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## Conference Paper

# Can income inequality contribute to understand inequalities in health? An empirical approach based on the European Community Household Panel

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**“CAN INCOME INEQUALITY CONTRIBUTE TO UNDERSTAND  
INEQUALITIES IN HEALTH? AN EMPIRICAL APPROACH BASED ON THE  
EUROPEAN COMMUNITY HOUSEHOLD PANEL” (\*)**

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**ABSTRACT**

In this paper the causal effects of socioeconomic status, in particular income, on individuals health in the European Union are analysed. We focus on the relationship between income and health. Finally, an international comparison of concentration indices for socioeconomic inequality in health based on the European Community Household Panel (ECHP) is presented. This survey contains data on individuals and households and the information is homogeneous across European Countries.

**KEY WORDS:** Inequality, Health, Social Capital, European Community Household Panel, Ordered probit.

**JEL CATEGORY:** D31, D63, I10

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## 1. INTRODUCTION

The study of income inequality and population health is an important goal in modern societies and demands careful attention for economic analysis. New data on income distribution are now available for the European Union countries and allow us to test different hypotheses. In recent papers, several authors have advanced that income inequality is related with population health. Life expectancy and population mortality have been used as key indicators of population health and economic development (Van Doorslaer and Koolman, 2002). Le Grand (1987) found a negative association between the “absolute mean difference” in age at death and the reported share of overall income earned by the bottom quintile of the population in seventeen Organization for Economic Cooperation and Development (OECD) countries and in Eastern Europe. Wilkinson (1992) in his seminal article showed a strong negative correlation between the proportion of income earned by the bottom 70 percent of the population and life expectancy in nine western industrialized countries of the OECD. Similar results have been showed by Waldmann (1992), Kawachi *et al.*<sup>i</sup> (1996) using different measures of inequality.

This paper is focused on reporting self-assessed health (SAH) using the European Community Household Panel (ECHP). Self-assessed health has been used in other studies of the relationship between health and socio-economic status (see Hernandez et al., 2004; Adams et al., 2003; Benzeval et al., 2000; Deaton and Paxon, 1998). Obviously SAH is a subjective measure of health that provides an ordinal ranking of perceived health status.

The structure of the paper is as follows. The source of data and the self-assessed health variable are described in Section 2. Section 3 is focused on the relationship between health, income and other socio-economic variables using ordered probit models. Finally, conclusions are presented in Section 4.

## **2. THE EUROPEAN COMMUNITY HOUSEHOLD PANEL: METHODOLOGICAL DECISIONS**

This new survey contains data on individuals and households for the European Union countries with eight waves available (1994-2001). The main advantage is that information is homogeneous among countries since the questionnaire is similar across them. This source of data is coordinated by the Statistical Office of the European Communities (EUROSTAT). Also, this survey includes rich new information about income, education, employment, health, etc. In this sense, it is important to highlight that it is the first fixed and harmonized panel for studying socio-economic factors of the households and individuals inside the European Union. TABLE 1 includes information about households' sample composition.

The total net income of each household is available and it covers the total income received by all the member of the household from all sources. The reference period of income is the year prior to interview. The interviews corresponding to the first eight waves of the ECHP were performed in the years 1994, 1995, 1996, 1997, 1998, 1999, 2000 and 2001, meaning that the corresponding incomes refer to, respectively, the years 1993, 1994, 1995, 1996, 1997, 1998, 1999 and 2000.

The self-assessed health variable is a subjective response to the question "How is your health in general?" and it takes the values "1" (very good), "2" (good), "3" (fair), "4" (bad) and "5" (very bad). TABLE 2 shows the relative Frecuencies for the classifications of Self-Assessed Health in Spain.

**TABLE 1**  
Households' sample composition in the ECHP (1994-2001):  
Number of unweighted observations

		Wave 1 (1994)	Wave 2 (1995)	Wave 3 (1996)	Wave 4 (1997)	Wave 5 (1998)	Wave 6 (1999)	Wave 7 (2000)	Wave 8 (2001)
Germany	Households	4968	4688	4593	-	-	-	-	-
	Individuals	12435	11730	11384	-	-	-	-	-
Germany (SOEP)	Households	6207	6336	-	6163	5962	5847	5693	5563
	Individuals	16284	16682	-	15942	15251	14860	14340	13969
Denmark	Households	3482	3223	2955	2745	2512	2387	2281	2283
	Individuals	7693	7200	6560	6204	5666	5427	5222	5136
Netherlands	Households	5187	5110	5179	5049	4963	5008	-	4851
	Individuals	13029	12791	12662	12584	12373	12446	-	12079
Belgium	Households	3490	3366	3210	3039	2876	2712	2572	2362
	Individuals	9149	8839	8363	7916	7408	6970	6560	5985
Luxembourg (PSELL I)	Households	1011	962	933	-	-	-	-	-
	Individuals	2807	2672	2584	-	-	-	-	-
Luxembourg (PSELL II)	Households	-	-	-	2654	2523	2551	2373	2428
	Individuals	-	-	-	7093	6647	6585	6184	6306
France	Households	7344	6722	6600	6176	5866	5620	5345	5345
	Individuals	18916	17408	16886	15758	14849	14109	13368	13263
United Kingdom	Households	5779	4548	3775	-	-	-	-	-
	Individuals	14342	11282	9322	-	-	-	-	-
United Kingdom (BHPS)	Households	5126	5032	-	4965	4996	-	4890	4819
	Individuals	12844	12508	-	12396	12432	-	12186	12051
Ireland	Households	4048	3584	3173	2945	2729	2378	1951	1760
	Individuals	14585	12577	10887	9952	9000	7721	6276	5565
Italy	Households	7115	7128	7132	6713	6571	6370	6052	5606
	Individuals	21934	21757	21506	20074	32855	18621	17602	16162
Greece	Households	5523	5220	4907	4604	4211	3986	3918	3916
	Individuals	16321	15309	14384	13491	12298	11654	11383	11244
Spain	Households	7206	6522	6267	5794	5485	5418	5132	4966
	Individuals	23025	20708	19712	18167	16728	16222	15048	14320
Portugal	Households	4881	4916	4849	4802	4716	4683	4633	4614
	Individuals	14706	14826	14623	14428	14085	13529	13481	13285
Austria	Households	-	3380	3292	3142	2960	2815	2644	2544
	Individuals	-	9579	9249	8733	8184	7739	7169	6873
Finland	Households	-	-	4139	4106	3920	3822	3104	3115
	Individuals	-	-	11214	10888	9973	9587	7552	7498
Sweden	Households	-	-	-	5891	5807	5732	5734	5680
	Individuals	-	-	-	13661	13230	13002	12918	12870

Source: Authors' calculation based on ECHP data

**TABLE 2**

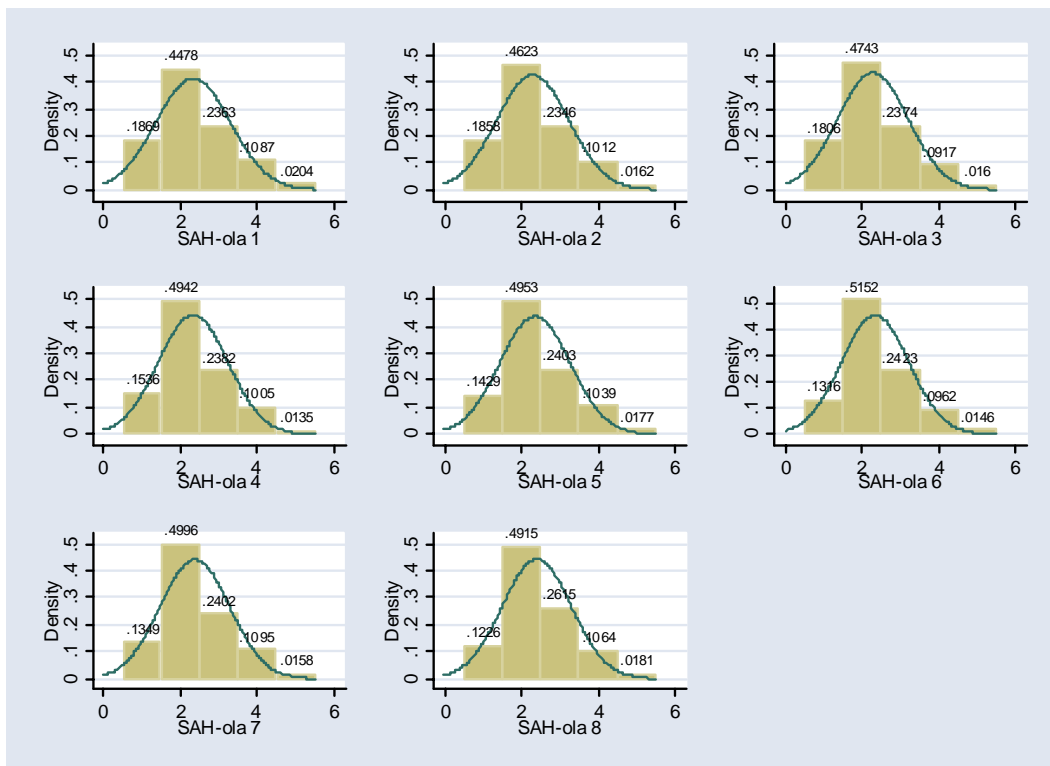
Relative Frecuencies for the classications of Self-Assessed Health.  
Source of data: ECHP. Country: Spain.

Self-Assessed Health	Wave 1 (1994)	Wave 2 (1995)	Wave 3 (1996)	Wave 4 (1997)	Wave 5 (1998)	Wave 6 (1999)	Wave 7 (2000)	Wave 8 (2001)
Very Good (1)	18.69	18.58	18.06	15.36	14.29	13.16	13.49	12.26
Good (2)	44.78	46.23	47.43	49.42	49.53	51.52	49.96	49.15
Fair (3)	23.63	23.46	23.74	23.82	24.03	24.23	24.02	26.15
Bad (4)	10.87	10.12	9.17	10.05	10.39	9.62	10.95	10.64
Very Bad (5)	2.04	1.62	1.60	1.35	1.77	1.46	1.58	1.81

Source: Authors' calculation based on ECHP data

Finally, GRAPH 1 shows the distribution of Self-Assessed Health (SAH) for each wave, using the Spanish balanced panel of individuals who are observed for all eight waves. The different categories are shown on the horizontal axis with “1” representing the highest level of health and “5” the lowest. The histograms have a similar pattern. We can observe a skewed distribution with the majority of individuals reporting their health is good.

**GRAPH 1**  
Distribution of Self-Assessed Health.  
Spain: 1994-2001



Source: Authors' elaboration based on the ECHP data.

### 3. HEALTH AND INCOME: AN APPROACH BASED ON ORDERED PROBIT MODELS

In the last years new techniques allow us to deepen in the study of multinomial choice variables (Greene, 2003). In this way, regression analysis of SAH can be achieved through specifying an ordered probit model. These models are usually motivated by a latent variable specification:

$$H_i^* = X_i\beta + \varepsilon_i, \quad i = 1, 2, \dots, n,$$

where  $x$  is a set of regressors and  $\varepsilon$  is an error term uncorrelated with the regressors with normal distribution.

However,  $H^*$  is unobserved and what we do observe is:

$$H_i = \begin{cases} 0 & \text{si } \gamma_1 \geq H_1^* \\ 1 & \text{si } \gamma_2 \geq H_1^* \geq \gamma_1 \\ \dots & \dots \dots \\ (M-1) & \text{si } H_1^* \geq \gamma_{(M-1)} \end{cases}$$

where  $\gamma_1, \gamma_2, \dots, \gamma_{(M-1)}$  are unknown parameters to be estimated with  $\beta$ . The probabilities of each category are:

$$\begin{aligned} \Pr(H_i = 0 / X_i, \beta, \gamma) &= \Phi(\gamma_1 - X_i\beta) \\ \Pr(H_i = 1 / X_i, \beta, \gamma) &= \Phi(\gamma_2 - X_i\beta) - \Phi(\gamma_1 - X_i\beta) \\ &\dots \\ \Pr(H_i = (M-1) / X_i, \beta, \gamma) &= 1 - \Phi(\gamma_{(M-1)} - X_i\beta) \end{aligned}$$

where function  $\Phi(\cdot)$  denotes the standard normal distribution. The corresponding estimators are obtained maximizing the log-likelihood function:

$$\Gamma(\beta, \gamma) = \sum_{Y=0} \log[\Pr(H_i = 0 / X_i, \beta, \gamma)] + \sum_{Y=1} \log[\Pr(H_i = 1 / X_i, \beta, \gamma)] + \dots + \sum_{Y=(M-1)} \log[\Pr(H_i = (M-1) / X_i, \beta, \gamma)]$$



and the marginal effects of changes in the regressors are:

$$\begin{aligned}\frac{\partial \Pr(H = 0)}{\partial X_k} &= -\Phi(\gamma_1 - X_i\beta)\beta_k, \\ \frac{\partial \Pr(H = 1)}{\partial X_k} &= [-\Phi(\gamma_2 - X_i\beta) + \Phi(\gamma_1 - X_i\beta)]\beta_k, \\ &\dots \\ \frac{\partial \Pr(H = M - 1)}{\partial X_k} &= -\Phi(\gamma_{(M-1)} - X_i\beta)\beta_k\end{aligned}$$

In this paper, three different specifications of ordered probit models have been considered. Self-assessed health is defined for waves 1 to 8 in the ECHP as the response to the question “How is your health in general?” In this way, “Very good” is coded as “1”, “Good” as “2”, “Fair” as “3”, “Bad” as “4” and, finally, “Very bad” as “5”. The independent variables which are used in the analysis are classified in four groups (personal characteristics, education, labour experience and job market, and other variables related with health).

As personal characteristics we have considered *sex* (dummy variable which takes the value one if the individual is man and zero otherwise) and *age* (in years). Another two dummy variables have been constructed to represent maximum level of education achieved. These variables are “*Recognised third level education*” for the first one and “*Less than second stage of secondary education*” for the second one.

Other variables we have considered related to job market are:

- *Total Net Personal Income*
- *Main activity status* (defined as a dummy variable which takes the value one if individual *i* is unemployed and zero otherwise).
- *Status in employment*. We have considered two dummy variables. The first one takes the value one if the individual is working with an employer in paid employment and zero otherwise, and the second one takes the value one if the individual is self-employment and zero otherwise.
- *Private sector*. This variable takes the value one if current job is in private sector (including non-profit private organisations) and zero otherwise.
- *Type of employment contract*. This variable takes the value one if employment contract is fixed term or short term (but not permanent) and zero otherwise.

- *Labor experience* (calculated as worker's age less the age in which the individual began his/her working life).

Finally, we have considered other variables related with health status:

- *Chronic health problem* (defined as a dummy variable which takes the value one if the individual has a chronic physical or mental health problem and zero otherwise).
- *Admitted to a hospital* (defined as a dummy variable which takes the value one if during the past 12 months, the individual has been admitted to a hospital as an in-patient and zero otherwise).
- *Sick during the past two weeks*. This dummy variable takes the value one if during the past two weeks the individual has had to cut down things he/she usually do about the house, at work or in free time because of illness or injury and zero otherwise.

Estimation of the models are based on the method of maximum likelihood and results are presented in TABLES 3 and 4. We can observe that except for variable "private sector", all variables are significant and signs are as expected.

**TABLE 3**  
 Ordered probit models. Year 2000. Country: Spain.  
 Source of data: ECHP 2000 and 2001.

	Model 1		Model 2		Model 3	
<b>Personal Characteristics</b>	<b>Coefficient</b>	<b>z</b>	<b>Coefficient</b>	<b>z</b>	<b>Coefficient</b>	<b>z</b>
Age.....			0.0214312	9.92	0.0172928	7.83
			(0.0021605)	(0.000)	(0.0022073)	(0.000)
Male.....			-0.0524485	-2.01	-0.0779789	-2.94
			(0.0260919)	(0.044)	(0.0265562)	(0.003)
<b>Education</b>						
Less than second stage of secondary education.....			0.2376201	8.08	0.211188	7.11
			(0.029423)	(0.000)	(0.0296992)	(0.000)
<b>Job Market</b>						
Personal Income.....	-0.0372	-4.42	-0.0268	-2.93	-0.0278	-3.00
	(0.00842)	(0.000)	(0.00915)	(0.003)	(0.00926)	(0.003)
Unemployed.....	-0.2716073	-4.95	-0.1848845	-3.31	-0.1265321	-2.23
	(0.0548227)	(0.000)	(0.0558206)	(0.001)	(0.0568313)	(0.026)
Employer in paid employment.....	-0.3892724	-8.55	-0.2920505	-6.31	-0.177403	-4.81
	(0.0455029)	(0.000)	(0.0463203)	(0.000)	(0.0368877)	(0.000)
Self-employment.....	-0.2537509	-4.34	-0.1910879	-3.24	-0.0872059	-1.87
	(0.0584651)	(0.000)	(0.0589054)	(0.001)	(0.0466254)	(0.061)
Private Sector .....	-0.0644347	-1.60	-0.0631056	-1.53		
	(0.040244)	(0.109)	(0.0412985)	(0.127)		
Fixed term or short term contract....	0.1082809	2.59	0.121606	2.89		
	(0.0418099)	(0.010)	(0.0420568)	(0.004)		
Labor experience.....	0.0247239	32.42	0.0063617	3.37	0.0056515	2.92
	(0.0007626)	(0.000)	(0.001886)	(0.001)	(0.0019335)	(0.003)
<b>Health</b>						
Chronic Health Problem.....	1.328856	46.28	1.317229	45.81	1.35709	39.35
	(0.0287109)	(0.000)	(0.0287557)	(0.0000)	(0.0344917)	(0.000)
Admitted to a hospital (in-patient).....	0.5029505	13.64	0.5010224	13.59	0.5126522	11.61
	(0.0368676)	(0.000)	(0.0368604)	(0.0000)	(0.0441374)	(0.000)
Sick during the past two weeks.....					0.8942338	9.49
					(0.0942742)	(0.000)

NOTE:

\*\* Coefficient multiplied by 1 million.

Number of unweighted observations = 8956.

Finally and after proving with different specifications, we have considered as dependent variable the log-income in order to take into account the concavity relationship between income and health (Gravelle, 1998). In this case (TABLE 4), all the considered variables (personal characteristics, education, job market and other variables related with health) are significant.

**TABLE 4**  
 Ordered probit models. Year 2000. Country: Spain:  
 Source of data: ECHP 2000 and 2001.

	Model	
	<b>Coefficiente</b>	<b>z</b>
<b>Personal Characteristics</b>		
Age.....	0.0120874 (0.0025141)	4.81 (0.0000)
Male.....	-0.1429751 (0.0283923)	-5.04 (0.0000)
Married.....	0.0875633 (0.0280005)	3.13 (0.0020)
<b>Education</b>		
Less than second stage of secondary education.....	0.1682689 (0.0397092)	4.241 (0.0000)
Third level education.....	-0.0892096 (0.0441452)	-2.02 (0.0430)
<b>Job Market</b>		
Log Net Income.....	-0.0249042 (0.0115741)	-2.15 (0.031)
Labor experience.....	0.0078856 (0.002198)	3.59 (0.0000)
Unemployed.....	-0.2554511 (0.0635955)	-4.02 (0.0000)
Employer in paid employment.....	-0.2930652 (0.0435091)	-6.74 (0.0000)
Self-employment.....	-0.207757 (0.0507107)	-4.10 (0.0000)
<b>Health</b>		
Chronic Health Problem.....	1.330119 (0.0370164)	35.93 (0.0000)
Admitted to a hospital (in-patient).....	0.4934309 (0.047148)	10.47 (0.0000)
Sick during the past two weeks.....	0.9378346 (0.1011078)	9.28 (0.0000)

NOTE: Number of unweighted observations = 7768.

#### 4. CONCLUSIONS

In this paper new evidence about the relationship between health and income is obtained. The ECHP offers a rich source of information on individuals and socio-economic situation in the European Union. For this purpose ordered probit models have been used regressing Self-Assessed Health on a relevant socio-economic variables. In this way, we can conclude that education and income have a positive effect on health. Furthermore, the positive correlation between income and health must generate considerable policy concern. The main findings of this study are in line with others using British data: Income have significant effects on health, even when we consider factors such as gender, age, education and other characteristics related with job market. The observed differences in health between birth cohorts are significant suggesting that health declines rapidly with age. However, as the health measure is self-reported it could reflect either objective differences in health or individuals' expectations. Finally, the finding of a positive effect of log-income on health should encourage to support policies to improve population health through income.

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<sup>i</sup>They used a measure of income distribution that is called the “Robin Hood Index” and it is a measure of the proportion of total income that must be redistributed from “rich” (above-mean) households to “poor” (below-mean) ones to achieve perfect equality.