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How are Unemployed Individuals with Obesity Affected by an Economic Crisis?

Manel Antelo [1], Pilar Magdalena [2], Juan C. Reboredo [1] and Francisco Reyes-Santias [3,*]

[1] Facultad de Ciencias Económicas, Universidade de Santiago de Compostela, 15782 Santiago de Compostela, Spain; manel.antelo@usc.es (M.A.); juancarlos.reboredo@usc.es (J.C.R.)

[2] Hospital Povisa, 36211 Vigo, Spain; mmagdalenal@gmail.com

[3] Facultad de Ciencias Empresariales y Turismo, GEN, Universidade de Vigo, 32004 Ourense, Spain

* Correspondence: francisco.reyes@uvigo.es

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Abstract: Objective: The purpose of this study was to measure the extent to which the advent of an economic crisis affects the magnitude of the impact of unemployment on obesity prevalence (IUOP). Methods: Using data corresponding to a boom period and a bust period of the Spanish economy, we calculated the IUOP in the Spanish population aged 16–65 years using propensity score matching, and using the difference-in-differences approach, analyzed to what extent the advent of an economic crisis affected the magnitude of such an IUOP. Results: The results point to significant differences in the body mass index (BMI) values of Spanish unemployed individuals depending on the phase of the economic cycle. Compared to a period of economic boom, a bust period increases the (log) BMI values of unemployed people by 0.22% and the (log) BMI of long-term unemployed people by a further 0.011%. Conclusions: The design of health policies for the treatment and prevention of adult obesity should be tailored to the phase of the economic cycle and focus especially on the long-term unemployed individuals.

Keywords: unemployment; adult obesity; boom; bust; matching techniques; difference-in-difference

1. Introduction

That labor market status, and particularly involuntary job loss, have an impact on obesity prevalence in affected individuals has been widely documented [1–8]. However, less well understood is how this impact operates in different phases of the economic cycle: In other words, is impact the same or different in a boom versus bust period, when unemployment rate and duration oscillate considerably from one to other? We aimed to answer this question empirically by estimating and comparing the impact of unemployment on obesity prevalence (IUOP) in a boom and a bust period. Our target population to carry out this research was active Spanish adults, defined as employed or unemployed individuals aged 16–65 years.

The question of whether or not the IUOP in Spanish adults differs in boom and bust times is of relevance for a number of reasons. If unemployment is a major determinant of body mass index (BMI), then an analysis of the IUOP in boom and bust periods would be useful, given that: (a) Adult obesity prevalence in Spain is among the highest in the developed world and is growing (prevalence in active Spanish adults aged 16–65 years increased from 12.4% in 2006–2007—a period characterized by an economic boom) to 14.5% in 2011–2012—a bust period); and (b) the global economic crisis unleashed in 2008 particularly affected the Spanish economy, which saw unemployment rates rocket (from a mere 8.3% in 2006—a historically low rate for Spain—to 22.6% in 2011).

To perform our analysis, we obtained data from Spanish National Health Surveys carried out in June 2006–June 2007 and July 2011–June 2012 by the Spanish Ministry of Health, Social Services and

Equality, the Institute of Health Information and the National Statistics Institute. Clearly, the period in which the first survey was conducted corresponds to a boom period of the Spanish economy and that in which the second survey was performed belongs to a bust period. The collected data covered health, lifestyle and socioeconomic and geographic characteristics for active adults only. We used propensity score matching (PSM) techniques to analyze the impact of unemployment on BMI, and difference-in-differences (DiD) techniques to examine whether the economic crisis reinforced or dampened the magnitude of the IUOP. Both models were applied to all unemployed individuals in our sample and also to sub-samples reflecting certain unemployment duration categories.

Our findings show that IUOP magnitude differs during boom and bust periods; while the IUOP is not significant in a boom period, an economic crisis increases obesity levels in individuals who were unemployed during the boom period and especially in those who belong to two unemployment duration categories: Long-term unemployed individuals and recently unemployed individuals. As a result, it can be concluded that public policies to combat and prevent obesity should be tailored according to the phase of the economic cycle in which they are applied.

2. Background

Adult overweight and obesity—classically defined as an imbalance between energy consumed through dietary intake and energy expended through metabolism and physical activity—are serious health problems as reflected in alarming figures worldwide. According to the world's largest obesity study [9], around one in ten men and one in seven women are now affected by obesity. In 2014, 266 million men and 375 million women worldwide were affected by obesity, with people adding on around 1.5 kg per decade since 1975. The same study predicted, based on these trends, (a) that 18% of the world's men and 21% of women would be affected by obesity by 2025, and (b) that the World Health Organization (WHO) global obesity target of no rise in obesity above 2010 levels by 2025 is very unlikely to be achieved (see https://www.imperial.ac.uk/ news/171536/worlds-obese-population -hits-640-million/).

The consequences of obesity have been spelled out: It is associated with more deaths than malnutrition, and it is a major risk factor for non-communicable conditions, such as cardiovascular disease, diabetes, musculoskeletal disorders, and certain cancers (primarily, endometrial, breast, and colon) [10].

In Europe, it is anticipated that adult obesity will reach crisis proportions by 2030, with severity varying across Europe [11]. Spain is predicted to be one of the most affected countries, as obesity is expected to affect as many as one in three Spaniards. Indeed, the prevalence rate of 17% for Spaniards aged 18 years and older are already unacceptably high [12]—having increased steadily from 7.4% three decades ago (Spanish National Health Surveys).

The causes of overweight and obesity in adults are manifold. Although genetic factors do play a role, little physical activity and poor lifestyle choices seem to be major determining factors [13]. Certain socioeconomic and demographic variables are also important determinants of obesity, namely, education [14], sex [15], age [16], income [17,18], and marital status [19–21]. Likewise, research in developed countries points to a strong association between economic conditions and health [22]; for instance, during temporary economic downturns, smoking and height-adjusted weight decline and leisure-time physical activity rises. Why behaviors become healthier when economic performance weakens may be explained by reduced hours spent at work, which, in turn, increases the non-market time available for lifestyle investments [22].

One factor assumed to have important social and economic consequences for adulthood obesity is labor market status. The reduced income implied by involuntary job loss may impact negatively on health, as it frequently results in individuals consuming obesogenic diets [1,2]. Long-term unemployment, in particular, seems to be a major risk factor for obesity prevalence [3–8]. The obesity risk when unemployed increases significantly, the longer the duration of unemployment and the older the individual [23]. Komlos and Carson [24] found that US prison inmates incarcerated in the depression-hit 1930s had significantly lower BMI values (up to 1.01 units) than inmates incarcerated in the late 19th century, a reduction attributed to the high unemployment levels of the period; in contrast, the BMI values of military college cadets in the 1930s increased by 1.5 units.

The health economics literature tends to point out that, beyond the impact on obesity prevalence, involuntary job loss causes a general deterioration in health [25–29]. However, in a study of the 2008 economic recession in Iceland, Ásgeirsdóttir, Corman, Noonan and Reichman [30] found that most health behaviors reverted to pre-crisis levels or trends during the economic recovery, suggesting that changes resulting from the crisis were probably too short-lived to have any major impact on health. A notable exception, however, was alcohol consumption, which did not revert back to the pre-crisis upward trend. Crost and Friedson [31] explored the impact of education-specific unemployment rates on mortality as a more exact measure of the likelihood of an individual is directly affected by a recession, finding that the unemployment rate of an education group was positively related to mortality in that group. This is consistent with the hypothesis that, while the overall unemployment level may have indirect health benefits, being directly affected by a recession has a detrimental effect on health. Finally, Caliendo and Lee [32] explored whether obese job applicants were treated or behaved differently from non-obese applicants, finding that only women who were obese experienced labor market discrimination (despite investing greater efforts in job-seeking) and also that this sub-group, once employed, earned significantly lower wages than healthy-weight women.

Zdrojowy-Wełna et al. [33] found that unemployment was a determinant of obesity for females, whereas, Noh et al. [34] pointed out that unemployment at age 60 or older, as well as women's unemployment, is associated with an increase in BMI compared to the unemployment of young people or men, respectively. Likewise, in a study developed to understand the epidemic situation of overweight and obesity among couples in planned pregnancy in the city of Chongqing (China), Liu et al. [35] identified that unemployment was more prone to overweight. In parallel, Coll et al. [36] aiming at evaluating a ten-year trend (2000–2010) in the prevalence of overweight among women in the Balearic Islands (Spain) and their association with socioeconomic factors, identify overweight and/or obesity increasing among young women, with unemployment. Moreover, Monsivais et al. [37] studying weight changes associated with job loss, retirement and job retention in two samples of adults working in the United Kingdom found that in two samples of adult workers revealed strong associations between job loss and excessive weight gain. Hughes and Kumari [38] showed that unemployment-adiposity relationship could not be properly studied assuming unidirectionality of effects, suggesting that unemployment could affect health via divergent adiposity-mediated pathways. However, Okop et al. [39] in determining the factors associated with excess body fat in black African men and women living in rural and urban communities in South Africa found that unemployment did not predict excessive body fat in men or women. Finally, Norte et al. [40] studying how socioeconomic changes have modified BMI values and eating habits of the Spanish population found that the employment situation is the variable that showed the greatest differences between years, while in a boom period, being unemployed did not represent a risk of having a poor diet.

What the current research adds to the health economics literature is that unemployment status—and to a significant degree, long-term unemployment—increases the BMI values of unemployed Spanish adults during the bust period more than during the boom period. More specifically, whereas, the IUOP is non-significant during a boom period, this no longer holds during a bust period, when the (log) BMI values of unemployed people increased by 0.22%. Furthermore, the likelihood of obesity increasing during a bust period is greatest for long-term unemployed individuals (an additional 0.011% in the BMI values). The DiD model we used confirms this aggravation of the IUOP during a recession. These findings point to the need for public policy measures during an economic crisis to prevent and treat obesity in unemployed adults, and especially in long-term unemployed adults. Measures to promote healthy lifestyles should, in particular, target unemployed individuals with a low education level living a sedentary life.

The results provided in this paper parallel previous findings from the health economics literature, indicating that an economic recession tends to increase obesity prevalence [18,41,42], and to induce unhealthy habits that promote obesity [43]. Our results also allow us to conclude that unemployment, and especially long-term unemployment, represents a huge cost for individuals—in terms of poorer health and lowered life expectancy—and for the economy as a whole, beyond the negative multiplier effects, the loss of income and the increase in spare economic capacity. Our findings highlight the need for public unemployment and health policies that are specifically tailored to economic-cycle phase as a means to better prevent adult obesity, rather than policies with a long term scope, and thus, less flexible to differentiate a period of economic boom from one of recession.

3. Methods

Below we briefly describe the empirical approach used to account for the causal effects of an economic crisis on the magnitude of the IUOP. As in previous studies on the impact of unemployment on health variables [44,45], we used PSM techniques to disentangle the IUOP, and DiD approach to check how the advent of a bust period conditions the impact of unemployment on obesity prevalence. Furthermore, we also analyze whether the intensity of the IUOP differs across BMI quantiles by combining the DiD regression and quantile regression techniques.

3.1. Propensity score matching

PSM methods were introduced by Rosenbaum and Rubin [46] to reduce the impact of treatment-selection bias in estimating the causal treatment effect of a variable using observational data. We used this approach to measure the IUOP.

Let Y_1 (Y_0) denote the BMI of an unemployed (employed) individual, and let D be a binary "treatment" indicator that takes the value 1 (0) if the individual is unemployed (employed). Thus, $Y_1 - Y_0$ measures whether unemployment has an impact on an individual's BMI. Since unemployment is the treatment effect, our primary goal is to estimate the average treatment effect on the treated (ATT), i.e., the average gain from treatment for individuals who were actually treated. This can be formally stated as:

$$\text{ATT} = E[Y_1 - Y_0/D = 1] = E[Y_1/D = 1] - E[Y_0/D = 1], \quad (1)$$

where the term $E[Y_0/D = 1]$ —called the counterfactual—accounts for what an unemployed individual's BMI would be if employed. To identify average unobserved counterfactuals, we used logit regressions for the boom period and the bus period, taking a vector X of observable characteristics that are assumed to capture all differences between treated (unemployed) and non-treated (employed) individuals. We imposed the common support condition on treated units [47], that is, we did not consider treated individuals with a probability of being treated that was greater (lesser) than the highest (lowest) probability for the non-treated group. Although we used different matching methods for robustness purposes (e.g., k-nearest neighbor, kernel with a normal distribution), we only report evidence for matching with a Gaussian kernel. We also report results for short- and long-term unemployment and considering different BMI distribution interquartile ranges, namely, 0–0.05, 0.05–0.1, 0.1–0.25, 0.25–0.5, 0.5–0.75, 0.75–0.9, 0.9–0.95, and 0.95–1.

3.2. Difference-in-differences framework

We used the DiD approach to account for how the magnitude of the IUOP was affected by the economic crisis. We pooled BMI data for a boom period (the data collected by the 2006–2007 survey) and a bust period (the data collected by the 2011–2012 survey) with different (un)employment categories and different socioeconomic parameters, included in a vector X of explanatory variables, and ran the following regression model:

$$Y_i = \alpha + \delta D_i + \lambda t_i + \gamma D_i t_i + X_i' \beta + \varepsilon_i, \quad (2)$$

where Y_i measures the BMI of individual i, D_i is a binary variable that takes the value 1 (0) if individual i is unemployed (employed), t_i is a binary time variable that adopts the value 0 (1) if individual i is observed in the boom (bust) period, and ε_i is a stochastic variable with zero mean that is independent of regressors. On the other hand, parameter β accounts for the socioeconomic variables included in vector X_i that could affect BMI, whereas parameters δ and $\delta + \lambda + \gamma$ reflect the magnitude of the IUOP in the boom and bust period, respectively. The sign and significance of parameter γ, therefore, provide information on how the economic crisis affects the magnitude of the IUOP. The DiD estimator assumes common trends. Hence, conditional on the observables X_i, "controls evolve from a pre- to a post-program period as treatments would have evolved had they not been treated" [48].

Equation (2) was estimated using: (a) A non-matched sample that included all observations in either boom or bust periods for unemployed and employed individuals; and (b) a matched sample obtained from a kernel-based propensity score. In the latter case, given repeated cross-sectional data and following Blundell and Dias [48], we estimated propensity scores as a function of observable characteristics in vector X, using a logit model in which the dependent variable was equal to 1 if the subject was unemployed in the bust period and 0 otherwise. We used estimated propensity scores to calculate three sets of kernel weights for the employed group in the boom period, the employed group in the bust period and the unemployed group in the boom period. We then estimated Equation (2) with the matched sample in order to obtain a matching-DiD estimate of the effect of the economic crisis on the magnitude of the IUOP. We imposed the common support condition and restricted the analysis to treated observations which had a counterfactual in each of the three control samples [49].

3.3. Difference-in-differences framework via quantile regression

We also assessed whether the crisis affected the intensity of the IUOP differently across BMI quantiles. We estimated the DiD regression in Equation (2) using a quantile regression technique [50], considering that the conditional τ quantile of BMI, $Q_{Y_i}(\tau|D_i, t_i, X_i)$ is given by:

$$Q_{Y_i}(\tau \vee D_i, t_i, X_i) = \alpha_\tau + \delta_\tau D_i + \lambda_\tau t_i + \gamma_\tau D_i t_i + X_i' \beta_\tau, \quad (3)$$

where, for quantile τ, parameters δ_τ and $\delta_\tau + \lambda_\tau + \gamma_\tau$ quantify the IUOP during boom and bust periods, respectively. All the parameters included in Equation (3) were estimated by minimizing the weighted absolute deviation as:

$$\text{argmin}_{(\alpha_\tau, \delta_\tau, \lambda_\tau, \gamma_\tau)} \sum_{i=1}^{N} \rho_\tau (Y_i - \alpha_\tau - \delta_\tau D_i - \lambda_\tau t_i - \gamma_\tau D_i t_i - X_i' \beta_\tau), \quad (4)$$

where $\rho_\tau(u) = u\big(\tau - I(u < 0)\big)$ for $0 < \tau < 1$, $I(\cdot)$ denotes the indication function, and N stands for the number of individuals in the sample. We solved the problem defined in Equation (4) using the linear programming algorithm proposed by Koenker and D'Orey [51], while standard errors for the estimated parameters were computed using the bootstrapping procedure proposed by Buchinsky [52]. Finally, we estimated Equation (3) using both a non-matched sample and a matched sample from PSM as done for the DiD approach outlined above.

4. Data collection

Our data were obtained from Spanish National Health Surveys conducted in June 2006–June 2007 and July 2011–June 2012. The first survey clearly corresponds to a boom period of the Spanish economy and the second one to a bust period. Both surveys—which apply stratified multistage sampling to annually sample around 29,000 households in Spain—retrieve information on individual health, lifestyle and socioeconomic and geographical characteristics. Restricting our sample to active individuals aged 16–65 years, we obtained a sample of 13,783 individuals for 2006–2007 (the so-called boom period) and 10,830 individuals for 2011–2012 (the so-called bust period), geographically located in all the Spanish autonomous regions. For each individual, we computed BMI as weight in kilograms divided by the square of height in meters, and following standard international criteria [53], obesity was computed in terms of BMI as a binary variable that took the value 1 (affected by obesity) if the BMI value was above a cutoff value, and 0 (non-affected by obesity) otherwise, with the cutoff determined according to the International Obesity Taskforce BMI cutoff tables [54].

For each individual we obtained information as follows: Employment status (employed or unemployed); unemployment duration if unemployed; educational level (no education, primary, secondary or university); age, sex and marital status; physical activity level; self-reported health status (labelled "health" in this study); weekly consumption of selected foods; and the Spanish autonomous region of residence.

Table 1. Definition of variables and descriptive statistics for 2006–2007 (boom period) and 2011–2012 (bust period).

Variable	**Definition**	**2006–2007 (*N* =**	**2011–2012 (*N* =**	
BMI	Body mass index	25.3	25.6 (4.256)	(**)
(log)BMI	Logarithm of BMI	3.2 (0.001)	3.2 (0.002)	(**)
Obesity	Dummy variable: 1, obese; 0, otherwise	12.414	14.497	(**)
Labor status				
Employed	Dummy variable: 1, employed; 0, otherwise	88.116	77.091	(**)
Unemp_never	Dummy variable: 1, unemployed and never worked; 0,	0.566	0.988	(**)
<6 months	Dummy variable: 1, unemployed <6 months; 0,	5.202	6.805	(**)
6-12 months	Dummy variable: 1, unemployed 6-12 months; 0,	1.654	3.638	(**)
>12 months	Dummy variable: 1, unemployed >12 months; 0,	4.099	11.330	(**)
Socioeconomic status				
Age	Age in years	40.3	41.9 (0.103)	(**)
Male	Dummy variable: 1, male; 0, otherwise	48.349	54.515	(**)
Health	Dummy variable: 1, vision good; 0, otherwise	76.638	81.237	(**)
Health regular	Dummy variable: 1, vision regular; 0, otherwise	19.060	15.125	(**)
Health poor	Dummy variable: 1, vision bad; 0, otherwise	4.302	3.638	(**)
Marital status	Dummy variable: 1, not single; 0, otherwise	65.733	64.441	(**)
No education	Dummy variable: 1, no education; 0, otherwise	3.026	3.093	
Primary education	Dummy variable: 1, completed primary education; 0,	47.203	51.348	(**)
Secondary	Dummy variable: 1, completed secondary education; 0	26.112	22.946	(**)
University	Dummy variable: 1, completed university education; 0,	23.660	22.613	(*)
Physical activity	Dummy variable: 1, physically active; 0, otherwise	58.550	25.642	(**)
Fruit	Dummy variable: 1, if 3 or more times/week to daily; 0,	79.830	78.901	(*)
Meat	Dummy variable: 1, if 3 or more times/week to daily; 0,	75.383	68.818	(**)
Eggs	Dummy variable: 1, if 3 or more times/week to daily; 0,	29.137	26.519	(**)
Fish	Dummy variable: 1, if 3 or more times/week to daily; 0,	40.499	37.313	(**)
Pasta	Dummy variable: 1, if 3 or more times/week to daily; 0,	96.409	94.922	(**)
Vegetables	Dummy variable: 1, if 3 or more times/week to daily; 0,	80.062	83.564	(**)
Sausages	Dummy variable: 1, if 3 or more times/week to daily; 0,	43.118	38.984	(**)
Milk	Dummy variable: 1, if 3 or more times/week to daily; 0,	94.464	92.207	(**)
Sugars	Dummy variable: 1, if 3 or more times/week to daily; 0,	47.972	44.515	(**)
Soda	Dummy variable: 1, if 3 or more times/week to daily; 0,	26.968	23.666	(**)
Region 1	Dummy variable: 1, if resident in Andalusia; 0, otherwise	8.024	12.115	(**)
Region 2	Dummy variable: 1, if resident in Aragon; 0, otherwise	9.410	3.804	(**)
Region 3	Dummy variable: 1, if resident in Asturias; 0, otherwise	2.808	3.416	(**)
Region 4	Dummy variable: 1, if resident in Balearic Islands; 0,	6.798	3.638	(**)
Region 5	Dummy variable: 1, if resident in Canarias; 0, otherwise	4.484	5.466	(**)
Region 6	Dummy variable: 1, if resident in Cantabria; 0, otherwise	5.674	2.650	(**)
Region 7	Dummy variable: 1, if resident in Castilla-Leon; 0,	3.932	5.577	(**)
Region 8	Dummy variable: 1, if resident in Castilla-La Mancha; 0,	3.359	4.377	(**)
Region 9	Dummy variable: 1, if resident in Catalonia; 0, otherwise	7.255	11.099	(**)
Region 10	Dummy variable: 1, if resident in Valencia; 0, otherwise	6.675	8.772	(**)
Region 11	Dummy variable: 1, if resident in Extremadura; 0,	2.714	4.211	(**)
Region 12	Dummy variable: 1, if resident in Galicia; 0, otherwise	10.187	4.986	(**)
Region 13	Dummy variable: 1, if resident in Madrid; 0, otherwise	8.119	10.323	(**)
Region 14	Dummy variable: 1, if resident in Murcia; 0, otherwise	6.254	4.192	(**)
Region 15	Dummy variable: 1, if resident in Navarre; 0, otherwise	6.225	3.980	(**)
Region 16	Dummy variable: 1, if resident in Basque Country; 0,	3.998	5.873	(**)
Region 17	Dummy variable: 1, if resident in Rioja; 0, otherwise	2.677	3.398	(**)
Region 18	Dummy variable: 1, if resident in Ceuta or Melilla; 0,	1.408	2.124	(**)

Note: Sample of Spanish employed and unemployed people aged 16–65 years from the Spanish Health Surveys.

[a] Data are reported as percentages for the categorical variables and as means (standard deviations) for the continuous variables.
* and ** denote significant differences in means or in categories between 2006–2007 (boom period) and 2011–2012 (bust period) according to the t-test (continuous variables) or chi-square test (categorical variables) at the 10% and 5% level, respectively.

Table 1 shows descriptive statistics for the sample for the representative boom and bust periods (years 2006–2007 and 2011–2012, respectively). Between both periods, obesity prevalence increased from 12.4% to 14.5% and mean BMI increased from 25.3 to 25.6, while overall employment fell from 88.1% to 77.1% and long-term unemployment rose considerably, from 4.1% to 11.3%. Obesity rates differed according to labor market status (Table 2). Obesity rates for employed people remained almost constant over the boom and bust periods, whereas, obesity rates for unemployed people, independently of unemployment duration, rose.

Table 2. Obesity percentages by labor market status for 2006–2007 (boom period) and 2011–2012 (bust period).

Obesity (%)	2006–2007	2011–2012	
Employed	12.194	13.523	(**)
Never worked	12.821	13.084	
Unemployed	14.042	17.775	(**)
<6 months	12.552	15.197	
6–12	13.158	18.020	
>12 months	15.929	19.641	(*)
Total	12.414	14.497	

Note: * and ** denote significant differences at the 10% and 5% level, respectively, in obesity prevalence between employed and unemployed individuals for the years 2006–2007 and 2011–2012 according to the chi-square test.
Source: Spanish Health Surveys 2006–2007 (*N* = 13,783) and 2011–2012 (*N* = 10,830).

The same trend was reflected in BMI terms (Table 3). Note that the level of physical exercise fell significantly during the bust period, whereas, no significant changes occurred in food consumption or in other socioeconomic variables.

Table 3. BMI and (log) BMI values in relation to employment status for 2006–2007 and 2011–2012.

	2006–2007			2011–2012		
	Employed	Unemployed		Employed	Unemployed	
BMI	25.335	25.148	(**)	25.516	25.912	(**)
(log) BMI	3.220	3.210	(**)	3.227	3.240	(**)

Note: ** denotes significant differences at the 5% level in mean BMI between employed and unemployed individuals for the years 2006–2007 and 2011–2012 according to the t-test.

5. Results and discussion

Below we first report boom and bust results regarding significant differences in average and (log) BMI for unemployed and employed individuals and in obesity prevalence for unemployed and employed individuals (see Tables 2 and 3 above). The chi-square test and the t-test for differences in obesity prevalence and differences in mean BMI, respectively, confirmed significant differences in BMI values for employed versus unemployed individuals in the different phases of the economic cycle.

5.1. Evidence regarding average treatment effect on the treated

Empirical results for the ATT (Gaussian kernel) for employed (non-treated) individuals and unemployed (treated) individuals in the boom and bust periods are reported in Table 4.

Table 4. Estimates of the unemployment effect on (log) BMI values for 2006–2007 (boom period) and 2011–2012 (bust period).

	2006–2007				**2011–2012**			
	Unemployed (average)[a] $E(Y_1 \mid D=1)$	Estimated counterfactual (average)[b]	Impact (average)[c] ATT	t-statistic	Unemployed (average)[a] $E(Y_1 \mid D=1)$	Estimated counterfactual (average)[b]	Impact (average)[c] ATT	t-statistic
Panel A. Overall (log) BMI								
	3.210	3.214	-0.005	-1.02	3.240	3.232	0.007	1.87*
Panel B. (log) BMI by quantile range								
0–0.05	2.924	2.926	-0.002	-0.33	2.911	2.921	-0.010	-1.56
0.05–0.10	2.997	2.998	-0.001	-0.69	3.004	3.006	-0.002	-1.41
0.10–0.25	3.065	3.066	-0.001	-0.74	3.079	3.078	-0.000	-0.14
0.25–0.50	3.159	3.161	-0.002	-1.15	3.174	3.173	0.001	0.51
0.50–0.75	3.264	3.263	0.000	0.04	3.275	3.274	0.001	0.78
0.75–0.90	3.366	3.366	-0.001	-0.25	3.380	3.378	0.003	1.36
0.90–0.95	3.450	3.455	-0.005	-1.87*	3.468	3.470	-0.002	-0.80
0.95–1	3.579	3.582	-0.003	-0.29	3.592	3.596	-0.005	-0.56
Panel C. (log) BMI by unemployment category								
Never Unemployed	3.163	3.209	-0.046	-2.08**	3.173	3.200	-0.026	-1.28
<6m	3.200	3.216	-0.016	-2.49**	3.235	3.227	0.009	1.42
6-12m	3.218	3.219	-0.001	-0.08	3.234	3.228	0.009	0.74
>12m	3.224	3.224	-0.000	-0.03	3.250	3.239	0.011	1.99**

Notes: We used matching methods with propensity score and a Gaussian kernel for a sample size of 13,783 individuals in 2006–2007 and 10,830 individuals in 2011–2012.

* and ** denote $p < 0.10$ and $p < 0.05$, respectively.

Control variables: Age, sex, health (vision), marital status, education, physical activity, food consumption and region.

[a] Sample data correspond to unemployed individuals.

[b] Estimates for unemployed if they had been working (counterfactual).

[c] The average treatment effect (ATT) is given by column 2 minus column 3. Expressed as BMI units, it measures the change in mean BMI attributable to unemployment.

In Table 4, for each studied year, the first column reports (log) BMI values for unemployed individuals; the second column reports the counterfactual, i.e., (log) BMI if the unemployed individual was employed; the third column—showing differences between the two previous columns—reports the rise or fall in (log) BMI explained by unemployment (labelled ATT); and the final column reports statistical significance for the ATT estimates.

Panel A in Table 4 shows ATT empirical evidence for total unemployment, indicating that when individuals became unemployed in the bust period, (log) BMI increased significantly (at the 10% significance level), whereas, the change was non-significant in the boom period. Taking into account the effect of the different factors reflected in the vector *X*, our results indicate that the impact of unemployment on BMI values was greater in magnitude in the bust period than in the boom period. Specifically, unemployment reduced (log) BMI levels by 0.005 in the boom period and increased (log) BMI levels by 0.007 in the bust period—reflecting a reduction of 0.16% and an increase of 0.22%, respectively.

Panel B in Table 4 displays empirical ATT results for (log) BMI by interquartile range. The impact of unemployment on different (log) BMI interquartile ranges was concentrated among individuals in the upper interquartile ranges in the boom period, leaving individuals in the lower and median interquartile ranges unaffected by unemployment status. This negative effect may be explained by the fact that an unemployment shock in the short term may lead overweight or obese individuals to take better care of themselves and improve their appearance to facilitate finding a new job.

Panel C in Table 4 reflects the effect of unemployment status on BMI values for different unemployment durations, indicating that the positive impact of unemployment status on (log) BMI values were reinforced with increased unemployment duration in the bust period. Thus, being unemployed for more than 12 months significantly increased (log) BMI values. These results corroborate previous studies that confirm poorer health among long-term unemployed individuals [23,55]. In the boom period, however, unemployment had the opposite effect on BMI values, i.e., (log) BMI values fell for short-term unemployed individuals (less than six months).

5.2. Difference-in-differences evidence

Tables 5 and 6 report the overall results for the impact of unemployment status on BMI—obtained using the DiD method reflected in Equation (2)—for the non-matched and matched samples (using Gaussian kernel matching for the refined control group), respectively.

Table 5. DiD estimates of the impact of unemployment on BMI for 2006–2007 (boom period) and 2011–2012 (bust period) using non-matched samples.

Parameter	All	Never employed	<6 months unemployed	6–12 months unemployed	>12 months unemployed
Constant (α)	3.098*** (323.85)	3.092*** (291.98)	3.094*** (303.16)	3.091*** (296.32)	3.095*** (306.42)
IUOP in boom (δ)	-0.002 (-0.38)	0.004 (0.24)	-0.005 (-0.82)	0.011 (1.12)	-0.003 (-0.44)
Bust effect (λ)	-0.008*** (-3.63)	-0.008*** (-3.61)	-0.008*** (-3.78)	-0.008*** (-3.62)	-0.008*** (-3.45)
Bust effect on IUOP (γ)	0.010* (1.93)	-0.006 (-0.30)	0.017** (2.15)	-0.002 (-0.16)	0.010 (1.28)
Control variables					
Age	0.003*** (32.92)	0.003*** (30.83)	0.003*** (32.02)	0.003*** (31.06)	0.003*** (30.86)
Sex	0.087*** (44.50)	0.091*** (43.75)	0.090*** (44.45)	0.090*** (43.74)	0.088*** (43.38)
Health regular	0.020*** (7.85)	0.020*** (9.12)	0.019*** (7.29)	0.020*** (7.42)	0.020*** (7.72)
Health poor	0.025*** (5.08)	0.033*** (5.89)	0.032*** (5.97)	0.029*** (5.45)	0.026*** (5.04)
Marital status	0.020*** (10.19)	0.020*** (9.12)	0.020*** (9.54)	0.020*** (9.29)	0.020*** (9.41)
Primary education	-0.012** (-2.18)	-0.013** (-2.01)	-0.013** (-2.16)	-0.011* (-1.78)	-0.011* (-1.77)
Secondary education	-0.033*** (-5.71)	-0.032*** (-4.81)	-0.033*** (-5.20)	-0.030*** (-4.69)	-0.032*** (-5.16)
University education	-0.058*** (-9.86)	-0.058*** (-8.67)	-0.058*** (-9.13)	-0.056*** (-8.57)	-0.056*** (-9.06)
Physical activity	-0.018*** (-8.69)	-0.017*** (-7.73)	-0.017*** (-7.99)	-0.017*** (-7.87)	-0.017*** (-8.08)
Fruit	0.007*** (2.66)	0.005* (1.80)	0.006** (2.14)	0.005** (1.99)	0.006** (2.35)

Meat	0.017*** (7.71)	0.017*** (7.04)	0.016*** (7.04)	0.017*** (7.35)	0.017*** (7.45)
Eggs	-0.006*** (-2.84)	-0.006*** (-2.72)	-0.007*** (-3.02)	-0.007*** (-3.07)	-0.007*** (-2.88)
Fish	0.0020 (1.00)	0.003 (1.23)	0.001 (0.49)	0.003 (1.26)	0.003 (1.48)
Pasta	-0.025*** (-5.39)	-0.024*** (-4.70)	-0.025*** (-5.15)	-0.023*** (-4.71)	-0.026*** (-5.24)
Vegetables	0.005** (1.97)	0.005* (1.65)	0.006** (2.14)	0.006** (2.18)	0.004 (1.64)
Sausages	-0.003 (-1.23)	-0.002 (-0.95)	-0.002 (-0.88)	-0.002 (-0.99)	-0.002 (-1.00)
Milk	0.003 (0.88)	0.004 (0.95)	0.005 (1.11)	0.004 (1.07)	0.004 (0.93)
Sugars	-0.0144*** (-7.44)	-0.015*** (-7.01)	-0.014*** (-7.06)	-0.015*** (-7.39)	-0.014*** (-6.81)
Soda	0.002 (0.75)	0.002 (0.80)	0.002 (0.71)	0.003 (1.09)	0.002 (0.84)
R^2	0.18	0.19	0.19	0.19	0.18

Notes: DiD model to estimate the impact of unemployment status on (log) BMI for a sample size of 24,613 individuals. Equation (2) was estimated by controlling for the variables reported in the table and for regional effects (not reported in the table, but available on request). *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 6. DiD estimates with Gaussian kernel matching for the impact of unemployment on BMI for 2006–2007 (boom period) and 2011–2012 (bust period).

Parameter	**All**	**Never employed**	**<6 months unemployed**	**6–12 months unemployed**	**>12 months unemployed**
Constant (α)	3.108*** (332.44)	3.113*** (237.10)	3.104*** (306.72)	3.091*** (297.25)	3.133*** (310.18)
IUOP in boom (δ)	-0.002 (-0.77)	0.011*** (2.64)	-0.003 (-1.16)	0.011*** (3.19)	-0.006 (-1.53)
Bust effect (λ)	-0.007** (-2.37)	-0.008* (-1.87)	-0.010*** (-3.32)	-0.008*** (-2.69)	-0.008** (-2.20)
Bust effect on IUOP (γ)	0.009** (2.27)	-0.010* (-1.83)	0.015*** (3.85)	-0.001 (-0.31)	0.011** (2.43)
Control variables					
Age	0.003*** (32.42)	0.004*** (30.24)	0.003*** (30.83)	0.003*** (30.05)	0.003*** (25.47)
Sex	0.076*** (36.44)	0.108*** (37.45)	0.083*** (39.71)	0.076*** (35.20)	0.071*** (31.34)
Health regular	0.021*** (8.31)	0.010** (2.44)	0.017*** (6.45)	0.021*** (7.50)	0.025*** (9.51)
Health poor	0.018*** (4.29)	0.059*** (7.90)	0.027*** (4.97)	0.006 (1.18)	0.016*** (3.84)
Marital status	0.020*** (9.73)	0.018*** (6.30)	0.021*** (10.06)	0.019*** (8.70)	0.016*** (7.33)

Primary education	-0.010** (-2.08)	-0.035*** (-5.14)	-0.017*** (-2.82)	-0.004 (-0.63)	-0.009* (-1.91)
Secondary education	-0.033*** (-6.34)	-0.016** (-2.14)	-0.038*** (-6.22)	-0.018*** (-2.95)	-0.039*** (-7.36)
University education	-0.057*** (-10.37)	-0.053*** (-7.38)	-0.063*** (-10.05)	-0.043*** (-7.07)	-0.058*** (-10.21)
Physical activity	-0.022*** (-9.46)	-0.034*** (-11.31)	-0.019*** (-8.77)	-0.025*** (-10.52)	-0.023*** (-9.02)
Fruit	0.011*** (4.34)	-0.011*** (-3.20)	0.009*** (3.48)	0.007*** (2.87)	0.013*** (4.70)
Meat	0.017*** (7.48)	0.007** (2.36)	0.015*** (6.28)	0.027*** (11.12)	0.018*** (7.22)
Eggs	-0.006*** (-2.43)	0.029*** (-9.36)	-0.007*** (-2.98)	-0.010*** (-4.17)	-0.006** (-2.42)
Fish	-0.000 (-0.15)	0.011*** (3.47)	-0.009*** (-4.21)	0.003 (1.32)	0.004* (1.84)
Pasta	-0.028*** (-5.63)	-0.008 (-1.05)	-0.034*** (-6.76)	-0.019*** (-3.42)	-0.035*** (-6.65)
Vegetables	0.003 (1.16)	-0.018*** (-5.46)	0.008*** (3.00)	0.017*** (6.10)	-0.002 (-0.59)
Sausages	-0.004 (-1.93)	-0.029*** (-9.87)	-0.003 (-1.32)	-0.008*** (-3.57)	-0.002 (-0.89)
Milk	0.002 (0.64)	-0.013** (-2.50)	0.008* (1.82)	0.004 (0.89)	-0.000 (-0.10)
Sugars	-0.014*** (-6.90)	-0.024*** (-8.41)	-0.012*** (-5.85)	-0.025*** (-11.47)	-0.009*** (-4.17)
Soda	0.001 (0.37)	-0.002 (-0.79)	-0.001 (-0.54)	0.012*** (4.79)	0.002 (0.78)
R^2	0.15	0.22	0.18	0.17	0.13

Notes: DiD model to estimate the impact of unemployment status on (log) BMI using Gaussian kernel matching with a common support of 24,589 observations (the common support discarded 3 out of 4,119 unemployed individuals and 21 out of 20,494 employed individuals). Equation (2) in the main text was estimated by controlling for the variables reported in the table and for regional effects (not reported in the table, but available on request). *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The evidence reported in the first column in Tables 5 and 6 shows that, once the effect of different control variables was taken into account, the parameter δ was not significant, indicating that unemployment in the boom period had no causal impact on BMI values, thereby corroborating the evidence reported in Table 4. Contrariwise, the γ parameter indicates that, during the bust period, the impact of unemployment status on BMI values was positive and significant (at the 5% significance level). It can therefore be concluded that the combination of unemployment and economic recession increased BMI values in bust periods relative to boom periods. Furthermore, unemployment had the most impact on BMI values for long-term unemployed or recently unemployed individuals. A plausible explanation—confirmed by lower rates of physical activity in the bust period, 25.6% versus 58.6% in the boom period—may be that long-term unemployment during an economic crisis generates a negative shock that leads individuals to neglect their health (see Table 1).

Considering the effects of covariables X, the influence of socioeconomic status (reflected in educational level) on BMI values was notable, as individuals with a university education had lower

BMI values in both boom and bust periods. This finding corroborates findings by Drewnowski and Specter [17], who reported higher obesity rates among poorer and less well-educated US population subgroups (the outcome of cheaper, more obesogenic diets). Our results are also consistent with those of Urbanos-Garrido and López-Valcarcel [44], who reported that economic crises led to poorer health—although note that these authors studied mental rather than physical health.

5.3. Difference-in-differences evidence via quantile regression

Tables 7 and 8 report the results for DiD via quantile regression for the non-matched and matched samples (using Gaussian kernel matching for the refined control group), respectively, as per Equation (3).

Table 7. Quantile DiD estimates of the impact of unemployment on BMI for 2006–2007 (boom period) and 2011–2012 (bust period) using non-matched samples.

Parameter	Q(0.05)	Q(0.10)	Q(0.25)	Q(0.50)	Q(0.75)	Q(0.90)	Q(0.95)
Constant (α)	2.840*** (157.77)	2.876*** (188.29)	2.973*** (290.60)	3.066*** (272.18)	3.197*** (192.77)	3.341*** (139.56)	3.487*** (106.81)
IUOP in boom (δ)	-0.019*** (-2.98)	-0.018*** (-3.00)	-0.006 (-1.09)	-0.001 (-0.10)	0.011* (1.71)	0.011 (1.50)	0.034** (2.38)
Bust effect (λ)	-0.004 (-1.26)	-0.002 (-0.59)	-0.006** (-2.50)	-0.008*** (-2.95)	-0.009*** (-2.74)	-0.014*** (-2.77)	-0.014* (-1.91)
Bust effect on IUOP (γ)	0.007 (0.83)	0.007 (0.90)	0.003 (0.46)	0.009 (1.26)	0.006 (0.87)	0.015 (1.49)	-0.009 (-0.51)
Control variables							
Age	0.003*** (16.31)	0.003*** (20.31)	0.003*** (27.73)	0.003*** (26.65)	0.003*** (20.63)	0.003*** (12.96)	0.003*** (8.52)
Sex	0.112*** (31.62)	0.114*** (39.75)	0.109*** (47.83)	0.099*** (41.79)	0.074*** (23.74)	0.050*** (12.17)	0.035*** (6.37)
Health regular	-0.005 (-1.02)	0.004 (0.97)	0.006* (1.73)	0.018*** (5.77)	0.035*** (8.59)	0.042*** (8.76)	0.038*** (4.83)
Health poor	-0.020* (-1.85)	-0.012 (-1.43)	-0.006 (-0.91)	0.024*** (3.00)	0.050*** (5.55)	0.055*** (5.25)	0.069*** (5.04)
Marital status	0.019*** (5.05)	0.021*** (7.07)	0.020*** (8.45)	0.024*** (11.71)	0.021*** (7.33)	0.014*** (3.56)	0.007 (1.21)
Primary education	0.002 (0.19)	0.011 (1.03)	-0.005 (-0.81)	-0.010 (-1.46)	-0.022** (-2.38)	-0.005 (-0.47)	-0.020 (-1.03)
Secondary education	-0.016 (-1.61)	-0.005 (-0.46)	-0.024*** (-3.57)	-0.029*** (-3.86)	-0.047*** (-4.58)	-0.029** (-2.49)	-0.049** (-2.50)
University education	-0.021** (-2.44)	-0.014 (-1.39)	-0.040*** (-5.86)	-0.052*** (-7.20)	-0.077*** (-8.05)	-0.070*** (-5.97)	-0.090*** (-4.53)
Physical activity	0.008** (2.14)	0.002 (0.79)	-0.006***	-0.019***	-0.022***	-0.041***	-0.051***

			(-2.62)	(-8.33)	(-7.79)	(-9.58)	(-8.39)
Fruit	0.019*** (3.97)	0.013*** (3.56)	0.005** (2.01)	0.006** (2.20)	0.001 (0.41)	-0.000 (-0.06)	-0.001*** (-0.08)
Meat	0.012*** (3.06)	0.013*** (4.00)	0.016*** (6.73)	0.018*** (7.09)	.021*** (6.07)	0.016*** (3.70)	0.019*** (2.54)
Eggs	-0.007 (-1.56)	-0.007** (-2.27)	-0.002 (-1.00)	-0.004* (-1.69)	-0.008** (-2.44)	-0.010** (-2.32)	-0.018*** (-2.87)
Fish	0.000 (0.14)	0.000 (1.00)	0.001 (0.44)	0.003 (1.08)	0.001 (0.47)	0.001 (0.39)	0.000 (0.05)
Pasta	-0.011 (-1.09)	-0.016** (-2.13)	-0.021*** (-3.41)	-0.019*** (-3.02)	-0.028*** (-3.56)	-0.039** (-2.55)	-0.068*** (-4.19)
Vegetables	-0.000 (-0.09)	-0.000 (-0.01)	0.005 (1.51)	0.003 (0.93)	0.008** (2.20)	0.007 (1.13)	0.007 (0.95)
Sausages	-0.005 (-1.45)	-0.005* (-1.73)	-0.004* (-1.74)	-0.003 (-1.40)	0.002 (0.53)	0.003 (0.62)	0.008 (1.33)
Milk	0.012 (1.40)	0.014** (2.52)	0.006 (1.11)	0.000 (0.04)	-0.003 (-0.39)	-0.008 (-1.18)	-0.005 (-0.50)
Sugars	-0.010*** (-3.08)	-0.010*** (-3.97)	-0.014*** (-6.53)	-0.015*** (-6.74)	-0.012*** (-4.58)	-0.011*** (-2.62)	-0.011* (-1.95)
Soda	-0.016*** (-3.40)	-0.011*** (-2.86)	-0.003 (-1.20)	0.001 (0.59)	0.012*** (3.50)	0.011** (2.30)	0.010 (1.36)
R^2	0.13	0.14	0.14	0.11	0.09	0.07	0.06

Notes: Quantile DiD model of the impact of unemployment on BMI during the boom for a sample size of 24,613 individuals. Equation (3) in the main text was estimated by controlling for the variables reported in the table and for regional effects (not reported in the table, but available on request). *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 8. Quantile DiD estimates with Gaussian kernel matching for the impact of unemployment on BMI for 2006–2007 (boom period) and 2011–2012 (bust period).

Parameter	**Q(0.05)**	**Q(0.10)**	**Q(0.25)**	**Q(0.50)**	**Q(0.75)**	**Q(0.90)**	**Q(0.95)**
Constant (α)	2.829*** (148.36)	2.884*** (190.51)	2.983*** (235.65)	3.068*** (237.25)	3.207*** (185.88)	3.349*** (164.77)	3.522*** (105.73)
IUOP in boom (δ)	-0.016*** (-2.66)	-0.016*** (-3.35)	-0.008** (-2.09)	-0.003 (-0.77)	0.006 (1.15)	0.010 (1.57)	0.032*** (3.00)
Bust effect (λ)	-0.003 (-0.76)	0.004 (1.19)	-0.002 (-0.87)	-0.008*** (-3.00)	-0.013*** (-3.37)	-0.012*** (-2.69)	-0.019*** (-2.68)
Bust effect on IUOP	0.009	0.006	0.003	0.009*	0.012*	0.009	-0.013

(γ)	(1.09)	(1.02)	(0.58)	(1.74)	(1.66)	(1.08)	(-0.91)
Control variables							
Age	0.003*** (12.33)	0.003*** (17.74)	0.003*** (23.59)	0.003*** (25.61)	0.003*** (16.87)	0.003*** (14.10)	0.003*** (7.90)
Sex	0.098*** (22.97)	0.100*** (29.74)	0.097*** (34.62)	0.088*** (30.96)	0.067*** (17.27)	0.041*** (9.09)	0.022*** (3.02)
Health regular	-0.006 (-1.03)	0.005 (1.23)	0.009** (2.54)	0.018*** (5.04)	0.037*** (7.63)	0.047*** (8.30)	0.041*** (4.43)
Health poor	-0.037*** (-3.96)	-0.018** (-2.50)	-0.006 (-0.95)	0.022*** (3.53)	0.049*** (5.81)	0.059*** (6.19)	0.062*** (4.06)
Marital status	0.020*** (4.88)	0.023*** (6.96)	0.020*** (7.35)	0.024*** (8.74)	0.020*** (5.38)	0.016*** (3.54)	0.007 (0.92)
Primary education	0.000 (0.05)	0.005 (0.68)	-0.006 (-0.90)	-0.008 (-1.19)	-0.012 (-1.30)	0.004 (0.40)	-0.014 (-0.79)
Secondary education	-0.019* (-1.70)	-0.010 (-1.15)	-0.021*** (-2.94)	-0.031*** (-4.16)	-0.037*** (-3.73)	-0.023** (-2.06)	-0.040** (-2.09)
University education	-0.018 (-1.63)	-0.014* (-1.67)	-0.040*** (-5.38)	-0.052*** (-6.78)	-0.069*** (-6.68)	-0.063*** (-5.34)	-0.089*** (-4.57)
Physical activity	0.008* (1.79)	0.006* (1.70)	-0.008*** (-2.79)	-0.022*** (-7.32)	-0.032*** (-7.67)	-0.048*** (-9.98)	-0.064*** (-8.20)
Fruit	0.030*** (6.06)	0.015*** (3.99)	0.009*** (2.78)	0.011*** (3.31)	0.005 (1.10)	-0.002 (-0.32)	-0.004*** (-0.43)
Meat	0.013*** (2.92)	0.014*** (3.93)	0.010*** (3.37)	0.020*** (6.19)	0.020*** (4.70)	0.017*** (3.35)	0.022*** (2.69)
Eggs	-0.006 (-1.38)	-0.012** (-3.18)	-0.001 (-0.48)	-0.004 (-1.38)	-0.008* (-1.85)	-0.002 (-0.40)	-0.012 (-1.51)
Fish	-0.004 (-0.97)	-0.003 (-0.86)	-0.001 (-0.49)	0.002 (0.76)	-0.001 (-0.29)	-0.000 (-0.04)	-0.005 (-0.65)
Pasta	-0.017 (-1.83)	-0.026*** (-3.56)	-0.022*** (-3.31)	-0.022*** (-3.24)	-0.027*** (-2.89)	-0.045*** (-4.17)	-0.081*** (-4.58)
Vegetables	0.003 (0.49)	-0.002 (-0.43)	0.001 (0.27)	0.001 (0.33)	0.009* (1.80)	0.002 (0.41)	-0.005 (-0.50)
Sausages	-0.009** (-2.19)	-0.006 (-1.63)	-0.006** (-2.25)	-0.006* (-1.93)	-0.001 (-0.28)	0.005 (1.12)	0.013* (1.72)
Milk	0.023*** (2.95)	0.010* (1.72)	0.001 (0.28)	0.002 (0.32)	0.001 (0.18)	-0.009 (-1.06)	-0.011 (-0.79)
Sugars	-0.007	-	-	-	-	-0.011**	-0.008

	(-1.56)	0.010*** (-3.97)	0.013*** (-4.68)	0.017*** (-6.02)	0.018*** (-4.78)	(-2.52)	(-1.03)
Soda	-0.010** (-2.21)	-0.009** (-2.35)	-0.004 (-1.28)	0.004 (1.21)	0.011** (2.44)	0.010** (1.80)	0.001 (0.18)
R^2	0.11	0.12	0.12	0.10	0.08	0.06	0.06

Notes: Quantile DiD model to estimate the impact of unemployment status on quantiles of (log) BMI in an economic recession. We used Gaussian kernel matching with a common support of 24,589 observations (the common support discarded 3 out of 4,119 unemployed individuals and 21 out of 20,494 employed individuals). Equation (3) was estimated by controlling for the variables reported in the table and for regional effects (not reported in the table, but available on request). *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Estimates for the δ_τ parameter confirm that unemployment status during the boom period had a significant negative (positive) impact on BMI values for lower (upper) (log) BMI quantiles, independently of whether we used the non-matched or matched samples. The results, thus, confirm that, in boom times, unemployment reduces BMI levels for individuals in lower BMI quantiles and increases BMI levels for individuals in upper BMI quantiles. However, regarding the IUOP during the bust period, our γ_τ parameter estimates indicate that the economic crisis reinforced the magnitude of the IUOP in the upper-median BMI quantile. Thus, the positive effect of unemployment on BMI values in the bust period was significant for individuals whose BMI values were in the upper-median quantile.

6. Conclusions

We analyzed the impact of unemployment status on obesity prevalence (IUOP) and assessed how the magnitude of the IUOP might differ in a boom versus a bust period. This issue is undoubtedly relevant in a context, like that of Spain, where obesity increased from 12.4% in 2006–2007 to 14.5% in 2011–2012 (representative years of a boom and bust period, respectively). Therefore, understanding the factors that condition rising obesity and BMI levels in economic recessions represent a potentially important contribution to our understanding of various aspects of obesity as a pandemic, not only in Spain, but also across the world. Before the economic crisis that unfolded from 2008, the fact that 58.6% of working-age Spaniards were physically active in their spare time, compared to only 25.6% after recession onset, would suggest that reduced activity levels had a bearing on rising obesity and BMI levels.

Our main findings show that while unemployment did not significantly impact on the BMI levels of unemployed people in a boom period, but did have a significant impact in a bust period. More specifically, unemployment in the boom period had no causal effect on obesity. However, the advent of an economic crisis increased the (log) BMI values of individuals who had been unemployed during the previous boom by 0.007—and by as much as 0.011 for long-term unemployed individuals. Moreover, unemployment has the most impact on BMI values for long-term unemployed or recently unemployed individuals. This result would suggest that the physical health of occupationally active individuals is impaired once they become unemployed during an economic crisis and also that this effect is positive and significant.

We also show that the socioeconomic status (reflected in educational level) had a notable impact on BMI values, as individuals with a university education had lower BMI values in both boom and bust periods. Likewise, certain socioeconomic and lifestyle characteristics were significant risk factors for obesity. Not being university-educated or physically active, in particular, significantly increase BMI levels. This link between education and health parallels similar findings by previous studies [56,57]. The increase in BMI values among unemployed individuals during a crisis period as compared to a boom period could be a consequence of weight gain associated with lowered morale, reduced physical activity and neglected health with the advent of an economic crisis.

Overall, our work suggests that, in order to prevent and combat obesity, public policies should be differentially designed according to the phase of the economic cycle and should aim specifically at the long-term unemployed in bust periods. Measures to promote healthy lifestyles should particularly target sedentary, long-term unemployed individuals with lower education levels during crisis times. Thus, rather than a long-term health policy that indistinctly covers boom and bust periods, a shorter term policy and adjusted to the specific phase of the cycle through which the economy goes through might be more effective. Our conclusions are aligned with those of Suhrcke and Stuckler [58], who propose that public health policies should focus on preventing health deterioration in particularly vulnerable populations, including the unemployed and lower socioeconomic groups. Beyond this, what our research highlights is that such measures might also be tailored to the particular phase of the economic cycle.

Abbreviations

BMI: Body mass index IUOP: Impact of unemployment on obesity prevalence ATT: Average treatment effect on the treated DiD: Difference-in-differences PSM: Propensity score matching WHO: World Health Organization

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