Impact of macroeconomic conditions on obesity in adults and children

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Abstract

Economic evidence from the USA suggests that obesity in adults declines during temporary economic downturns. The aim of this study was to investigate the impact of macroeconomic conditions on obesity in both adults and children in England. We use individual level data on adults aged 16 years and older and children aged 2-15 years from the *Health Survey for England* over the period 1998 to 2009, supplemented with regional data on macroeconomic conditions. Obesity is calculated using standard measures for adults and children. Based on previous studies, our measure of macroeconomic conditions is the regional employment rate in the area in which the individual lives, measured in the previous quarter before their obesity was measured. We regress obesity against macroeconomic conditions, age, gender, ethnicity, household composition, household income, employment status, month of interview, region and year. The month indicators control for seasonal variations. The regional indicators control for time-invariant differences between regions. The year indicators control for factors that vary uniformly over time across regions. Our results show that conditional on the covariates, the coefficient on the employment rate variable is significant and positive in adults and significant and negative in children. We find that a 1 percentage point increase in regional employment is on average associated with a 1.7% *increase* in obesity in adults and a 3.9% *decrease* in children. These effects are mainly concentrated among poorer households and in adults, among those with children. Consistent with findings from the USA we show that in adults obesity declines during temporary economic downturns. We find that this is not the case in children and there is some evidence of the opposite effect.

Keywords: obesity; body mass index; macroeconomic conditions; employment

1. Introduction

When the economy temporarily worsens, we might expect this to have a negative impact on health. Similarly, health might be expected to improve when the economy improves. This could be for a number of reasons. For example, the actual and perceived threat of job losses may affect the mental and physical health of workers and their families. Households may have less, or may expect to have less, disposable income and so may adopt less healthy lifestyles: living conditions may worsen, and households may consume cheaper less nutritional food and undertake less physical activity in order to reduce the financial costs incurred. Health care and public health systems might provide fewer services due to budget cuts and households may be less likely to seek care because of the time and financial costs that would be incurred.

Contrary to this expectation there is a growing body of research suggesting that health *improves* during temporary economy downturns, and vice versa. For example, mortality among adults has been shown to decline when macroeconomic conditions worsen (Ruhm 2000; Tapia Granados, 2005; Neumayer, 2004; Gerdtham& Ruhm, 2006), health status, especially physical health, has been shown to improve (Ruhm, 2003), and so too have lifestyles (Ruhm, 2005). The evidence base to date focuses mainly on adults and there is little evidence of these effects in children. In one study, Dehejia and Lleras-Muney (2004) show that children conceived during recessions have reduced morbidity and mortality. They find that this is likely to be due selection effects and better health among parents during these periods.

Why might health *improve* when macroeconomic conditions temporarily worsen, as these studies suggest? One reason could be that households undertake fewer unhealthy lifestyles, e.g., they are less likely to excessively consume food, cigarettes and alcohol. Another reason could be that recessions give rise to cost saving activities that are health-promoting, such as walking instead of driving. Consistent with these ideas, Ruhm (2005) provides evidence that better lifestyles are one reason for the improvements in health when the economy declines. Using data for adults in the USA taken from the Behavioral Risk Factor Surveillance System during the period 1987 to 2000 he showed that smoking, obesity and physical inactivity all decline when macroeconomic conditions worsen. In other papers (Ruhm, 1995; Ruhm and Black 2003) he showed that alcohol consumption and related problems are positively associated with improvements in the economy, suggesting that any stress-related increases in alcohol consumption during recessions are more than offset by declines in consumption resulting from changes in economic factors such as lower incomes.

There is little evidence of these effects outside of the USA, and scant evidence in children. Against this background we explore the relationship between macroeconomic conditions and lifestyles using English data for adults and children. Our outcome of interest is obesity, given widespread concerns about rising obesity levels in many countries, that obesity is a major risk factor for a number of serious health problems as well as being a debilitating condition in its own right, and that it imposes substantial costs on the health care system and society.

The aim of our paper is to investigate the impact of macroeconomic conditions on obesity in both adults and children in England. We adopt a similar methodology to Ruhm (2005). Our approach is to regress obesity against an indicator for macroeconomic conditions plus a comprehensive set of covariates. We find that, consistent with findings from the USA, obesity in adults declines during temporary economic downturns in England, but that this is not the case in children.

2. Data and methods

2.1. Data

The analysis is based on data from 12 rounds (1998–2009) of the *Health Survey for England* (HSE) (National Centre for Social Research & University College London). The HSE is a cross-sectional representative national survey which draws a different sample every year of individuals living in England. Respondents are interviewed on a range of topics including their age, socioeconomic status and lifestyle. Height and weight are measured by the interviewer during the interviewer visit. The information used in this study has consistently been collected during the years included in the analysis. We run separate analyses in adults (aged 16 years and over) and children (aged 2 to 15 years). Pooling observations across the period there are 108,606 individual observations in the adult sample and 25,108 in the child sample.

Macroeconomic conditions are measured at the regional level, based on individual level data from the *Labour Force Survey* aggregated to Government Office Regions (GORs). (From 1998 to 2009 there were nine GORs in England, each with a population of about five and a half million residents (ONS, 2010).) The regional data were obtained from the Office for National Statistics website (http://www.ons.gov.uk/ons/index.html [accessed 8 December 2011]) and the NOMIS database (http://www.nomisweb.co.uk/ [accessed 8 December 2011]).

2.2. Obesity variables

Our outcomes variables are body mass index (BMI) and obesity. BMI is measured as weight in kilogrammes divided by height in metres squared (kg/m^2). BMI is computed from the height and weight measures obtained during the interviewer visit in the survey; it is not based on self reported height and weight, which means that there is less likelihood of systematic measurement error.

Obesity in adults is defined as a binary variable taking the value one if the individual has BMI >30 kg/m^2 and zero otherwise. Children were classified as obese if their BMI was in the highest five per cent of values for boys or girls of their age based on the 1990 UK BMI reference data (Cole, Freeman and Preece, 1995, 1998), i.e., if they were at or above the age- and gender-specific 95^{th} BMI percentiles of the 1990 reference population.

2.3. Macroeconomic conditions variables

Macroeconomic conditions are measured by the employment rate in the region where the individual lives. Our main measure is the regional employment rate defined as percentage of the working age population (women aged 16–59 years,

men aged 16–64 years) employed, self-employed, on a government-supported training programme or employment programme, or doing unpaid family work in the individual's region of residence during the quarter prior to the date of the survey interview when their obesity was measured.

We also used different specifications of the employment rate variable by varying the denominator (including the whole population aged 16 and over), the duration over which it is measured (using similar employment rates over the previous year and two years) and employing a further lag (the employment rate in the previous quarter but one to the date of interview).

2.4. Other variables

In all models we control for month of interview (12 categories), region (nine categories) and year (12 categories). We also control for various combinations of the following variables in different model specifications: age (a cubic function); gender; interactions between age and gender; ethnic group (white/non-white), education (three categories, adults only), marital status (five categories, adults only); number of children in household (five categories in the models for adults, four in the models for children); whether or not the household has a single parent (children only); annual household income; and, employment status (of the individual in the models for adults, of the household reference person in the models for children).

Annual household income is included as the log transformation of a continuous variable based on the prediction of an interval regression model of annual household income reported in 31 income bands, against a set of individual and household characteristics. The predicted values were fixed to fall within the range of the original income band, and were equivalised using the weights provided in the HSE to account for household composition. Missing income values were imputed based on out of sample predictions from the interval regression model of income bands which allows us to include observations with missing income in our analyses. A binary indicator for imputed income is also included.

2.5. Econometric specification

Based on Ruhm (2005) the econometric specification is:

$$Y_{ijmt} = \alpha E_{jmt} + \beta X_{ijmt} + \rho_j + \mu_m + \psi_t + \varepsilon_{ijmt} \qquad (1)$$

Y is the outcome (BMI, obesity) for individual i living in region j interviewed in month m during year t. E is the macroeconomic conditions variable. X is a vector of individual and household characteristics described above. ρ, μ and ψ represent unobserved determinants of obesity that are associated with the region, month and survey year, respectively. ε is a residual error term. α and β are coefficients and α is the coefficient of interest.

The month indicators control for seasonal variations that occur each year, e.g., reduced physical activity in Winter. The regional indicators control for time-invariant differences between regions, e.g., disparities in health and lifestyles between the North and South of England. The year indicators control for factors that vary

uniformly over time across all regions, e.g., technological changes that affect lifestyles. α therefore gives the effect of the macroeconomic conditions variable measured as within-region variations relative to corresponding changes in other regions, after accounting for seasonal variations and yearly trends, as well as differences in individual and household characteristics.

When BMI is the dependent variable we use ordinary least squares regression to estimate Eq.(1). When obesity is the dependent variable we use probit regression.

We rerun our models on the richest and poorest 50% of adults and of children in the sample, defined using annual household income, to see if the observed effects vary by socioeconomic status. Given that we investigate the impact of macroeconomic conditions on obesity on children we rerun our models on adults with and without children to see if we can further identify a children effect.

We apply the survey weights reported in the HSE to each observation. This adjusts for the fact that different observations have different probabilities of selection and participation in the survey. It is also possible that, due to the sampling strategy used in the HSE, observations are independent across Primary Sampling Units (PSUs), but not within PSUs. If this is the case then if we use estimators that assume independence within these clusters the standard errors on our regression coefficients will be too small and we will overestimate the statistical significance of the independent variables in our models. We therefore control for clustered sampling within PSUs using unique PSU/year identifiers that produce Huber/White/sandwich robust variance estimators that allow for within-group dependence (Kish & Frankel, 1974).

We present average marginal effects of the association between macroeconomic conditions and obesity controlling for the covariates. In the BMI models the average marginal effect is the coefficient on the macroeconomic conditions variable and it gives the change in BMI with a one percentage point increase in the employment rate. In the obesity models the average marginal effect is the change in the probability of being obese with a one percentage point increase in the employment rate.

3. Results

Table 1 summarises the national annual trends in employment, mean BMI and obesity among adults and children over the period 1998-2009. The national employment rate increased during the first third of the period, followed by a relatively stable middle period, and then a decline in the final third of the period, with a relatively sharp decline in the last year. Mean BMI and obesity increased throughout the period in adults, with a small decrease in the final year. The mean values for children were more erratic, reaching a peak in 2004 and declining thereafter.

Figures 1 and 2 show these trends in employment and BMI and employment and obesity, respectively. In both cases the top panel (a) shows the national annual means with 1998 values normalised to 100. In the bottom panel (b) the variables are detrended using a linear trend for months elapsed since January 1998 and are then normalised by subtracting the mean of the detrended variables and dividing this by

its standard deviation. These graphs indicate a positive relationship between national employment rates and BMI and obesity in adults. In children the relationship is not as clear. However, note that these comparisons are based on national annual data and the observed patterns might be affected by confounding factors.

Table 2 shows the summary statistics for the covariates included in the regression models. Around half the samples of adults and children are female and in adults (children) the mean age is 47 years (9 years). Around 90% of both samples are from the white ethnic group. Around 70% of adults live in households with no children. In the children's sample the modal number of children in the household is two (48%). Eighteen percent of children live in a household with a single parent. Annual household income was similar in the adult and children samples, though there was a higher proportion of missing income data in the adult sample. Around 60% of adults were in paid employment, and around 65% of children lived in households where the household response person was in paid employment. Around one quarter of adults sampled had no educational qualifications and 18% had a degree or higher. More than half the adults sampled were married. The numbers of adults and children interviewed each calendar month ranged from 5% to 10%; the percentages were lowest in December. Between 5% and 15% of each sample lived in each region; ranging from 5% in the North East to 15% in the South East. Each year contributed between 5% and 11% of the total sample sizes.

Table 3 shows the first set of regression results. Four sets of results are presented with different covariates, models (a) to (d), for both groups (adults and children), and for both dependent variables (BMI, obesity) using different regression models (OLS, probit).

The unadjusted results in model (a) show that in adults both BMI and obesity are positively correlated with improving macroeconomic conditions. The statistical significance and magnitude of the effect is maintained as we control for additional covariates (models (b) to (d)). In children the association is negative and statistically significant in all specifications except in the case of the unadjusted BMI model.

Our preferred specification is model (d) because it includes the most covariates and so the relationship between the employment rate and obesity is less likely to be contaminated by confounding factors. We interpret the size of the effects for this model. The average marginal effect of the macroeconomic conditions variable in the BMI model for adults is 0.037. This is the change in BMI (in kg/m^2) associated with a one percentage point increase in the regional employment rate. The mean BMI across all adults in the sample is around 27 kg/m^2, so the percentage effect is approximately (100)(0.037)/27 = 0.137%, i.e., a one percentage point increase in regional employment is on average associated with a 0.14% increase in BMI. In the case of the obesity model the average marginal effect is 0.004. This is the change in the probability of obesity in absolute terms associated with a one percentage point increase in the regional employment rate. The mean level of obesity across all adults in the sample is 0.23 (i.e., 23%) so the percentage effect is approximately (100)(0.004)/0.23 = 1.7%, i.e., a one percentage point increase in regional employment is on average associated with a 1.7% increase in the probability of obesity among adults.

In children the effects take the opposite sign. The average marginal effect in the BMI model is –0.048. The mean BMI across all children in the sample is around 18 kg/m^2, so the percentage effect is approximately (100)(–0.048)/18 = –0.267%, i.e., a one percentage point increase in regional employment is on average associated with a 0.27% *reduction* in BMI. In the obesity model the average marginal effect is –0.007. The mean level of obesity across the children's sample is 0.18 so the percentage effect is approximately (100)(–0.007)/0.18 = –3.9%, i.e., a one percentage point increase in regional employment is on average associated with a 3.9% *decrease* in the probability of obesity among children.

Table 4 shows the results using different specifications of the macroeconomic conditions variable. Models (f), (g) and (h) show the impact of regional employment measured over different time periods. In adults the marginal effects are either similar or larger and more significant in each case compared with model (d). In children the effects are smaller and non-significant in every case.

Table 5 shows the results in different sub-groups, stratifying by household income and, in adults, the presence of children in the household. We find that the positive impact of macroeconomic conditions on obesity among adults and the negative effect among children is concentrated on the poorest 50% of the population. We also find that the positive effect of macroeconomic conditions on obesity in adults is concentrated mainly in adults with children.

4. Concluding remarks

There are two main findings of this study. The first is that, consistent with previous evidence from the USA, adults in England tend to become more obese when the economy expands, and vice versa. Our estimates suggest that a one percentage point increase in the employment rate is on average associated with a 0.137% increase in BMI and a 1.7% increase in the probability of obesity among adults. The effect on obesity in England is slightly larger than the figure for the USA found previously by Ruhm (2005) of 0.4%.

The second main finding is that the statistically significant and positive relationship between obesity and regional employment found in adults does not apply to children; there is some evidence of the opposite effect, i.e., of a negative relationship between obesity and regional employment. This finding is somewhat tentative because while this effect is retained with different specifications of the covariates (Table 3), it becomes non-significant with different specifications of the employment variable (Table 4).

We note that in both adults and children the impact of a percentage point change in regional employment on obesity is greater than the impact on BMI. This could be because the impact on BMI is non-linear, with greater impacts among those near to the obesity threshold. Or, it could be because the distribution of the sample across the range of BMI values is not uniform, with clustering around the obesity threshold.

Taken at face value it is maybe surprising that regional employment rates measured during a three-month period affect individual obesity, because obesity probably responds slowly to changes in macroeconomic conditions. However, employment

rates are likely to be correlated over time, which means that the estimates, which are for the previous quarter, may be capturing the impact of macroeconomic conditions over a longer period than the previous three months. The results in Table 4 shows that in adults regional employment measured over the previous year or two years or lagged by one quarter has a larger and more significant effect on BMI than the preferred model. Obesity may be thought of as representing a stock of BMI that is determined by in-flows of calories and out-flows of energy expenditure, and these effects accumulate over time. Hence, as noted by Ruhm (2005), we might expect macroeconomic conditions measured over a long period to have a greater impact on obesity. However, this does not seem to be the case in children, possibly because the changing height and weight of children as they grow does not allow the effects of macroeconomic conditions over time to accumulate.

Our sub-group analyses in both adults and children show that the effect of macroeconomic conditions are found mainly in poorer households rather than richer ones (Table 5). If the impact of worsening macroeconomic conditions on obesity operates mainly via its impact on disposable income (e.g., in reduced overconsumption of food by adults, and fewer after school and weekend activities for children) then we would expect this to give rise to the results shown by models (m) and (n) since income is more likely to have a binding constraint on consumption activities among the poor. Models (o) and (p) suggest that the effect of macroeconomic conditions is greater for adults with children than without children. One explanation is that in times of recession parents sacrifice their own unhealthy lifestyle and worsen their children's unhealthy lifestyle

The major limitation of our study is that although we find evidence of a differential effect of macroeconomic conditions on adults and children we cannot identify the mechanisms that might cause these results. For example, could it be that among children, during times of recession, diet worsens because parents substitute cheaper high-carbohydrate foods for healthy foods? Is it that children undertake less physical activity because parents are less able to afford to take their children to after-school and weekend activities? Do parents sacrifice their own unhealthy lifestyle and with good intentions pass it on to their children? As well as these issues our study raises a number of other interesting questions that could be the subject of future research. Are our results in children also found in other countries? What is the impact of macroeconomic conditions on other lifestyles in children such as physical activity? What is the impact on health? Data limitations preclude us from investigating many of these issues, and future research to investigate them would be beneficial.

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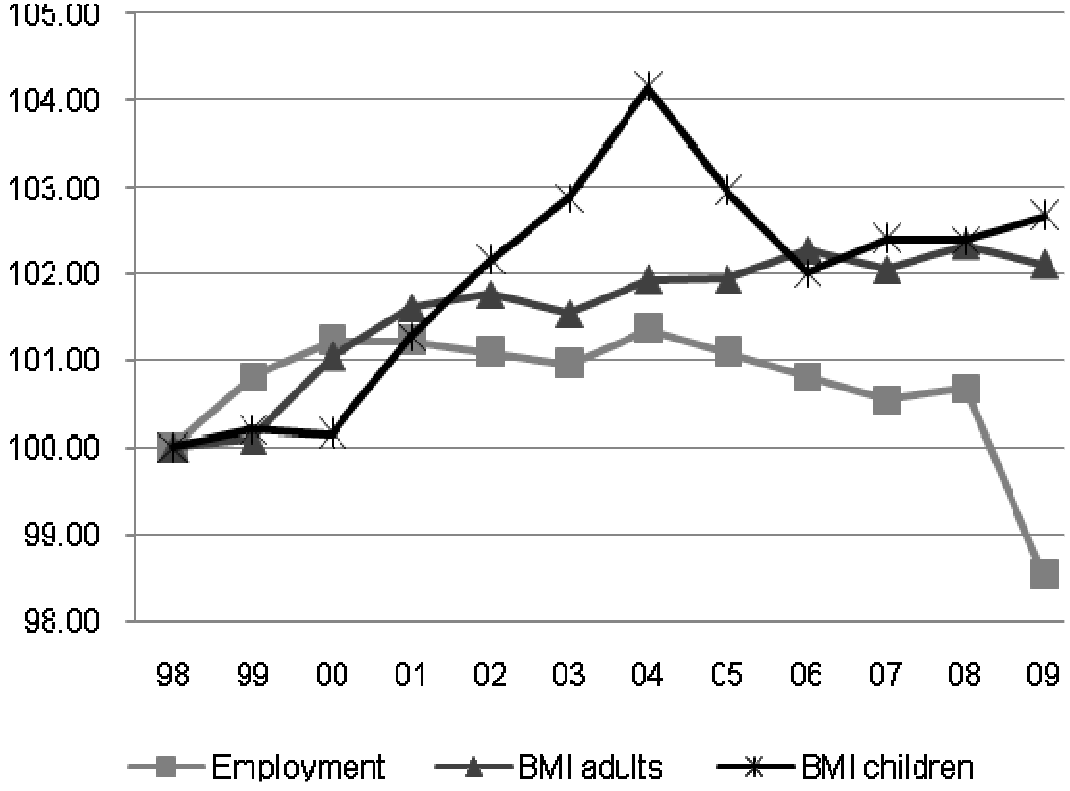
Table 1. Mean employment rate, BMI and obesity for adults and children by year

		Adults		Children	
	Employment rate	BMI (kg/m^2)	Obesity (BMI >30 kg/m^2)	BMI (kg/m^2)	Obesity (BMI >95th centile)
1998	74.2	26.50	0.196	17.94	0.147
1999	74.8	26.52	0.202	17.98	0.165
2000	75.1	26.77	0.214	17.97	0.148
2001	75.1	26.92	0.226	18.17	0.162
2002	75.0	26.96	0.230	18.33	0.186
2003	74.9	26.91	0.229	18.46	0.181
2004	75.2	27.01	0.233	18.68	0.203
2005	75.0	27.01	0.236	18.47	0.195
2006	74.8	27.10	0.243	18.30	0.174
2007	74.6	27.04	0.244	18.37	0.174
2008	74.7	27.11	0.249	18.37	0.171
2009	73.1	27.06	0.233	18.42	0.167

Figure 1. Variation in employment and BMI in adults and children

(a) Normalised trends (1998=100)



(b) Detrended using a linear trend for months elapsed

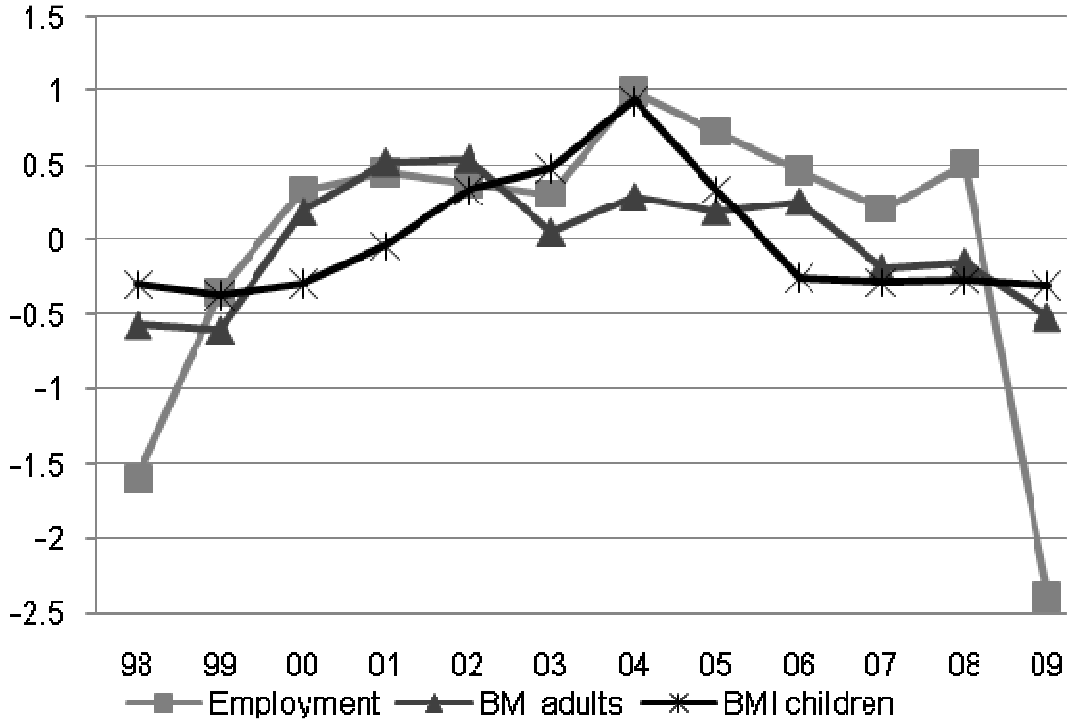
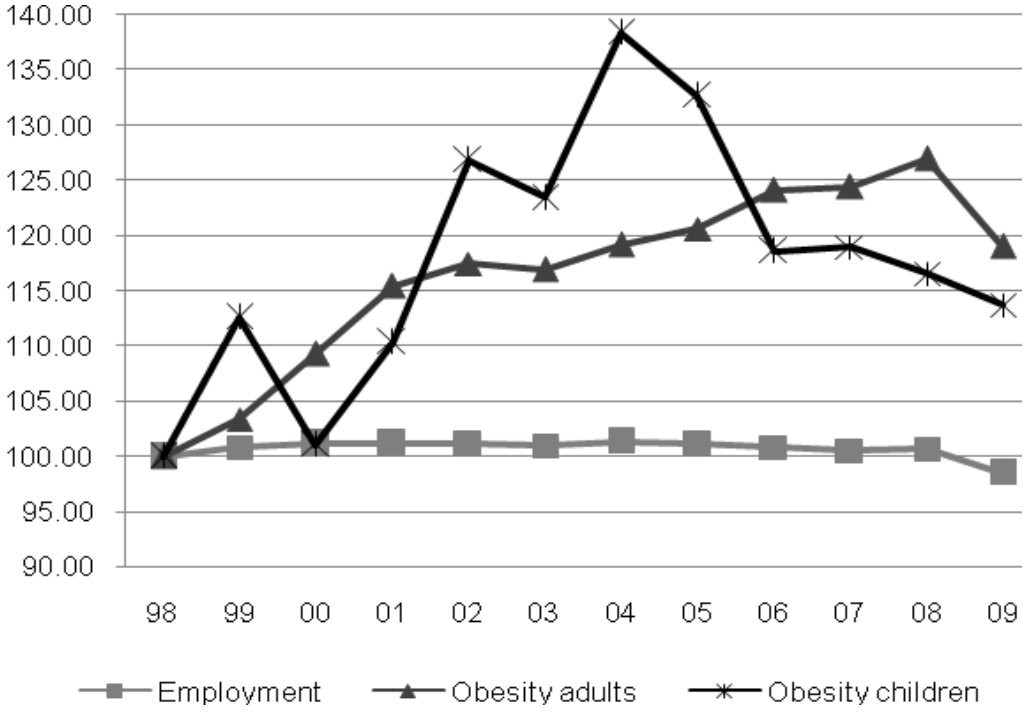


Figure 2. Variation in employment and obesity in adults and children

(a) Normalised trends (1998=100)



(b) Detrended using a linear trend for months elapsed

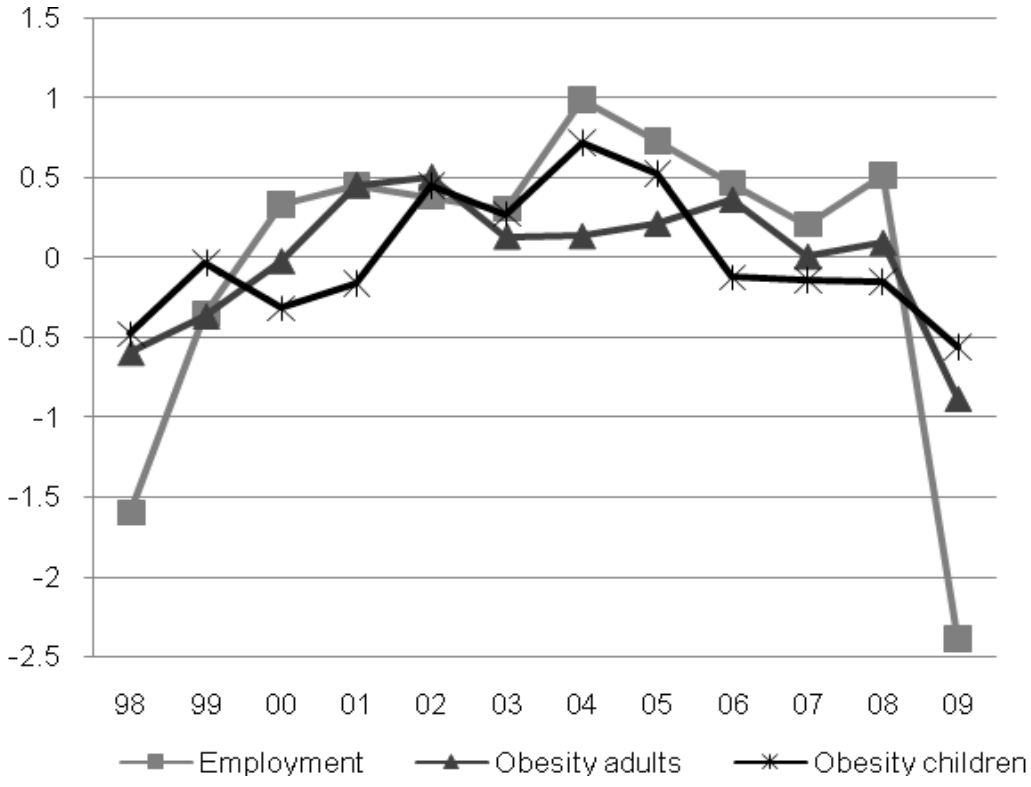


Table 2. Summary statistics for covariates

	Adults		Children	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
Demographic indicators				
Female	0.518	0.500	0.490	0.500
Age/100	0.466	0.178	0.086	0.034
White ethnic group	0.913	0.282	0.862	0.345
Household composition				
No children in household	0.690	0.463		
1 child	0.145	0.352	0.211	0.408
2 children	0.119	0.324	0.482	0.500
3 children	0.035	0.184	0.215	0.411
4 or more children	0.011	0.106	0.092	0.290
Household with single parent			0.177	0.382
Socioeconomic indicators				
Log annual household income	9.875	0.964	9.717	0.792
Missing income variable	0.194	0.396	0.114	0.318
In paid employment¶	0.591	0.492	0.659	0.474
Education – degree level of above	0.180	0.384		
Education – no qualifications	0.254	0.435		
Married	0.572	0.495		
Single	0.257	0.437		
Separated	0.022	0.147		
Divorced	0.070	0.255		
Widowed	0.071	0.257		
Month of interview				
January	0.094	0.291	0.099	0.298
February	0.086	0.281	0.088	0.283
March	0.087	0.282	0.085	0.279
April	0.085	0.279	0.089	0.285
May	0.084	0.277	0.083	0.277
June	0.080	0.271	0.081	0.272
July	0.084	0.278	0.080	0.271
August	0.082	0.274	0.079	0.270
September	0.085	0.278	0.087	0.282
October	0.084	0.277	0.085	0.278
November	0.099	0.299	0.097	0.295
December	0.050	0.219	0.048	0.213
Government Office Region				
London	0.127	0.333	0.128	0.334
North East	0.057	0.232	0.053	0.223
North West	0.137	0.344	0.147	0.354
Yorkshire	0.105	0.307	0.105	0.307
East Midland	0.091	0.288	0.090	0.286
West Midland	0.106	0.307	0.105	0.307

East of England	0.115	0.318	0.113	0.317
South East	0.157	0.364	0.157	0.364
South West	0.105	0.306	0.102	0.303
Year of data				
1998	0.112	0.315	0.117	0.321
1999	0.054	0.226	0.057	0.231
2000	0.055	0.227	0.060	0.237
2001	0.105	0.306	0.117	0.322
2002	0.097	0.296	0.119	0.324
2003	0.103	0.303	0.100	0.299
2004	0.044	0.204	0.042	0.200
2005	0.069	0.254	0.065	0.247
2006	0.115	0.318	0.107	0.309
2007	0.078	0.268	0.071	0.257
2008	0.122	0.327	0.109	0.312
2009	0.048	0.213	0.037	0.188
Observations	108,606		25,108	

¶ In models for adults this variable measures the employment status of the individual, in models for children it measures the employment status of the household reference person.

Table 3.Impact (average marginal effects) of macroeconomic conditions (employment rate) on obesity and BMI in adults and children

Sample	Dependent variable	Regression model	Unadjusted (a)	Covariates, month, region, year (b)	As (b) plus annual household income (c)	As (c) plus employment status¶ (d)
Adults	BMI (kg/m^2)	OLS	0.056***	0.038*	0.037*	0.037*
Adults	Obesity (BMI>30 kg/m^2)	Probit	0.003***	0.004***	0.004***	0.004***
Children	BMI (kg/m^2)	OLS	-0.012	-0.051*	-0.048*	-0.048*
Children	Obesity (BMI>95th centile)	Probit	-0.003***	-0.008**	-0.007**	-0.007**

Notes:
***p<0.01, **p<0.05, *p<0.1.
¶ In models for adults this variable measures the employment status of the individual, in models for children it measures the employment status of the household reference person.
In the models for adults there are 108,606 observations. In the models for children there are 25,108 observations.
The macroeconomic conditions variable is the regional employment rate (number employed/all those of working age) in the previous quarter.
The covariates in models for adults are age, gender, ethnicity, education, marital status and number of children in household.
The covariates in models for children are age, gender, ethnicity, single parent and number children in household.
Sample weights are used throughout. All SEs are adjusted for clustering by PSU.

Table 4. Impact (average marginal effects) of different employment variables on obesity and BMI in adults and children

Sample	Dependent variable	Regression model	Working age, previous quarter (d)	16+, previous quarter (e)	As (d) for previous year (f)	As (d) for previous 2 years (g)	As (d), lagged by one quarter (h)
Adults	BMI (kg/m^2)	OLS	0.037*	0.046*	0.063***	0.059**	0.043**
Adults	Obesity (BMI>30 kg/m^2)	Probit	0.004***	0.004*	0.004**	0.003*	0.003**
Children	BMI (kg/m^2)	OLS	-0.048*	-0.002	0.009	-0.007	-0.029
Children	Obesity (BMI>95th centile)	Probit	-0.007**	-0.006	-0.003	-0.004	-0.004

***p<0.01, **p<0.05, *p<0.1.
In the models for adults there are 108,606 observations. In the models for children there are 25,108 observations.
The macroeconomic conditions variables are the regional employment rate (number employed/all those of working age) in the previous quarter, year and 2 years, lagged by one quarter, and defined as number employed/all those of aged 16 and over.
The covariates in models for adults are age, gender, ethnicity, education, marital status and number of children in household.
The covariates in models for children are age, gender, ethnicity, single parent and number children in household.
Sample weights are used throughout. All SEs are adjusted for clustering by PSU.

Table 5. Subgroup analysis of impact (average marginal effects) of employment on obesity and BMI in adults and children

Sample	Dependent variable	Regression model	Working age, previous quarter (d)	As (d) for richest 50% (m)	As (d) for poorest 50% (n)	As (d) for adults without children (o)	As (d) for adults with children (p)
Adults	BMI (kg/m^2)	OLS	0.037*	0.016	0.044	0.021	0.082**
Adults	Obesity (BMI>30 kg/m^2)	Probit	0.004***	0.003	0.005**	0.003	0.082***
Children	BMI (kg/m^2)	OLS	-0.048*	-0.026	-0.080**	N/A	N/A
Children	Obesity (BMI>95th centile)	Probit	-0.007**	-0.005	-0.009*	N/A	N/A

***p<0.01, **p<0.05, *p<0.1.
N/A: not applicable
In the models for adults there are 108,606 observations. In the models for children there are 25,108 observations.
The macroeconomic conditions variable is the regional employment rate (number employed/all those of working age) in the previous quarter.
The covariates in models for adults are age, gender, ethnicity, education, marital status and number of children in household.
The covariates in models for children are age, gender, ethnicity, single parent and number children in household.
Sample weights are used throughout. All SEs are adjusted for clustering by PSU.