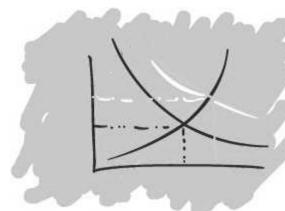# ECONOMIC ANALYSIS

# WORKING PAPER SERIES

Socioeconomic Gradient in Health: How Important is Material Deprivation?

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# DEPARTAMENTO DE ANÁLISIS ECONÓMICO:
# TEORÍA ECONÓMICA E HISTORIA ECONÓMICA

# SOCIOECONOMIC GRADIENT IN HEALTH: HOW IMPORTANT IS MATERIAL DEPRIVATION?

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## Abstract

In this paper we use the *Spanish Living Conditions Survey* (2005-2008) to investigate whether there is a socioeconomic gradient in health when alternative measures of socioeconomic status, apart from income, are considered. In particular we construct a material deprivation index that reflects some minimum standards of quality of life, and we analyze its impact on self-reported health. To address this issue, we use a deprivation index that incorporates comparison effects with societal peers and we estimate health equations using a random effects model. Furthermore, the model is extended to include a Mundlak term that corrects for the potential correlation between the error term and the regressors. Our results reveal that the relationship between health and income operates through comparison information with respect to societal peers. In contrast, material deprivation in terms of financial difficulties, basic necessities and housing conditions exerts a direct effect on individual health.

**Keywords**: Material deprivation, Mundlak correction, random effects model, self-assessed health.

**JEL-Codes**: C23, D63, I10

## 1. Introduction

It is well documented that people in lower socioeconomic groups have much worse health outcomes than those in higher socioeconomic groups (see Fox, 1994; Nazaroo, 1998; Marmot and Wilkinson, 1999; Smith, 1999; among others). Socioeconomic status (SES) represents the position of an individual in the society, which comprises several components. On the one hand, components reflecting the material resources an individual controls (spending power and physical living conditions as an example). On the other hand, components that reflect differences in lifestyles, attitudes or knowledge.

But which dimensions of socioeconomic status actually matter to determine agents' health status? The level of income has been a commonly used indicator. After controlling for significant determinants of health, such as sex, age, educational level or occupation, a strong positive correlation is widely found in the literature between good health and absolute income (see for example Subramanian et al., 2002 and Subramanian and Kawachi, 2006). This has been defined in the literature as the "absolute income hypothesis", such that increase in income increases investments in health-enhancing goods, and that health is a normal good (Grossman 1972). However, it has also been argued that there are a number of indirect mechanisms that might be also important determinants of health (Deaton, 2002), which can be due to income inequality, relative deprivation, social capital or some other pathways. Income inequality and relative deprivation are closely related concepts. However, important differences between them are worth noting. First, the inequality-health relationship could also be influenced by factors unrelated to the relative deprivation hypothesis, such as concavity of the income-health relationship and less provision of public goods (e.g., health services) in communities with greater income inequality due to political economy reasons, etc. Second, while income inequality is an aggregate measure, relative deprivation is individual specific. For instance, two people living in the same region could show the same inequality levels but remarkably different levels of relative deprivation. Thus, from a policy perspective it is important to distinguish between these hypotheses: the absolute-income hypothesis, the relative-income hypothesis and the income-inequality hypothesis.

In this paper we claim that other forms of deprivation, apart from that of income, might also exert a significant influence on health status. Focusing only on income may come at the cost of neglecting other channels by which individuals may improve their command over resources, such as financial and real assets, non-cash

transfers from the government and support from family and friends. If these channels operate, it is likely that individuals care about their ability to consume rather than to receive. In this respect, other aspects of material deprivation apart from income may be relevant. In particular, we refer to deprivation in terms of having access to basic functionings related to some minimum standards of quality of life.

Material deprivation is closely related to social exclusion, a concept that in the last years has received increasing attention among social scientists discussing the attributes, differences and novelties of it with respect to more traditional concepts such as income poverty, multidimensional poverty and inequality (see Duffy, 1995; Room, 1995; Atkinson, 1998; Klasen, 1998; Mejer, 2000; and Atkinson et al., 2002; among others). This shift from the concept of poverty to material deprivation and social exclusion reflects the need for a multidimensional approach to study social disadvantage. In this respect, as Sen (1985) points out, the multidimensional aspect refers to the failure to attain adequate levels of various functionings that are deemed valuable in the society.

Another fundamental element identifying the concepts of material deprivation and social exclusion is relativity. Relativity comes from the idea that a person's feeling of deprivation in a society arises out of comparing his situation with those who are better off (Runciman, 1966, p.10). Economic theory assumes that individual utility is a function not only of own level of consumption but also of the consumption level of others individuals in the same reference group. Thus, we cannot say whether an individual is deprived or socially excluded by looking at his position alone. The positions of others in the society have to be taken into consideration for a proper implementation of measure of deprivation or exclusion.

Thus, apart from own income, individual health may be influenced by other variables relating the socioeconomic status. To the extent that health is vital for a flourishing life (Culyer, 1993), understanding the different pathways between socioeconomic status and health becomes of special relevance for the design of the most appropriated policies aimed at improving the well-being of a society.

Using Spanish data of the *Living Condition Survey* for the period 2005-2008, this paper makes an important contribution to the literature focused on the socioeconomic gradient in health. Apart from testing the standard "absolute income hypothesis", we examine the effect of material deprivation in different life domains – financial situation, basic necessities, durables and housing conditions – on individual self-assessed health (SAH).

Furthermore, we consider the possibility that deprivation influences individual health through two channels. A first one through which lack of monetary resources and/or inaccessibility to specific items have *per se* a direct negative impact on SAH. And a second channel that consists of comparison effects with the societal peers. To examine how unfavourable comparisons with respect to individuals in a reference group affect SAH, we follow Bossert et al. (2007), and we define relative deprivation as the product of two terms. The first term corresponds to the Yitzhaki (1979) index, that is, the average of the functioning-failure differences between a person and those who are better off. The second term, the share of agents with fewer functioning-failures, captures the capacity of an individual to identify with other members of the society.[2]

A common concern with self-reported data, like SAH, is the existence of omitted individual characteristics that might simultaneously influence the dependent and the explanatory variables[3]. While we are not able to control directly for these counfounding factors, we improve over the existing literature in two ways. First we use a multidimensional index of material deprivation. Second, since the relative deprivation effect is driven by unobserved factors correlated both with low income and poor health, we exploit the panel structure of the data and we estimate a model that includes individual effects. Ideally a fixed effect (FE) model should be applied, in which the idiosyncratic components are fully factored out from the results. However, the FE results are exclusively based on within-groups variation in the variables of interest. To the extent that an important fraction of individuals does not change their deprivation status over the sample period, these results into limited information. This is not the case of a random effects (RE) model which, in turn, cannot preclude the possibility that the personality-driven random term of each individual is correlated with the observables. In this paper we deal with these caveats by proposing a RE model extended to include a Mundlak term that allows for correlations between the errors and the observable variables. Finally, since health dynamics may be influenced

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[2] For the relative income variable the first term would correspond to the average of income differences between individuals with higher income and individual's own income. The second term would be the share of agents in the reference group with higher income.

[3] We should also be aware of the fact that if relative deprivation affects health by increasing the probability that an individual takes health risks, then one would see a link between relative deprivation and risky behaviours. For example Eibner and Evans (2005) find that an increase in relative deprivation leads to worse health habits (smoking, etc..). Unfortunately our data set does not provide any information on healthy behaviour and thus we are not able to control for this effect directly.

by gender, as in Contoyannis et al. (2004)[4] we carry out separate estimations for males and females. We also provide a series of sensitivity tests that support our results.

The paper is organized as follows. Section 2 provides a brief review on the relationship between socioeconomic status and health. In Section 3 we describe the data set and the measure of deprivation. Section 4 focuses on the estimating strategy, while the main results are provided in Section 5. Finally, Section 6 concludes.

## 2. Related literature

The existence of socioeconomic inequality in health is firmly established (see Adler et al., 1994; Van Doorslaer et al., 1997; Mackenbach et al., 1997, 2008; Smith, 1998, 1999; Van Doorslaer and Koolman, 2004). Most of this literature provides evidence of an inverse relationship between socioeconomic status and health – the so called health-gradient.

Health gradients are not unidimensional, reflecting the fact that there are multiple dimensions of social standing and multiple ways in which people can gain access to resources (Graham 2007; House et al., 2005). Two central ones have been considered in the literature: education and income. The majority of works have considered income has the main "marker" for an underlying concept of socioeconomic status, and therefore a crucial cause of health discrepancies.

Much of the evidence about the relationship between income and health is based on cross-sectional data (Benzeval et al., 2001), and find a negative correlation between increasing income and poor health. More interesting, however, are those studies that examine the link between income dynamic and health status. Some common findings can be extracted from this branch of the literature based on longitudinal analysis. First, long-term income has a much larger impact on health than current income (Mullis, 1992; Benzeval and Judge, 2001). Second, income loss appears to have a much stronger effect on health than increases in income (Hirdes et al., 1986); Finally, a number of studies focus specifically on measures of very low income, or poverty (Smith and Zick, 1994; Menchik, 1993; Benzeval et al., 2001; Deaton, 2002; Contoyanis et al., 2004). They find that

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[4] They study the relationship between health and socioeconomic status using the British Household Panel and find little evidence that increased income leads to improved health.

persistent poverty appears to be most damaging for health. Those people who are persistently poor have worse health outcomes than those who experience poverty only occasionally or not at all.

Some papers have also showed that the relationship between income and health is not a smooth linear relationship, but a non-linear one, which is steepest among low-income groups (Backlund et al., 1996; Mirowsky and Hu, 1996; Benzeval et al., 2001; Der et al., 1999; Benzeval and Judge, 2001).

Additionally, other researchers have postulated that the correlation between income and health reflects the operation of some third factor, particularly education (Grossman, 1972, 2000). Thus, education might be a crucial component of SES and its relation to health, since in addition to the material resources it may provide, it gives people knowledge that shapes their health behaviors that impact health and illness (Lahelma, 2001).

If income causes health, it is possible that health is determined, not by absolute income but by income relative to some aspiration level, or relative to the income of others[5]. Psychosocial stress is one of the pathway through which interpersonal comparisons influence health (Wilkinson, 1997). Stress level of an individual would depend on differences between own income and income of his peers, and that could affect health both directly (higher propensity of heart disease, high blood pressure, etc.) and indirectly (via increased smoking, poor eating habits and alcohol abuse)[6].

A growing literature provides evidence that individual health is influenced by relative economic status. Using US microdata, the works of Eibner and Evans (2005) and Subramanyam et al. (2009) examine the impact of relative deprivation, within a reference group, on health, where reference groups are constructed based on observable demographic characteristics (state of residence, race, education and age). They find that relative deprivation, in the sense of Yitzhaki (1979), may have detrimental implications on health. In the same line, the work of Mangyo and Park (2010), based on Chinese data, focuses on the definition of an appropriate reference group to which individuals compare themselves and suggests that relative income with respect to relatives and neighbors significantly influences individual health outcomes. The work of Jones and Wildman (2008), however,

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[5] The relative deprivation hypothesis could also explain a negative relationship between income inequality and average health of the population (Wilkinson, 1996). Nonetheless, in this paper we do not address all the literature related to the link between income inequality and aggregate health (Daly et al., 1998; Deaton and Paxson, 1999; Deaton, 2001 and 2002; Kaplan et al., 1996; Kawachi et al., 1997; Kennedy et al., 1998; Mellor and Milyo, 2002; Sturm and Gresenz, 2002; Wilkinson, 1997).

[6] The local housing case is an example, where people who live in a town are the market to local land for housing.

shows that when more sophisticated estimation strategies are applied the effect of relative deprivation on individual health disappears. But still some evidence remains under semiparametric estimations that allow an unspecified relationship between health and income.

This 'relative deprivation hypothesis' (Runciman, 1966) involves, however, comparison in a variety of life domains, insofar as social status is not solely determined by income. As pointed out by Atkinson (1998) and Sen (1998), it is important to note a difference between deprivation measured in terms of income and an alternative approach where functioning failures in various living standards determine the degree of deprivation. Unlike poverty, material deprivation and social exclusion are better defined in the space of capabilities, as they refer to individual's lack of access to essentials of life.

In this paper we thus claim that material forms of deprivation, apart from income, might have significant impact on health. As pointed out in the work of Goldman (2001), which provides a survey of the health-gradient literature, the association between SES and health is found in different eras, places, genders, and ages, and occurs over the whole range of SES levels, so that it is not linked solely to poverty or education. In particular the association holds for a variety of health variables (most illnesses, mortality, self-assessed health status, psychological well-being, etc.) and alternative measures of SES (wealth, education, occupation, income, level of social integration).


## 3.  Data set: health and deprivation measures

### 3.1 Spanish Living Conditions Survey

In estimating the effects of material deprivation on self-assessed health, we exploit the panel data of the Spanish *Living Condition Survey* for the period 2005-2008. This is the national version of the European Union Statistics on *Income and Living Conditions (EU-SILC)*, which is a voluntary (for potential respondents) survey of private households. The primary focus of the survey is the collection of comparative data on the income and living conditions of different types of households, from which indicators on poverty, deprivation and social exclusion are derived.

Social exclusion and housing conditions information is collected at household level while labour, education and health information is obtained for persons aged 16 and over. The core of the instrument, income at very

detailed component level, is mainly collected at personal level but a few components are included in the household part of the survey.

The two key variables in the analysis are health and deprivation. Information of self-assessed health (SAH) is derived from the question "How is your health in general?". It is a five-point response scale ranging from very bad to very good. SAH variables have been widely used in the literature that analyze the socioeconomic health-gradient (e.g. Adams et al., 2003; Benzeval et al., 2000; Deaton and Paxson, 1998; Ettner, 1996; Frijters et al., 2003; Salas, 2002; Smith, 1999). SAH has been shown to be a powerful predictor of subsequent mortality (see e.g. Idler and Kasl, 1995; Idler and Benyamini, 1997), and it has been traditionally used as the measure of individual health in the social sciences for several reasons. Firstly, most population surveys do not include objective measures of health and the self-assessed health is the sole and most widely available indicator of individual health (Bound, 1991)[7]. Secondly, social scientists frequently believe that self-evaluations of health more accurately reflect individual's overall, physical and mental, well being and would therefore be a better predictor of individual labour force participation, retirement decisions, etc. Third, unlike other indicators of health most population surveys across the world are very consistent in the framing of the question on self-assessment of health facilitating some earlier work on cross-country comparisons in production and differences in health (Doorslaer et. al, 1997). Finally, even with the increased availability of more objective measures of health in several new population surveys, self-reported health continues to be the most reasonable source of health data[8].

Our second variable of interest is material deprivation. Following Bossert et al. (2007), we use a deprivation measure that incorporates both multidimensional and relative aspects. With the Laeken European Council in December 2001 it was established that, apart from income, other indicators of the quality of life of an individual are necessary to evaluate the well-being or citizens. This idea about accumulation of disadvantages over a number of domains was first used by Gailly and Hausman (1984). Since then, this methodological framework has been used to analyze the risks of disadvantageous economic, social and living conditions (Atkinson et al. 2002; Atkinson 2003; Ayala et al., 2011; Bossert et al., 2007; Bossert et al., 2009; Bourguignon

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[7] For this reason most early studies in Economics used self-reported measures of health (see Boskin and Hurd (1978), Diamond and Hausman (1984), Burkhauser and Quinn (1983), Burtless and Moffit (1984) and Gustman and Steinmeir (1986), among others)

[8] See the work of Gupta et al., (2010) for a more detailed explanation on the merits and pitfalls of both subjective and objective measures of health.

and Chakravarty 2003; Chakravarty and D'Ambrosio 2006; Fahey 2007; Haisken-DeNew and Sinning 2010; Whelan, Nolan and Maître 2008; Nolan and Whelan 1996, 2009 among others).

Following the suggestions of Eurostat (2000) and other studies for the European Union on material deprivation (Bossert et al., (2007) among others), we consider a set of 14 indicators grouped according to four domains of quality of life (see Table 1)[9].

| Table 1: Dimensions of deprivation | |
|---|---|
| **Indicator type** | **Single items of material deprivation from EUSILC 2005-2008** |
| Financial difficulties (2 items) | 1. Great difficulties in making ends meet (BOSSERT) <br> 2. In arrears with (re)payment of housing or utility bills (BOSSERT, EUROSTAT) |
| Basic necessities (3 items) | 3. Cannot afford meat, fish or chicken every second day (BOSSERT, EUROSTAT) <br> 4. Cannot afford a week's holiday away from home (BOSSERT, EUROSTAT) <br> 5. Cannot afford unexpected expenses (EUROSTAT) |
| Housing conditions (4 items) | 6. Dwelling with damp walls, floors, foundations, etc. (BOSSERT) <br> 7. Cannot keep their home adequately warm in winter (EUROSTAT) <br> 8. Dwelling without a bath or shower (BOSSERT) <br> 9. Dwelling without toilet |
| Durables (5 items) | Not having specific durables due to a lack of financial resources in the household: <br> 10. No telephone (BOSSERT, EUROSTAT) <br> 11. No colour TV (BOSSERT, EUROSTAT) <br> 12. No computer <br> 13. No washing machine(BOSSERT, EUROSTAT) <br> 14. No car (BOSSERT, EUROSTAT) |

[9] In parenthesis we indicate how our indicators relate to existing literature that we take as reference in the construction of deprivation indices, namely we report if the single item was included in the indicators of deprivation developed by Bossert et. al (2007, 2009) or by EUROSTAT (2000).

### 3.2. Construction of measures of deprivation

Deprivation is modeled as a function of the differential between an individual score in the dimension under consideration – the number of functionings not available to the agent – and the score of those who are better off. Let $\mathbb{N}$ be the set of all positive integers and $\mathbb{R}$ ($\mathbb{R}_+$, $\mathbb{R}_{++}$) the set of all (all non-negative, all positive) real numbers. For a non-empty and finite set $M \subseteq \mathbb{N}$, the set $\mathbb{R}_+^M$ is the set of $|M|$-dimensional vectors of non-negative real numbers whose components are labeled by the elements in $M$. Moreover, let $\mathcal{N} = \mathbb{N}\backslash\{1\}$ and $\mathcal{P}$ be the set of all finite subsets of $\mathbb{N}$ with at least two elements. Individual $i \in \mathbb{N}$ living standard in the dimension under consideration is given by score $q_i \in \mathbb{R}_+$. The degree of deprivation suffered by the individual, $D_i(q)$, is defined as follows:

$$D_i(q) = 0 \; if \; B_i(q) = 0$$

$$D_i(q) = \frac{|B_i(q)|}{|N|^2} \sum_{j \in B_i(q)} \left(q_i - q_j\right) \; if \; B_i(q) \neq 0 \tag{1}$$

where $B_i(q) = \left\{j \in N | q_j < q_i\right\}$ is the set of individuals whose functioning failure is lower than that of $i$ in $q$, and $\alpha_i \in \mathbb{R}_{++}$. The term $\frac{\sum_{j \in B_i(q)}(q_i - q_j)}{|N|}$ reflects the average of the functioning-failure difference between the individual and those who are better off (the Yitzhaki index). And the share of individuals with fewer functioning failures than the individual under consideration is captured by $\frac{|B_i(q)|}{|N|}$.

The novelty of this deprivation measure is that, in addition to the aggregate alienation experienced by the agent with respect to those who have fewer functioning failures, it depends also on the capacity of an individual to identify with other members of the society.

Furthermore, the index satisfies a number of desirable properties: normalization, focus, conditional anonymity, homogeneity, strong translation invariance, population proportionality and deprivation proportionality (see Theorem 1 in Bossert et al., 2007).

An important issue when constructing relative measures of deprivation is the definition of reference groups. The determination of the relevant reference group and the relevant reference outcome for a given class of individuals is ultimately an empirical question. The social context, the saliency of particular agents, and the

social proximity among individuals are all likely to influence reference groups and outcomes. Surveys usually contain no direct questions about the composition of reference groups and there is no direct evidence to identify those whom people really compare themselves to. In general only indirect information about who are the relevant others for each individual is found. In most of the applied literature reference groups are constructed according to both geographic characteristics (e.g region of residence) and personal characteristics such as age and/or education. In this paper, reference groups are constructed based on year, region (17 Spanish Autonomous Communities) and age[10]. In particular we end up with 408 different groups.

After eliminating those people with missing information in the variables of interest, we end up with an unbalanced panel of 25,334 individuals (59,901 observations). Sample statistics for the total sample and separately for the five categories of self-assessed health status are provided in Table 2. In our data, self-assessed health (SAH) information is provided as an ordered discrete variable from 1 (very bad) to 5 (very good). As table 2 shows, around 70% of the sample reports to have good or very good health status, 20% moderate health, and the remainder 10% bad or very bad. The descriptive statistics show an inverse relationship between socioeconomic status and health. On the one hand, the distribution of SAH improves as per capita equivalent household income increases[11]. And on the other hand, a higher probability of lack of essential living standards (higher percentages in the abovementioned 14 items) is found among the lowest categories of the SAH distribution.

Regarding the individual characteristics, we can observe that females and old people report worse health status. With respect to marital status we find that single people report better levels of health compared to the rest of categories. Evidence of the socioeconomic gradient in health is also found when we look at the relationship between education and health. 70% of individuals reporting very bad health status correspond to people that completed just primary education. In contrast, the corresponding value among those with very good levels of health is below 15%. The labor market situation also affects self-assessed health, with a remarkable percentage of retired, disable and housework people reporting bad levels of health. Household characteristics slightly influence individual health. In particular the numbers suggest a positive relationship

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[10] The Autonomous Communities of Ceuta and Melilla are eliminated from the analysis due to their high sample errors.

[11] In order to compute per capita equivalent income we use the OECD equivalence scales, which assign weights of 1, 0.5 and 0.3 to the householders, each of the remaining adults and each child in the household respectively.

between health and both the number of adults and children in the household. Finally, better levels of health

are found among individuals being the reference person in the household.

| Table 2: Descriptive Statistics (Mean Values) | | | | | | |
|---|---|---|---|---|---|---|
| | Total | Very Bad (1.59%) | Bad (7.85%) | Regular (19.96%) | Good (54.84%) | Very Good (15.76%) |
| Equivalent income (euros) (1) | 12,880.5 | 9,501.2 | 9,659.4 | 11,658.4 | 13,498.4 | 14,223.0 |
| Female | 51.63% | 58.76% | 58.41% | 55.26% | 50.18% | 47.95% |
| Age | 46.9 | 66.1 | 63.3 | 57.0 | 43.5 | 35.8 |
| *Household composition* | | | | | | |
| Number adults | 2.8 | 2.6 | 2.5 | 2.7 | 2.9 | 2.9 |
| Number of children | 0.5 | 0.3 | 0.3 | 0.4 | 0.6 | 0.6 |
| Householders | 67.51% | 67.47% | 65.21% | 64.56% | 66.74% | 75.07% |
| Partner | 31.37% | 32.21% | 34.13% | 34.76% | 31.96% | 23.56% |
| Other members | 1.12% | 0.31% | 0.66% | 0.69% | 1.30% | 1.37% |
| *Marital Status* | | | | | | |
| Single | 31.05% | 11.86% | 12.25% | 15.98% | 33.54% | 52.80% |
| Married | 58.34% | 57.92% | 64.55% | 67.25% | 58.95% | 41.88% |
| Separated | 2.04% | 3.36% | 2.53% | 2.54% | 1.83% | 1.75% |
| Widow | 6.73% | 24.34% | 18.26% | 12.12% | 4.01% | 1.83% |
| Divorced | 1.85% | 2.52% | 2.40% | 2.11% | 1.69% | 1.75% |
| *Education* | | | | | | |
| Primary | 31.59% | 69.99% | 64.19% | 49.26% | 24.36% | 14.29% |
| Secondary 1º Stage | 24.81% | 17.21% | 19.22% | 22.08% | 25.90% | 28.01% |
| Secondary 2º Stage | 20.35% | 6.72% | 8.61% | 14.09% | 22.81% | 26.94% |
| Professional Training | 0.75% | 0.21% | 0.64% | 0.52% | 0.79% | 1.01% |
| Tertiary | 22.50% | 5.88% | 7.34% | 14.05% | 26.14% | 29.76% |
| *Labour market situation* | | | | | | |
| Employed full-time | 46.28% | 6.30% | 14.40% | 33.11% | 54.51% | 54.25% |
| Employed part-time | 5.29% | 1.26% | 2.15% | 4.42% | 5.89% | 6.27% |
| Unemployed | 6.26% | 3.46% | 5.00% | 5.69% | 6.59% | 6.79% |
| Student | 7.57% | 0.10% | 0.49% | 1.31% | 8.01% | 18.24% |
| Retired | 15.23% | 40.50% | 37.02% | 27.21% | 9.96% | 4.98% |
| Disable | 1.89% | 17.00% | 9.93% | 3.03% | 0.41% | 0.10% |
| Housework | 13.08% | 17.94% | 20.22% | 19.31% | 11.41% | 7.00% |
| Other | 4.39% | 13.43% | 10.80% | 5.92% | 3.23% | 2.39% |
| *Functioning failures* | | | | | | |
| Financial difficulties | | | | | | |
|    Item 1: Great difficulties making ends meet | 56.36% | 72.82% | 70.57% | 60.59% | 53.60% | 51.88% |
|    Item 2: In arrears payment housing utility bills | 3.22% | 4.20% | 3.93% | 3.57% | 2.96% | 3.22% |
| Basic Necessities | | | | | | |
|    Item 3: Cannot afford meat, fish or chicken | 1.78% | 5.67% | 3.23% | 2.16% | 1.45% | 1.34% |
|    Item 4: Cannot afford a week's holiday | 35.48% | 63.06% | 55.24% | 41.07% | 31.34% | 30.21% |
|    Item 5: Cannot afford unexpected expenses | 26.45% | 47.32% | 41.82% | 31.01% | 22.92% | 23.22% |
| Housing Conditions | | | | | | |
|    Item 6: Damp walls, Floors….. | 16.99% | 25.71% | 25.37% | 20.81% | 15.13% | 13.55% |
|    Item 7: Cannot keep home warm in winter | 6.39% | 15.53% | 12.69% | 8.51% | 5.06% | 4.29% |
|    Item 8: No bath or shower | 0.22% | 0.10% | 0.49% | 0.33% | 0.19% | 0.08% |
|    Item 9: No toilet | 0.21% | 0.10% | 0.51% | 0.30% | 0.17% | 0.12% |
| Durables | | | | | | |
|    Item 10: No telephone | 0.29% | 0.84% | 0.51% | 0.33% | 0.20% | 0.35% |
|    Item 11: No colour TV | 0.07% | 0.10% | 0.21% | 0.10% | 0.05% | 0.05% |
|    Item 12: No computer | 8.03% | 12.91% | 10.82% | 8.41% | 7.58% | 7.24% |
|    Item 13: No washing machine | 0.15% | 0.52% | 0.23% | 0.23% | 0.10% | 0.16% |
|    Item 14: No car | 3.90% | 6.82% | 6.61% | 4.19% | 3.46% | 3.38% |
| Average number of items with deprivation | 1.60 | 2.56 | 2.32 | 1.82 | 1.44 | 1.39 |

(1) To compute per capita equivalent income we use the OECD equivalence scales, which assign weights of 1, 0.5 and 0.3 to the

householders, each of the remaining adults and each child in the household respectively.

With respect to indices of deprivation, namely *Financial Difficulties*, we find that more than half of the total

sample report to have great difficulties in making ends meet – more than 70% among those people with the

worst levels of health – while less than 4% are in arrears with (re)payment of housing or utility bills.

Concerning *Basic Necessities* we observe a significant proportion of people who cannot afford either a week's holiday away from home (35.48%), or unexpected expenses (26.45%). Again, significantly higher values of these numbers are reported by the lowest categories of the SAH distribution. Regarding *Housing Conditions*, the highest failure rates correspond to "dwelling with damp walls, floors, foundations, etc." (around 17% of the total sample, and more than 25% for the categories of "bad" and "very bad" health). In contrast, very few people – less than 0.5% – live in dwelling without bath or shower and toilet. Finally, we find that very few individuals lack basic *Durables* such as telephone (0.29%), colour TV (0.07%) and washing machine (0.15%). The highest failure rates in this domain correspond to lack of computer (8.03%) and car (3.90%).

| Table 3: Health and relative deprivation (mean values) | | | | | | |
|---|---|---|---|---|---|---|
| | Total | Very Bad | Bad | Moderate | Good | Very Good |
| Financial difficulties | 0.128 | 0.169 | 0.161 | 0.139 | 0.120 | 0.122 |
| Basic Necessities | 0.283 | 0.564 | 0.460 | 0.333 | 0.244 | 0.240 |
| Housing Conditions | 0.154 | 0.280 | 0.261 | 0.196 | 0.131 | 0.114 |
| Durables | 0.099 | 0.173 | 0.147 | 0.106 | 0.091 | 0.089 |

Table 3 provides a descriptive analysis on the relationship between relative deprivation and health. In particular, mean values of the deprivation index constructed following equation (1) are reported for the different health categories. Results suggest a negative relationship between the deprivation indicators, in any of the life domains considered, and self-assessed health. Meaning that individuals reporting very good health also report to be less deprived compared to their peers. These might reflect a comparison effect, by which unfavorable comparisons with the social peers depress individual levels of SAH.

## 4. Econometric approach

### 4.1 The self-assessed-health equation

As we pointed out previously, self-assessed health (SAH) information is provided in the data as an ordered discrete variable with the following $j = \{1, …., 5\}$ categories:  Very bad ($j = 1$); Bad ($j = 2$); Moderate ($j = 3$); Good ($j = 4$); and Very good ($j = 5$). Given the ordinal nature of the  dependent variable, the most prevailing econometric models to be used are ordered probit (see Blanchflower and Oswald, 2000a; Clark and Oswald, 1994; Plug, 1997; Ferrer-i-Carbonell, 2002; Frey and Stutzer, 1999, 2000; Hartog and Oosterbeek,

1998; McBride, 2001; Pradhan and Ravaillon, 2000; van Praag et al., 2003; and Wottiez and Theeuwes, 1998). However, some papers in the literature have showed that linear and ordered categorical models provide very similar results in terms of the trade-offs between variables (see Ferrer-i-Carbonell and Frijters, 2004; van Praag and Ferrer-i-Carbonell, 2004, Chap 2; Ferrer-i-Carbonell and Gërxhani, 2010).

Following Ferrer-i-Carbonell and Frijters (2004), we take the ranking of health status to be more nearly cardinal. While the assumption of cardinality instead of ordinality is typically unimportant, it has the advantage of yielding coefficients that can be directly interpreted as marginal effects. Thus, in our estimates we use probit adapted ordinary least squares (POLS) as developed by Van Praag and Ferrer-i-Carbonell (2008 p. 29-34). Implementing POLS begins by deriving $\{\mu_j\}_{j=0}^{J}$ values of a standard normal associated with the cumulative frequencies of the $J$ different categories of the dependant variable, with $\mu_0 = -\infty$, $\mu_J = \infty$. Then the expectation of a standard normally distributed variable is taken for an interval between any two adjacent values. Thus if the true unobserved continuous variable for individual $i$ at time $t$ is $SAH_{it}^*$ where the observed is $SAH_{it} = j$ if $\mu_{j-1} < SAH_{it}^* \leq \mu_j$, $j = 1, ...., J$, then the conditional expectation of the latent variable is given by:

$$\overline{SAH_{it}} = E\left(SAH_{it}^* | \mu_{j-1} < SAH_{it}^* < \mu_j \right) = \frac{n(\mu_{j-1}) - n(\mu_j)}{N(\mu_j) - N(\mu_{j-1})} \qquad (2)$$

where $n$ is the normal density and $N$ is the cumulative normal distribution. This approach allows the application of a linear estimator on the conditional expectations, which is assumed to be a function of observable characteristics:

$$\overline{SAH_{it}} = \alpha X_{it} + \beta y_{it} + \gamma F_{it} + \delta D_{it} + \upsilon_i + \eta_{it} \qquad (3)$$

where $X_{it}$ is the set of individual and household characteristics[12], $y_{it}$ denotes the equivalized net household income, $\upsilon_i$ is a time-invariant effect and $\eta_{it}$ is an independent error term for individual $i$ at time $t$.

In equation (3) we incorporate the possibility that material deprivation affects SAH thorough two channels. First, we would expect that inaccessibility to specific items have a negative impact on SAH *per se*, i.e.,

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[12] This vector comprises standard demographic characteristics (such as age, household composition, 5 civil status dummies, 5 educational dummies, 8 labour market dummies, 17 regional and 4 year dummies). Summary statistics were reported in Table 2.

regardless of the individual position in the societal distribution. To allow for such effects, we include a vector $F$ of dummy variables that capture individual functioning failures in any specific item (the 14 items specified in Table 1). The second channel consists of a comparison effect by which unfavourable comparisons with societal peers depress individual levels of SAH. Such comparison information enters the equation by means of vector $D$. The vector $D$ includes both relative income and the individual deprivation scores in the various life domains (financial difficulties, basic necessities, housing conditions and durables). By measuring the distance between the individual profile and the profile of those who are better off, $D$ captures the relativity aspect of deprivation.

The empirical analysis will be based on 3 different specifications of equation (3). Specification 1 assumes that SAH depends on the individual living standard in the various life domains ($F$), but not on his relative position in the society ($D$). This specification ignores potential comparison effects that may take place for SAH determination and it is merely used to show that most items are relevant sources of SAH. Specification 2 exclusively focuses on the relativity aspect of deprivation by assuming that SAH depends on comparisons with others ($D$) and not on the individual living standard and functionings profile ($F$). Specification 3 moves on to allow simultaneously for direct and relative effects and it is, therefore, the preferred specification. This model is used to test whether conditional on a living standard $F$, having a deprivation profile $D$ has an additional, negative effect on SAH. In all cases, we carry out separate estimations for males and females.

**4.2 Controlling for unobserved heterogeneity**

In this setting, it is assumed that the random component is not correlated with the explanatory variables. However, it is plausible that individuals' perception of health depends not only on the individual's objective situation but also on some unobserved time-invariant characteristics. These unobserved factors would, therefore, co-determine both SAH and some of the explanatory variables included in $X$. This would imply that such explanatory factors would be correlated with the error term $v_i$. In order to account for this possible endogeneity bias, we estimate a random effects (RE) model and we add a Mundlak correction term that parameterizes the potential correlation between the individual effect and the right-hand side variables (Mundlak, 1978). The Mundlak correction term consists of a vector $\bar{X}_{it}^M$ with the time-averaged values of a subset of $M$ explanatory variables: proportion of years in the panel for which the individual is in either of the employment situations (employed full-time, employed part-time, unemployed, retired, housework, others),

averaged number of adults and averaged number of children in the household[13]. With this strategy the unobserved heterogeneity of the standard RE model is assumed to consist of two parts, $v_i = u_i + \lambda \bar{X}_{it}^M$. The first part is a pure error term. The second part is assumed to vary linearly with the within-group means, whereby a possible correlation between the independent variables and the idiosyncratic characteristics is accounted for. Thus, equation (3) becomes:

$$\overline{SAH_{it}} = \alpha X_{it} + \beta y_{it} + \lambda \bar{X}_{it}^M + \gamma F_{it} + \delta D_{it} + u_i + \eta_{it} \qquad (5)$$

where $u_i$ is a time-invariant (random) effect and $\eta_{it}$ is an independent error term, with $u_i \sim N(0, \sigma_u^2), \eta_{it} \sim N(0,1)$ and $Cov(u_i, \eta_{it}) = 0$.

## 5. Results

Results are reported for males and females in Tables 4 and 5 respectively[14]. For expositional purposes, we first describe main findings regarding deprivation indices and income variables. Then, we discuss the effects of other personal and household characteristics.

Results corresponding to Specification (1) (first column) provide evidence of an inverse relationship between individual health status and material deprivation both among male and female sample. In particular, we find that SAH is negatively related to 8 out of the 14 items considered[15] for males, while 7 out of 14 for females. Thus, we can say that most of the items are relevant determinants of self assessed health.

Some differences between males and females are also worth mentioning. For males, the absolute income hypothesis still holds when other indicators of socioeconomic status are considered as determinants of SAH. This implies that the coefficient on equivalized income is positive and statistically significant at 99%, meaning that richer people report better health. In contrast, this is not the case for females for whom the coefficient of per capita income is positive but not statistically significant.

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[13] Although discretionary, these choices are broadly in line with previous work (Ferrer-i-Carbonell, 2005; van Praag and Ferrer-i-Carbonell, 2008).

[14] In the next section we also propose a set of robustness checks changing the dependent variable.

[15] There are no gender differences with the exception of the negative impact that 'not having a computer' exerts on SWB among males, which is not observed for the female counterparts.

In particular, with respect to deprivation indices, for both male and female, the highest impacts are shown by Item 6 "Damp walls, floors" and item 7 "Cannot keep home warm in winter", being specially high for women (-0.139 versus -0.091). Contrary to existing literature (Stronks, et al. 1998 for example) living with a lack in terms of housing conditions seems to have a sizeable negative effect on the health of both male and female in our sample. This could be due to the fact that previous studies, in contrast with us, based their analyses on cross sectional data thus failing to account for unobserved heterogeneity in any way. Individuals that cannot afford one week's holiday (item 4) report significantly lower levels of health (-0.072 for male versus -0.109 for female), while cannot afford unexpected expenses show smaller coefficients (-0.038 for male versus -0.052 for female). No significant effect is found with respect to food deprivations (item 3). We can thus conclude that, material deprivation in terms of basic necessities shows higher effects for female compared to their male counterparts.

In terms of durables, the model shows significant effects for item 14 "Not having a car" (for both male and female) and for item 12 "Not having a computer" (for male only). Finally, financial difficulties in terms of "Great difficulties in making end meet" (item1) and "In arrears payment housing utility bills" (item 2) show a statistically significant effect for both male and female. It seems that, male suffer more from deprivation in terms of financial difficulties compared to their female counterpart. Differences across gender seem to suggest that exist a deprivation effect that is likely to be more important for male. This might be explained by a breadwinner model, which has been shown predominant in southern European countries (for example Mutari and Figart, 2001), where the possibilities of working part-time are very restricted and women with family tasks depend economically on the income of the man.

Specification (2) (second column) considers that access to specific items and resources does not exert a direct effect on SAH. Instead, its impact is through social comparison processes according to which lower societal position depresses SAH. Several points are worth noting. First, our results are in line with previous literature supporting that health is influenced by relative income (Eibner and Evans, 2005; Subramanyam et al., 2009; Mangyo and Park, 2010; Jones and Wildman, 2008). Furthermore, the effect of own income is no longer significant in explaining males' individual health. Second, in all domains considered deprivation leads a substantial damage on SAH. Some gender differences are observed in this respect: among males, SAH is worse when material deprivation refers to the domains of *Financial Difficulties* and access to *Durables*. In contrast,

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lack of access to essentials in the domains of *Basic Necessities* and *Housing Conditions* exert a larger impact on females' health status. This is in line with the explanations and results referring to specification (1). Finally, in all cases we obtain that the estimated coefficients of deprivation scores are larger – in absolute terms – than those of relative income. Results obtained from Specification (2) would suggest that the effect of interpersonal comparisons on individual health is stronger when we consider deprivation in a variety of life dimensions, others than income, to measure individual's socioeconomic status.

Nonetheless, the role of social comparisons in determining SAH might be overstated, insofar Specification (2) is not controlling for distributional-unrelated effects. It is necessary, therefore, to test whether comparison effects remain once the domain specific items are included in the regression. This is done with Specification (3) (column 3). Our results reveal that only unfavourable interpersonal comparisons in terms of income significantly depress individual health, and they are overall less statistically significant compared to specification (2). Only in the female subsample we find a significant effect of deprivation in terms of financial difficulties. However, this does not mean that material deprivation does not play a role in determining SAH. Inaccessibility to specific items in the domains of financial difficulties, basic necessities and housing conditions have *per se* a negative impact on health, even when comparison influences are accounted for. In contrast with specification (1) we find that durables seem not to have any effect on both male and female.

Moving to the health effects of socioeconomic characteristics, the coefficient estimates are mostly as expected and do not change across different specifications, but several points are worth noting. First, for both males and females we see that as people age their health become worse at a declining rate (this convex relationship is statistically significant only for males but not for females, e.g. the coefficient on age squared is positive and statistically significant at 95% level only for the male sample).

Gender differences appear when looking at the composition of the household. Taking individuals who are the "reference person in the household" as the reference category, we find that males who occupy a position of "partners" within the household report significantly worse states of health. In contrast, these variables do not exert a significant impact on health among females, although in this case the majority of women in the sample occupy a household position as partner. At the same time, for both males and females, individual health is not affected by the number of adults or by the number of children present in the household.

The effect of marital status on self-perception of health presents some differences across gender. Taking single persons as the reference category, only separated men report significantly lower level of self reported health. On the contrary, widow and divorced women are more likely -compared to single women- to perceive a worse health, while there is no significant effect if they are married or separated.

Overall, health increases with educational attainment. The educational dummies all show a positive coefficient, which is in line with previous works in the literature (Grossman, 1972, 1975, 2000; Lahelma, 2001). This relationship is stronger in the female sample (e.g. in the case of Specification 3, the dummy on tertiary education shows a coefficient ranging between 0.145 and 0.16 for female compared to a coefficient ranging from 0.121 to 0.134 for male).

No differences across gender are found with respect to labour market status. In particular results show that workers retired and disabled, compared to those with a full time contract, suffer from worse health.

| Table 4: POLS Model (Male Sample) | | | | | | |
|---|---|---|---|---|---|---|
| | Specification 1 | | Specification 2 | | Specification 3 | |
| | (1) | | (2) | | (3) | |
| | Coef. | t | Coef. | t | Coef. | t |
| *Income measures* | | | | | | |
| Log Equivalized income (euros) | 0.021 | 3.38 | 0.004 | 0.48 | 0.004 | 0.46 |
| Log Relative income (euros) | | | -0.015 | -4.29 | -0.012 | -3.32 |
| *Deprivation Measures* | | | | | | |
| Financial difficulties | | | | | | |
| Item 1: Great difficulties making ends meet | -0.089 | -8.35 | | | -0.078 | -4.76 |
| Item 2:  In arrears payment housing utility bills | -0.076 | -3.00 | | | -0.042 | -0.61 |
| ***Deprivation in financial*** | | | -0.135 | -6.40 | -0.037 | -0.59 |
| Basic Necessities | | | | | | |
| Item 3: Cannot afford meat, fish or chicken | -0.015 | -0.45 | | | -0.04 | -0.89 |
| Item 4: Cannot afford a week's holiday | -0.072 | -6.20 | | | -0.08 | -4.46 |
| Item 5: Cannot afford unexpected expenses | -0.038 | -3.13 | | | -0.05 | -2.34 |
| ***Deprivation in basic necessities*** | | | -0.094 | -7.73 | 0.025 | 0.77 |
| Housing Conditions | | | | | | |
| Item 6: Damp walls, Floors….. | -0.097 | -7.91 | | | -0.116 | -3.26 |
| Item 7: Cannot keep home warm in winter | -0.098 | -5.28 | | | -0.118 | -2.88 |
| Item 8: No bath or shower | -0.03 | -0.21 | | | -0.063 | -0.40 |
| Item 9: No toilet | 0.106 | 0.71 | | | 0.133 | 0.82 |
| ***Deprivation in housing conditions*** | | | -0.124 | -8.69 | 0.031 | 0.59 |
| Durables | | | | | | |
| Item 10: No telephone | 0.085 | 1.14 | | | 0.168 | 1.39 |
| Item 11: No colour TV | 0.075 | 0.49 | | | 0.07 | 0.36 |
| Item 12: No computer | -0.042 | -2.41 | | | 0.025 | 0.29 |
| Item 13: No washing machine | 0.111 | 1.02 | | | 0.216 | 1.43 |
| Item 14: No car | -0.06 | -2.36 | | | -0.014 | -0.15 |
| ***Deprivation in durables*** | | | -0.054 | -3.39 | -0.086 | -0.81 |
| *Demographics* | | | | | | |
| Age | -0.024 | -9.34 | -0.023 | -8.57 | -0.024 | -9.10 |
| Age^2 | 0 | 2.17 | 0 | 1.53 | 0 | 1.98 |
| Number of adults | 0.047 | 0.45 | 0.059 | 0.57 | 0.052 | 0.50 |
| Number of children | -0.035 | -1.04 | -0.034 | -1.02 | -0.033 | -1.00 |
| Householder | *Reference* | - | *Reference* | - | *Reference* | - |
| Partner | -0.024 | -1.85 | -0.025 | -1.93 | -0.024 | -1.86 |
| Other members | -0.055 | -1.07 | -0.066 | -1.28 | -0.059 | -1.16 |
| *Marital Status* | | | | | | |
| Single | *Reference* | - | *Reference* | - | *Reference* | - |
| Married | -0.015 | -0.80 | -0.013 | -0.72 | -0.015 | -0.82 |
| Separated | -0.079 | -1.87 | -0.077 | -1.83 | -0.079 | -1.88 |
| Widow | -0.023 | -0.57 | -0.021 | -0.53 | -0.026 | -0.64 |
| Divorced | -0.009 | -0.21 | -0.005 | -0.12 | -0.009 | -0.21 |
| *Education* | | | | | | |
| Primary | *Reference* | - | *Reference* | - | *Reference* | - |
| Secondary 1ºStage | 0.042 | 3.04 | 0.045 | 3.23 | 0.041 | 2.92 |
| Secondary 2ºStage | 0.078 | 4.82 | 0.082 | 5.08 | 0.074 | 4.58 |
| Professional Training | 0.036 | 0.73 | 0.043 | 0.86 | 0.035 | 0.71 |
| Tertiary | 0.129 | 7.78 | 0.134 | 8.01 | 0.121 | 7.16 |
| *Labour market situation* | | | | | | |
| Employed full-time | *Reference* | - | *Reference* | - | *Reference* | - |
| Employed part-time | 0.029 | 0.68 | 0.028 | 0.65 | 0.029 | 0.67 |
| Unemployed | -0.038 | -1.42 | -0.038 | -1.44 | -0.038 | -1.43 |
| Student | 0.077 | 1.98 | 0.081 | 2.08 | 0.079 | 2.01 |
| Retired | 0.001 | 0.02 | -0.002 | -0.05 | 0.001 | 0.01 |
| Disable | -0.155 | -2.91 | -0.156 | -2.94 | -0.159 | -2.99 |
| Housework | 0.118 | 0.58 | 0.126 | 0.61 | 0.115 | 0.56 |
| Other | -0.135 | -2.86 | -0.138 | -2.93 | -0.135 | -2.88 |
| Constant | 0.413 | 3.55 | 0.578 | 4.30 | 0.633 | 4.70 |
| sigma_u | 0.467 | | 0.469 | | 0.467 | |
| sigma_e | 0.609 | | 0.609 | | 0.609 | |
| rho | 0.371 | | 0.373 | | 0.371 | |
| Number of observations | | | 28,969 | | | |

| Table 5: POLS Model (Female Sample) | | | | | |
|---|---|---|---|---|---|
| | Specification 1 | | Specification 2 | | Specification 3 | |
| | (1) | | (2) | | (3) | |
| | Coef. | t | Coef. | t | Coef. | T |
| *Income measures* | | | | | | |
| Log Equivalized income (euros) | 0.006 | 0.91 | -0.003 | -0.35 | -0.004 | -0.44 |
| Log Relative income (euros) | | | -0.011 | -3.09 | -0.007 | -1.92 |
| *Deprivation Measures* | | | | | | |
| Financial difficulties | | | | | | |
| Item 1: Great difficulties making ends meet | -0.091 | -8.64 | | | -0.056 | -3.36 |
| Item 2:  In arrears payment housing utility bills | -0.046 | -1.84 | | | 0.125 | 1.77 |
| ***Deprivation in financial*** | | | -0.127 | -6.20 | -0.166 | -2.61 |
| Basic Necessities | | | | | | |
| Item 3: Cannot afford meat, fish or chicken | -0.046 | -1.45 | | | -0.076 | -1.75 |
| Item 4: Cannot afford a week's holiday | -0.109 | -9.70 | | | -0.121 | -6.86 |
| Item 5: Cannot afford unexpected expenses | -0.052 | -4.47 | | | -0.068 | -3.31 |
| ***Deprivation in basic necessities*** | | | -0.14 | -11.96 | 0.03 | 0.96 |
| Housing Conditions | | | | | | |
| Item 6: Damp walls, Floors….. | -0.118 | -9.77 | | | -0.118 | -3.39 |
| Item 7: Cannot keep home warm in winter | -0.139 | -7.54 | | | -0.14 | -3.43 |
| Item 8: No bath or shower | 0.055 | 0.34 | | | 0.04 | 0.23 |
| Item 9: No toilet | 0.054 | 0.37 | | | 0.047 | 0.30 |
| ***Deprivation in housing conditions*** | | | -0.17 | -11.96 | 0.002 | 0.03 |
| Durables | | | | | | |
| Item 10: No telephone | 0.11 | 1.24 | | | 0.18 | 1.35 |
| Item 11: No colour TV | -0.274 | -1.56 | | | -0.259 | -1.30 |
| Item 12: No computer | -0.002 | -0.12 | | | 0.058 | 0.71 |
| Item 13: No washing machine | 0.071 | 0.59 | | | 0.137 | 0.88 |
| Item 14: No car | -0.086 | -3.68 | | | -0.021 | -0.24 |
| ***Deprivation in durables*** | | | -0.042 | -2.78 | -0.075 | -0.74 |
| *Demographics* | | | | | | |
| Age | -0.02 | -8.08 | -0.018 | -7.28 | -0.02 | -7.89 |
| Age^2 | 0 | 0.02 | 0 | -0.79 | 0 | -0.13 |
| Number of adults | 0.006 | 0.06 | 0.002 | 0.02 | 0.005 | 0.05 |
| Number of children | -0.037 | -1.11 | -0.036 | -1.09 | -0.037 | -1.12 |
| Householder | *Reference* | - | *Reference* | - | *Reference* | - |
| Partner | -0.009 | -0.66 | -0.006 | -0.46 | -0.009 | -0.65 |
| Other members | 0.012 | 0.26 | 0.005 | 0.11 | 0.01 | 0.21 |
| *Marital Status* | | | | | | |
| Single | *Reference* | - | *Reference* | - | *Reference* | - |
| Married | -0.005 | -0.25 | -0.001 | -0.06 | -0.005 | -0.25 |
| Separated | -0.023 | -0.66 | -0.027 | -0.79 | -0.021 | -0.60 |
| Widow | -0.046 | -1.77 | -0.047 | -1.77 | -0.045 | -1.71 |
| Divorced | -0.063 | -1.74 | -0.065 | -1.80 | -0.06 | -1.66 |
| *Education* | | | | | | |
| Primary | *Reference* | - | *Reference* | - | *Reference* | - |
| Secondary 1ºStage | 0.066 | 4.72 | 0.071 | 5.07 | 0.066 | 4.68 |
| Secondary 2ºStage | 0.113 | 6.77 | 0.12 | 7.17 | 0.112 | 6.67 |
| Professional Training | 0.171 | 3.12 | 0.174 | 3.16 | 0.168 | 3.07 |
| Tertiary | 0.15 | 8.32 | 0.161 | 8.89 | 0.145 | 8.01 |
| *Labour market situation* | | | | | | |
| Employed full-time | *Reference* | - | *Reference* | - | *Reference* | - |
| Employed part-time | -0.031 | -1.30 | -0.033 | -1.39 | -0.031 | -1.29 |
| Unemployed | -0.009 | -0.36 | -0.011 | -0.43 | -0.007 | -0.29 |
| Student | 0.028 | 0.75 | 0.029 | 0.78 | 0.029 | 0.76 |
| Retired | -0.066 | -1.65 | -0.072 | -1.80 | -0.065 | -1.62 |
| Disable | -0.154 | -2.68 | -0.153 | -2.65 | -0.153 | -2.66 |
| Housework | -0.027 | -1.03 | -0.028 | -1.06 | -0.025 | -0.96 |
| Other | -0.1 | -3.42 | -0.103 | -3.51 | -0.098 | -3.34 |
| sigma_u | 0.489 | | 0.492 | | 0.488 | |
| sigma_e | 0.611 | | 0.612 | | 0.611 | |
| rho | 0.39 | | 0.393 | | 0.389 | |
| Number of observations | | | 30,932 | | | |

## 6. Sensitivity Checks

In this section we perform a couple of sensitivity checks to test the robustness of our results. These tests are performed with reference to our preferred specification, Specification 3. First we check if the results are sensitive to changes in the dependent variable. To this purpose we construct an alternative measure of health status that combines information from the following two questions: i) "*Do you have a chronic illness or disability or chronic deficiency?*"; ii) "*Have you felt limited for the development of your daily activities during the last 6 months due to health problems?*". We create a binary variable that is equal to 0 if respondents answer 'yes' to any of the two previous questions. A value 1 in this new dependent variable will, therefore, reflect a good health status. In total about 30% of our sample reports some incapacity/chronic illness or limitation in daily activities. We estimate a random effect probit model, and results are reported in columns 1-2 of Table 6 for males and females respectively. Overall, these results are closely in line with baseline results reported in Table 4 and Table 5. With the exception of few cases – item 8 in the female estimation and deprivation in durables for the results of males – the sign, magnitude and statistical significance of our synthetic measures of relative deprivation are not significantly affected by the change of the dependent variable.

Secondly, to account for individuals time-invariant unobserved heterogeneity, that correlate with deprivation and poor health, we use individual FE regressions. In fact, the estimations reported in Table 4 and 5 impose a functional form on the relationship between the error term and the covariates through Mundlak correction term, while now we make use of FE models that relax this hypothesis and can be used as an alternative explanation. Results corresponding to Specification (3) are reported in columns 3-4 of Table 6. For males, we find that 4 items remain statistically significant with a negative sign, suggesting a major role played by financial difficulties and housing conditions in affecting individual's self assessed health even when we directly control for unobserved individual heterogeneity that is fixed over time. However it should be noted that the coefficient estimates are smaller compared to the results from random effects models, showing also higher standard errors. This could be due to the fact that there is high level of persistence in health statuses across time. In fact, the identification of this model relies on the existence of "movers" across health statuses, where mobility is assumed to be exogenous, conditionally on the observed controls and on the time invariant unobservables.

| | New dependent variable | | | | SAH, Fixed Effects | | | |
|---|---|---|---|---|---|---|---|---|
| | Male | | Female | | Male | | Female | |
| *Income measures* | | | | | | | | |
| Log Equivalised income (euro) | -0,01 | -0,4 | 0,004 | 0,18 | -0.005 | 0.045 | 0.001 | 0.01 |
| Log relative income (euros) | 0,007 | 0,66 | 0,016 | 1,62 | -0.027 | 0.025 | 0.017 | -1.55 |
| *Deprivation Measures* | | | | | | | | |
| Financial difficulties | | | | | | | | |
| Item 1: Great difficulties making ends meet | -0,121 | -2,52 | -0,103 | -2,20 | -0.011 | -2.11 | 0.009 | 1.84 |
| Item 2: In arrears payment housing utility bills | -0,04 | -0,2 | 0,357 | 1,77 | -0.046 | -2.29 | -0.027 | -1.36 |
| ***Deprivation in financial*** | -0,224 | -1,26 | -0,565 | -3,12 | -0.082 | -1.07 | -0.125 | -1.63 |
| Basic Necessities | | | | | | | | |
| Item 3: Cannot afford meat, fish or chicken | -0,035 | -0,28 | -0,226 | -1,91 | 0.03 | 0.35 | 0.102 | 1.20 |
| Item 4: Cannot afford a week's holiday | -0,143 | -2,76 | -0,22 | -4,57 | -0.024 | -0.43 | -0.009 | -0.17 |
| Item 5: Cannot afford unexpected expenses | -0,095 | -1,54 | -0,097 | -1,73 | -0.034 | -1.51 | -0.055 | -2.53 |
| ***Deprivation in basic necessities*** | 0,000 | 0,00 | 0,057 | 0,68 | 0.007 | 0.18 | -0.014 | -0.36 |
| Housing Conditions | | | | | | | | |
| Item 6: Damp walls, Floors….. | -0,359 | -3,58 | -0,192 | -2,03 | -0.013 | -0.48 | -0.011 | -0.42 |
| Item 7: Cannot keep home warm in winter | -0,138 | -1,18 | -0,19 | -1,73 | -0.093 | -2.16 | -0.095 | -2.28 |
| Item 8: No bath or shower | -0,447 | -0,93 | 1,489 | 2,96 | -0.110 | -2.24 | -0.138 | -2.89 |
| Item 9: No toilet | 0,767 | 1,52 | -0,601 | -1,25 | -0.062 | -0.25 | -0.441 | -1.87 |
| ***Deprivation in housing conditions*** | 0,034 | 0,23 | -0,173 | -1,24 | 0.040 | 0.63 | 0.027 | 0.43 |
| Durables | | | | | | | | |
| Item 10: No telephone | -0,506 | -1,46 | 0,295 | 0,80 | 0.168 | 1.39 | 0.094 | 0.49 |
| Item 11: No colour TV | -0,571 | -1,06 | -0,738 | -1,35 | 0.276 | 1.27 | 0.010 | 0.06 |
| Item 12: No computer | -0,461 | -1,88 | -0,096 | -0,43 | 0.12 | 0.81 | -0.153 | -0.59 |
| Item 13: No washing machine | -1,026 | -2,35 | 0,092 | 0,23 | 0.129 | 0.49 | -0.072 | -0.72 |
| Item 14: No car | -0,52 | -1,91 | -0,243 | -1,00 | -0.013 | -0.13 | 0.043 | 0.22 |
| ***Deprivation in durables*** | 0,573 | 1,86 | 0,053 | 0,19 | -0.040 | -0.31 | 0.109 | 0.87 |
| N | 28,968 | | 30,930 | | 28,969 | | 30,932 | |

**Table 6: Sensitivity Analyses**

## 7. Conclusions

Research in social sciences has increasingly paid attention to the controversial relationship between income, relative deprivation and health, but findings are ambiguous mostly because of lack of proper data that are able to follow individuals longitudinally.

Most of the existing literature that has analyzed the socioeconomic gradient in health, has considered income as the main indicator of socioeconomic status. Using the *Spanish Living Condition Survey* (2005-2008) this paper shows that other forms of deprivation, apart from income, may exert a significant impact on individual health. In particular, we consider deprivation in a number of domains including *Financial Difficulties*, *Basic Necessities*, *Housing Conditions* and *Durables*. Furthermore, since health is very likely to be not only influenced

by individual's own situation, but also in comparison with a reference group, we consider the possibility that deprivation also affects health through unfavourable comparisons with societal peers.

The econometric strategy is based on random effects models. In particular, we follow Van Praag and Ferrer-i-Carbonell (2008) and we estimate a probit adapted ordinary least square (POLS) model, including a Mundlak correction term to parameterize the potential correlation between the individual effects and the regressors. In line with previous works (Graham 2007; House et al., 2005), our results provide evidence that socioeconomic gradient in health is not unidimensional. However, we find interesting differences regarding the influence of income and material deprivation on SAH. Higher distances between own income and others' income significantly depresses individual health, which supports the relative income hypothesis. However, once comparisons in terms of income are considered as determinants of health, own income does not play any role. Additionally, material deprivation leads to a substantial decrease in SAH, especially in terms of *Financial Difficulties*, *Basic Necessities* and *Housing Conditions*. However, unlike income, the SAH effects of being deprived in these domains mainly operate through a direct channel, with inaccessibility to specific items exerting *per se* a negative impact on health.

To the extent that individual deprivation frequently extends to different domains – apart from income – our results warn that their consequences on individual health may be overwhelming. We suggest that other life domains should not be neglected and claim for the necessity of a renewed approach where more emphasis should be directed to other dimensions reflecting some minimum standards of living. This may be potentially relevant for policy makers in the design of the most appropriated policies and the most effective targeting of resources intended to improve the health of citizens, and that so far have been almost exclusively focused on income support.

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