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THE RICHER, THE HAPPIER? AN EMPIRICAL INVESTIGATION IN SELECTED EUROPEAN COUNTRIES*

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ABSTRACT. This study analyses the relationship between subjective and objective measures of well-being in selected European countries using the data of the European Community Household Panel (ECHP). In the first part of the paper, we develop a random-effect ordered probit model, separately for each country, relating the subjective measure of income satisfaction to actual income, and controlling for some individual and household socio-demographic fixed effects. In the second part of the paper, we fit a Bayesian cross-classified multilevel model, in order to control for intra-family correlation in subjective well-being, which actually appears to be present.

KEY WORDS: economic well-being, panel data, subjective well-being

1. INTRODUCTION

Poverty is a major concern, both at the theoretical, the empirical, and the policy level. Nevertheless, the issue of what poverty really is, and how it should be measured, is still an open and controversial one.

Probably, the most important reason why poverty is so carefully studied is that it is assumed to (drastically) reduce individual well-being, while, conversely, high levels of income (or consumption, assets, etc.) are implicitly associated with high levels of well-being. Microeconomic theory states that, as income and consumption increase, a greater number of needs can be satisfied, and, by definition, a higher standard of well-being can be attained. This is basically why the ''success'' of an individual or a country is generally measured in terms of levels of, or increments in, per capita income. Alternative, and more complex measures, combining different dimensions of

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"success", do not solve the problem. Take the Human Development Index, for instance (UNDP, 2005): it combines per capita income with school performance and life expectancy, all of which are probably, but not surely, or invariably, linked to a higher subjective feeling of well-being. Indeed, well-being is a complex notion, affected by several dimensions of life, at the personal, household, and societal level, as is now amply documented by scientific research.

But even the more limited notion of "financial satisfaction" does not depend exclusively, or even primarily, on one's income as we will try to show in this paper, where we focus on the relationship between income and income satisfaction, controlling for several other socio-demographic variables, in selected European countries in the period 1994–2001, on the basis of internationally comparative panel data – that of the European Community Household Panel (EHCP).

The paper is organized as follows: in Section 2 we introduce the most important findings in the literature on subjective well-being (SWB) and the main measurement problems. We briefly describe the database and the methods we use in Section 3. In Section 4 we provide some descriptive statistics of the variables used in the analysis. Section 5 presents two attempts to explain the differences in the relationship between objective and subjective measures of well-being: the first is an application of an ordered random effect probit, in all the countries considered in the analysis, while the second regards the analysis of the same relationship in Italy, using another kind of statistical methods: a cross-classified multilevel model. Finally, Section 6 presents a summary of the main findings and conclusions.

2. A BRIEF INSIGHT INTO THE LITERATURE ON SWB

2.1. Main Findings

Over the last decades, information on SWB has been recorded with increased frequency and care, by psychologists, sociologists, and, more recently, also economists. Attention has mainly focused on two issues: how to measure individual well-being, and what factors (money, in particular) are associated with it (see, e.g., Diener and Biswas-Diener, 2002). In the attempt to understand why economic variables do not relate so strictly to being happy as one might at first suspect, four leading theories have been proposed, all of which resort to the notion of "aspirations".

The first is the *relative theory*, introduced by Easterlin (1974, 2001), a forerunner in the study of the reported level of happiness across countries

and over time. He suggests that happiness is relative: people get utility from a comparison between themselves and their neighbours. In his works, Easterlin also found that the correlation between happiness and income, although highly significant, is relatively modest already in itself (only about 0.2), and is further weakened if one introduces controls for other socio-demographic determinants. SWB is positively, but weakly correlated with income and negatively correlated with individual material aspirations, which are in turn proxied by the socio-demographic variables that characterise an individual. "Income growth does not cause well-being to rise either for higher or lower income persons, because it generates equivalent growth in material aspirations, and the negative effect of the latter on SWB undercuts the positive effect of the former" (Easterlin, 2001, p. 481).

With the *absolute theory*, Venhoveen (1984, 1992) assumes a positive relationship between income and SWB: people with higher income levels can satisfy all their basic needs and can therefore feel happier. However, the relationship between income and subjective measures is not linear: income has "diminishing returns" on happiness, especially after the basic needs have been satisfied. The theory suggests the existence of a threshold beyond which further increases in income may impact subjective well-being only marginally, or even not at all.

The *adaptation theory* (Brickman and Campbell, 1971) focuses on the way individuals adapt to levels of additional income. Initially, additional income or material goods provide extra SWB. However, the rising aspirations that this extra income generates lower the utility individuals get from it, as the joy of additional consumption wears off. Thus the ability of persons to adapt to positive and negative events plays an important role. For instance, when income is low, persons with higher adaptation capabilities tend to be happier.

Finally, the *aspiration theory* (Michalos, 1985) states that the degree of satisfaction/dissatisfaction of individuals relates to the gap between what people desire, in terms of income or consumption for instance, and the level that they can actually achieve. Those who believe that their desires are fully satisfied tend to be happier than those who have unsatisfied desires, regardless of their income levels.

Independently of the theory adopted, most of the studies in the area of SWB demonstrate the existence of a positive relationship between objective and subjective measures of satisfaction: e.g. Venhooven (1984, 1992), Mullis (1992), Clark and Oswald (2002), Prince and Manolis (2003), etc. Nonetheless, these studies consistently suggest that economic measures are *not* the most important determinants of individual happiness, and income is more

often than not only loosely related to well-being. Therefore, there is ample scope for the inclusion of additional variables, for instance of socio-demographic nature, in the attempt to bring under control the (large) part of variability in SWB that is not explained by direct economic measures.

For example, using the British Household Panel Survey (BHPS), Clark and Oswald (1994) find a strong relationship between SWB and unemployment. Many other studies in this field (e.g. Frey and Stutzer, 2000; Van Praag et al., 2002; Easterlin, 2003; etc.) indicate that happiness is generally higher for women, for the well educated, and for the retired; and is U-shaped in age. Cultural values also play their part, although in a rather in a complex way (Suthers et al., 2003; Yetim, 2003).

However, given that SWB is a multidimensional measure comprising psychological and emotional feelings, mostly related to individual goals and expectations, trying to find the right way to measure it and to identify all of its determinants remains a difficult task.

2.2. The Measurement of SWB

Studies on happiness usually gather survey information from answers to satisfaction questions, and use them as measures of (individual) well-being. Commonly, the answers vary on a discrete scale, ranging from, say, "unsatisfied" to "fully satisfied", with typically between 5 and 11 classes, depending on the survey method (Maggino and Schifini D'Andrea, 2003).

Most of the surveys ask individuals how satisfied they feel with their life as a whole, or with some specific domains, like leisure, work, financial situation, and so on. Researchers may decide to focus on overall SWB (Kohler et al., 2005), on a single domain, or, as is now more frequent, on several domains, each considered in its own self, and in connection with overall well-being (e.g. Van Praag et al., 2002; Nieboer et al., 2005; etc.).

Economists have long identified individual well-being with objective indicators, such as income, consumption, or economic growth, and the like. Although exceptions are more and more frequent in recent years (e.g. Easterlin, 2001, 2003; Kenny, 2005; etc.), they are typically sceptical about the use of subjective measures, for three main reasons: ordinality, scaling, and omitted-dispositions. The first two drawbacks relate to the fact that individuals may use different mental scales, so that, for instance, your 4 may be closer to my 5 than to my 4 – and there is no easy way to make sure that comparison is carried out properly.

The omitted-disposition problem derives from the unreliability of people's expressions of subjective feelings, because individuals' innate personalities

(or dispositions) may play a major part, both on how people actually feel and on how prepared they are to reveal their feelings. Thus, for instance, a pessimistic person may declare him/herself less happy than an optimistic one, even though there is no difference in their socio-economic objective situations. Ignoring this form of individual heterogeneity, possibly correlated with observable variables, may bias the final result of any analysis.

Only rarely can one access data sets that eliminate, or at least reduce, these problems, like that on the Danish twins used by Kohler et al. (2005). In all other cases, the usual way to overcome the three problems is to treat the measure of SWB as ordinal, and to control for unobservable individual heterogeneity by using longitudinal data (instead of cross-sectional equations).

3. DATA AND METHODS

We use data from the ECHP, a standardised multipurpose annual longitudinal survey carried within the European Union (EU), under the coordination of the Statistical office of the European Communities (Eurostat), in which a sample of private households and persons are first interviewed in 1994, and then re-interviewed annually, up to 2001.

The survey was conducted on a standardised questionnaire, investigating several dimensions of the life of families and households, including income and employment, housing and education, social relationships, health and migration. Although the questionnaire was designed centrally at Eurostat, in close consultation with the Member States, it allowed for some flexibility for adaptation to national systems. Most EU members participated in the survey from the beginning, in 1994, but some countries joined in later, and notably Austria (1995), Finland (1996), and Sweden (1997). In the fourth wave of the ECHP, in 1997, the original ECHP surveys were discontinued in three countries, namely Germany, Luxembourg and United Kingdom. In these countries, existing national panels were then used and comparable data were derived from the German and UK survey from 1994 onwards, and for the Luxembourg survey from 1995 onwards.

The central role of the ECHP is that of providing data that are comparable across countries and over time, thus enabling also the study of the interrelationships between different dimensions concerning households and individuals. For an extensive review on the ECHP, see Peracchi (2002).

In our analysis, we consider only those countries that joined the survey from the beginning, and notably Denmark, The Netherlands, Belgium, France, Italy, Greece, Ireland, Spain and Portugal. Further, we to focus solely on the connections between income and financial well-being, and we

ignore other dimensions of well-being which appear to be much less well predicted by income or other economic variables, as indicated by our preliminary analysis, nor reported here. Thus, our key dependent variable derives from the following question of the ECHP questionnaire:

"How satisfied are you with your financial situation?"

The discrete answer varies on a six-position scale, from 1 = "not satisfied" to 6 = "fully satisfied".

The other key variable of our study is the net yearly household equivalent income. This variable is given by household income in Euros, and we made it comparable both across countries, with the use of PPPs, and across household typologies, with the use of an the OECD modified equivalence scale, which assigns weight 1 to the first adult, 0.5 to every other adult household member (aged 14 +), and 0.3 to each child, below age 14.

In this paper we assume that individuals' answers to the satisfaction question are (ordinally) comparable among respondents. In this way, we assume that two individuals answering, say, with a "5", experience the same level of income satisfaction, although their material circumstances may differ.

Consistently with this working hypothesis, we proceed in two steps: firstly, we relate the reported satisfaction – a discrete, observable variable – to levels of an unobservable, continuous variable, which we will call the "latent" satisfaction of each individual, and which is what we would really want to measure. Subsequently, we associate these levels of satisfaction to observable socio-economic and demographic characteristics.

Finally, by adopting a model with random effects, we admit that the relationship between the covariates and the dependent variable (satisfaction) may differ among individuals, due to a possible heterogeneity in the process that "generates" well-being. As we will show later, omitting this heterogeneity from the model would bias our results.

We first run a random-effect ordered probit model, separately for each country, relating the subjective measure of satisfaction to income and controlling also for some individual and household socio-demographic fixed effects. Subsequently, we try to take into account the interdependence of satisfaction levels among those who live in the same household. In other words, we control for the existence of a possible intra-family correlation, which may make individuals within a household more alike in terms of financial satisfaction than individuals coming from different households, everything else equal. Again, if this intra-household correlation (a form of heterogeneity) happens to be statistically significant, failure to consider it may lead to incorrect estimates.

4. MAIN DESCRIPTIVE FINDINGS

Our main descriptive findings are reported in Table I for individual variables and Table II for household variables.

The average level of financial satisfaction varies approximately between 2 (for the unemployed in the Mediterranean countries) and 5 (the richest, and oldest, in Denmark and the Netherlands). Most satisfied, in virtually all conditions, appear to be those who live in Northern Countries – in particular in Denmark, the Netherlands and Belgium – while Southern Europeans present lower levels of satisfaction. With regard to sex and age, the differences are modest: men are slightly more satisfied than women in the southern countries (Spain, Italy, Portugal, and Greece) while the elderly

TABLE I

Average level of satisfaction by country and selected individual characteristics

Variables	Countries								
	DK	NL	B	EI	F	E	I	P	EL
Gender									
Female	4.50	4.42	4.02	3.64	3.58	3.18	3.07	2.94	2.89
Male	4.50	4.46	4.05	3.59	3.59	3.22	3.16	3.08	3.01
Age									
16–29	4.00	4.14	3.83	3.26	3.39	3.00	2.83	3.05	2.84
30–49	4.38	4.48	3.92	3.55	3.52	3.21	3.25	3.07	3.15
50–64	4.78	4.53	4.14	3.77	3.68	3.22	3.22	2.99	2.98
65+	5.06	4.58	4.38	4.10	3.87	3.40	3.12	2.89	2.73
Marital status									
Never married	4.11	4.21	3.84	3.34	3.39	3.04	2.84	2.98	2.81
Married	4.73	4.61	4.19	3.77	3.73	3.30	3.27	3.06	3.04
Divorced	4.10	3.76	3.36	2.89	3.14	2.69	2.92	2.81	2.71
Widow	4.96	4.26	4.14	3.84	3.63	3.17	2.91	2.82	2.66
Health status									
Good	4.52	4.53	4.15	3.69	3.71	3.30	3.24	3.21	3.07
Fair	4.49	4.28	3.81	3.36	3.49	3.13	3.04	2.99	2.70
Bad	4.17	3.78	3.29	2.92	2.97	2.76	2.61	2.61	2.39
Education level									
Low	4.51	4.42	3.89	3.49	3.50	3.08	2.98	2.92	2.70
High	4.50	4.48	4.12	3.75	3.69	3.43	3.36	3.43	3.31
Unemployment									
No	4.55	4.49	4.11	3.70	3.67	3.30	3.22	3.05	3.00
Yes	3.61	3.70	2.87	2.11	2.38	2.10	1.94	2.08	2.05
Total	4.50	4.44	4.03	3.62	3.59	3.20	3.12	3.01	2.95

TABLE II

Average level of satisfaction by country and selected household characteristics

Variables	Countries								
	DK	NL	B	EI	F	E	I	P	EL
Income quinitile									
1	4.22	3.75	3.45	2.94	2.97	2.50	2.35	2.57	2.20
2	4.32	4.23	3.88	3.37	3.29	2.90	2.81	2.78	2.58
3	4.44	4.51	4.07	3.67	3.58	3.19	3.14	2.93	2.91
4	4.61	4.71	4.22	3.85	3.86	3.46	3.43	3.15	3.22
5	4.89	5.00	4.53	4.26	4.23	3.94	3.85	3.61	3.83
Home ownership									
No	4.11	4.08	3.52	2.89	3.29	2.86	2.74	2.79	2.92
Yes	4.66	4.67	4.19	3.17	3.73	3.24	3.19	3.05	2.95
hhld dimension									
1	4.41	4.10	3.88	3.73	3.54	3.24	3.00	2.84	2.69
2	4.71	4.65	4.19	3.96	3.76	3.37	3.23	3.01	2.87
3	4.38	4.38	3.95	3.69	3.56	3.24	3.22	3.04	3.01
4+	4.32	4.39	4.00	3.46	3.45	3.11	3.03	3.01	3.00
Mean hhld age									
16–29	4.17	4.35	3.90	3.41	3.50	3.15	3.13	3.06	3.14
30–49	4.40	4.41	3.93	3.58	3.46	3.14	3.09	3.05	2.97
50–64	4.82	4.56	4.18	3.81	3.73	3.27	3.19	2.93	2.89
65+	5.03	4.58	4.36	4.13	3.86	3.38	3.09	2.90	2.69
Index_area[a]									
Worse off	4.19	4.28	3.84	3.36	3.45	3.04	2.95	2.92	2.98
Better off	4.59	4.56	4.16	3.67	3.68	3.31	3.24	3.04	2.94
Index_hhld[a]									
Worse off	4.07	4.19	3.74	3.15	3.34	2.90	2.75	2.75	2.64
Better off	4.65	4.56	4.26	3.82	3.74	3.43	3.37	3.24	3.20
Index_durables[a]									
Worse off	4.18	4.09	3.69	3.16	3.25	2.89	2.69	2.73	2.55
Better off	4.61	4.55	4.12	3.76	3.65	3.32	3.21	3.19	3.17
Total	4.50	4.44	4.03	3.62	3.59	3.20	3.12	3.01	2.95

[a]Fuzzy indexes, varying between 0 (not poor) and 1 (poor).

seem to be more satisfied than the average, in almost every country, except Greece and Portugal. The married are the group reporting the highest level of financial satisfaction, while the divorced and the never married are, apparently, the worst off. As for the widowed, their opinions differ across countries: in some contexts, like Denmark and in Ireland, they seem to be relatively happy with their income, while in others, like the Netherlands, Italy, Spain and Portugal, the opposite is true.

As expected, being in good health increases the level of satisfaction with the financial situation, and so does, not surprisingly, a high level of education (although not in Denmark), being employed and having a good equivalent income. In particular, in almost all the countries, differences in the reported level of satisfaction between the first quintile (the poorest) and the fifth (the richest) are remarkable.

The highest level of financial satisfaction characterise those who live in households with two to three components, and whose average age is relatively high, except in the Mediterranean countries (Greece, Italy, and Portugal).

In Table II, we also calculated 3 synthetic measures that combine evaluations on various facets of the environment the individuals live in: "Index_area" refers to the quarter (including the neighbourhood), "Index_hhld" to the characteristics of the house, and "Index_durables" to selected durables of the households.[1] All of them are obtained through an application of the fuzzy sets analysis to selected variables taken from the household section of the ECHP questionnaire (for a brief description of the fuzzy-sets methodology, see Appendix A). All the indices developed with the fuzzy sets method are normalised, and vary between 0 (best situation, or absence of poverty symptoms) and 1 (worst situation or deepest manifestation of poverty symptoms). Our descriptive findings show all of these indicators are related to financial satisfaction: those who are better off (above the median) in terms of the dimensions explored are also happier with regard to their financial situation, although the differences are, all in all, relatively modest.

5. ECONOMETRIC ANALYSIS

5.1. The Ordered Random Effects Probit Model

Let us now analyse the problem by first applying models specifically designed for panel data, using the longitudinal feature of the ECHP. With respect to cross-section models, this method has the advantage of controlling for individual unobservable characteristics, like natural optimism or pessimism, for instance, that can be correlated with the observable variables.

The panel methodology applied in this study considers an individual i and his or her financial well-being y_{it}^{*} at each time t (the eight waves of our study). In addition, the individual financial satisfaction is assumed to be linearly determined by both individual and household characteristics, x_{it} and by an individual, specific, unobserved term, u_i

$$y_{it}^{*} = \beta_0 + \beta_1 x_{it} + u_i + \varepsilon_{it}$$

where β are coefficients that measure the impact of the characteristics x_{it} on economic satisfaction y_{it}^{*}, ε_{it} is a normally distributed random error with mean 0 and variance σ_{ε}, capturing non-measured and non-measurable effects on y_{it}^{*}.

Remember, however, that subjective financial well-being y_{it}^{*} is a latent variable that cannot be observed directly. What we observe is the individual's response to a question on financial satisfaction at time t, expressed through S ordered labels (in our case, $S=6$, from "not satisfied" to "fully satisfied"). Thus the observed satisfaction level y_{it} is a categorical, ordered response variable and we assume that it is related to what we really want to measure, the latent variable y_{it}^{*}, in the following way:

$$y_{it} = s \quad \text{if} \quad k_{s-1} < y_{it}^{*} \leq k_s$$

where $s=1,\ldots,S$ is the number of response categories and k_s are ordered thresholds, to be estimated empirically. The equation states simply that if the individual financial well-being y_{it}^{*} lies between k_{s-1} and k_s, the response to the financial satisfaction question will be s ($y_{it}=s$).

For a given individual i, the probability that $y_{it}=s$, conditional on β and k, is given by:

$$\text{Prob}(y_{it} = s/\beta) = \Phi\left(\frac{k_s - z_{it}}{\sigma_{\varepsilon}}\right) - \Phi\left(\frac{k_{s-1} - z_{it}}{\sigma_{\varepsilon}}\right)$$

where $z_{it} = \beta_0 + \beta_1 x_{it} + u_i$ and $\Phi(.)$ represent the cumulative standard normal distribution function. For identification purposes, we set $k_0=0$ and $\sigma_{\varepsilon}=0$, which is the standard specification of the well-known ordered probit model (McKelvey and Zavoina, 1975).

The presence of individual heterogeneity in the production of financial satisfaction due to his or her in-born disposition is introduced through the term u_i which is treated as a random effect, and is assumed to be normally distributed. This unit-specific residual differs between individuals, but is assumed to remain constant over time for any particular individual. We estimated our model separately in each country over the six waves, with the software STATA, using maximum likelihood estimation, where the likelihood for each unit is approximated by Gauss–Hermite quadrature (for details, please see Butler and Moffitt, 1982).

Table III suggests that most of the results that emerged from the descriptive analysis of Tables I and II also hold in a multidimensional context. In particular, in all the countries considered, equivalent household income influences financial satisfaction significantly (at 5%) and in the expected direction (the poor report lower levels of satisfaction). The effect varies with the country: where financial satisfaction is already high, respondents need a strong addition of equivalent income (about 50 thousand Euros per year) to raise by one unit their response about financial satisfaction on the 6-position scale used in the ECHP. On the contrary, where financial satisfaction is low (e.g. Portugal and Greece) "only" about 20 thousand extra equivalent euros, per year, would make individuals report a higher level of satisfaction, on average.

But income is not the only variable that influences financial satisfaction, and other variables also play their part. For instance, in all the Northern countries male respondents are less content than females; on the contrary, in Southern countries (Italy, Greece and Portugal) females are more likely to report a low subjective economic well-being than their male counterparts. What is it that makes women in the Mediterranean countries less satisfied with their financial situation, everything else equal? Has this anything to do with the low level of gender equity that prevails here, that some authors (e.g. McDonald, 2000) allege? We do not have any ready explanation to offer, at this stage.

In most countries, except for Portugal and Greece, financial satisfaction increases with age, and frequently more than proportionally. The married are more likely to report high levels of financial satisfaction than the divorced, the widowed or the never married, everything else equal.

In addition, our results indicate a highly positive relation between SWB and self-rated health: being in good health increases the probability of declaring a high subjective economic well-being, always under the *ceteris paribus* condition.

The employed individuals have higher probability of being financially satisfied than the unemployed, and the well-educated are better off than those with low education; the only exceptions are the Netherlands and Denmark where the relationship with education is respectively negative and not significant.

As for household variables, living in a large household appears to be detrimental for SWB in every country, while co-residing with relatively old people seems to affect positively individual well-being only in Denmark and in Portugal. Moreover, in all the countries considered, those who live in houses in a general bad state of repair, or in area with vandalism, noise or pollution have low probability of declaring high financial well-being.

TABLE III
Parameter estimates for the random effect ordered probit model. Dependent variable: the level of satisfaction

Variables	Countries								
	DK (coef.)	NL (coef.)	B (coef.)	EI (coef.)	F (coef.)	E (coef.)	I (coef.)	P (coef.)	EL (coef.)
Age	−0.00821*	0.01924	−0.01201	0.01425	−0.01312	−0.01087	0.01291	0.00055 n	0.00058 n
Age2	0.00037	−0.00001 n	0.00029	0.00007*	0.00027	0.00023	−0.00006	0.00001 n	0.00002 n
Income*1000	0.02360	0.01950	0.00737	0.00512	0.01320	0.03940	0.03690	0.04590	0.05310
Sex (ref. female)									
Male	−0.07293	−0.12230	−0.04273 n	−0.04305*	−0.05409	−0.00184 n	0.05472	0.12106	0.03819
Marital status (ref. married)									
Divorced	−0.37142	−0.73287	−0.52623	−0.49364	−0.44560	−0.31128	−0.38390	−0.22854	−0.32662
Widowed	−0.29045	−047065	−0.24625	−0.18503	−0.29176	−0.28397	−0.22331	−0.03620 n	−0.12774
Never married	−0.06862*	−0.12081	−0.09106*	0.07993*	−0.16960	−0.07661	−0.23908	−0.10185	−0.22235
Health status (ref. fair)									
Good	0.21081	0.19725	0.25049	0.30329	0.30461	0.21190	0.25177	0.19447	0.19192
Bad	−0.34570	−0.24465	−0.38523	−0.36256	−0.39703	−0.28032	−0.29290	−0.31877	−0.21705
Education level (ref. low)									
High	−0.00447 n	−0.05527	0.12420	0.18128	0.03155*	0.11054	0.20108	0.16364	0.32343
Activity status (ref. employed)									
Unemployed	−0.52264	−0.50839	−0.78615	−1.02145	−0.99887	−0.85231	−0.95417	−1.07984	−0.93293
Home ownership (ref. no)									
Yes	0.20863	0.39302	0.19107	0.23039	0.13591	0.12416	0.21537	0.12485	0.13647
hh dimension	−0.03039	−0.08528	−0.02058*	−0.05191	−0.08995	−0.04175	−0.05069	−0.01236	−0.02501
Mean hh age	0.00202*	−0.00384	−0.00082 n	−0.00077 n	−0.00384	−0.00179	−0.00146	0.00100*	−0.00281
Index_hhld[a]	−0.34933	−0.62776	−0.66932	−1.13743	−0.66193	−0.95342	−1.05355	−0.62336	−0.56693
Index_durables[a]	−0.56545	−0.65289	−0.48210	−0.43192	−0.56857	−0.39709	−0.60295	−0.30749	−0.51397
Index_area[a]	−0.18136	−0.17531	−0.22906	−0.08129*	−0.17281	−0.27556	−0.28512	−0.25071	−0.17682
Rho	0.46859	0.51393	0.52288	0.44630	0.47807	0.27184	0.39236	0.42160	0.27944

Data Source: ECHP. All estimates are significant at 5% level, apart from the ones marked with (*) significant at 1% and with (n) non-significant.[a]Fuzzy indexes, varying between 0 (not poor) and 1 (poor).

An important result is that in all of the countries, approximately between 50 and 30% of the total variability is due to differences within the observations (see the 'rho' line): this supports our hypothesis about the presence of heterogeneity among individuals, which we will address more in depth in the next section.

5.2. The Bayesian Cross-classified Multilevel Model

In the second part of our analysis, we will try to go one step further in the search for explanations for the variability in financial well-being.

One of the main findings of the ordered probit analysis is the statistical significance of the variables at the household level in explaining individual financial satisfaction. Therefore, we try to explore the potential role that the family may play in shaping the intrinsic well-being of the individual, by applying a multilevel model to the same data used in the probit regression above. The literature on individual satisfaction shows several examples of mono-level analysis, focused either on variables at the individual level, or on variables at the group level (i.e. households, regions, countries ...). In studies where families are recognised to affect individual satisfaction, family influences are modelled by treating them as covariates in the SWB regression. For instance, Clark (2003) finds that individual well-being is negatively correlated with both regional unemployment and the unemployment of other household members, and Clark and Oswald (2002) find a positive relation between household size and the well-being of their members, using the BHPS.

However, treating household variables as covariates in the regression models limits the information about how households influence individuals. Moreover, a variable that is specified at the macro (in this case, household) level refers to macro-units, and not directly to the micro-units (individuals). And "a correlation between macro-level variables cannot be used to make assertions about micro-level relations" (Snijders and Bosker, 1999, p. 14). This kind of aggregation leads to a potential error commonly known as ecological fallacy (Robinson, 1950), which is basically a distortion in the interpretation of the results of an analysis. ECHP data can be considered as having a hierarchical structure, where measurement occasions are "nested" within subjects, who, in turn, are nested within households. This structure may have two main effects.

On the one hand, there can be a sort of dependence of the different measurements for a given individual (who will presumably tend to give more or less the same answer on the several waves of the panel) and a dependence

across individuals living in the same households (who, once again, will likely tend to give all more or less the same answer). On the other hand, it is very well possible that diverse effects take place at different levels of the hierarchy at the same time. For example, in this study, it may be the case that, at the household level, richer households "produce" a higher average level of satisfaction, but that at the within-household level, individual income is only modestly correlated with individual financial well-being.

Therefore, it may be worthwhile to pursue one step further our analysis on the relationship between subjective and objective economic well-being, by applying also a different regression method, the multilevel one. In multilevel modelling, the data structure in the population is (assumed to be) hierarchical and sample data are viewed as multistage sample from this hierarchical population. For instance, in a household survey, the population consists of households (higher level units) and individuals (lowest level units), nested within these households. The natural assumption, here, is that people within a household share similar attitudes, and are more similar than individuals from different households. As a result, people from the same household are not completely independent. Given this, the assumption of independence of the observations in the traditional regression models is violated. Multilevel models are able to detect if and how this hierarchical structure affects the variable of interest. They analyse variables from the different levels simultaneously, taking into account the various dependencies: in other words, they do not treat individuals or households as having the same error variance, but they can explicitly model differences in variance at both levels.

In our study, too, individuals can be seen as lower level units, nested in higher level units, the households in which they live. In addition, given the longitudinal dimension of the data, the hierarchical structure can be defined as a three-level structure with repeated measurements (first level) nested within individuals (second level), nested within households (third level).

As a definition of private household, we adopt the criteria of the ECHP, which defines it as a group of people sharing the same dwelling and having common living arrangements. Since this group may be very small, a person living on his or her own, too, is defined as household.

Nevertheless, the longitudinal structure of our data can raise some difficulties in the regression analysis. As Murphy (1996) points out, households are dynamic, changeable units whose definition over time is problematic. During a panel survey, households may change, because individuals may move from one to another, or form new ones. And if we take into account the dynamic composition of the households in our sample, we cannot

assume that our data have a pure hierarchical structure. We must therefore apply a different scheme, and two possibilities emerge: cross-classified and multiple membership structures. For example, with educational data, a student may be classified as belonging to a particular combination of primary and secondary school, which implies cross-classification. On the other hand, a student may spend a fraction of time in one class and then decide to change class. In this case the student is a "multiple member of" 2 (or more) classes.

In our study, we could have both cases: measurement occasions are contained within a cross classification of individuals by households, and, in addition, individuals are multiple members of the households they belong to during the survey. But, eventually, we decided to assume that the financial satisfaction of those individuals who change household (the observed response) is not affected by all previous households the individuals have lived in. In practice, we treat our data as if they had only a cross-classified structure, and we ignore the cases of multiple memberships.

Besides, we decided to estimate the model only for Italy, because the procedure is too demanding for a large set of data, and because we hoped we would be in a position to better interpret the results. The set of covariates used in the multilevel analysis are the same we used before, in the random effect ordinal probit model of Table III.

Finally, in order to give more readily interpretable results, we decided to consider SWB as a continuous, rather than an ordinal variable. This simplification introduces some ambiguity in the interpretation of the order of magnitude of the estimated parameters, but leaves the sign, i.e. the qualitative interpretation, unaffected (Headey and Wooden, 2003).

The multilevel model applied in this analysis is specified as follows:

$$y_{tij} = \beta_{0tij} + \sum_{k=1}^{K} \beta_{ktij} + \sum_{l=1}^{L} \beta_{lij}$$

$$\beta_{0tij} = \beta_0 + v_{0j} + u_{0ij} + e_{0tij}$$

where y_{tij} (financial satisfaction)~N(XB,Ω), v_{0j} (household-level variability)~N(0,Ω_v), u_{0ij} (individual-level variability)~N(0,Ω_u) and e_{0tij} (occasion-level variability)~N(0,Ω_e), and where $t = 1,\ldots,8$ waves, $i = 1,\ldots,129{,}029$ individuals, $j = 1,\ldots,8800$ households.

The prior specifications are:

$$p(\beta) \propto 1$$

$$p(1/\sigma^2_{v0}) \propto \text{Gamma}(\varepsilon, \varepsilon)$$

$$p(1/\sigma^2_{u0}) \propto \text{Gamma}(\varepsilon, \varepsilon)$$

$$p(1/\sigma^2_{e0}) \propto \text{Gamma}(\varepsilon, \varepsilon)$$

where $\varepsilon = 0.001$.

The results of the multilevel regression, presented in Table IV, once again confirm the findings obtained in the previous analysis. Income and financial satisfaction are weakly, but positively correlated. Being married, a male, well educated, and with a good health status is associated with higher financial satisfaction level. Living in "good-condition" households makes individual happier. As one's own age and the age of other household members increase, financial satisfaction slightly diminishes – a finding that, as we have seen before, does not seem to apply to others countries.

However, what really matters in a multilevel analysis is the statistical significance of the household effects in shaping individual's satisfaction. The simplest possible model, so-called "variance components model" (i.e. without explanatory variables, where the residual variance is partitioned into components corresponding to each level in the hierarchy), gives a significant household variance component of 0.679. This means that the estimated intra-class correlation (calculated as $\Omega_v/(\Omega_v + \Omega_u + \Omega_e)$), which can be interpreted either as the proportion of the total variance of the dependent variable due to household heterogeneity, or the correlation between individuals living in the same household, is 40.1%. In other words, 40% of the total unexplained variation in financial satisfaction is due to the fact that individuals live in different households.

In the attempt to refine this approach, the best model we could fit is that of Table III, where the estimated correlation decreases to about 30% [.392/(.392 + .111 + .815)], which means that the variables included in this model contribute to explain some of the variation at the household level, which, however, remains an important underlying force shaping financial satisfaction.

In terms of model diagnostic, the full model of Table IV presents an improvement compared to the variance components one, since the deviance information criterion (a diagnostic test, similar to the "frequentist" deviance statistic, obtained using the deviance with Monte Carlo Markov Chain, or MCMC, techniques – cf. Spiegelhater et al., 2002) declines from 343

thousand in the null model to 324 in the full one. In short: the addition of the explanatory variables shown in Table IV is warranted.

6. CONCLUSIONS

The results presented here seem to confirm previous findings: although the rich are typically more satisfied with their financial situation than the poor, this happens only up to a point. A possible explanation can be that other

TABLE IV

Parameter estimates for the Bayesian cross classified multilevel model. Dependent variable: level of satisfaction

Variables	Variance component model		Full model	
	Coef.	Std. err.	Coef.	Std. err.
Age			0.01623	0.00153
Age2			−0.00010	0.00002
Income*1000			0.00003	0.00000
Sex (ref. female)				
Male			0.04797	0.00761
Marital status (ref. married)				
Divorced			−0.33466	0.02933
Widowed			−0.17725	0.02082
Never married			−0.15598	0.01594
Health status (ref. fair)				
Good			0.19420	0.00750
Bad			−0.22538	0.01221
Education level (ref. low)				
High			0.12676	0.00887
Activity status (ref. employed)				
Unemployed			−0.71660	0.01207
Home ownership (ref. no)				
Yes			0.16635	0.01458
hh dimension			−0.03516	0.00509
mean hh age			−0.00158	0.00046
Index_hhld[a]			−0.72608	0.03519
Index_durables[a]			−0.22455	0.01327
Index_area[a]			−0.46348	0.02792
Const	3.146	0.010	2.44401	0.04886
Ω_v	0.679	0.013	0.39235	0.00856
Ω_u	0.167	0.004	0.11115	0.00336
Ω_e	0.848	0.004	0.81498	0.00368

[a]Fuzzy indexes, varying between 0 (not poor) and 1 (poor).Data source: own elaborations on ECHP.

individual and environmental characteristics influence subjective satisfaction at least as much as, and possibly even more than, income. Among these, some can be measured directly with the ECHP database, but others (expectations, personal dispositions ...) can only be taken into account indirectly, by including individual random effects in the regression equation.

An innovative result of our study is that SWB, among other things, appears to be strongly influenced by the environment where people live. We also found that a large part of the variability in the individual satisfaction, probably about 30%, is influenced by the characteristics of the household.

Finally, our analyses seem to show that subjective indicators, even if often criticised by economists for their unreliability, can, and perhaps should, be used in conjunction with objective measures in the assessment of individuals' well-being, which, in fact, is influenced not only by economic conditions, but also by other socio-demographic factors.

If subjective and objective measures are complementary, if they do indeed capture different aspects of the same phenomenon, they should be studied together: objective measures inform us on the externally observable conditions of an individual, while subjective measures take individual's views, perspectives and other feelings into account.

NOTE

[1] *Index_hhld* is a fuzzy synthesis of household facilities such as: indoor flushing toilet ; hot running water, heating or electric storage heaters, shortage of space, leaky roof, damp walls, floors or foundations, rot in window frames or floors. *Index_durables* is a fuzzy synthesis of the following household durables: car or van for private use; colour TV; telephone. Index_area is a fuzzy synthesis of the following area characteristics: presence of noise from outside the house, any pollution, grime or other environmental problem caused by traffic or industry, crime or vandalism in the area.

APPENDIX A: THE FUZZY SETS METHODOLOGY

The "fuzzy" approach proves useful in that it permits researchers to capture the multidimensional nature of poverty, while at the same time avoiding the use of arbitrary threshold values, because poverty is defined here in terms of degrees (of belonging) rather than as an all-or-nothing condition. The theory behind this methodology was first introduced by Zadeh (1965) and then Dubois and Prade (1980). Later, Cheli and Lemmi (1995) modified and developed a contribution by Cerioli and Zani (1990) to the fuzzy theory and proposed the so-called Totally Fuzzy and Relative (TFR) approach.

The TFR measures refer to the entire distribution of the considered poverty indicators, while relative poverty measures usually depend on a given parameter of the income distribution such as the mean or the median.

All the indices developed with the fuzzy sets method are normalised and vary between 0 (best situation, or absence of poverty symptoms) and 1 (worst situation or deepest manifestation of poverty symptoms). Normally, however, each of them and, even more so, their synthesis lie somewhere in between.

In mathematical terms, these intermediate situations of poverty can be represented by a "membership function", by which an element can belong entirely (or not at all, or only partially) to a given set. In our analysis, we calculated three TFR measures using some variables from the ECHP questionnaire referring to three (assumedly) different spheres: housing conditions (lack of adequate heating, leaky roof, damp floors and so on), household durables (television, phone, car), and household surroundings (pollution and other environmental problems, crime and vandalism, noise).

Once this set of variables is selected, the appropriate membership function for each variable can be determined. Perhaps, the most important point here is the weighting system. The basic idea behind the TFR approach is that, in the measurement of poverty, the importance of any indicator depends on how representative it is of the community's lifestyle. In other words, the more a given facility (or item) is widespread in that community, the more severe it is to be deprived of it. So, for instance, not having a TV set strongly suggests that one is poor, because almost everybody has it. Conversely, not having a yacht is only a very mild symptom of poverty, because only very few people own a yacht. There are several ways of keeping frequencies into account: we tried several of them, but results hardly changed with respect to those presented in the text.

APPENDIX B: BAYESIAN METHODS OF ESTIMATION

Bayesian is a sequential learning approach: first some prior beliefs about the problem (the unknown parameter θ) are condensed in a prior distribution $p(\theta)$. Then the data y are collected and they produce a likelihood function $L(y|\theta)$, which is the same as in the "frequentist" approach. Finally this last function is combined with the prior distribution to produce the posterior distribution of θ, $p(\theta|y) \propto p(\theta)L(y|\theta)$ from which inference about the parameter is reached. To obtain estimates from the posterior distribution, MCMC methods are used.

In the Bayesian formulation of multilevel models, prior information about both the fixed and the random parameters is combined with the data.

After fitting the model, a posterior distribution is produced for the above parameters. MCMC methods make a large number of simulated random draws from the joint posterior of all parameters and use these random draws to infer a summary of the underlying distributions. Thus, the aim of the approach is to generate a sample of values from the posterior distribution of the unknown parameters. Finally, from the random draws of the parameter of interest it is then possible to calculate the posterior mean and standard deviation.

The MlwiN software, besides the likelihood-based approach, includes also the Bayesian modelling procedures. In the latter case, the software uses a combination of two MCMC procedures: the Gibbs sampling and the Metropolis-Hastings sampling.

The Gibbs sampling method works well if the conditional posterior distributions are easy to simulate from. In situations where the distributions do not have a simple form, the Metropolis-Hasting sampling procedure is used. For a review of MCMC procedures in MlwiN, see Browne (2002).

Often little is known about the parameters that one wants to estimate: in this case ''non informative'' prior distributions are used. The default priors used in MlwiN are flat or diffuse ones for all the parameters. In particular, improper uniform, $p(\beta) \propto 1$ are used as prior distribution for fixed parameters. Gamma distribution is used for scalar variance: $p(1/\sigma^2) \sim \text{Gamma}(\varepsilon, \varepsilon)$ where ε is very small.

For variance matrices, $p(\Omega^{-1}) \sim \text{Wishart}_p(p, p\hat{\Omega})$ is used, where p is the number of rows in the variance matrix and $\hat{\Omega}$ is an estimate of the true value Ω. The estimate $\hat{\Omega}$ will be the starting value of Ω (usually from IGLS/RIGLS estimation routines) and so the prior is an informative one, however the first parameter, which represents the sample size on which our prior belief is based, is set to the smallest possible value so that this prior is only weakly informative.

REFERENCES

Brickman, J. and D.T. Campbell: 1971, 'Hedonic relativism and planning the good society', in Adaptation Level Theory: A Symposium (Academic Press, New York).

Browne, W.J.: 2002, MCMC Estimation in MLwiN (Centre of Multilevel Modelling, Institute of Education, University of London).

Butler, J.S. and R. Moffitt: 1982, 'A computationally efficient quadrature procedure for the one-factor multinomial probit model', Econometrica 50, pp. 761–764.

Cerioli, R. and S. Zani: 1990, 'A fuzzy approach to the measurement of poverty', in C. Dagum and M. Zenga (eds.), Income and Wealth Distribution, Inequality and Poverty, Studies in Contemporary Economics (Springer Verlag, Berlin), pp. 272–284.

Cheli, R. and A. Lemmi: 1995, 'A totally fuzzy and relative approach to the multidimensional analysis of poverty', Economic Notes 1, pp. 115–134.
Clark, A.E.: 2003, 'Unemployment as a social norm: Psychological evidence from panel data', Journal of Labor Economics 21(2), pp. 323–351.
Clark, A. and A.J. Oswald: 1994, 'Unhappiness and unemployment', The Economic Journal 104, pp. 648–659.
Clark, A. and A.J. Oswald: 2002, Well-Being in Panels, Delta, Mimeo (http://www2.warwick.ac.uk/fac/soc/economics/staff/faculty/oswald/).
Diener, E. and R. Biswas-Diener: 2002, 'Will money increase subjective well-being?', Social Indicators Research 57, pp. 119–169.
Dubois, R.A. and H. Prade: 1980, Fuzzy Sets and Systems (Academic Press, Boston).
Easterlin, R. A.: 1974, 'Does economic growth improve human a lot?', in Nations and Households in Economic Growth: Essays in Honour of Moses Abramovitz (Academic Press, New York).
Easterlin, R.A.: 2001, 'Income and happiness: Towards a unified theory', Economic Journal 111, pp. 465–484.
Easterlin, R.A.: 2003, 'Happiness of women and men in later life: Nature, determinants and prospects', in M.J. Sirgy, D. Rahtz and A.C. Samli (eds.), Advances in Quality-of-Life Theory and Research, vol. 20, Social Indicators Research Series (Kluwer Dordrecht), pp. 13–25.
Frey, B. and A. Stutzer: 2000, 'Maximising happiness?', German Economic Review 1, 145–167.
Headey, B. and M. Wooden: 2003, 'The effect of wealth and income on subjective well-being and ill-being', presented at the 32nd Conference of Economists (Australia and New Zealand), 29 September–1 October, 2003 (ANU, Canberra).
Kenny, C.: 2005, 'Does development make you happy? Subjective well-being and economic growth in developing countries', Social Indicators Research 73, pp. 199–219.
Kohler, H.P., J.R. Behrman and A. Skytthe: 2005, 'Partner + children = happiness? The effects of partnerships and fertility on well-being', Population and Development Review 31(3), pp. 407–445.
Maggino, F. and S. Schifini D'Andrea: 2003, 'Different scales for different surveys methods: validation in measuring the quality of university life', in M. J. Sirgy, D. Rahtz and A.C. Samli (eds.), Advances in Quality-of-Life Theory and Research, vol. 20, Social Indicators Research Series, (Kluwer, Dordrecht), pp. 233–265.
McDonald, P.: 2000, 'Gender equity in theories of fertility transition', Population and Development Review 26(3), pp. 427–439.
McKelvey, R.D. and W. Zavoina: 1975, 'A statistical model for the analysis of ordinal dependent variables', Journal of Mathematical Sociology 4, pp. 103–120.
Michalos, A.: 1985, 'Multiple discrepancy theory', Social Indicators Research 16, pp. 347–413.
Mullis, R.: 1992, 'Measures of economic well-being as predictors of psychological well-being', Social Indicators Research 26, pp. 119–135.
Murphy, M.: 1996, 'The dynamic of a household as logical concept and its use in demography', European Journal of Population 12, pp. 363–381.
Nieboer, A., S. Lindenberg, A. Boomsma and A.C. Bruggen: 2005, 'Dimensions of well-being and their measurement: The SPF-IL Scale', Social Indicators Research 73, pp. 313–353.
Peracchi, F.: 2002, 'The European Community household panel: A review', Empirical Economics 27, pp. 63–90.
Prince, M. and C. Manolis: 2003, 'Consumer income and beliefs affecting happiness', in M. J. Sirgy, D. Rahtz and A.C. Samli (eds.), Advances in Quality-of-Life Theory and Research, vol. 20, Social Indicators Research Series (Kluwer, Dordrecht), pp. 27–39.
Robinson, W.S.: 1950, 'Ecological correlations and the behaviour of individuals', American Sociological Review 15, pp. 351–357.

Snijders, T. and R. Bosker: 1999, Multilevel Analysis (Sage Publications, London).
Spiegelhater, D.J., N.G. Best, B.P. Carlin and A. Linde: 2002, 'Bayesian measures of model complexity and fit', Journal of the Royal Statistical Society Series B64, pp. 583–640.
Suthers, K., Y. Saito and E. Crimmins: 2003, 'Emotional well-being among older persons: A comparative analysis of the 70+ population in Japan and the United States', in M. J. Sirgy, D. Rahtz and A.C. Samli (eds.), Advances in Quality-of-Life Theory and Research, vol. 20 Social Indicators Research Series (Kluwer, Dordrecht), pp. 41–50.
UNDP: 2005, Human Development Report, New York. http://hdr.undp.org/reports/global/2005/.
Praag, B.M., P. Frijters and A. Ferrer-i-Carbonell: 2002, The Anatomy of Subjective Well-Being (Institute Discussion Papers, Tinbergen).
Veenhoven, R.: 1984, Conditions of Happiness (Kluwer, Dordrecht).
Veenhoven, R.: 1992, Happiness in Nations (Erasmus University, Rotterdam),.
Yetim, U.: 2003, 'The impact of individualism/collectivism self-esteem and feeling of mastery on life satisfaction among the Turkish University students and academicians', Social Indicators Research 61, pp. 297–317.
Zadeh, L.A.: 1965, 'Fuzzy sets', Information and Control 8, pp. 338–353.

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