THE IMPACT OF OVER-HEALTH ON WAGES: AN EMPIRICAL ANALYSIS FOR SPAIN

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Abstract

Spain is suffering an important economic slowdown which affects significantly to health. In this paper, we analyze the problem of over-health and under-health and its effect on earnings in Spain. Using the whole waves of the European Union Statistics on Income and Living Conditions (EU-SILC, 2004-2012), this study analyses over-health situation of people employed and compares over-health rates and earnings of these individuals. Cross sectional and longitudinal analysis are performed. We apply different matching techniques based on propensity score methods to evaluate the impact of over-health on personal earnings. As a result, we can confirm that, in Spain, there exist over-health individuals whose situation varies among occupations. Although the results depend on the way we define over-health (interval or modal method), those individuals with over-health receive greater earnings than they correspond to.

Key words: Over-health, Matching techniques, EU-SILC, Earnings, Spain.

1. INTRODUCTION

During the last years, population health has been considered as a fundamental aspect in all countries and one of the most important indicators of life quality. In this way, policy makers have an increased interest in social inequalities in health and on those characteristics of individuals that are related to health. Traditionally, population health has been measured through different indicators such as life expectancy, infant mortality, death rates, disability, self-assessed health, happiness or well being. However, health and its outcomes continue being a complex matter and therefore difficult to measure. By this way, individuals' health has being specified as an individual characteristic function based on different inputs (Grossman, 1972; Fuchs, 2004). Thus, one of the most commonly used indicators of individuals' health status is Self-Assessed Health (SAH) which is classified into five categories reflecting negative health rating (bad or very bad health) *versus* positive or neutral health ratings (very good, good or fair health). In this sense, there exist important relationships between health and socioeconomic status (Salas, 2002; Adams *et al.*, 2003) and between health and lifestyles (Contoyannis and Jones, 2004).

The structure of the paper is the following one. In next Section it is showed a review of previous literature and the methodological aspects and the data set. The following section is devoted to comment on the results. And, finally, the last section summarizes the main conclusions and points out some policy implications.

2. MEASURING OVER-HEALTH

There are three main different methods to measure over-health and the mismatch of health similarly to the overeducation ones: the objective, subjective and statistical method. The presentation of different methods can be found in Hartog (2000) and Madrigal (2002).

The objective method is based on the comparison of the level of formal health that the person has, with the one is deemed necessary in his life. Some authors who applied this method for example in over-education are Rumberger (1987), Hartog and Oosterbeek (1988), Kiker and Santos (1991), Kiker et al. (1997) and Garcia-Montalvo (1995).

The subjective method (direct and indirect) is based on the persons themselves who reveal whether their level of formal health is adapted to use. Authors who have used this method are Duncan and Hoffman (1981) and Sicherman (1991) for United States, Hartog and Oosteerbeck (1988) for Holland and Alba (1993) for Spain.

Finally, the statistical methodology is based on two approaches. The first one is the method of interval. The average person is defined as overhealthier if their health is more than one standard deviation above the mean of all individuals in their health. Authors who have used this method for example in over-education in their work are Verdugo and Verdugo (1989), Cohn and Kahn (1995) or Garcia-Montalvo (1995). This is the way we are going to define over-health. The second version is the modal one which assumes that the level of health that is considered appropriate for a particular person is the mode criterion of the health levels of individuals who develop this occupation.

When the health attainment of a person is equal the health level of the mode persons, it is considered that the person is adequately healthier. Authors who have used this method are Kiker et al. (1997), Mendes de Olivera et al. (2000). Therefore, we are going to use also this definition in order to test the robustness of our results.

3. DATA DESCRIPTION

Furthermore, to test the different hypothesis of the main determinants of over-health, we have used the microdata contained in the last four waves (2009-2012) of the European Statistics on Income and Living Conditions (EU-SILC).

The main advantage of this survey is that information is homogeneous among countries since the questionnaire is similar across them. Thus, the EU-SILC is an annual, EU-wide, survey which allows us to obtain information on the income and living conditions of different types of households and individuals in the European Union. It has been established to provide data to be used for the structural indicators of social cohesion. EU-SILC includes rich information about income, education, employment, health, etc. Also, it is designed to insure the comparability between the European Union countries.

In EU-SILC, income details are collected at both household and individual level. The income measure we have used in our empirical analysis is disposable individual income and the reference period of income is the year prior to interview. As a consequence, although the interviews corresponding to the last four waves of the EU-SILC where performed from 2009 to 2012, the corresponding incomes refer, respectively, from 2008 to 2011.

Therefore, we are going to quantify overhealthier individuals in Spain. Afterward, the impact of over-health of individuals will be analysed. So, we are going to focus our analysis on those individuals who had several health levels in 2009, 2010, 2011 and 2012. Thus, we follow the approach proposed by Verdugo and Verdugo (1989). Thus, a person is overhealthier if his/her health is more than one standard deviation above the average for his/her health.

On one hand, a person is underhealthier if his/her health is more than one standard deviation below the average for his/her health. So, adequately persons are those within ± 1 standard deviation of the average health for their health level. We also study over-health using the statistical method based on the mode. In this case, a person is overhealthier if his/her health is greater than the mode for his/her health level. On the other hand, a person is underhealthier if his/her health is less than the mode of the level of health for his/her health level. It is important to note that this method is more restricted than the first one.

4. DOES OVER-HEALTH EXIST IN SPAIN? METHODS AND EMPIRICAL RESULTS

Over-health is the fact of having a level that exceeds the health requirements necessary to perform a normal life. As we have noticed before, we are going to classify individuals as overhealthier using two definitions. The first one is based on the average health for his/her health level and the second one is based on the mode of the same variable. To classify individuals we have used information contained in the EU-SILC.

Therefore, the following Tables provide the proportions of individuals defined as overhealthier, adequately healthier and underhealthier within each of the broad occupational categories. Obviously, the proportion of over and under healthier varies among persons.

Moreover, the results obtained using as criteria of classification the mode health level of the corresponding category do not differ very much from those obtained previously.

Table 1. Health (under, over, adecuate). Media. Total

	% Under-health				% Over-health				% Adecuate health			
	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012
1.- Legislators, seniors officials	26,43	25,96	22,19	19,26	13,95	16,44	16,56	18,18	59,62	57,60	61,26	62,55
2.- Professionals	12,74	12,40	11,71	11,57	21,31	22,52	26,45	28,00	65,95	65,08	61,84	60,43
3.- Technicians and associate professionals	17,00	15,02	17,52	18,81	21,44	22,45	23,47	23,91	61,56	62,53	59,02	57,28
4.- Clerks	18,83	19,18	17,53	15,88	17,64	18,16	23,66	20,57	63,53	62,66	58,81	63,55
5.- Service workers and shop and market sales workers	27,24	26,19	22,67	23,15	14,91	16,80	20,81	21,84	57,86	57,02	56,52	55,02
6.- Skilled agricultural and fishery workers	53,04	53,44	48,70	49,23	6,08	6,43	10,54	6,40	40,88	40,13	40,76	44,37

7.- Craft and related trades workers	33,97	34,40	31,60	32,82	11,69	12,23	15,34	14,80	54,34	53,37	53,06	52,38
8.- Plant and machine operators and assemblers	32,62	32,22	28,68	26,99	11,33	13,30	16,16	16,82	56,05	54,47	55,16	56,18
9.- Elementary occupations	41,98	41,90	34,76	38,75	10,52	11,31	14,38	15,23	47,50	46,79	50,87	46,02
Total	15,17	14,13	11,00	11,22	18,02	19,18	23,69	24,00	66,82	66,69	65,31	64,78

Table 2. Media Inmigrants

	% Under-health				% Over-health				% Adecuate health			
	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012
1.- Legislators, seniors officials	34,07	19,42	21,74	19,67	19,78	22,33	15,94	19,67	46,15	58,25	62,32	60,66
2.- Professionals	24,41	13,04	13,93	10,81	16,54	30,43	29,51	39,64	59,06	56,52	56,56	49,55
3.- Technicians and associate professionals	16,36	17,65	15,45	15,25	19,09	26,05	31,82	27,12	64,55	56,30	52,73	57,63
4.- Clerks	17,65	13,46	11,34	17,27	22,69	25,64	28,87	20,00	59,66	60,90	59,79	62,73
5.- Service workers and shop and market sales workers	23,90	19,76	15,26	15,05	20,73	21,45	23,94	23,61	55,37	58,80	60,80	61,34
6.- Skilled agricultural and fishery workers	32,35	19,64	17,02	15,87	8,82	16,07	34,04	7,94	58,82	64,29	48,94	76,19

7.- Craft and related trades workers	21,60	19,67	16,07	20,83	14,51	22,30	25,71	18,91	63,89	58,03	58,21	60,26
8.- Plant and machine operators and assemblers	19,27	14,94	13,28	17,07	13,76	25,97	30,47	18,29	66,97	59,09	56,25	64,63
9.- Elementary occupations	25,93	26,21	17,02	18,76	15,20	20,59	23,94	22,16	58,87	53,20	59,04	59,08
Total	20,07	16,11	11,00	12,30	17,64	24,82	26,93	23,59	62,29	59,08	62,07	64,11

Table 3. Media Natives

	% Under-health				% Over-health				% Adecuate health			
	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012
1.- Legislators, seniors officials	25,95	26,36	22,21	19,24	13,58	16,08	16,59	18,08	60,47	57,56	61,19	62,69
2.- Professionals	12,11	12,33	11,60	11,61	21,57	22,11	26,31	27,45	66,31	65,56	62,09	60,94
3.- Technicians and associate professionals	17,04	14,84	17,63	19,03	21,57	22,20	23,01	23,71	61,40	62,96	59,36	57,26
4.- Clerks	18,88	19,52	17,79	15,81	17,41	17,71	23,44	20,60	63,71	62,77	58,76	63,59
5.- Service workers and shop and market sales workers	27,60	26,91	23,54	24,10	14,26	16,28	20,45	21,63	58,13	56,80	56,01	54,26
6.- Skilled agricultural and fishery workers	53,55	54,88	49,92	51,02	6,01	6,02	9,64	6,31	40,43	39,10	40,44	42,66

7.- Craft and related trades workers	35,00	35,68	33,09	33,91	11,46	11,35	14,34	14,43	53,54	52,97	52,56	51,66
8.- Plant and machine operators and assemblers	33,43	33,35	29,70	27,53	11,18	12,48	15,21	16,74	55,40	54,17	55,09	55,72
9.- Elementary occupations	44,35	44,40	37,68	41,77	9,79	9,83	12,80	14,20	45,86	45,77	49,52	44,03
Total	15,15	14,40	11,22	11,32	18,58	19,26	23,86	24,46	66,27	66,34	64,93	64,23

Table 4. Media. Total												
	% Under-health				% Over-health				% Adecuate health			
	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012
25<Age<40	13,57	12,71	9,91	9,52	22,48	25,16	32,27	33,78	63,95	62,13	57,82	56,70
39<Age<50	21,99	20,70	16,13	15,83	13,58	15,30	19,12	20,16	64,43	63,99	64,76	64,01
49<Age<65	10,60	9,86	8,62	8,72	8,43	8,62	11,27	10,99	80,98	81,52	80,11	80,29
Total	14,93	13,98	11,26	11,11	14,83	16,25	20,45	20,86	70,24	69,77	68,30	68,03
Media Inmigrants												
	% Under-health				% Over-health				% Adecuate health			
	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012
25<Age<40	16,95	14,07	8,41	10,10	18,41	25,67	32,82	26,30	64,65	60,26	58,77	63,60
39<Age<50	25,84	23,48	16,78	17,64	15,37	20,20	20,21	20,80	58,78	56,32	63,01	61,56
49<Age<65	7,06	5,00	4,42	5,37	11,30	12,89	14,09	14,69	81,64	82,11	81,49	79,94
Total	17,91	15,26	10,34	11,75	16,06	21,41	24,92	22,00	66,03	63,33	64,75	66,24
Media Nativos												
	% Under-health				% Over-health				% Adecuate health			
	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012
25<Age<40	11,06	10,12	20,47	8,12	23,62	25,76	79,53	35,49	65,32	64,11	0,00	56,39
39<Age<50	20,50	19,38	15,21	15,00	13,55	14,91	19,18	20,24	65,95	65,71	65,61	64,77
49<Age<65	9,91	8,92	8,34	8,37	8,36	8,50	11,18	10,86	81,73	82,58	80,48	80,77
Total	13,32	12,33	10,38	10,26	14,93	15,98	20,19	20,92	71,75	71,69	69,43	68,82

Table 5. Media. Total												
	% Under-health				% Over-health				% Adecuate health			
	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012
Male	9,06	8,87	24,84	25,28	16,14	17,23	21,02	21,75	74,80	73,90	54,15	52,98
Female	11,80	11,38	10,25	10,68	13,42	14,78	18,95	19,34	74,78	73,84	70,80	69,98
Total	10,50	10,18	17,04	17,70	14,71	15,95	19,59	20,50	74,79	73,87	63,37	61,80
Media Inmigrants												
	% Under-health				% Over-health				% Adecuate health			
	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012
Male	4,33	3,74	13,60	15,73	19,85	27,04	29,41	24,39	75,82	69,22	56,99	59,88
Female	3,99	4,29	2,99	3,62	16,18	20,41	24,74	24,39	79,83	75,30	72,27	71,99
Total	4,14	4,04	7,85	9,20	17,83	23,49	26,87	24,39	78,03	72,48	65,28	66,41
Media Natives												
	% Under-health				% Over-health				% Adecuate health			
	2009	2010	2011	2012	2009	2010	2011	2012	2009	2010	2011	2012
Male	7,81	7,66	24,77	25,34	16,13	16,70	20,61	21,74	76,06	75,64	54,62	52,92
Female	11,44	10,64	9,89	10,76	13,33	14,50	17,82	19,01	75,23	74,86	72,29	70,23
Total	9,71	9,21	17,02	17,79	14,67	15,55	19,16	20,33	75,63	75,24	63,82	61,89

In Spain, as expected, there exists over-health. Obviously, it has important consequences. In order to test this hypothesis we are going to use again the data included in the EU-SILC and we are going to consider different socio-demographic variables which could explain differences in Spain.

The analysis is also based on matching techniques. We are going to define the causal effect in terms of potential outcomes or counterfactuals (Angrist and Imbens, 1995). We consider an individual *i*. He or she can receive the treatment (to be over-healthier) and his/her outcome is y_1. If he/she do not receive the treatment (not to be over-healthier), then his/her outcomes is y_0. Obviously, an individual can not be in the two states, therefore we can not observe both.

Thus, causal effects are comparisons of y_0 and y_1, for example $y_1 - y_0$ or y_1 / y_0 (Rosenbaun and Rubin, 1983). We will focus on measuring $y_1 - y_0$. For it we need to do an assumption: We have an independent, identically distributed sample from the population. This implies that the treatment on individual *i* affects only to the individual *i*, which is called the stable unit treatment value assumption (SUTVA), (Wooldridge, 2002).

Let the variable w be a binary treatment indicator, where $w = 1$ denotes treatment and $w = 0$ otherwise. We have a random vector (y_0, y_1, w) from an individual of the population of interest. Rosenbaum and Rubin (1983) gave the next definitions:

Definition 1: The average treatment effect on treated (ATE_1) is:

$$ATE_1 \equiv E(y_1 - y_0 \mid w = 1) \tag{1}$$

ATE_1 is the average effect on participants in the program.

Let x be a set of covariates of individual characteristics, for example age, education, health status, etc. Then we can define both previous treatments conditioning on x. The ATE_1 conditional on x is $E(y_1 - y_0 \mid x, w = 1)$.

Our problem is that we want to estimate the previous effects, ATE_1, and we can only observe:

$$y = (1 - w)y_0 + wy_1 = y_0 + w(y_1 - y_0). \tag{2}$$

Matching methods are based on comparing two groups. On one hand, in the first group are individuals who have received treatment and in the second group, called the control group, are the individuals who have not received treatment but they have similar characteristics to those who received treatment. In particular, each individual of the first group is paired with one or more individuals in the control group. With this method different outcomes are due to treatment. To use these methods we need to accept A*ssumption 1*, which is a particular case of a balancing score.

Definition 2: A balancing score is a function $b(x)$ of the observed covariates such that $(y_0, y_1 \perp w) \mid b(x)$ (Rosenbaum and Rubin, 1983).

As we said, the simplest case of balancing score is $b(x) = x$. To ensure compliance of the *Assumption 1*, the vector of covariates x should contain all information affecting the participation in the program and the variable that is being studied. One of the balancing score most used is the propensity score (Rosenbaum and Rubin, 1983).

Definition 3: Let x be a set of covariates. The propensity score is the conditional probability of assignment to treatment one, given the covariates. We denote it:

$$p(x) \equiv P(w = 1 \mid x).$$

(3)

We can use the propensity score to calculate the average treatment effect and the average treatment effect on the treated. The propensity score is useful because reduces the size of the problem.

Proposition 2 (Wooldridge, 2002): Under Assumption 2 and suppose that

$$0 < p(x) < 1, \quad \text{all } x.$$

(4)

Then

$$ATE = E(\{w - p(x)\}y / \{p(x)[1 - p(x)]\})$$

(5)

and

$$ATE_1 = E\{[w - p(x)]y / [1 - p(x)]\} / P(w = 1).$$

(6)

Equation (6) along with *Assumption 1* is called strong ignorability of treatment (given covariates x). (Rosenbaum and Rubin, 1983). Equation (6) can be transformed and we obtain the following expression (Wooldridge, 2002):

$$ATE_1 = \{P(w = 1)E(y_1 - y_0 \mid w = 1)\} / P(w = 1).$$

(7)

The initial bias in x is

$$B = E(x \mid w = 1) - E(x \mid w = 0).$$

(8)

If we use matching methods and suppose that each treated individual is matched with a control individual, then the expected bias in matched samples is:

$$B_m = E(x \mid w = 1) - E_m(x \mid w = 0),$$

(9)

where *m* indicates the distribution in matched samples. Rosenbaum and Rubin (1983) showed that B_m is the zero vector if we have done exact matches on a balancing score. Therefore, if we do matches using propensity score, the expected bias will be zero.

Once we have calculated the propensity score we have several methods to make matching. In particular, we are going to describe nearest-neighbour matching and radius matching.

- Nearest-neighbour matching: This method will match the individuals whose propensity score with the smaller difference. Nearest-neighbour matching sets (Becker and Ichino, 2002):

$$C(i) = \min_j \left\| p_i - p_j \right\|,$$

(10)

where $C(i)$ is the set of control individuals matched to the treated individual i with an estimated value of the propensity of p_i and p_j is the propensity score of each individual of the control group.

- Radius matching: For the individual treated i, he or she will be matched with those individuals of the control group whose propensity scores are at a distance less than a given number, r:

$$C(i) = \left\{ p_j : \left\| p_i - p_j \right\| < r \right\}.$$

(11)

To test the sensibility of our results we have considered different values for r (r=0.1; r=0.5; r=0.01).

6. CONCLUSIONS

Spain is suffering an important economic slowdown which affects significantly to health. In this paper, we analyze the problem of over-health and under-health and its effect on earnings in Spain. Using the whole waves of the European Union Statistics on Income and Living Conditions (EU-SILC, 2004-2012), this study analyses over-health situation of people employed and compares over-health rates and earnings of these individuals. Cross sectional and longitudinal analysis are performed. We apply different matching techniques based on propensity score methods to evaluate the impact of over-health on personal earnings.

As a result, we can confirm that, in Spain, there exist over-health individuals whose situation varies among occupations. Although the results depend on the way we define over-health (interval or modal method), those individuals with over-health receive greater earnings than they correspond to.

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