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"INCOME INEQUALITY RANKINGS FOR DIFFERENT EQUIVALENCE SCALES AND POPULATION HEATLH"

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Abstract

This paper is divided in two parts. The first one is dedicated to analyse the inequality of the income distribution in Spain during the convergence process to the European Monetary Union. To carry out this task, we propose two robust models based on the quantile functions. Specifically, we use the Gamma and Beta quantile functions. The income inequality in Spain and the sensitivity of the results for different equivalence scales are analysed using the data corresponding to the first five waves (1994-1998) of the European Community Household Panel (ECHP). This survey contains data on individuals and households and the information is homogeneous across European countries. The second part of the paper is dedicated to study the correlation between income inequality and one of the most important health indicators such as life expectancy. With this aim we will focus on relations between socio-economic factors and health of the individuals. In conclusion, this analysis seems to confirm the results obtained in previous researches. Income distribution has significant effects on health indicators. Although we can not confirm that the social capital is highly related with health, at least it is an important factor which helps to explain it.

Key words: Inequality, social capital, health, European Community Household Panel

1. INTRODUCTION

The aim of this paper is to analyse inequality in the income distribution in the European Union and population health in the period 1993-1997.

The study of income inequality and population health is an important goal in modern societies and demands careful attention for economic analysis. In recent papers, several authors have advanced that income inequality is related with population health. Wilkinson (1992) showed a strong negative correlation between income inequality and life expectancy. A few years later, Kaplan *et al*. (1996) and Kennedy *et al*. (1996) studied income inequality and mortality in the United States. Life expectancy and population mortality are key indicators of population health and economic development. Recent data on income distribution are now available for the European Union countries and allow us to test different hypothesis.

This paper is divided in two parts. The first one is referred to the evolution of income inequality in Spain. With this aim, we use parametric quantile functions and we will consider different equivalence scales. The purpose is to study personal income distribution in Spain using different parametrical specifications testing their robustness and sensivity to different equivalence scales. We propose two robust models based on quantile functions. Specifically, we use the Gamma and Beta quantile functions. The second part of the paper is focused on the relationship among inequality and health in the European Union.

To achieve these goals, we have used the information contained in the European Community Household Panel (ECHP). This survey contains data homogeneous across countries making comparisons possible. Also, we have used health indicators taken from the Organisation for Economic Development and Cooperation (OEDC) Health Data.

The rest of this paper is organized as follows. In Section 2 the European Community Household Panel (ECHP), which will be used along the following paper, will be introduced. In Section 3 population functions, inequality measures and estimation methods are studied. In Section 4, the relationship among income inequality and health is analysed. Finally, Section 5 presents some conclusions.

2. THE EUROPEAN COMMUNITY HOUSEHOLD PANEL (ECHP)

This representative survey of households of different European Union countries was carried out for the first time in 1994 and the sample was formed by 60.500 households (approximately 170.000 individuals). In the case of Spain the first wave was of 7.200 households (approximately 18.000 individuals). This survey contains data on individuals and households for the European Union countries with four waves available (or five in some countries) and the main advantage is that information is homogeneous among countries since the questionnaire and the elaboration process is similar across them. This source of data is coordinated by the Statistical Office of the European Communities (EUROSTAT).

This survey includes information about income, education, employment, etc. In this sense, it is important to highlight that it had never existed, for the whole European Union, a fixed and harmonized panel for studying socio-economic factors of the households and individuals inside the European Union.

In this paper, we have used the microdata for Spain in order to test the sensitivity and robustness of the results to different hypothesis. TABLE 1 includes information about households' sample composition for Spain. For the rest of the European countries, we have used the results given by Alvarez *et al.* (2002).

TABLE 1: Households' sample composition in the ECHP (1994-1997). Spain.

	Wave 1 (1994)	**Wave 2 (1995)**	**Wave 3 (1996)**	**Wave 4 (1997)**	**Wave 5 (1998)**
Number of households	7206	6522	6268	5794	5485
Number of individuals	23025	20706	19715	18167	16728

Source: Authors' calculation based on ECHP data

However, for the interpretation of statistical data on income distribution is important to define the *income unit* upon which measurement is to be based. We have used household information rendering the component family by using equivalence scales. An equivalence scale is a device to convert the incomes of different income unit types to a common base measuring income unit purchasing power (Lambert, 1989).

The heterogeneity of the households has been approached using the specification given by Buhmann *et al*. (1988) and Coulter *et al*. (1992) that summarize different equivalence scales through a single parameter supposing that this scale only depends on the number of members of the household. According with this method, the "*equivalent income*", Y_h, of a household with n_h members and with income without adjusting X_h is:

$$Y_h = \frac{X_h}{n_h^s}.$$

The parameter "*s*" ranks from zero to one. When *s*=1, we obtain the distribution of *income per individual*. When s=0 we obtain *income per household*. Also, the sensibility of the results has been analysed estimating the inequality for different values of parameter "s". In particular, we have considered *s* =0, 0.25, 0.5, 0.75, and 1. Parameter "*s*" can be interpreted as a measure of economies of scale within the household.

3. MODELLING INEQUALITY: QUANTILE FUNCTIONS

3.1 PREVIOUS RESULTS

Let L be the class of all non-negative random variables with positive finite expectation. For a random variable *X* in L with distribution function $F_X(x)$ we define its inverse distribution function $F_X^{-1}(x)$ by:

$$F_X^{-1}(p) = \inf\{x : F_X(x) \geq p\}.$$

The quantile function is given by:

$$X(p) = F_X^{-1}(p), \quad 0 \leq p \leq 1,$$

The quantile function represents the value of a variable for which *p* percent of the values of the distribution are smaller.

Thus, the Lorenz curve associated with *X* is defined by:

$$L_X(p) = \left[\int_0^p F_X^{-1}(y)dy\right] \Big/ \left[\int_0^1 F_Y^{-1}(y)dy\right], \quad 0 \le p \le 1.$$

Note that $\mu_X = \int_0^1 F_X^{-1}(y)dy$ is the expectation of the random variable *X*.

So, the quantile function can be obtained from the Lorenz curve:

$$X(p;\mu) = \mu L'_X(p), \quad 0 \le p \le 1,$$

The above definition suggests a method for obtaining quantile functions based on parametric Lorenz curves.

3.2 POPULATION FUNCTIONS

In this paper we use two particular quantile functions:

1) Beta quantile function:

$$X(p;a,b,\mu) = \frac{\mu p^{a-1}(1-p)^{b-1}}{B(a,b)}, \quad 0 \le p \le 1, \quad a \ge 1,\ 0 < b \le 1$$

where *B*(.) represents the Euler beta function.

2) Gamma quantile function:

$$X(p;\alpha,\lambda,\mu) = \frac{\mu\lambda^{\alpha} p^{\lambda-1}(-\log p)^{\alpha-1}}{\Gamma(\alpha)}, \quad 0 \le p \le 1, \quad \alpha \le 1, \quad \lambda > 1$$

where *Γ*(.) represents the usual gamma function.

3.2.1 Properties of Beta and Gamma Quantile functions

The Beta quantile functions have been obtained from the following Lorenz curve:

$$L(p;a,b) = \int_0^p \frac{x^{a-1}(1-x)^{b-1}}{B(a,b)}dx, \quad a \ge b,\ 0 < b \le 1.$$

This Lorenz curve is defined on $(0,\infty)$ and the Gini index is given by:

$$G(a,b) = \frac{a-b}{a+b}.$$

The *k-th* order moment for the variable *X* is given by:

$$E(X^k) = \mu^k \frac{B(k(a-1)+1, k(b-1)+1)}{B(a,b)^k},$$

and $E(X^k) < \infty \Leftrightarrow b \geq 1 - 1/k$.

The Gamma quantile functions have been obtained from the following Lorenz curve:

$$L(p;\alpha,\lambda) = \int_0^p \frac{\lambda^\alpha}{\Gamma(\alpha)} x^{\lambda-1}(-\log x)^{\alpha-1} dx,\ \ \lambda > 1,\ \alpha > 0.$$

The Gini index is given by:

$$G(\alpha,\lambda) = 2\left(\frac{1}{1+\lambda^{-1}}\right)^\alpha - 1.$$

The *k-th* order moment for the variable *X* is given by:

$$E(X^k) = \mu^k \frac{\lambda^{k\alpha}\Gamma(k(\alpha-1)+1)}{[k(\lambda-1)+1]^{k(\alpha-1)+1}\Gamma(\alpha)^k}.$$

3.3 ESTIMATION OF BETA QUANTILE FUNCTIONS

For the estimation we begin with a set of *n* income data $(p_i, x(p_i)),\ \ i = 1, 2,..., n$ coming from the observed quantile functions. Replacing $(p_i, x(p_i))$ and taking logarithms, we obtain $(c = \log(\mu / B(a,b)))$:

$$\log x(p_i) = c + (a-1)\log p_i + (b-1)\log(1-p_i),$$

which is a linear model in the parameters. From this expression we can obtain the estimators of parameters a, b y μ. An alternative robust method of estimation is given by Castillo, Hadi and Sarabia (1998).

3.4 ESTIMATION OF GAMMA QUANTILE FUNCTIONS

In the same way, replacing and taking logarithms, we obtain:

$$\log x(p_i) = c + (\lambda-1)\log p_i + (\alpha-1)\log(-\log(p_i)),\quad 0 \leq p \leq 1,$$

$(c = \log(\mu\lambda^\alpha / \Gamma(\alpha)))$ which is again a lineal model in the parameters. From this expression we can obtain estimators of parameters μ, λ y α.

3.5 EMPIRICAL RESULTS

Results of the estimation of the quantile functions are presented in this section. TABLES 2 and 3 include the estimators of both of the models together with the standard deviation of the parameters. The empirical results reported in this study indicate that both models are very satisfactory in fitting data although gamma quantile functions are lightly better. From the corresponding estimators we have obtained the Gini indices for each year, each functional form and according to the different values of parameter "*s*". Finally GRAPHS 1 and 2 show the sensitivity of the results to the different values of "s". As we can see, the parameter has effects on the income inequality but the temporal evolution is not modified. The highest levels of the Gini index occur when s=0.

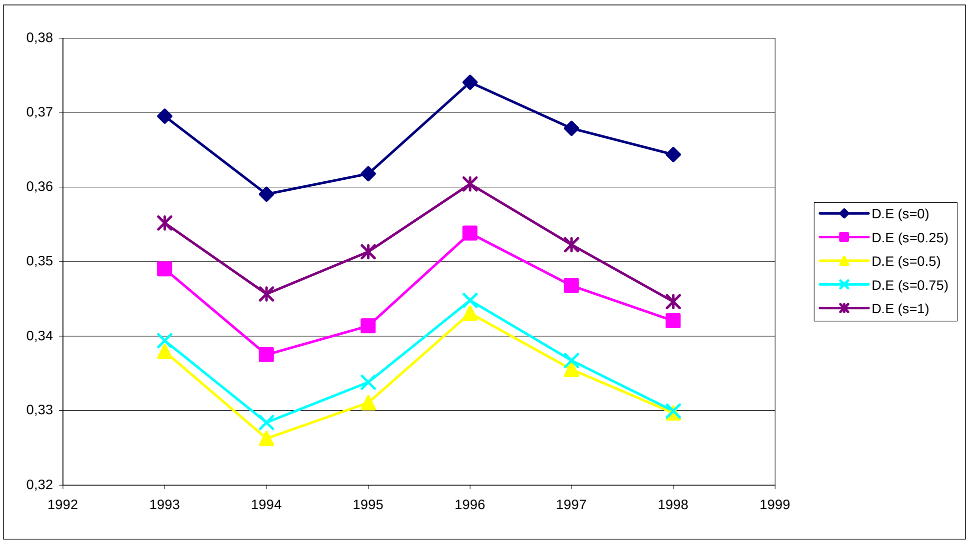
TABLE 2: Fitted Beta Quantile Functions. Standard deviations in parentheses. Country: Spain. Source of data: ECHP.

Wave	s=0		s=0.25		s=0.5		s=0.75		s=1	
	a	***b***	***a***	***b***	***a***	***b***	***a***	***b***	***a***	***b***
1994	1.4727	0.6532	1.4106	0.6599	1.3726	0.661068	1.3714	0.6658	1.3985	0.6563
	(0.0176)	(0.0176)	(0.0137)	(0.0137)	(0.0092)	(0.0092)	(0.0087)	(0.0087)	(0.0076)	(0.0076)
1995	1.4587	0.6638	1.3892	0.6649	1.3571	0.6691	1.3633	0.6725	1.4000	0.6696
	(0.0193)	(0.0193)	(0.0160)	(0.0160)	(0.0121)	(0.0121)	(0.0094)	(0.0094)	(0.0081)	(0.0081)
1996	1.4478	0.6495	1.3905	0.6596	1.3603	0.6620	1.3703	0.6682	1.4037	0.6636
	(0.0208)	(0.0208)	(0.0167)	(0.0167)	(0.0103)	(0.0103)	(0.0121)	(0.0121)	(0.0098)	(0.0098)
1997	1,4619	0,6381	1,4075	0,6490	1,3829	0,6567	1,3923	0,6630	1,4294	0,6613
	(0,0190)	(0,0190)	(0,0171)	(0,0171)	(0,0112)	(0,0112)	(0,0115)	(0,0115)	(0,0111)	(0,0111)
1998	1,4464	0,6378	1,3924	0,6535	1,3670	0,6622	1,3746	0,6703	1,4125	0,6709
	(0,0243)	(0,0243)	(0,0188)	(0,0188)	(0,0112)	(0,0112)	(0,0108)	(0,0108)	(0,0088)	(0,0088)

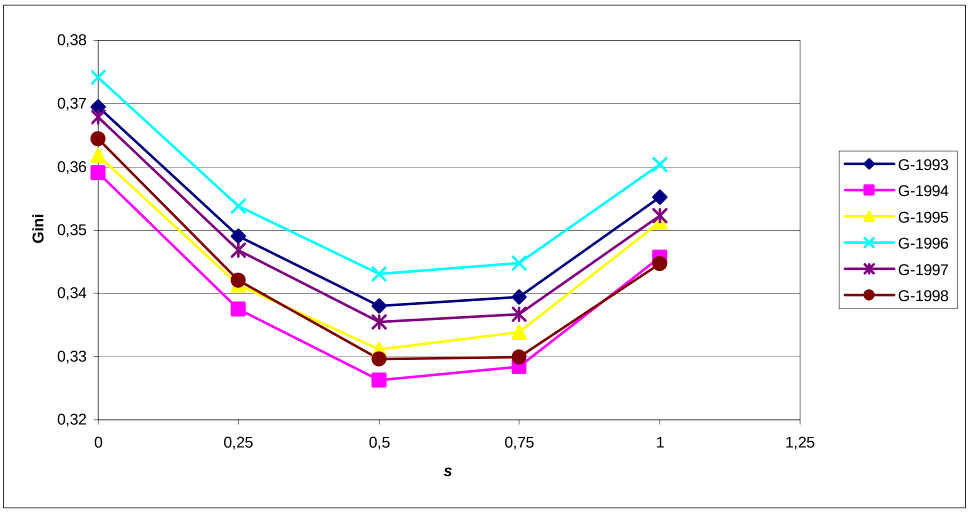
TABLE 3: Fitted Gamma Quantile Functions. Standard deviations in parentheses. Country: Spain. Source of data: ECHP.

Wave	s=0		s=0.25		s=0.5		s=0.75		s=1	
	λ	α	λ	α	λ	α	λ	α	λ	α
1994	1.3514	0.6660	1.2922	0.6728	1.2556	0.6748	1.2571	0.6802	1.2813	0.6714
	(0.0196)	(0.0146)	(0.0149)	(0.0111)	(0.0108)	(0.0080)	(0.0128)	(0.0095)	(0.0126)	(0.0094)
1995	1.3409	0.6758	1.2723	0.6774	1.2427	0.6823	1.2512	0.6866	1.2873	0.6841
	(0.0219)	(0.0163)	(0.0179)	(0.0133)	(0.0144)	(0.0107)	(0.0134)	(0.0099)	(0.0128)	(0.0095)
1996	1.3248	0.6620	1.2718	0.6724	1.2437	0.6757	1.2573	0.6830	1.2893	0.6786
	(0.0237)	(0.0176)	(0.0191)	(0.0142)	(0.0124)	(0.0093)	(0.0177)	(0.0131)	(0.0154)	(0.0114)
1997	1,3352	0,6512	1,2852	0,6622	1,2644	0,6706	1,2774	0,6778	1,3144	0,6766
	(0,0211)	(0,0157)	(0,0195)	(0,0145)	(0,0135)	(0,0100)	(0,0168)	(0,0125)	(0,0172)	(0,0128)
1998	1,3191	0,6505	1,2712	0,6662	1,2502	0,6757	1,2619	0,6846	1,3004	0,6855
	(0,0281)	(0,0209)	(0,0214)	(0,0159)	(0,0130)	(0,0097)	(0,0154)	(0,0114)	(0,0139)	(0,0104)

GRAPH 1: Evolution of income inequality in Spain (1993-1998) for different values of parameter “s”. Source of data: ECHP.



GRAPH 2: Sensibility of the Gini index to parameter “s” in Spain (1993-1998) for different values of parameter “s”. Source of data: ECHP.



Lastly TABLE 4 includes the rates of income variation for each quantile considered.

TABLE 4: The Spain distribution of income for different values of “s”. Rates of income variation. Spain, 1993-1998. Source of data:ECHP.

Quantile	s=0					s=0,25					s=0,5					s=0,75					s=1				
	1994	1995	1996	1997	1998	1994	1995	1996	1997	1998	1994	1995	1996	1997	1998	1994	1995	1996	1997	1998	1994	1995	1996	1997	1998
P 5	4,75	0,69	-5,97	8,60	10,85	5,56	-2,41	-5,39	8,86	14,95	4,02	-2,52	-5,67	7,90	17,23	2,52	-4,34	-4,75	9,22	17,73	1,19	-2,87	-6,12	10,12	19,11
P 10	1,90	-1,45	-1,89	0,34	7,09	5,13	-0,61	-3,40	2,21	5,64	5,08	-2,71	-4,03	5,22	9,59	2,94	-2,22	-4,39	6,24	11,86	1,18	-1,64	-4,44	7,57	15,77
P 15	1,17	-0,91	-1,52	0,53	6,78	1,46	-2,47	-1,37	1,09	7,49	2,69	-2,50	-2,18	4,66	9,24	2,14	-1,17	-2,56	4,48	8,93	3,62	-1,32	-2,72	6,47	11,87
P 20	1,70	-3,20	-2,24	0,98	11,06	1,99	-2,63	-3,76	3,91	10,05	1,46	-0,37	-2,59	2,62	6,67	1,82	0,48	-2,92	4,77	11,66	1,43	-0,28	-1,67	3,46	10,01
P 25	1,10	-2,22	-3,00	2,13	10,85	1,40	-1,47	-2,48	2,50	9,53	0,87	-0,20	-3,46	4,08	9,10	0,26	0,77	-2,17	4,92	9,82	0,22	0,25	-1,35	4,68	11,65
P 30	0,86	-1,17	-2,04	1,73	8,58	0,22	-0,92	-2,07	3,40	8,95	0,09	0,16	-3,01	4,16	8,55	1,35	-0,44	-0,99	4,26	5,16	0,35	-0,69	-0,60	5,45	10,54
P 35	0,76	-1,38	-1,79	2,44	7,41	0,86	-1,16	-2,45	3,80	6,69	-0,25	-0,29	-1,24	3,75	7,45	0,13	0,12	-1,58	2,74	7,80	-0,14	-0,67	0,78	4,50	10,76
P 40	-0,75	-1,16	-1,76	2,39	7,36	-0,38	-0,76	-1,39	2,30	7,28	0,62	-1,34	-1,06	3,63	8,08	-0,16	-0,71	-0,32	3,87	8,45	0,32	-0,91	-0,29	4,92	9,75
P 45	-0,92	-1,52	-1,54	2,78	6,77	-0,98	-0,89	-0,91	2,04	8,96	-0,48	-1,15	0,02	2,34	9,30	0,47	-1,51	-0,24	3,60	9,13	1,86	-0,90	0,04	4,55	6,11
P 50	-0,60	-1,87	-0,94	0,95	8,96	-0,72	-1,43	-0,03	1,61	8,99	-0,65	-1,67	0,91	2,21	9,86	-0,08	-1,11	0,12	2,63	8,95	1,95	-0,69	-0,63	2,72	7,12
P 55	-0,22	-1,57	-0,07	0,97	8,30	0,77	-2,92	0,85	1,62	9,36	0,01	-2,41	0,92	2,19	10,15	0,25	-1,67	1,36	2,44	9,23	0,98	-1,18	-0,31	4,47	7,93
P 60	-0,02	-2,14	0,11	1,37	9,19	0,80	-1,85	-0,14	1,95	9,71	0,60	-1,66	0,17	2,42	9,62	0,67	-1,23	-0,04	3,55	9,75	0,72	-0,76	0,92	3,50	8,68
P 65	-0,47	-1,78	0,87	0,73	8,38	-0,13	-0,81	0,42	1,12	9,66	0,43	-0,28	-0,37	2,74	9,20	0,83	-0,96	0,70	2,48	9,76	0,23	-0,80	0,33	3,68	8,47
P 70	-0,73	-0,44	-0,03	0,89	8,51	-0,52	-0,50	0,75	1,59	7,94	0,72	0,12	0,31	1,98	8,48	0,90	-0,90	0,38	2,07	9,71	0,11	-1,11	1,47	2,77	8,80
P 75	-1,24	-1,10	0,84	0,58	7,75	-0,93	-0,55	1,06	1,61	7,65	0,31	-1,13	0,78	2,08	7,96	-0,10	-0,74	0,66	2,39	8,89	0,23	-0,56	0,59	3,92	8,53
P 80	-1,96	-1,24	0,73	-0,02	8,95	-1,29	-1,47	0,81	1,42	7,52	-0,81	-0,89	1,00	1,76	7,83	-0,60	0,22	1,59	2,99	6,84	-0,33	0,46	0,81	2,43	8,71
P 85	-2,08	-1,21	1,97	0,77	7,40	-2,12	-0,35	1,24	0,47	7,89	-2,18	-0,32	2,81	0,65	7,01	-1,32	0,59	2,46	1,21	7,28	-1,12	0,25	2,48	2,30	7,52
P 90	-2,84	0,42	1,81	-1,15	7,58	-2,82	-0,40	2,76	-0,71	7,62	-3,50	1,32	1,92	0,90	6,84	-1,30	-0,07	2,76	0,84	6,75	0,18	0,75	2,70	1,30	6,88
P 95	-4,05	0,48	2,86	0,36	4,83	-2,78	-0,02	2,77	-0,35	5,36	-2,63	1,16	1,93	-0,07	5,62	-1,74	2,11	1,90	-0,71	6,81	-2,90	1,43	2,60	-0,54	7,60

4 INCOME INEQUALITY AND HEALTH

In recent studies about the relationship between income inequality and health two hypothesis have been proposed: The absolute income hypothesis and the relative income hypothesis. The absolute income hypothesis states that the higher an individual's income the better is their health, holding other factors constant (Preston, 1975; Pritchett, 1996 and Adler *et al*., 1993). On the other hand, the relative income hypothesis states that individual's health is also affected by the distribution of income within society (Ben-Shlomo *et al*., 1996; Kaplan *et al*., 1996; Kennedy *et al*., 1996; Wilkinson, 1994, 1995, 1996 and 1997; Waldman, 1992). Both hypothesis have been tested empirically in recent papers. These studies suggest that reducing inequality is good for the health of the whole population and not only for those individuals with the lowest incomes.

Obviously, income affects health but, how much? When we compare income inequality and population mortality it is supposed that as inequality increases, population mortality (or children mortality) raises. So, population mortality and income inequality are positively associated. In this paper, we test this hypothesis using ECHP and OECD health data indicators for the European Union Countries. TABLES 4-7 include information about life expectancy of males and females, children mortality and Gini indices for these countries.

TABLE 4: Male´s life expectancy (years) in European Union. Selected years 1980-1998

Countries	1980	1985	1990	1995	1996	1997	1998
Germany	69,9	71,5	72,7	73,3	73,6	74,1	74,5
Austria	69	70,4	72,3	73,5	73,9	74,3	74,7
Belgium	70	70,9	72,4	73,6	73,5	74,7	74,8
Denmark	71,2	71,6	72	72,6	72,9	73,3	73,7
Spain	72,5	73,3	73,4	74,4	74,5	74,6	74,8
Finland	69,2	70,1	70,9	72,8	73	73,4	73,5
France	70,2	71,3	72,7	73,9	74,2	74,6	74,6
Greece	72,2	73,5	74,6	74,6	74,6	74,6	74,6
Netherlands	72,5	73,1	73,8	74,6	74,7	75,2	75,2
Ireland	69,5	71	72,1	73	73,2	73,4	73,5
Italy	70,6	72	73,5	74,6	75	75,3	n.d.
Luxembourg	68	n.d.	72,3	72,9	73	74,1	73,7
Portugal	67,7	69,7	70,9	71	71,2	71,4	71,7
United Kingdom	71	71,7	72,9	74,1	74,3	74,6	74,8
Sweden	72,8	73,8	74,8	75,9	76,5	76,7	76,9
EU-15 Average	70,42	66,93	72,75	73,65	73,87	74,29	69,4

SOURCE: OECD Health Data (2002).

TABLE 5: Female´s life expectancy (years) in European Union. Selected years 1980-1998

País	1980	1985	1990	1995	1996	1997	1998
Germany	76,6	78,1	79	79,8	79,9	80,3	80,5
Austria	76,1	77,3	78,9	80,1	80,2	80,6	80,9
Belgium	76,8	77,7	79,1	80,2	80,2	81,8	81,1
Denmark	77,3	77,5	77,7	77,8	78	78,4	78,6
Spain	78,6	79,7	80,5	81,6	81,8	82	82,2
Finland	77,8	78,5	78,9	80,2	80,5	80,5	80,8
France	78,4	79,4	80,9	81,9	82	82,3	82,2
Greece	76,6	78,4	79,4	79,4	79,4	79,4	79,4
Netherlands	79,2	79,7	80,1	80,4	80,4	80,6	80,7
Ireland	75	76,7	77,6	78,6	78,5	78,6	79,1
Italy	77,4	78,4	80	81	81,3	81,6	n.d.
Luxembourg	75,1	n.d.	78,5	79,4	80	79,8	80,5
Portugal	n.d.	76,7	77,9	78,2	78,5	78,7	78,8
United Kingdom	77	77,6	78,5	79,4	79,5	79,7	79,7
Sweden	78,8	79,7	80,4	81,3	81,5	81,8	81,9
EU-15 Average	72,05	73,03	79,16	79,95	80,11	80,41	n.d.

SOURCE: OECD Health Data (2002).

TABLE 6: Children mortality in European Union. Selected years 1980-2000

Countries	1980	1985	1990	1995	1996	1997	1998	1999	2000
Germany	12,6	8,9	7	5,3	5	4,9	4,7	4,5	4,4
Austria	14,3	11,2	7,8	5,4	5,1	4,7	4,9	4,4	4,8
Belgium	12,1	9,8	8	7	6	6,1	5,6	4,9	5,2
Denmark	8,4	7,9	7,5	5,1	5,6	5,2	4,7	4,2	5,3
Spain	12,3	8,9	7,6	5,5	5,5	5	4,9	4,5	4,6
Finland	7,6	6,3	5,6	4	3,9	3,9	4,1	3,7	3,8
France	10	8,3	7,3	4,9	4,8	4,7	4,6	4,3	4,5
Greece	17,9	14,1	9,7	8,1	7,2	6,4	6,7	6,2	6,1
Netherlands	8,6	8	7,1	5,5	5,7	5	5,2	5,2	5,1
Ireland	11,1	8,8	8,2	6,3	5,5	6,2	6,2	5,5	5,9
Italy	14,6	10,5	8,2	6,2	5,9	5,6	5,4	5,1	5,1
Luxembourg	11,5	9	7,3	5,5	4,9	4,2	5	4,6	5,1
Portugal	24,3	17,8	11	7,5	6,9	6,4	6	5,6	5,5
United Kingdom	12,1	9,4	7,9	6,2	6,1	5,9	5,7	5,8	5,6
Sweden	9,1	6,9	6,8	4,1	4	3,6	3,5	3,4	3,4
EU-15 Average	12,4	9,72	7,8	5,77	5,47	5,18	5,12		

SOURCE: OECD Health Data (2002).

TABLE 7: Inequality Gini indices for different values of parameter “s”.

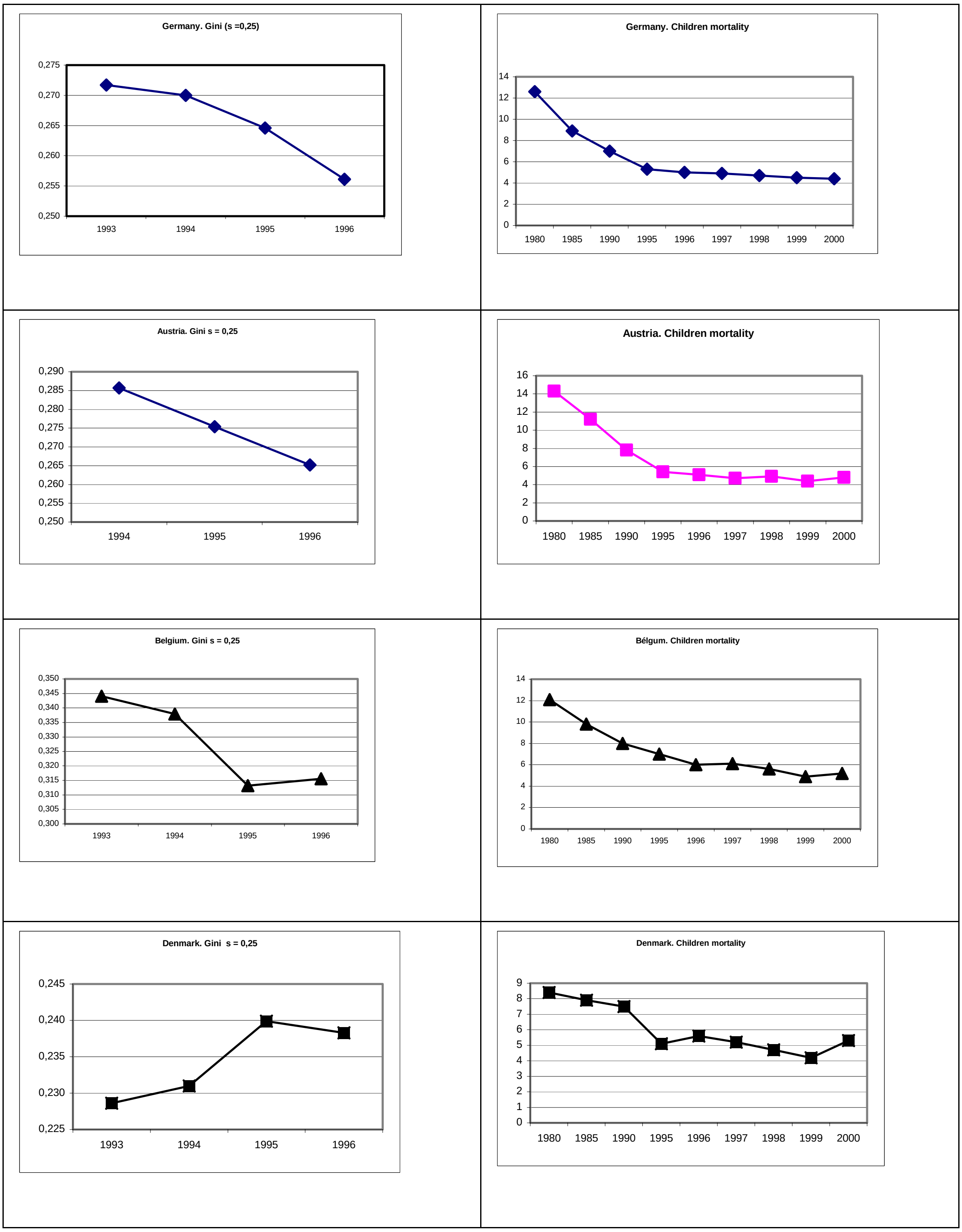
	s=0.25				*s* =0.5				*s* =0.75			
Years	**1993**	**1994**	**1995**	**1996**	**1993**	**1994**	**1995**	**1996**	**1993**	**1994**	**1995**	**1996**
Germany	0,2717	0,2700	0,2646	0,2561	0,2735	0,2684	0,2636	0,2544	0,2899	0,2807	0,2764	0,2671
Austria	n.a.	0,2857	0,2754	0,2652	n.a.	0,2786	0,2670	0,2570	n.a.	0,2877	0,2749	0,2655
Belgium	0,3441	0,3379	0,3132	0,3155	0,3407	0,3315	0,3078	0,3079	0,3486	0,3371	0,3156	0,3134
Denmark	0,2286	0,231	0,2399	0,2383	0,2143	0,2156	0,2231	0,2226	0,2176	0,2173	0,2232	0,2251
Spain	0,3444	0,3345	0,3444	0,3471	0,3396	0,3278	0,3387	0,3402	0,3433	0,3303	0,3419	0,3417
Finland	n.a.	n.a.	0,2398	0,2446	n.a.	n.a.	0,2329	0,2365	n.a.	n.a.	0,2413	0,2444
France	0,3328	0,2884	0,2867	0,2906	0,3299	0,2852	0,2818	0,2851	0,3392	0,2947	0,2898	0,2931
Greece	0,3695	0,3533	0,3430	0,3550	0,3656	0,3476	0,3391	0,3497	0,3685	0,3491	0,3429	0,3515
Netherlands	0,2479	0,2703	0,2741	0,2593	0,2526	0,2746	0,2782	0,2624	0,2715	0,2929	0,2962	0,2801
Ireland	0,3175	0,3259	0,3388	0,3330	0,3127	0,3216	0,3346	0,3290	0,3191	0,3277	0,3404	0,3352
Italy	0,3282	0,3191	0,3069	0,3093	0,3275	0,3165	0,3061	0,3068	0,3353	0,3228	0,3145	0,3135
Luxembourg	0,3054	0,2829	0,2800	n,a,	0,3044	0,2817	0,2788	n.a.	0,3168	0,2947	0,2916	n.a.
Portugal	0,3967	0,3773	0,3708	0,3676	0,3907	0,3713	0,3650	0,3624	0,3916	0,3722	0,3663	0,3642
U.Kingdom	0,3122	0,3139	0,3049	0,3172	0,3118	0,3142	0,3063	0,3178	0,3223	0,325	0,3183	0,3286
Sweden	n.a.	n.a.	n.a.	0,2292	n.a.	n.a.	n.a.	0,2229	n.a.	n.a.	n.a.	0,2335

Note : n.a. means not available
SOURCE: Alvarez *et al*. (2002).

Although life expectancy is one of the most important indicators of population health and economic development, we have not include this variable later on because the developed countries variations in the average expectation of life are small.

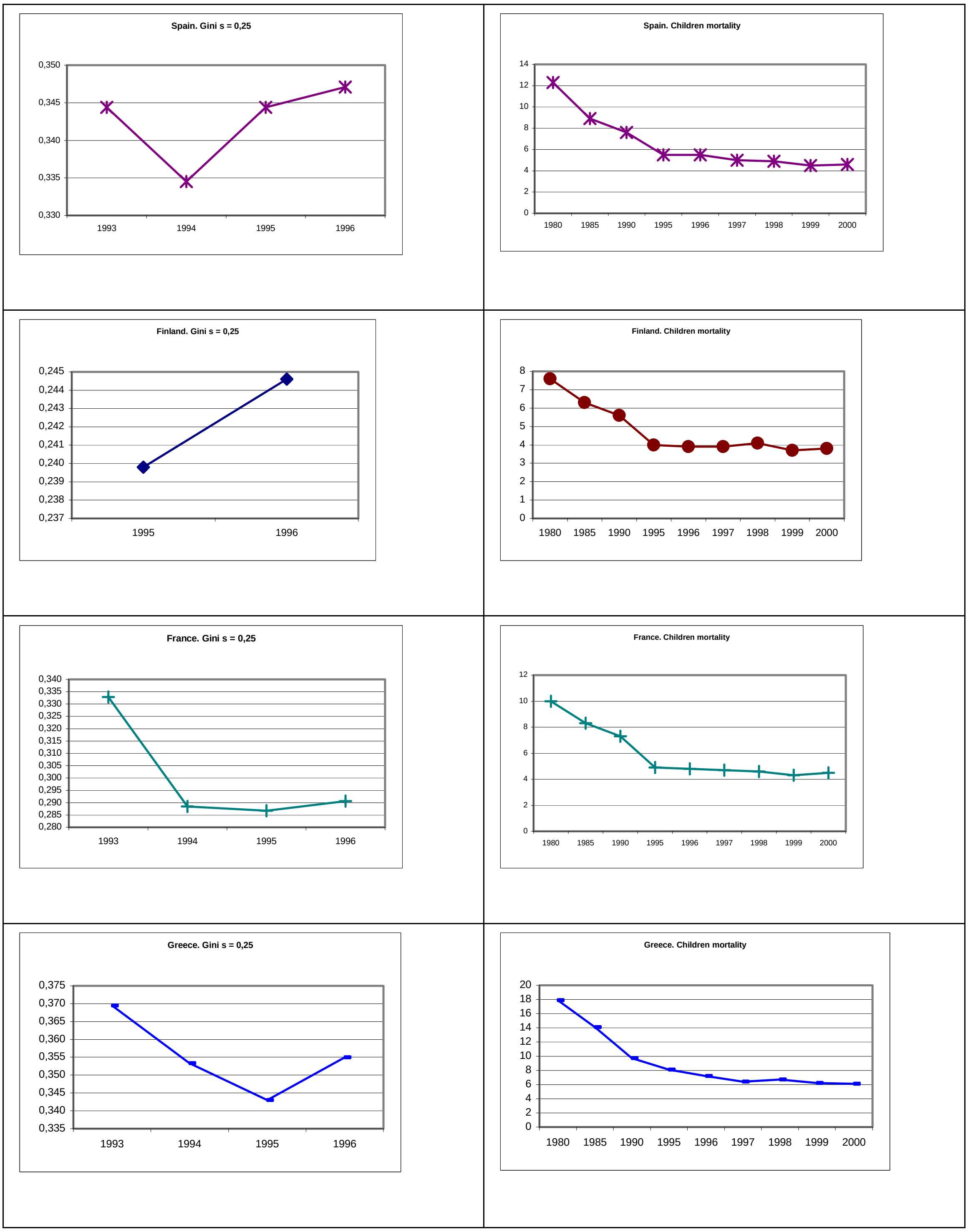
In this part of the paper, we are going to focus on the relation between population mortality and income inequality. GRAPH 1 shows the evolution of Gini index when *s*=0.25 and children mortality in the European Union. Analogous results have been obtained for other values of “s”.

GRAPH 3: Evolution of income inequality and children mortality in the European Union.



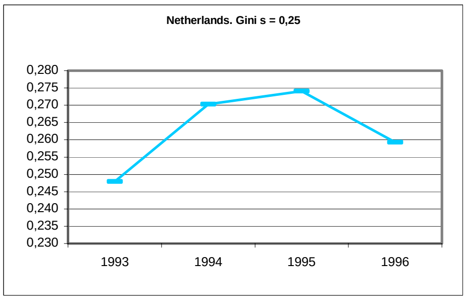
Source: Authors ' compilation based on Alvarez *et al.* (2002) and OECD *Health Data*.

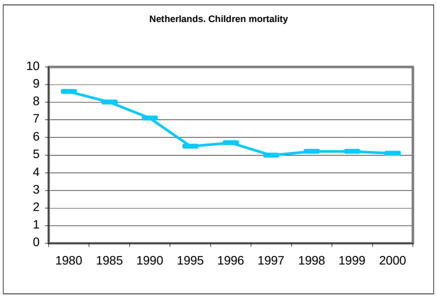
GRAPH 3 (continue): Evolution of income inequality and children mortality in the European Union.

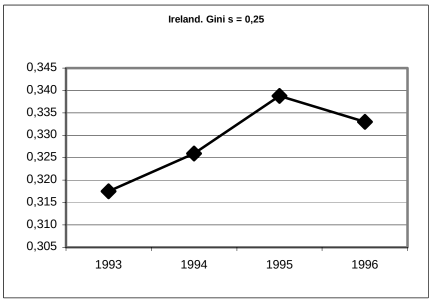


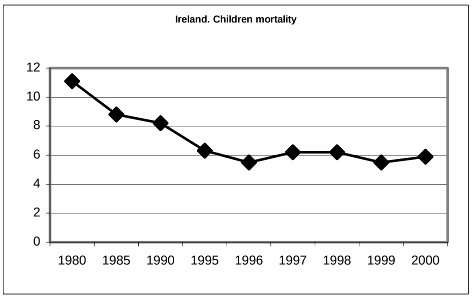
Source: Authors ' compilation based on Alvarez *et al*. (2002) and OECD *Health Data*.

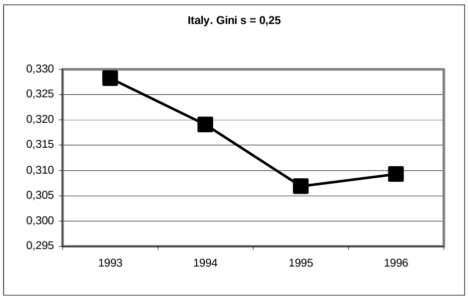
GRAPH 3 (continue): Evolution of income inequality and children mortality in the European Union.

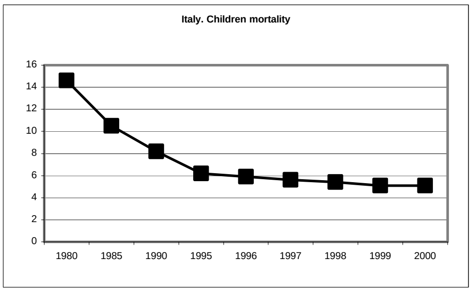






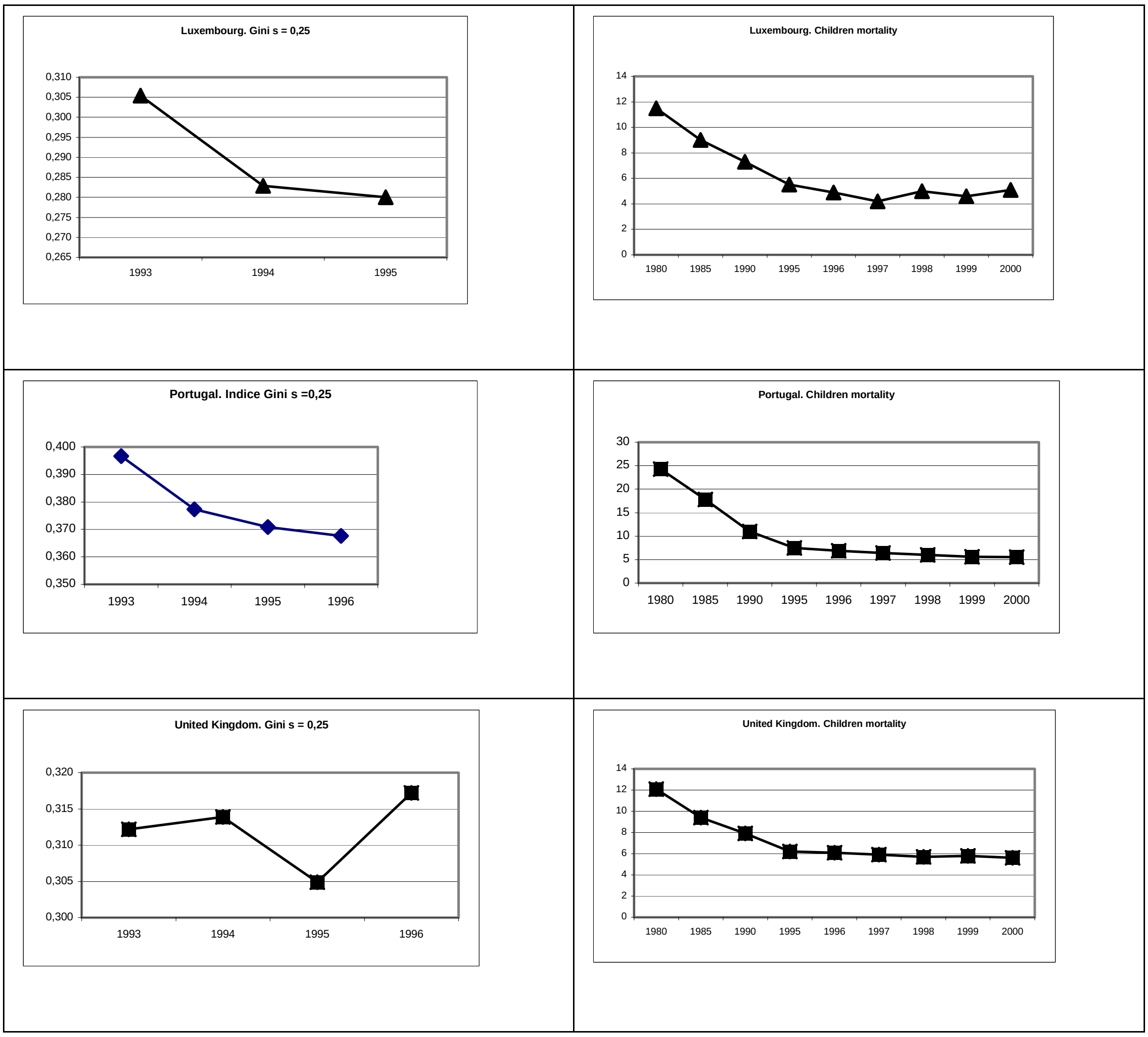






Source: Authors ' compilation based on Alvarez *et al*. (2002) and OECD *Health Data*.

GRAPH 3 (continue): Evolution of income inequality and children mortality in the European Union.



Source: Authors ' compilation based on Alvarez *et al.* (2002) and OECD *Health Data.*

As we can see, in most of the countries there is a clear positive relationship between income inequality and children mortality. TABLE 8 shows correlation coefficients between Gini index, mortality rates, children mortality rates and birth rates. Although no statistically significant relations can be identified in all cases it could be due to the data. However, some countries such as Denmark and Netherlands reduce thier Gini index in some years but increase children mortality rates.

TABLE 8: Correlation coefficients.

	Gini	Mortality	Children mortality	Birth rates
Gini	---	0.803 (*p*=0.197)	-0.265 (*p*=0.735)	-0.150 (*p*=0.850)
Mortality	---	---	-0.737 (*p*=0.263)	-0.683 (*p*=0.317)
Children mortality	---	---	---	0.986 (*p*=0.014)
Birth rates	---	---	---	---

Source: Authors' compilation

In order to these issues, the absolute income hypothesis (holding other factors constant, the higher an individual's income the better is their health) is supported by a considerable number of papers (Preston, 1975; Pritchett, Summers, 1996; Adler, Boyce, Chesney, Folkman and Fymes, 1993).

5 CONCLUSIONS

This paper is focused on income inequality and its relationship with health indicators. Firstly, we have studied income inequality in Spain using the European Community Household Panel (ECHP). This survey contains data on individuals and households and the information is homogeneous across European countries. We propose two robust models based on the quantile functions. Specifically, we use the Gamma and Beta quantile functions and we test the sensitivity of the results to different equivalence scales. Secondly, we have studied. the correlation between income inequality and one of the most important health indicators such as life expectancy. In conclusion, income inequality seems to have significant effects on health indicators. Although we can not confirm that the social capital is highly related with health, at least it is an important factor which healps to explain it.

However, associations between income inequality and population health may be a statistical artefact resulting from the use of aggregate rather than individual data (an example of "*ecological fallacy*") in inferring relations at the individual level from associations between variables at the population level (Robinson, 1950; Deaton and Muellbauer, 1980).

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