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Bad times, slimmer children?*

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Abstract

In this paper we study the effect of business cycle conditions on infant underweight, overweight and obesity. We exploit 8 waves (1987-2012) of the Spanish National Health Survey for children aged 2-15 and use the regional unemployment rate of the trimester of the interview as a proxy for the business cycle phase at the local level. We find that an increase in the unemployment rate is associated with lower obesity incidence, especially for children under 6 years old and over 12 years old. Negative economic shocks also increase the prevalence of infant underweight, particularly for boys under 6 years old. Moreover, we show that one of the possible mechanism through which the cycle is impacting infant obesity is the nutritional composition of the children's diet, as well as, increases in the frequency of exercise. Although we show a deterioration in self-reported health for children under 6 years old, we provide some preliminary evidence that suggests that the impact of business cycle conditions on infant weight disorders have little objective health consequences in the short-run and do not persist in the medium-run.

Tiempos difíciles, ¿niños más delgados?

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La obesidad infantil y el sobrepeso son uno de los principales problemas de salud en muchos países industrializados, entre ellos España. De hecho, la Asociación Internacional para el Estudio de la Obesidad (IASO), estableció en 2011 que el 33% de los varones y el 23% de las niñas de 5 a 17 tienen sobrepeso en España. Estos porcentajes se encuentran entre los más altos de Europa. En este trabajo se estudia el efecto de las condiciones del ciclo económico sobre el bajo peso, sobrepeso y la obesidad de los niños de 2 a 15. Utilizamos 8 olas (1987-2012) de la Encuesta Nacional de Salud y usamos la tasa de desempleo regional del trimestre de la entrevista como un proxy de la fase del ciclo económico a nivel local.

Nuestro trabajo contribuye a la literatura sobre el efecto de las condiciones del ciclo económico sobre los trastornos de peso infantiles. Byron y Fertig (2012) es el único papel que ha analizado los efectos de las condiciones del ciclo económico sobre el peso de los niños estadounidenses en hogares con deuda. Nuestros resultados son consistentes con este trabajo previo ya que también encontramos que las tasas de desempleo más altas se asocian con un menor peso de los niños. Además extendemos el análisis en varias dimensiones ya que consideramos todos los hogares en su conjunto, utilizamos un periodo de tiempo mayor (desde 1987 hasta 2012) y consideramos los mecanismos de transmisión del ciclo al peso. Por último, se analizan las posibles consecuencias a corto plazo de estos trastornos de peso en la salud infantil y la posible persistencia de los efectos en el largo plazo.

Resultados

Encontramos que un aumento del 10 por ciento en la tasa de desempleo de la región donde vive el niño se asocia con una disminución en la probabilidad de ser obesos en 3,9 puntos porcentuales para los niños menores de 6 años de edad y en 2,5 puntos porcentuales para los niños de más de 12 años de edad. Más importante, encontramos que un aumento en la tasa de desempleo del 10%, aumenta la probabilidad de tener un peso por debajo de lo normal en 1,8 puntos porcentuales. Este efecto es mayor para los varones (2,3 puntos porcentuales) y niños menores de 6 años de edad (3,8 puntos porcentuales). Además encontramos los efectos sobre la obesidad y el bajo peso no difieren para los diferentes niveles de educación del cabeza de familia. Respecto a los mecanismos de transmisión, son la composición nutricional de la dieta de los niños (quizás más pobre en tiempos de crisis y la frecuencia del ejercicio físico.
Respecto a los efectos sobre la salud a corto plazo, no son muy importantes. De hecho solo encontramos un cierto deterioro del estado de salud autopercibido en los niños menores de 6 años, quizás derivado del aumento de la prevalencia de un peso bajo. En esta línea, no encontramos ninguna evidencia de persistencia de los efectos del ciclo en el tiempo en términos de mayor prevalencia altura reducida o aumento de la prevalencia de bajo peso en edades más avanzadas. Esto podría ser una posible explicación para no observar ninguna consecuencia importante para la salud del aumento de la prevalencia de desnutrición en niños menores de 6 años de edad.

Referencias:

Byron, S. and A. Fertig (2012). The effect of business cycles and parental indebtedness on childhood obesity.

1 Introduction

Infant overweight and obesity is one of the major health issues in many industrialized countries, including Spain. In fact, the International Association for the Study of Obesity (IASO) established in 2011 that 33% of boys and 23% of girls aged 5 to 17 are at least overweight in Spain. These percentages are even higher for boys and girls between 6 and 9 years old (50 and 42%, respectively). Thus, Spain is among one of the ten countries of the OECD with a higher prevalence of infant overweight, as can be observed in Figure 1. Moreover, as reported by Serrano et al. (2012), in 2011 the percentage of obese children increased by more than 5 percentage points for girls and 3 percentage points for boys if we compare it to 2006 values or by 10 percentage points for both genders if we compare it to1984 values (Bueno and Sarría (1985)).

The evolution of children's obesity rates represent an important public policy issue as a number of short-term adverse effects and risks have been associated with obesity in the early stages of life. For example, obese children have a greater risk of being teased, bullied and socially isolated. Moreover, overweight and obese children are more likely to stay obese into adulthood (Guo and Chumlea (1999)). Then, these children will have a higher probability of suffering certain chronic diseases later in life as cardiovascular diseases, type 2 diabetes and many cancers (colorectal, kidney and oesophageal cancer)[1]. These diseases normally referred to as noncommunicable diseases (NCDs), do not only cause premature mortality but also long-term morbidity, becoming, subsequently, a major public health and public finance concern. Furthermore, these weight disorders have been proved to lower school performance (Kaestner and Grossman (2009)) and affect long-run labour market outcomes (Cawley (2004)).

Recent literature has examined the impact of economic conditions on health and mortality rates. The pioneering work of Ruhm (2000), using fixed-effects models, found that health improves during temporal economic slowdowns. Ruhm's work showed that mortality is countercyclical and the cyclical variation is especially pronounced for males, employed persons and those of prime-working age (Ruhm (2003)). This same procyclicality of total mortality was found in other countries such as Germany (Neumayer (2004)), Spain (Granados (2005)), OECD countries (Gerdtham and Ruhm (2006)), France (Buchmueller, Grignon, and Jusot (Buchmueller et al.)), Pacific-Asian nations (Lin (2009)), Mexico (Gonzalez and Quast (2011)) or Canada

[1]For more information on the health consequences of obesity: Organization et al. (2015) or Müller-Riemenschneider et al. (2008).

(Ariizumi and Schirle (2012)). One common feature of all these studies, is that they mainly used data from before the 2000. The conclusions of studies that used data for recent years are less conclusive. Thus, these studies present evidence that in the last 10-15 years mortality has become less procyclical (Stevens et al. (2014)), countercyclical (Svensson (2007) and McInerney and Mellor (2012)) or unrelated to macroeconomic conditions (Ruhm (2013)). More specifically, for the case of Spain, Urbanos-Garrido and Lopez-Valcarcel (2014) use national microdata from the Spanish Health survey for the years 2006 and 2011-2012 and conclude that unemployment has a significant negative impact on self-reported health.

Focusing on the size of these effects for adults Ruhm (2005) showed, using US microdata form the Behavioural Risk Factor Surveillance System from 1987 to 2000, that a one percentage point increase in the state unemployment rate reduces body mass index (BMI) by 0.016 and lowers the probability of being underweight, overweight and obese by 0.06, 0.17 and 0.21 percentage points, respectively. The author shows that the decline in body weight is concentrated among severely obese individuals and among men, African Americans, and Hispanics. He also provides evidence that changes in lifestyles is one of the main reasons for the decrease in BMI during slumps. During bad economic conditions the opportunity cost of time decreases and is, thus, less costly to undertake health-producing activities such as exercise or homemade meals.

On the other hand, Böckerman et al. (2007) found that an improvement in the regional economic conditions in Finland, measured by employment rates, produced a decrease in BMI, contradicting the results reported for the US. Similar results were found in the US by Charles and DeCicca (2008) for African American men and those with low ex-ante employment probability. Similarly, Latif (2014) found that an increase in the unemployment rate in Canada, increases BMI and the probability of being severely obese. However, they didn't find any significant impact of the unemployment rate on the probability of being overweight or obese. Finally, Arkes (2009) obtained that teenage girls gained weight in weaker economic periods while boys gained weight in stronger economic periods.

The analysis of the relationship between business cycle and health has mainly been focusing on adults. As far as we are aware of, the only studies that exploit the impact of economic conditions and infant health have put their attention on the health of children at the time of delivery. Dehejia and Lleras-Muney (2004), using US birth certificate data from 1975 onward, found

that babies conceived in times of high unemployment have better health outcomes at birth (such as more birth-weight or lower neonatal and post neonatal mortality). Part of these results can be attributed to a selection effect, as the "worse" mothers seem to opt out of fertility. Additionally, their results indicate that part of this association comes too from the improvement of health-related behaviours when unemployment is high. However, the literature has also found opposite conclusions for other countries such as India (Bhalotra (2010)), Argentina (Bozzoli and Quintana-Domeque (2014)) or no significant results for Sweden (van den Berg and Modin (2013)). For the case of Spain, Aparicio and González (2014) found similar results to those of the US; new-borns health improves when the local unemployment rate is high. They provide evidence to show that the main mechanism is not selection but the engagement in healthier behaviours during recessions.

Most of the research on infant overweight and obesity has been centred on the association between child obesity and female unemployment (von Hinke Kessler Scholder (2008)) or in the impact of the intergenerational transmission of parental influence on infant obesity (Costa-Font and Gil (2013)). Yet, the majority of the research connecting recessions with body-weight has focused on adults or babies, as revised above. The only exception that we are aware of is Byron and Fertig (2012). In this paper, the authors examine how business cycle conditions affect infant obesity in the US. They find that a higher unemployment rate is associated with lower weight for children in households with debt as the probability of these children practising exercise increases. However, they only use three waves of the Child Development Supplement of the Panel Study of Income Dynamics (1997, 2002 and 2007). Thus, given that the period analysed is only measured at three points in time, it might be the case that the instability over time is poorly measured, as suggested by Ruhm (2013).

Thus, the aim of this paper is to move this scarce literature one step forward by studying the effect of business cycle conditions on infant underweight, overweight and obesity. In order to do that, we exploit 8 waves (1987-2012) of the Spanish National Health Survey, a nationwide cross-section survey that collects health information of adults and minors. We concentrate on children between the ages of 2 and 15 years old. Our identification strategy takes advantage of the variation in the unemployment rate across regions and survey years, using the regional unemployment rate of the trimester of the interview as a proxy for the business cycle phase at the local level.

We find that an increase in the unemployment rate is associated with a lower probability of being obese for children under 6 years old and over 12 years old. Moreover, temporary negative economic conditions also increase the probability of infant underweight, especially for boys and children under 6 years old. Furthermore, we also examine the possible channels through which the cycle could be impacting infant underweight and obesity. We show that some of the possible mechanisms are the nutritional composition of children's diet as well as the frequency of exercise.

However, we also report little short-run consequences of the incidence of weight disorders in that early stage of life. In fact, we only observe one objective health consequence of the decrease in the prevalence of obesity on children with more than 12 years old, which is a significant increase in the probability of suffering from asthma. We do not observe other objective health consequences of the increase in the prevalence of underweight for children with less than 6 years old but we do find a significant deterioration in subjective self-assessed health for children in this age bracket. This last effect could be attributed to the increase in the probability of suffering underweight for children in this age bracket. However, we provide evidence that suggests that the effect of business cycle conditions on children's weight does not persist in the medium-run.

2 Effect of business cycles on infant weight

2.1 Descriptive evidence

We first proceed with the estimation of the effect of the business cycle phase on infant obesity, overweight and underweight. We proxy the business cycle phase at the local level with the unemployment rate of the trimester of the interview and the region where children reside.

For these estimations, we use 8 waves (1987-2012) of the Spanish National Health Survey. This is a nationwide cross-sectional survey that collects health related information as well as the socio-economic status of children (up to 15 years old) and adults. The pooled sample con-

tains 37,562 observations of children between the ages of 2 and 15 years old [2].

Adults are universally considered obese, overweight or underweight if they have a Body Mass Index (BMI)[3] of more than 30 kg/m2 , 25 kg/m2 or less of 18.5 kg/m2, respectively. However, for children there does not exist a universal measure as this measure depends on the age and gender of the child. Therefore, we apply two of the most used methods in the literature to measure childhood obesity, overweight and underweight.

We first apply the BMI cut-off points for children aged 2-18 years old calculated by Cole et al. (2000) (infant overweight and obesity) and Cole et al. (2007) (infant underweight). This is normally considered as the worldwide reference for infant overweight, obesity and underweight. The authors in these papers used data for six countries (Brazil, Great Britain, Hong Kong, the Netherlands, Singapore, and the United States) and calculated the centile curves such that, at age 18, passed through the cut off points of 25, 30 and 18.5 kg/m2 (that are considered as the adult overweight, obesity and underweight thresholds respectively). Then, the specific cut off points for children between 2 and 18 years old were provided averaging the centile curves. As a robustness check [4], we have also experimented with the BMI cut-off points corresponding to the 97th (for obesity), 85th (for overweight), 3th (for underweight) centiles that were calculated specifically for the Spanish children population (specified in the "Orbegozo Foundations' tables", Sobradillo and Eizaguirre (2004)) and results remain substantially the same.

The first potential problem that we encounter in our database is that, around 16% of the children do not report either height or weight. In this case, we follow Costa-Font and Gil (2013) and take advantage of another survey question that asks the following question: "in relationship with his/her height, would you say that the weight of the child is: significantly greater than normal, somewhat greater than normal, normal, or less than normal ". We can then assume that a child is obese if he/she is reported as having a weight significantly greater than normal; overweight if he/she is reported as having a weight somewhat greater than normal; and underweight if he/she is reported as having a weight less than normal[5].

[2]We deliberately eliminate all children below 2 as some of the measures of infant obesity, overweight and underweight that we will use only consider children that are between 2 and 18 years old.

[3]The BMI is calculated dividing the weight in kilograms by the height in squared meters.

[4]results only by request

[5]The results go in the same direction if, instead, we exclude from the analysis those children whose height

Following previous literature, we have reasons to believe that the children's weight will depend on the level of education of their family. Thus, we divide the educational level of the head of the family into low, middle and high education. We consider that a head of the family has low education if they have only completed the compulsory years of schooling. Middle education corresponds to the case where the head of the family reports having a maximum level of education of either high school (bachillerato) or some basic professional studies (FP de grado medio). Finally, high education corresponds to children whose head of the household reports having at least some university studies or advanced professional studies. We can observe from Figure 2 that the distribution of the children's BMI is shifted to the right the lower the education of the head of the household is. This goes in line with what is found in previous literature, where the prevalence of infant obesity and overweight is more common among low educated households (see for instance, Lamerz et al. (2005)).

We use the unemployment rate (in trimesters) of the region (Comunidad Autónoma) of residence of the child at the moment of the interview as proxy for the business cycle phase at the local level. The unemployment rate for each region and time is obtained from the Spanish Labour Force Survey (Encuesta de Poblacion Activa, EPA). When information about the trimester of the interviews is not available, we take the average unemployment rate of the four trimesters where all interviews of the survey took place [6].

We can observe in Figure 3 that the evolution of the percentage of children that is obese at the national level seems to be pro-cyclical over time, as it goes in the opposite direction of the evolution of the unemployment rate at the national level. We can also notice that the prevalence of obesity is greater for younger children; around 15 to 25% of the children between 2 and 6 years old suffer from obesity. On the other hand, only around 2.5% of children over 12 years old are obese. Moreover, we can also see that obesity for children under 6 years old seems to be more responsive to changes in the local unemployment rate than the older groups of children. For the evolution of infant overweight, we observe in Figure 4 a very similar pattern than the one

and weight is not reported. However, the results on obesity for children with less than 6 years old loose statistical significance and the magnitude of the results for underweight is slightly reduced.

[6] This happens in the surveys of 2006/2007 and 2011/2012 . For the survey that took place in 2006, we take the mean unemployment rate of the third and fourth trimester of 2006. For the survey of 2007, the mean unemployment rate of the first and second trimester of 2007. Finally, for the surveys that took place during 2011/2012, we take the mean unemployment of the third and fourth trimesters of 2011 and the first and second trimesters of 2012.

described above for obesity. Although for all age groups the evolution of overweight follows the same pattern as the pattern for obesity, the incidence of overweight is greater than the incidence of obesity for a given unemployment rate level. Finally, we can observe the same age gradient for overweight than the one observed for obesity: that is, around 30% of children under 6 and between 7 and 12 years old are overweight, while only 15% of children over 12 years old are overweight.

On the other hand, infant underweight seems to show a different behaviour with respect to changes in business cycle conditions: infant underweight seems to be counter-cyclical, instead of pro-cyclical, as the evolution of the percentage of children that are underweight at the national level goes in the same direction as the evolution of the unemployment rate (Figure 5). In addition, the procyclicality seems to be greater for younger children as, for instance, the percentage of underweight children almost doubled during the last recession. Also, the incidence of underweight is much lower than the incidence of overweight or obesity, where only around 2 to 6% of children are underweight in Spain during our sample period.

2.2 Econometric specification

We use as identification strategy a fixed effect model where we take advantage of the variation in the unemployment rate across regions and survey years. More specifically, the econometric model that we use is:

$$Y_{ijt} = \alpha + \beta_1 UR_{jt} + X_{ijt}\beta_2 + \delta_j + \gamma_t + Trend_{jt} + \epsilon_{ijt}$$

where Y_{ijt} is one of the outcomes of weight disorders (BMI, obesity, overweight or underweight) for child i living in region j interviewed in the trimester and year t, X_{ijt} a vector of individual characteristics (age, gender, education of the head of the family and size of the municipality), UR_{jt} the unemployment rate in region j in the trimester and year t, δ_j and γ_t are the region and time fixed effects. Finally we also add region specific time trends $Trend_{jt}$ to control for shocks that are specific to each of the included regions. The fixed effects control for the unobserved characteristics that can influence any of these weight disorders outcomes that are associated with the region and the survey year where they are measured. The effect of the

unemployment rate on the weight disorders will be identified by β_1. We cluster the standard errors by region. Additionally, following Lindo (2015) we allow shocks to be correlated across regions in a given year by including standard errors double clustered by region and year of the interview. In fact, two-way clustering, defined as in Cameron et al. (2011), on regions and years tends to yield larger standard error estimates than just clustering at the region level. For convenience, we report both standard errors in our tables.

We will also check for the heterogeneous effects of business cycle conditions on children of different genders, ages and levels of education of the head of the family. We divide children from 2 to 6 years old, between 7 and 12 and between 13 and 15 years old. The first division is due to the fact that children enter the compulsory educational system at the age of 6/7. We hypothesize that the fact of going to school can change the behaviour of the child towards food and exercise, as these two factors will no longer depend entirely on his/her family. The threshold at age 12 is chosen because the medical literature states that puberty starts around the age of 12/13. As puberty is characterized by some morphologic changes in size, shape, composition, and functioning of the body, we believe that these changes can ultimately affect the relationship between height and weight of the children.

We also divide the educational level of the head of the family[7] of the children into low, middle and high education. We consider that a head of the family has low education if they have only completed the compulsory years of schooling, middle education if the maximum level of education is high school (bachillerato) or if the head of the household has done some basic professional studies (FP de grado medio). Finally, high education is defined as having at least some university studies or advanced professional studies. In some of the regressions we also include interactions of the unemployment rate with the education of the head of the family to analyse whether the effect of business cycle conditions is greater for children within households of different background.

[7]Head of the family is defined as the person that earns the higher percentage of total income of the household. It is a self-reported variable.

2.3 Results

Before analysing the results of our variable of interest, we can observe in Tables 1 to 4 that the covariates that we include as controls in our econometric specification have the expected sign. Boys normally have a higher weight than girls and have also a higher probability of being obese and overweight. Also, children that live in households where the head of the family has middle or high education have a lower probability of suffering from overweight, obesity or underweight. On the other hand, age seems to have a differential impact to each of the weight disorders. The incidence of overweight follows an inverted u-shape function of age while obesity decreases for older children. Underweight follows a u-shape function of age. Finally, the size of the municipality where children live do not play a significant role on the probability of suffering any of the weight disorders.

Regarding the impact of our variable of interest, business cycle conditions, on weight disorders we can observe from Table 1 and 2 that BMI and the probability of suffering from overweight do not seem to be significantly affected by business cycle variations. However, an increase in the unemployment rate does significantly decrease the probability of being obese, as we can observe in Table 3. This effect is only significant for children under 6 years old and for those with more than 12 years old. More specifically, a 10% increase in the unemployment rate of the region where the child lives, decreases the probability of suffering obesity by 3.9 percentage points for children under 6 years old and by 2.5 percentage points for children with more than 12 years old. As can be seen by the interaction variables of education and gender, there are no differential effects of business cycle conditions for different levels of education of the household's head or for the sex of the children.

In order to know if an increase in the local unemployment rate shifts the entire weight distribution to the left or, instead, increases its tails, we examine the effect of unemployment on the probability of being underweight. In Table 4 we can observe that an increase in the unemployment rate of 10%, decreases the probability of being underweight by 1.8 percentage points. This effect is higher for boys (2.3 percentage points) as well as for children under 6 years old (3.8 percentage points).

To sum up, an increase in the unemployment rate shifts the entire weight distribution to the left, decreasing the probability of suffering obesity and overweight but increasing the probability of

being underweight for children under 6 years old and children over 12 years old. The decrease in the probability of being obese is significant for both groups of children whereas the increase in the probability of being underweight is only significant for children under 6 years old.

Caloric intake and sedentary lifestyle are traditionally thought to play very important roles in children's risk for building up unhealthy weight. Thus, in the following section, we try to disentangle the possible channels through which the unemployment rate is affecting these weight disorders by analysing the effect of business cycle conditions on nutritional composition of the children's diet as well as on the probability of practising exercise. Finally, we also examine the possible health consequences in the short and medium-run of these infant weight disorders.

3 Channels

In this section we try to disentangle the different channels through which business cycle conditions could be affecting infant obesity and underweight.

First, we analyse the extent to which business cycle conditions affect the probability of having a more active leisure. We do that by looking at the effect of the unemployment rate on the probability of exercising on a monthly basis and watching television on a daily basis. We can observe from the first two panels of Table 5, that an increase in the local unemployment rate increases the probability of all children, regardless of their age, of exercising monthly. On the other hand, the probability of watching television daily is only affected for children between 7 and 12 years old. Therefore, it seems that, as suggested in the previous literature for adults, an increase in the unemployment rate decreases the opportunity cost of active leisure. The results for children between 7 and 12 are less clear as they exercise more but also watch more television in bad economic times. This result is consistent, however, with the result reported in the previous section of weight disorders not being significantly affected by business cycle conditions for children between 7 and 12 years old.

The second possible determinant of weight disorders is nutrition. We investigate the effect of business cycle conditions on the probability of following a Mediterranean Diet or having, what we consider, bad dietary habits. Following Costa-Font and Gil (2013) we created a variable that

defines a Mediterranean Diet. We consider that children follow a Mediterranean Diet if they consume fruits, vegetables and pasta everyday, legumes and fish at least four times a week and meat not everyday. Panel 3 of Table 5 shows that an increase in the local unemployment rate increases the probability of having good dietary habits such as consuming fruit daily. However, we also find that an increase in the local unemployment rate induces a decrease in the probability of following a Mediterranean Diet, which has typically been considered by nutritionists as one of the healthiest dietary options. More worryingly, this negative results is significant for younger children under 6 years old. On the other hand, we can see in panel 5 and 6 of Table 5 that there is no effect of business cycle conditions on the probability of having sweets daily or on the probability of consuming cold meat daily, which, on a daily basis, can be considered as bad dietary habits.

The Aladino study ("Estudio Aladino"), developed in 2013, highlights the influence of breakfast on the incidence of overweight and obesity. Thus, following this study, we analyse the effect of the unemployment rate on the probability of having some protein for breakfast as well as on the probability of not having breakfast at all. We can observe in Panel 7 and 8 of Table 5 that for children between 7 and 12 years old the increase in the unemployment rate decreases the probability of having some kind of protein for breakfast. The questionnaires define protein as the consumption of eggs, cheese, ham or similar products. On the other hand, the probability of not having breakfast does not seem to be affected by the business cycle.

Therefore, we have shown in this section that one of the potential mechanisms through which business cycle conditions are affecting infant obesity is nutrition and changes in the frequency of exercise. Children under 6 years old and those that have more than 12 years old increase the probability of exercising during bad economic times. Furthermore, they also present an improvement in their nutritional habits during high unemployment temporary shocks by increasing the consumption of fruits. However, we also find that children under six years old decrease the probability of following a Mediterranean diet during negative local economic shocks. This negative impact of business cycle conditions for children under 6 years old, coupled with the finding of an increase in the probability of being underweight for this age group (reported in the previous section), may potentially have longer-run consequences on the development of this very young group of children.

4 Health consequences of changes in obesity

4.1 Short-run

Although the majority of the health consequences of obesity, overweight and underweight should manifest later in life, during adulthood, we examine whether the decrease in the probability of suffering obesity and the increase in the probability of suffering underweight have any short-run effects on children's health. Thus, we analyse the effect of the unemployment rate on some subjective and objective self-reported measures of infant health. As the health consequences of weight disorders may be manifested with some delay, in this specifications we additionally include a lag of the unemployment rate of the region (the same trimester of previous year)[8].

We begin our analysis by studying whether business cycle conditions have a direct effect on subjective self-reported health of these children. In Panel 1 of Table 6 we can observe that an increase in the local unemployment rate decreases the probability that children under 6 years old self-report having good health. This could be related to the fact that this same age group showed a significant increase in the probability of being underweight during times of high unemployment rate. Thus, for children under 6 years old, an increase of 10% in the local unemployment rate increases the probability of reporting being in bad health by 8.1 percentage points. Note also that the negative effect comes from the current unemployment rate while the lag unemployment rate does not show a significant coefficient.

We next use some of the questions of the Survey on general health to analyze the incidence of business cycle conditions on more objective measures of health such as suffering from a specific diseases/illnesses in the last 12 months[9]. In Table 6, we do not observe any impact of the cycle on the probability that children suffer from diabetes or metabolic/endocrinal diseases at any age[10]. The only diseases that seems to be affected by the economic conditions at the local level is the probability of suffering from asthma, which increases for children under 6 years old and

[8] In addition, the survey asks for the health status of the children in the 12 months prior to the interview, which provides more support to the argument of including a lag value for the unemployment rate.

[9] The metabolic or endocrinal disease is only reported in five out of the eight waves of the Survey, from 1993 to 2003, which explains the reduction in the number of observations.

[10] Some of other diseases that we checked and for which we did not find any impact are psychological problems, influenza, pharyngitis, sinusitis, otitis, problems with the articulations, vomit, convulsions, fractures, eye or ear diseases, circulatory, respiratory, neurological or digestive problem, blood related diseases and skin diseases.

decreases for children with more than 12 years old when the local unemployment rate increases.

To sum up, we do find a deterioration of self-reported health for children under 6 years old in bad economic times which is consistent with the increase in the probability of being underweight being significant only for this age group. However, apart from this subjective measure of health, we find little evidence of short-term consequences on the incidence of diseases and illnesses from negative shocks.

4.2 Long-run

In the preceding analysis, we find that negative economic shocks increase the probability of being underweight, especially for children under 6 years old, and decrease the probability of being obese for children in the same age group as well as for children with more than 12 years old. However, in terms of short-term health consequences of the increase in the probability of being underweight for children under 6 years old we only observe an increase in the probability of reporting bad health while none of the outcomes that capture diseases and illnesses are significant.

Thus, in this section, we try to understand whether the lack of short-term effects is due to the fact that the increase in underweight represents just a temporary impact and does not persist over time. In order to test for the existence of persistence over time, we analyse the effect of the (mean) local unemployment rate experienced by children when they were between 2 and 6 years old on the probability of being underweight at an older age. We can see in Table 7 that the impact of the (mean) unemployment rate when the child was aged 2 to 6 years old is positive but not significant for children between 7 and 12 years old and again positive (although smaller) and insignificant for children over 12 years old. These results seem to confirm that the effect of business cycle conditions on underweight is only temporary and does not persist over time. In turn, these results are also consistent with the reported inexistence of a link between business cycle conditions and the incidence of diseases and illnesses.

An alternative way of analysing the existence of long-term effects of business cycle conditions on children's future development is by looking at the impact on height of this children. It can be argued that any impact on height will have more permanent consequences and is less reversible than any impact on weight. Thus, we analyse the effect of business cycle conditions on the

probability that children have a height lower than the height that corresponds to the lowest 3rd centile of the population (at each age). For this analysis we use the height cut-off points that were calculated specifically for the Spanish children population and are specified in the "Orbegozo Foundations' tables" (Sobradillo and Eizaguirre (2004)) given that The International Obesity Task Force do not report these height cut-off points. In Panel 1 of Table 8 we can observe that the unemployment rate at the moment of the interview does not have any significant impact on the probability that the child has a height lower than that corresponding to the 3rd centile of the population. As it can be argued that the impact of business cycle conditions on children's height may take time to manifest, we also include in the regression one lag of the unemployment rate (unemployment rate one year before the interview). We can see in Panel 2 that there is still no significant effect on height for any of the age groups analysed.

Thus, we can conclude that one potential explanation of the inexistence of an effect of underweight on objective measures of children's health (incidence of diseases and illnesses) is the temporary nature of the increase in the probability of being underweight, which does not persist in the long-run.

5 Robustness checks

5.1 Migration

In this section we aim to discuss the possible implications of the presence of external (from outside Spain) as well as internal (from other regions of Spain) migration in our previous results.

We begin the analysis by focusing on external migration. Although in Spain this type of migratory flows were relatively small before the 2000s, the country received a massive migratory inflow from the beginning of the 2000s. Migrants from outside Spain represented around 1.4% of the total domestic population from 2000 to 2007 and around 1.2% in the period 2008-2010[11]. With respect to this type of migration, the literature has shown evidence of the presence of a "healthy immigrant effect" which is the positive health advantage of recent immigrants with respect to both the average individual in the sending country as well as the local population in the

[11] Source: Izquierdo et al. (2015).

host country. One of the most important explanations of this effect is immigrant self-selection, for which only the healthiest and wealthiest individuals have financial and physical possibilities to migrate[12]. Our database includes information on immigrants that reside in Spain at the moment of the interview only from 2003 onwards. Thus, we can check the robustness of our results to the inclusion/exclusion of immigrant children[13].

Overall, we can see in Table 9 that our results hold when we exclude from the analysis children that do not have Spanish nationality. However, there are a number of differences worth mentioning; the decrease in BMI as well as the probability of being overweight and obese seems to be stronger while the increase in the probability of being underweight seems to be smaller when we exclude immigrant children. This result provides some evidence pointing to the fact that business cycle conditions may be impacting differently native and immigrant children. In order to explore this possibility in more detail, we repeat the analysis but with a sample that includes only immigrant children. Table 10 shows that the coefficient that captures the unemployment rate of the region becomes positive and significant for the regression of BMI, the probability of being overweight and the probability of being obese. Thus, it seems that an increase in the unemployment rate of the region increases the probability of being overweight (obese) by 3.02 (1.55) percentage points for immigrant children. In a similar way, we find that an increase in one percentage points in the unemployment rate increases the probability of being underweight by 2.97 percentage points for immigrant children under 6 years old. Thus, although we cannot rule out that sample selection issues drive these results of the effect of business cycle conditions on immigrant children, preliminary evidence seems to suggest that business cycle conditions have a stronger (and opposite) effect on immigrant than on native children.

We now move the focus of our analysis to the second type of migration; internal migration. It could be plausibly argued that our results could also be threatened by the existence of interregional migration of children aged 2 to 15 years old. As far as we expect children that migrate to be different from children that stay, this migration between Spanish regions could be potentially biasing our results. However, the direction of this potential bias is less clear.

[12]Some of the papers that found this positive selection are: CHIQUIAR and HANSON (2005), McKenzie and Rapoport (2010), Orrenius and Zavodny (2005), Chiswick (1999) Belot and Hatton (2012) and Farré (2013)

[13]Note that before 2003 our database only contains Spanish children as the survey is not administered to immigrant families.

Unfortunately, the database does not include data on the region of birth of the children interviewed. Thus, in order to assess the extent to which internal migration could be affecting our results, we use data from the Spanish Statistics of Residential Variation[14] , which is available from the National Institute of Statistics. Figure 6 plots the percentage of children aged 2-15 that moved from one Spanish region to another from 1986 to 2012 together with the unemployment rate (at the national level) during that period. We can see that less than 1.5% of children in that age bracket moved between Spanish regions in the 1990s and 2000s. Even if the flow of interregional migration was very small during those years, we cannot rule out that these flows are correlated with business cycle conditions. In fact, Table 11 shows that, even if the current unemployment rate is not significantly correlated with the percentage of children that migrate between regions, the lag of the unemployment rate is.

In order to address this concern we estimate the same models separately for regions in which the net internal migration is low and those with higher internal migration flows. We define regions with lower (higher) internal migration as those with a lower (higher) percentage of children between 2 and 15 years old who enter and leave the region from 1986 to 2012. Table 12 shows the results of the models for the regions with low internal migration[15]. We can see that the only difference with respect to our baseline results is that the coefficient of the unemployment rate is no longer significant for the probability of being obese for children under 6 years old and above 12 years old. On the other hand, the results on underweight are very similar to the baseline results. When we look at the results for regions with a higher value of internal migrations[16]), Table 13 shows that the effect of business cycle conditions on the probability of being underweight for children under 6 years old is now much stronger. This result is consistent with the "healthy immigrant effect" as, if the unemployment rate of the region increases, the "healthiest" individuals will migrate to another region and individuals with "worst" health will remain in the affected region. Thus, this is consistent with an increase in the probability of being underweight for children that stay in the region.

[14]Estadísitica de Variaciones Residenciales

[15]These regions are: Cataluña, Galicia, Andalucía, País Vasco and Comunidad Valenciana.

[16]These regions are: Baleares, Castilla- La Mancha, La Rioja, Extremadura, Cantabria and Madrid.

5.2 Level of aggregation

When analysing the relationship between economic conditions and health there are several levels of geographic aggregation that can be considered. As explained in Lindo (2015), the level of aggregation used will influence the interpretation of the results. For instance, the mechanism through which economic conditions are influencing weight disorders will depend on the level of geographic aggregation that is used in the analysis. While some analyses that use more disaggregated proxies of economic conditions normally offer more precise estimates, as they are exploiting the variation in the economic conditions of the particular area, they are also more subject to measurement errors in their economic indicators. One of the major problems with the choice between different levels of geographic aggregation is migration. As we have shown above, for the Spanish case migration proves to be influenced by economic conditions. If, moreover, the types of immigrants that are more influenced by temporal shocks in the economy are more educated and healthy individuals, then, the estimated improvements in health will be underestimated during recessions if we are using a more disaggregated measure of economic conditions. In our analysis we have chosen to use regions (Autonomous Communities) as the level of aggregation but there exists lower entities (such as provinces) that could be used for the analysis. A final concern from using provinces instead of regions is given by the potential movement of household's head between provinces in order to work. Thus,, it could be the case that some of the parents of the children that live in one of the provinces commute to work to another province of the same region. In this case these children, although living in one province, will be more influenced by the unemployment rate of the province where their parents work.

Although for the reasons given above we prefer to model the business cycle at the regional level (instead than at the province level), as a further robustness check we follow Lindo (2015) and examine the effect of the business cycle on the different weight disorders using the unemployment rate at the level of the province.. We can see in Table 14 that, even though the effects of the unemployment rate in the province on BMI or the different weight disorder measures (obesity, overweight and underweight) follow the same direction than our baseline results (in which the business cycle was proxied with the unemployment rate at the region level), the estimated effects are smaller than the ones using a more aggregated measure. This reduction in the coefficient is driven by the spillovers across provinces of the same region. In order to understand why the estimated effects of province economic conditions are smaller than the estimated effects of regional economic conditions, we simultaneously consider both the effect of the unemploy-

ment rate at the province of the child's residence as well as the mean unemployment rate of the provinces that belong to the same region. Finally, we have reasons to believe that the level of education of the head of the household can affect the probability that this child is influenced by the unemployment rate of other provinces of the same region. For instance, low educated individuals might be more influenced by the provincial unemployment rate and may be more likely to be forced to commute to other province to work. Thus, we separate our analysis into children with heads of households with low, middle and high education. We can see in Table 15 that the mean unemployment rate of the surrounding provinces is significantly related to the children's probability of suffering from weight disorder. This results is especially important for children whose household head has a low and middle level of education. Thus, we confirm the existence of spillovers effects across provinces of the same region in the effects of economic conditions on infant weight disorders.

Therefore, as the estimated effects of the regional economic conditions on infant weight disorders include all the spillovers effects across provinces of the same region, we prefer the results obtained with the measure of economic conditions aggregated at the regional level.

6 Conclusion

Infant overweight and obesity is one of the major health issues in many industrialized countries, including Spain. In fact, the International Association for the Study of Obesity (IASO) established in 2011 that 33% of boys and 23% of girls aged 5 to 17 are overweight in Spain. These percentages are among the highest in Europe. In this paper we have analysed the effect of business cycles conditions on the probability of children being underweight, overweight and obese. We exploit the 8 waves (1987-2012) of the Spanish National Health Survey, a nationwide cross-section survey that collects health information of adults and minors. We use a fixed effect model where our variable of interest is the regional unemployment rate, which is a proxy that captures the business cycle phase at the local level.

We find that a 10 percent increase in the unemployment rate of the region where the child lives is associated with a decrease in the probability of being obese by 3.9 percentage points for children under 6 years old and by 2.5 percentage points for children of more than 12 years old. In

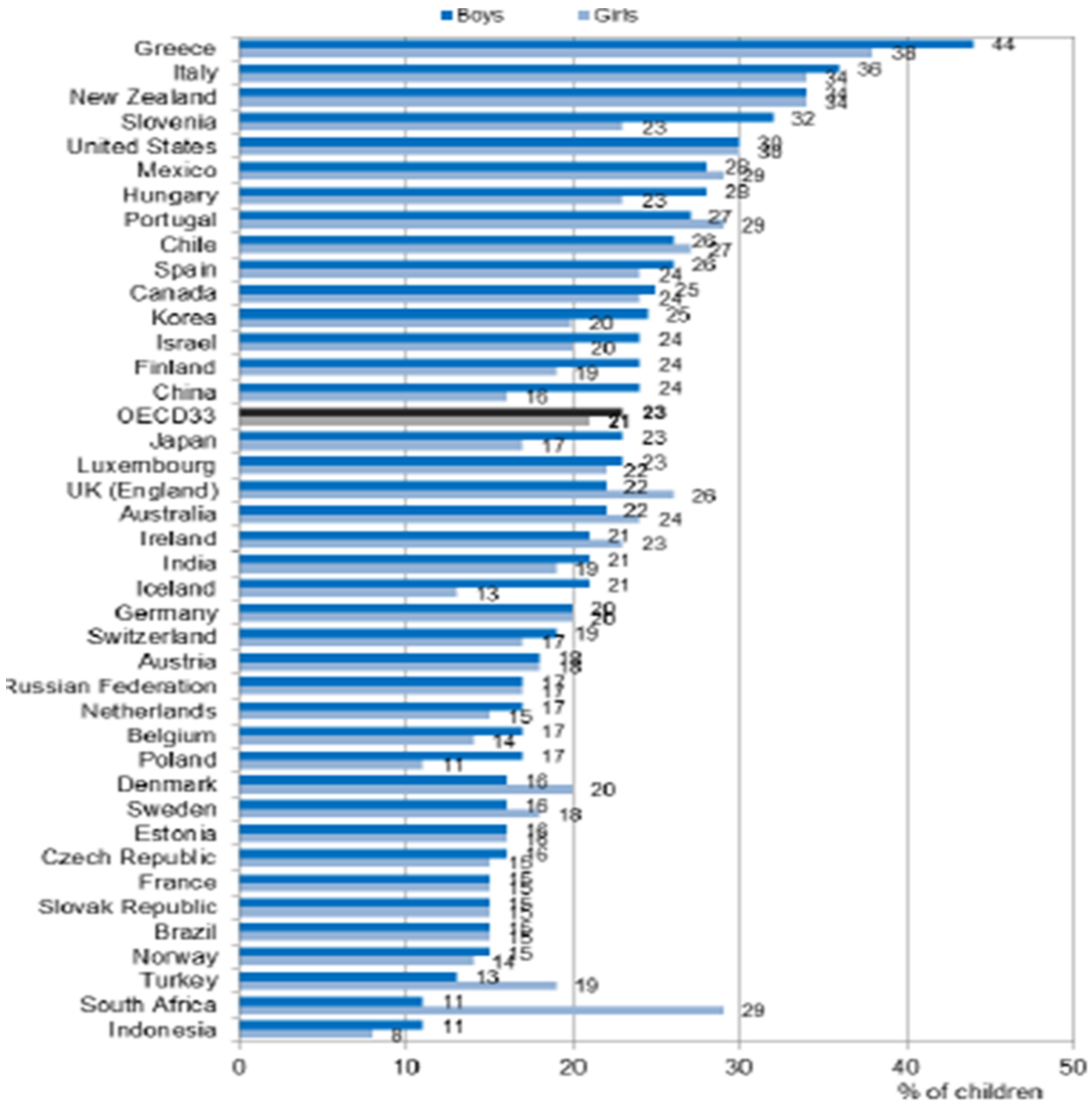
addition, we also find that an increase in the unemployment rate of 10%, increases the probability of being underweight by 1.8 percentage points. This effect is higher for boys (2.3 percentage points) and children under 6 years old (3.8 percentage points). Finally, the effects on obesity and underweight do not differ for different levels of education of the head of the household.

One possible mechanism through which the business cycle is impacting infant underweight and obesity is the nutritional composition of the children's diet and the probability of doing some kind of exercise. Furthermore, although we do report an increase in bad self-assessed health for children under 6 years old (which is consistent with the increase in the probability of suffering underweight for this age group) we find little impact of business cycle conditions on objective health consequences (incidence of diseases/illnesses). In fact, we only observe a (differential) impact on the probability of suffering from asthma for children under 6 years old (increase) and for children over 12 years old (decrease). Finally, when analysing the long-run persistence of these weight disorder effects, we find no evidence of persistence over time in terms of reduced height or increased underweight at older ages. This might be (at least) one potential explanation for not observing any major health consequences of the increase in the prevalence of underweight for children under 6 years old.

Our paper contributes to the literature on the effect of business cycle conditions on infant weight disorders. As far as we are aware of, Byron and Fertig (2012) is the only paper that has analysed the effects of business cycle conditions on weight for US children in households with debt. Our results are consistent with this previous work as we also find that higher unemployment rates are associated with lower weight for children. However, we extent the previous work of Byron and Fertig (2012) in several dimensions that provide additional new findings. First, we generalize the effects for all households, not focusing only on those households with debt. Second, we use a longer time span (1987-2012) and we extend the analysis of the mechanisms. Finally, we analyse the possible short-term consequences of these weight disorders on children's health and the possible persistence of the effects over the longer run.

7 Tables and Figures

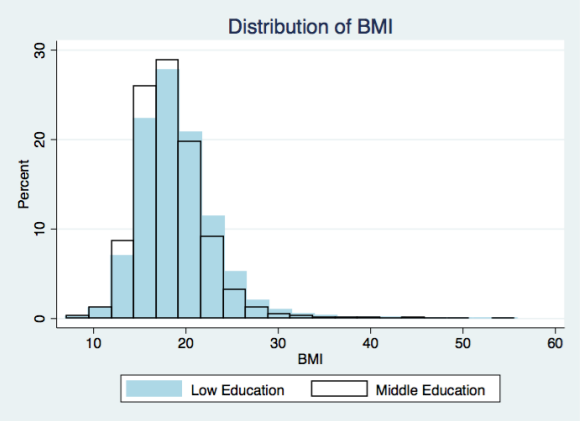
Figure 1: Prevalence of infant overweight (5-17 years old) among all OCDE countries



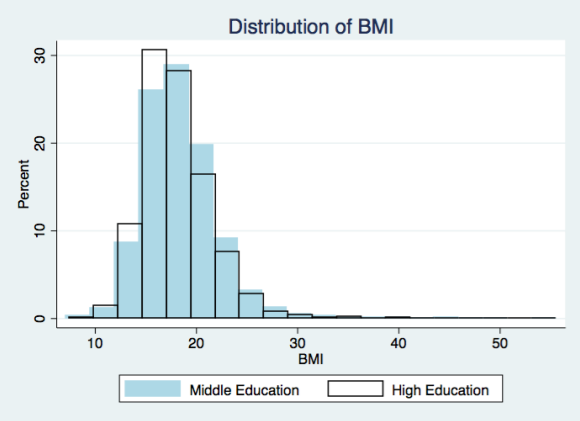
Note: Percentage of total boys and girls between 5 and 17 years old that are at least overweight (including obesity) in all the OCDE countries in 2010 or nearest year.

Source: International Association for the Study of Obesity (2013); Bös et al. (2004), Universität Karlsruhe and Ministères de l'Education nationale et de la Santé for Luxemburg and KNHANES 2011 for Korea.

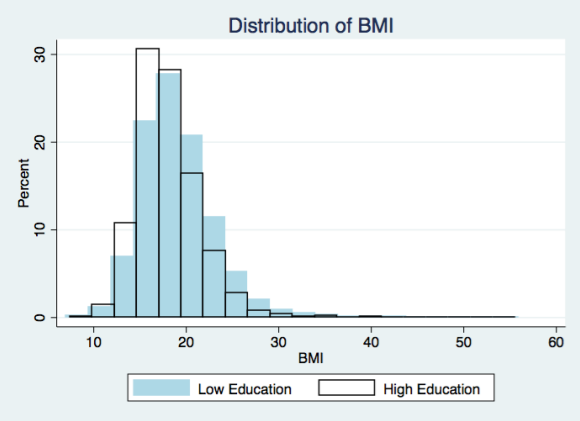
Figure 2: Graphical representation the distribution of BMI of the children by level of education of the head of their household



(a) Low Education vs. Middle Education



(b) Middle Education vs. High Education

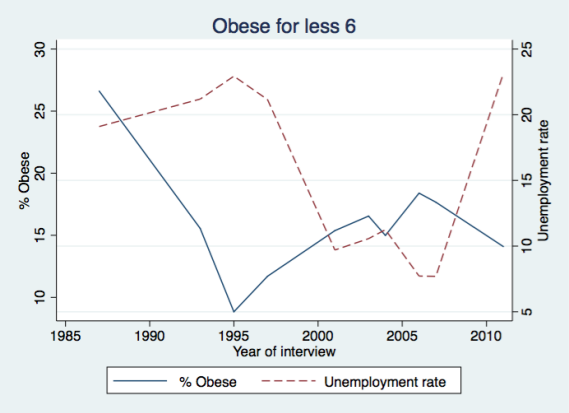


(c) Low Education vs. High Education

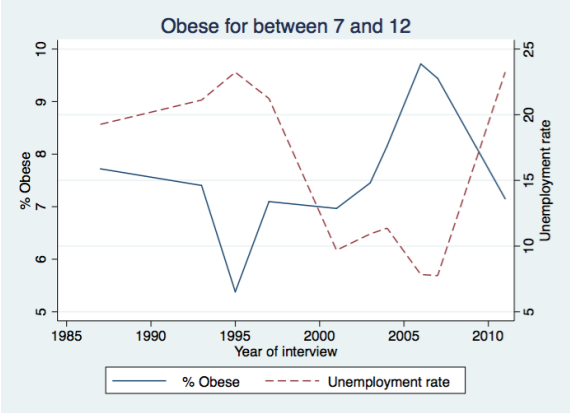
Note: We divide the educational level of the head of the family of the children into low, middle and high education. We consider that a head of the family has low education if they have only completed the compulsory years of schooling, middle education if the maximum level of education is high school (bachillerato) or have done some basic professional studies (FP de grado medio) and high education is they have at least some university studies or advanced professional studies.

Source: Spanish National Health Survey (1987-2012)

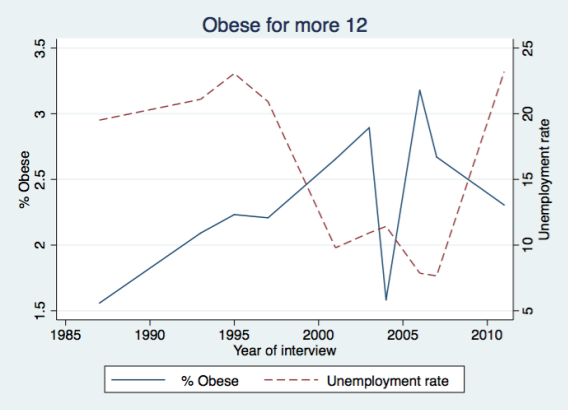
Figure 3: Graphical representation the evolution of the unemployment rate and the percentage of obese children over time



(a) For children with less than 6 years old



(b) For children between 7 and 12 years old

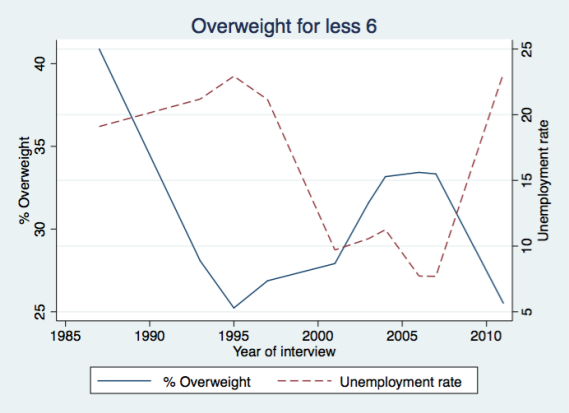


(c) For children with more than 12 years old

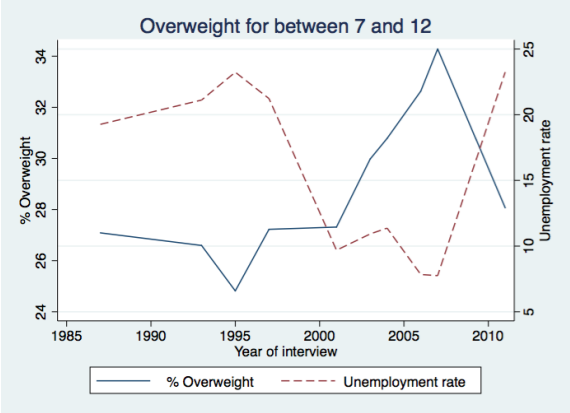
Note: The definition of infant obesity depends on the BMI, the age and gender of the child. The International Obesity Task Force considers that children are obese if their BMI is such that it will pass through BMI of 30 at age 18. The unemployment rate is for each region at the trimester the interview took place.

Source: Spanish National Health Survey (1987-2012)

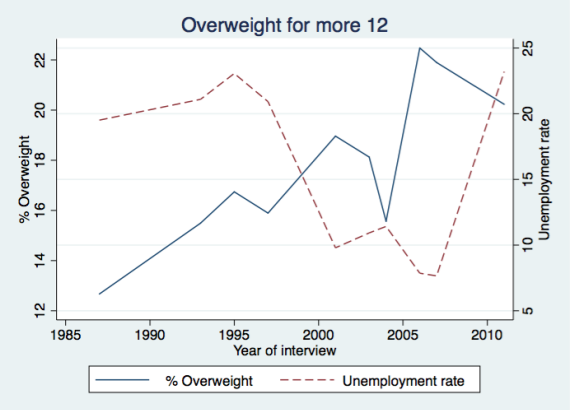
Figure 4: Graphical representation the evolution of the unemployment rate and the percentage of overweigth children over time



(a) For children with less than 6 years old



(b) For children between 7 and 12 years old

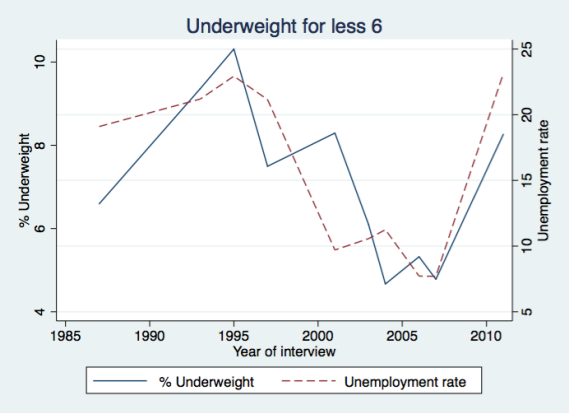


(c) For children with more than 12 years old

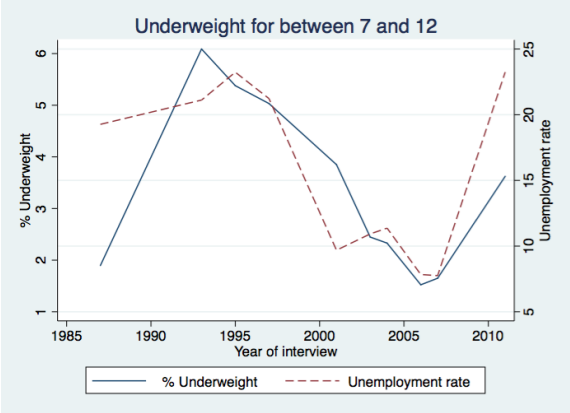
Note: The definition of infant overweight depends on the BMI, the age and gender of the child. The International Obesity Task Force considers that children are overweight if their BMI is such that it will pass through BMI of 25 at age 18. The unemployment rate is for each region at the trimester the interview took place.

Source: Spanish National Health Survey (1987-2012)

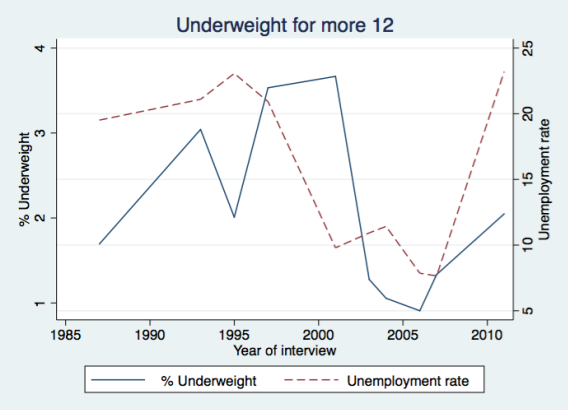
Figure 5: Graphical representation the evolution of the unemployment rate and the percentage of underweight children over time



(a) For children with less than 6 years old



(b) For children between 7 and 12 years old



(c) For children with more than 12 years old

Note: The definition of infant underweight depends on the BMI, the age and gender of the child. The International Obesity Task Force considers that children are overweight if their BMI is such that it will pass through BMI of 18 at age 18. The unemployment rate is for each region at the trimester the interview took place.

Source: Spanish National Health Survey (1987-2012)

7.1 BMI

Table 1: Effect of the business cycle on infant BMI

	BMI				
			By age		
			Less 6	Between 7 and 12	More 12
	(1)	(2)	(3)	(4)	(5)
Unemployment	-0.02	-0.01	-0.02	-0.00	-0.04
	(0.02)	(0.03)	(0.06)	(0.02)	(0.04)
	[0.02]	[0.02]	[0.04]	[0.02]	[0.03]
Unemployment x Boy		-0.01			
		(0.01)			
		[0.01]			
Boy	0.23	0.38	0.10	0.20	0.45
	(0.07)***	(0.12)***	(0.17)	(0.08)**	(0.11)***
	[0.04]***	[0.09]***	[0.14]	[0.07]**	[0.06]***
Unemployment x Middle Education		-0.00			
		(0.01)			
		[0.00]			
Middle Education	-0.35	-0.31	-0.32	-0.41	-0.33
	(0.07)***	(0.12)***	(0.18)*	(0.12)***	(0.11)***
	[0.04]***	[0.08]***	[0.13]**	[0.07]***	[0.07]***
Unemployment x High Education		-0.01			
		(0.01)			
		[0.00]*			
High Education	-0.59	-0.46	-0.41	-0.72	-0.59
	(0.12)***	(0.12)***	(0.27)	(0.09)***	(0.14)***
	[0.07]***	[0.06]***	[0.15]**	[0.08]***	[0.09]***
Age	-0.19	-0.19	-0.83	0.52	-4.65
	(0.07)***	(0.07)***	(0.41)**	(0.26)**	(3.50)
	[0.05]***	[0.05]***	[0.34]**	[0.21]**	[3.59]
Age^2	0.03	0.03	0.09	-0.01	0.18
	(0.00)***	(0.00)***	(0.05)*	(0.01)	(0.12)
	[0.00]***	[0.00]***	[0.04]**	[0.01]	[0.13]
Small city	0.09	0.09	0.20	0.07	0.05
	(0.06)	(0.06)	(0.20)	(0.07)	(0.11)
	[0.06]	[0.06]	[0.14]	[0.05]	[0.08]
Constant	18.96	18.78	21.72	15.02	50.04
	(0.80)***	(0.82)***	(1.76)***	(1.48)***	(24.74)**
	[0.55]***	[0.55]***	[1.27]***	[1.23]***	[25.31]*
Observations	26,493	26,493	7,717	11,759	7,017
R-squared	0.08	0.08	0.03	0.04	0.04
Calendar FE	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES
Region-specific time trends	YES	YES	YES	YES	YES

Note: The dependent variable is the Body Mass Index of the child, calculated dividing the weight in kilograms by the squared height in meters. Regressions include the unemployment rate of the region where the child resides at the trimester that the interview took place, as well as, calendar time, region dummies and region specific time trends. When information about the trimester of the interviews is not available, we take the average unemployment rate of the four trimesters where all interviews of the survey took place. This happens in the surveys of 2006/2007 and 2011/2012. We also include some basic covariates as the age and gender of the child. The results are robust in sign and significance to the inclusion of dummies of the education of the head of the family and a dummy for the size of the municipality of residence of the child. Robust standard errors doubled clustered at calendar year and region level in parentheses and clustered only at region level in brackets.

Source: Spanish National Health Survey (1987-2012)

Significance: *** p<0.01, ** p<0.05, * p<0.1.

7.2 Overweight

Table 2: Effect of the business cycle on infant overweight

	Overweight				
			By age		
			Less 6	Between 7 and 12	More 12
	(1)	(2)	(3)	(4)	(5)
Unemployment	-0.11	-0.11	-0.23	0.02	-0.41
	(0.21)	(0.23)	(0.34)	(0.25)	(0.44)
	[0.20]	[0.22]	[0.32]	[0.22]	[0.34]
Unemployment x Boy		-0.05			
		(0.08)			
		[0.07]			
Boy	2.14	2.89	-2.68	1.96	8.89
	(0.54)***	(1.26)**	(1.44)*	(0.87)**	(0.83)***
	[0.58]***	[1.36]**	[1.24]**	[0.70]**	[0.64]***
Unemployment x Middle Education		0.06			
		(0.10)			
		[0.06]			
Middle Education	-2.25	-3.14	0.21	-3.22	-4.38
	(0.81)***	(1.11)***	(1.39)	(1.27)**	(1.27)***
	[0.48]***	[1.32]**	[0.79]	[0.95]***	[1.15]***
Unemployment x High Education		0.20			
		(0.09)**			
		[0.06]***			
High Education	-4.95	-7.85	-2.85	-7.00	-4.44
	(1.01)***	(1.16)***	(1.87)	(1.26)***	(1.85)**
	[0.86]***	[1.43]***	[1.55]*	[0.86]***	[1.48]***
Age	3.75	3.75	2.00	3.95	-57.76
	(0.65)***	(0.63)***	(2.42)	(3.36)	(40.16)
	[0.27]***	[0.26]***	[2.43]	[2.32]	[37.37]
Age^2	-0.29	-0.29	-0.00	-0.34	1.96
	(0.03)***	(0.03)***	(0.31)	(0.17)**	(1.44)
	[0.01]***	[0.01]***	[0.28]	[0.12]**	[1.33]
Small city	-0.65	-0.61	-1.64	0.38	-1.03
	(0.81)	(0.81)	(1.72)	(1.16)	(1.08)
	[0.65]	[0.65]	[1.23]	[1.00]	[0.94]
Constant	26.62	26.36	39.12	25.87	447.42
	(8.04)***	(8.28)***	(11.53)***	(19.09)	(275.54)
	[6.64]***	[6.83]***	[10.96]***	[13.77]*	[258.74]
Observations	31,350	31,350	9,812	13,907	7,631
R-squared	0.03	0.03	0.03	0.02	0.03
Calendar FE	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES
Region-specific time trends	YES	YES	YES	YES	YES

Note: The dependent variable is a dummy that is equal to 1 if the child is considered overweight, and 0 otherwise (multiplied by 100). The consideration of overweight depends on the BMI, the age and gender of the child. The International Obesity Task Force considers that children are overweight if their BMI is such that it will pass through BMI of 25 at age 18. Regressions include the unemployment rate of the region where the child resides at the trimester the interview took place, as well as, calendar time, region dummies and region specific time trends. When information about the trimester of the interviews is not available, we take the average unemployment rate of the four trimesters where all interviews of the survey took place. This happens in the surveys of 2006/2007 and 2011/2012. We also include some basic covariates as the age and gender of the child. The results are robust in sign and significance to the inclusion of dummies of the education of the head of the family and a dummy for the size of the municipality of residence of the child. Robust standard errors doubled clustered at calendar year and region level in parentheses and clustered only at region level in brackets.

Source: Spanish National Health Survey (1987-2012)

Significance: *** p<0.01, ** p<0.05, * p<0.1.

7.3 Obesity

Table 3: Effect of the business cycle on infant obesity

	Obesity				
			By age		
			Less 6	Between 7 and 12	More 12
	(1)	(2)	(3)	(4)	(5)
Unemployment	-0.12	-0.11	-0.39	0.03	-0.25
	(0.13)	(0.14)	(0.28)	(0.14)	(0.13)**
	[0.10]	[0.11]	[0.21]*	[0.12]	[0.09]**
Unemployment x Boy		-0.05			
		(0.06)			
		[0.05]			
Boy	0.74	1.57	-0.38	0.99	1.92
	(0.47)	(0.93)*	(1.01)	(0.51)*	(0.44)***
	[0.28]**	[0.83]*	[0.93]	[0.26]***	[0.40]***
Unemployment x Middle Education		0.06			
		(0.06)			
		[0.04]			
Middle Education	-1.57	-2.65	-1.08	-2.14	-1.19
	(0.36)***	(0.81)***	(0.98)	(0.42)***	(0.56)**
	[0.29]***	[0.71]***	[0.86]	[0.39]***	[0.43]**
Unemployment x High Education		0.02			
		(0.09)			
		[0.06]			
High Education	-3.11	-3.47	-3.06	-3.78	-2.17
	(0.71)***	(1.02)***	(1.63)*	(0.44)***	(0.37)***
	[0.46]***	[0.87]***	[1.28]**	[0.36]***	[0.31]***
Age	-0.87	-0.87	0.96	-7.29	-6.64
	(0.57)	(0.57)	(2.87)	(2.00)***	(13.04)
	[0.30]**	[0.30]**	[2.45]	[1.35]***	[11.76]
Age^2	-0.03	-0.03	-0.09	0.26	0.24
	(0.03)	(0.03)	(0.38)	(0.10)***	(0.47)
	[0.02]**	[0.02]**	[0.30]	[0.07]***	[0.42]
Small city	-0.21	-0.20	-0.75	0.13	0.03
	(0.39)	(0.39)	(1.37)	(0.44)	(0.46)
	[0.36]	[0.36]	[1.09]	[0.45]	[0.40]
Constant	27.29	26.82	36.12	54.48	54.70
	(5.92)***	(6.03)***	(10.66)***	(10.42)***	(91.19)
	[3.31]***	[3.46]***	[7.50]***	[6.98]***	[82.78]
Observations	31,350	31,350	9,812	13,907	7,631
R-squared	0.05	0.05	0.03	0.03	0.01
Calendar FE	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES
Region-specific time trends	YES	YES	YES	YES	YES

Note: The dependent variable is a dummy that is equal to 1 if the child is considered obese, and 0 otherwise (multiplied by 100). The consideration of obesity depends on the BMI, the age and gender of the child. The International Obesity Task Force considers that children are obese if their BMI is such that it will pass through BMI of 30 at age 18. Regressions include the unemployment rate of the region where the child resides the trimester the interview took place, as well as, calendar time, region dummies and region specific time trends. When information about the trimester of the interviews is not available, we take the average unemployment rate of the four trimesters where all interviews of the survey took place. This happens in the surveys of 2006/2007 and 2011/2012. We also include some basic covariates as the age and gender of the child. The results are robust in sign and significance to the inclusion of dummies of the education of the head of the family and a dummy for the size of the municipality of residence of the child. Robust standard errors doubled clustered at calendar year and region level in parentheses and clustered only at region level in brackets.

Source: Spanish National Health Survey (1987-2012)

Significance: *** p<0.01, ** p<0.05, * p<0.1.

7.4 Underweight

Table 4: Effect of the business cycle on infant underweight

	Underweight				
			By age		
			Less 6	Between 7 and 12	More 12
	(1)	(2)	(3)	(4)	(5)
Unemployment	0.18	0.15	0.38	0.02	0.19
	(0.08)**	(0.08)*	(0.14)***	(0.09)	(0.12)
	[0.06]***	[0.06]**	[0.09]***	[0.07]	[0.12]
Unemployment x Boy		0.08			
		(0.04)**			
		[0.02]***			
Boy	0.37	-0.96	-0.10	0.63	0.47
	(0.33)	(0.48)**	(0.73)	(0.31)**	(0.38)
	[0.27]	[0.43]**	[0.58]	[0.37]	[0.33]
Unemployment x Middle Education		-0.01			
		(0.05)			
		[0.02]			
Middle Education	-0.57	-0.33	-0.97	-0.76	0.39
	(0.25)**	(0.86)	(0.90)	(0.61)	(0.72)
	[0.24]**	[0.45]	[0.71]	[0.26]**	[0.52]
Unemployment x High Education		-0.04			
		(0.08)			
		[0.06]			
High Education	-0.59	-0.03	-1.08	-0.53	0.07
	(0.51)	(0.88)	(1.03)	(0.57)	(0.71)
	[0.43]	[0.73]	[0.75]	[0.44]	[0.42]
Age	-1.03	-1.04	2.44	-3.65	2.31
	(0.23)***	(0.24)***	(1.19)**	(1.13)***	(9.09)
	[0.12]***	[0.12]***	[1.17]*	[0.92]***	[8.76]
Age^2	0.03	0.03	-0.38	0.16	-0.10
	(0.01)**	(0.01)*	(0.16)**	(0.06)***	(0.32)
	[0.01]***	[0.01]***	[0.15]**	[0.04]***	[0.31]
Small city	-0.14	-0.15	-0.84	0.44	-0.22
	(0.46)	(0.44)	(1.03)	(0.53)	(0.47)
	[0.33]	[0.32]	[0.69]	[0.43]	[0.39]
Constant	6.14	6.84	-2.14	21.76	-16.70
	(3.01)**	(2.89)**	(4.95)	(5.75)***	(63.66)
	[1.95]***	[1.96]***	[3.43]	[5.33]***	[61.32]
Observations	31,350	31,350	9,812	13,907	7,631
R-squared	0.02	0.02	0.01	0.02	0.01
Calendar FE	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES
Region-specific time trends	YES	YES	YES	YES	YES

Note: The dependent variable is a dummy that is equal to 1 if the child is considered underweight, and 0 otherwise (multiplied by 100). The consideration of underweight depends on the BMI, the age and gender of the child. The International Obesity Task Force considers that children are underweight if their BMI is such that it will pass through BMI of 16 at age 18. Regressions include the unemployment rate of the region where the child resides the trimester the interview took place, as well as, calendar time, region dummies and region specific time trends. When information about the trimester of the interviews is not available, we take the average unemployment rate of the four trimesters where all interviews of the survey took place. This happens in the surveys of 2006/2007 and 2011/2012. We also include some basic covariates as the age and gender of the child. The results are robust in sign and significance to the inclusion of dummies of the education of the head of the family and a dummy for the size of the municipality of residence of the child. Robust standard errors doubled clustered at calendar year and region level in parentheses and clustered only at region level in brackets.

Source: Spanish National Health Survey (1987-2012)

Significance: *** p<0.01, ** p<0.05, * p<0.1.

7.5 Mechanisms

Table 5: Effect of the business cycle on the probability of exercising, watching television and nutritional intake

	Possible Mechanisms				Possible Mechanisms		
	Less 6	Between 7-12	More 12		Less 6	Between 7-12	More 12
	(1)	(2)	(3)		(1)	(2)	(3)
Panel 1: Exercise monthly				**Panel 5: Sweets daily**			
Unemployment	1.21	1.63	1.08	Unemployment	-0.27	-0.62	0.41
	(0.21)***	(0.47)***	(0.37)***		(0.51)	(0.52)	(0.67)
	[0.31]***	[0.44]***	[0.42]**		[0.63]	[0.48]	[0.62]
Observations	8,598	12,018	6,386	Observations	6,262	8,428	4,463
R-squared	0.20	0.12	0.12	R-squared	0.05	0.06	0.05
Panel 2: Watch tv daily				**Panel 6: Cold meat daily**			
Unemployment	0.62	1.09	-0.10	Unemployment	0.25	-0.64	-0.00
	(1.09)	(0.80)	(0.81)		(0.74)	(0.68)	(0.84)
	[0.75]	[0.48]**	[0.75]		[0.73]	[0.64]	[0.63]
Observations	7,364	10,025	5,364	Observations	6,265	8,428	4,474
R-squared	0.14	0.08	0.09	R-squared	0.06	0.03	0.04
Panel 3: Fruit daily				**Panel 7: Breakfast: Protein**			
Unemployment	0.71	0.64	1.78	Unemployment	-0.33	-0.88	-1.07
	(0.59)	(0.35)*	(0.52)***		(0.28)	(0.31)***	(0.66)
	[0.55]	[0.30]**	[0.31]***		[0.28]	[0.24]***	[0.78]
Observations	7,344	10,012	5,349	Observations	3,602	4,570	2,427
R-squared	0.04	0.03	0.04	R-squared	0.24	0.30	0.34
Panel 4: Mediterranean Diet				**Panel 8: Breakfast: Nothing**			
Unemployment	-0.33	0.09	-0.06	Unemployment	-0.09	0.03	0.19
	(0.24)	(0.18)	(0.34)		(0.17)	(0.11)	(0.28)
	[0.18]*	[0.17]	[0.30]		[0.22]	[0.11]	[0.27]
Observations	6,256	8,420	4,460	Observations	3,609	4,593	2,489
R-squared	0.03	0.02	0.03	R-squared	0.91	0.89	0.80
Controls	YES	YES	YES	Controls	YES	YES	YES
Calendar FE	YES	YES	YES	Calendar FE	YES	YES	YES
Region FE	YES	YES	YES	Region FE	YES	YES	YES
Region-specific time trends	YES	YES	YES	Region-specific time trends	YES	YES	YES

Note: The dependent variables are dummies that are equal to 1 if the child (1) exercices at least a couple of times a month , (2) watches tv everyday , (3) consumes fruit everyday , (4) ffollows a Mediterranean Diet, (5) consumes sweets everyday, (6) consumes cold meat everyday, (7) consumes proteins during breakfast or (8) has no breakfast at all, and 0 otherwise (all multiplied by 100). We define Mediterranean Diet to consume vegetables, fruit and pasta daily, legums at least 3 or 4 times a week , fish at leas 3 or 4 times a week and meat not daily. Regressions include the unemployment rate of the region where the child resides the trimester the interview took place, as well as, calendar time, region dummies and region specific time trends. When information about the trimester of the interviews is not available, we take the average unemployment rate of the four trimesters where all interviews of the survey took place. This happens in the surveys of 2006/2007 and 2011/2012. We also control some basic covariates as the age, gender of the child and the size of the municipality of residence of the child and the education of the head of the family. Robust standard errors doubled clustered at calendar year and region level in parentheses and clustered only at region level in brackets.

Source: Spanish National Health Survey (1993- 2012)

Significance: *** p<0.01, ** p<0.05, * p<0.1.

7.6 Short-term health consequences

Table 6: Effect of the business cycle on self-reported health and diseases in the last 12 months

	Health measures		
	Less 6	Between 7-12	More 12
Panel 1: Good Heath			
Unemployment	-0.81	0.05	-0.09
	(0.58)	(0.17)	(0.48)
	[0.39]*	[0.18]	[0.31]
Unemployment at t-1	0.33	-0.14	-0.11
	(0.50)	(0.22)	(0.34)
	[0.23]	[0.18]	[0.19]
Observations	9,807	13,903	7,630
R-squared	0.04	0.02	0.02
Panel 2: Diabetes			
Unemployment	-0.03	-0.02	0.02
	(0.03)	(0.03)	(0.07)
	[0.03]	[0.02]	[0.05]
Unemployment at t-1	0.01	-0.01	-0.05
	(0.03)	(0.03)	(0.05)
	[0.03]	[0.03]	[0.04]
Observations	9,791	13,892	7,622
R-squared	0.01	0.00	0.01
Panel 3: Asthma			
Unemployment	-0.10	0.18	0.25
	(0.10)	(0.18)	(0.31)
	[0.13]	[0.17]	[0.21]
Unemployment at t-1	0.25	-0.08	-0.38
	(0.17)	(0.21)	(0.25)
	[0.14]*	[0.20]	[0.16]**
Observations	9,797	13,895	7,622
R-squared	0.03	0.04	0.04
Panel 4: Metabolic			
Unemployment	-0.02	-0.01	0.03
	(0.02)	(0.06)	(0.09)
	[0.02]	[0.05]	[0.06]
Unemployment at t-1	0.04	0.08	-0.18
	(0.03)	(0.07)	(0.13)
	[0.03]	[0.06]	[0.12]
Observations	3,791	5,432	2,629
R-squared	0.01	0.02	0.04
Controls	YES	YES	YES
Calendar FE	YES	YES	YES
Region FE	YES	YES	YES
Region-specific time trends	YES	YES	YES

Note: The dependent variables are dummies that are equal to 1 if the interviwer self-reported that his/her child (1) has good health or (2) has suffered from diabetes, (3) asthma or (4) any metabolic or endocrinical problem in the last 12 months since the interview or 0 otherwise (all multiplied by 100). Regressions include the unemployment rate of the region where the child resides the trimester the interview took place, as well as, a the same unemployment rate but lagged one year. We also include calendar time, region dummies and region specific time trends. When information about the trimester of the interviews is not available, we take the average unemployment rate of the four trimesters where all interviews of the survey took place. This happens in the surveys of 2006/2007 and 2011/2012. We also control some basic covariates as the age, gender of the child, education of the head of the family and the size of the municipality of residence of the child. Robust standard errors doubled clustered at calendar year and region level in parentheses and clustered only at region level in brackets.

Source: Spanish National Health Survey (1987-2012) for the self-reported health, diabetes and asthma and (1995-2012) for metabolic or endocrinical diseases.

Significance: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

7.7 Long-term health consequences

Table 7: Effect of the economic conditions suffered between the 2 to 6 years old on the probability of being underweight at an older age

VARIABLES	(1) Underweight Between 6 and 12	(2) Underweight More 12
Mean Unemployment at age 2 to 6	0.11	0.02
	(0.09)	(0.15)
	[0.08]	[0.15]
Constant	17.52	19.55
	(5.54)***	(76.61)
	[6.58]**	[79.01]
Observations	13,529	6,411
R-squared	0.02	0.01
Controls YES	YES	YES
Calendar FE	YES	YES
Calendar FE	YES	YES
Region FE	YES	YES
Region-specific time trends	YES	YES

Note: The dependent variable is a dummy that is equal to 1 if the child is considered underweight, and 0 otherwise (multiplied by 100). The consideration of underweight depends on the BMI, the age and gender of the child. The International Obesity Task Force considers that children are underweight if their BMI is such that it will pass through BMI of 16 at age 18. Regressions include the mean unemployment rate of the region where the child resides when the child was between 2 and 6 years old. We also include, calendar time, region dummies and region specific time trends. We also control some basic covariates as the age, gender of the child, education of the head of the family and the size of the municipality of residence of the child. Robust standard errors doubled clustered at calendar year and region level in parentheses and clustered only at region level in brackets.

Source: Spanish National Health Survey (1987-2012)

Significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Effect of the bussiness cycle on the probability of having a height under the third percentile

	Height under the percentil 3		
	Less 6	Between 6 and 12	More 12
	(1)	(2)	(3)
Panel 1: At t			
Unemployment at t	-0.12	-0.01	-0.01
	(0.26)	(0.13)	(0.15)
	[0.20]	[0.11]	[0.08]
Constant	31.92	19.23	-178.87
	(8.08)***	(10.31)*	(77.54)**
	[9.62]***	[6.98]**	[85.76]*
Panel 2: At t-1			
Unemployment at t	-0.26	-0.03	0.06
	(0.38)	(0.29)	(0.16)
	[0.21]	[0.25]	[0.14]
Unemployment at t-1	0.18	0.03	-0.08
	(0.48)	(0.27)	(0.24)
	[0.22]	[0.24]	[0.16]
Constant	30.90	19.06	-177.60
	(9.33)***	(10.38)*	(75.88)**
	[10.28]**	[6.91]**	[84.80]*
Observations	9,812	13,529	6,411
R-squared	0.04	0.02	0.02
Calendar FE	YES	YES	YES
Region FE	YES	YES	YES
Region-specific time trends	YES	YES	YES

Note: The dependent variable is a dummy that is equal to 1 if the child self-reports a height that is lower than the height cut-off points corresponding to the 3th centiles of the population, and 0 otherwise (multiplied by 100). We use the height cut-off points corresponding to the 3th centiles that were calculated specifically for the Spanish children population and are specified in the "Orbegozo Foundations' tables" (Sobradillo and Eizaguirre (2004)). In Panel 1 we include the unemployment rate of the region where the child resides the trimester of the interview while in Panel 2 we include the unemployment rate of the region where the child resides one year before the trimester of the interview. When information about the trimester of the interviews is not available, we take the average unemployment rate of the four trimesters where all interviews of the survey took place. This happens in the surveys of 2006/2007 and 2011/2012. Regressions also include calendar time, region dummies and region specific time trends. We also control some basic covariates as the age, gender of the child, education of the head of the family and the size of the municipality of residence of the child. Robust standard errors doubled clustered at calendar year and region level in parentheses and clustered only at region level in brackets.

Source: Spanish National Health Survey (1987-2012)

Significance: *** p<0.01, ** p<0.05, * p<0.1.

7.8 Robustness checks

Table 9: Effect of the bussiness cycle on BMI and the probability of being obese, overweight or underweight for spanish children

	(1)	Less 6 (2)	Between 7 and 12 (3)	More 12 (4)
Panel 1: BMI				
Unemployment	-0.02	-0.04	-0.01	-0.04
	(0.02)	(0.07)	(0.02)	(0.04)
	[0.02]	[0.05]	[0.02]	[0.03]
Observations	25,646	5,958	11,390	6,793
Panel 2: Obesity				
Unemployment	-0.15	-0.56	0.02	-0.25
	(0.13)	(0.35)	(0.15)	(0.13)*
	[0.10]	[0.22]**	[0.12]	[0.09]**
Observations	30,397	7,516	13,487	7,392
Panel 3: Overweight				
Unemployment	-0.14	-0.31	-0.03	-0.46
	(0.21)	(0.38)	(0.26)	(0.45)
	[0.20]	[0.37]	[0.21]	[0.34]
Observations	30,397	7,516	13,487	7,392
Panel 4: Underweight				
Unemployment	0.18	0.32	0.04	0.18
	(0.08)**	(0.21)	(0.08)	(0.12)
	[0.06]***	[0.14]**	[0.07]	[0.11]
Observations	30,397	7,516	13,487	7,392
Calendar FE	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Region-specific time trends	YES	YES	YES	YES

Note: We only consider children that have a the spanish nationality .The dependent variables are (Panel 1) the children's Body Mass Index or a dummy variable that is equal to 1 if the child is (Panel 2) obese, (Panel 3) overweight or (Panel 4) underweight and 0 otherwise (multiplied by 100). The Body Mass Index of the child, calculated dividing the weight in kilograms by the squared height in meters. The consideration of obesity, overweight and underweight depends on the BMI, the age and gender of the child. The International Obesity Task Force considers that children are obese, overweight or underweight if their BMI is such that it will pass through BMI of 30, 25 or 16 at age 18. All regressions include the unemployment rate of the region where the child resides of the trimester of the interview, as well as, calendar time, region dummies and region specific time trends. When information about the trimester of the interviews is not available, we take the average unemployment rate of the four trimesters where all interviews of the survey took place. This happens in the surveys of 2006/2007 and 2011/2012. We also control some basic covariates as the age, gender of the child, and the size of the municipality of residence of the child. Robust standard errors doubled clustered at calendar year and region level in parentheses and clustered only at region level in brackets.

Source: Spanish National Health Survey (1987-2012).

Significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Effect of the bussiness cycle on BMI and the probability of being obese, overweight or underweight for inmigrants children

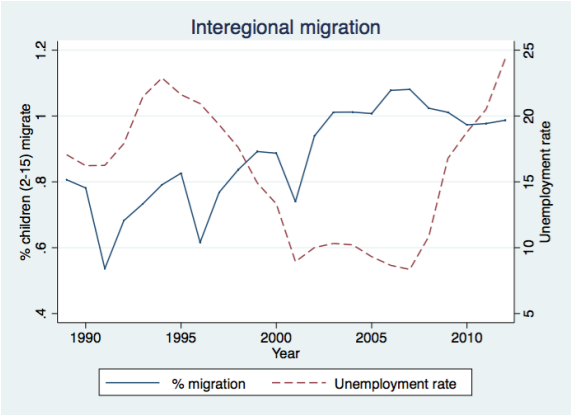
	(1)	Less 6 (2)	Between 7 and 12 (3)	More 12 (4)
Panel 1: BMI				
Unemployment	0.14	-0.10	0.49	-0.23
	(0.04)***	(0.41)	(0.32)	(0.18)
	[0.10]	[0.39]	[0.30]	[0.20]
Observations	835	202	364	220
Panel 2: Obesity				
Unemployment	1.55	-1.12	2.81	-0.29
	(0.78)**	(2.54)	(2.26)	(1.55)
	[1.10]	[2.78]	[2.47]	[1.48]
Observations	941	228	415	235
Panel 3: Overweight				
Unemployment	3.02	0.66	4.95	1.65
	(1.01)***	(2.44)	(3.13)	(2.48)
	[1.34]**	[2.63]	[3.42]	[3.22]
Observations	941	228	415	235
Panel 4: Underweight				
Unemployment	0.51	2.97	-0.04	0.28
	(0.29)*)	(1.21)**	(0.91)	(0.54)
	[0.35]	[1.78]	[0.54]	[0.50]
Observations	941	228	415	235
Controls	YES	YES	YES	YES
Calendar FE	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Region-specific time trends	YES	YES	YES	YES

Note: We only consider children that have a different nationality from the spanish one. The dependent variables are (Panel 1) the children's Body Mass Index or a dummy variable that is equal to 1 if the child is (Panel 2) obese, (Panel 3) overweight or (Panel 4) underweight and 0 otherwise (multiplied by 100). The Body Mass Index of the child, calculated dividing the weight in kilograms by the squared height in meters. The consideration of obesity, overweight and underweight depends on the BMI, the age and gender of the child. The International Obesity Task Force considers that children are obese, overweight or underweight if their BMI is such that it will pass through BMI of 30, 25 or 16 at age 18. All regressions include the unemployment rate of the region where the child resides of the trimester of the interview, as well as, calendar time, region dummies and region specific time trends. When information about the trimester of the interviews is not available, we take the average unemployment rate of the four trimesters where all interviews of the survey took place. This happens in the surveys of 2006/2007 and 2011/2012. We also control some basic covariates as the age, gender of the child, and the size of the municipality of residence of the child. Robust standard errors doubled clustered at calendar year and region level in parentheses and clustered only at region level in brackets.

Source: Spanish National Health Survey (2003-2012).

Significance: *** p<0.01, ** p<0.05, * p<0.1.

Figure 6: Graphical representation the evolution of interregional migration for children and adults as a fraction of the total population



Note: Interregional migration at the level of comunidad autónoma. The percentage is calculated by dividing (a) the total number of children from 2 to 15 years old by the population of children of that age that lives in each region or (b) the total number of adults (with more than 16 years old) that migrate from one region to another divided by the total population of adults.

Source: Encuesta de variaciones residenciales (1989-2012)

Table 11: Effect of business cycle over intereginal migration of children between 2 and 15 years old

	Perc. children (2-15) migrate between regions (1)	Perc. children (2-15) migrate between regions (2)
Unemployment rate at t	-0.01	
	(0.01)	
Unemployment rate at t-1		-0.02**
		(0.01)
Constant	0.73***	0.84***
	(0.25)	(0.19)
Observations	432	432
R-squared	0.90	0.90
Calendar FE	YES	YES
Region FE	YES	YES

Note: The dependent variable is the percentage of children between 2 and 15 years old that migrate from one region to another. The regression include the unemployment rate of the region of destination , as well as, calendar time and region dummies. Robust standard errors clustered at calendar year in parentheses.

Source: Encuesta de variaciones residenciales (1989-2012).

Significance: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 12: Effect of the bussiness cycle on BMI and the probability of being obese, overweight or underweight for those regions with less migration

	(1)	Less 6 (2)	Between 7 and 12 (3)	More 12 (4)
Panel 1: BMI				
Unemployment	-0.03	-0.01	-0.02	-0.06
	(0.01)**	(0.06)	(0.02)	(0.06)
	[0.01]**	[0.04]	[0.02]	[0.05]
Observations	10,972	3,233	4,848	2,891
Panel 2: Obesity				
Unemployment	-0.20	-0.48	-0.14	-0.17
	(0.14)	(0.41)	(0.18)	(0.25)
	[0.09]*	[0.33]	[0.09]	[0.19]
Observations	13,208	4,164	5,876	3,168
Panel 3: Overweight				
Unemployment	-0.27	-0.22	-0.36	-0.44
	(0.28) ¡	(0.54)	(0.20)*	(0.61)
	[0.28]	[0.49]	[0.10]**	[0.53]
Observations	13,208 ¡	4,164	5,876	3,168
Panel 4: Underweight				
Unemployment	0.20	0.34	0.11	0.17
	(0.11)*	(0.21)	(0.07)	(0.15)
	[0.06]**	[0.05]***	[0.06]	[0.10]
Observations	13,208	4,164	5,876	3,168
Controls	YES	YES	YES	YES
Calendar FE	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Region-specific time trends	YES	YES	YES	YES

Note: We only consider those regions in Spain with less internal migration: Cataluña, Galicia, Andalucía, País Vasco and Comunidad Valenciana.The dependent variables are (Panel 1) the children's Body Mass Index or a dummy variable that is equal to 1 if the child is (Panel 2) obese, (Panel 3) overweight or (Panel 4) underweight and 0 otherwise (multiplied by 100). The Body Mass Index of the child, calculated dividing the weight in kilograms by the squared height in meters. The consideration of obesity, overweight and underweight depends on the BMI, the age and gender of the child. The International Obesity Task Force considers that children are obese, overweight or underweight if their BMI is such that it will pass through BMI of 30, 25 or 16 at age 18. All regressions include the unemployment rate of the region where the child resides of the trimester of the interview, as well as, calendar time, region dummies and region specific time trends. When information about the trimester of the interviews is not available, we take the average unemployment rate of the four trimesters where all interviews of the survey took place. This happens in the surveys of 2006/2007 and 2011/2012. We also control some basic covariates as the age, gender of the child, and the size of the municipality of residence of the child. Robust standard errors doubled clustered at calendar year and region level in parentheses and clustered only at region level in brackets.

Source: Spanish National Health Survey (1987-2012).

Significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 13: Effect of the bussiness cycle on BMI and the probability of being obese, overweight or underweight for regions with more migration

	(1)	Less 6 (2)	Between 7 and 12 (3)	More 12 (4)
Panel 1: BMI				
Unemployment	-0.01	-0.19	0.04	0.05
	(0.08)	(0.17)	(0.09)	(0.07)
	[0.08]	[0.15]	[0.09]	[0.04]
Observations	7,233	1,730	3,203	1,887
Panel 2: Obesity				
Unemployment	-0.14	-0.69	0.30	-0.49
	(0.42)	(0.81)	(0.31)	(0.19)**
	[0.45]	[0.84]	[0.38]	[0.10]***
Observations	8,656	2,213	3,825	2,050
Panel 3: Overweight				
Unemployment	0.50	-0.26	0.86	0.23
	(0.93)	(1.47)	(1.05)	(0.55)
	[0.97]	[1.54]	[1.11]	[0.56]
Observations	8,656	2,213	3,825	2,050
Panel 4: Underweight				
Unemployment	0.14	0.94	-0.21	-0.05
	(0.06)**	(0.33)***	(0.25)	(0.15)
	[0.06]*	[0.23]***	[0.22]	[0.17]
Observations	8,656	2,213	3,825	2,050
Controls	YES	YES	YES	YES
Calendar FE	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Region-specific time trends	YES	YES	YES	YES

Note: We only consider those regions in Spain with more net migration: Baleares, Castilla- La Mancha, La Rioja, Extremadura, Cantabria and Madrid. The dependent variables are (Panel 1) the children's Body Mass Index or a dummy variable that is equal to 1 if the child is (Panel 2) obese, (Panel 3) overweight or (Panel 4) underweight and 0 otherwise (multiplied by 100). The Body Mass Index of the child, calculated dividing the weight in kilograms by the squared height in meters. The consideration of obesity, overweight and underweight depends on the BMI, the age and gender of the child. The International Obesity Task Force considers that children are obese, overweight or underweight if their BMI is such that it will pass through BMI of 30, 25 or 16 at age 18. All regressions include the unemployment rate of the region where the child resides of the trimester of the interview, as well as, calendar time, region dummies and region specific time trends. When information about the trimester of the interviews is not available, we take the average unemployment rate of the four trimesters where all interviews of the survey took place. This happens in the surveys of 2006/2007 and 2011/2012. We also control some basic covariates as the age, gender of the child, and the size of the municipality of residence of the child. Robust standard errors doubled clustered at calendar year and region level in parentheses and clustered only at region level in brackets.

Source: Spanish National Health Survey (1987-2012).

Significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 14: Level of aggregation: the effect of the business cycle on weight disorders at the province level

	(1)	Less 6 (2)	Between 7 and 12 (3)	More 12 (4)
Panel 1: BMI				
Unemployment province	-0.01	-0.01	-0.01	-0.01
	(0.01)	(0.02)	(0.01)	(0.02)
	[0.01]	[0.02]	[0.01]	[0.01]
Constant	18.86	21.78	15.22	54.96
	(0.72)***	(0.66)***	(1.78)***	(26.70)**
	[0.39]***	[0.95]***	[1.08]***	[25.44]**
Observations	22,990	6,710	10,278	6,002
R-squared	0.08	0.03	0.04	0.04
Panel 2: Obesity				
Unemployment province	-0.08	-0.04	-0.06	-0.19
	(0.08)	(0.24)	(0.06)	(0.07)***
	[0.07]	[0.17]	[0.06]	[0.06]***
Constant	25.90	28.22	55.23	52.48
	(5.67)***	(10.00)***	(12.93)***	(97.27)
	[2.52]***	[5.91]***	[8.64]***	[81.37]
Observations	27,594	8,671	12,334	6,589
R-squared	0.05	0.03	0.03	0.02
Panel 2: Overweight				
Unemployment province	-0.09	0.04	-0.14	-0.16
	(0.17)	(0.29)	(0.15)	(0.22)
	[0.13]	[0.23]	[0.12]	[0.14]
Constant	26.64	32.88	29.04	393.70
	(8.32)***	(11.01)***	(21.54)	(272.68)
	[4.08]***	[8.96]***	[12.84]**	[260.99]
Observations	27,594	8,671	12,334	6,589
R-squared	0.03	0.03	0.02	0.04
Panel 2: Underweight				
Unemployment province	0.04	0.02	0.03	0.07
	(0.05)	(0.09)	(0.08)	(0.06)
	[0.04]	[0.06]	[0.06]	[0.06]
Constant	10.63	8.99	19.22	-16.05
	(1.75)***	(2.94)***	(6.74)***	(73.66)
	[1.23]***	[2.13]***	[5.05]***	[66.76]
Observations	27,594	8,671	12,334	6,589
R-squared	0.02	0.01	0.02	0.01
Controls	YES	YES	YES	YES
Calendar FE	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Region-specific time trends	YES	YES	YES	YES

Note: The dependent variables are (Panel 1) the children's Body Mass Index or a dummy variable that is equal to 1 if the child is (Panel 2) obese, (Panel 3) overweight or (Panel 4) underweight and 0 otherwise (multiplied by 100). The Body Mass Index of the child, calculated dividing the weight in kilograms by the squared height in meters. The consideration of obesity, overweight and underweight depends on the BMI, the age and gender of the child. The International Obesity Task Force considers that children are obese, overweight or underweight if their BMI is such that it will pass through BMI of 30, 25 or 16 at age 18. All regressions include the unemployment rate of the province where the child resides of the trimester of the interview, as well as, calendar time, region dummies and region specific time trends. When information about the trimester of the interviews is not available, we take the average unemployment rate of the four trimesters where all interviews of the survey took place. This happens in the surveys of 2006/2007 and 2011/2012. .We also control some basic covariates as the age, gender of the child, and the size of the municipality of residence of the child. Robust standard errors doubled clustered at calendar year and region level in parentheses and clustered only at region level in brackets.

Source: Spanish National Health Survey (1987-2012).

Significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 15: Effect of the business cycle on weight disorders at the province level and the possible effect of spillovers

	BMI (1)	Obesity (2)	Overweight (3)	Underweight (4)
Panel 1: Low educated				
Unemployment province	-0.01	-0.09	-0.12	0.05
	(0.01)	(0.10)	(0.16)	(0.08)
	[0.01]*	[0.06]	[0.10]	[0.06]
Mean unemployment of provinces of the same region	-0.01	-0.22	-0.17	0.07
	(0.01)	(0.13)	(0.18)	(0.07)
	[0.01]	[0.11]*	[0.17]	[0.06]
Constant	19.44	33.41	30.96	7.61
	(0.96)***	(7.48)***	(11.35)***	(1.64)***
	[0.55]***	[3.46]***	[6.83]***	[2.03]***
Observations	13,518	16,489	16,489	16,489
R-squared	0.07	0.05	0.03	0.02
Panel 2: Middle educated				
Unemployment province	-0.03	-0.13	-0.26	-0.02
	(0.02)	(0.14)	(0.28)	(0.12)
	[0.02]	[0.14]	[0.25]	[0.08]
Mean unemployment of provinces of the same region	-0.01	-0.02	-0.07	0.21
	(0.04)	(0.19)	(0.30)	(0.16)
	[0.02]	[0.11]	[0.21]	[0.07]***
Constant	19.63	24.01	34.55	7.87
	(1.07)***	(8.04)***	(12.14)***	(4.34)*
	[0.77]***	[5.10]***	[8.92]***	[4.07]*
Observations	4,790	5,859	5,859	5,859
R-squared	0.07	0.05	0.04	0.02
Panel 3: High educated				
Unemployment province	0.00	-0.03	0.32	0.12
	(0.03)	(0.23)	(0.34)	(0.15)
	[0.02]	[0.12]	[0.18]*	[0.12]
Mean unemployment of provinces of the same region	0.01	-0.01	0.08	0.16
	(0.03)	(0.21)	(0.29)	(0.12)
	[0.02]	[0.16]	[0.25]	[0.09]*
Constant	16.48	20.89	8.38	1.21
	(0.97)***	(4.38)***	(9.84)	(4.20)
	[0.98]***	[5.59]***	[9.26]	[3.96]
Observations	3,636	4,186	4,186	4,186
R-squared	0.10	0.06	0.03	0.03
Controls	YES	YES	YES	YES
Calendar FE	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Region-specific time trends	YES	YES	YES	YES

Note: The dependent variables are (1) the children's Body Mass Index or a dummy variable that is equal to 1 if the child is (2) obese, (3) overweight or (4) underweight and 0 otherwise (all multiplied by 100). The Body Mass Index of the child, calculated dividing the weight in kilograms by the squared height in meters. The consideration of obesity, overweight and underweight depends on the BMI, the age and gender of the child. The International Obesity Task Force considers that children are obese, overweight or underweight if their BMI is such that it will pass through BMI of 30, 25 or 16 at age 18. Children are divided by the level of education of the head of their household: low educated (Panel 1), middle educated (Panel 2) and high educated (Panel 3). All regressions include the unemployment rate of the province where the child resides at the moment of the interview, as well as, the mean unemployment rate of the provinces of the same region. For those provinces that are also considered a region, the mean unemployment rate is zero. We also include for calendar time, region dummies and region specific time trends. We also control some basic covariates as the age, gender of the child, and the size of the municipality of residence of the child. Robust standard errors doubled clustered at calendar year and region level in parentheses and clustered only at region level in brackets.

Source: Spanish National Health Survey (1987- 2011).

Significance: *** p<0.01, ** p<0.05, * p<0.1.

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