week in 1979 and 1990/91 respectively, and median income was £127 and £156 per week in 1979 and 1990/91 respectively.

Table 4: Inequality and Imputed Incomes								
	Spain							
	1980				1990			
	Mean		Median		Mean		Median	
	25%	50%	25%	50%	25%	50%	25%	50%
Gini	0.3107	0.2860	0.3119	0.2995	0.2977	0.2767	0.2987	0.2882
GE(0)	0.1617	0.1298	0.1648	0.1441	0.1478	0.1211	0.1503	0.1331
GE(1)	0.1720	0.1497	0.1735	0.1608	0.1549	0.1363	0.1561	0.1456
GE(2)	0.7330	0.7009	0.7346	0.7172	0.6675	0.6401	0.6688	0.6549
ATK(0.5)	0.0793	0.0668	0.0803	0.0728	0.0723	0.0619	0.0731	0.0669
ATK(1)	0.1493	0.1218	0.1519	0.1342	0.1374	0.1141	0.1395	0.1246
ATK(1.5)	0.2129	0.1679	0.2180	0.1871	0.1973	0.1588	0.2015	0.1753
	UK							
Gini	0.2646	0.2522	0.2648	0.2577	0.3427	0.3100	0.3439	0.3272
GE(0)	0.1143	0.0998	0.1150	0.1050	0.1953	0.1532	0.1983	0.1719
GE(1)	0.1147	0.1046	0.1150	0.1086	0.2069	0.1763	0.2084	0.1913
GE(2)	0.1298	0.1212	0.1300	0.1249	0.2816	0.2503	0.2828	0.2666
ATK(0.5)	0.0556	0.0499	0.0558	0.0521	0.0954	0.0788	0.0964	0.0866
ATK(1)	0.1080	0.0949	0.1086	0.0997	0.1774	0.1421	0.1799	0.1579
ATK(1.5)	0.1574	0.1354	0.1585	0.1429	0.2487	0.1934	0.2532	0.2171