

**Maternal Employment and Childhood Obesity in Spain \***

by

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**DOCUMENTO DE TRABAJO 2006-17**

May, 2006

\* We acknowledge research funding from Asociación de Economía de la Salud (AES) and Bayer. This paper was presented at the XXVI Jornadas de Economía de la Salud, Toledo 2006. We are grateful for comments and suggestions of the participants.

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Depósito Legal: M-22031-2006

## **Abstract**

In this paper we explore to which extent the increase in childhood overweight and obesity are consequences of the participation of mothers in the labour market. We think that the increase in female labor force participation can explain, at least in part, the observed increase in the prevalence of overweight and obesity among children. Since it is very difficult to establish causal effects between both variables, we intend to measure it indirectly by using discrete choice models. Our results confirm that maternal employment could be at the root of this personal and social problem, which in absence of specific measures from several fields could become epidemic in the next decades. Otherwise, individuals' quality of life could be threatened, and expenditure devoted to control or alleviate this health problem could put pressure on the sustainability of the National Health System in the future.

**Keywords:** overweight, obesity, labour market participation, discrete choice.

**JEL Class:** J13, I12

## **Resumen**

En este artículo estudiamos en qué medida el aumento del sobrepeso y la obesidad infantil han sido un efecto de la integración de las madres en el mercado de trabajo. El incremento de la participación laboral femenina puede explicar, al menos en parte, el aumento observado en las tasas de prevalencia de sobrepeso y obesidad infantil. Dado que establecer efectos causales entre ambas variables resulta muy difícil, intentamos hacerlo de manera indirecta mediante la utilización de modelos de elección discreta. Nuestros resultados confirman que el empleo de las madres podría ser parte de la raíz de este problema individual y social que, en ausencia de medidas específicas de diferentes ámbitos, podría llegar a convertirse en epidemia en las próximas décadas. En ese caso, la calidad de vida de los individuos podría verse gravemente amenazada, mientras que los gastos destinados al tratamiento de este problema de salud podrían acentuar la presión sobre los recursos del sistema nacional de salud.

## 1. INTRODUCTION

Childhood obesity has become a serious health problem in the societies of most countries in the world. In particular, the percentage of overweight and obese children in Spain has noticeably increased during the last two decades. As a consequence of these marked upward trends, Spain has become one of the first European countries in childhood overweight and obesity rates. The concern caused by the worldwide increase in obesity rates has motivated that the World Health Organization (WHO) considers obesity as the epidemic of the XXI century. This is justified by the possibility that obesity becomes one of the main causes of death produced by non-infectious diseases.

Childhood obesity is an important problem because it can affect the emotional equilibrium, the social relations or even the academic performance of overweight children. Moreover, the problem gets even worst as children become adults: first, because the probability that an obese child becomes an obese adult is very high; and second, because it may cause future negative health consequences such as diabetes, coronary heart disease and even cancer, which imply negative effects on the quality of life and a potential decrease in the life expectancy of the affected population.

There are several reasons that explain the actual situation of overweight and obesity in developed countries (see Auld and Powell, 2005) and particularly in Spain. Traditional diet, for instance, has been replaced by more energy intensity diets. New life styles have reduced physical activity at school and leisure times. Moreover, changes in the relative prices of fast/healthy food and access to restaurants can also be important factors increasing the prevalence of overweight and obesity. All these conditionings together have implied that the relative price of consuming a calorie has fallen over time while the opportunity cost of burning a calorie has risen over time (Lakdawalla and Philipson, 2002). Another stylized fact during the last decades has been the increase in women's labor force participation. Mothers have had to reallocate their time between work and family responsibilities, with possible implications on children's life habits (physical activity, food intake, etc.) that may put their health in risk and threaten their quality of life.

Although physical activity and food intake are the direct causes of overweight and obesity, our purpose is to explore whether these habits have a deeper origin that might be associated to women's labor force participation. Despite establishing causal relationships between obesity and female labor force participation is complicated, the evolution of these variables over the last years in Spain makes us suspect that both could be related in some way. This has lead us to analyse the extent to which overweight and obesity are a consequence of

women's labor force participation, with the exception of those cases in which childhood obesity has a clear pathological origin. The study of the mechanisms by which these effects take place would allow putting in practice suitable economic, health-care, educational, social and familiar policy measures trying to avoid the serious consequences derived from this problem.

Therefore, this paper focuses on the study of one of the possible indirect causes of childhood obesity. In particular, our purpose is to explore whether the increase in overweight and obesity are, at least in part, an effect of the participation of mothers in the labor market. The analysis focuses on the relationship between childhood overweight and maternal employment for two main reasons. First, the increase in female labour force participation has been very important over the last years in Spain. Second, despite the social successes achieved by women in the last decades, information from different Spanish datasets still points out mothers as the main child care providers, independently of their professional responsibilities.<sup>1</sup>

In order to do this, the paper is structured as follows. In the next section we review the (empirical) literature on the causes and consequences of childhood obesity that exhibits arguments about the importance of their knowledge. We also analyse the theoretical mechanisms by which maternal employment may affect children's weight. Then, in section 3 we present the current situation of childhood obesity in Spain. Section 4 describes the empirical approach, the data and the results. Finally, Section 5 is devoted to discuss the main conclusions.

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<sup>1</sup> See, for instance, the Time Use Survey 2002-2003 and the National Health Survey 2003.

## 2. LITERATURE REVIEW ON THE CAUSES AND CONSEQUENCES OF OBESITY

In this section we survey the empirical literature that has tried to know and verify the causes and consequences of childhood obesity. The results obtained in previous papers show the importance of avoiding obesity consequences, by addressing its causes in a suitable way. Therefore, given their relevance both from individual and health policy points of view, causes and consequences of obesity are next reviewed.

### 2.1 Causes of obesity

There are many scientific studies of different fields of specialization, either medical, sociological or economic, that have examined the possible determinants of childhood obesity. However, only very few studies have focused on maternal employment as a potential cause of childhood overweight.

Among the causes explaining this health problem, some researchers point out genetics as playing an important role in explaining obesity. Several studies have found a strong correlation between parents and children weight problems (Vuille and Mellbin, 1979; Dietz, 1991). However, it is not clear that this correlation is due to genetic factors and not to the fact that parents and children share similar life styles. Nonetheless, even in the case that genetic plays an important role in explaining childhood obesity, based on the dramatic trends in overweight over the last years, we think that there must be other factors playing a role as well. For this reason, researchers have recently turned to the study of alternative potential causes of childhood obesity, mainly focusing on external factors.

An environmental factor that is considered to be related to the obesity increase is the consumption of high calorie foods. According to previous evidence, the consumption of calorie rich foods is positively related to children's weight (French *et al.*, 2001; Binkley *et al.*, 2000). In this sense, industrialization processes in food processing have lowered the fixed costs of producing food (Cutler *et al.*, 2003)<sup>2</sup>. Also related to nutrition, some recent studies suggest that infants who are breastfed by their mothers may be less likely to be overweight later in life than those who are not (von Kries *et al.*, 1999; Gilman *et al.*, 2001).

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<sup>2</sup> In Spain, there also exists evidence of a higher increase in the prices of fresh foods than in the prices of processed foods. For instance, between 1992 and 2005 the increase in the price of fresh vegetables and pulses was 58% higher than the increase in the price of their processed, while the increase in the price of fresh fruits was 16% higher than the increase in the price of processed fruits. In some Spanish regions, the differences between the increases in the prices of these products were even larger.

Among the life styles, watching television for many hours is another element that could have contributed to the rise in childhood obesity. Watching television may affect children weight through three different channels: (i) it is a sedentary activity that replaces outdoors activities that consume more energy, such as games and sports (ii) children usually eat while watching television; and (iii) television advertises high calorie foods that affect the foods children choose to eat. The empirical evidence shows a positive correlation between time spent watching television and overweight among children and teenagers (Proctor *et al.*, 2003; Andersen *et al.*, 1998; Gortmaker *et al.*, 1996).

Although there is not conclusive evidence about the effects of other factors determining children's weight such as family socioeconomic status and structure, some authors point them as being at the root of the explanation of the observed stylized facts (Sobal and Stunkard, 1989; Dietz, 1991; Gerald *et al.*, 1994; and Wolfe *et al.*, 1994).

Finally, studies that specifically analyse the link between maternal employment and childhood overweight are scarce. While some studies find a positive relationship between mothers' employment and children's probability of being overweight (Takahashi *et al.*, 1999; Anderson *et al.*, 2002), other studies do not find a statistically significant effect of maternal employment on nutrient intake (Johnson *et al.*, 1992).

## **2.2 Consequences of obesity**

Being overweight in the childhood could have immediate consequences and long-term implications for individuals, both from their health and social relationships perspectives, as well as for the society as a whole.

Firstly, it has been proved that being overweight has both medical and psychological consequences for kids. On the one hand, the increase in childhood overweight has been accompanied by a marked increased in the number of children developing type 2 diabetes (Thompson, 1998). On the other hand, some scientific researches have focused on the analyses of personal attitudes and behaviour of children. It may affect the academic performance of children (Datar *et al.*, 2004), influence their social relationships and cause them psychological problems. In addition, overweight children are much more likely to become overweight adults than normal weight children (Serdula *et al.*, 1993; Whitaker *et al.*, 1997). Hence, since prevalence in the adulthood is a direct consequence of prevalence in the childhood, adults may suffer serious health problems including diabetes, arterial hypertension, cardiovascular diseases, osteoarthritis and different types of cancer (Power *et al.*, 1997 and Chou *et al.*, 2004).

Regarding economic and social consequences of overweight, some studies have shown that obesity is negatively related to education and earnings (Averett and Korenman, 1996; Gortmaker *et al.*, 1993; and Cawley, 2000). Although Spanish health care authorities do not recognise obesity as a disease, the total costs of diseases related to obesity were estimated to be 7 per cent of total health care expenditure (2.5 billion euros) in 2004<sup>3</sup>. According to WHO's estimates, obesity accounts for 2-6% of total health care costs in several developed countries, although this figure could reach 7% in some cases. These figures, joined to WHO's future predictions on obesity, will increase the current pressure on the resources and sustainability of the National Health System as it actually stands. For these reasons, the identification of the causes of overweight and the valuation of its consequences become questions of undoubtedly academic, economic and social interest.

### **2.3. Maternal employment and childhood obesity**

Overweight and obesity appear to be a consequence of many different factors, as previously mentioned. In general, we can split them in genetic and environmental factors. Clearly, genetics or biological factors are one of the conditionings of the problem. However, we cannot attribute the sharp and rapid increase in the prevalence of overweight and obesity to a factor whose changes need long time to occur. For such genetic changes to have taken place and translated to the actual prevalence of overweight and obesity, a longer period of time than that considered here (approximately 20 years) should have passed. Thus, we must consider additional causes in explaining such increases. Environmental factors that may affect either the consumption or the expenditure of energy, as part of a wider set of changes in individual's behaviour, preferences and lifestyles, might be playing an important role.

Beyond metabolism, individuals gain weight when they consume more calories than they burn. The international evidence shows that the relationship between calories consumed and burned has considerably worsened (Auld and Powell, 2005). To the extent that children's consumption and physical activity (in short, life habits) are determined by their family characteristics, the labour market participation of their mothers or main care providers could affect their energetic balance.

The increase in the relative price of healthy versus fast food, the use of technologies to prepare food at home and the demand for food to take away are at the core of the explanation of the overweight and obesity trends. In turn, these behaviours were caused, in part, by increases in the female labour force

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<sup>3</sup> See Estudio Prospectivo Delphi. Libro Blanco.

participation (Lakdawalla and Philipson 2002, Chou *et al.* 2004). Anderson *et al.* (2002) provide further evidence on the causal effect of maternal hours of work on the increase of overweight among children.

Nowadays, the nutritional composition of the food population eats is dominated by high calorie ingredients, which absorption and effects on weight are considerable. On the one hand, maternal employment could alter the types of food eaten if, for instance, child care providers are more likely to give children food that is high in fat and calories, ignoring the nutritional equilibrium the kids need. Moreover, working mothers (with or without house-keeping help) may rely more heavily on higher calorie prepared or fast food, and unsupervised children may make poor nutritional choices because they have easy access, both inside and outside school, to these sorts of food. On the other hand, the additional earnings from work could produce a compensating effect as they allow healthier foods, typically more expensive, to be chosen, as well as the hiring of people in charge of giving healthy food to children, which suggest that maternal employment may actually reduce the consumption of such foods.

Regarding energy expenditure, any change in sedentariness attributable to maternal employment constitutes a mechanism that may affect childhood obesity. Since potential effects could go in both directions, the net effect is again ambiguous. Some after-school activities as sports may increase children's energy expenditure, for instance. Alternatively, unsupervised children may spend a great deal of their leisure time inside home (perhaps because of safety reasons), watching television or playing video games rather than engaging in more dynamic activities suitable to their age.

### 3. CHILDHOOD OBESITY IN SPAIN

#### 3.1. A first look at the data

This section attempts to illustrate the existence of severe childhood obesity problems in Spain. We measure the empirical evidence of overweight and obesity children using the information provided by the National Health Survey corresponding to 2003 (NHS). This survey collects data on the weight and height of individuals<sup>4</sup>, which are necessary to calculate the body mass index (BMI). The BMI is defined as the weight -measured in kilograms- divided by the height squared -measured in meters-. The BMI cut-offs used to define overweight and obesity correspond to the 85<sup>th</sup> and 97<sup>th</sup> percentiles of the BMI distribution for each age and sex published by the Fundación Orbegozo<sup>5</sup>.

The data show that the prevalence of overweight among children between 2 and 15 years is 25.5 percent. From this percentage, near the half (13.6 percentage points) correspond to obesity prevalence. Table 1 presents a breakdown of these rates by age and sex. By sex, overweight and obesity rates are higher for boys than for girls, although there are few exceptions at early ages. By age, the rates show a non-linear profile increasing until children are 8 years old, and decreasing afterwards.

<i>Ages</i>	<b>Overweight</b>		<b>Obesity</b>	
	<i>Girls</i>	<i>Boys</i>	<i>Girls</i>	<i>Boys</i>
2	34.3	25.5	22.6	20.1
3	29.5	38.0	15.1	26.6
4	34.4	31.4	20.1	22.3
5	32.7	36.9	20.4	24.8
6	22.7	37.3	8.0	21.7
7	26.5	28.6	14.9	20.8
8	29.0	35.6	13.6	23.5
9	28.0	36.1	14.9	16.9
10	24.5	30.5	11.7	16.4
11	20.7	28.5	7.8	13.1
12	20.1	28.1	7.9	11.5
13	11.6	25.0	5.0	11.4
14	10.4	16.5	4.1	7.3
15	11.7	16.1	2.9	7.8
Mean	21.8	27.9	10.4	15.7

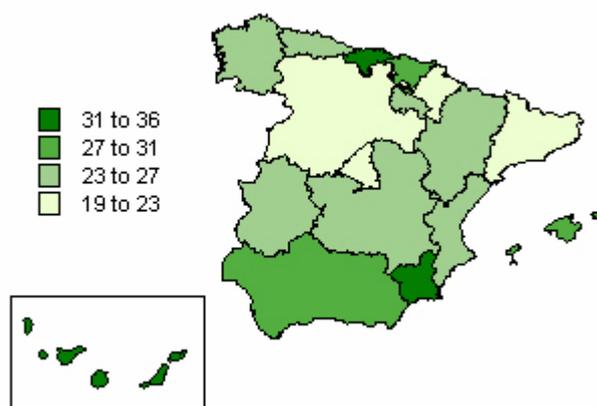
**Source:** National Health Survey, 2003

<sup>4</sup> Self-reported information.

<sup>5</sup> See Hernández *et al.* (1988). These cut points are commonly used as reference values in the literature. See, for example, Serra and Aranceta (2001).

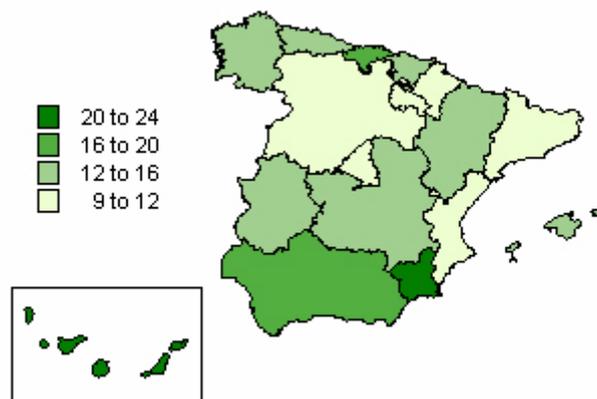
Pictures 1 and 2 show the rates of overweight and obesity rates in the Spanish regions. The highest rates are found in Andalusia, Canarias, Cantabria and Murcia, while the lowest ones are observed in Castilla y León, Madrid and Navarra.

**Picture 1. Overweight across Spanish regions**  
(percent of 2-15 years old children affected by overweight)



Source: National Health Survey, 2003

**Picture 2. Obesity across Spanish regions**  
(percent of 2-15 years old children affected by obesity)



Source: National Health Survey, 2003

Table 2 shows the prevalence of childhood overweight and obesity by different characteristics of the parents. Overweight and obesity rates are higher in the case of children whose mothers have a job outside home. The level of education of the mother and the children overweight and obesity rates are inversely related: the higher the level of education of the mother is, the lower the overweight and obesity rates of the children are. Children whose parents (mother or father) are overweight or obese are more likely to be overweight or obese than the rest of the children.

<b>Table 2. Prevalence of overweight and obesity among children aged 2-15 in Spain by characteristics of their parents.</b>		
	<b>Overweighth</b>	<b>Obesity</b>
<b>Mother's main economic activity</b>		
Work	25.1	13.3
Does not work	24.8	12.9
<b>Mother's level of education</b>		
No Education	30.0	19.5
Primary Education	26.6	14.5
Secondary Education	24.9	12.7
University Degree	21.3	10.5
<b>Parent's BMI</b>		
Normal	22.2	11.5
Overweight	26.7	13.7
Obesity	36.8	20.7
<b>Source:</b> National Health Survey, 2003		

### 3.2. A formal relationship between maternal employment and obesity

#### *Specification of a relationship*

After having described informal evidence of childhood obesity problems in Spain, we are aware of the importance of the topic we are dealing with. However, as we mentioned in previous sections, our purpose is to test the existence of correlation between childhood overweight or obesity and maternal employment. Although inferring causality from any correlation pattern is very difficult, we will also try to test it. To that end, a simple model in which children's weight is a function of energy expenditure and calorie intake may be specified as follows:

$$Weight_i = \beta_0 + \beta_1 Energy_i + \beta_2 Calories_i + \mu_i \quad (1)$$

Similarly, it is possible to state a relationship between the energy and calorie intake and the maternal employment situation (*ME*), the personal characteristics and habits of the children (*ChX*) and the demographic characteristics and habits of their mothers (*MX*), in the following way:

$$Energy_i = \gamma_0 + \gamma_1 ME_i + \gamma_2 ChX_i + \gamma_3 MX_i + v_i \quad (2)$$

$$Calories_i = \delta_0 + \delta_1 ME_i + \delta_2 ChX_i + \delta_3 MX_i + \varepsilon_i \quad (3)$$

Using (2) and (3), the reduced form corresponding to (1) can be expressed as:

$$Weight_i = \pi_0 + \pi_1 ME_i + \pi_2 ChX_i + \pi_3 MX_i + u_i \quad (4)$$

where  $\pi_0 = \beta_0 + \beta_1\gamma_0 + \beta_2\delta_0$ ,  $\pi_1 = \beta_1\gamma_1 + \beta_2\delta_1$ ,  $\pi_2 = \beta_1\gamma_2 + \beta_2\delta_2$ ,  $\pi_3 = \beta_1\gamma_3 + \beta_2\delta_3$  and  $u_i = \mu_i + \beta_1\nu_i + \beta_2\varepsilon_i$ . However, as information on energy and calories is not available, a problem for identifying the parameters of interest arises. As a result, our interest will lie in estimating the effects of mothers' employment on children weight. It is then possible to identify  $\pi_l$  (except for potential simultaneity between  $Weight_i$  and  $ME_i$ ).

We also like to study the effects of all determinants on the probability of children being overweight or obese. In order to do that, we define a discrete choice model from (4) as follows:

$$P(Weight_i > C) = \varphi_0 + \varphi_1 EM_i + \varphi_2 XN_i + \varphi_3 XM_i + e_i \quad (5)$$

where  $C$  is the cut point used to define overweight or obesity.

### *Data and variables*

To conduct our analysis, we use data from the NHS. The NHS is a cross-section survey that provides ample data on the health status of citizens and its determinants. It is carried out by the National Institute of Statistics (INE) in cooperation with the Ministry of Health and Consumption. In the wave corresponding to 2003, the INE interviewed up to 28.113 individuals. The survey contains three questionnaires: one for households, one for adults (16 years old or more) and one for children (between 0 and 15 years old). This last questionnaire is answered by the child's parents or the guardian. The survey collects information on the individual socioeconomic characteristics, morbidity, habits, and health care demand of respondents. It also contains information about the current employment situation of mothers, which is the key explanatory variable in our analysis, as well as a wide variety of other control variables (related to mother's, children's and family's habits and characteristics).

Now, we briefly describe the procedure followed to construct the sample and variables used in estimation procedure. Using children and household files we can link children's and mothers' data. This step results in a sample of 5099 observations (full sample), containing information about the child BMI, the characteristics of his family and the labour situation of his/her mother. In a further step, we obtain parents' BMI from the adults file, which might be helpful for controlling for genetic factors. In this case, the sample size decreases a little up to 4488 observations (restricted sample).

In addition to the continuous BMI dependent variable, in order to carry out the empirical analysis we define two discrete variables indicating whether the child is overweight or obese. The relationship between children weight

problems and maternal employment is analysed using non-linear probit models, which requires assuming  $e_i$  follows a standard normal distribution.

Table 3 contains the main descriptive statistics of the variables included in the different samples. In the full sample the overweight rate of children aged between 2 and 15 years is 24.9 percent (13.1 percent correspond to obese children). About fifty percent of the mothers work outside home. In the restricted sample, the overweight rate of children aged between 2 and 15 years is 25.6 percent, from which 13.4% correspond to obese children. Fifty one percent of the mothers in this sample have a job outside their homes.

**Table 3. Descriptive Statistics**

	Full Sample (N=5099)		Restricted Sample (N=4488)	
	Mean	Standard Dev.	Mean	Standard Dev.
Overweight	0.249	0.433	0.256	0.436
Obesity	0.131	0.338	0.134	0.341
Children Age	9.339	4.034	0.511	0.500
Children Sex	0.514	0.500	9.068	4.039
Mother: Works	0.496	0.500	0.499	0.500
Mother: No Education	0.041	0.199	0.037	0.189
Mother: Primary Education	0.280	0.449	0.265	0.442
Mother: Secondary Education	0.494	0.500	0.503	0.500
Mother: University Degree	0.184	0.388	0.195	0.396
Parents: Overweight			0.498	0.500
Parents: Obesity			0.116	0.321
Andalucía	0.111	0.314	0.109	0.311
Aragón	0.065	0.246	0.068	0.251
Asturias	0.025	0.155	0.025	0.157
Baleares	0.036	0.186	0.035	0.184
Canarias	0.048	0.214	0.046	0.209
Cantabria	0.030	0.171	0.031	0.173
Castilla y León	0.164	0.370	0.166	0.373
Castilla-La Mancha	0.045	0.207	0.042	0.200
Cataluña	0.085	0.278	0.086	0.280
Com. Valenciana	0.067	0.249	0.066	0.249
Extremadura	0.044	0.205	0.044	0.205
Galicia	0.041	0.199	0.041	0.199
Madrid	0.071	0.257	0.071	0.256
Murcia	0.043	0.204	0.043	0.203
Navarra	0.033	0.180	0.034	0.181
País Vasco	0.046	0.210	0.050	0.217
La Rioja	0.027	0.162	0.027	0.162
Ceuta y Melilla	0.019	0.137	0.017	0.129

### 3.3. Empirical results

#### *Parameter estimates*

Table 4 shows the results obtained from the estimation of the econometric models presented above. The specification controls for mother's current employment situation, child sex and age (and its square), mother's educational level and region of residence. The results show a positive significant effect of maternal employment on children's probability of being overweight or obese. In particular, the marginal effect indicates that the fact that a mother work increases her child's likelihood of being overweight by 2.5 percentage points, and that of being obese by 2.3 percentage points. Regarding other variables, overweight and obesity rates are higher for boys than for girls. Mother's education has a negative effect on the probability that her child is overweight or obese. As we mentioned in Section 2, there are some outstanding regional effects. Children from southern regions are more likely to be overweight and obese. The results are robust and persistent to all considered specifications.

<b>Table 4. Overweight and Obesity Determinants.</b>				
<b>Probit. Marginal Effects.</b>				
	<b>Overweight</b>		<b>Obesity</b>	
	<b>Coef.</b>	<b>P-value</b>	<b>Coef.</b>	<b>P-value</b>
Children Sex	0.070	0.000	0.075	0.000
Children Age	0.027	0.000	0.008	0.181
Children Age <sup>2</sup>	-0.002	0.000	-0.001	0.000
Mother: Works	0.026	0.059	0.023	0.058
Mother: Primary Education	-0.038	0.237	-0.047	0.037
Mother: Secondary Education	-0.072	0.022	-0.084	0.000
Mother: University Degree	-0.113	0.000	-0.102	0.000
Aragón	-0.069	0.015	-0.050	0.028
Asturias	-0.055	0.186	-0.001	0.978
Baleares	-0.022	0.536	-0.018	0.525
Canarias	0.062	0.085	0.053	0.098
Cantabria	0.030	0.473	0.024	0.522
Castilla y León	-0.078	0.000	-0.059	0.000
Castilla-La Mancha	-0.019	0.564	-0.019	0.502
Cataluña	-0.080	0.001	-0.044	0.028
Com. Valenciana	-0.055	0.054	-0.038	0.106
Extremadura	-0.065	0.033	-0.033	0.199
Galicia	-0.045	0.184	-0.031	0.269
Madrid	-0.094	0.000	-0.062	0.003
Murcia	0.046	0.217	0.061	0.069
Navarra	-0.093	0.007	-0.070	0.010
País Vasco	-0.019	0.570	-0.012	0.667
La Rioja	-0.071	0.067	-0.057	0.067
Ceuta y Melilla	0.029	0.557	0.051	0.250
<b>N</b>	<b>5099</b>		<b>5099</b>	

A more detailed specification of the probability model would also take into account genetic factors that could affect children's weight. This implies using the restricted sample that includes information on parents' weight status. Parents' weight status may reflect the impact of genetics on the child's probability of being overweight or obese<sup>6</sup> Table 5 presents the estimated marginal effects when we run the regressions on the restricted sample, that is, the sample that allows us to proxy this genetic factor. In this case, the effect of maternal employment on the probability of children being overweight or obese is again positive and significant. Therefore, the inclusion of the (pseudo)genetic factor as an explanatory variable does not significantly alter the impact of maternal employment on children's probability of being overweight or obese.

**Table 5. Overweight and Obesity Determinants.  
Probit. Marginal Effects.**

	Overweight		Obesity	
	Coef.	P-valor	Coef.	P-valor
Children Sex	0.058	0.000	0.059	0.000
Children Age	0.025	0.002	0.007	0.220
Children Age^2	-0.002	0.000	-0.001	0.000
Mother: Works	0.032	0.016	0.025	0.012
Mother: Primary Education	-0.003	0.935	-0.013	0.587
Mother: Secondary Education	-0.042	0.187	-0.046	0.020
Mother: University Degree	-0.074	0.007	-0.057	0.000
Parents: Overweight	0.055	0.000	0.032	0.009
Parents: Obesity	0.095	0.000	0.064	0.000
Aragón	-0.055	0.030	-0.024	0.193
Asturias	-0.059	0.097	-0.010	0.715
Baleares	-0.023	0.486	-0.006	0.790
Canarias	0.072	0.048	0.054	0.064
Cantabria	0.038	0.347	0.034	0.286
Castilla y León	-0.059	0.002	-0.033	0.009
Castilla-La Mancha	-0.009	0.778	-0.003	0.887
Cataluña	-0.066	0.003	-0.030	0.053
Com. Valenciana	-0.050	0.051	-0.019	0.309
Extremadura	-0.053	0.052	-0.019	0.349
Galicia	-0.056	0.061	-0.022	0.303
Madrid	-0.073	0.002	-0.038	0.023
Murcia	0.046	0.207	0.057	0.055
Navarra	-0.086	0.004	-0.041	0.054
País Vasco	-0.004	0.897	0.009	0.721
La Rioja	-0.066	0.061	-0.033	0.186
Ceuta y Melilla	0.032	0.530	0.041	0.289
<b>N</b>	<b>4488</b>		<b>4488</b>	

<sup>6</sup> It could also be reflecting the fact that parents and children share the same life styles, habits and life conditions.

### *Testing the model*

At this point, we should remember that even in the case of identification of the effects of maternal employment on childhood overweight and obesity in this reduced-form setting, we can be facing a problem of simultaneity which could bias the parameters. The source of this bias could be that working mothers could indeed have some specific characteristics that would affect their children's health status, and it could make maternal employment to be endogenous.

Regarding this potential endogeneity problem there are two different possibilities. The first one considers the possibility that these set of specific characteristics of the working mothers were observable. In this case, these observed variables could be added to the set of explanatory variables considered above, and we reduce or eliminate the bias. When the variables are not observed, the proper procedure consists on testing the exogeneity of the maternal employment variable. In order to do that, we use the approach proposed by Rivers and Vuong (1988). This consist in a two-stage procedure where in the first step, we estimate a probit model on the probability of working, including as explanatory variables those for which we are confident about their exogeneity, i.e, mother characteristics (age, educational level, civil status), family characteristics (number of children, age of the little child) and environment conditionings (town size and region). From this regression, we obtain the generalized residuals as:

$$-\phi(x'\beta)/[1-\Phi(x'\beta)] \text{ in case the mother is working}$$

and

$$\phi(-x'\beta)/[1-\Phi(-x'\beta)] \text{ for non-working mothers}$$

where  $x$  is the vector of explanatory variables included in the participation equation.<sup>7</sup>

In the second step we estimate augmenting overweight and obesity discrete models including as an additional explanatory variable the generalized residuals fitted at the first stage. The t-statistic of the residuals constitutes a valid test for the exogeneity of the maternal employment variable. The null hypothesis of exogeneity of maternal employment can not be rejected in any of the specifications estimated.

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<sup>7</sup> For additional details see Chesher and Irish (1987).

#### 4. CONCLUSIONS AND TENTATIVE POLICY IMPLICATIONS

Obesity has become a common and very important problem in many countries of the world and particularly in Spain. For these reasons, searching for the determinants of obesity is a question of undoubtedly social importance. In this line, this paper investigates whether maternal employment has an impact on children's probability of being overweight or obese.

During the last two decades, the percentage of overweight and obese children in Spain has noticeably increased. In 2003, 25.5 percent of the children between 2 and 15 years old were overweight, from which the half (13.6 percent) were obese.

One factor that has been identified as a potential cause of the increase in obesity rates is maternal employment. Although physical activity and food intake are the direct causes of the increase in the prevalence of overweight and obese children, the fact that more mothers are working could have affected children's life habits which, in turn, affect children's probability of being overweight or obese.

The marginal effects of maternal employment on children's probability of being overweight or obese are positive and significant. This result has been shown to be persistent and robust to all considered specifications. Existence of biases in the estimated coefficients has been controlled for and rejected.

Further investigation would demand proper statistical information and suitable procedures, which would allow us to deep in the knowledge of the causal relationship between obesity and maternal employment and the mechanisms through which this effect takes place. The study of the mechanisms by which these effects take place would allow putting in practice suitable economic, health-care, educational, social and familiar policy measures trying to avoid the serious consequences derived from obesity.

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