WINNING BIG BUT FEELING NO BETTER? THE EFFECT OF LOTTERY PRIZES ON PHYSICAL AND MENTAL HEALTH*

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We use British panel data to determine the exogenous impact of income on a number of individual health outcomes: general health status, mental health, physical health problems, and health behaviors (drinking and smoking). Lottery winnings allow us to make causal statements regarding the effect of income on health, as the amount won by winners is largely exogenous. Positive income shocks have no significant effect on general health, but a large positive effect on mental health. This result seems paradoxical on two levels. First, there is a well-known gradient in health status in cross-section data, and, second, general health should partly reflect mental health, so that we may expect both variables to move in the same direction. We propose a solution to the first apparent paradox by underlining the endogeneity of income. For the second, we show that lottery winnings are also associated with more smoking and social drinking. *This paper thus presents the first microeconomic analogue of previous work which has highlighted that in good macroeconomic conditions negative health behaviors develop.* General health will reflect both mental health and the effect of these behaviors, and so may not improve following a positive income shock.

JEL classification: D1, I1, I3.

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1. Introduction

The relationship between individual income and health is the subject of what is by now a very substantial literature, with the broad finding that higher socio-economic status is associated with better health. This kind of relationship has now been identified in a large number of countries and for a wide variety of health variables (Deaton and Paxson, 1999; Marmot and Bobak, 2000; Van Doorslaer et al., 1997; Winkleby et al., 1992).

While this association does indeed appear to be widespread, there is less common ground regarding its causal interpretation. That income, or socio-economic status more broadly, be correlated with health may indeed reflect a causal effect of the former on the latter. However, it is entirely possible that poor health also influences income, by reducing the ability to work for example. In addition, there are likely hidden common factors that affect both variables, such as the individual's genetic endowment, birth weight, or the quality of the school that she attended. In this case, income and health will be correlated, but not in any causal way.

The vast majority of the existing literature is not able to distinguish between these three alternative readings of the income-health correlation. Testing the causal impact of income on health requires exogenous movements in income, which can be identified in an instrumental or experimental setting. This is the approach to which we appeal here, using lottery winnings as an exogenous source of income variation in a large-scale panel dataset.

Most existing work on this question has used a general health status variable as the dependent variable. We are here able to provide much more detail by assessing the impact of exogenous changes in income on a number of different health measures: self-assessed overall health, a psychological measure of mental stress (the 12-item General Health Questionnaire, or GHQ-12), physical health problems, and health-related behaviors (smoking and drinking).

The effect of income on these different health variables is far from uniform. There is first no correlation between lottery winnings and general health. However, this

lack of a relationship actually masks statistically significant correlations in different health domains. Winning big does indeed improve mental health; however we uncover counteracting health effects with respect to risky behaviors. Those who win more on the lottery smoke more and engage in more social drinking, both of which are likely detrimental to general health. The positive effect on mental health and the negative effect from risky behaviors may well sum to a negligible overall relationship between income and general health.

The paper is organized as follows. The following section briefly summarizes the related literature and discusses our approach. Section 3 presents the data from the British Household Panel Survey, and Section 4 discusses identification of the effect of income on health. Section 5 contains the main results, and Section 6 presents robustness checks and some additional findings. Last Section 7 concludes.

2. Empirical findings on the income-health relationship and our approach

2.1. The causal effect of income on health

Some intuition

It is commonplace to hypothesize that higher income causes better health. If we assume that individuals maximize a utility function defined over health and other goods subject to budget and time constraints, a positive shock to income will loosen the budget constraint and will thus yield better health, if health is a normal good. However, it seems unlikely that health will be independent of the other elements of the utility function. We can in particular imagine certain "risky behaviors" or lifestyle choices which are positively correlated with utility (and which are themselves also normal goods), but which are negatively correlated with health. In this case, higher income will have an ambiguous effect on health, by increasing smoking, drinking or other risky activities which are detrimental to general health.

Findings in the previous literature

The positive relationship between income and health for adults is open to a number of interpretations, as underlined by Smith (1999): the causality may run from income to health, from health to income, or both may be determined by hidden common factors. Below, we discuss the small number of papers that have investigated

this relationship by appealing to exogenous changes in income.

Elesh and Lefcowitz (1977) look at the effect of the New Jersey-Pennsylvania Negative Income Tax Experiment on various health outcomes, including the number of chronic illnesses, hospital days and work days lot, and find no effect of the experiment on health outcomes. However, the sample is relatively small (732 households), and *no distinction* is made between the physical, mental and behavioral components of health.

Ettner (1996) estimates the effect of income on health using American data. The health variables she uses are self-assessed health, a scale of depressive symptoms, and daily limitations due to both physical and mental difficulties. The effect of income on physical and mental health is therefore not systematically separately evaluated. She addresses the problem of reverse causality via instrumentation, using the state unemployment rate, work experience, parental education, and spousal characteristics as instruments. A substantial impact of income on all of the health variables is found. It can however be countered that the instruments used here are not exogenous. As noted by Meer et al. (2003), the unemployment rate will only be a valid instrument if regional variations in health only reflect variations in income, which may well not be the case.

Lindahl (2005) appeals to Swedish longitudinal data, and constructs an overall health measure comprised of both the physical and mental aspects of health. Lottery prizes are used to provide exogenous variations in income.[1] A positive and significant relationship is found between income and this general health measure. Unusually, Lindahl also considers some of the different aspects of health separately. Lottery

[1]Lottery winnings are an arguably under-exploited source to assess the effect of exogenous variations of income on health outcomes (Connor et al., 1999). One of the first systematic uses of which we are aware is Brickman *et al.* (1978), although in a small-sample, and cross-sectional, context. Apart from work on health and well-being, described in this Section, they have also appeared in empirical Labor Economics. Henley (2004) considers the determinants of labor supply, and Lindh and Ohlsson (1996) and Taylor (2001) the decision to become self-employed, where lottery gains are supposed to relax liquidity constraints. Both Henley (2004) and Taylor (2001) use the same database as we do, the British Household Panel Survey. A separate literature has traced out the reaction of consumption and savings to exogenous movements in income. An early example is Bodkin (1959), using an unexpected National Service Life Insurance dividend paid out to World War II veterans in 1950; more recent examples include Imbens et al. (2001), who appeal to differences in winnings amongst major-prize winners of the Megabucks Lottery in Massachusetts between 1984 and 1988, and Kuhn et al. (2008), who appeal to differences in winnings in the Dutch postcode lottery.

winnings have a positive and significant effect on mental health, and a non-significant effect on overweight, headaches and cardiovascular diseases (see her Table 4, column (5)). However, Lindahl has only a relatively small number of winners (626 winners, who are called "players", see his Table 3). In addition, his data does not say in which year the lottery prize was won (Lindahl, 2005, end of page 148), and the effect of the average prize won over a period is evaluated on health at the end of the period: as such, the effect of lottery prizes on health is evaluated at different intervals for different individuals. Finally Lindahl does not address the issue of lottery wins and health behaviors, which is at the heart of our paper.

Meer et al. (2003) use self-assessed health as their main dependent variable, but also carry out robustness checks using a binary variable indicating physical or nervous disabilities which limit the individual's ability to work. In instrumental variable estimation (using data on inheritances), wealth is not found to have a significant effect on health.

Frijters et al. (2005) analyze the relationship between self-assessed health and income. They try to correct for both reverse causality and hidden common factors, using an exogenous change in income (due to the fall of the Berlin wall) in a fixed-effects framework. They find that income has a positive, but only very small, effect on health.

Last, recent work by Gardner and Oswald (2007) has explored the causality running from exogenous variations in income (from medium-sized lottery wins) to changes in mental health, as measured by the GHQ. They find that money has a significant and positive effect on mental health.

Table 1 summarizes the findings presented above.

2.2. Our approach

We appeal to monetary lottery wins to try to establish a causal link between exogenous movements in income and changes in a number of different health outcomes.

We do not construct a score summarizing the different aspects of health, as we wish to see whether these latter react differently to income shocks, and we clearly distinguish mental from physical health. Our reason for doing so, unlike most of

the existing literature, comes from the results in Ruhm (2000), which called into question the notion of one holistic concept of health, in particular in relation to the economic cycle.

Ruhm (2000) considered various measures of both individual-level and aggregate-level health, and tracked their movements over periods of boom and bust. His key finding is that different aspects of health move in different directions during recessions:

. First, short-run recessions seem to be associated with better physical health. The common belief that physical health declines during temporary economic contractions is wrong, and mortality is largely procyclical in US data. Regressions at the US-state level highlight that poor economic conditions are associated with lower death rates in general, and with reduced prevalence of a number of specific causes of death in particular (cardiovascular diseases, pneumonia, and motor vehicle accidents). This aggregate relationship is supported by evidence relating individual health outcomes to aggregate economic conditions. Using individual data from the Behavioral Risk Factor Surveillance system, Ruhm (2000, 2005) relates individual behaviors to the local unemployment rate (but not to the individual's labor-market status). He uncovers significant behavioral effects, in that individuals modify their lifestyles during short-term recessions: both tobacco consumption and BMI fall (so that individuals are more likely to have a healthier body weight), while regular physical activity increases. Physical health is therefore counter-cyclical, and this specifically seems to apply to the behavioral correlates of health.

. However, this negative relationship is not found for all of the health measures. There is one cause of death that is higher during recessions: suicide. As Ruhm (2001) notes, there is "some evidence that mental health is pro-cyclical".

Some of these results have been confirmed in recent work by Adda et al. (2009), who use a structural framework to model the dynamics of income and health, which latter are considered as stochastic processes. They decompose income into transitory and permanent components. Adda et al. construct aggregate synthetic cohort

data, and look at the effect of fluctuations in aggregate income (over the 1980s and 1990s), reflecting macro-economic factors, on health. They find that higher permanent income has no significant effect on self-reported health, blood pressure or cardiovascular diseases. The effect of permanent income on mental health is either negative or insignificant. However, permanent income is positively correlated with the number of cigarettes smoked per day.

The existing macroeconomic evidence therefore suggests that physical health (particularly its behavioral elements) and mental health may not be associated with exogenous income movements in the same way. However, it has not yet been established whether the same results hold at the entirely microeconomic level, when we correlate different individual health measures with movements in exogenous individual income. This is what we do below, using data on lottery winnings from eleven waves of large-scale panel data.

3. Data

Our data come from the British Household Panel Survey (BHPS), the first wave of which appeared in 1991. This general survey initially covered a random sample of around 10,000 individuals in around *5,500* different households in Great Britain; increased geographical coverage has pushed these figures to around 16,000 and 9,000 respectively in more recent waves. We here make use of health data from waves 6 to 18 (1996-2008), and of lottery data from waves 7 to 16 (1997-2006), as harmonized lottery information is not available in earlier waves.[2] The BHPS includes a wide range of information about individual and household demographics, mental and physical health, labor-force status, employment and values. There is both entry into and exit from the panel, leading to unbalanced data. The BHPS is a household panel: all adults in the same household are interviewed separately. Further details of this survey are available at the following address: http://www.iser.essex.ac.uk/ulsc/bhps/.

The list of the variables used in our analysis of the income-health relationship appears in Table 2; we describe below in a little more detail the key ones.

[2]The National Lottery was inaugurated in the UK in November 1994.

Health

The BHPS contains a large number of health variables; these allow us to investigate separately the relationships of income to general, mental and physical health. We consider four main measures of individual health.

General health status

Our first health variable is the widely-used measure of self-assessed health. This comes from the question:

> *"Please think back over the last 12 months about how your health has been. Compared to people of your own age, would you say that your health has on the whole been...?"*, with the possible responses *"Excellent, Good, Fair, Poor, and Very Poor"*.

These are coded in the data using the values 1 to 5. In our analysis, we reverse-code this variable so that higher values refer to better health outcomes. This question appears in all waves of the BHPS, except for wave 9, when a special module was introduced to calculate the SF-36 health index. This does include a general self-reported health question (actually the first question in the module), which is however both differently worded (*"In general would you say your health is..."*), and uses different response categories (*"Excellent, Very Good, Good, Fair, and Poor"*). As such, we drop wave 9 of the BHPS from our empirical analysis.

Mental health

To measure mental health, we use a score calculated from the General Health Questionnaire (GHQ). This latter is widely-used by psychologists, epidemiologists and medical researchers as an indicator of mental functioning. The BHPS contains the 12-item version of the GHQ, based on the following questions. BHPS respondents are asked:

> *"Here are some questions regarding the way you have been feeling over the last few weeks. For each question please ring the number next to the answer that best suits the way you have felt. Have you recently....*

a) *been able to concentrate on whatever you're doing?*
b) *lost much sleep over worry?*
c) *felt that you were playing a useful part in things?*
d) *felt capable of making decisions about things?*
e) *felt constantly under strain?*
f) *felt you couldn't overcome your difficulties?*
g) *been able to enjoy your normal day-to-day activities?*
h) *been able to face up to problems?*
i) *been feeling unhappy or depressed?*
j) *been losing confidence in yourself?*
k) *been thinking of yourself as a worthless person?*
l) *been feeling reasonably happy, all things considered?*"

Question a) is answered on the following four-point scale:

1: *Better than usual*
2: *Same as usual*
3: *Less than usual*
4: *Much less than usual*

Questions b), e), f), i), j) and k) are answered as follows:

1: *Not at all*
2: *No more than usual*
3: *Rather more than usual*
4: *Much more than usual*

And the replies to questions c), d), g), h) and l) are on the following scale:

1: *More so than usual*
2: *About same as usual*
3: *Less so than usual*
4: *Much less than usual*

The main mental health variable used in this paper is the Caseness GHQ score, which counts the number of questions for which the response is in one of the two "low well-being" categories. This count is then reversed so that higher scores indicate higher levels of well-being, running from 0 (all twelve responses indicating poor psychological health) to 12 (no responses indicating poor psychological health).[3]

Physical health - Health problems

[3]GHQ information from the BHPS has been used by Economists in a number of different contexts: see Clark and Oswald (1994), Clark (2003), Ermisch et al. (2004), Gardner and Oswald (2007), and Powdthavee (2009).

The data also contain a number of variables indicating the presence of specific health problems. Amongst these, we retain only those which describe specific physical problems. These refer to:[4]

1) Arms, legs, hands, etc
2) Sight
3) Hearing
4) Skin conditions/allergy
5) Chest/breathing
6) Heart/blood pressure
7) Stomach or digestion
8) Diabetes.

Physical health - Behaviors

We consider two separate risky behaviors: smoking and drinking. We have two distinct smoking variables. The first is a binary variable showing whether the respondent is a "current smoker" or not. This variable is called "Smoker". Our second variable called "Cig" indicates the number of cigarettes the individual smokes per day. We recode this number using the following scale:

1: Between 1 and 10 cigarettes per day
2: Between 11 and 15 cigarettes per day
3: Between 16 and 30 cigarettes per day
4: More than 30 cigarettes per day

Drinking is measured via an ordinal variable ("Drink") which indicates the frequency with which the respondent goes for a drink at a pub or club. This variable is coded as follows, where higher values indicate more social drinking:

1: Never/almost never
2: Once a year or less
3: Several times a year
4: At least once a month
5: At least once a week

Figures 1 and 2 show the distribution of these six health variables. The median and the mode of self-assessed health is "Good", and the GHQ score exhibits strong right skew. Around one-quarter of BHPS respondents are current smokers, and the

[4]The BHPS also asks about health problems with respect to Alcohol and Drugs, and Epilepsy. We do not analyze these two variables as few respondents report such problems.

modal category for social drinking is "At least once a week", although almost twenty percent never go out to pubs or clubs.

Lottery wins

We are interested in the relationship between income and these different health measures. To try to identify a causal relationship between income and health, we appeal to two BHPS questions on lottery wins as a source of exogenous changes in income. These have appeared every year from 1997 onwards, and are worded as follows:

> *"Since September 1st (year before) have you received any payments, or payment in kind, from a win on the football pools, national lottery or other form of gambling?"*

If this question was answered in the positive, then the respondent was asked:

> *"About how much in total did you receive? (win on the football pools, national lottery or other form of gambling)"*

As such, we know both whether the individual won, and how much in total they received. The average win reported, expressed in real 2005 Pounds, is around £220. Six per cent of winners win more than £500, and the largest win is over £150 000.

However, one potential weakness of the lottery data in the BHPS[5] is that it does not contain any direct information about the number of times (if any) that the individual has played the lottery. As such, we cannot distinguish non-players from unsuccessful players. A second point is that, both for lottery winners and playing non-winners, we do not know how much has been gambled.

On the other hand, there are significant advantages in using lottery winnings. Firstly, as noted previously, we can consider their receipt as being largely exogenous. Second, in Britain, as opposed to a number of other countries, many people play lotteries. A recent survey-based estimate (Wardle et al., 2007) is that over two-thirds of the British participate in some kind of gambling in a given year, with 57% of the

[5]Which weakness also appears in the Swedish lottery data used by Lindahl (2005), but not in the analysis of Kuhn et al. (2008), who are able to control for the number of lottery tickets purchased.

population playing the National Lottery (and almost 60% of the latter playing at least once a week). The Camelot Group, who are the current National Lottery operators, report that just under £5 Billion was spent on the lottery in the year 2007-2008 (http://www.camelotgroup.co.uk/aboutcamelot/annualreports/2008AnnualReport .html). Consequently, there are a considerable number of lottery winners in the BHPS data.

Lottery winnings are adjusted for inflation via the consumer price index (see Table 3) and are expressed in 2005 Pounds. In the empirical analysis, we will use the logarithm of lottery winnings, partly as income is very often entered in log form in the empirical analysis of health and well-being, and partly because the distribution of lottery winnings is, unsurprisingly, extremely right-skewed.[6] The distribution of the log of lottery winnings for winners is shown in Figure 3.

4. Identifying Exogenous Income Effects

Section 3 above highlighted the exogenous income variables that are available in the BHPS. However, the way in which lottery winnings should be used in a causal regression framework merits some reflection. The underlying issue is that, while we suppose that winning the lottery is a random event, conditional on having played, the actual fact of playing the lottery may well itself be endogenous: non-players and players are likely to differ in both their observable and unobservable characteristics. As noted above, the BHPS does not include information on whether individuals play the lottery or not: we cannot distinguish players from non-players, only winners from non-winners.

Winners versus Non-Winners

One simple way of using lottery-winnings information would be to compare the health of those who have not won the lottery (which group consists of both non-players and unlucky players) to the health of winners. However, these two groups are not likely to be comparable, as the decision to play the lottery is probably endogenous, which poses serious problems for the interpretation of the coefficient on lottery winnings.

[6]Experiments using a set of lottery-winnings dummies consistently produced qualitatively similar results to those using log of the prize.

This phenomenon is illustrated in the Venn diagram in Figure 4. The first, larger, set consists of those who play the lottery. These players likely have different characteristics, both observed and unobserved, to non-players. The key issue in the BHPS data (which we believe is common to many datasets covering lottery winnings) is that this distinction between those who play and those who do not play is unobserved (which is why we have drawn the frontier of this set as a broken line). There is a second set, entirely contained within the first: this is the set of winners, all of whom by definition are players. This is the frontier that we do observe (which is represented as an unbroken line).

While the group of winners in Figure 4 might be fairly homogeneous (we will test this explicitly below), amongst non-winners we have both those who did not play, and those who did play but did not win. If playing the lottery is endogenous, individual characteristics will differ between the groups. It can of course be argued that we can condition on any observable differences, once we have identified them. However, non-players and players (and therefore non-winners and winners) may also differ fundamentally in other unobservable ways. For example, non-players (who are included in the group of non-winners) may well be more risk-averse, and as a result invest more in their own health capital. This seriously flaws any comparison of health between winners and non-winners: as such we do not compare these two groups in our analysis.

To illustrate this potential bias, we create a dummy variable for having won the lottery (called "Win"), and regress it on a number of individual characteristics:

$$Win_{it} = F(\alpha + \beta h_{it-1} + \gamma x_{it-1})$$

where h_{it-1} represents health at date $t-1$ and x_{it-1} denotes the other control variables, including income.[7] The function F here is the cumulative normal distribution, and we estimate this equation as a simple probit.

Table 4 presents the regression results. These show that the probability of win-

[7]The non-lottery income variable that we use in this regression, and in our health and well-being regressions, is called "whhnyrde", a derived variable supplied with the BHPS, which measures total household annual income, equivalized using the McClements before housing costs scale, and adjusted for the prices of the reference month.

ning the lottery is significantly correlated with lagged income, household size, ethnicity, education, age and labor-market status. It is also correlated with *a number of lagged health variables: for instance people with physical health problems are more likely to win, and thus, we suggest, are more likely to play the lottery.* [8] The results in Table 4 hence underline that those who win and those who do not win differ in a number of observable ways, and thus we suggest likely differ in unobservables too. To overcome this problem, the remainder of the paper concentrates on the health outcomes of big compared to small lottery winners.

Big versus Small Winners

The exogenous effect of income amongst winners is identified from the comparison of those who have won larger amounts of money to those who won smaller amounts. This distinction is arguably far more exogenous (although it may still depend on how much individuals play). To show that there is less of an endogeneity problem here, we regress the amount won (for winners only) on the same right-hand side variables as previously used in Table 4:

$$Log(Prize)_{it} = \alpha + \beta h_{it-1} + \gamma x_{it-1} + \epsilon_{it}$$

Table 5 shows the results of this OLS regression. Fewer of the individual variables are correlated with the amount won. The populations of large and small winners seem to be similar according to labor market status and age (except for the 16-19 age group), which was not the case in Table 4. This relative similarity in observables leads us to suspect a corresponding similarity in unobservables, and it is on this basis that we will evaluate the effect of income on health.

5. The Effect of Income on Health Outcomes

In line with the existing literature, our health regressions include a number of fairly standard explanatory variables: age, ethnicity, education, labor-market and

[8] One dataset that does contain information on whether people played or not is the UK Family Expenditure Survey. Analysis of three cross-sectional waves of this data from 1998/1999, 1999/2000 and 2000/2001 shows that the probability of playing the lottery is related to standard individual demographics in very much the same way as the probability of winning in Table 4. The fact that the FES is not panel, and does not include health information, however renders it inapt for the question we analyze here

marital status, region and wave. We examine the effect of income on the different health outcomes listed above: self-assessed health, physical health problems, mental health, and smoking and drinking. Our key right-hand side variable is exogenous income from the comparison of large and small lottery winnings. For notation purposes, we consider lottery winnings that are reported in year t (for example, someone interviewed in Wave 10, say in October 2000, reports any lottery winnings between September 1999 and the date of their Wave 10 interview). To evaluate the effect of such winnings on health, we imagine that any health investments may take time to bear fruit, and consider health at date $t+2$ as our dependent variable (to continue the example above, we will consider health at Wave 12, that is between two to three years after the lottery win).[9] Further, as is fairly common in this literature, some of the regressions will control for the individual's lagged health status at $t-1$.[10]

The models below examine the average effect of lottery winnings on different types of health. For all health variables except social drinking, we use the following models:

$$h_{it+2} = F(\alpha + \beta.Log(Prize)_{it} + \eta.x_{it+2})$$

$$h_{it+2} = F(\alpha + \beta.Log(Prize)_{it} + \delta.h_{it-1} + \gamma.Log(income)_{it-1} + \eta.x_{it+2})$$

Here t is the year of the lottery win, h denotes health, and the x the other control variables. Compared to the first equation, the second equation adds both lagged health and the logarithm of equivalent household income, measured at $t-1$. We do this in particular as there is some evidence in Table 5 that individuals in richer households

[9] Oswald and Winkelmann (2008) also find a delayed effect of lottery winnings on a measure of well-being. They use GSOEP data to show that financial satisfaction is significantly positively correlated with the amount won by lottery winners, but only three years after the win. There is no significant effect one or two years after a win. They interpret their results as indicating deservingness: individuals only enjoy their winnings when they feel that they have deserved them. Deservingness is endogenous and can be created by the individual, but this costly investment takes time, which explains the lack of any significant effect immediately following the win. Equally, Kuhn et al. (2008) find no effect of the amount won in the Dutch postcode lottery on individual happiness six months later.

[10] In the context of completely exogenous movements in income, controls for lagged health are not necessary. When lottery prizes are distributed randomly, then controlling for lagged health will not affect the estimated coefficient on lottery winnings in a health equation. We believe that the size of lottery wins (amongst winners) is fairly random; the regression results in Table 5 support this reading. In practical terms, the presence or absence of lagged health in our regressions most often makes little qualitative difference to the estimated coefficient on lottery winnings.

win larger lottery prizes.

Because of data availability[11] we are obliged to replace h_{it-1} with h_{it-2} when looking at the effect of lottery prizes on social drinking:

$$h_{it+2} = F(\alpha + \beta.Log(Prize)_{it} + \delta.h_{it-2} + \gamma.Log(income)_{it-1} + \eta.x_{it+2})$$

The health equations are estimated via ordered probits or probits. In order to allow for correlation between errors for repeated observations on the same individual, we cluster standard errors at the individual level.

The following sub-sections discuss the estimation results for our different health variables in turn.

5.1. General health status

The regression results for the most general of our dependent variables, self-assessed health, appear in Table 6. This table shows the effect of lottery winnings reported at t on self-assessed health at $t + 2$. *There are two columns in this table, one for each model.*

The main coefficients of interest here are those on the log prize variables: these are positive but insignificant, and provide no evidence that exogenous income improves general health. This is consistent with previous results in Meer et al. (2003). It is worth underlining that this table does indeed show a social gradient in health: the significant estimate on log income at the end of the table tells us that individuals with higher incomes are in better health. The fact that lottery winnings do not affect health then leads us to suspect that the relationship between income and health is not causal in this direction: either health causes income, or both reflect some other omitted variable such as the quality of the maternal diet, or the type of school the individual attended.

A number of the other right-hand side variables in column (2) (which are not shown in Table 6 for space reasons) attract only insignificant coefficients. This is due to the fact that many of them move only little over time, and as such are picked

[11] Social drinking is only recorded every two years in the BHPS. As we sometimes condition on one-year lags in the health variable under consideration, we are not able to estimate a drinking equation with terms in both $t - 1$ and $t + 2$.

up by the four lagged health dummies (we exclude health category 4, corresponding to "good health", as this is the largest category).

It is likely that self-assessed health reflect both physical and mental elements. Following the well-known macro work of Ruhm (2000), it is possible that these move in opposite directions to produce an insignificant net effect of "better economic conditions" (i.e. higher income) at the individual level. With this distinction in mind, we now appeal to the separate measures detailed in Section 3 above to see whether physical and mental health do indeed have sharply different relationships with exogenous income. In line with Ruhm's results, we will pay particular attention to health behaviors.

5.2. Positive income shocks improve mental health

The results for mental health are shown in Table 7. There are two columns in this table. These show the relationship between lottery winnings at t and the individual's GHQ score at $t+2$ both with and without controlling for lagged mental health and lagged income at $t-1$. We actually expect the controls for lagged mental health to have little effect on the lottery coefficient, as Table 5 showed that, conditional on having won a prize, the size of the prize was not correlated *with the lagged GHQ variables, with one exception.*

The estimated coefficients on the lottery prize in the two specifications do indeed turn out to be very similar. These show that a positive income shock leads to better mental health two to three years later. This relationship had previously been highlighted by Gardner and Oswald (2007) using the BHPS data. The results in Table 7 show that this finding is robust to additional waves of data (we here use nine waves as compared to the two in Gardner and Oswald), and to a more complete set of individual-level control variables (we control in addition for household size and use more detailed marital status information). The findings in Table 7 also represent a totally micro-econometric counterpart to the correlation between suicide and local economic activity presented in Ruhm (2000, 2001, 2005).[12]

[12]The GHQ being a composite index, we can equally re-estimate the mental health equation for each of the twelve component questions listed in Section 3. *The positive effect of lottery winnings on well-being is particularly pronounced for the question referring to feeling reasonably happy, all things considered. We can confirm the effect of lottery winnings on this latter "hedonic" component*

It may appear somewhat paradoxical that income significantly improves mental health, but at the same time has only insignificant effects on general health (as found in a number of papers, including the present). The following sub-sections propose to resolve this paradox by suggesting that income does not alleviate physical health problems, but may lead to unhealthy lifestyle outcomes.

5.3. Positive income shocks have no effect on specific health problems

To investigate the relationship between income and specific physical, as opposed to mental, health problems, we carry out analogous regressions to those in Table 7, but replace GHQ by information on a series of physical health problems. These latter refer to problems with: Arms, legs, hands, etc; Sight; Hearing; Skin conditions/allergy; Chest/breathing; Heart/blood pressure; Stomach or digestion; and Diabetes. All of these problems are evaluated at $t+2$, whereas the lottery prize was reported at t.

We carried out the analysis for each of the above eight problems separately. *The regression results, presented in Table 8, systematically show no relationship between lottery winnings and these physical health problems. This might be argued to be unsurprising: higher income may well not improve individuals' sight, hearing, or skin conditions. However, one area where income might play a larger role is in the specific behaviors that individuals undertake (i.e. the way in which they live their lives), and their ensuing health effects. In the following, we specifically consider the relationship between lottery winnings, smoking and social drinking.*

5.4. Positive income shocks lead to worse lifestyles

The hypothesis we test in this last sub-section is that positive individual income shocks may have a detrimental effect on physical health via individual lifestyles. In what follows, we specifically consider smoking and drinking.

Around 25% of our estimation sample of lottery winners report being current smokers. Columns (1) and (2) of Table 8 model the probability that the individual

of well-being by re-running our analysis in Table 7 using the single-item overall life satisfaction score available in the BHPS, which is measured on a one-to-seven scale, instead of the composite GHQ-12 measure. The regression results show a significant correlation, at the one per cent level, between lottery winnings at time t and overall life satisfaction at time t + 2. [Not for publication: See Table 10]

be a smoker. The demographic control variables here (not shown) are the same as in Table 7. We are most interested in the effect of lottery winnings on smoking. The first line of Table 8 reveals that positive income shocks (which occurred between $t-1$ and t) significantly increase the probability of smoking at $t+2$. Columns (3) and (4) *provide some evidence* that lottery winnings increase the probability of smoking a greater number of cigarettes.[13] *We repeat our analysis for social drinking in columns (5) and (6) of Table 8. The results in this table indicate that the greater is the lottery prize, the greater the probability of more frequent social drinking.*

We then quantify the marginal effect of lottery winnings on different types of outcomes. These probabilities are calculated for an individual with characteristics that are fairly representative in our sample of winners. We evaluate the effect of winning £10,000, as opposed to the mean amount won of £220. The marginal effect of these higher winnings on GHQ, from Table 7, is of 3.0 percentage point rise in the probability of reporting the highest mental well-being score (i.e. 12), given that the person reported a score of 10 before winning the lottery. The same method applied to the results in Table 8 produces a 3.7 point increase in the probability of smoking 16 to 30 cigarettes per day, given that the person was a light smoker - 1 to 10 a day - before winning, and a rise of 2.9 percentage points in the probability of going to a pub or club at least once a week, given that the person was going to a pub or club several times a year before winning.

Table 8 therefore shows that, rather than producing better health, higher income is also associated with increased behaviors that are commonly thought to be unhealthy. Much work has shown that, in general, higher income is associated with more favorable health outcomes. Our results here nuance this empirical fact. Positive individual income shocks produce changes in lifestyles which may well be prejudicial to health. This is entirely consistent with Ruhm (2000, 2001, 2005), who considers the relationship between risky health behaviors and economic booms.

[13] Column (3) is an ordered probit of the four classes of cigarette consumption at $t+2$, described in Section 3, regressed on log winnings at time t and the other explanatory variables at time $t+2$. Current $(t+2)$ non-smokers are thus dropped from this analysis. Column (4) is also an ordered probit of current cigarette consumption, which controls in addition for the $t-1$ values of household equivalent income and cigarette consumption. As this latter is only defined for smokers, the regression sample in column (4) consists of continuing smokers between $t-1$ and $t+2$.

Ruhm's approach is very similar to ours at one level: by relating individual (and aggregate) health outcomes to local labor market conditions, he is able to appeal to the exogeneity of the latter in determining individual health. Our results above can be read as the micro-econometric analogy of those in Ruhm. At the individual level also, exogenously higher income produces unhealthy living.

The correlations revealed by these exogenous movements are therefore largely contradictory to the commonly-noted positive link between health and social status. In reality positive (exogenous) income shocks seem to lead to lifestyle choices which are associated with worse health outcomes.

6. Robustness Checks and Additional Findings

6.1. Net or Gross Winnings?

The BHPS question on lottery winnings asks individuals to report *"about how much in total did you receive"*. Although it is not made explicit, the most likely interpretation of this question is in terms of gross winnings. Playing the lottery costs money, and it is possible that some of our winners could have actually spent more on lottery tickets over the year than they ended up winning. In general, net winnings will be smaller than gross winnings. We are interested here in the effect of an individual's financial resources on their health and well-being. Our measure of (gross) lottery winnings then overstates the movement in the resources that they have available to them. As such, our estimated coefficient on lottery winnings is actually biased downwards. To explore this matter further, we re-estimated Tables 6-8, introducing not only the amount of the lottery win, but also an interaction between winnings and the fact of winning at least £1,000 (we imagine that with gross winnings of at least this amount were considerably less likely to be net losers). *Because interactions terms are difficult to interpret in non-linear settings (Ai and Norton, 2003), we used linear probability models for dichotomic health variables.*None of the coefficients on these interactions were close to significant, leading us to suspect that our main health results are robust.

[Not for publication: see Tables 11, 12, 13, 14.]

6.2. Social Drinking

Our analysis of the endogeneity of lottery winnings in Table 5 led to the broad conclusion that health at $t-1$ did not predict the amount won on the lottery at date t. One very significant exception to this rule appears in column (6) of that table, where the most frequent social drinkers at $t-2$ systematically win more on the lottery. This raises the possibility that "big winners" are different in some unobservable way from little winners, and that these unobserved variables are correlated with health outcomes. *As a robustness check, we drop those in the top social drinking category at date $t-2$ from our regressions, and our results are not affected.*

[Not for publication: see Table 15.]

6.3. Effect of lottery winnings at $t+1$ and $t+3$

On pourrait ajouter cette sous-section pour repondre aux critiques des referes.

We re-estimate the models at $t+1$ and $t+3$. Results indicate that higher lottery prizes are never associated with higher self-assessed health, but are associated with higher mental health at $t+2$ and $t+3$, and with poorer heath behaviors at $t+1$, $t+2$ and $t+3$.

[Not for publication: See Table 16 for health variables at $t+1$ and Table 17 for $t+3$.]

6.4. Interaction between lottery winnings and socioeconomic variables

We included in our models interaction terms between lottery winnings and several socioeconomic variables. We find that the effect of lottery prizes on health variables does not depend on income in general, but we do note a stronger GHQ effect for those with higher income. There is no sharp difference in the shape of the results neither for younger and older individuals. Inspired by some of the results in Miller (2009), we equally considered the effects of lottery winnings according to labor-market attachment and found a greater smoking effect amongst the unemployed and inactive.

7. Conclusion

This paper has asked whether money makes individuals healthier. While it seems well-known that the rich enjoy better health, it is far more difficult to establish the causality of this relationship. A small recent literature has appealed to exogenous

movements in income, for example lottery winnings and inheritances, to reveal either small or negligible effects of income on general health. At the same time, lottery winnings have been shown to produce better mental health.

We have suggested resolving this apparent paradox by appealing to an entirely individual-level analogy of the well-known work of Ruhm (2000, 2001, 2005), and distinguishing between physical and mental health. Ruhm showed that recessions are associated with healthier living but more suicides. Using a sample of lottery winners only, "better economic conditions", which at our micro level are picked up by greater lottery winnings, produce higher GHQ mental health scores, but also a greater likelihood of smoking and social drinking.

The results presented here have more generally underlined three arguably central points in the analysis of health outcomes. The first is that it is unlikely that income is exogenous, so that instrumentation is essential for the understanding of causal relationships. Second, health is not a holistic concept, and we need to both be clear about what kind of health we are talking about, and be ready for the possibility that different types of health behave in very different ways. Last, the comparison of results from different levels of aggregation of both dependent and explanatory variables is a fruitful avenue of research in the economics of health and well-being.

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Figure 1: Distribution of Health Variables

Note: 7,150 observations.

Figure 2: Distribution of Health Variables

Note: 9,519 observations for Health problems, 7,150 for Smoking, 2,053 for the No. of cigarettes per day and 4,453 for Social drinking.

Figure 3: Distribution of the Logarithm of Prizes for Winners

Note: 7,150 observations.

Table 1: Findings in the Literature

	General Health		Mental Health
	General Health Score	Self-Assessed Health	
Ettner (1996)		+	+ (Scale of Depressive Symptoms)
Lindahl (2005)	+		+ No of Poor Mental Health Symptoms
Meer et al. (2003)		ns	
Frijters et al. (2005)		+ (Very small)	
Gardner and Oswald (2007)			+ (GHQ)

Note: "+" stands for a "positive and significant effect of income on the Health Score in question" and "ns" stands for "no significant effect".

Figure 4: Non-Players, Players who do not win and Winners

Table 2: Definition of Analysis Variables

Health	
General health	
Self-assessed health	=1 if poor health to =5 if excellent health
Mental health	
GHQ	=0 for worst mental health to =12 for best mental health
Physical health	
Health Pb X	=1 if reports health problem X
Smoker	=1 if the individual smokes
Cig	=1 if the individual smokes between 1 and 10 cigarettes per day to =4 if the individual smokes more than 30 cigarettes per day
Drink	=1 if the individual goes out for a drink to a pub or club never or almost never, to =5 if the individual goes out for a drink to a pub or club at least once a week
Lottery	
Win_t	=0 if the individual does not win at date t =1 if the individual wins at date t
Log(Prize)	Logarithm of lottery prize
Control variables	
Log(inc)	Logarithm of income (real annual household income, equivalized)
Log(hh size)	Logarithm of household size
White	*Reference*
Non-white	=1 if not white
No education	*Reference*
O-levels	=1 if has O-levels
A-levels	=1 if has A-levels
college degree	=1 if has a College degree
Uni degree	=1 if has a University degree
Employed	*Reference*
Unemp	=1 if unemployed
Retired	=1 if retired
NLF	=1 if not in the labor force
Married	*Reference*
Divsep	=1 if separated or divorced
Widowed	=1 if widowed
Nvr mar	=1 if never married
Age	Dummy variables for age groups: 16-19, 20-24, 25-29, 30-34,.... 75-79, 80+
Region	Dummy variables for each region
Year	Dummy variables for each year

Table 3: The Consumer Price Index for the UK

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
CPI	89.7	91.1	92.3	93.1	94.2	95.4	96.7	98.0	100.0	102.3	104.7

Source. http://www.statistics.gov.uk/statbase/TSDdownload2.asp

Table 4: Probit Regressions of Being a Winner at date t on Individual Characteristics at date $t-1$

	(1)	(2)	(3)	(4)	(5)	(6)
Self-Assessed Health=1 at $t-1$	0.0180					
	(0.0556)					
Self-Assessed Health=2 at $t-1$	-0.0520*					
	(0.0306)					
Self-Assessed Health=3 at $t-1$	0.00792					
	(0.0183)					
Self-Assessed Health=5 at $t-1$	-0.0267					
	(0.0187)					
GHQ=0 at $t-1$		-0.139***				
		(0.0532)				
GHQ=1 at $t-1$		-0.0209				
		(0.0569)				
GHQ=2 at $t-1$		-0.0443				
		(0.0554)				
GHQ=3 at $t-1$		-0.0377				
		(0.0503)				
GHQ=4 at $t-1$		-0.0329				
		(0.0469)				
GHQ=5 at $t-1$		-0.00566				
		(0.0422)				
GHQ=6 at $t-1$		-0.0254				
		(0.0390)				
GHQ=7 at $t-1$		-0.0165				
		(0.0355)				
GHQ=8 at $t-1$		0.0224				
		(0.0320)				
GHQ=9 at $t-1$		0.00891				
		(0.0274)				
GHQ=10 at $t-1$		0.00481				
		(0.0240)				
GHQ=11 at $t-1$		-0.0169				
		(0.0190)				
Pb Arms, legs, hands at $t-1$			0.0664***			
			(0.0194)			
Pb Sight at $t-1$			0.00924			
			(0.0362)			
Pb Hearing at $t-1$			0.0728**			
			(0.0332)			
Pb Skin conditions/allergy at $t-1$			0.0746***			
			(0.0257)			
Pb Chest/Breathing at $t-1$			0.0224			
			(0.0261)			
Pb Heart/Blood pressure at $t-1$			0.0813***			
			(0.0255)			
Pb Stomach at $t-1$			0.0408			
			(0.0290)			
Pb Diabetes at $t-1$			-0.0249			
			(0.0525)			
Smoker at $t-1$				0.0104		

				(0.0220)		
Cig=2 at $t-1$					0.0941**	
					(0.0392)	
Cig=3 at $t-1$					0.0640*	
					(0.0380)	
Cig=4 at $t-1$					0.125	
					(0.0981)	
Drink=2 at $t-1$						0.0214
						(0.0379)
Drink=3 at $t-1$						0.101***
						(0.0302)
Drink=4 at $t-1$						0.0952***
						(0.0304)
Drink=5 at $t-1$						0.164***
						(0.0295)
Log(income) at $t-1$	0.108***	0.107***	0.109***	0.108***	0.164***	0.0960***
	(0.0157)	(0.0157)	(0.0158)	(0.0157)	(0.0312)	(0.0173)
Log(hh size) at $t-1$	-0.0790***	-0.0795***	-0.0716***	-0.0783***	-0.119***	-0.0753***
	(0.0234)	(0.0235)	(0.0235)	(0.0235)	(0.0408)	(0.0256)
Non-white	-0.310***	-0.308***	-0.313***	-0.308***	-0.218*	-0.244***
	(0.0772)	(0.0773)	(0.0770)	(0.0772)	(0.121)	(0.0776)
O-levels at $t-1$	0.0624**	0.0617**	0.0657**	0.0627**	0.116**	0.0475
	(0.0272)	(0.0272)	(0.0272)	(0.0273)	(0.0470)	(0.0293)
A-levels at $t-1$	0.0106	0.00997	0.0135	0.0113	0.0194	0.0115
	(0.0296)	(0.0295)	(0.0296)	(0.0297)	(0.0529)	(0.0317)
College degree at $t-1$	-0.0795*	-0.0812**	-0.0732*	-0.0792*	0.000110	-0.0999**
	(0.0410)	(0.0409)	(0.0410)	(0.0412)	(0.0853)	(0.0440)
Uni degree at $t-1$	-0.230***	-0.231***	-0.224***	-0.229***	-0.208**	-0.235***
	(0.0363)	(0.0363)	(0.0364)	(0.0367)	(0.0852)	(0.0391)
16-19 at $t-1$	0.0727	0.0697	0.166*	0.0673	0.331*	-0.0106
	(0.0849)	(0.0847)	(0.0856)	(0.0846)	(0.183)	(0.0949)
20-24 at $t-1$	0.169**	0.168**	0.248***	0.162**	0.407**	0.0753
	(0.0805)	(0.0804)	(0.0812)	(0.0804)	(0.176)	(0.0903)
25-29 at $t-1$	0.144*	0.144*	0.217***	0.137*	0.281*	0.0865
	(0.0765)	(0.0764)	(0.0773)	(0.0767)	(0.170)	(0.0860)
30-34 at $t-1$	0.149**	0.149**	0.220***	0.141*	0.256	0.0950
	(0.0756)	(0.0756)	(0.0764)	(0.0758)	(0.169)	(0.0845)
35-39 at $t-1$	0.180**	0.181**	0.246***	0.174**	0.281*	0.172**
	(0.0753)	(0.0752)	(0.0758)	(0.0753)	(0.169)	(0.0837)
40-44 at $t-1$	0.195***	0.196***	0.257***	0.188**	0.295*	0.129
	(0.0752)	(0.0752)	(0.0756)	(0.0753)	(0.169)	(0.0838)
45-49 at $t-1$	0.215***	0.217***	0.273***	0.209***	0.360**	0.168**
	(0.0747)	(0.0748)	(0.0750)	(0.0749)	(0.167)	(0.0831)
50-54 at $t-1$	0.227***	0.228***	0.277***	0.221***	0.365**	0.194**
	(0.0729)	(0.0729)	(0.0730)	(0.0730)	(0.163)	(0.0815)
55-59 at $t-1$	0.209***	0.210***	0.251***	0.204***	0.246	0.185**
	(0.0708)	(0.0708)	(0.0707)	(0.0708)	(0.161)	(0.0793)
60-64 at $t-1$	0.161**	0.161**	0.195***	0.158**	0.272*	0.120
	(0.0679)	(0.0680)	(0.0677)	(0.0679)	(0.157)	(0.0755)
65-69 at $t-1$	0.158**	0.157**	0.184***	0.156**	0.286*	0.136*
	(0.0663)	(0.0664)	(0.0662)	(0.0663)	(0.153)	(0.0733)
70-74 at $t-1$	0.102	0.101	0.122*	0.101	0.156	0.0714
	(0.0654)	(0.0654)	(0.0651)	(0.0654)	(0.161)	(0.0729)
75-79 at $t-1$	0.0257	0.0261	0.0376	0.0254	0.139	-0.0300
	(0.0632)	(0.0632)	(0.0630)	(0.0632)	(0.158)	(0.0730)
Unemployed at $t-1$	-0.213***	-0.207***	-0.222***	-0.215***	-0.253***	-0.249***

	(0.0496)	(0.0497)	(0.0499)	(0.0496)	(0.0784)	(0.0561)
Retired at $t-1$	-0.00879	-0.00723	-0.0262	-0.00929	0.0261	0.0132
	(0.0358)	(0.0358)	(0.0360)	(0.0358)	(0.0768)	(0.0414)
NLF at $t-1$	-0.0975***	-0.0947***	-0.124***	-0.100***	-0.0612	-0.0741***
	(0.0259)	(0.0260)	(0.0259)	(0.0260)	(0.0442)	(0.0287)
Div/sep at $t-1$	-0.0867**	-0.0847**	-0.0897***	-0.0889**	-0.184***	-0.0821**
	(0.0347)	(0.0346)	(0.0345)	(0.0349)	(0.0526)	(0.0366)
Widowed at $t-1$	-0.126***	-0.126***	-0.125***	-0.127***	-0.165*	-0.115**
	(0.0446)	(0.0446)	(0.0445)	(0.0446)	(0.0889)	(0.0480)
Nvr mar at $t-1$	0.0374	0.0381	0.0391	0.0374	-0.0793	0.0352
	(0.0311)	(0.0311)	(0.0310)	(0.0313)	(0.0559)	(0.0339)
Female	-0.250***	-0.248***	-0.252***	-0.249***	-0.186***	-0.238***
	(0.0202)	(0.0203)	(0.0203)	(0.0203)	(0.0371)	(0.0218)
Observations	92,769	92,769	92,769	92,769	22,775	53,390

Notes. Omitted categories: White, No education, Age≥80, Employed, South-East, Male.
Omitted health categories: Self-assessed health=4, GHQ=12, Cig=1, Drink=1.
Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: OLS Regressions of the Amount Won on the Lottery by Winners at date t on Individual Characteristics at date $t-1$

	(1)	(2)	(3)	(4)	(5)	(6)
Self-Assessed Health=1 at t-1	-0.00930					
	(0.159)					
Self-Assessed Health=2 at t-1	0.0365					
	(0.0824)					
Self-Assessed Health=3 at t-1	0.0495					
	(0.0466)					
Self-Assessed Health=5 at t-1	0.0425					
	(0.0477)					
GHQ=0 at t-1		-0.349***				
		(0.133)				
GHQ=1 at t-1		-0.00962				
		(0.151)				
GHQ=2 at t-1		-0.00394				
		(0.142)				
GHQ=3 at t-1		0.00546				
		(0.132)				
GHQ=4 at t-1		-0.0687				
		(0.136)				
GHQ=5 at t-1		0.0665				
		(0.133)				
GHQ=6 at t-1		-0.139				
		(0.0975)				
GHQ=7 at t-1		-0.127				
		(0.0968)				
GHQ=8 at t-1		-0.106				
		(0.0909)				
GHQ=9 at t-1		-0.0260				
		(0.0724)				
GHQ=10 at t-1		0.0164				
		(0.0647)				
GHQ=11 at t-1		0.0136				
		(0.0543)				
Pb Arms, legs, hands at t-1			0.00875			
			(0.0435)			
Pb Sight at t-1			-0.182**			
			(0.0790)			
Pb Hearing at t-1			0.0425			
			(0.0651)			
Pb Skin conditions/allergy at t-1			0.0129			
			(0.0575)			
Pb Chest/Breathing at t-1			-0.0757			

			(0.0567)			
Pb Heart/Blood pressure at t-1			-0.0120			
			(0.0527)			
Pb Stomach at t-1			0.0532			
			(0.0694)			
Pb Diabetes at t-1			0.0995			
			(0.127)			
Smoker at t-1				0.0733		
				(0.0523)		
Cig=2 at t-1					0.126	
					(0.102)	
Cig=3 at t-1					0.0428	
					(0.0976)	
Cig=4 at t-1					0.147	
					(0.232)	
Drink=2 at t-2						-0.0499
						(0.0980)
Drink=3 at t-2						0.0291
						(0.0812)
Drink=4 at t-2						0.111
						(0.0806)
Drink=5 at t-2						0.215***
						(0.0770)
Log(income) at t-1	0.215***	0.211***	0.204***	0.216***	0.269***	0.238***
	(0.0421)	(0.0422)	(0.0391)	(0.0423)	(0.0782)	(0.0500)
Female	-0.214***	-0.212***	-0.199***	-0.217***	-0.159*	-0.185***
	(0.0465)	(0.0464)	(0.0425)	(0.0463)	(0.0888)	(0.0519)
Non-white	-0.325**	-0.317**	-0.350***	-0.326**	-0.0689	-0.199
	(0.137)	(0.138)	(0.123)	(0.139)	(0.318)	(0.177)
16-19 at t-1	-0.182	-0.168	-0.185	-0.194	-0.864	0.0723
	(0.224)	(0.224)	(0.216)	(0.224)	(0.642)	(0.278)
20-24 at t-1	0.259	0.275	0.142	0.235	-0.622	0.159
	(0.214)	(0.213)	(0.206)	(0.214)	(0.627)	(0.266)
25-29 at t-1	0.250	0.268	0.193	0.229	-0.556	0.225
	(0.203)	(0.202)	(0.196)	(0.203)	(0.618)	(0.255)
30-34 at t-1	0.199	0.215	0.182	0.180	-0.498	0.274
	(0.195)	(0.195)	(0.190)	(0.196)	(0.613)	(0.250)
35-39 at t-1	0.348*	0.365*	0.243	0.330*	-0.420	0.303
	(0.195)	(0.195)	(0.190)	(0.196)	(0.611)	(0.248)
40-44 at t-1	0.300	0.321	0.242	0.284	-0.473	0.304
	(0.196)	(0.196)	(0.191)	(0.197)	(0.623)	(0.248)
45-49 at t-1	0.360*	0.377*	0.297	0.342*	-0.285	0.282
	(0.201)	(0.200)	(0.194)	(0.201)	(0.614)	(0.253)
50-54 at t-1	0.314	0.326*	0.208	0.297	-0.451	0.257
	(0.193)	(0.192)	(0.186)	(0.194)	(0.608)	(0.245)
55-59 at t-1	0.195	0.203	0.125	0.182	-0.805	0.169
	(0.184)	(0.183)	(0.179)	(0.185)	(0.601)	(0.238)
60-64 at t-1	0.368**	0.378**	0.297*	0.361**	-0.357	0.322
	(0.184)	(0.183)	(0.175)	(0.184)	(0.600)	(0.229)
65-69 at t-1	0.299*	0.306*	0.365**	0.293*	-0.0125	0.397*
	(0.177)	(0.176)	(0.166)	(0.177)	(0.560)	(0.219)
70-74 at t-1	0.350**	0.355**	0.330**	0.347**	-0.109	0.350
	(0.177)	(0.176)	(0.165)	(0.177)	(0.558)	(0.218)
75-79 at t-1	-0.0728	-0.0696	-0.0312	-0.0748	-0.170	0.0409

	(0.180)	(0.179)	(0.168)	(0.180)	(0.600)	(0.218)
Div/sep at t-1	0.182**	0.187**	0.207***	0.174**	0.287**	0.229**
	(0.0850)	(0.0850)	(0.0788)	(0.0849)	(0.130)	(0.101)
Widowed at t-1	0.380***	0.386***	0.365***	0.380***	0.187	0.435***
	(0.119)	(0.119)	(0.104)	(0.119)	(0.204)	(0.140)
Nvr mar at t-1	0.320***	0.312***	0.297***	0.313***	0.448***	0.242***
	(0.0881)	(0.0879)	(0.0798)	(0.0881)	(0.168)	(0.0933)
Log(hh size) at t-1	0.0596	0.0533	0.0462	0.0614	0.0326	0.0762
	(0.0689)	(0.0691)	(0.0614)	(0.0690)	(0.109)	(0.0740)
O-levels at t-1	0.000122	0.000250	-0.0199	0.00384	-0.0345	-0.0259
	(0.0620)	(0.0620)	(0.0566)	(0.0621)	(0.111)	(0.0699)
A-levels at t-1	-0.0880	-0.0860	-0.114*	-0.0787	-0.0530	-0.107
	(0.0668)	(0.0668)	(0.0615)	(0.0672)	(0.118)	(0.0754)
College degree at t-1	0.0435	0.0465	0.0229	0.0512	-0.199	0.0183
	(0.109)	(0.109)	(0.0980)	(0.109)	(0.169)	(0.114)
Uni degree at t-1	-0.331***	-0.329***	-0.342***	-0.314***	-0.426**	-0.340***
	(0.0828)	(0.0830)	(0.0781)	(0.0840)	(0.214)	(0.0944)
Unemployed at t-1	0.133	0.146	0.0934	0.126	0.0210	0.00877
	(0.141)	(0.141)	(0.117)	(0.141)	(0.192)	(0.144)
Retired at t-1	-0.0319	-0.0255	-0.0814	-0.0307	-0.469*	0.0677
	(0.0944)	(0.0940)	(0.0894)	(0.0942)	(0.260)	(0.120)
NLF at t-1	-0.0361	-0.0161	-0.0511	-0.0331	-0.0518	0.0697
	(0.0643)	(0.0641)	(0.0562)	(0.0635)	(0.116)	(0.0739)
Observations	7,150	7,150	9,467	7,150	2,021	4,415

Notes. Omitted categories: White, No education, Age≥80, Employed, South-East, Male.
Omitted health categories: Self-assessed health=4, GHQ=12, Cig=1, Drink=1.
Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Ordered Probit Regressions of Self-Assessed Health at date $t+2$

	(1)	(2)
Log(Prize) at t	0.00624	0.00591
	(0.0110)	(0.0100)
Self-Assessed Health=1 at t-1		-1.775***
		(0.139)
Self-Assessed Health=2 at t-1		-1.241***
		(0.0709)
Self-Assessed Health=3 at t-1		-0.614***
		(0.0361)
Self-Assessed Health=5 at t-1		0.831***
		(0.0420)
Log(income) at t-1		0.0698**
		(0.0289)
Observations	7,150	7,150

Notes. Other control variables: Household size, Ethnicity, No. children, Education, Age, Labor market status, Marital status, Region, Gender, Year, all evaluated at $t+2$.
Omitted health categories: Self-assessed health=4 at $t-1$.
Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7: Ordered Probit Regressions of Mental Health Score (Caseness GHQ) at date $t+2$

	(1)	(2)
Log(Prize) at t	0.0240**	0.0197*
	(0.0116)	(0.0108)
GHQ=0 at t-1		-1.247***
		(0.147)
GHQ=1 at t-1		-1.407***
		(0.138)
GHQ=2 at t-1		-0.952***
		(0.137)
GHQ=3 at t-1		-1.308***
		(0.105)
GHQ=4 at t-1		-1.045***
		(0.106)
GHQ=5 at t-1		-0.967***
		(0.0872)
GHQ=6 at t-1		-0.933***
		(0.0875)
GHQ=7 at t-1		-0.915***
		(0.0722)
GHQ=8 at t-1		-0.821***
		(0.0626)
GHQ=9 at t-1		-0.744***
		(0.0596)
GHQ=10 at t-1		-0.691***
		(0.0484)
GHQ=11 at t-1		-0.474***
		(0.0418)
Log(income) at t-1		0.0585*
		(0.0303)
Observations	7,150	7,150

Notes. Other control variables: Household size, Ethnicity, No. children, Education, Age, Labor market status, Marital status, Region, Gender, Year, all evaluated at $t+2$.
Omitted health categories: GHQ=12 at $t-1$.
Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Log(Prize) at t
Pb Arms, legs, hands at t-1
Pb Sight at t-1
Pb Hearing at t-1
Pb Skin conditions/allergy at t-1
Pb Chest/Breathing at t-1
Pb Heart/Blood pressure at t-1
Pb Stomach at t-1
Pb Diabetes at t-1
Log(income) at t-1
Observations

Notes. Other control vari
Robust standard errors i
* significant at 10%; ** s

Table 9: Regressions of Physical Health-Behaviors at date $t+2$

	Smoker at $t+2$		No. of cig at $t+2$		Social Drinking at $t+2$	
	Probit		Ordered probit		Ordered probit	
	(1)	(2)	(3)	(4)	(5)	(6)
Log(Prize) at t	0.0315**	0.0428**	0.0314	0.0352*	0.0556***	0.0294**
	(0.0160)	(0.0188)	(0.0214)	(0.0203)	(0.0139)	(0.0132)
Smoker at t-1		2.868***				
		(0.0628)				
Cig=2 at t-1				1.136***		
				(0.0818)		
Cig=3 at t-1				2.268***		
				(0.0925)		
Cig=4 at t-1				4.054***		
				(0.281)		
Drink=2 at t-2						0.400***
						(0.0892)
Drink=3 at t-2						0.907***
						(0.0728)
Drink=4 at t-2						1.519***
						(0.0767)
Drink=5 at t-2						2.467***
						(0.0853)
Log(income) at t-1		-0.127***		-0.0907		0.0224
		(0.0456)		(0.0605)		(0.0357)
Observations	7,150	7,150	2,021	2,021	4,415	4,415

Notes. Other control variables: Household size, Ethnicity, No. children, Education, Age, Labor market status, Marital status, Region, Gender, Year, all evaluated at $t+2$.
Omitted health categories: Non-Smoker at $t-1$, Cig=1 at $t-1$, Drink=1 at $t-2$.
Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 10: Regressions of Happiness and Life Satisfaction at date $t+2$

	Happiness at $t+2$		Life Satisfaction at $t+2$	
	Probit		Ordered probit	
	(1)	(2)	(3)	(4)
Log(Prize) at t	0.0286*	0.0268*	0.0538***	0.0346***
	(0.0147)	(0.0141)	(0.0108)	(0.00989)
Happiness at t-1		-0.682***		
		(0.0507)		
Life satisfaction=2 at at t-1				0.217
				(0.216)
Life satisfaction=3 at at t-1				0.412**
				(0.199)
Life satisfaction=4 at at t-1				0.830***
				(0.195)
Life satisfaction=5 at at t-1				1.289***
				(0.195)
Life satisfaction=6 at at t-1				1.890***
				(0.196)
Life satisfaction=7 at at t-1				2.754***
				(0.206)
Log(income) at t-1		-0.0104		0.0418
		(0.0351)		(0.0272)
Observations	8,354	8,354	7,488	7,488

Notes. Other control variables: Household size, Ethnicity, No. children, Education, Age, Labor market status, Marital status, Region, Gender, Year, all evaluated at $t+2$.
Omitted health and satisfaction categories: Unhappy at $t-1$, Life Satisfaction=1 at $t-1$.
Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 11: Linear Probability Models of Excellent Self-Assessed Health at date $t+2$

	(1)	(2)
Log(Prize) at t	0.00155	0.00156
	(0.00343)	(0.00398)
Log(Prize)×**1**(Prize≥1,000) at t		-2.09e-05
		(0.00397)
Exc. Self-assessed Health at t-1	0.380***	0.380***
	(0.0148)	(0.0149)
Log(income) at t-1	0.0125	0.0125
	(0.00990)	(0.00990)
Observations	7,150	7,150

Notes. Dependent variable=1 if Self-Assessed Health is excellent (SAH=5) at $t+2$; Dependent variable=0 if Self-Assessed Health is less than excellent (SAH<5) at $t+2$
Other control variables: Household size, Ethnicity, No. children, Education, Age, Labor market status, Marital status, Region, Gender, Year, all evaluated at $t+2$.
Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 12: Linear Probability Models of Excellent Mental Health at date $t+2$

	(1)	(2)
Log(Prize) at t	0.00966**	0.00746
	(0.00422)	(0.00503)
Log(Prize)×**1**(Prize)≥1,000) at t		0.00391
		(0.00470)
GHQ=12 at t-1	0.299***	0.299***
	(0.0129)	(0.0129)
Log(income) at t-1	0.0187	0.0187
	(0.0123)	(0.0123)
Observations	7,150	7,150

Notes. Dependent variable=1 if mental health is excellent (GHQ=12) at $t+2$; Dependent variable=0 if mental health is not excellent (GHQ<12) at $t+2$

Other control variables: Household size, Ethnicity, No. children, Education, Age, Labor market status, Marital status, Region, Gender, Year, all evaluated at $t+2$.

Robust standard errors in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Log(Prize) at t
Log(Prize)×**1**(Prize≥1,0 at t
Pb Arms, legs, hands at t-1
Pb Sight at t-1
Pb Hearing at t-1
Pb Skin conditions/allergy at t-1
Pb Chest/Breathing at t-1
Pb Heart/Blood pressure at t-1
Pb Stomach at t-1
Pb Diabetes at t-1
Log(income) at t-1
Observations

Notes. Other control vari
Robust standard errors i
* significant at 10%; ** s

Table 14: Linear Probability Models of Physical Health-Behaviors at date $t+2$

	Smoker at $t+2$		No.Cig per day≥11 at $t+2$		Social Drinking at $t+2$	
	(1)	(2)	(3)	(4)	(5)	(6)
Log(Prize) at t	0.00521**	0.00484**	0.0106*	0.0119*	0.0116***	0.0130***
	(0.00220)	(0.00245)	(0.00579)	(0.00681)	(0.00378)	(0.00436)
Log(Prize) at t ×Prize $\geq 1,000$		0.000658		-0.00268		-0.00271
		(0.00260)		(0.00617)		(0.00424)
Smoker at t-1	0.791***	0.792***				
	(0.0117)	(0.0117)				
No.Cig>15 per day at t-1			0.599***	0.599***		
			(0.0244)	(0.0244)		
Drink>3 at t-1						0.508***
						(0.0192)
Log(income) at t-1	-0.0156***	-0.0156***	-0.0350**	-0.0347*	0.0147	0.0147
	(0.00567)	(0.00567)	(0.0177)	(0.0177)	(0.0107)	(0.0107)
Observations	7,150	7,150	2,021	2,021	4,415	4,415

Notes. Dependent variables are dichotomic: Smoker, versus Non-smoker; Smoking more than 11 cigarettes per day, versus Smoking less than 11 cigarettes; Going to a pub or club at least several times a year, versus Going less often, at $t+2$.
Other control variables: Household size, Ethnicity, No. children, Education, Age, Labor market status, Marital status, Region, Gender, Year, all evaluated at $t+3$.
Omitted health categories: Non-Smoker at $t-1$, No. Cig per day≤10 at $t-1$, Drink<3 at $t-1$.
Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 15: Regressions of Physical Health-Social Drinking at date $t+2$

	Ordered probit	
	(1)	(2)
Log(Prize) at t	0.0530***	0.0419**
	(0.0167)	(0.0163)
Drink=2 at t-2		0.390***
		(0.0932)
Drink=3 at t-2		0.902***
		(0.0770)
Drink=4 at t-2		1.514***
		(0.0819)
Log(income) at t-1		0.0501
		(0.0419)
Observations	2,793	2,793

Notes. Other control variables: Household size, Ethnicity, No. children, Education, Age, Labor market status, Marital status, Region, Gender, Year, all evaluated at $t+2$.
Omitted health categories: Drink=1 at $t-2$.
Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 16: Regressions of Health Variables at date $t+1$

VARIABLES	Self-Assessed Health at $t+1$ (1)	GHQ at $t+1$ (2)	Smoker at $t+1$ (3)	No Cig at $t+1$ (4)	Social Drinking at $t+1$ (5)
Log(Prize) at t	0.000454	0.0120	0.0674***	0.0318*	0.0231**
	(0.00922)	(0.00904)	(0.0177)	(0.0185)	(0.0115)
Self-Assessed Health=1 at t-1	-1.940***				
	(0.134)				
Self-Assessed Health=2 at t-1	-1.308***				
	(0.0665)				
Self-Assessed Health=3 at t-1	-0.710***				
	(0.0351)				
Self-Assessed Health=5 at t-1	0.920***				
	(0.0400)				
GHQ=0 at t-1		-1.485***			
		(0.118)			
GHQ=1 at t-1		-1.492***			
		(0.113)			
GHQ=2 at t-1		-1.345***			
		(0.112)			
GHQ=3 at t-1		-1.194***			
		(0.0992)			
GHQ=4 at t-1		-1.005***			
		(0.0864)			
GHQ=5 at t-1		-1.174***			
		(0.0748)			
GHQ=6 at t-1		-1.119***			
		(0.0668)			
GHQ=7 at t-1		-0.972***			
		(0.0631)			
GHQ=8 at t-1		-0.917***			
		(0.0535)			
GHQ=9 at t-1		-0.794***			
		(0.0499)			
GHQ=10 at t-1		-0.658***			
		(0.0419)			
GHQ=11 at t-1		-0.474***			
		(0.0347)			
Smoker at t-1			2.991***		
			(0.0597)		
Cig=2 at t-1				1.195***	
				(0.0775)	
Cig=3 at t-1				2.300***	
				(0.0880)	
Cig=4 at t-1				3.989***	
				(0.218)	
Drink=2 at t-1					0.477***
					(0.0805)
Drink=3 at t-1					1.139***

					(0.0674)
Drink=4 at t-1					1.797***
					(0.0755)
Drink=5 at t-1					3.013***
					(0.0871)
Log(income) at t-1	0.0856***	0.0524**	-0.188***	-0.0564	0.0455
	(0.0259)	(0.0229)	(0.0425)	(0.0554)	(0.0310)
Observations	8,309	10,324	8,311	2,317	5,564

Notes. Other control variables: Household size, Ethnicity, No. children, Education, Age, Labor market status, Marital status, Region, Gender, Year, all evaluated at $t+1$.
Omitted health categories: Non-Smoker at $t-1$, Cig=1 at $t-1$, Drink=1 at $t-1$.
Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 17: Regressions of Health Variables at date $t+3$

VARIABLES	Self-Assessed Health at $t+3$ (1)	GHQ at $t+3$ (2)	Smoker at $t+3$ (3)	No Cig at $t+3$ (4)	Social Drinking at $t+3$
Log(Prize) at t	0.0115	0.0218**	0.0661***	0.0417**	0.00798
	(0.0102)	(0.0110)	(0.0184)	(0.0209)	(0.0132)
Self-Assessed Health=1 at t-1	-1.545***				
	(0.122)				
Self-Assessed Health=2 at t-1	-1.062***				
	(0.0681)				
Self-Assessed Health=3 at t-1	-0.562***				
	(0.0355)				
Self-Assessed Health=5 at t-1	0.784***				
	(0.0387)				
GHQ=0 at t-1		-0.994***			
		(0.120)			
GHQ=1 at t-1		-1.243***			
		(0.125)			
GHQ=2 at t-1		-1.016***			
		(0.116)			
GHQ=3 at t-1		-0.902***			
		(0.0991)			
GHQ=4 at t-1		-1.094***			
		(0.102)			
GHQ=5 at t-1		-0.942***			
		(0.0826)			
GHQ=6 at t-1		-0.815***			
		(0.0792)			
GHQ=7 at t-1		-0.725***			
		(0.0751)			
GHQ=8 at t-1		-0.780***			
		(0.0564)			
GHQ=9 at t-1		-0.657***			
		(0.0535)			
GHQ=10 at t-1		-0.545***			
		(0.0480)			
GHQ=11 at t-1		-0.380***			
		(0.0383)			
Smoker at t-1			2.615***		
			(0.0597)		
Cig=2 at t-1				1.078***	
				(0.0940)	
Cig=3 at t-1				2.134***	
				(0.103)	
Cig=4 at t-1				4.091***	
				(0.246)	
Drink=2 at t-1					0.468***
					(0.0890)
Drink=3 at t-1					0.977***

					(0.0743)
Drink=4 at t-1					1.556***
					(0.0795)
Drink=5 at t-1					2.489***
					(0.0878)
Log(income) at t-1	0.0719**	0.0443	-0.128***	-0.0601	0.0532
	(0.0286)	(0.0282)	(0.0458)	(0.0595)	(0.0383)
Observations	7,503	8,355	7,504	1,746	4,510

Notes. Other control variables: Household size, Ethnicity, No. children, Education, Age, Labor market status, Marital status, Region, Gender, Year, all evaluated at $t+3$.
Omitted health categories: Non-Smoker at $t-1$, Cig=1 at $t-1$, Drink=1 at $t-1$.
Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Commentaires:

* Les passages modifies sont en italique.

* Tous les tableaux et figures ont ete changes, a l'exception de la derniere figure.

* Comme les 2 referees trouvent que SAH est difficilement comprehensible, SAH a ete remplace par "self-assessed health".

* J'ai indique entre crochets [] les references a des tables qui ne sont pas destinees a etre publiees, mais qui prouvent des resultats peripheriques dans notre papier.

* Un des refere dit a propos de la table 9: "the point estimate of column (2) is higher than that of column (1). This does not happen when we consider the number of cigarettes smoked (column 4 of the same table). Maybe the authors want to point this result out."

Je ne comprends pas ce que le refere veut dire...

* J'ai ecrit dans le papier les equations des deux modeles, car cela me semble plus clair. On peut enlever la deuxieme si tu trouves que ce n'est pas utile.