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THE INFLUENCE OF DEMOGRAPHICS AND HOUSEHOLD SPECIFIC PRICE INDICES ON EXPENDITURE BASED INEQUALITY AND WELFARE: A COMPARISON OF SPAIN AND THE UNITED STATES

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Abstract

The purpose of this research is to examine the role of household size and household specific price indices on inequality and welfare measurement in Spain and the U.S. Total household expenditures from each countries' 1990-91 consumer expenditure surveys, with adjustments to reflect more accurately households' current consumption, are used as the basis for the analysis. Household size scale factors are used to produce adjusted expenditures. Household specific price indices are used to expresss the 1990-91 expenditure distribution at winter of 1981 and winter of 1991 prices. Decomposable measurement instruments are used both for the inequality and social welfare analyses.

Our results show that wide differences in household size can be very important in international comparisons. Inequality and welfare comparisons are drastically different for smaller and larger households. For both countries we find that from the point of view of winter 1981, the amount of expenditures that we would need to give to richer households to compensate them for inflation, over the 1981 to 1991 period, would be greater than the amount that we would need to give to poorer households for them to be able to acquire the same bundle of goods. Our inequality comparisons are robust to the choice of the reference price vector.

Keywords: Theil Inequality; Welfare; Demographic Factors; Household Expenditures; Household Specific Price Indexes.

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I. INTRODUCTION

In this paper we compare levels of living in Spain and the United States (U.S.) using current household consumption expenditures as our level of living measure. As in most welfare analyses (For instance, see Slesnick (1998) and Shorrocks (1983)), we assume that social or aggregate welfare can be expressed in terms of two statistics of the expenditure distribution: the mean and an index of relative inequality.

Like intertemporal comparisons of income inequality and welfare in a single country, international comparisons of expenditures require the solution to the following four classical problems: (a) how to make comparable two heterogeneous populations consisting of households with different needs; (b) how to make comparable the money distributions in both countries; (c) which measurement instruments to use among the admissible inequality measures; and (d) which measurement instruments to use among the admissible welfare measures, and

To solve the difficulties arising from the demographic heterogeneity in international comparisons, researchers usually compare the distributions of equivalent expenditures (or equivalent income) using some common equivalence scale.[1] 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. In this paper, to make the analysis tractable we assume that equivalence scales depend only on the number of persons in the household. Following Buhmann *et al.* (1988) and Coulter *et al.* (1992a, 1992b), to pool all households into a unique distribution within each country we use a parametric model of

[1]See, for example, Phipps and Garner (1994). See Merz *et al.* (1993) for comparisons of equivalence scales that are based on using the same methods but data from West Germany and the U.S.

equivalence scales which allows for different views about the importance of economies of scale in consumption within the household.[2]

In the equivalence scales model, expenditures for households of the same size are directly comparable. Thus, we believe it is important to start our analysis from inequality (or welfare) comparisons *separately* for each of the subgroups in the partition by household size. Then, in order to go from the household size to the population level, we find it illuminating to work with additively decomposable measurement instruments. For every population partition, decomposable measures of (relative) inequality allow us to express overall inequality in a cross-section as the sum of two terms: a weighted sum of *within-group* inequalities, plus a *between-group* inequality component calculated as if each person within a given group received the group's mean income.

Using decomposable measures, in this paper we explain the overall inequality differences between the U.S. and Spain in terms of three factors: i) the difference in within-group inequality (due to differences in subgroup inequality values), ii) the difference in between-group inequality (due to the relative differences in subgroup means), and iii) the demographic change across partition subgroups (due to differences in subgroup population shares). In addition, following a suggestion in Coulter *et al.* (1992a) and developed in Del Río and Ruiz-Castillo (1997a), we use a method to free the decomposition analysis from the possible 'contamination' that will arise if we use an inappropriate equivalence scale.

[2]For the use of this model in international comparisons, see also Atkinson *et al.* (1995). For other recent papers that stress the issue of the sensitivity of international poverty comparisons to the choice of equivalence scales, see Burkhauser *et al.* (1996), De Vos and Zaidi (1997), and Duclos and Mercader-Prats (1999).

As far as the measurement of welfare is concerned, we are interested in social evaluation functions (SEF for short) which permit the explanation of welfare differences in terms of differences in the mean and differences in relative inequality. As in the inequality case, additively decomposable SEFs have been found useful in intertemporal welfare comparisons within a single country (see Ruiz-Castillo 1998). In this paper we show that these methods are equally useful in international comparisons. This is important in a context in which we find considerable welfare and demographic inter-country differences between the subgroups in the partition by household size.

We address each of these issues using data from consumer expenditure surveys. The Spanish data are from the *Encuesta de Presupuestos Familiares* (EPF) conducted by the *Instituto Nacional de Estadística* (INE), and the U.S. data are from the Consumer Expenditure Survey (CEX) from the Bureau of Labor Statistics (BLS). We compare annual consumer unit (referred to here as household) expenditures for the 1990-1991 period. We express both distributions at constant prices for two periods in each country: the winter of 1991 and the winter of 1981. Since we use household specific price indices, we are able to take into account the distributional role of changes in price relatives during the 1980's in both countries. Finally, we express the Spanish distributions in U.S. dollars using purchasing power parities (PPPs)

The comparison between Spain and the U.S. is an interesting one. First, Spain has been experiencing a complex process of economic modernization and liberalization since the mid-1970's, including full membership into the European Union in January 1986, resulting in a more open and market oriented economy. In contrast, the U.S. has a much larger economic system that is rather open and market oriented. Second, during this period Spain has been taking important steps toward a fairly comprehensive social safety net, in the European style, while that of the U.S. is more limited. Third, tax structures are rather different too. Although a modern income tax system did not start in Spain until 1978, it is more progressive today than is the U.S. tax system. On the other hand, the EU membership lead to the introduction in 1986 of a value added tax in Spain, in contrast to the indirect tax system in the U.S. Fourth, recent trends in inequality and welfare are quite different in the two countries. In particular, from 1973-74 to 1990-91, expenditure inequality fell in Spain (Del Río and Ruiz-Castillo 1997a, 1997b; Ruiz-Castillo 1995a), but increased during the 1980's in the U.S. (for example, see Johnson and Shipp 1997). And fifth, the demographic structure of the two countries is very different, with larger consuming units in Spain on average than in the U.S.

Our results show that differences in demographic factors can be very important in international comparisons. We find that inequality and welfare comparisons are drastically different for smaller and larger households. Thus, the inequality and welfare differences between both countries depend strongly on the assumptions made about economies of scale in consumption within the households. Our main findings are that as economies of scale tend to diminish, (i) overall inequality in the U.S. is smaller, about the same or considerably larger than in Spain, and (ii) welfare is always greater in the U.S., but the difference in welfare between the two countries grows continuously from 12 to 40 per cent.

We complete the analysis testing the robustness and statistical significance of our results. In order to do that, we follow two different approaches. Firstly, we follow Cowell *et al.* (1999) and study the robustness of the inequality results to systematic trimming at both ends of the household expenditures distributions. Secondly, we perform inequality and welfare comparisons in terms of the dominance results in Shorrocks (1983), applying procedures of statistical inference developed by Bishop *et al.* (1989, 1994).

The remainder of this paper is organized into four sections and an Appendix. Section two presents the methods and Section three, a description of the data. Section four includes our results and Section five summaries and concludes. The Appendix is devoted to a brief discussion of the data for comparative purposes.

II. METHODS

A. Interpersonal Comparisons of Welfare

Assume we have a population of h = 1,...,H households whose levels of living can be adequately represented by a one-dimensional variable we call income, x^h. Households can differ in income and/or a vector of household characteristics. As indicated in the Introduction, we assume 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 are directly comparable. Larger households have greater needs, but also greater opportunities to achieve economies of scale in consumption. Assume that there are m = 1,...,M household sizes. Following Buhmann *et al.* (1988) and Coulter *et al.* (1992a, 1992b), for each household h of size m we define adjusted income by

$$z^h(\Theta) = x^h/m^\Theta, \ \Theta \in [0,1]. \tag{1}$$

Taking a single adult as the reference type, the expression m^Θ can be interpreted as the number of equivalent adults in a household of size m. Thus, the greater is the equivalence elasticity Θ, the smaller are the economies of scale in consumption or, in other words, the larger is the number of equivalent adults. In particular, when $\Theta = 0$ economies of scale are assumed to be infinite and adjusted income coincides with unadjusted household income, while if $\Theta = 1$ there are no economies of scale and adjusted income becomes *per capita* household income.

Let $\mathbf{x}^m$ and $\mathbf{z}^m(\Theta)$ be, respectively, the vector of original and adjusted incomes for households of size m. Notice that, if I (.) is any index of relative inequality, then for each m

$$I(\mathbf{z}^m(\Theta)) = I(\mathbf{x}^m/(m^{\Theta}) = I(\mathbf{x}^m). \tag{2}$$

Thus, within each subgroup with the same needs, we assume that the inequality of adjusted income is equal to the inequality of original income, independently of individual income and prices.

In welfare economics, we are mostly interested in personal economic well-being and welfare, rather than that of the household. Thus, following standard practice for overall inequality and welfare measurement, household adjusted income is weighted by the number of persons in the household. Or in other words, each person is assigned the adjusted income of the household to which he or she belongs.

B. Inequality Measurement

We say that an inequality index is decomposable by population subgroup if the decomposition procedure of overall inequality into a within-group and a between-group term is valid for any arbitrary population partition. It is well known that the Generalized Entropy (GE) family of inequality indices are the only measures of relative inequality that satisfy the usual normative properties required from any inequality index and, in addition, are decomposable by population subgroup. (See, for example, Shorrocks (1984)). The family can be described by means of the following convenient cardinalization:

$$I_c(z(\Theta)) = (1/H)\,(1/c^2 - c) \sum_h \{(z^h(\Theta)/\mu(z^h(\Theta)))^c - 1\} \quad c \neq 0,1 \qquad (3)$$

where $\mu(\cdot)$ is the mean of the distribution. The parameter c summarizes the sensitivity of I_c in different parts of the income distribution: the more positive (negative) c is, the more sensitive I_c is to differences at the top (bottom) of the distribution (Cowell and Kuga (1981)). When c=0 the following results:

$$I_0(z(\Theta)) = (1/H) \sum_h \log\{\mu(z^h(\Theta)/z^h(\Theta)\}. \qquad (4)$$

When c=1 the following results:

$$I_1(z(\Theta)) = (1/H) \sum_h \{(z^h(\Theta)/\mu(z^h(\Theta)\}\log\{z^h(\Theta)/\mu(z^h(\Theta)\}. \qquad (5)$$

I_0 is the mean logarithmic deviation, while I_1 is the original Theil index.

Coulter *et al.* (1992a, 1992b) have shown how the inequality estimates provided by the GE family vary systematically with the parameter Θ which captures the generosity of the scale. They illustrate their analysis with UK data.[3] However, using the GE family in its decomposable form restricts the 'contamination' of the inequality orderings that will arise if there is incomplete or incorrect information about the equivalence scales. To see this, consider the formula for the GE index when written in decomposable form for the partition by household size:

[3]This has been confirmed in other countries. For Portugal, see Rodrigues (1993). For Spain, see Ruiz-Castillo (1995a) for the period 1973-74 to 1980-81. For Spain and the U.S. during the period 1980-81 to 1990-91, see Section four of this paper.

$$I_c(\mathbf{z}(\Theta)) = \sum_m (v^m(\Theta))^c (p^m)^{1-c} I_c(\mathbf{z}^m(\Theta)) + I_c(\mu^1(\Theta),\ldots,\mu^M(\Theta)). \quad (6)$$

where $v^m(\Theta)$ is the share of total adjusted income held by households of size m for each Θ; p^m is group m's population share, and $I_c(\mu^1(\Theta),\ldots,\mu^M(\Theta))$ is the between-group inequality calculated as if each household of a given size m received that group's mean adjusted income $\mu^m(\Theta)$. Recall that, for each m, $I_c(\mathbf{z}^m(\Theta)) = I_c(\mathbf{x}^m)$. When c = 0 the expression $v^m(\Theta)^c (p^m)^{1-c}$ reduces to p^m, so that using the 'wrong' equivalence scale contaminates only the between group component. Denoting U and $C(\Theta)$ the uncontaminated and the contaminated terms, we have:

$$I_0(\mathbf{z}(\Theta)) = U + C(\Theta), \quad (7)$$

where

$$U = \sum_m p^m I_0(\mathbf{x}^m) \quad (8)$$

is the weighted average of the inequality within each household size with weights equal to population shares, and

$$C(\Theta) = I_0(\mu^1(\Theta),\ldots,\mu^M(\Theta)) \quad (9)$$

is the between-group inequality that depends on Θ.

C. Welfare Measurement

A SEF is a real valued function S defined in the space R^H of adjusted incomes, with the interpretation that for each income distribution $\mathbf{x} = (x^1,\ldots,x^H)$, $S(\mathbf{x})$ provides the "social" or, simply, the aggregate welfare from a normative point of view. Let us assume that our SEFs satisfy the requirements discovered by Dutta and Esteban (1992) for expressing welfare as a function of the mean and an index of relative inequality. In addition, let us adopt a multiplicative trade off between the mean and inequality, that is:

$$S(\mathbf{x}) = \mu(\mathbf{x})(1 - I(\mathbf{x})). \tag{10}$$

But which SEFs within these classes should we use in applied work? The following property leads us to an appropriate selection.

Suppose that we have two islands where income is equally distributed but whose means are different. If they now form a single entity, there will be no within-island inequality but there would be inequality between them. In income inequality theory we search for additively separable measures capable of expressing this intuition. In our context, for any partition we are interested in expressing social welfare for the population as the sum of two terms: a weighted average of welfare within the subgroups, with weights equal to demographic shares, minus a term which penalizes the inequality between subgroups. In this case, we say that the SEF is additively decomposable.

Consider SEFs that can be expressed as the product of the mean and a term equal to one minus a member of the GE family of inequality measures. Ruiz-Castillo (1995b) shows that the only SEF among them with the property of additive decomposability with demographic weights, is the following:

$$S^*(\mathbf{x}) = \mu(\mathbf{x})(1 - I_1(\mathbf{x})) = \sum_m p^m S^*(\mathbf{x}^m) - \mu(\mathbf{x}) I_1(\mu^1, \ldots, \mu^M), \tag{11}$$

where I_1 is the original Theil index. Thus, social welfare is seen to be a weighted average of the welfare within each subgroup with weights equal to demographic shares, minus the between-group inequality weighted by the population mean. Taking into account our definitions of adjusted income, we have:

$$S^*(\mathbf{z}(\Theta)) = A(\Theta) - B(\Theta) \tag{12}$$

where:

$$A(\Theta) = \square_m \; p^m \,[S^*(\mathbf{x}^m)/m^\Theta], \tag{13}$$

and

$$B(\Theta) = \mu(\mathbf{z}(\Theta))I_1(\mu^1(\Theta),\ldots,\mu^M(\Theta)), \lfloor \; \Theta \,[0,1]. \tag{14}$$

Equation (13) is the within-group welfare, while equation (14) is the penalty associated to between-group inequality in the partition by household size.

III. DATA

For our analysis, we use data from consumer expenditure surveys. The Spanish data are from the EPF conducted by the INE, and the U.S. data are from CEX Interview (augmented with data from the Diary) from the BLS. For both expenditure surveys, data are collected from consumer or economic units (referred to in this paper as a household, as noted earlier), defined as a collection of people who share some expenditures and possibly living quarters.[4] The U.S. population is defined as the total civilian non-institutional population and a portion of the institutional population living in the following group quarters: boarding houses, housing facilities for students and workers, staff units in hospitals, and homes for the aged, infirmed or needy, permanent living quarters in hotels and motels, and mobile home parks. For the U. S. CEX,

[4] See BLS (1995) for the definition of a consumer unit and INE (1992) for the definition of a household in Spain. Also see the Appendix.

students living in college residences are considered separate consumer units even if they are economically dependent upon the financial support of their parents or others.

The Spanish population refers exclusively to the civilian non-institutional population living in residential housing. However, the transfers made to household members who are dependent on household resources but who live elsewhere at the time of the interview, including those living in institutional or collective housing (e.g., university residences, student apartments, hotels, hospitals, and elderly residences), are recorded in the Spanish survey.

We use consumption expenditures as our measure of income. We start with the expenditure bundle used by the statistical agencies for the production of their official Consumer Price Indexes (CPIs) to define expenditures and adjust it in order to reflect more accurately households current consumption (see the Appendix for a detailed description).

We analyze annualized household consumption expenditures taking into account the data collected from April 1990 through March 1991 for Spain and from January 1990 through December 1991 for the U.S. We refer to this time period as 1990-91. We selected this time period since it represents the most recent period for which Spanish data were collected and available. (For further details on the difficulties encountered in each country, see the Appendix). We express both distributions at constant prices, using household specific price indexes (for descriptions of the production of these indexes for the U.S. and Spain, see Cage *et al.* 1997 and Ruiz-Castillo *et at.* 1999, respectively) for two periods in each country: the winter of 1991 and the winter of 1981. Since we use household specific price indices, we are able to take into account the distributional role of changes in price relatives during the 1980's in both countries.

For comparing expenditures and welfare in the two countries, we use purchasing power parities (PPPs) for private consumption expenditures. These are rates of currency conversion that equalize the purchasing power of the two countries[5]. PPPs based on the Elteto-Koves-Szulc (EKS) method of aggregation are used (OECD 1993). Although the EKS indexes are not additive, the OECD notes that the EKS can be used to compare levels.[6] The EKS indexes are used since we are interested in comparing levels of expenditures and welfare. For 1991, the PPP conversion factor is 108.9, so that Spanish expenditures in pesetas are divided by 108.9 to obtain Spanish expenditures in U.S. dollars. For 1981, the PPP conversion factor is 74.74 (Godbout 1997; OECD 1993).

For all analyses, household or consumer unit population weights are used. When we show means and distributions by persons, each household or consumer unit population weight is multiplied by the number of persons in each unit in order to obtain a person population weight for each person in the unit. For the U.S., the average consumer unit weight for the number of quarters that the consumer unit is in the sample is used; for the household size variable, the average size is also assumed.

[5] This means that a given sum of money, when converted into different currencies at the PPP rates, will buy the same basket of goods and services. PPPs have the advantage over exchange rates in that they reflect only differences in the volume of goods and services purchased; in contrast, exchange rates reflect both, differences in the volumes purchased in each country and also differences in price levels.

[6] An alternative is to use the Geary-Khamis (GK) index which is additive. This index is most appropriate to use when comparing structures and applying subindexes such that the sum of the adjusted subcomponent expenditures, for example, will equal total PPP adjusted expenditures. Since we are using the overall index and not subcomponent indexes to make our PPP adjustments for total expenditures, it is acceptable to use the EKS indexes. Dikhanov (1997) has noted that substantial differences result however when the two different indexes are used in adjusting subcomponents and then adding up to produce overall national account incomes, for example. However, for our study, we do not expect major differences, given that the GK PPP index for 1981 is 73.3 (versus 74.74) and the index for 1991 is and 106.8 (versus 108.9).

IV. RESULTS

IV. A. Household Size and Mean Household Expenditures

In this section we examine some fundamental demographic and economic features in both countries. Table 1 shows the population distributions and mean household expenditures by household size. Due to the small size of the remaining groups, we only include from one to seven member households. We use these households to examine in detail differences between Spain and the U.S. with regard to inequality and welfare. However, when we produce inequality and welfare results, we use data from the entire weighted samples. Households with seven or fewer members represent about 99 per cent of all households and 97 per cent of all persons in the population.

Table 1 around here

We observe that one and two person households in the U.S. are more prevalent and have much greater mean expenditures than those in Spain. For three person households, representing about 20 percent of all persons in each country, mean household expenditures are still substantially higher for the U.S. Four and more person households represent a larger share of the population in Spain, and although mean household expenditures are greater in the U.S. (except for six person households), the difference is not as great as for smaller household sizes. [7]

In order to understand better the differences in the two populations, we examine the age distributions of the two countries, with particular attention being paid to the one and two person

[7] Duclos and Mercader-Prats (1999) find also similar differences between Spain and the U.K. in 1980-81: there are about four times as many one-adult households in the U.K. as there are in Spain, while there are many more households with three and more adults in Spain. This, together with the fact that there are many more fewer households with children in the U.K. than in Spain, turns out to be a crucial factor in the poverty comparison between these two countries.

households. As can be seen in Table 2, the Spanish population we are dealing with in this study is composed of households with older reference persons than those in the U.S. About 53 percent of the Spanish households have reference persons who are 51 years of age or older compared to 39 percent of the households in the U.S. Among one and two person households, Spain clearly has the older population. Single persons aged 65 years or greater represent 64 percent of the Spanish single person population, as opposed to single persons in the U.S. who represent only 34 percent of such households. Older two person households are also more prevalent in Spain: 53 percent of these households are headed by persons in the upper age group versus 30 percent in the U.S.

The opposite is the case for young households. Only 7.5 percent of the Spanish households are headed by a person less than 31 years of age, while the percentage is almost 20 percent in the U.S. The differences are more pronounced for single-person households: 5.5 percent of them are less than 31 in Spain, while 25.6 percent belong to that age group in the U.S.

There is no doubt that some of these differences can be attributable to data definitions since, as we said before, college students living in college residences are counted as a separate unit in the CEX, even if they are economically dependent from their parents, while these people are counted as members of their parents households in the EPF. Yet, such persons only represent 1.4 percent of all households in the U.S. weighted sample and 7.4 percent of those living in households in which the head is less than 31 years of age. Thus, the differences in population distribution by household size are sufficiently large to indicate that living arrangements are truly at variance between the two countries. This is an important fact in inequality and welfare comparisons, as we will see below.

Table 2 around here

The results in Table 3 illustrate the impact on the means of adjusted expenditures when using person versus household weighting. With person weighting, each person in a household is assigned the adjusted household expenditure while with household weighting each household is assigned a weight of 1 only. This means persons living in larger households will have more weight in the overall distribution of expenditures. Two points in Table 3 deserve to be noticed. In the first place, in both countries household weighted mean expenditures are less than person weighted expenditures when the scale factor adjustment is smaller, although the pattern is more pronounced for Spain. In the second place, when comparing both countries, adjusted expenditures are greater in the U.S. relative to those in Spain for each scale adjustment factor. However, in view of what we observed in Table 1, the percentage difference is smaller when adjusted expenditures are weighted by person. Thus the difference is due to the different household size structure in Spain versus the U.S.

Table 3 around here

IV. B. Relative Inequality

Theil indexes for households of size one to seven, based on 1990-91 expenditures in Winter 1991 prices, are presented in Table 4. For both the U.S. and Spain, inequality is greater when $c = -1$ than when $c = 0$, and also when $c = 2$ versus $c = 1$. This means that, in both countries, for every household size inequality is greater at both the upper and the lower ends of the distribution. On the other hand, the inequality comparisons reveal a rather robust pattern: i) for all values of c, inequality is considerably greater in Spain for single-person and two-person households; ii) for the important group of three and four person households -which account for 44 and 48 per cent of all persons in the U.S. and Spain respectively - comparisons depend on the index used: when c=-1 or c=0 it appears that inequality is slightly greater in the U.S., but the opposite is the case for c=1 and c=2; iii) for larger households and all values of c, inequality is clearly larger in the U.S.

Table 4 around here

The use of decomposable inequality measures facilitates our understanding of the results for the population as a whole. In particular, recall that for the index I_0, we have from equation (7) that

$$I_0(\mathbf{z}(\Theta)) = U + C(\Theta), \tag{7}$$

where U is the weighted average of the inequality within each household size with weights equal to population shares, and $C(\Theta)$ is the between-group inequality which depends on Θ. Table 5 provides the results on this decomposition. [8] As expected, within group inequality in each country accounts for more of total inequality than does between group inequality. More importantly, overall, inequality is greater in Spain than in the U.S. when smaller scale adjustment factors are used, but the opposite is the case for Θ greater than or equal to 0.5.

Table 5 around here

To understand better the differences in inequality that we obtain for the two countries, we disentangle the role played by differences in within-group inequality, demographics, and mean expenditures by considering the following decomposition of overall inequality change. Let us

[8] Lacking any basis for a differential treatment of economies of scale in each country, all comparisons in this paper for the population as a whole are made for common values of the parameter Θ. For the impact on poverty

denote by $\Delta I(\Theta)$ the difference in inequality between Spain (country 1) and the U.S. (country 2), according to the mean logarithmic deviation, i.e. $\Delta I(\Theta) = I_0(z_2(\Theta)) - I_0(z_1(\Theta))$. This magnitude can be expressed as

$$\Delta I(\Theta) = \Delta U + \Delta C(\Theta), \tag{15}$$

where:

$$\Delta U = U_2 - U_1 = \Delta W + \Delta D, \tag{16}$$

$$\Delta W = \sum_m p_1^m [I_0(x_2^m) - I_0(x_1^m)], \tag{17}$$

$$\Delta D = \sum_m [p_2^m - p_1^m] I_0(x_2^m), \tag{18}$$

$$\Delta C(\Theta) = I_0(\mu_2^1(\Theta), \ldots, \mu_2^M(\Theta)) - I_0(\mu_1^1(\Theta), \ldots, \mu_1^M(\Theta)). \tag{19}$$

Equation (16) is the difference in uncontaminated inequality, which is seen to be the sum of two terms: equation (17), which is the weighted sum of inequality differences within each household size, and equation (18) which captures the impact on the uncontaminated inequality of demographic differences across the partition by household size. Both are independent of Θ, which only affects equation (19), namely, the difference in between-group inequality in the partition by household size.

Of course, demographic shares for country 2, rather than for country 1, and the inequality for country 1 can be used in the above decomposition. In this case, we have:

$$\Delta U = U_2 - U_1 = \Delta W' + \Delta D', \tag{16'}$$

$$\Delta W' = \sum_m p_2^m [I_0(x_2^m) - I_0(x_1^m)], \tag{17'}$$

$$\Delta D' = \sum_m [p_2^m - p_1^m] \, I_0(x_1^m). \tag{18'}$$

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measurement of applying different definitions of equivalent income in each country, see Duclos and Mercader-Prats (1999).

Table 6 presents the results of the above decompositions.

Table 6 around here

According to equation (15), we should take into account two factors. Starting with the term Δ U, which is independent of Θ, we observe that uncontaminated inequality is 2.9 percent smaller in Spain than in the U.S. (see Table 5). This is the result of the asymmetries in within-group inequality, combined with the asymmetries in the opposite direction in the demographic composition of the two countries. Let us focus first on the differences in within-group inequality in the partition by household size between the U.S. and Spain. As we see in Table 4 and Figure 1 (see the column Theil(0)), this difference is negative for small households, close to zero for households of intermediate size, and positive for large households. When according to equation (17) these differences are weighted by the Spanish population frequency distribution (person population shares) by household size (see Table 1), where large households are more prevalent, the term Δ W, in Table 6, becomes positive. However, when according to equation (17') the weighting is provided by the U.S. population distribution, where smaller sizes are more prevalent, Δ W' in Table 6, becomes negative.

Figure 1 around here

Let us now examine the role of demographic differences between the U.S. and Spain. These differences (see Table 1) are positive for smaller households, close to zero for intermediate household sizes, and negative for larger households. When according to equation (18) these differences are weighted by the U.S. inequality figures, which show a symmetric U pattern (column Theil (0) in Table 4 and Figure 1), the term Δ D becomes practically zero. However, when according to equation (18') the weighting is with the Spanish inequality figures, which show a much greater inequality for small households headed by the old, the term $\Delta D'$ becomes positive. Of course $\Delta W > 0$ plus $\Delta D = 0$ is equal to $\Delta W' <= 0$ plus $\Delta D' > 0$, since we saw that $\Delta U > 0$ indicating that uncontaminated inequality is smaller in Spain than in the U.S.

The second factor in equation (15) is the term $\Delta C(\Theta)$, which depends on Θ. In both countries, the importance of $C(\Theta)$ as an explanatory factor of overall inequality follows a non-linear pattern with Θ. As we see in Table 5 and in Figure 2, when no allowance is made for household size, i.e. $\Theta = 0$, between-group inequality accounts for a sizable percentage of overall inequality, 13-18 per cent. As Θ increases, reflecting the decreasing importance of economies of scale in consumption within the household, re-orderings take place: larger households, who have larger unadjusted expenditures, tend to occupy lower positions as household size increases its role in the definition of adjusted expenditures. The opposite is the case for smaller households, whose adjusted expenditures depend relatively less on household size. As a consequence of this complex process in which the identity of households at the top and the bottom of the distribution is changing dramatically, the ratio $C(\Theta)/I(\Theta)$ rapidly declines and increases again as Θ approaches 1 and adjusted total expenditure becomes *per capita* total expenditure.

Figure 2 around here

However, it is important to understand the differences across countries. Although mean expenditure is essentially an increasing factor of household size in both countries (see Table 1 and Figure 3), two points deserve to be noticed. In the first place, smaller households in the U.S. are younger, more affluent (as represented by their expenditures), and more abundant than in Spain (see Tables 1 and 2). As a consequence, the range of variation between mean household expenditure by household size is smaller in the U.S. than in Spain (see also Figure 3). Thus, when $\Theta = 0$, between group inequality is lower in the U.S. than in Spain. In the second place, for larger households the relationship between mean expenditure and household size is smoother in Spain (as a matter of fact, mean expenditure for six person households in the U.S. is lower than for five person households). We observe also that the difference in favor of the U.S. tend to decline as household size increases (for six persons households, mean expenditures are slightly greater in Spain). As Θ grows toward 1, these differences manifest themselves in a different U pattern for the ratio $C(\Theta)/I(\Theta)$ (see Table 5). The re-orderings among households of different sizes, which take place as Θ increases are more dramatic in the U.S, where between groups inequality reaches a minimum before and increases afterwards more rapidly than in Spain.

Figure 3 around here

As we see in Table 5, among the two terms in equation (15) the between groups component tend to dominate so that the results on overall inequality for the person weighted distributions depend crucially on our assumptions about the importance of economies of scale: as the scale adjustment factor (Θ) varies from 0 to 1 and economies of scale tend to diminish, overall inequality in the U.S. is smaller, about the same, or considerably larger than in Spain.

IV. C. Welfare

In Table 7 we present overall welfare for households with one to seven members. Recall that welfare is equal to mean expenditures corrected by a factor related to inequality. For the welfare analysis, we use the Theil inequality index with c = 1 (See Section II. C for a justification).

Table 7 around here

According to equation (11), for each household size we have

$$S^*(x^m) = \mu(x^m)F(x^m) \tag{11}$$

where $F(x^m) = 1 - (I_1(x^m))$. In Table 1 and Figure 1 we saw that, except for six person households, mean household expenditures are greater in the U.S. for the remaining household sizes. However, the difference is considerably greater for small households. In table 4 we saw that inequality was smaller in the U.S. for small households, but greater than in Spain for large households. Consequently, the adjustment factor $F(x^m)$ in equation (11) tends to increase the welfare differences for small households and to ameliorate it for larger ones. As we can see in Table 7, for one and two person households welfare in the U.S. is above 70 per cent greater than in Spain, while for other groups it is only between 9 to 30 per cent greater.

How does this pattern manifest itself when we study the population as a whole? Recall that, as we saw in equation (12), overall welfare is a weighted average of within-group welfare, minus a penalty imposed by our SEF to between-group-inequality:

$$S^*(z(\Theta)) = A(\Theta) - B(\Theta) \tag{12}$$

where:

$$A(\Theta) = \sum_m p^m [S^*(x^m)/m^\Theta], \tag{13}$$

and

$$B(\Theta) = \mu(z(\Theta))I_1(\mu^1(\Theta), \ldots, \mu^M(\Theta)), \Theta \in [0,1]. \tag{14}$$

As Θ increases, the role of household size in the denominator of equation (13) increases also, causing within-group welfare to decrease. Naturally, this effect is more pronounced for larger households. Consequently, as we see in Table 8, the within-group decrease with Θ is larger for Spain than for the U.S.

Table 8 around here

On the other hand, between group inequality is greater in Spain than in the U.S. when $\Theta = 0$ or 0.3, and the opposite is the case for larger values of Θ (see Table 5). Thus, the penalty imposed on overall welfare by our SEF through this term is correspondingly larger (smaller) for Spain when Θ is low (high). This effect works in the opposite direction to the previous one, but it is of a much lower order of magnitude. Therefore, we can conclude that although overall welfare in the U.S. is greater than in Spain, the difference grows continuously form 12 to 40 percent as Θ increases.

IV. D. Accounting for Differences in Prices

Differences in prices over time affect the differences in mean expenditures of the countries as well as differences in inequality and overall welfare. In this section, we present an approach to identify the impact of price change on overall inequality between country 1 and country 2. A similar analysis can be done for welfare.

Let us denote $\Delta I_t(\Theta)$ as the difference in inequality between two countries 1 and 2 at prices of period t, i.e.,

$$\Delta I_t(\Theta) = I_0(\mathbf{z}_{2t}(\Theta)) - I_0(\mathbf{z}_{1t}(\Theta)). \qquad (23)$$

similarly, at prices of period t' < t we have

$$\Delta I_{t'}(\Theta) = I_0(\mathbf{z}_{2t'}(\Theta)) - I_0(\mathbf{z}_{1t'}(\Theta)). \qquad (24)$$

For each country i = 1, 2, let us denote by $\Delta P_i(\Theta)$ the distributive effect of the change in relative prices from period t' to period t, that is,

$$\Delta P_i(\Theta) = I_0(\mathbf{z}_{it}(\Theta)) - I_0(\mathbf{z}_{it'}(\Theta)). \qquad (25)$$

Suppose that the rate of inflation during this period has been greater for the rich than for the poor, in which case we say that the change in relative prices from t' to t has been pro-poor. Then the Paasche indices to express money magnitudes in period t at period t' prices are greater for the rich than for the poor. The income necessary to acquire the period t bundle of goods at t' prices is reduced for everyone, but is reduced by more for the rich. Therefore, inequality at t' prices is smaller than inequality at t prices, that is to say, $\Delta P_i(\Theta) = I_0(\mathbf{z}_{it}(\Theta)) - I_0(\mathbf{z}_{it'}(\Theta)) > 0$.

It is easy to see that

$$\Delta I_t(\Theta) = \Delta P_2(\Theta) - \Delta P_1(\Theta) + \Delta I_{t'}(\Theta) \qquad (26)$$

that is:

$$I_0(\mathbf{z}_{2t}(\Theta)) - I_0(\mathbf{z}_{1t}(\Theta)) = (I_0(\mathbf{z}_{2t}(\Theta)) - I_0(\mathbf{z}_{2t'}(\Theta))) - ((I_0(\mathbf{z}_{1t}(\Theta)) - I_0(\mathbf{z}_{1t'}(\Theta)))$$
$$+ (I_0(\mathbf{z}_{2t'}(\Theta)) - I_0(\mathbf{z}_{1t'}(\Theta))). \qquad (27)$$

Therefore, $\Delta I_t(\Theta) = \Delta I_{t'}(\Theta)$ if and only if $\Delta P_2(\Theta) = \Delta P_1(\Theta)$.

In our case, we take t = Winter 1991 and t' = Winter 1981. In Table 9 we present our estimates of $\Delta I_t(\Theta), \Delta I_{t'}(\Theta)$, $\Delta P_2(\Theta)$ and $\Delta P_1(\Theta)$ for the population as a whole[9]. Our results reveal that $\Delta P_2(\Theta)$ and $\Delta P_1(\Theta)$ are both positive, that is, changes in relative prices

[9]Results by household size are available upon request.

from the Winter of 1981 to the Winter of 1991 are pro-poor in both countries. Although in Spain the strength of this phenomenon decreases with household size, while the opposite is the case in the U.S., the differences between countries are small (results not shown). Therefore, we conclude that the percentage difference in inequality in the U.S. 1990-91 expenditure distribution relative to the Spanish one is rather robust to the choice of the reference price vector. As we found earlier with the winter of 1991 prices, the winter of 1981 prices result in the same main finding: when the scale adjustment factor equals 0.0 or 0.3, inequality is greater in Spain, but when it is equal of greater than 0.5, inequality is greater in the U.S.

Table 9 around here

IV.E. Robustness to Trimming

Intertemporal and international comparisons at a point in time should take into account problems of data imperfection. In this section, we explore whether the inequality comparisons performed in Table 5 could be attributable to data deficiencies, including mis-measurement, mis-reporting or mis-recording.

Inequality comparisons are very vulnerable to what happens at both ends of the distributions, where data imperfections might be particularly serious. Following Cowell *et al.* (1999), we present, in Table 10, the results of systematically trimming the U.S. and the Spanish household expenditure distributions for the population as a whole at various values of the parameter Θ.

Table 10 around here

We extend the robustness by trimming each country's distribution. Two trimming factors are used: 1 percent and 5 percent in both one-tailed and two-tailed exercises. Table 10 shows that whatever trimming factor we use and whether we trim both tails or just one, the results obtained in previous sections hold. That is, inequality is lower in Spain than in the U.S. for values of Θ=0.5 and Θ=1, and the opposites holds for Θ=0.

IV. F. Robustness and Statistical Significance of the Results

In this subsection we pose the following fundamental question: how robust are our main results to the choice of an inequality or a social welfare index? We provide an answer in terms of the dominance results in Shorrocks (1983). Let Ω be the set of all admissible SEFs satisfying a number of commonly agreed desirable properties.[10] Then, given two distributions $\mathbf{z}_1$ and $\mathbf{z}_2$, $W(\mathbf{z}_1) \geq W(\mathbf{z}_2)$ for all SEFs W(.) in Ω, if and only if the mean of $\mathbf{z}_1$ is greater than the mean of $\mathbf{z}_2$, and the Lorenz curve of $\mathbf{z}_1$ is never below the Lorenz curve of $\mathbf{z}_2$.

Of course, the Lorenz dominance relation provides only a partial ordering of all conceivable distributions. Furthermore, numerical comparisons of Lorenz ordinates might be easily affected by sampling variability. Unlike the initial results in this area, which only provide a partition of the sample space into two regions (acceptance and rejection regions), the procedures of statistical inference developed by Bishop *et al.* (1989, 1994), based on the union-intersection principle[11], make it possible to distinguish between three differentiated regions associated with dominance, equality and non-comparability in pair-wise Lorenz comparisons.

Although the original analysis was presented in terms of i.i.d. observations, Beach and Kaliski (1986) have extended this methodology to samples that involve weighted observations.

[10]In particular, Shorrocks (1983) considers the following: S-concavity, scale invariance, monotonicity along rays from the origin, and the population replication axiom.

This extension is important in our case because our Spanish and U.S. data are systematically weighted by the consumer unit population weights which allows us to get from the sample to the population statistics.[12]

In **Table 11** we present the results on the Lorenz dominance criterion as well as the results on the significance of the differences in the U.S. and the Spanish means, when comparing Spain and U.S. distributions at winter 1991 prices, both by household size and for the population as a whole using several scale adjustment factors. Whenever a country (weakly) dominates another one in the Lorenz sense and its mean is greater, we can unambiguously conclude that it has a greater social welfare.

Table 11 around here

The results for one, two, four and seven person households are rather robust to the choice of an inequality index and a SEF: according to the Lorenz criterion, the U.S. distribution has less inequality than the Spanish one (in the one and two person cases), or their differences are non-significant (in the four and seven person cases); since the U.S. mean is significantly greater in all cases, we can conclude that the U.S. distributions provide grater social welfare than the Spanish ones. For three and five person households, Spain shows less inequality; as the U.S. mean is greater, we can reach no conclusion in this instance. Finally, inequality, mean and welfare differences for six person households are non-significant.

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[11] Richmond (1982) provides the methodology used to construct joint confidence intervals.

[12] These authors demonstrate that the central results are maintained, 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 referring to each sample observation.

For the population as a whole, when we assume relatively large economies of scale, i.e., when Θ is equal to 0 or 0.3, then the U.S. has less or equivalent inequality, a greater mean and more social welfare. Whenever Θ is equal or greater than 0.5, since Spain exhibits less inequality and a smaller mean, no unambiguous conclusion on social welfare can be reached by these methods. To resolve the trade-off between efficiency and distributional considerations, in those cases where Spain shows less inequality and a smaller mean, we could compare the generalized Lorenz curves for both countries in an attempt to establish unambiguous welfare conclusions for a less demanding group of SEF[13]. Forced to take a step in this direction, we believe that it suffices to appeal to a specific SEF belonging to this group, like the convenient SEF defined in equation 11. As we saw in Tables 7 and 8, for 3 and 5 persons households, and whenever the scale adjustment factor is equal or greater than 0.5, the in-conclusiveness of the robustness analysis is resolved, giving more weight to the differences in the means relative to the differences in inequality. This leads to the conclusion that in all these cases the U.S. expenditure distributions exhibit greater welfare than the Spanish ones.

As we saw in Table 9, the positive sign of $\Delta P_2(\Theta)$ and $\Delta P_1(\Theta)$ reveals that, using complete inequality indices, changes in relative prices from the Winter of 1981 to the Winter of 1991 are pro-poor in both countries. Although the magnitude of this impact is relatively small for both countries, we concluded that differences in inequality and means were robust to the choice of the reference price vector. Lorenz curve comparisons of the Spanish 1990-91 household expenditures distributions at Winter of 1981 prices and winter of 1991 prices comparisons (not

[13] From the axioms listed in note 10, the monotonocity of the SEF along rays from the origin would be dropped and substituted by Pareto efficiency, or the condition that the SEF be increasing in all its arguments. See Shorrocks

shown here) reveal that changes during the 1980s prices are significantly pro-poor in Spain, but the differences are not significant for any value of Θ. For the U.S., we obtain the same result: differences are non-significant for all values of Θ. These results indicate that price changes during this period in both countries have been essentially neutral from a distributional point of view. Nevertheless, when all comparisons in Table 11 are repeated at Winter of 1981 dollars, results already obtained at Winter of 1991 dollars are all exactly replicated[14]. In this sense, we conclude that the results obtained from inequality and welfare comparisons between the two countries are significantly robust to the choice of the reference price vector.

V. SUMMARY AND CONCLUSIONS

The purpose of this research was to examine the role of demographics and household specific price indices on expenditure based inequality and welfare comparisons for Spain and the U.S. Equivalence scales were assumed to depend only on household size. The 1990-91 expenditure distributions in both countries were expressed at winter of 1991 and winter of 1981 prices. Our results show that differences in demographic factors can be very important in international comparisons. We find that inequality and welfare comparisons are drastically different for smaller and larger households. In particular, smaller households in the U.S. are more prevalent, younger, affluent (based on expenditures) and exhibit less inequality; while larger households are relatively less prevalent, not as affluent and have greater inequality. Given this

(1983).

[14] Lorenz curve comparisons on the distributive impact of changes in relative prices during the 1980's in both countries, and all comparisons in Table 11 at Winter of 1981 dollars are available upon request.

diversity, decomposable measurement instruments help to explain how results at the household size level get translated at the population level.

In terms of the influence of relative prices on inequality, for both countries, prices are pro-poor. This implies that we would need to give more income to richer households than to poorer households to compensate them for inflation, over the 1981 to 1991 period. Because the distributional impact of relative prices is of a comparable order of magnitude, our inequality comparisons are robust to the choice of the reference price vector.

In order to take into account problems of data imperfections and to test how robust our results are to the choice of an inequality or social welfare index, we followed two different approaches. First, we followed Cowell *et al.* (1999) and studied the robustness of the inequality results to systematic trimming at both ends of the household expenditures distributions. Second, we performed inequality and welfare comparisons in terms of the dominance results in Shorrocks (1983), applying procedures of statistical inference developed by Bishop *et al.* (1989, 1994). The main results of this study are robust to the choice of the inequality or social welfare index, and to potential problems associated with the data in the extreme ends of the expenditure distributions.

In future analyses, decompositions by other demographic subgroups could also be useful in helping us understand the differences that we obtain for Spain and the U.S.

APPENDIX

A. Spanish Data

The 1990-91 EPF is a representative sample consisting of 21,155 observations for a population of 11,298,509 households and 38,494,006 persons living in residential housing over all of Spain, including the African cities of Ceuta and Melilla. The EPF is a household budget survey in which interviews are spread out uniformly over a period of 52 weeks. All household members, 14 years of age or older, are supposed to record, in a Diary, all expenditures taking place during a sample week. Then in-depth personal interviews are conducted to register past expenditures over reference periods beyond a week and up to a year. From that information the INE estimates annual household total expenditures. Annual expenditures on food and drinks take into account the available information on bulk purchases according to the procedure developed in Peña and Ruiz-Castillo (1998). For our study, annual household total expenditures, based on this set of different reporting periods, are assigned the reference 1990-91 period according to the quarter in which the interview took place. For further details on the Spanish survey, see INE (1992). The Spanish sample for this study included 21, 155 households.

B. U.S. Data

The U.S. CEX has two components: a Diary or record-keeping survey which is designed to be completed by participating consumer units for two consecutive one-week periods, and an Interview survey in which the expenditures of consumer units are to be obtained in five interviews conducted once every three months. Survey participants record dollar amounts for goods and services purchased during the week of data collection for the Diary and report these amounts to an interviewer for the previous three months from the date of the interview for the Interview. The expenditure amounts (full purchase price regardless of financing with the exception of vehicles, housing, and medical care) include all sales and excise taxes for all items purchased by the consumer unit for itself or for others. Excluded from both surveys are all business-related expenditures and expenditures for which the consumer unit is reimbursed.

Data are collected from consumer units. A consumer unit comprises either: all members of a particular household who are related by blood, marriage, adoption, or other legal arrangements; a person living alone or sharing a household with others or living as a roomer in a private home or lodging house or in permanent living quarters in a hotel or motel, but who is financially independent; or two or more persons living together who use their incomes to make joint expenditure decisions. Financial independence is determined by the three major expense categories: housing, food, and other living expenses. To be considered financially independent, a least two of the three major expense categories have to be provided entirely, or in part, by the respondent.

The Interview sample is selected on a rotating panel basis, targeted at 5,000 consumer units each quarter. About twenty percent of the sample are interviewed for the first time each quarter while twenty percent are interviewed for the last time. As previously noted, consumer units are interviewed up to five times, at three-month intervals. Data from the first interview are used to 'bound' expenditures for subsequent interviews and are not used in estimation.

Since we are interested in total expenditures, we use data from both the Diary and Interview following a method developed by Rob Cage at the BLS (Cage *et al.* 1997). The BLS (1995) estimates that about 80 to 95 percent of total household expenditures are accounted for in the Interview. Not accounted for in the Interview are roughly 40 specific goods and services, e.g., soaps, laundry and cleaning products, tolls, over-the-counter drugs, pet food, and personal care products. We use data from the Diary to impute additional expenditures for these omitted items to the Interview households. This is accomplished by calculating the expenditure for the Diary-unique item, as a percent of total food expense, and taking the product of this factor and the total food expense reported in the Interview. The budget shares for these items are produced by index-area and consumer unit size in the Diary sample. These shares are then mapped to the CEX Interview sample by index area and consumer unit size, and are used to impute expenditures for these additional items in the Interview.

The continuous and rotating nature of the CEX Interview in the U.S. case poses special problems for the determination of the 1990-91 household expenditures distribution at current prices, that is, the equivalent of the expenditure distribution in the Spanish case. We limit ourselves to the Interview survey consumer units only, since these consumer units provide the maximum of data over the longest period of time, relative to the Diary sample. For our analysis we do not assume that the quarterly expenditure reports are independent (as in official CEX publications, see BLS 1995), but require each consumer unit to have reported expenditures for two, three, or four quarters during the time period of our study. We refer to our sample as horizontal. Restricting ourselves to households with four quarters of complete data would have been unnecessarily restrictive, while including some incomplete households allows us to increase the sample size. If we selected our households with interviews occurring over the exact time period as in the Spanish case (Spring 1990 to Winter 1991), there would only be 1,367 consumer units in the U.S. sample. In contrast, our horizontal sample is composed of 6,284 consumer units, representing 118,481,815 consumer units in the population and 307,204,548 persons. The U. S. data were collected from January 1990 to December 1991. Data from the reported quarters, during this time period, are used to produce annualized expenditures for each consumer unit. The consumer unit characteristics of household size[15] and age of head are based on the average of the quarterly values for the values reported. The population weights used for our analysis are also the result of averaging the quarterly weights over the number of quarters for which the consumer unit participates in the survey.

C. Definition of household expenditures

Since we are most interested in household levels of living, we use household consumption expenditures as our measure, as is said in section III. However, obtaining such expenditures for each country is difficult. For example, we know that in both countries, health care and education are consumed by the population; however, the household may or may not pay for these consumption services and related goods, or they pay relatively little. This is of particular importance when making comparisons between countries when one country has national health insurance, for example, and the other does not, as is the case with Spain and the U.S. To include the household's expenditures for the U.S., and not the comparable expenditures made on the household's part through government programs for Spain, would be to under-account for the consumption of an item like health care (and its value) in Spain. Thus, the level of living in Spain would be underestimated compared to that in the U.S. using reported household expenditures. Likewise, home production for own consumption can add to the household's level of living. Not

[15]Rounded values of average household size were used for our analysis.

including the value of home production in one's measure of household consumption expenditures would bias the level of living downward.

Although we would have liked to include the value of all the items that households consume in our measure, we were restricted by the data available to us. However, given this, our focus remained on current consumption expenditures. Therefore some differences in the Spanish and U.S. definition of household consumption expenditures remain. For example, the value of home production is collected in the EPF and we use these data. Such information is not collected in the CEX. Other analyses that we did show that excluding the value of home production from the measure for Spain did not alter our overall results however. Also, in the Spanish measure, but not the U.S., are cash transfers to members of the household who are not living at the residence. These were expected to be for consumption expenditures for these persons (for example, college students). However, again, if we exclude these expenditures, our overall results do not change. Thus we conclude that if we include the value of home production and these cash transfers or not, our overall results with respect to inequality and social welfare in Spain as compared to the U.S. change very little.

We start with the expenditure bundle used by the statistical agencies for the production of their official Consumer Price Indexes (CPIs) to define expenditures and to reflect more accurately household current consumption. Included in the U.S. CPI bundle but not the Spanish CPI bundle are items like funeral articles, gambling expenditures, fines, hunting, fishing and other fees, rent and food in-kind from work, and expenditures for automobile insurance. All of these are considered current consumption for our study so we added the expenditures for these additional items to the Spanish bundle as well. As noted above, also included in Spanish expenditures are cash transfers to persons not living in the household[16] and the value of home production.[17],[18] Data on these transfers are not available to us for this analysis for all the households in the U.S. sample.[19] Again, as noted previously, information on home production in the U.S. is not collected.

Expenditures for the acquisition of vehicles for private transportation, house maintenance and repairs, and life insurance are considered to be more of a form of savings than current consumption. Thus, they are excluded for the analysis. Expenditures for housing (rent for renters and some type of rental equivalence for owners, as well as utilities), and health and vehicle insurance are included. Adjustments to expenditures as collected by the statistical offices are made to account for the flow of services from owner occupied housing (this is done by the statistical office for the U.S. and Spain). In addition, for the U.S., adjustments are made to account for the flow of services from selected household durables (see *Cage et al.* 1997).

[16] The share of total expenditures in the Spanish weighted sample which is allocated to cash transfers to persons not belonging to the household is 0.005.

[17] Home production includes self-consumption and self-supply. Self-consumption is defined to be goods (mainly food) produced on one's own farm, in one's own factory or workshop, or by one or some member of the household. These goods are consumed by household members or given as gifts to others not of this household during the reference period. These goods are valued at local retain market prices. The share of total expenditures in the Spanish weighted sample which is allocated to home production is 0.007.

[18] When the overall inequality (Theil c=0) results were produced for each Θ with cash transfers and home production not included, the sign of the U.S.-Spanish differences did not change. However, expenditure inequality in Spain increased marginally with the exclusion of these expenditures. When Θ =0.0, the overall inequality index value was 0.171 (versus 0.166), when Θ =0.3, the index was 0.149 (versus 0.145), when Θ =0.5, the index was 0.143 (versus 0.139), when Θ =0.7, the index was 0.143 (versus 0.140), and when Θ =1.0, the index was 0.158 (versus 0.155).

[19] Cash contributions to non-profit institutions and to persons not living in the household data are only collected in the fifth quarter of the CEX Interview. Our sample includes consumer units who may not have a fifth interview; based on this, we decided to define expenditures so that they would be the same across all quarters covered. Thus, these contributions are not included in the U.S. definition of current consumption expenditures.

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Table 1. Population Distributions and Mean Household Expenditures by Household Size in Spain and the United States

1990-91 Distributions, Expenditures in Winter 1991 Prices

Expenditures in U.S. Dollars Based on EKS Purchasing Power Parities

Household Size	Population Distribution of Persons			Population Distribution of Households			Mean Household Expenditures		
	Spain	United States	% difference	Spain	United States	% difference	Spain	United States	% difference
1	2,9	10,3	252,1	10,0	26,8	168,0	$9.993,24	$15.726,00	57,4
2	13,1	23,4	78,8	22,3	30,3	36,1	15.417,42	25.126,74	63,0
3	18,3	19,8	8,1	20,8	17,1	-17,8	21.702,08	27.970,45	28,9
4	29,3	23,7	-19,2	25,0	15,3	-38,5	26.646,48	30.664,80	15,1
5	19,4	12,7	-34,3	13,2	6,6	-50,0	28.016,07	31.646,61	13,0
6	9,6	5,4	-43,5	5,4	2,3	-57,0	29.785,21	29.005,84	-2,6
7	4,5	2,1	-52,8	2,2	0,8	-64,1	30.056,00	37.382,72	24,4
	97,1	97,4	0,4	98,9	99,3	0,4			

EKS purchasing price parity conversion factor is 108.9 Spanish pesetas to $1 U.S. for 1991

% difference=((U.S.-Spain)/Spain)*100

Table 2. Household Population Distribution by Age of Reference Person and Household Size

in Spain and the United States, 1990-91

	Spain			United States		
Reference Person's Age in Years	All	One Person	Two Persons	All	One Person	Two Persons
less than 31	7,5	5,5	8,2	19,2	25,6	15,6
31 to less than 41	18,7	5,3	6,7	22,8	14,5	14,3
41 to less than 51	20,1	4,6	5,1	19,2	11,3	13,9
51 to less than 65	28,5	20,7	27,3	18,0	14,1	26,0
greater than or equal to 65	25,0	63,8	52,7	20,8	34,4	30,1

Table 3. Mean Adjusted Household Expenditures for All Households in Spain and the United States

1990-91 Distributions, Expenditures in Winter 1991 Prices

Expenditures in U.S. Dollars Based on EKS Purchasing Power Parities

Scale Adjustment Factor	Person Weighted Mean Household Expenditures			Household Weighted Mean Household Expenditures		
	Spain	United States	% difference	Spain	United States	% difference
0,0	$24.727,08	$27.643,47	11,8	$21.958,12	$24.642,51	12,2
0,3	16.229,58	19.498,38	20,1	15.218,54	18.928,60	24,4
0,5	12.355,62	15.656,51	26,7	12.052,83	16.122,20	33,8
0,7	9.471,01	12.711,96	34,2	9.639,08	13.903,28	44,2
1,0	6.445,01	9.504,06	47,5	7.031,38	11.393,82	62,0

EKS purchasing power parity conversion factor is 108.9 Spanish pesetas to $1 U. S. for 1991
% difference=((U.S.-Spain)/Spain)*100

Table 4. Relative Inequality Indexes by Household Size for Spain and the United States, 1990-91 Distributions of Household Expenditures in Winter 1991 Prices

Household Size	Theil (-1)	Theil (0)	Theil (1)	Theil (2)
		Spain		
1	0,315	0,243	0,244	0,323
2	0,207	0,177	0,181	0,230
3	0,149	0,128	0,131	0,159
4	0,146	0,128	0,133	0,172
5	0,142	0,122	0,122	0,141
6	0,159	0,128	0,131	0,161
7	0,143	0,122	0,117	0,127
		United States		
1	0,208	0,164	0,163	0,222
2	0,156	0,136	0,140	0,175
3	0,163	0,133	0,129	0,145
4	0,151	0,127	0,124	0,140
5	0,171	0,148	0,156	0,210
6	0,200	0,158	0,165	0,222
7	0,192	0,162	0,160	0,184
		% difference between the United States and Spain		
1	-34,0	-32,5	-33,2	-31,1
2	-24,7	-23,1	-22,6	-23,9
3	9,4	3,7	-1,3	-9,2
4	3,5	-0,8	-6,7	-18,4
5	20,1	21,2	27,2	48,8
6	25,9	23,7	26,3	37,9
7	34,2	32,6	36,1	44,7

% difference=((U.S.-Spain)/Spain)*100

Table 5. Relative Inequality (Theil c=0) Indexes of 1990-91 Distributions of Adjusted Household

Expenditures in Winter 1991 Prices

All Households in Spain and the United States

(person weighted)

Scale Adjustment Factor	Inequality in Spain					Inequality in the United States				
		Within Group		Between Groups			Within Group		Between Groups	
	Overall		% of total		% of total	Overall		% of total		% of total
0,0	0,166	0,136	81,8	0,030	18,2	0,161	0,140	86,9	0,021	13,0
0,3	0,145	0,136	93,7	0,009	6,3	0,144	0,140	97,0	0,004	3,0
0,5	0,139	0,136	97,9	0,003	2,1	0,146	0,140	95,6	0,006	4,4
0,7	0,140	0,136	97,4	0,004	2,6	0,160	0,140	95,6	0,020	13,4
1,0	0,155	0,136	88,1	0,018	11,9	0,201	0,140	69,6	0,061	30,4

Table 6. Decomposition of Differences in Inequality (Theil c=0)

U.S. Inequality-Spain Inequality

All Households (person weighted)

1990-91 Distributions at Winter 1991 Prices

	Spanish Shares and U.S. Inequality			
theta	$\boxed{\Delta W}$	$\boxed{\Delta D}$	$\boxed{\Delta C(\Theta)}$	$\boxed{\Delta I(\Theta)}$
0	0,003	0,000	-0,009	-0,005
0,3	0,003	0,000	-0,005	-0,001
0,5	0,003	0,000	0,004	0,008
0,7	0,003	0,000	0,016	0,020
1	0,003	0,000	0,043	0,047

	U.S. Shares and Spain Inequality			
theta	$\boxed{\Delta W'}$	$\boxed{\Delta D'}$	$\boxed{\Delta C(\Theta)}$	$\boxed{\Delta I(\Theta)}$
0	-0,010	0,014	-0,009	-0,005
0,3	-0,010	0,014	-0,005	-0,001
0,5	-0,010	0,014	0,004	0,008
0,7	-0,010	0,014	0,016	0,020
1	-0,010	0,014	0,043	0,047

NOTE: differences in the sums of the changes in W and W' are due to rounding.

Table 7. Overall Welfare (Theil c=1) by Household Size Based on 1990-91 Distributions of Unadjusted Household Expenditures in Winter 1991 Prices in Spain and the United States

(person weighted)

Household Size	Spain	United States	% difference between the United States and Spain
1	$7.552,91	$13.159,99	74,2
2	12.623,77	21.600,89	71,1
3	18.867,20	24.365,14	29,1
4	23.102,40	26.859,48	16,3
5	24.590,56	26.723,39	8,7
6	25.891,05	24.215,68	-6,5
7	26.528,68	31.412,34	18,4

Table 8. Overall Welfare (Theil c=1) Based on 1990-91 Distributions of Adjusted Household Expenditures in Winter 1991 Prices

All Households in Spain and in the United States

Expenditures in U.S. Dollars Based on EKS Purchasing Power Parities

(person weighted)

Scale	Welfare in Spain					Welfare in United States					% difference between the		
		Within Group		Between Groups			Within Group		Between Groups		United States and Spain		
Adjustment			% of		% of			% of		% of		Within	Between
Factor	Overall		total		total	Overall		total		total	Overall	Group	Groups
0,0	$20.748,78	$21.411,95	103,2	$663,16	3,2	$23.212,13	$23.757,05	102,3	$544,92	2,3	11,9	11,0	-17,8
0,3	13.885,10	14.021,83	101,0	136,73	1,0	16.679,46	16.762,07	100,5	82,60	0,5	20,1	19,5	-39,6
0,5	10.620,52	10.655,68	100,3	35,16	0,3	13.362,29	13.458,17	100,7	95,88	0,7	25,8	26,3	172,7
0,7	8.118,73	8.151,08	100,4	32,36	0,4	10.687,04	10.923,62	102,2	236,59	2,2	31,6	34,0	631,2
1,0	5.411,52	5.526,35	102,1	114,84	2,1	7.602,38	8.159,77	107,3	557,38	7,3	40,5	47,7	385,4

EKS purchasing price parity conversion factor is 108.9 Spanish pesetas to $1 U.S. for 1991

% difference=((U.S.-Spain)/Spain)*100

Table 9. Changes in Relative Inequality (Theil c=0) Between the United States and Spain at Constant Prices

in Two Different Time Periods

All Households (person weighted)

	Spain	United States	At winter 1981 prices	At winter 1991 prices
scale adjustment factor	Inequality at winter 1991 prices minus Inequality at winter 1981 prices $\boxed{\Delta P_1(\Theta)}$	Inequality at winter 1991 prices minus Inequality at winter 1981 prices $\boxed{\Delta P_2(\Theta)}$	Inequality in the U.S. minus Inequality in Spain $\boxed{\Delta I_{t\sigma}(\Theta)}$	Inequality in the U.S. minus Inequality in Spain $\boxed{\Delta I_t(\Theta)}$
0	0,005	0,003	-0,004	-0,005
0,3	0,004	0,005	-0,001	-0,001
0,5	0,004	0,006	0,005	0,008
0,7	0,003	0,007	0,016	0,020
1	0,002	0,009	0,041	0,046

Table 10. Relative Inequality (Theil c=0) Index of 1990-91 Distributions of Adjusted Household Expenditures

in Winter 1991 Prices: Spain and the United States

(person weighted)

	Theil (0) Theta=0			Theil (0) Theta=0.5			Theil (0) Theta=1		
	United States	Spain	% difference	United States	Spain	% difference	United States	Spain	% difference
All households with positive expenditures	0,161	0,166	3,1%	0,146	0,139	-5,1%	0,201	0,155	-23,2%
Trimming lower tail 1%	0,151	0,155	2,6%	0,138	0,131	-5,3%	0,191	0,147	-23,4%
Trimming lower tail 5%	0,131	0,133	1,5%	0,120	0,115	-4,7%	0,168	0,131	-22,0%
Trimming upper tail 1%	0,142	0,150	5,6%	0,130	0,123	-5,4%	0,180	0,135	-24,9%
Trimming upper tail 5%	0,121	0,128	5,8%	0,110	0,103	-6,4%	0,151	0,110	-27,0%
Trimming both tails 1%	0,133	0,139	4,8%	0,122	0,115	-5,8%	0,171	0,128	-24,7%
Trimming both tails 5%	0,092	0,095	3,3%	0,084	0,079	-6,1%	0,118	0,084	-28,7%

Table 11. Lorenz Curve Comparison of Social Welfare in Spain and the United States
1990-91 Distributions, 1991 dollars
(persons weighted)

Household Size	Lorenz Comparison	Mean	Social Welfare
1	U.S.	U.S.	U.S.
2	U.S.	U.S.	U.S.
3	Spain	U.S.	?
4	*	U.S.	U.S.
5	Spain	U.S.	?
6	*	*	*
7	*	U.S.	U.S.
Scale Adjustment Factor			
0	U.S.	U.S.	U.S.
0,3	*	U.S.	U.S.
0,5	Spain	U.S.	?
0,7	Spain	U.S.	?
1	Spain	U.S.	?

* Non-significant differences

? Non comparability

Figure 1
Relative inequality (Theil c=0) by Household Size for Spain and the U.S., 1990-91 Distributions of Household Expenditures in Winter 1991 Prices

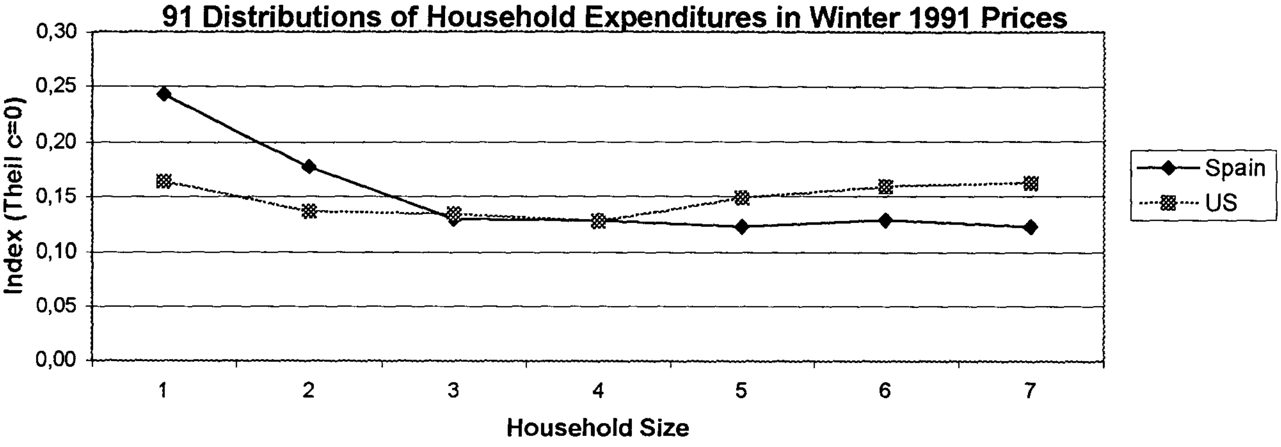

Figure 2.
Relative Inequality (Theil c=0) Indexes of 1990-91 Distributions of Adjusted Households Expenditures in Winter 1991 Prices.All Households in Spain and the U.S. (person weighted)

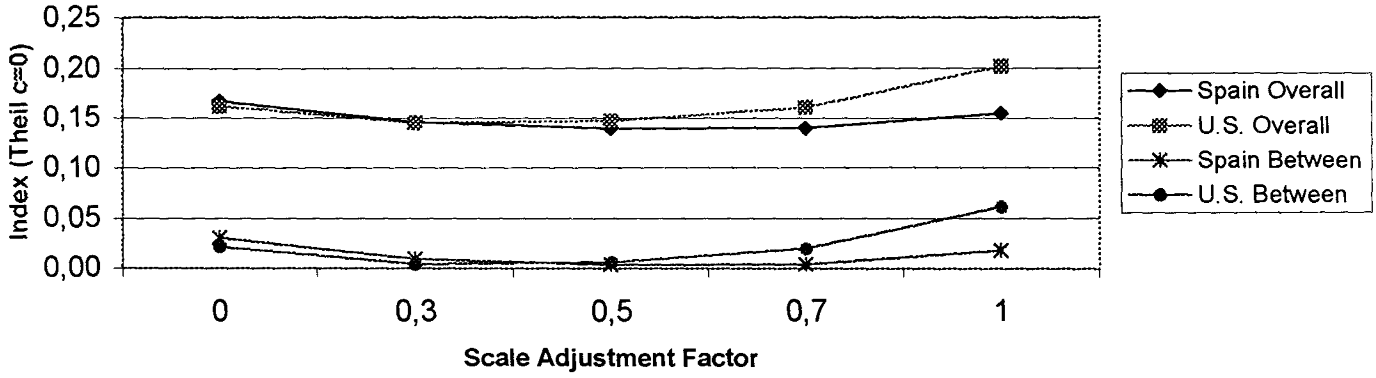

Figure 3
Mean Household Expenditures by Household Size in Spain and the U.S. 1990-91 Distributions, Expenditures in Winter 1991 Prices. Expenditures in U.S. $ based on EKS purchasing power parities