# The Impact of the Great Recession on Health-Related Risk Factors, Behaviour and Outcomes in England

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## Abstract

This paper examines the impact that the Great Recession had on individuals' health behaviours and risk factors such as diet choices, smoking, alcohol consumption, and Body Mass Index, as well as on intermediate health outcomes in England. We exploit data on about 9,000 households from the Health Survey for England for the period 2001-2013 and capture the change in macroeconomic conditions using regional unemployment rates and an indicator variable for the onset of the recession. Our findings indicate that the recession is associated with a decrease in the number of cigarettes smoked - which translated into a moderation in smoking intensity - and a reduction in alcohol intake. The recession indicator itself is associated with a decrease in fruit intake, a shift of the BMI distribution towards obesity, an increase in medicines consumption, and the likelihood of suffering from diabetes and mental health problems. These associations are often stronger for the less educated and for women. When they exist, the associations with the unemployment rate (UR) are nevertheless similar before and after 2008. Our results suggest that some of the health risks and intermediate health outcomes changes may be due to mechanisms not captured by worsened URs. We hypothesize that the uncertainty and the negative expectations generated by the recession may have influenced individual health outcomes and behaviours beyond the adjustments induced by the worsened macroeconomic conditions. The net effect translated into the erosion of the propensity to undertake several health risky behaviours but an exacerbation of some morbidity indicators. Overall, we find that the recession led to a moderation in risky behaviours but also to worsening of some risk factors and health outcomes.

***Keywords:*** England, Great Recession, health behaviour, risky health behaviour, morbidity, unemployment, Health Survey for England

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## 1 Introduction

The virulence of the Great Recession has triggered interest on its social spill-overs, in particular its impact on population's health and wellbeing. Indeed, while the direct effect of the crisis in terms of worsened macroeconomic indicators is obvious, there are negative externalities in terms of population welfare that demand quantifying. The relationship between macroeconomic conditions and health outcomes has been studied in the literature (Ruhm, 2000; Ruhm, 2003, 2005; Neumayer, 2004; Gerdhtham and Ruhm, 2006) but a clear understanding of this relationship is yet to be established. Evidence is often limited to few countries and, most recently, it has largely focused on EU-bailout countries and their conclusions seem to depend on the methodological approach and the type of health outcomes considered.

This paper contributes to the growing body of literature on the impact of economic recessions on health risks and outcomes by focussing on the specific case of the Great Recession in England. The UK is the second largest economy in the EU, one of the largest financial hubs in the world, and was therefore one of the countries hit the hardest by the Great Recession. The UK shrunk by 4.3% in 2009 alone (*Eurostat,* 2017) and the government had to bail out and nationalise large domestic banks (National Audit Office, 2017), leading to increased government debt and deficit. While we would expect the impact of the Great Recession in England to be paradigmatic, the effects of the crisis in this country have received less attention than others. Besides filling this gap, this paper also contributes to the literature by, first, examining individual level data (rather than country or regional aggregated data) in England. Second, we include not only risks factors and behaviours such as smoking, drinking or BMI (more commonly examined in the literature), but also examine health outcomes and dietary choices such as consumption of fruit and vegetables. Our approach is original insofar we use intermediate health behaviours and morbidity instead of mortality. Our assumption is that health behaviours, as intermediate factors in the health production function, provide a wider picture of the impact of the recession, as changes in health behaviours may precede changes in mortality rates. Third, we capture adverse macroeconomic conditions by exploiting not only the regional Unemployment Rate (*UR)*, but also a *post-2008* indicator variable that reflects the impacts of the recession that trascend worsened *UR*s. Fourth, our specifications account for the potential endogeneity of income. The relationship between income and health has long been established with individuals in higher income levels being in better health. The

problem of reverse causality between health measures and income in this context has not been considered when using individual level data and our estimates account for this using an instrumental variables approach.

We use the Health Survey for England (HSE), a repeated cross sectional dataset, for the period 2001-2013. Our results indicate that changes in regional URs are associated with a *decrease* in cigarette consumption, explained by a shift from heavy to moderate smoking and a *decrease* in drinking. Higher URs are associated with a decrease in the probability of mental problems. Effects on all other measures are captured by the *post-2008* indicator variable instead: the aftershock of the Great Recession translates into a *decrease* in fruit intake; an *increase* in BMI and the likelihood of being obese; *increased* demand for medicines and in the likelihood of suffering from diabetes and mental health problems. All these associations are often stronger for those less educated and vary by gender.

The paper is structured as follows. Section 2 summarises the existing literature relating to health outcomes and economic downturns. Section 3 presents the HSE data on health risks, health intermediate outcomes, and socio-economic controls and describes the variables used to capture macroeconomic conditions. Section 4 lays out the empirical strategy and Section 5 presents the results of the benchmark case and its extensions. Section 6 provides a discussion and section 7 concludes.

## 2 Background

The link between economic recessions and health has been documented by Ruhm in a number of studies that use data pre-dating the 2008 recession mostly with regional UR as a measure of worsened economic conditions. It has been shown that risk factors such as smoking increase during economic expansions while there is a reduction in physical activity and a boost in less healthy diets (Ruhm, 2000; 2005). Overall, physical health often deteriorates during economic upturns as shown by increased mortality (Ruhm, 2000; Neumayer, 2004). There appears to be some consensus that worsened economic conditions also lead to poorer mental health (Ruhm, 2003; Charles and DeCicca, 2008) but the effect on suicides has been mixed, with some evidence that mortality is counter-cyclical (Ruhm, 2000; Lopez-Bernal et al., 2013; Reeves et al 2014; Reeves et al., 2012; Barr et al 2012), but another study showing that suicides are pro-cyclical (Neumayer, 2004).

In general, changes in mortality appear to be partly attributed to changes in behaviour. Tight economic conditions typically are associated with a shift towards more moderate drinking habits possibly because of an income effect (Ruhm and Black, 2002; Ettner, 1997; Xu, 2013; Charles and DeCicca, 2008). Evidence on the association between economic recessions and weight is mixed. Ruhm (2005) and Jonsdottir and Asgeirsdottir (2014) find it is reduced when the economy worsens whereas Charles and DeCicca (2008) conclude that obesity increases.

Such health effects are not necessarily the same for the entire population and often appear to be dependent on age, gender, ethnicity and education. Typically, for young adults and those in working age, downturns in the business cycle translate into reduced mortality and higher healthcare use (Ruhm, 2000; Ruhm, 2003). Older individuals tend to experience an amelioration of risk behaviours instead (Ruhm and Black, 2002). Women are less affected by adverse economic conditions and even improve their mortality rates (Neumayer, 2004). However, males experience the biggest reduction in morbidity (Ruhm, 2003) possibly through less engagement in risky behaviours such as drinking (Ruhm and Black, 2002), decreased smoking and increased physical inactivity (Ruhm, 2005). Unhealthy behaviours in the US appear to be procyclical in particular for non-whites (Ruhm, 2005). Haaland and Telle (2015) find that less educated and lower income groups are not hit harder by increased unemployment in terms of mortality indicators than the more advantaged groups. However, there is evidence that better educated (young) individuals respond more to higher unemployment by reducing risky behaviours such as drinking and smoking (Cutler et al, 2015). Other studies have found no gender differences in changes in health status, mental health and drinking intensity due to economic downturns (Davalos and French, 2011; Davalos et al., 2012).

Several other papers have supported an overwhelmingly procyclical effect of the economic environment on health (Brenner and Mooney, 1983; Brenner, 1987; Tapia-Granados, 2005; Gerdtham and Johanneson, 2005; Gerdtham and Ruhm, 2006; Tapia-Granados and Diez-Roux, 2009; Haaland and Telle, 2015). Yet, some limited evidence exists of a countercyclical relationship between economic crises and mortality indicators (Cutler et al, 2002; Gerdtham and Johannesson, 2005; Svenson, 2007; Economou et al, 2008). Most of this early evidence on the pro-cyclical impact of economic fluctuations on health outcomes is based on data from

the 1970s to the 2000s. When more recent data has been used, the procyclical hypothesis has been weakened substantially (McInerney and Mellor, 2012; Stevens et al, 2015; Ruhm, 2015).

The Great Recession that started in December 2007 has been the deepest world economic crisis since the 1950s. Not surprisingly, there has been a large body of literature examining its impact on health outcomes (Stuckler et al., 2011; and Suhcker et al., 2012). Empirical evidence shows that the 2008 recession led to an increase in suicides (Lopez-Bernal et al., 2013; Reeves et al 2014; Reeves et al., 2012), which appears to be associated with government spending and is gender and age specific (Antonakakis and Collins, 2014, 2015).

Some evidence from Europe suggests that the 2008 recession had a beneficial impact on health, except for suicides (Toffolutti and Suhrcke, 2014; Regidor et al., 2014), but Gili et al (2013) and Modrek et al. (2015) find that unemployment increases mental health problems. The evidence is not supportive of the pro-cyclical effect of the business cycle for Greece, one of the most hard hit by the Great Recession (Simou and Koutsogeorgou, 2014; Vandoros et al., 2013, 2014, 2015; Hessel et al., 2014). Using data from Iceland, Jonsdottir and Asgeirsdottir (2014) found an impact on body weight and the effects of losing weight were stronger for those who lost their job relative to those that remained working.

Recent studies from the US have largely focused on how the recession of 2008 affected population subgroups. Pabilonia (2015) show that Hispanic boys were more likely to consume alcohol, marijuana and to become obese, girls more likely to smoke and black girls to drink more. Further evidence shows unemployment was associated with lower self-reported mothers' health and increased tobacco and drug use, especially for those with a disadvantaged background (Currie et al 2015). Older adults in the US reported lower subjective measures of mental health as a consequence of a wealth loss after the market collapsed in the last quarter of 2008 (McInerney et al., 2013). Access to health care may also be affected by lower health insurance coverage (Cawley et al, 2015). Other approaches have also concluded that financial distress has a negative outcome on healthcare resource use, mental health and life expectancy across OECD countries (Currie and Tekin, 2011; Clayton et al, 2015).

## 3 Data

To further explore this issue our analysis exploits data from the HSE, a cross-sectional survey taken yearly from a representative sample of about 9,000 English households. We specifically use data on respondents above 16 years of age for the period 2001-2013.. In addition to socio-economic characteristics, the HSE includes information on a wide range of health lifestyles and health conditions. We select variables covering a range of individual morbidity variables, health behaviours and lifestyle characteristics that are present in all waves in our sample. We complement the HSE with aggregate macroeconomic indicators at the regional level obtained from the Office of National Statistics (ONS). This paper uses secondary data and therefore there was no ethical approval required.

### 3.1. Dependent variables: health risks, behaviours and health outcomes

*Health risks and behaviours*

The HSE provides health behaviour information such as individual fruit and vegetable intake, cigarette and alcohol consumption as well as weight and height measurements. Consumption of fruit and vegetables is measured as the portions of fruit and vegetables that an individual has eaten the day before being surveyed. This information was not available for the 2012 survey but was again included in the 2013 survey.

We also consider the potential impact of the recession on BMI, which is highly correlated with health. A BMI of 25 and above in adults is considered to be a risk factor for the development of heart disease, stroke and diabetes. As summarised in Section 2, unemployment has already been shown to increase the proportion of obese and overweight individuals (Charles and DeCicca, 2008). We examine how the recession is associated with changes in BMI, measured as a continuous variable, and also with the likelihood of being overweight, obese or severely obese. We construct indicator variables for being overweight, obese and severely obese that take a value equal to 1 when individuals have a BMI between 25 and 29.9, between 30 and 39.9, and equal or higher than 40, respectively, and are zero otherwise.

We also examine the effect on smoking. Our first measure is cigarette consumption defined as the number of cigarettes smoked per day. For smokers, the effect of the Great Recession might presumably be different

along the distribution of the cigarette consumption. Therefore, we create three smoking dummies that reflect smoking intensity: light smoking (under 10 cigarettes per day); moderate smoking (between 10 and under 20 cigarettes per day); and heavy smoking (20 or more cigarettes per day). The data are rich enough for us to exploit information on drinking intensities. Based on alcohol consumption in the heaviest drinking day of the previous 7 days, respondents are classified as non-drinkers (if they report not drinking during the previous week); light drinkers (up to 4 units for men or 3 units for women); moderate drinkers (between 4 and 8 units for men or between 3 and 6 for women); and, heavy drinkers (above 8 units for men or 6 units for women). Note that financial conditions are expected to have ambiguous effects on cigarette and alcohol consumption. Reduced affordability may decrease intake, but stress and anxiety may increase consumption to the point of offsetting the income effect.

*Health Outcomes*

We exploit the HSE information on individual morbidity. The first measure is the number of medicines taken prescribed by the doctor, e.g. zero means no medicine. Adverse economic conditions decrease the probability of hospitalisation but the evidence is mixed for doctor visits (Ruhm, 2003; Xu, 2013). In the UK, new prescriptions can only be obtained after a visit to the doctor and repeat prescriptions are monitored by General Practitioners, thus number of medicines may be seen as a measure of morbidity as well as a proxy for health care utilisation.

We also have detailed information on whether respondents suffer from any illness and if so, on type of illness. This allows us to create indicator variables for cancer; digestive problems (stomach ulcer, other digestive, bowel, other); diabetes (also includes any other metabolic and endocrine disorders); high blood pressure (BP); heart problems (stroke, heart attack, angina, or other heart problems); and mental problems (mental illness, anxiety, depression). These health conditions are likely to be sensitive to the economic environment. Table A1 in the Appendix presents summary statistics of all dependent variables**.**

## 3.2. Control variables

In addition to the economic environment, we control for a number of socio-demographic factors summarised in Table B1 of the Appendix (tables in the online Appendix are labeled with letter B, henceforth).

Previous research has underlined the role of gender on health and health-related behaviour (Kandrack et al 1991; McDonough and Walters 2001), and we expect being female to be positively correlated with having better health. Also, being married may be a protective factor (Kaplan and Kronick 2006, Molloy et al. 2009). Education enters the model as it has been shown to have a causal effect on health (Conti et al 2010) and health behaviours (Cutler and Lleras-Muney 2010), with higher education contributing to better health. Employment status is included because previous evidence shows that it can impact health (Bartley et al 2004; Ferrie et al 2001, Ruhm 2003). Job loss is associated with fewer workplace and traffic accidents, and possibly an increase in drinking, smoking, inactivity and obesity (Ruhm 2003). Nevertheless, people who are afraid of becoming unemployed may be exposed to distress, anxiety and poorer diet (Ferrie et al 2002); and the unemployed lose the protective effect of higher income, while exposed to stress that comes with economic insecurity (Ruhm 2003). Socioeconomic status can have a similar effect (Glymour et al 2008; Johnston et al 2007), possibly because of worse nutrition and smoking for deprived individuals (Galobardes et al 2006) and the protective effect of higher income (Ruhm 2003). The effect of retirement on health, however, is inconclusive (see for instance Moon et al., 2012; Westerlund et al., 2009). In the empirical specification we also control for ethinicity as it might explain some differences in health and health behaviour (Crespo et al 2000; Jeffreys et al 2005). Wealth and income are positively associated with health and health behaviour (Ettner, 1996), even when accounting for socioeconomic status (Pollack et al 2007) and therefore we control for equivalised income.

## 3.3. Economic Cycle Indicators

Our central measure of macroeconomic conditions in England is annual UR in each Government Office Region (GOR),the highest tier of sub-national geographical division of England. The ONS reports each GOR's UR in 3 months intervals, which we average to compute yearly URs. Figure 1 depicts the evolution of regional *UR* from 2001 to 2013. Interestingly, in 2013, the UR in all regions was still well above the their pre-2008 levels, reflecting the severity of the economic crisis.

**[Insert Figure 1 about here]**

To differentiate the impact of changes in *UR* before and after the 2008 Great Recession, we create an indicator variable, *d08*, with value equal to 1 from 2008 onwards, and 0 before. This variable also captures changes triggered by the Great Recession that are not captured by fluctuations in regional *UR*s alone such as variations of other macroeconomic indicators, expectations and perception of the general economic outlook.

## 4 Empirical Strategy

In order to capture the association between macroeconomic conditions and health behaviour and health outcomes using the HSE, we first use the following general empirical specification:

$$health_{itr} = \quad _0 + UR_{rt_1} + X'_{itr_2} + ?_t + d_r + e_{itr} \quad (1)$$

where $health_{irt}$ represents one of the health-related variables of interest (i.e. fruit and vegetable intakes; BMI and indicators of obesity; measures of drinking and smoking; medicine intake; having cancer, digestive, diabetes, high blood pressure, heart and mental health problems). Subscripts *i, r,* and *t* indicate observations by individual *i*, living in region *r,* and interviewed in period *t*. The variable $UR_{rt}$ denotes the UR of region *r* at time *t* (hereafter, we will refer to this as $UR_t$), aimed at capturing macroeconomic conditions in the economy. Individual socio-economic characteristics are contained in vector $X'_{irt}$. Unobserved regional and time effects are captured by regional and year dummies $\delta_r$ and $\gamma_t$, respectively, and $\varepsilon_{irt}$ reflects the unexplained individual idiosyncratic variation. Time and regional indicators are especially important as they control for changes over time and/or at the regional level. For instance, over these years there were a number of public health campaigns encouraging healthier lifestyles that may have had a cumulative effect on nutrition habits, smoking, drinking and morbidity. Our second specification includes *d08* instead of $UR_t$, the third $UR_t$, *d08*, and their interaction.

*Endogeneity of the income variable*

The vector of explanatory variables includes income*,* which can potentially cause endogeneity problems for the estimation, i.e., those with better health and having healthier lifestyles are more likely to have higher income, and, reversely, wealthier individuals tend to be healthier (Ettner, 1996; Deaton and Paxton, 1998; Marmot, 2002; Lynch et al., 2004). Ruhm (2005) discusses the potential endogeneity of personal income because income and health measures are likely to be determined simultaneously. He overcomes this by using

state-level measures of income as controls instead of individual income. Clayton et al. (2015) use instrumental variables (IV) to correct for the simultaneity between household debt and health outcomes. In this paper, we adopt an IV approach. To the best of our knowledge, this is the first individual level data study in this area that addresses the problem of reverse causality between health measures and income. Our two instruments, number of bedrooms in the household and the tenure type of the household (i.e. own, rent, etc.), are correlated with income and satisfy the standard moment condition of not being correlated with the error term. Further, being pre-determined, they should not be not correlated with changes in health behaviour linked to temporary income fluctuations.

## 5 Results: The Great Recession beyond regional URs

In this section, we present the estimates of models for diet, BMI, obesity indicator variables, smoking, drinking and morbidity. For all models, our identification strategy includes estimating the specification first including only $UR_t$; second, only the post-2008 dummy *d08*; and third, including both $UR_t$ and *d08,* and their interaction, $UR_t$ x *d08*. Hereafter, we will refer to the latter as the *full specification.* With the exception of the Two-Stage Least Squares (2SLS) method for the continuous variable BMI, we use non-linear estimation methods (Tobit and probit). As coefficients in non-linear models do not reflect the magnitudes of the associations, we report Average Marginal Effects (AMEs) instead. In the Online Appendix, Tables B2 to B4 report the coefficients and Tables B5 to B7 report control variables' estimates for the the full specification.

All estimates have been obtained after addressing the potential issues caused by the existence of outliers. To do so we have replaced the observations of the continuous variables above (below) the top (bottom) 1% distribution threshold by the percentile cut-off point value. We also instrument income in all specifications to address the potential bias caused by its endogeneity. Corroborating this strategy, in most specifications the Wald test rejects the hypotheses of exogeneity of income with a 1% confidence level except for the equations for moderate smoking (p-values between 0.116 and 0.120) and cancer (p-value between 0.139 and 0.143). As the first stage (reduced form of income) F-statistic is well above 10, the strength of our instruments is supported. For the BMI 2SLS models, we obtain the Kleibergen-Paap rk LM statistic to test for under-identification and the Cragg-Donald Wald F-statistic to test for weak identification. The results of these tests,

as explained in Table B2 and subsequent tables, confirm that our models do not suffer from under identification nor of weak instruments' choice and support our identification strategy.

Table 1 contains the AMEs for the models for fruit and vegetable intake and BMI, Table 2 presents those for the smoking and drinking models, and Table 3 those for the morbidity indicators. In each table, Column (1) shows the AMEs for the specification that includes $UR_t$ only, Column (2) the AME when we include only the indicator variable *d08*, and Column (3) the AME of the total effect of *d08*, which involves the effect of the *d08* coefficient plus its effect through the interaction with $UR_t$. The AME for *d08* in Column (1) is obtained as the average of the effect over all observations of changing *d08* from 0 to 1 on the probability of the outcome of interest (e.g. probability of being obese). Similarly, the AME for $UR_t$ in Column (2) is obtained as the average effect of a change in *UR* over all observations. The AMEs for the full specification in Column (3) show the AMEs associated to *d08* including the effect it has via its interaction with $UR_t$. We obatin the average marginal effect of $UR_t$ over all observations when *d08* equals 0 (before 2008) and we do the same when setting *d08* equal to 1 (on or after 2008). Distinguishing the effect of $UR_t$ before and after 2008 allows to capture whether the association of UR with the health related variables of interest changed before and after the Great Recession. Columns (4) and (5) report the results when we use instead the lagged UR, $UR_{t-1}$. Following Poterba and Samwick (1999) and Ruhm (2003, 2005), Table B8 provides the economic significance of the results as a percentage change due to a one percentage point increase in *UR*, before and after 2008.

## 5.1 Benchmark Model: Great Recession and $UR_t$

Column (1) in Table 1 shows that $UR_t$ is not significantly associated with changes in the intake of vegetables or fruit, in BMI, or the likelihood of being overweight, obese or severely obese. The AMEs in Column (2), when including only the recession indicator, *d08*, show its negative association with dietary habits and positive with BMI. After the recession individuals are heavier, as reflected by a higher likelihood of being obese or severely obese and a lower probability of being overweight. Estimates in Column (3), which includes *d08*, $UR_t$ and their interaction, show that the only significant effect on diet and weight is associated with the recession dummy (*d08*). These results suggest that the recession had an impact that did not originate in changes in UR but by other factors. Overall, the results of the full specification corroborate the findings associated with the other

specification reported in Columns (1) and (2), so, for brevity, we restrict our discussion of further results to the full specification.

The AMEs in Column (3) indicate that, after 2008, vegetable consumption was higher by 0.092 portions (although weakly statistically significant and with a very small magnitude), fruit consumption went down in 0.196 portions on average and BMI increased by 0.93 units. The increase in BMI seems to translate into a change of the BMI distribution: whereas post-2008 there is a decrease in the probability of being overweight by 4.6 percentage points (pp), the probability of being obese (severely obese) is up by 4.1 (2.4) pp. There is no statistically significant effect of the UR either before or after 2008.

**[Insert Table 1 about here]**

Colimn (3) in Table 2 shows the AMEs for the full specification for the smoking and drinking variables. The AMEs for the recession indicator variable *d08* show that, post 2008, cigarette consumption decreases by 0.84 units, the probability of heavy smoking by 11pp and of light drinking by 5.1pp. There is an increase in light smoking by 7.4pp and of no drinking by 9.5pp.

The marginal effect of $UR_t$ before the recession shows a decrease in the probability of being a heavy smoker by 2.5 pp and that of moderately drinking by 1 pp. Instead, it increases the likelihood of being a moderate smoker by 2.1 pp and that of not drinking in the last week by 1.7 pp. In general, all these effects prevail after 2008 at very similar levels or slightly smaller, with the exception of no drinking for which the AME of $UR_t$ goes up after 2008. Note that changes in cigarette consumption, being a light smoker and light drinker are driven by changes in *d08* alone; moderate smoking and drinking are associated to changes in $UR_t$ alone; and those associated to heavy smoking and no drinking are associated to both $UR_t$ and *d08*. The estimates reported in Table B8 in the Online Appendix imply that a one percent increase in *UR* post 2008 is associated with a decrease in the population of heavy smokers by 0.55 percent; an increase in the population of moderate smokers by 0.08 percentage points; a decrease by 0.15 percent of the population drinking moderately; and a 0.32 percent increase in the number of those who do not drink.

**[Insert Table 2 about here]**

With respect to the intermediate health outcomes displayed in Table 3, we observe that $UR_t$ is only significantly and negatively associated with reported changes in mental health problems. The AME of $UR_t$ on the probability of having mental health problems increases from 0.31 pp before 2008 to 0.7 after the recession. As shown in Table B8 in the Online Appendix, a one percent increase in $UR_t$ translates into a small decrease in the proportion of the population reporting mental health problems by 0.09 percent before 2008 and by 0.72 percent after 2008.The AME of *d08* indicates there is an increase of 0.36 units in the consumption of medicines. There is also a higher likelihood of suffering from diabetes and mental health problems by 1.5 and 4 pp. The probability of suffering from high BP is lowered by 2 pp. These results imply that the effects of the recession on morbidity are channelled mostly through changes that go beyond worsened *URs*.

**[Insert Table 3 about here]**

## 5.2 Robustness and extensions

### 5.2.1 Recession and lagged regional unemployment

The effect of worsened *UR* on health risks, behaviours and outcomes may not necessarily be contemporaneous but reflect cumulative effects over time. In order to explore whether lagged effects prevail, we re-estimate all specifications including lagged *UR*. Results for these specifications are shown in Columns (4) and (5) in Tables 1 to 3.

Overall, lagged *UR,* ($UR_{t-1}$), as was the case in the contemporaneous specifications, is not the main explanation of changes observed in diet and BMI (Table 1). For smoking and drinking (Table 2), the only difference with respect to the contemporaneous specification is that $UR_{t-1}$ is now positively and significantly associated with the probability of light smoking and the effect becomes insignificant for moderate smoking. However, while $UR_t$ was *only* significantly associated with the likelihood of having mental health problems, $UR_{t-1}$ is negatively associated with the probabilities of cancer, digestive problems and diabetes. This highlights that *UR* has a delayed effect on these morbidity indicators. There was no statistical effect of the lagged UR on mental health which indicates that the fluctuation in UR only has a short-term effect on mental health

problems.Results using lagged *UR* suggest that *URs* had a simialr association with health outcomes before the Great Recession than after, with a modest reduction in the probability of cancer (0.21/0.25pp), digestive (0.33pp), diabetes (0.3/0.42pp) and a slightly higher probability of having heart problems after 2008.

We also re-estimate the full specification using an indicator variable *d09* that takes value 1 for 2009 onwards and $UR_t$ instead of using 2008 to investigate if there was a deferral in the unfolding of the effects of the crisis. The results, presented in Table B9, show minimal differences in coefficients with respect to the benchmark. The main difference is that for vegetables, the coefficient for *d09* and the interaction with UR become significant and retain the same sign.

### 5.2.2. Estimates by gender

In this section we explore whether there are differences in the results by gender by estimating our models separately for females and males (as supported by Chow tests reported in Table B10). Columns (1) and (2) in Tables B11 to B13 show the AMEs by gender for the full specification. As shown in Table B11, the main significant estimate for health outcomes is the indicator variable *d08*. There is an increase in vegetables consumption since 2008 affecting only males, while females decrease fruit intake and an increase in BMI for both males and females. The decrease in overweight and increase in obesity mainly affect males also, while the increase in the likelihood of being severely obese is stronger for women. In general, the AMEs of *d08* are larger for women than for men. For instance, the effects on BMI and on the probability of being severely obese are roughly twice as large (1.13 BMI units and 0.31 pp for females, as opposed to 0.67 BMI units and 1.5 pp for males).

Table B12 shows that there is a negative association between $UR_t$ and the number of cigarettes smoked for females, and the AME is slightly smaller after the Great Recession. For women, the AME of an increase in the $UR_t$ by one pp before 2008 is associated with a reduction in daily cigarette consumption by 0.14 units and 0.12 after 2008. Similar patterns emerge for heavy smoking. Larger $UR_t$ affect alcohol consumption by reducing heavy drinking and increasing the likelihood of not drinking at all in the previous week. The AME of $UR_t$ on moderate drinking for women is approximately 1.2 pp lower before and after 2008. Our results suggest that, when significant, the effect of $UR_t$ after 2008 generally becomes smaller in magnitude.

From Table B13, we note that, for morbidity indicators the significant coefficients are those associated to the 2008 indicator variable and are larger for males than those for females, except for mental health. UR only affects mental health problems with an increase in $UR_t$ by one pp before the recession being associated with a decrease in its likelihood by 0.35 pp for men compared to a reduction of 0.79 after 2008.

### 5.2.3. Estimates by Education Level

Columns (3) and (4) in Tables B11 to B13 report the AMEs by education level. We distinguish individuals with a degree or above from those with lower educational attainment. Table B11 reinforces the conclusion that the recession affected health behaviours and BMI through changes that went beyond worsened $UR_t$ and it did so with different intensities by educational level: the recession indicator is associated with an increase in 0.18 units in vegetable consumption for the more educated but a decrease in fruit intake in 0.38 units for the less educated. The increase in BMI is larger in magnitude for the lesser educated (1.26 units) than for those with at least a degree (0.63 units). This translates into a shift in the overweight prevalence that is experienced more acutely by the less educated also as they are 6.9 and 3.8 pp more likely of being obese or severely obese after 2008, respectively. The estimate of $UR_t$ is only significant for overweight and associated to an increase in 1.28 pp both before and after the recession, which compensates the negative estimate associated to *d08* of 6.9 pp.

In Table B12, we observe that changes in $UR_t$ increase moderate smoking and decrease heavy smoking affecting the less educated more acutely. For this group, a one pp increase in $UR_t$ is associated to 2.3 pp higher likelihood of moderate smo*king* prior to and after 2008. The same change in $UR_t$ is associated to a decrease in the likelihood of smoking heavily by 3.1 (2.6) pp before (after) 2008. Those less educated are 1.8 (2) pp more likely to not drink before (after) 2008 with each percentage increase in $UR_t$ and a similar reduction in the probability of moderate drinking of 1.24pp.

For those with higher education the $UR_t$ has no effect on smoking, only the onset of the recession is associated to a reduction in the likelihood of smoking heavily by 19 pp after 2008. For this same group, drinking behaviour is significantly associated to changes in $UR_t$ and the onset of the recession itself. The

probability of not drinking of the more educated increases in 8pp, but the effect of an increase in one pp in $UR_t$ is 1.6pp after 2008 compared to 1.4pp before 2008..

From Table B13 we note that the effect on morbidity is through *d08*. In general, the panel for the less educated has more significant and larger in absolute value AMEs than the panel for those with more education, suggesting the recession may have hit more heavily the less educated. For instance, medication intake increases in 0.45 units since 2008 for those less educated as opposed to 0.22 for the more educated. Those with education below degree show an increase in the probabilities of having mental problems by 4.8 pp after 2008, compared to 4pp for those with higher eduction, and are also 2.4pp less likely to suffer from high BP.

### 5.2.4. Further robustness checks

To check the extent to which extent the effects of UR we obtain are entirely driven by the Great Recession, we re-estimate the specification with only UR using the data for years 2001-2007. As shown in Table B14, before the Great Recession, UR had a negative impact on BMI and the probability of being severely obese. For health risks, UR reduces cigarette consumption and the probability of being a heavy smoker, while increasing the likelihood of being a light smoker, but there is no impact of UR on drinking. With repect to the morbidity indicators, in addition to mental health problems, UR only affects cancer. In general, the magnitude of the coefficients is larger compared to the results using the full 2001-2013 sample and this could be indicative that the UR effect was greater before 2008.

## 6 Discussion

This study examines the impact of the Great Recession on health-related behaviour, risk factors and intermediate health outcomes in England. Our results indicate that the 2008 downturn had a damaging effect for some health indicators (diabetes, fruit consumption and obesity), while being protective for others (smoking and drinking). This is not surprising given the mixed effects that have previously been

identified and the ongoing debate on whether economic downturns are good or bad for health (see for example Ruhm 2016).

We find that the recession (rather than unemployment rate changes) led to less fruit consumption, higher BMI and more people being obese. This might be a consequence of tighter budget constraints leading to less healthy dietary habits. We also identify an increase in vegetable consumption, which is, however, small in magnitude and statistically significant only at the 10% level. In terms of BMI, our results confirm those of Charles and DeCicca (2008) who found an increase in obesity, but are not consistent with Ruhm (2005) and Jonsdottir and Asgeirsdottir (2014) who reported opposite effects. A plausible explanation for this difference may be the exact nature of this health outcome, and the presence of substitution or income effects. Financial difficulties might lead to consumption of less healthy food which is cheaper to purchase, i.e. a substitution of fruit by food with higher fat and suger levels. However, such difficulties might also lead to less overall calorie intake for some people, possibly for those who choose not to change the type of food they consume, thus leading to weight loss. The overall outcome possibly depends on the particular setting and pre-recession eating patterns.

The decrease in heavy smoking results possibly reflect a reduced affordability of cigarettes and are in line with the disproportionate decrease in heavy smoking in Ruhm (2005) and the reduction in smoking by Ruhm (2000). The reduction in the proportion of heavy, moderate and light drinking during the recession may be again possibly due to an income effect. In addition, the proportion of the population that reports no drink increased. These effects are even larger than those reported in previous studies that suggest a shift from heavy towards more moderate drinking during recessions (Ruhm and Black, 2002; Ettner, 1997; Xu, 2013; Charles and DeCicca, 2008). A reason why our effects are stronger might be that our study period covers one of the worse economic recessions on record, whereas previous studies examined time periods prior to the Great Recession. In any case, the reductions in smoking and drinking are relevant given that lifestyle-related health problems cost the NHS £11 billion a year (Public Health England, 2016).

We sometimes find different effects of the *UR* and recession. The unemployment rate can reflect how increased joblessness affects individual and aggregate behaviour, risk factors and health outcomes, which could relate to protective factors (Ruhm 2000; Ruhm 2003; Ruhm 2005). The recession indicator, however, captures global conditions and general mood. Interestingly, our results show that mental health worsened due to its association to the recession itself rather than regional unemployment changes. Previous research has shown that the population's mood in England deteriorated during the recession (Lansdall-Welfare et al 2012), and such general negative view might already have triggered negative mental effects. In addition, people might have feared losing their jobs, and the existing literature shows that such uncertainty and job insecurity can lead to worse health outcomes (Bunnings et al 2017; Burgard et al 2009; Caroli and Godard 2016; Ferrie et al 1998a; Ferrie et al 1998b; Ferrie et al 1995; Vahtera et al 1997). Our results on the effects of the recession on mental health are not surprising given the wealth of literature linking recessions and suicide (Barr et al 2012; Ruhm 2000; Reeves et al 2012; Antonakakis and Collins 2015) or even road traffic accidents due to stress and anxiety (Vandoros et al 2014).

In terms of other morbidity indicators, we only find a procyclical trend for high blood pressure and an increase in the prevalence of diabetes, possibly through difficulties managing the condition when individuals experience financial difficulties. On a related issue, Seligman et al. (2014) showed that hypoglycemia-related hospitalisations increased at the end of the month for people who relied on food budgets, as their budgets ran out. Importantly, the consumption of medicines increased during the recession, which can be a proxy for deteriorated health outcomes.

Across all our specifications we find evidence of a similar impact of *UR* before and after the Great Recession, except for not drinking and the probability of having mental health problems for which the effect of UR is slightly larger after 2008. When we use lagged regional *UR* the results on smoking and drinking behaviours are maintained. However they also suggest that there was some delay in the impact of the 2008 economic contraction on morbidity. In terms of specific effects, lagged *UR* effects indicate a

counter-cyclical association with cancer, digestive problems and diabetes. We also find that the direct regional *UR* effects are generally larger for women and the less educated.

This paper contributes to the literature because: (a) it focuses on England, a country that was hit hard by the recession but had previously received limited attention in the literature; (b) it considers not only health outcomes but also health behaviours and risk factors - as health effects often take a length of time to materialise, by including behavioural risk factors in the analysis we are able to point out potential short and long term effects of the economic downturn on health; (c) it jointly studies the impact of both the unemployment rate changes and the outbreak of the recession; (d) it considers morbidity (exploring a wide range of illnesses) instead of mortality; and (e) it addresses the simultaneity between income and health. But, it should be stressed that all our estimates may be lower bound effects of the economic downturn on health outcomes. The impact of economic fluctuations on health risk factors and behaviours is likely to have long term effects through a belated impact on morbidity and mortality. Alcohol consumption can increase mortality rates and negatively affect life expectancy. Smoking has also been linked to increased mortality or lower life expectancy during economic downturns and the evidence on diet is mixed (Grubaugh and Santerre, 1994; Cremieux et al., 1999; Cremieux et al., 2005; Brainerd and Cutler, 2005). Thus, any changes in these health risks that imply a negative effect on future health outcomes will only be partially captured by our results.

The nature of some of the variables may be considered a limitation of the study. Our morbidity measures are very aggregate: mental disorders include depression as well as other disorders (such as schizophrenia), which are less likely to be triggered by an economic downturn. Similarly, heart problems include a variety of conditions, apart from heart attacks and strokes. Finally, some of the effects of the recession may take some considerable time to materialise.

Our findings are relevant for policy makers and clinicians. Universal health coverage and free provision of healthcare via the NHS might have worked as a protective factor during economic hardship. Certain socioeconomic groups and people with chronic conditions are exempt from prescription fees, removing financial barriers to access. However, as some health outcomes deteriorate during recessions,

demand for health services might increase, leading to longer waiting times, that can further worsen any negative effects. An increase in welfare benefits is another factor that may have protected people during the recession (Cribb et al 2017). All these considerations require further investigation. The fact that the less educated were more vulnerable to the health effects of the recession highlights the need for a policy response. It seems important that this population receive information on health behaviours and risk factors to avoid part of the negative consequences. Our results show that during recessions people tend to reduce alcohol and tobacco consumption. This requires the right level of support from health specialists if these positive behavioural changes are to be preserved beyond the duration of economic downturns.

Other aspects that we do not examine are the impact on suicides or mortality, which has been shown to increase during recessions (Barr et al 2012; Reeves et al 2012; Haaland and Telle 2015; Gerdtham and Johannesson 2005); the protective or damaging effect of different types of jobs or the effect of the unemployment status of one's spouse on health, which should be addressed in future research.

## 7 Conclusion

The paper studies the changes in individual health experienced in England with the onset of the Great Recession of 2008, providing evidence on the more general question of whether adverse macroeconomic conditions affect health. We capture macroeconomic conditions using regional *UR*, as well as an indicator variable for the onset of the 2008 Great Recession and an interaction term of both. This specification allows us to explore whether the effects of the economic downturn transcend those associated with changes arising purely from worsened regional *UR*s and if the recession altered the relationship between health risks, intermediate health outcomes and UR.

Our results suggest that changes in regional *UR* mainly affect smoking and alcohol intake. The only morbidity indicator significantly associated with changes in regional *UR* is the likelihood of having mental health problems, which decreases with higher regional *UR.* This decrease, nevertheless, is more than offset by its positive relationship with the onset of the recession, resulting in a net increase of mental health

problems after 2008. Thus, the increase of mental health problems associated with economic recessions respond to mechanisms that are beyond worsened regional URs.

Turning to the direct impact of the recession onset (rather than *UR*s), results suggest that the start of the recession is associated with worse dietary habits and increased BMI and obesity. It is also associated with a shift away from heavy risky behaviours, favouring moderate smoking and alcohol consumption. There is also an increase in the use of medicines and a higher likelihood of suffering diabetes and mental health problems, all of which are in general experienced more acutely by those with less education and by women.

Overall, our study highlights the impact of the Great Recession on health and health-related risk factors and behaviours in England, confirming the close relationship between health and the economic environment, and thus giving an indication of what may drive future changes in health outcomes due to risk factors shifts originated in the recession.

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# Appendix

## Table A1. Descriptive Statistics: health risks, behaviours and morbidity indicators

| | | *pre-2008* | | | *post-2008* | | | |
|---|---|---|---|---|---|---|---|---|
| | | (1) **Mean** | (2) **SDev** | (3) **N** | (4) **Mean** | (5) **SDev** | (6) **N** | (7) **Difference in means** |
| *Health Risks and Behaviours* | | | | | | | | |
| Vegetables | Portions of vegetables eaten yesterday | 1.43 | 1.18 | 61868 | 1.51 | 1.24 | 29176 | *** |
| Fruit | Portions of fruits eaten yesterday | 2.12 | 1.87 | 61869 | 2.09 | 1.79 | 29176 | ** |
| BMI | weight/height^2 | 26.97 | 4.92 | 56275 | 27.36 | 5.17 | 36809 | *** |
| Overweight | =1 if BMI betweeen 25 and 29.9 | 38.2% | 49.0% | 56275 | 38.1% | 49.0% | 36809 | |
| Obese | =1 if BMI between 30 and 39.9 | 21.7% | 41.0% | 56275 | 23.5% | 42.0% | 36809 | *** |
| Severely Obese | =1 if BMI above 40 | 1.9% | 14.0% | 56275 | 2.6% | 16.0% | 36809 | *** |
| Cigdaily | Daily number of cigarettes | 13.34 | 7.73 | 15411 | 12.19 | 7.21 | 8582 | *** |
| Light Smoker | =1 if the respondant consumes less than 10 cigarettes daily | 30.3% | 46.0% | 15411 | 34.0% | 48.0% | 8582 | *** |
| Moderate Smoker | =1 if the respondant consumes between 10 and 20 cigarettes daily | 40.6% | 49.0% | 15411 | 42.0% | 49.0% | 8582 | ** |
| Heavy Smoker | =1 if the respondant consumes more than 20 cigarettes daily | 29.0% | 45.0% | 15411 | 23.5% | 42.0% | 8582 | *** |
| Not drinking | =1 if respondent did not drink during last week | 32.2% | 46.0% | 63008 | 36.0% | 48.0% | 42359 | *** |
| Light drinking | =1 if respondent drunk up to 4 (3) units of alcohol last week for men (women) | 31.8% | 47.0% | 63008 | 28.8% | 45.0% | 42359 | *** |
| Moderate drinking | =1 if respondent drunk between 4 and 8 (3 and 6) alcohol units last week for men (women) | 19.2% | 39.0% | 63008 | 17.2% | 38.0% | 42359 | *** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Heavy drinking | =1 if respondent drunk above 8 (6) alcohol units last week for men (women) | 16.7% | 37.0% | 63008 | 18.0% | 38.0% | 42359 | *** |
| *Health Outcomes* | | | | | | | | |
| Medicines | Number of medicines | 1.47 | 2.24 | 46478 | 1.87 | 2.69 | 30809 | *** |
| Cancer | =1 if the respondant suffers from Cancer | 1.97% | 13.89% | 63881 | 2.16% | 14.55% | 42669 | *** |
| Digestive | =1 if the respondant suffers from Digestive Problems | 5.14% | 22.08% | 63881 | 4.87% | 21.52% | 42669 | * |
| Diabetes | =1 if the respondant suffers from Diabetes | 3.90% | 19.30% | 63863 | 5.04% | 21.00% | 42667 | *** |
| High BP | =1 if the respondant from High Blood Pressure | 7.01% | 25.54% | 63863 | 7.00% | 25.60% | 42667 | |
| Heart | =1 if the respondantt suffers from Heart problems | 5.90% | 23.58% | 63863 | 6.03% | 23.79% | 42667 | |
| Mental | =1 if the respondant suffers from Mental Health problems | 3.40% | 18.00% | 63863 | 4.62% | 21.00% | 42667 | *** |

*Notes:* Descriptive statistics are presented for the pooled sample. Sample includes individuals aged 16 and above. Time period 2001-2013, except for vegetables and fruit consumption for which data covers 2001-2011. Column (7) shows the test for the difference in sample means. Significance levels: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

## Tables

### Table 1. AMEs Health Risks and Behaviours (I): Diet and BMI

| | | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|---|
| | *N* | *UR (t)* | *d08* | *d08#UR(t)* | *UR(t-1)* | *d08#UR(t-1)* |
| ***Vegetables*** | 91,044 | | | | | |
| *UR(t/t-1)* | | -0.0090 | | | -0.0001 | |
| | | (0.010) | | | (0.009) | |
| *d08* | | | 0.0151 | 0.0916* | | 0.1001* |
| | | | (0.017) | (0.051) | | (0.054) |
| *UR at d08=0* | | | | -0.0017 | | 0.0032 |
| | | | | (0.011) | | (0.009) |
| *UR at d08=1* | | | | -0.0018 | | 0.0034 |
| | | | | (0.012) | | (0.010) |
| ***Fruit*** | 91,045 | | | | | |
| *UR(t/t-1)* | | 0.0073 | | | -0.0071 | |
| | | (0.014) | | | (0.013) | |
| *d08* | | | -0.1120*** | -0.1962*** | | -0.1774** |
| | | | (0.023) | (0.068) | | (0.073) |
| *UR at d08=0* | | | | -0.0020 | | -0.0107 |
| | | | | (0.016) | | (0.013) |
| *UR at d08=1* | | | | -0.0019 | | -0.0100 |
| | | | | (0.015) | | (0.013) |
| ***BMI*** | 93,084 | | | | | |
| *UR(t/t-1)* | | -0.0571 | | | -0.0321 | |
| | | (0.0503) | | | (0.0458) | |
| *d08* | | | 0.752*** | 0.933*** | | 0.879*** |
| | | | (0.0932) | (0.234) | | (0.252) |
| *UR at d08=0* | | | | -0.0531 | | -0.0288 |
| | | | | (0.0574) | | (0.0480) |
| *UR at d08=1* | | | | -0.0531 | | -0.0288 |
| | | | | (0.0574) | | (0.0480) |
| ***Overweight*** | 93,084 | | | | | |
| *UR(t/t-1)* | | 0.0029 | | | 0.0014 | |
| | | (0.004) | | | (0.004) | |
| *d08* | | | -0.0248*** | -0.0461** | | -0.0533** |
| | | | (0.008) | (0.020) | | (0.022) |
| *UR at d08=0* | | | | 0.0006 | | -0.0006 |
| | | | | (0.005) | | (0.004) |
| *UR at d08=1* | | | | 0.0006 | | -0.0006 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | (0.005) | | (0.004) |
| ***Obese*** | 93,084 | | | | | |
| *UR(t/t-1)* | | -0.0032 | | | -0.0011 | |
| | | (0.004) | | | (0.004) | |
| *d08* | | | 0.0336*** | 0.0406** | | 0.0367* |
| | | | (0.007) | (0.018) | | (0.019) |
| *UR at d08=0* | | | | -0.0035 | | -0.0011 |
| | | | | (0.004) | | (0.004) |
| *UR at d08=1* | | | | -0.0038 | | -0.0012 |
| | | | | (0.005) | | (0.004) |
| ***Severely Obese*** | 93,084 | | | | | |
| *UR(t/t-1)* | | -0.0012 | | | -0.0010 | |
| | | (0.001) | | | (0.001) | |
| *d08* | | | 0.0140*** | 0.0236*** | | 0.0260*** |
| | | | (0.003) | (0.006) | | (0.007) |
| *UR at d08=0* | | | | 0.0000 | | -0.0000 |
| | | | | (0.001) | | (0.001) |
| *UR at d08=1* | | | | 0.0000 | | -0.0001 |
| | | | | (0.003) | | (0.002) |

Note: Models for vegetables and fruit are estimated using IV Tobit, BMI is estimated using 2SLS methods, all others using IV Probit. Columns (1) and (4) show the AMEs related to the estimated coefficients of the regression using URt and URt-1 only, respectively. Column (2) shows the AMEs when including d08 only. Columns (3) and (5) show the AMEs when the URt or URt-1, d08 and their interaction are included. Refer to Table B2 in the Online Appendix for estimated coefficients. The AME is computed as the partial effect of the relevant economic variable on the corresponding health measure. In columns (3) and (5) where the interaction is included, the partial effect is for the UR evaluated first when d08 equals 0 and then when d08 is equal to 1. This is to reflect on potential differences of the UR before and after the Great Recession. Robust standard errors are reported in parenthesis. Estimation clustered by household. Socio-economic controls included: log of income, gender, age, household size, marital status (single, married, separated/divorced, widow), ethnicity (white, mixed, black/black British, Asian/Asian British, other), education (no qualifications, GCSE, Alevel, degree or higher, foreign degree, FT education), economic activity (employed, unemployed, retired, inactive) and whether the individual suffers from a long-standing illness. Time and regional dummies also included. Reference categories Single, White, No Qualifications, Employed. Time and regional dummies included. The p-value of the test of exogeneity of income variable (H0: exogenous) is 0 across all specifications. N indicates number of observations. *** p<0.01, ** p<0.05, *p<0.1. Vegetables and fruits' estimates are based on study period 2001-2011. Adding 2013 yields results qualitatively identical in sign and significance to those obtained using only years 2000 to 2011.

## Table 2. AMEs Health Risks and Behaviours (II): Smoking and Alcohol

| | | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|---|
| | *N* | *UR (t)* | *d08* | *d08#UR(t)* | *UR(t-1)* | *d08#UR(t-1)* |
| ***Cigdaily*** | 105,995 | | | | | |
| *UR(t/t-1)* | | -0.0538 | | | -0.1109** | |
| | | (0.056) | | | (0.052) | |
| *d08* | | | -0.6771*** | -0.8370*** | | -0.6417** |
| | | | (0.105) | (0.267) | | (0.288) |
| *UR at d08=0* | | | | -0.1101 | | -0.1346** |
| | | | | (0.067) | | (0.056) |
| *UR at d08=1* | | | | -0.0982 | | -0.1233** |
| | | | | (0.060) | | (0.052) |
| ***Light Smoker*** | 23,993 | | | | | |
| *UR(t/t-1)* | | 0.0039 | | | 0.0118 | |
| | | (0.009) | | | (0.008) | |
| *d08* | | | 0.0659*** | 0.0737* | | 0.0591 |
| | | | (0.015) | (0.041) | | (0.044) |
| *UR at d08=0* | | | | 0.0067 | | 0.0131* |
| | | | | (0.009) | | (0.008) |
| *UR at d08=1* | | | | 0.0073 | | 0.0141* |
| | | | | (0.010) | | (0.008) |
| ***Moderate Smoker*** | 23,993 | | | | | |
| *UR(t/t-1)* | | 0.0180** | | | 0.0093 | |
| | | (0.009) | | | (0.008) | |
| *d08* | | | 0.0486*** | 0.0138 | | 0.0200 |
| | | | (0.016) | (0.043) | | (0.047) |
| *UR at d08=0* | | | | 0.0205** | | 0.0090 |
| | | | | (0.010) | | (0.009) |
| *UR at d08=1* | | | | 0.0207** | | 0.0091 |
| | | | | (0.010) | | (0.009) |
| ***Heavy Smoker*** | 23,993 | | | | | |
| *UR(t/t-1)* | | -0.0174** | | | -0.0194*** | |
| | | (0.008) | | | (0.007) | |
| *d08* | | | -0.1208*** | -0.1089*** | | -0.0983** |
| | | | (0.015) | (0.040) | | (0.043) |
| *UR at d08=0* | | | | -0.0249** | | -0.0225*** |
| | | | | (0.010) | | (0.008) |
| *UR at d08=1* | | | | -0.0201** | | -0.0185*** |
| | | | | (0.008) | | (0.007) |
| ***No Drinking*** | 105,367 | | | | | |
| *UR(t/t-1)* | | 0.0115*** | | | 0.0099** | |
| | | (0.004) | | | (0.004) | |

| | | | | | |
|---|---|---|---|---|---|
| *d08* | | 0.0918*** | 0.0949*** | | 0.0929*** |
| | | (0.008) | (0.020) | | (0.021) |
| *UR at d08=0* | | | 0.0168*** | | 0.0118*** |
| | | | (0.005) | | (0.004) |
| *UR at d08=1* | | | 0.0188*** | | 0.0131*** |
| | | | (0.005) | | (0.004) |
| ***Light Drinking*** | 105,367 | | | | |
| *UR(t/t-1)* | -0.0032 | | | -0.0004 | |
| | (0.004) | | | (0.004) | |
| *d08* | | -0.0367*** | -0.0508*** | | -0.0658*** |
| | | (0.008) | (0.019) | | (0.021) |
| *UR at d08=0* | | | -0.0076 | | -0.0032 |
| | | | (0.005) | | (0.004) |
| *UR at d08=1* | | | -0.0071 | | -0.0029 |
| | | | (0.005) | | (0.004) |
| **Moderate Drinking** | 105,367 | | | | |
| *UR(t/t-1)* | -0.0088** | | | -0.0100*** | |
| | (0.003) | | | (0.003) | |
| *d08* | | -0.0347*** | -0.0163 | | -0.0098 |
| | | (0.006) | (0.016) | | (0.017) |
| *UR at d08=0* | | | -0.0102** | | -0.0103*** |
| | | | (0.004) | | (0.003) |
| *UR at d08=1* | | | -0.0096** | | -0.0100*** |
| | | | (0.004) | | (0.003) |
| **Heavy Drinking** | 105,367 | | | | |
| *UR(t/t-1)* | -0.0052 | | | -0.0043 | |
| | (0.003) | | | (0.003) | |
| *d08* | | -0.0164*** | -0.0043 | | 0.0075 |
| | | (0.006) | (0.016) | | (0.017) |
| *UR at d08=0* | | | -0.0056 | | -0.0033 |
| | | | (0.004) | | (0.003) |
| *UR at d08=1* | | | -0.0056 | | -0.0034 |
| | | | (0.004) | | (0.003) |

Note: Model for Cigdaily is estimated using IV Tobit and for the other health dependent variables are obtained using IV Probit. Sample size for Light, Moderate and Heavy Smoker only includesthose respondents with a positive consumption of cigarettes and therefore the number of observations is reduced as non-smokers are excluded. The p-value of the test of exogeneity of income variable (H0: Exogenous) is 0 across all specifications, except for Moderate Smoker with p-values between 0.116 and 0.120 and Heavy Drinking with p-values between 0.032 and 0.034. N indicates number of observations. *** p<0.01, ** p<0.05, *p<0.1. See notes in Table 1.

## Table 3. AMEs Health Outcomes: Morbidity

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|

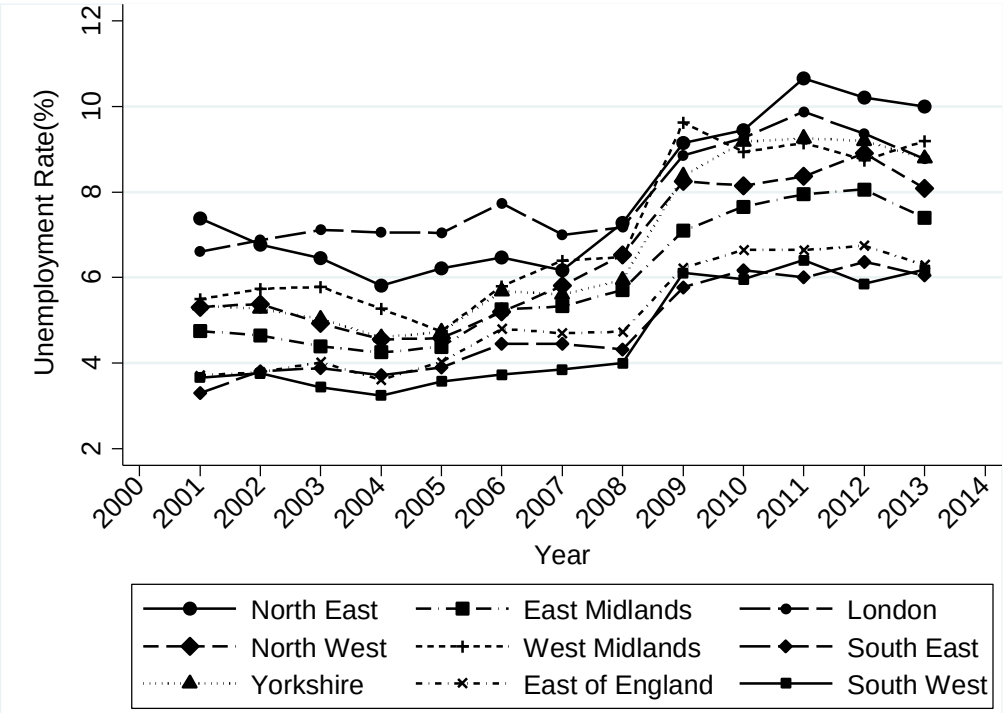
| | *N* | *UR (t)* | *d08* | *d08#UR(t)* | *UR(t-1)* | *d08#UR(t-1)* |
|---|---|---|---|---|---|---|
| ***Medicines*** | 77,287 | | | | | |
| *UR(t/t-1)* | | 0.0045 | | | 0.0103 | |
| | | (0.015) | | | (0.013) | |
| *d08* | | | 0.4167*** | 0.3660*** | | 0.3429*** |
| | | | (0.026) | (0.067) | | (0.071) |
| *UR at d08=0* | | | | -0.0027 | | 0.0060 |
| | | | | (0.016) | | (0.013) |
| *UR at d08=1* | | | | -0.0031 | | 0.0069 |
| | | | | (0.019) | | (0.015) |
| ***Cancer*** | 106,550 | | | | | |
| *UR(t/t-1)* | | -0.0000 | | | -0.0020* | |
| | | (0.001) | | | (0.001) | |
| *d08* | | | 0.0018 | 0.0021 | | 0.0044 |
| | | | (0.002) | (0.005) | | (0.006) |
| *UR at d08=0* | | | | -0.0000 | | -0.0021* |
| | | | | (0.001) | | (0.001) |
| *UR at d08=1* | | | | -0.0000 | | -0.0025* |
| | | | | (0.001) | | (0.001) |
| ***Digestive*** | 106,550 | | | | | |
| *UR(t/t-1)* | | -0.0009 | | | -0.0028 | |
| | | (0.002) | | | (0.002) | |
| *d08* | | | -0.0024 | -0.0026 | | 0.0008 |
| | | | (0.003) | (0.009) | | (0.009) |
| *UR at d08=0* | | | | -0.0015 | | -0.0033* |
| | | | | (0.002) | | (0.002) |
| *UR at d08=1* | | | | -0.0014 | | -0.0033* |
| | | | | (0.002) | | (0.002) |
| ***Diabetes*** | 106,550 | | | | | |
| *UR(t/t-1)* | | -0.0006 | | | -0.0028* | |
| | | (0.002) | | | (0.002) | |
| *d08* | | | 0.0178*** | 0.0149* | | 0.0186** |
| | | | (0.003) | (0.008) | | (0.008) |
| *UR at d08=0* | | | | -0.0013 | | -0.0030** |
| | | | | (0.002) | | (0.001) |
| *UR at d08=1* | | | | -0.0017 | | -0.0042** |
| | | | | (0.002) | | (0.002) |
| ***High BP*** | 106,550 | | | | | |
| *UR(t/t-1)* | | 0.0011 | | | 0.0010 | |
| | | (0.002) | | | (0.002) | |

| | | | | | |
|---|---|---|---|---|---|
| *d08* | | | -0.0030 | -0.0198* | -0.0278** |
| | | | (0.004) | (0.010) | (0.011) |
| *UR at d08=0* | | | | -0.0015 | -0.0011 |
| | | | | (0.003) | (0.002) |
| *UR at d08=1* | | | | -0.0012 | -0.0008 |
| | | | | (0.002) | (0.002) |
| ***Heart*** | 106,550 | | | | |
| *UR(t/t-1)* | | 0.0003 | | 0.0018 | |
| | | (0.002) | | (0.002) | |
| *d08* | | | 0.0010 | 0.0106 | 0.0099 |
| | | | (0.004) | (0.009) | (0.010) |
| *UR at d08=0* | | | | 0.0022 | 0.0029 |
| | | | | (0.002) | (0.002) |
| *UR at d08=1* | | | | 0.0025 | 0.0033* |
| | | | | (0.002) | (0.002) |
| ***Mental*** | 106,550 | | | | |
| *UR(t/t-1)* | | -0.0039** | | -0.0022 | |
| | | (0.002) | | (0.001) | |
| *d08* | | | 0.0311*** | 0.0402*** | 0.0385*** |
| | | | (0.003) | (0.007) | (0.008) |
| *UR at d08=0* | | | | -0.0031** | -0.0015 |
| | | | | (0.001) | (0.001) |
| *UR at d08=1* | | | | -0.0070** | -0.0032 |
| | | | | (0.003) | (0.003) |

Note: Model for Medicines is estimated using IV Tobit. The rest are obtained using IV Probit. The p-value of the test of exogeneity of income variable (H0: exogenous) is 0 across all specifications, except for Cancer p-value between 0.139 and 0.143 and High BP p-value=0.003. N indicates number of observations. *** p<0.01, ** p<0.05, *p<0.1. See notes in Table 1.

# Figures

**Figure 1. UR by Government Office Region (GOR)**


Unemployment Rate(%)
2
4
6
8
10
12
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year
North East
East Midlands
London
North West
West Midlands
South East
Yorkshire
East of England
South West

*Source: ONS*