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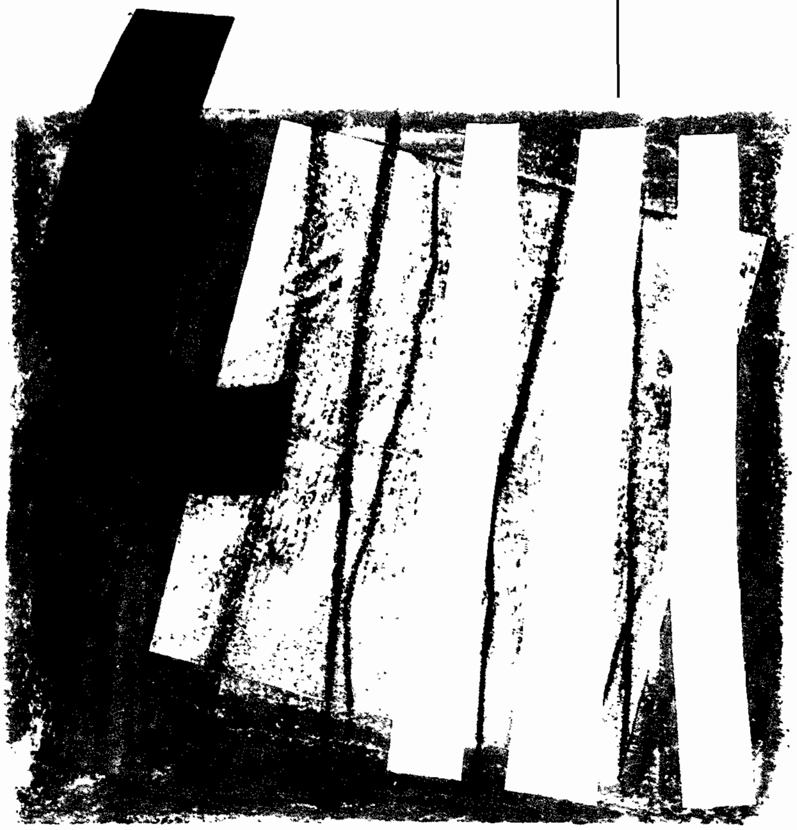

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"A SIMPLIFIED MODEL FOR SOCIAL WELFARE ANALYSIS. AN APPLICATION TO SPAIN, 1973-74 TO 1980-81"

Javier Ruiz-Castillo [1]

Abstract

Most of the literature on income distribution has been concentrated on inequality. In this paper we introduce also efficiency considerations to analize social welfare according to the established theory in Welfare Economics. We propose a simple but useful specification which combines three features: (i) a procedure to make welfare comparisons across households with different needs; (ii) the use of household specific statistical price indices to make intertemporal comparisons in real terms, and (iii) the selection of measurement instruments on the grounds of their properties for applied work, including the important additive separability property. The methodology is applied to the study of the role of prices and demographic effects in the evolution of the standard of living in Spain from 1973-74 to 1980-81.

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INTRODUCTION

Most welfare analysis implicitly assume that social or aggregate welfare can be expressed in terms of only two statistics of the income distribution: the mean, and a measure of inequality. As Dutta and Esteban (1991) have shown, to achieve these objectives we need to specify the type of mean-invariance property we want our inequality indices to satisfy. This is politically important, since we know from the early discussion in Kolm (1976) that the choice of a mean-invariance class of inequality measures is not merely a technical matter, but a value laden question[1]. In this paper, we will consider only the two polar cases: a relative inequality concept, according to which a proportional change in all incomes leaves the level of inequality unchanged; and an absolute inequality concept, according to which inequality remains constant only if all individuals experience the same absolute income change.

Of course, a larger mean and a reduction in inequality are always to be prefered, but what are we to make of situations in which the two magnitudes move in the same direction? To be able to decompose welfare changes into changes in the mean and changes in either relative or absolute inequality, we need complete social evaluation functions (SEFs for short) capable of ordering all conceivable income distributions. Such indicators specify the trade off between efficiency and distributional considerations: a multiplicative trade off in the relative case, and an additive trade off in the absolute case.

Finally, 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 to express 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.

So far we have implicitly assumed that all individuals are identical. However, from a practical as well as a normative point of view, the first difficulty one encounters in income distribution theory is that persons come grouped in households of different characteristics and, therefore, different needs. Consequently, their incomes are not directly comparable. To advance the analysis we must select a population partition acording to some ethically relevant characteristics. Since all households belonging to a given subgroup are assumed to have the same needs, it is always important to investigate separately each of the subgroups in the basic partition. However, social evaluation within subgroups need not yield unanimous results. In any case, it is always convenient to extract conclusions for the population as a whole. The problem, of course, is that in order to pool all households into a unique distribution, we need a procedure to compare non-income needs across subgroups.

If we allow households to have different preferences, we would be forced to establish a "welfare correspondence" in the sense of Pollak (1991), determining which indifference curve on one's household's map yields the same welfare level as a particular curve on each other's map. Lacking a theory for that purpose, we must restrict ourselves to what Pollak calls "situational comparisons". Since Pollak and Wales (1979) these are made in terms of a fundamental unconditional utility function, common to all households, defined on commodities and ethically relevant household characteristics. Then, following Muellbauer (1974) and standard practice since that date, we can adjust incomes for price change and non-income needs, taking as reference a vector of base prices and a household type.

In general, inequality within each subgroup depends on the choice of the reference type, say an adult or a couple. The reason is that identical characteristics might be enjoyed differently depending on the income level. For instance, identical households might experience different economies of scale in consumption depending on their income level. To avoid this, theoretical and econometric models make equivalence scales independent of the utility level. This simplification requires certain restrictions on unconditional preferences, but allows equivalence scales to depend both on ethically relevant characteristics and prices[2].

Attempts to infer from observed behavior household welfare comparisons and price effects along these lines, are expensive econometric exercises plagued with well known difficulties. Thus, for example, in their review of such difficulties, Coulter *et al* (1992a) conclude that "there is no single 'correct' equivalence scale for adjusting incomes -a range of scale relativities is both justifiable and inevitable".

In this paper, we choose a less expensive strategy in two steps. On the one hand, following Coulter *et al* (1992a, 1992b) and Jenkins and Cowell (1994), we use parametric equivalence scales which depend only on demographic variables. In particular, we study the robustness of our results to parameter changes which represent different views about the importance of economies of scale and/or the weight we should give children relative to adults. Naturally, the price independence is achieved at the cost of further restrictions on preferences.

On the other hand, for the adjustment of money incomes to price change we use household specific statistical price indices. This allows us to study two issues. In the first place, we measure the distributional impact of changes in relative prices, and compare our results with those obtained under the usual assumption of a single inflation rate common to all households. In the second place, contrary to standard practice, we confront also the classical index number problem by expressing money incomes at the prices of the two situations under comparison. However, our results must be interpreted taking into account that our statistical price indices do not reflect household behavioral changes in response to price and income effects. Thewrefore, our indices provide only an upper (lower) bound to the true cost-of-living constructions of the Laspeyres (Paasche) type.

Notice that there are several reasons for requiring additive separability from SEFs. We have mentioned already that we ought to evaluate separately each ethically homogeneous subgroup of the basic partition. Consequently, we want to understand how the evaluation for the population is built up from the evaluation for the subgroups. That the weights in the within-group term are demographic shares is decisive to explain the differences which obtain when the household or the person is taken as the unit of analysis. Moreover, as pointed out in Coulter *et al* (1992a), because any procedure for taking non-income needs into account is open to objections, we want to isolate as much as possible in the between-group inequality term the impact of changing equivalence scales parameter values[3].

As reviewed in Ruiz-Castillo (1995a), (i) the requirements for expressing welfare as a function of the mean and an index of relative or absolute inequality, (ii) the specification of a multiplicative or an absolute trade off between these two magnitudes, plus (iii) the additive separability property, lead to specific functional forms for SEFs: in the relative case, to a single member of the generalized entropy family and, in the absolute case, to the Kolm-Pollak family indexed by a parameter representing degrees of aversion to inequality.

These measurement tools are applied to Spanish data from two large household budget samples, of about 24.000 observations each: the *Encuestas de Presupuestos Familiares* (EPF for short), collected in 1973-74 and 1980-81 by the Spanish *Instituto Nacional de Estadística* (INE for short) with the main purpose of estimating the base weights of the official system of Consumer Price Indices. Like Slesnick (1991, 1993), we propose to identify a household standard of living with current commodity consumption. In our case, this will be better approximated by a measure of total expenditures, net of acquisitions of certain durables, rather than total income.

During this period, right after the first oil crisis and in the middle of a radical political change in Spain, according to National Accounts data GNP grew at an average annual rate of about 2.3 percent at constant prices of 1986, while according to the Consumer Price Index there was a 322 percent inflation rate. In this context, our main empirical conclusions are the following:

i) In Ruiz-Castillo (1995b) we found an improvement in relative inequality in real terms larger than in money terms, reflecting a pro-poor effect of this period's change in relative prices. Here we confirm this finding for our measure of absolute inequality. In both cases, such improvements are reasonably robust to the choice of base prices. However, while mean household expenditure increased by about 2 percent at prices of the Winter of 1981, denoted by p_2, it decreased at least 3.5 percent at an average of 1973 and 1974 prices, denoted by p_1. Thus, at p_2 we estimate a welfare improvement of about 8 percent in the relative case, or 3.5-10.0 percent in the absolute case, but at p_1 we estimate a negligible improvement in relative welfare, at most equal to 1.5 percent, or a change in absolute welfare ranging from minus 3.5 to plus 2 percent.

ii) When we apply the same inflation rate to all households in situation 1, estimates of welfare change are similar to those registered at p_2 with household specific price indices. However, since the only inequality improvement that can now be captured is the improvement in money terms, most of the real welfare improvement is wrongly attributed to an increase in the mean.

iii) Both in the relative and the absolute case, cross-section estimates follow a non-linear pattern as a function of the parameter representing the weight to be given to household size. When economies of scale are small, the smaller the weight given to a child relative to an adult, the smaller the inequality in both cross-sections. However, inequality or welfare intertemporal comparisons vary little with such parametrizations. In the absolute case, the greater the aversion to inequality the smaller the improvement in real welfare.

iv) There are considerable variations among subgroups in the partition by household size. For instance, in the relative case at p_2, small households end up with welfare increases greater than 15 percent, 3 to 7 person households with increases about 4-5 percent, and large households with welfare losses close to 10 percent. Given the fact that larger households do worse than smaller ones, welfare changes suffer a downward shift when adjusted household expenditure is weighted by household size.

The rest of the paper is organized in three sections. The first section presents the measurement framework, including (i) the single parameter model of inter-household welfare comparisons, (ii) SEFs for the relative and the absolute case, (iii) our operative definition of a household standard of living, and (iv) the nature of our approximation to social welfare change as a consequence of our method for the repricing of the scale variable. The second section, together with an statistical Appendix, is devoted to the empirical results. We first study the role of prices in welfare evaluation for each homogeneous subgroup within the partition by household size. Then we analize welfare change for the population as a whole, as well as the robustness of our results to (i) the different schemes to make interhousehold welfare comparisons and (ii) the unit of analysis. The final section offers some concluding comments.

I. THE MEASUREMENT FRAMEWORK

I.1. Interhousehold welfare comparisons

Suppose we have a population of h = 1,...,H households which can differ in a single dimensional variable -say, income- representing its standard of living, x^h, and/or a vector of household characteristics. In this section, households of the same size are assumed to have the same needs and, therefore, their incomes will be directly comparable. Larger households have greater needs, but also greater opportunities to achieve economies of scale in consumption. Denote household size by s^h and, for each household h, define adjusted income in the relative case by

$$y^h(\Theta) = x^h / (s^h)^\Theta, \; \Theta \in [0,1].$$

When $\Theta = 0$, adjusted income coincides with unadjusted household income, while if $\Theta = 1$, it equals *per capita* household income. In the absolute case, we have

$$y^h(\lambda) = x^h - \lambda(s^h - 1), \; \lambda \in [0, \lambda^*],$$

where the parameter λ can be interpreted as the cost of an adult. Of course, the greater is Θ or λ, the smaller are the economies of scale within the household.

Assume that there are m = 1,...,M household sizes, and let x^m be the vector of original incomes for households of size m. Notice that, if I(.) is any index of relative inequality, then for each m we have

$$I(y^m(\Theta)) = I(x^m / (m^\Theta) = I(x^m).$$

Similarly, if A(.) is any index of absolute inequality, then for each m we have

$$A(y^m(\lambda)) = A(x^m - \lambda(m - 1)) = A(x^m).$$

Thus, in both cases, within each ethically homogeneous subgroup, the inequality of adjusted income is equal to the inequality of original income, independently of individual incomes, prices and the choice of the reference group.

I.2. Admissible Social Evaluation Functions

A SEF is a real valued function W defined in the space R^H of adjusted incomes, with the interpretation that for each income distribution $y = (y^1,...,y^H)$, W(y) provides the "social" or, simply, the aggregate welfare from a normative point of view. As indicated in the Introduction, the requirements for expressing welfare as a function of the mean and an index of relative or absolute inequality, the specification of a multiplicative or an absolute trade off between these two magnitudes, plus an additive separability property, lead to specific functional forms for SEFs.

Let us denote by μ the function giving the mean of a distribution, and let μ^* be the distribution in which each household is assigned the mean income of the subgroup to which it belongs, $\mu(y^m)$, in the partition by household size. Let $I_T(.)$ be the first index of relative inequality originally suggested by Theil:

$$I_T(y) = (1/H)[\Sigma_h(y^h/\mu(y)) \ln(y^h/\mu(y))].$$

Consider SEFs which can be expressed as the product of the mean and a term equal to one minus a relative inequality index. The only SEF among them with the property of additive decomposability with demographic weights, is the following:

$$W_T(y) = \mu(y)(1 - I_T(y)) = \Sigma_m[H^m/H]W_T(y^m) - \mu(y)\, I_T(\mu^*),$$

where H^m is the number of households of size m, so that $\Sigma_m H^m = H$. Thus, social welfare is seen to be a weighted average of the welfare within each subgroup, minus the between-group inequality weighted by the population mean.

In the absolute case, analogous requirements lead to the Kolm-Pollak family of SEFs:

$$W_\gamma(y) = - [1/\gamma] \ln[(1/H)\, \Sigma_h\, e^{-\gamma y^h}], \quad \gamma > 0,$$

where γ is interpreted as an aversion to inequality parameter: as γ increases, social indifference curves show increasing curvature until, in the limit, only the poorest household income matters. The absolute inequality index associated with W_γ is

$$A_\gamma(\mathbf{y}) = [1/\gamma] \ln [(1/H)\Sigma_h e^{\gamma(\mu(\mathbf{y}) - y^h)}].$$

Let us denote by ξ^* the distribution in which each household is assigned the equally distributed equivalent income of the subgroup to which it belongs, $\xi(\mathbf{y}^m)$. Then

$$A_\gamma(\mathbf{y}) = \Sigma_m [H^m/H] A_\gamma(\mathbf{y}^m) + A_\gamma(\xi^*),$$

so that

$$W_\gamma(\mathbf{y}) = \mu(\mathbf{y}) - A_\gamma(\mathbf{y}) = \Sigma_m [H^m/H] W_\gamma(\mathbf{y}^m) - A_\gamma(\xi^*).$$

Thus, social welfare is equal to the mean minus the Kolm-Pollak absolute inequality index. On the other hand, social welfare is a weighted average of the welfare within each subgroup, minus the inequality between the subgroups.

Taking into account our definitions of adjusted income, in the relative case we have

$$W_T(\mathbf{y}(\Theta)) = \Sigma_m [H^m/H][W_T(\mathbf{x}^m)/m^\Theta] - \mu(\mathbf{y}(\Theta)) I_T(\mu^*(\Theta)),\ \Theta \in [0,1],$$

and in the absolute case

$$W_\gamma(\mathbf{y}(\lambda)) = \Sigma_m [H^m/H] W_\gamma(\mathbf{x}^m) - \Sigma_m [H^m/H]\lambda(m-1) - A_\gamma(\xi^*(\lambda)),\ \lambda \in [0,\lambda^*].$$

The upper bound for λ, as well as the values for the aversion to inequality parameter γ, must be jointly selected taking into account that absolute inequality measures are not independent of the measurement unit.

In Welfare Economics we are mostly interested in personal welfare, rather than on household welfare. Following standard practice, we can extend the SEF domain to distributions in which each household adjusted income is weighted by household size or, in other words, in which each person is assigned the adjusted income of the household to which she belongs. The above formulas for W_T and W_γ can be easily transformed for this case:

demographic shares, H^m/H, as well as expressions $\mu^*(\Theta)$ and $\xi^*(\lambda)$, must be replaced by their counterparts in the distributions of persons.

I. 3. The measurement of a household standard of living

We agree with Slesnick (1991, 1993) that, ideally, we should identify the standard of living with commodity consumption. Lacking information on leisure and public goods consumption, our starting point must be household consumption of private goods and services.

Given the nature of our data, we have several reasons for choosing household total expenditure rather than household total income to approximate household private consumption. i) There is a general presumption that current expenditure reflects permanent income, while current income includes more volatile transitory components. ii) The EPF's include information on income perceived by a maximum of four household members. However, they are designed to measure household expenditure with the purpose of estimating the Consumer Price Index weighting system. iii) Several groups might be inclined to underreport income. For instance, those working in the underground economy, the self-emplyed, professionals of all sorts, or agricultural workers. But none of them need be particularly prone to missreport their expenditures. iv) More than 60 percent of households spend more than they accrue as income[4], and there is evidence showing less total income inequality than total expenditure inequality[5], contrary to all expectations. In our opinion, these facts need some explanation before income data can be comfortably used.

In our surveys, we have a rather wide concept of total expenditure, including household transfers, as well as a number of imputations for self-consumption and wages in kind, subsidized meals at work, and a market rental value, estimated by the owner, for owner-occupied housing. However, our experience with the 1980-81 EPF indicates[6] that discontinuous household expenditures on some durables, whose occurrence may distort heavily the total, are best considered investment rather than consumption. These include current acquisitions of cars, motorcycles and other means of private transportation, as well as house repairs financed by either tenants or owner-occupiers. Thus, our estimate of household current consumption will be total household expenditures, net of these investment items.

I. 4. The measurement of welfare change at constant prices

We want to compare two populations confronting different price vectors in situations $\tau = 1, 2$. Let $y_\tau = (y_\tau^1, ..., y_\tau^H)$ be the vector of household adjusted expenditures in situation τ. Take the case $\tau = 1$, and let y_{12}^h be household h's adjusted expenditure in situation 1 expressed at prices of situation 2. Then, ideally we would compute $y_{12}^h = y_1^h L(p_2, p_1; u_1^h)$, where $L(p_2, p_1; u_1^h)$ is a true cost-of-living index of the Laspeyres type and u_1^h is the utility level achieved by household h in situation 1. When $\tau = 2$, to express y_2^h at prices of situation 1, we would use the expression $y_{21}^h = y_2^h / P(p_2, p_1; u_2^h)$, where $P(p_2, p_1; u_2^h)$ is a true cost-of-living index of the Paasche type with an analogous interpretation for u_2^h.

To evaluate the social welfare change in real terms, we would compare y_2 with $y_{12} = (y_{12}^1, ..., y_{12}^H)$, and $y_{21} = (y_{21}^1, ..., y_{21}^H)$ with y_1. In the relative case, we do this at prices p_2, for example, by means of the expression

$$\Delta W_{T2} = \Delta\mu_2 \, \Delta E_{T2},$$

where

$$\Delta W_{T2} = W_T(y_2)/W_T(y_{12}),\ \Delta\mu_2 = \mu(y_2)/\mu(y_{12}),\ \Delta E_{T2} = [1 - I_T(x_2)] \,/ [1 - I_T(y_{12}].$$

Notice that there are no *a priori* reasons for $\Delta\mu_2$ or ΔE_{T2} to be greater or smaller than $\Delta\mu_1$ or ΔE_{T1}, respectively. Hence, nothing can be said about the relationship between ΔW_{T2} and ΔW_{T1}. In the absolute case, the joint impact on welfare of changes in absolute inequality and changes in the mean at prices p_2, for example, are evaluated relative to the welfare in situation 1. Thus, in the expression

$$\Delta W_{\gamma 2} = \Delta\mu_2 + \Delta E_{\gamma 2},$$

we have

$$\Delta W_{\gamma 2} = [W_\gamma(y_2) - W_\gamma(y_{12})] / W_\gamma(y_{12}),\ \Delta\mu_2(\lambda) = [\mu(y_2) - \mu(y_{12})] / W_\gamma(y_{12}),$$

and

$$\Delta E_{\gamma 2}(\lambda) = [A_\gamma(y_2) - A_\gamma(y_{12})] / W_\gamma(y_{12}).$$

II.5. The nature of our approximation

Our data comes from two budget surveys collected from July 1973 to June 1974, and from April 1980 to March 1981. They consist of 24.151 and 23.971 observations, respectively, for a population of approximately 10 million household occupying residential housing. In the empirical application we choose p_2 = Winter of 1981 and $p_1 = (1/2)\, p_{73} + (1/2)\, p_{74}$. Let w^h_τ be the 57-dimensional vector of total expenditure commodity shares by household h in the survey year τ. For each h in 1973-74, we approximate the index $L(p_2, p_1; u^h_1)$ by its upper bound $L(p_2, p_1; w^h_1)$; while for each h in 1980-81, we approximate the index $P(p_2, p_1; u^h_2)$ by its lower bound $P(p_2, p_1; w^h_2)$. Therefore, our constructions $y^h_1\ L(p_2, p_1; w^h_1)$ and $y^h_2 / P(p_2, p_1; w^h_2)$ overestimate the true ones, y^h_{12} and y^h_{21}, for all h. Hence, at prices p_2 (p_1) our estimates for the real change in the mean, $\Delta\mu_2$ ($\Delta\mu_1$) provide a lower (upper) bound for their true value. On the other hand, if the substitution bias is greater for the rich, as can be expected, and the change in relative prices from p_1 to p_2 is less damaging to the poor than to the rich, as we know to be the case for Spain in this period, then at p_2 (p_1) our estimates for ΔE_{T2} (ΔE_{T1}) in the relative case provide an upper (lower) bound for the true constructions. Therefore, nothing definite can be said in our case about the nature of the approximation of our estimates for ΔW_{T2} and ΔW_{T1} to their true values. However, in any empirical situation one would like to obtain that $\Delta\mu_2 \leq \Delta\mu_1$ and $\Delta E_{T2} \geq \Delta E_{T1}$, in the hope that the true constructions lie between these limits. Of course, an entirely analogous problem must be faced in the absolute case.

Finally, it should be noticed that we have used the information on sampling weighting factors provided by INE. Thus, ours are not sample estimates but blown up estimates for the total population.

II. EMPIRICAL RESULTS

II. 1. The role of prices. Previous results on relative inequality

In Ruiz-Castillo (1995b), we decomposed the change in money inequality into two terms: the change in inequality at constant prices, and a term capturing the distributional impact of changes in relative prices between 1973-74 and 1980-81 in a 57 commodity space. Relative inequality was measured using several members of the entropy family, including the index $I_T(.)$ which will be used in the sequel. Original money distributions were expressed at prices of the Winter of 1981, denoted by p_2, and at an average of 1973 and 1974 prices, denoted by p_1.

The main finding was that, at both p_2 and p_1 prices, the improvement in money inequality was smaller than the improvement in real inequality. This result was rather robust to the choice of entropy indices and to the value of parameter Θ which reflects the importance given to household size in the definition of adjusted household expenditures. The explanation, of course, is that changes in relative prices during this period had been less damaging to the poor than to the rich.

This is illustrated in Table 1 for the 8 commodity case. The first column shows the commodity price relativities, ordered from the minimum to the maximum inflation rate. Columns 2 to 5 present average household size and the 8 expenditure shares for the poor, defined as the lower quintile in each of the following two household distributions: the distribution of total household expenditures ($\Theta = 0$), and the distribution of *per capita* total household expenditures ($\Theta = 1$). The information is shown for both survey years. Columns 6 to 9 present identical information for the rich, defined as the upper quintile of the corresponding distributions.

Table 1 around here

Given the usual positive (negative) correlation between household size and total household expenditure (*per capita* household expenditure), the poor have a low (high) mean household size in the distribution for $\Theta = 0$ ($\Theta = 1$). The opposite is the case for the rich: in both years, when economies of scale are assumed to be large ($\Theta = 0$), mean household size is large, while when we assume no economies of scale ($\Theta = 1$), mean household size is small. Notice the variation in demographic characteristics experienced by the two groups over the period: relatively to 1973-74, at both $\Theta = 0$ and $\Theta = 1$

Table 1. **Commodity inflation rates, and expenditure shares for the poor and the rich in both survey years, in percentage terms**

		THE POOR				THE RICH			
	Inflation	1973-74		1980-81		1973-74		1980-81	
Goods	rates*	Θ = 0	Θ = 1	Θ = 0	Θ = 1	Θ = 0	Θ = 1	Θ = 0	Θ = 1
(1)	276	1,8	3,2	8,5	3,6	8,5	7,0	8,0	6,7
(2)	280	2,8	2,3	1,9	1,8	2,8	3,0	2,3	2,4
(3)	286	59,4	60,3	51,5	52,2	32,7	31,3	25,5	25,0
(4)	295	1,8	2,7	3,0	4,9	13,0	11,9	17,7	16,0
(5)	312	18,9	15,2	24,8	19,5	14,3	17,2	18,3	21,8
(6)	333	4,9	5,0	5,0	5,5	10,4	10,5	10,1	9,9
(7)	349	4,8	4,8	5,2	5,2	9,9	10,8	8,8	9,5
(8)	367	5,6	6,5	6,4	7,3	8,4	8,3	9,3	8,7
		100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Hous. size		2,31	4,20	2,26	4,26	4,79	3,15	4,62	2,97

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(1) Education, leisure (2) Medical expenditures (3) Food, drinks and tobacco
(4) Transport and communications (5) Housing (6) Other personal goods and services
(7) Household goods (8) Clothing and footwear

* General inflation rate: 306 percent

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mean household size for the poor increases slightly in 1980-81, while it decreases for the rich.

To undestand the pro-poor bias of relative price changes, measured at p_2, we have to concentrate on household commodity shares in 1973-74. For both values of Θ, the share of the last three goods, whose prices increased the most, is almost double for the rich than for the poor. For the important good 5, housing, there is not much of a difference. But the share of food and drinks (good 3), whose price increased less than the general index, is very much smaller for the rich.

Price and income effects lead to the following main changes in expenditure shares. For goods 6 to 8, substitution effects seem to dominate for the rich, whose share is maintained or slightly decreased; the opposite is the case for the poor. Both groups increase their share of housing, and decrease their share of food and drinks, although the reduction of the latter is relatively greater for the rich. Thus, we expect a smaller pro-poor effect when changes in relative prices are evaluated at p_1 from the point of view of 1980-81 households. Indeed, in Ruiz-Castillo (1995b) our estimates indicate a greater improvement in real inequality at p_2 than at p_1.

II.2. Welfare change within the partition by household size

To isolate the role of prices in inequality and welfare comparisons, independently of the complications introduced by demographic considerations, we analize first each homogeneous subgroup in the partition by household size. The results in the relative case are shown in Table 2. Recall that, at p_2 for example, for each household size we write

$$\Delta W_{T2} = \Delta\mu_2 \, \Delta E_{T2},$$

where

$$\Delta W_{T2} = W_T(y_2)/W_T(y_{12}),\ \Delta\mu_2 = \mu(y_2)/\mu(y_{12}),\ \Delta E_{T2} = [1- I_T(y_2)] \,/\, [1- I_T(y_{12}].$$

Moreover, ΔE_{T2} (ΔE_{T1}) provides an upper (lower) bound for the true relative inequality change in real terms, while $\Delta\mu_2$ ($\Delta\mu_1$) provides a lower (upper) bound for the true real change in the mean.

Table 2 around here

TABLE 2. Change in real welfare in the partition by household size. The relative case.

Number of persons	At p_2 $\Delta W'_{T2}=$	$\Delta\mu$ *	$\Delta E'_{T2}$	At p_1 $\Delta W'_{T1}=$	$\Delta\mu$ *	$\Delta E'_{T1}$
1	1.3334	1.1296	1.1804	1.2135	1.0644	1.1402
2	1.1683	1.0617	1.1003	1.0901	1.0056	1.0841
3	1.0491	1.0232	1.0253	0.9869	0.9657	1.0221
4	1.0554	1.0219	1.0329	0.9913	0.9643	1.0279
5	1.0461	1.0012	1.0449	0.9812	0.9441	1.0394
6	1.0462	0.9801	1.0675	0.9816	0.9276	1.0583
7	1.0437	0.9988	1.0449	0.9795	0.9409	1.0411
8	0.9294	0.9172	1.0134	0.8702	0.8646	1.0065
9 +	0.9081	0.8763	1.0364	0.8599	0.8277	1.0390

Demographic shares

	Households 73-74	Households 80-81	Persons 73-74	Persons 80-81
	8.2	7.8	2.2	2.1
	20.4	21.1	11.0	11.4
	19.5	18.6	15.8	15.1
	22.2	23.6	23.9	25.6
	14.7	14.9	19.8	20.2
	8.2	7.7	13.3	12.6
	3.7	3.6	6.9	6.8
	1.7	1.5	3.6	3.3
	1.4	1.2	3.4	2.9
TOTAL	100.0	100.0	100.0	100.0

As in Ruiz-Castillo (1995b), we observe that, for each household size, $\Delta E_{T2} > \Delta E_{T1}$; that is, the improvement in real inequality is larger at p_2 than at p_1. This would appear to indicate that the true magnitudes are contained between the upper and the lower bounds provided by our estimates. However, we find also that, for each household size, $\Delta\mu_2 > \Delta\mu_1$. This is unfortunate, since the true magnitudes appear to be driven apart. A possible explanation is that our household specific price indices are biased downwards, so that for all h, y^h_{12} is too low while y^h_{21} is too high. This will make $\mu(y_{12})$ too low and $\mu(y_{21})$ too high, so that $\Delta\mu_2$ will be biased upwards and $\Delta\mu_2$ will be biased downwards. In addition, $I(y_{12})$ and $I(y_{21})$ might be biased downwards and upwards, respectively, so that ΔE_{T2} and ΔE_{T1} are brought together, as we have observed before. The end result is that, for each household size, welfare at p_2 and p_1 might actually be closer together than what our estimates indicate. Nevertheless, in most cases the distance between our estimates in the two price regimes is about 6/7 percentage points.

In any case, it is important to study the heterogeneity we find within this basic partition. There are three groups to consider. We begin with households consisting of 3- to 7-members which represent, approximately, two thirds of all households and 80 percent of all persons. They experience a relatively small or no improvement in the mean at constant prices, as well as some improvement in relative inequality. As a consequence, their real welfare goes up by about 4.5-5 percent at p_2, or goes down by about 1.5 percent at p_1. Next, there are two tails with opposite fortunes. Households of 1 or 2 persons -28 percent of all households and 13 percent of all persons- combine a large improvement in both mean and relative inequality, and therefore a large increase in real welfare. The remaining 3 percent of all households but 7.5 of all persons, consisting of 8 or more persons, experience losses in the mean, little or no change in real inequality and considerable losses in real welfare, of about 7 to 13 percent depending on whether we look at p_2 or p_1, respectively.

The results for the absolute case are in Table 3. Recall that, for every value of the inequality aversion parameter γ, and for every household size, the joint impact on welfare of changes in absolute inequality and changes in the mean are evaluated relative to welfare at situation 1. Table 3 contains estimates of absolute inequality and welfare change for γ values equal to[7] 5.10^{-7}, 5.10^{-6}, and 10^{-5}.

Table 3 around here

To interpret the results, we must take into account that, mantaining relative inequality constant, any change in the mean causes absolute inequality to vary in the same direction. Thus, large increases (decreases) in the mean for small (large) households pushes down (up) changes in absolute inequality. On the other hand, maintaining the mean constant, a change in relative inequality causes a change in the same direction in absolute inequality. Given the general improvement in relative inequality, except for 1 and 3 person households for which the mean grows substantially, all groups experiment an improvement in absolute inequality. Finally, as in the relative case, we have a 3 group breakdown at the welfare level: at p_2, for example, we observe considerable increases for 1 and 2 person households, smaller ones for the majority of the population consisting of 3 to 7 members, and a welfare loss for very large households.

II. 3. The population as a whole in the single parameter model

We have seen that, during this period, there are considerable differences in the social evaluation of households of different sizes. How do these differences get aggregated at the population level? Our view depends necessarily on the way household size is taken into account in the definition of adjusted household expenditure. Recall that, in the relative case, adjusted expenditure for household h is defined by

$$y^h(\Theta) = x^h / (s^h)^\Theta, \ \Theta \in [0,1].$$

Therefore,

$$\mu(\mathbf{y}(\Theta)) = \Sigma_m [H^m / H][\mu(x^m) / m^\Theta],$$

so that the mean is a decreasing function of Θ. On the other hand, in Spain, like in the U.K., we found in Ruiz-Castillo (1995b) that relative inequality follows a U pattern. As we see in Table 4 in the Appendix, relative welfare turns out to be decreasing with Θ at both p_1 and p_2 in both surveys.

The information about changes in real welfare, in terms of changes in the mean and changes in inequality, is in the upper part of Table 5 in the

TABLE 3. Change in the mean, absolute inequality and real welfare in the partition by household size. In percentages relative to $W_\gamma(y_{10}^m)$, m=1,2,...,9+, $p_0 = p_2$ and $p_0 = p_1$.

	At p_2			At p_1		
Num. of persons	$\Delta W_{\gamma 2}$ =	$\Delta\mu$ +	$\Delta E_{\gamma 2}$	$\Delta W_{\gamma 1}$ =	$\Delta\mu$ +	$\Delta E_{\gamma 1}$
$\gamma = 5 \cdot 10^{-7}$						
1	15.3	14.2	-1.2	7.2	6.6	0.6
2	8.6	6.8	1.9	1.4	0.6	0.8
3	3.2	2.5	0.7	-3.0	-3.5	0.5
4	3.5	2.4	1.1	-3.0	-3.6	0.6
5	2.2	0.1	2.1	-4.8	-5.8	1.0
6	0.9	-2.2	3.1	-5.9	-7.5	1.6
7	2.2	-0.1	2.3	-5.0	-6.1	1.1
8	-6.8	-9.4	2.6	-12.9	-14.1	1.2
9 +	-9.2	-14.6	5.4	-19.1	-21.1	2.0
$\gamma = 5 \cdot 10^{-6}$						
1	19.8	20.1	-0.3	10.6	7.8	2.8
2	13.2	9.8	3.4	4.9	0.7	4.3
3	3.6	3.5	0.1	-1.5	-4.1	2.6
4	6.9	3.4	3.6	-0.8	-4.2	3.4
5	5.6	0.2	5.4	-1.5	-6.9	5.4
6	7.4	-3.3	10.8	-2.1	-9.0	6.9
7	5.1	-0.2	5.3	-1.3	-7.6	6.2
8	-6.7	-14.9	8.1	-10.7	-17.8	7.1
9 +	-5.7	-24.2	18.4	-13.6	-27.7	14.0
$\gamma = 1 \cdot 10^{-5}$						
1	20.2	24.1	-3.9	12.0	8.7	3.3
2	14.3	12.1	2.2	6.6	0.8	5.8
3	2.3	4.4	-2.1	-1.0	-4.5	3.5
4	8.6	4.2	4.4	0.5	-4.8	5.3
5	5.1	0.2	4.9	-0.1	-7.8	7.7
6	8.4	-4.3	12.7	0.4	-10.3	10.7
7	2.3	-0.3	2.6	0.1	-8.7	8.8
8	-11.3	-19.2	7.9	-10.3	-20.7	10.4
9 +	-10.4	-32.2	21.8	-11.2	-32.7	21.5

Appendix, while the patterns in percentage terms, as a function of Θ, are shown in the left-hand panel of Figure 1. The main conclusions are the following: i) at p_2, there has been an improvement in real mean, real inequality and, hence, real welfare; ii) however, at p_1 decreases in real inequality barely offset losses in real mean; iii) in both cases the change in real welfare is remarkably stable as a function of Θ.

Figure 1 around here

In the absolute case, adjusted household expenditure is defined as

$$y^h(\lambda) = x^h - \lambda(s^h - 1), \lambda \in [0, \lambda^*],$$

where the parameter λ can be interpreted as the cost of an adult. We have selected parameter values for λ and γ so as to achieve a wide range of variation of the ratio of absolute inequality to the distribution mean. At p_2, the upper bound for λ has been fixed at 90.000 pesetas, which is 35 percent of the mean of *per capita* household expenditures in 1980-81, or close to *per capita* household expenditure for very large units consisting of more than 10 members. Given the selection of γ's already mentioned, values of λ beyond 90.000 lead to negative welfare estimates which are difficult to interpret. At p_1, household adjusted expenditures are smaller than at p_2 by a factor greater than 3. Correspondingly, in this case we have fixed the upper bound for λ at 30.000 pesetas.

The estimates for the unweighted distributions in both survey years are available upon request. The main result is that absolute inequality decreases with λ most of the time. However, as can be seen in the upper left hand panel of Figure 2, for high values of γ at p_2 absolute inequality for both survey years first decreases and then increases as λ approaches its upper bound. Such curvature is less pronounced at p_1. On the other hand, we observe in the right hand panel of Figure 2 that at both p_2 and p_1 there is an improvement in absolute inequality for all values of γ. Such an improvement is greater the smaller the aversion to inequality, and in all cases varies little as a function of λ.

Figure 2 around here

For the intermediate value $\gamma = 5.10^{-6}$, numerical estimates of welfare change in terms of changes in the mean and changes in absolute inequality, relative to welfare at situation 1, are presented in Table 6 in the Appendix.

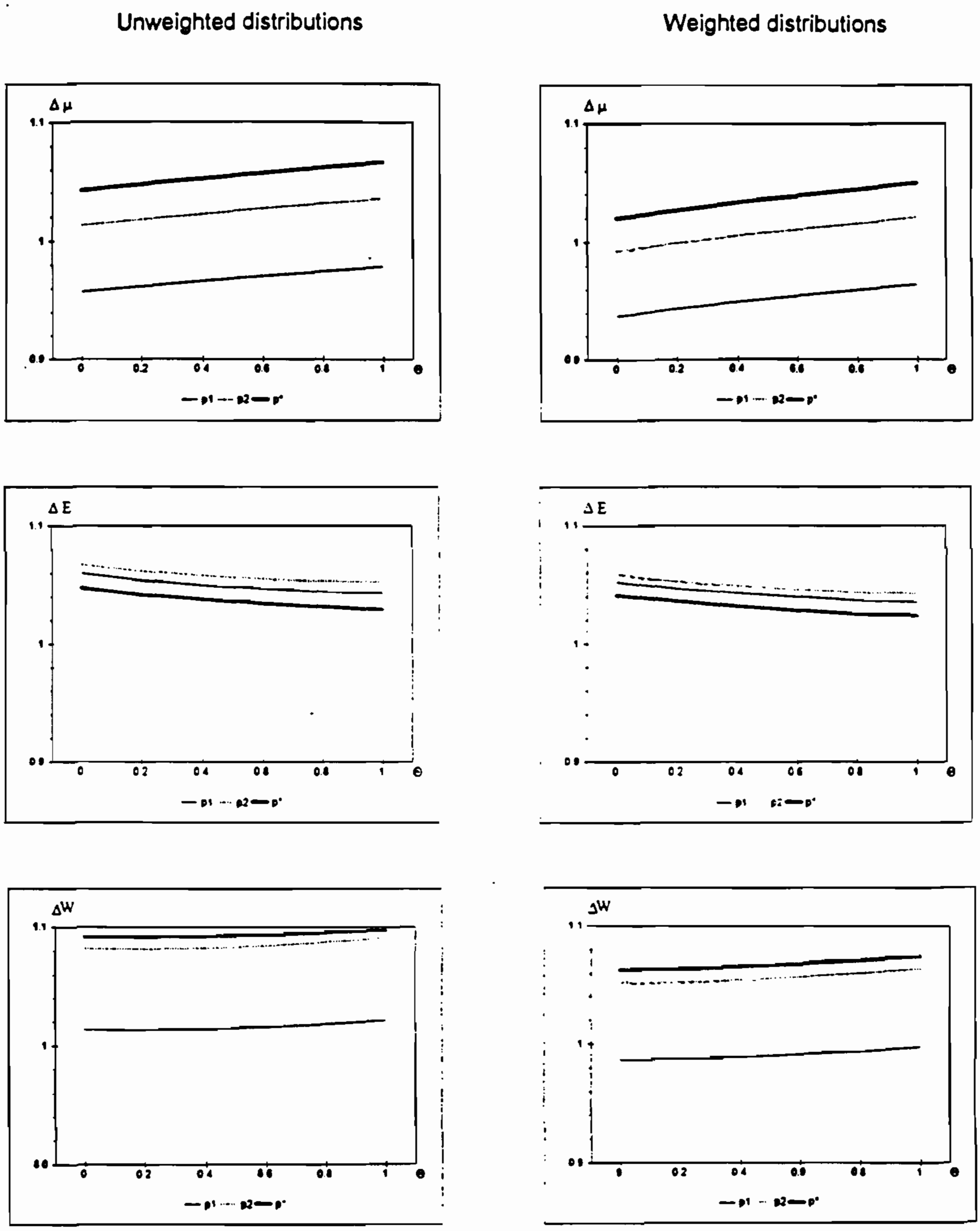
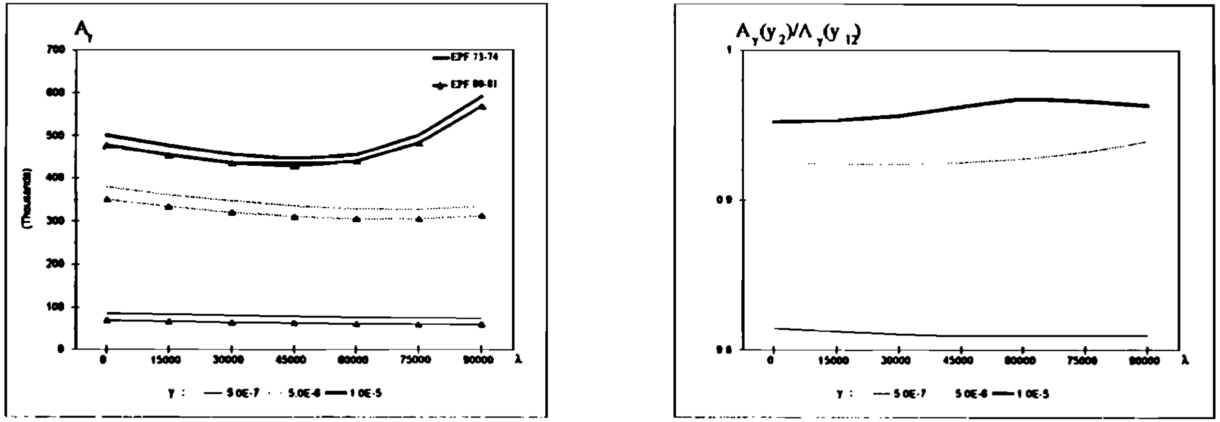


Figure 1. Changes in the mean, relative equality and welfare as a function of theta and base prices

Unweighted distributions at p2



Unweighted distributions at p1

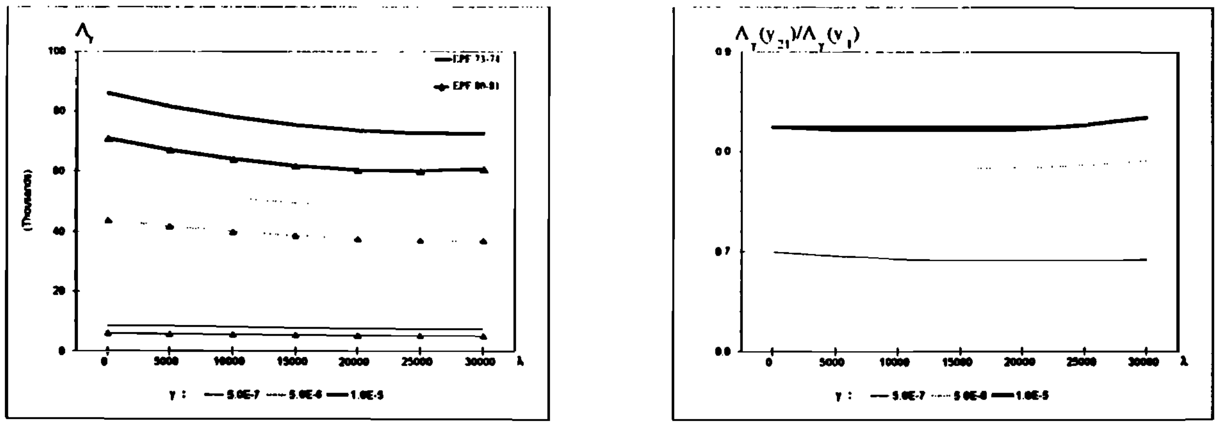


Figure 2. Absolute inequality as a function of gamma and lambda

Figure 3 provides a graphical representation for all γ. The main conclusions are that: i) at every value of λ, the improvement in real welfare tends to be smaller the greater the aversion to absolute inequality. ii) For every value of γ, the change in real welfare increases slightly as a function of λ, exploding at high values of γ and λ as a consequence of large increases in inequality, partly induced by large increases in the mean[8]. iii) As in the relative case, the results vary considerably depending on whether real change is expressed at p_2 or p_1.

Figure 3 around here

II.4. The distinction between children and adults in the two parameter model and the OECD scale

Next we consider the case in which adults and children receive different treatment. In particular, we study the convenient parametrization in which "effective household size" is seen to be equal to

$$s_A^h + \eta\, s_C^h, \quad \eta \in (0,1]$$

where s_A^h and s_C^h are the number of adults and children in household h, and η is a parameter. Then, in the relative case we will have

$$y_{\tau 0}^h(\Theta,\eta) = x_{\tau 0}^h / ((s_A^h + \eta\, s_C^h)^\Theta.$$

We compare previous results, in which $\eta = 1$, with the following values for η: 0.75, 0.50, and 0.25. Estimates of the full grid for the two parameter model (Θ, η) in the unweighted case at p_2, are available upon request. Here, by way of example, we concentrate in the the 1973-74 distribution at prices of situation 2. In the upper part of Figure 4 we show how the estimate of $E_T(y_{12}(\Theta,\eta)) = 1 - I_T(y_{12}(\Theta,\eta))$ varies with Θ and η for the unweighted distribution.

Figure 4 around here

As predicted in Jenkins and Cowell (1994), i) when Θ is low (≤ 0.4), variations in η have a negligible impact on equality: as a function of η the corresponding curves are very flat (upper left hand side of Figure 4), while as a function of Θ they are very close together (upper right hand side of that Figure). Also ii) the inverse-U pattern implied by Θ variations are less pronounced when η is relatively low. At any rate, for each household size, Unweighted distributions at p1

Unweighted distributions at p2 and p*

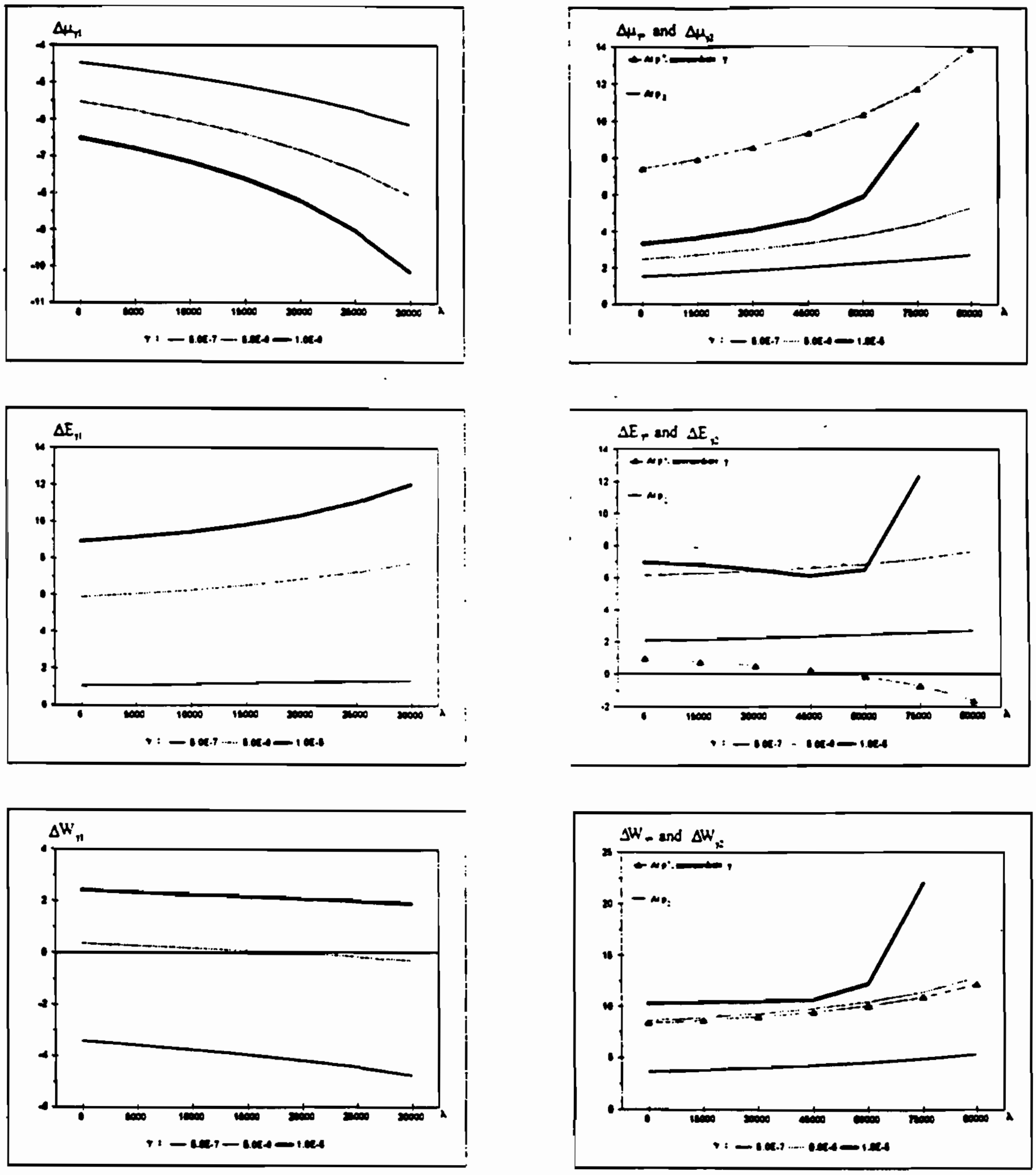


Figure 3. Changes in the mean, absolute inequality and welfare as a function of gamma, lambda and base prices

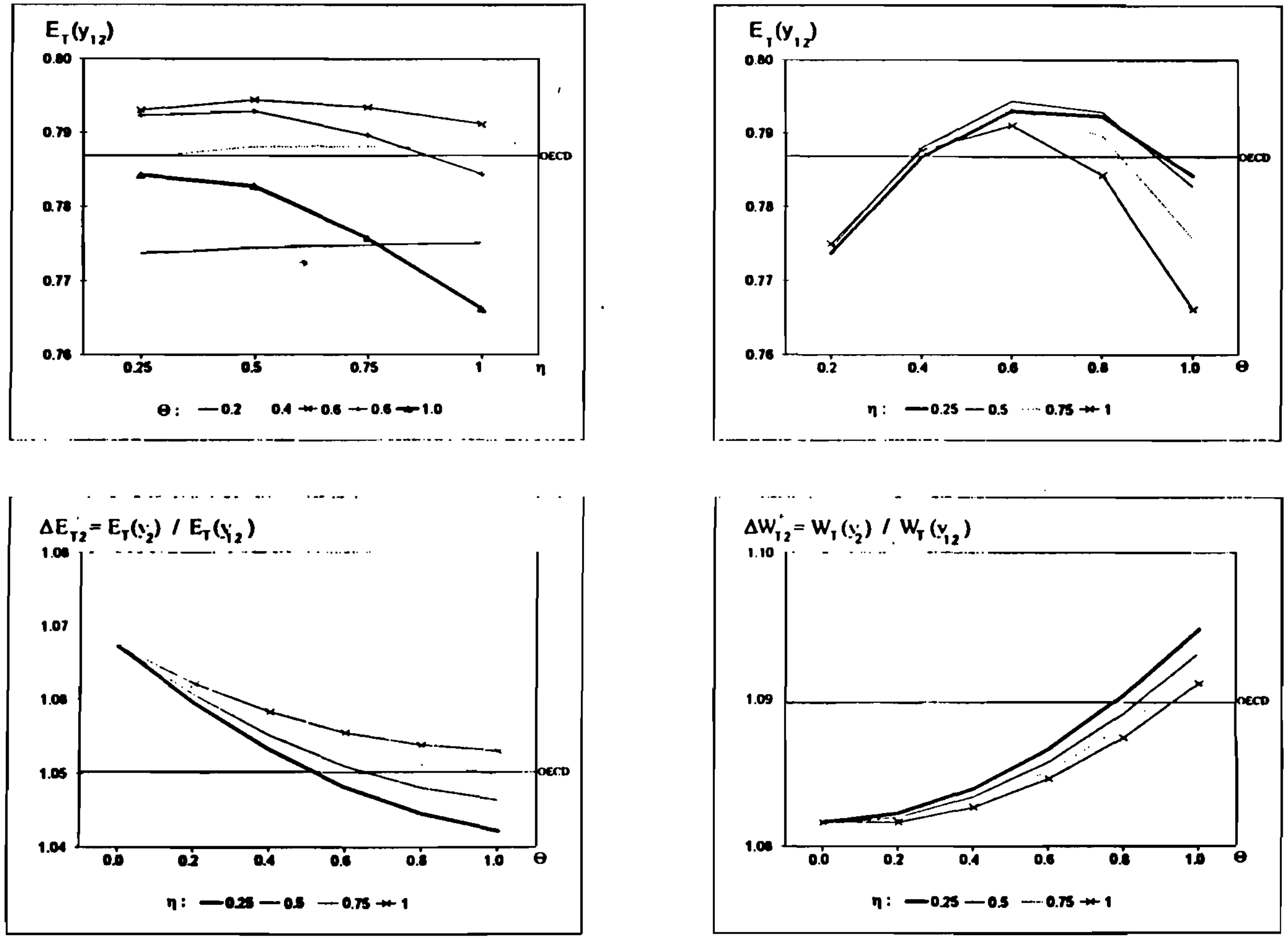


Figure 4. The impact of weighting children differently than adults: the relative case

lowering η raises the equivalent expenditures of larger households relative to those of smaller households; given the negative covariance between number of children and total household expenditure, there is an equalising impact. The gross grid we have investigated does not allow us to see whether there is a non-monotonic relationship of the type detected by Jenkins and Cowell (1994) at low values of η .

Since we find sufficient stability in shape for other distributions, we end here the report for single cross-sections. Furthemore, we are mostly interested in trends. The lower part of Figure 4 shows the change in relative inequality and welfare at p_2. We observe that the improvement in real inequality is uniformly smaller as the weight given to children decreases. The impact on the mean (not shown) goes in the opposite direction. The net result is that, at every value of Θ, the improvement in real welfare increases as η decreases. However, the magnitude of the impact is very small indeed.

To complete this study of the sensitivity of our results to different models for taking into account demographic factors, we have considered the so-called OECD equivalence scale, widely used internationally, including the Spanish INE. It gives a unit weight to the first adult -a person 14 or more years old- 0.7 to each additional adult, and 0.5 to every person less than 14 years old. In other words, efficient household size is now equal to

$$1 + 0.7\,(s_A^h - 1) + 0.5\,(s_C^h).$$

Estimates in Tables 4 to 6 in the Appendix and graphical representations in Figure 4 for the realtive case are referred to by the symbol OECD.

We see that, for the individual cross-sections, the OECD estimate corresponds to a low value of Θ -and hence any value of η- or a high value of both Θ and η. For the change in real welfare in the unweighted case at p_2, the OECD estimate corresponds to the choice $(\Theta, \eta) = (0.8, 0.25)$; that is, counting children at half what the OECD suggests, but admitting small economies of scale in consumption. This result is robust to changes in the reference price vector and in the weighting scheme.

II. 5. The unit of analysis: households *versus* persons

Given the pattern within the partition by household size, where smaller households experience a greater welfare improvement than larger ones, we must have smaller overall improvements when comparing the personal distributions. The graphical information on weighted distributions in the relative and the absolute case is in Figures 1 and 3 (see Tables 5 and 6 in the Appendix, respectively). In the absolute case, for instance, at p_2 welfare increases vary from 6.5 to 9.3 percent as a function of γ *-versus* 8.6 to 12.8 percent in the unweighted case- while at p_1, welfare losses go from 1.4 to 2.9 percent *-versus* a variation in the interval (+0.3, -0.3) in the unweighted case.

II.6. Using a single price index for all households

That intertemporal comparisons of welfare require an adjustment for price change is, of course, widely recognized. However, researchers often correct the original distributions with a single measure of price change for all households[9]. As a final exercise, we have done that for the population as a whole taking into account the 322 percent inflation rate during this period, measured by the official consumer price index. Notice that now, in the relative case

$$\Delta\mu_*(\Theta) = \mu(y_2(\Theta))/[\mu(y_1(\Theta))\ 3.22]$$

and

$$\Delta E_{T*}(\Theta) = E_T(y_2(\Theta))/E_T(y_1(\Theta)) = [1 - I_T(y_2(\Theta))]/[1 - I_T(y_1(\Theta))].$$

Both expressions give the ratios in *money* terms. Estimates appear under the p^* heading in Tables 5 and 6 in the Appendix, as well as in Figure 1.

We see that, in both the unweighted and the weighted cases, the change in real welfare at p^* as a function of Θ is not that different from the change estimated at p_2. However, as far as the reasons for it, estimates at p^* tell the wrong story: a large improvement in the mean and a relatively small improvement in money inequality. Because the change from p_1 to p_2 has damaged the standard of living of the rich more than that of the poor, what has happened in Spain during this period is exactly the opposite: a relatively small increase in the mean, but a considerable improvement in real inequality.

The absolute case is illustrated in Figure 3, also under the p^* heading (for the numerical information, see Table 6 in the Appendix). At an intermediate value of γ, for instance, the picture is very similar: i) welfare change at p^* is of the same order of magnitude than at p_2. ii) However, the mean effect is exagerated at the expense of the improvement in inequality. As a matter of fact, at high λ values and high mean increments we observe a nonexistent loss in absolute inequality.

IV. CONCLUSIONS

In this paper we have investigated the evolution of the standard of living in Spain from 1973-74 to 1980-81 for a population of about 10 million household and 34 or 37 million persons occupying residential housing. The standard of living has been approximated by a measure of private consumption: total household expenditures, net of certain investment items. Comparisons in real terms have been made possible by household specific statistical consumer price indices, constructed on a 57-dimensional commodity space. The heterogeneity of the household population has been taken into account by means of several parametrizations of the weight to be given to household size, or to a child's needs relative to those of an adult.

Social evaluations have been performed by scalar indicators which permit to summarise judgements about an entire distribution by means of two statistics: the mean and an index of either relative or absolute inequality. Standard restrictions, as well as the requirement of additive separability, lead to a member of the general entropy family of SEFs in the relative case, and to several members of the Kolm-Pollak family in the absolute case. Comparisons have been made with and without weighting household adjusted expenditure by household size in the domain of the SEF.

The main empirical conclusions are the following:

1. According to our budget surveys, mean household expenditure increased about 2 percent at prices of situation 2 (Winter 1981), or decreased at least 3.5 percent at prices of situation 1 (an average of 1973 and 1974 prices). This fundamental change has not been distributed uniformly across subgroups. Households of 1 or 2 persons enjoy a considerable increase in the mean even at p_1; a majority of the population consisting of households from 3 to 7 persons experience a slight increase at p_2 or a slight decrease at p_1; the remaining of the population, consisting of large households, experience large losses.

2. Relative inequality has improved for all subgroups at both price regimes, but the ordering by household size according to the magnitude of such improvement is the same as before. Hence, at p_2 small households end up with welfare increases greater than 15 percent, 3 to 7 person households with increases about 4-5 percent, and large households with welfare losses close to 10 percent. At p_1, only small households have some welfare gains.

Because the measurement of absolute inequality depends on the measurement unit, large increases (decreases) in the mean for small (large) households pushes down (up) changes in absolute inequality. Nevertheless, except for 1 or 3 person households, all subgroups have an improvement in absolute inequality. Consequently, welfare changes follow the same pattern as in the relative case at both p_2 and p_1.

3. Pooling these subgroups into a single population requires value judgements to make welfare comparisons across subgroups. When we control the ethical weight to be given to household size by parameters Θ and λ in the relative and the absolute case, respectively, we find that although cross section estimates are affected in a non linear manner, aggregate welfare trends do not depend much on such parametrisations. However, in the absolute case, welfare change increases slightly with λ. This, together with the variation induced by changes in the aversion to inequality parameter, opens up the results range of variation.

4. When we recognize that children might very well be given smaller weights than adults, we find that counting a child at 75, 50, or 25 percent of an adult has an equalising effect at the cross section level but a small impact on welfare comparisons.

5. In the relative case, the central conclusion is that at prices p_2 there has been a mean improvement at least as large as 2 percent, an improvement in relative inequality at most equal to 5.5 percent, and an improvement in real welfare of about 8 percent. At prices p_1, there has been a loss in real mean at least as large as 3.5 percent, an improvement in inequality at least as large as 5 percent, and a negligible improvement in real welfare at most equal to 1.5 percent.

In the absolute case, inequality improvements are larger the smaller the aversion to inequality parameter γ. At p_2 there has been an increase in real welfare of about 3.5-10.0 percent, depending on the choice of λ and γ. Between 2.0-6.5 percent of such an increase should be attributed to an improvement in absolute inequality, and the rest to a slight improvement in the mean. At p_1, the estimates for the change in real welfare vary from a decrease of about 3.5 percent to an improvement of 2 percent, depending on λ and γ. This is the result of a relatively large loss in the mean in the range 4.5-8.0 percent, partially offset by an improvement in absolute inequality of 1.0-9.0 percent.

6. If one applies the same inflation rate to all households in situation 1, estimates of welfare change are similar to those registered at p_2 with household specific price indices. However, most of the change is attributed to an increase in the mean. This missperception is to be expected in a period in which relative prices have evolved so as to cause a larger reduction in the standard of living of the rich, relative to the poor, hereby improving real inequality beyond the improvement in money inequality.

7. Given the fact that larger households do worse than smaller ones, welfare changes suffer a downward shift when in the domain of the social evaluation functions each household's adjusted expenditure is weighted by household size. This is the case at both p_1 and p_2 in the relative and the absolute approach.

8. From a quantitative point of view, choosing p_1 or p_2 to express aggregate welfare change in real terms causes a larger impact than counting or not children differently from adults, giving a large or no weight to household size, weighting or not household expenditure by household size in the domain of the social evaluation function, or even choosing a relative or an absolute notion of inequality. However, there is some evidence of a possible downward bias in our estimate of household specific price indices. If this is the case, our estimates of welfare change at both price regimes should be closer, thereby reducing the role of the base year choice.

NOTES

1. Recent reports based on questionnaires indicate that people are by no means unanimous in their choice between relative, absolute or other intermediate notions of inequality. See, for instance, Amiel and Cowell (1992), and Ballano and Ruiz-Castillo (1994).

2. The assumption was first introduced in the theoretical literature by Lewbel (1989) and Blackorby and Donaldson (1993, 1994). Among many econometric applications see, for instance, Jorgenson and Slesnick (1987).

3. Of course, additive separability is essencial for the study of any other partition. For an application to partitions by geographic and socioeconomic characteristics, which will not be treated here, see Ruiz-Castillo (1995c).

4. This is in agreement with results in Sanz (1995) showing a loss close to 40 percent when income information in the EPF's is compared with National Accounts data.

5. See Ayala *et al* (1993).

6. See Ruiz-Castillo (1987).

7. In the only previous empirical study we know with complete indicators of absolute inequality from this family, Blackorby *et al* (1981) choose values of γ equal to 5.10^{-6}, 5.10^{-5}, 10^{-4}, and 5.10^{-4} for distributions expressed in Canadian dollars.

8. For $\gamma = 10^{-5}$ and $\lambda = 90.000$, welfare at y_{12} is barely positive. Welfare change at p_2 and that λ value causes a large discontinuity which, to avoid distortions, has not been represented in Figure 3.

9. See, for instance, Jenkins (1991).

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APPENDIX II

TABLE 4. Mean, relative equality, and welfare in both survey years. Unweighted distributions.

	θ 0.0	0.2	0.4	0.6	0.8	1.0	OECD
1973-74 at $p_1 : y_1$							
μ	254,608	195,073	150,843	117,787	92,933	74,131	96,054
E_T	0.7684	0.7897	0.8029	0.8071	0.8010	0.7837	0.8040
W_T	195,635	154,040	121,110	95,061	74,443	58,095	77,227
1980-81 at $p_1 : y_{21}$							
μ	243,627	187,561	145,707	114,285	90,558	72,535	94,114
E_T	0.8143	0.8327	0.8434	0.8452	0.8370	0.8177	0.8374
W_T	198,378	156,187	122,889	96,595	75,799	59,310	78,811
1973-74 at $p_2 : y_{12}$							
μ	842,677	645,743	499,413	390,034	307,783	245,552	318,015
E_T	0.7543	0.7750	0.7876	0.7911	0.7843	0.7661	0.7876
W_T	635,614	500,448	393,341	308,550	241,395	188,116	250,477
1980-81 at $p_2 : y_2$							
μ	854,091	657,611	510,921	400,782	317,608	254,429	330,010
E_T	0.8050	0.8231	0.8335	0.8350	0.8265	0.8067	0.8271
W_T	687,504	541,303	425,861	334,658	262,494	205,249	272,947
1973-74 at $p^* : y_{1*}$							
μ	819,640	627,983	485,597	379,182	299,172	238,644	309,219
E_T	0.7684	0.7897	0.8029	0.8071	0.8010	0.7837	0.8040
W_T	629,792	495,889	389,880	306,022	239,649	187,021	248,611

TABLE 5. Change in real welfare in terms of changes in the mean and relative equality, in ratio form.

UNWEIGHTED DISTRIBUTIONS

	At p_1			At p_2			At p^*		
θ	ΔW_{T1} =	$\Delta\mu_1$ *	ΔE_{T1}	ΔW_{T2} =	$\Delta\mu_2$ *	ΔE_{T2}	ΔW_{T*} =	$\Delta\mu_*$ *	ΔE_{T*}
0.0	1.0140	0.9569	1.0597	1.0817	1.0135	1.0672	1.0917	1.0420	1.0476
0.2	1.0138	0.9615	1.0545	1.0816	1.0184	1.0621	1.0915	1.0472	1.0423
0.4	1.0147	0.9660	1.0505	1.0827	1.0230	1.0583	1.0923	1.0522	1.0382
0.6	1.0161	0.9703	1.0472	1.0846	1.0276	1.0555	1.0935	1.0570	1.0346
0.8	1.0182	0.9744	1.0449	1.0874	1.0319	1.0538	1.0954	1.0616	1.0318
1.0	1.0209	0.9785	1.0434	1.0911	1.0362	1.0530	1.0974	1.0661	1.0293
OECD	1.0205	0.9798	1.0415	1.0897	1.0377	1.0502	1.0979	1.0672	1.0287

WEIGHTED BY SIZE

0.0	0.9870	0.9375	1.0528	1.0518	0.9932	1.0590	1.0629	1.0203	1.0418
0.2	0.9880	0.9433	1.0474	1.0529	0.9993	1.0535	1.0641	1.0267	1.0364
0.4	0.9898	0.9488	1.0432	1.0548	1.0051	1.0494	1.0660	1.0329	1.0320
0.6	0.9921	0.9540	1.0400	1.0574	1.0107	1.0462	1.0683	1.0387	1.0285
0.8	0.9949	0.9591	1.0373	1.0607	1.0160	1.0440	1.0711	1.0443	1.0256
1.0	0.9981	0.9639	1.0354	1.0645	1.0210	1.0426	1.0741	1.0497	1.0233
OECD	0.9971	0.9658	1.0324	1.0629	1.0232	1.0388	1.0735	1.0514	1.0211

TABLE 6. Change in real welfare in terms of a change in the mean and a change in absolute inequality at $\gamma = 5 \cdot 10^{-6}$, in percentages.

UNWEIGHTED DISTRIBUTIONS

At p_2

λ	0	15,000	30,000	45,000	60,000	75,000	90,000	OECD
$\Delta\mu_2$	2.46	2.69	2.95	3.29	3.72	4.33	5.24	4.88
$\Delta E_{\gamma 2}$	6.18	6.26	6.38	6.56	6.80	7.14	7.60	2.07
$\Delta W_{\gamma 2}$	8.65	8.95	9.34	9.84	10.52	11.46	12.83	6.95

At p_1

λ	0	5,000	10,000	15,000	20,000	25,000	30,000	OECD
$\Delta\mu_1$	-5.52	-5.77	-6.07	-6.43	-6.86	-7.39	-8.06	-2.22
$\Delta E_{\gamma 1}$	5.89	6.06	6.26	6.51	6.83	7.23	7.75	2.01
$\Delta W_{\gamma 1}$	0.37	0.28	0.18	0.08	-0.04	-0.17	-0.31	-0.22

At p^*

λ	0	15,000	30,000	45,000	60,000	75,000	90,000	OECD
$\Delta\mu_*$	7.42	7.90	8.49	9.25	10.26	11.68	13.85	8.52
$\Delta E_{\gamma *}$	0.98	0.78	0.55	0.25	-0.14	-0.72	-1.67	-0.79
$\Delta W_{\gamma *}$	8.40	8.68	9.04	9.50	10.12	10.96	12.18	7.73

WEIGHTED DISTRIBUTIONS BY HOUSEHOLD SIZE

At p_2

λ	0	15,000	30,000	45,000	60,000	75,000	90,000
$\Delta\mu_2$	-0.89	-0.79	-0.69	-0.57	-0.43	-0.24	0.01
$\Delta E_{\gamma 2}$	7.36	7.59	7.90	8.30	8.84	9.58	10.70
$\Delta W_{\gamma 2}$	6.47	6.80	7.21	7.74	8.41	9.34	10.71

At p_1

λ	0	5,000	10,000	15,000	20,000	25,000	30,000
$\Delta\mu_1$	-7.73	-8.17	-8.69	-9.32	-10.11	-11.11	-12.42
$\Delta E_{\gamma 1}$	6.33	6.61	6.96	7.39	7.93	8.63	9.54
$\Delta W_{\gamma 1}$	-1.40	-1.55	-1.73	-1.93	-2.18	-2.48	-2.87