

# Winning Big but Feeling no Better?

The Effect of Lottery Prizes  
on Physical and Mental Health

Bénédicte APOUEY  
Andrew E. CLARK

Paris School of Economics  
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# Introduction

- The association between income and health is well-documented in social sciences.  
Finding : higher income is associated with better health.  
This is observed in a number of countries, for different health measures, for different age groups, at different dates.
- However debate on the causal interpretation of this correlation :
  - causal relationship of income on health
  - causal relationship running from health to income
  - no causality : hidden common factors could affect both variablesThe vast majority of the existing literature is not able to distinguish between these three interpretations.
- Testing the causal impact of income on health requires exogenous movements in income.  
Our approach : using lottery wins as an exogenous source of variation in income.

- Most existing work has used a variable indicating general health status.

We are able to assess the impact of exogenous changes in income on different types of health measure :

- general health status (self-assessed health),
- a psychological measure of mental stress,
- physical health problems, and
- health-related behaviours.

The effect of income on these different health variables is far from uniform.

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## Previous literature and our approach

### Some intuitions on the effect of income on health

- Higher income could cause better health.  
If we assume that individuals maximise a utility function of health and other goods subject to a budget and a time constraint, a positive shock on income modifies the budget constraint and will probably be associated with health improvements if health is a normal good.
- But increases in income could also deteriorate health through changes in lifestyles, if these are also normal goods.

# Empirical relationship between income and health

The positive relationship between income and health is open to interpretation :

- income  $\rightarrow$  health
- health  $\rightarrow$  income
- income and health may be determined by common hidden factors.

We discuss the small number of papers that have investigated this relationship appealing to exogenous changes in income.

- Ettner, *JHE*, 1996
  - American data
  - Self-assessed health, a scale of depressive symptoms, daily limitations due to both physical and mental difficulties (not separately evaluated).
  - Instrumentation
  - Finding : a substantial impact of income on all of the health variables
  - Traditional critiques of this paper : the instruments are not really exogenous, she does not analyze physical health.

- Lindhal, *Journal of Human Resources*, 2002
  - Swedish data
  - A health measure which summarizes physical and mental aspects
  - Instrument : lottery prizes among winners
  - Finding : a positive causal relationship between income and this general health measure
  - Drawback : the construction of the health score
- Meer et al., *JHE*, 2003
  - Self-assessed health, binary variable indicating physical or nervous disabilities which limit the individual's ability to work
  - Instrument : inheritances
  - Finding : wealth does not have a significant effect on health
  - Drawback : no distinction between physical and mental health outcomes
- Frijters et al., *AER*, 2005
  - Self-assessed health
  - They correct for both reverse causality and hidden common factors, using an exogenous change in income (the falling of the Berlin wall) in a fixed-effects framework
  - Finding : income has a positive, but only very small, effect on health.

- Gardner and Oswald, *JHE*, 2007
  - British data (BHPS)
  - Mental health (GHQ-36)
  - Exogenous change in income : lottery winnings among players
  - Finding : income has a positive effect on mental health
- Summary :

TABLE: Findings in the literature

	General		Mental
	General Health Score	SAH	
Ettner (1996)		+	+ (Scale of depressive symptoms)
Lindhal (2002)	+		
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".



# Our approach

- We try to establish a causal relationship between exogenous variations in income (provided by monetary lottery wins) and variations in health.
  - We do not construct a score that summarizes different aspect of health. Indeed Ruhm (2000) : different aspects of health do not move in the same direction during a recession :
    - Physical health :
      - Macro level : Short-run recessions are associated with better physical health. Poor economic conditions are negatively correlated with the death rate and with a number of specific causes of death.
      - Micro level : Ruhm relates individual behaviours to the local unemployment rate (not the individual labour market status).  
Findings : tobacco consumption is reduced, average BMI falls, and regular physical activity increases.
    - Mental health : Suicide is higher during recessions.
- ⇒ We will clearly distinguish general health, from mental health, physical problems and behaviours.

# Data

- The British Household Panel Survey (BHPS)= a general and longitudinal survey covering a random sample of around 16,000 individuals in around 9,000 different households in Great Britain in recent waves
- A wide range of information about individual and household demographics, mental and physical health, labour force status...
- Waves 6 to 15 (1996-2005)

# Health outcomes

We separately analyze general, mental and physical health.

- General health status = Self-assessed health = SAH.

*“Compared to people of your own age, would you say that [over the last 12 months] your health has on the whole been... ? Excellent, Good, Fair, Poor, and Very Poor”*

Higher values refer to better health outcomes :

1=Very poor ; 5=Excellent.

- Mental health = the General Health Questionnaire = GHQ.  
This is widely-used internationally by psychologists, epidemiologists and medical researchers.  
The BHPS contains the 12-item version of the GHQ, based on the following questions :

*Have you recently 1) been able to concentrate on whatever you're doing?; 2) lost much sleep over worry?; 3) felt that you were playing a useful part in things?; 4) felt capable of making decisions about things?; 5) felt constantly under strain?; 6) felt you couldn't overcome your difficulties?; 7) been able to enjoy your normal day-to-day activities?; 8) been able to face up to problems?; 9) been feeling unhappy or depressed?; 10) been losing confidence in yourself?; 11) been thinking of yourself as a worthless person?; 12) been feeling reasonably happy, all things considered?*

Our score counts the number of questions for which the response indicates “high well-being” :

0=poor mental health ; 12=excellent mental health.

Obvious skew in mental health with most individuals reporting high psychological well-being.

- Physical health - Health problems

We use a number of variables indicating the presence of a specific physical health problem. These refer to :

- 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 - Behaviours

. Smoker : Dummy variable indicating that the individual is a smoker.  
Around 27% are smokers.

. No. of Cigarettes smoked per day :

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.

. Drink :

*“How often they go for a drink at a pub or club : At least once a week, At least once a month, Several times a year, Once a year or less, Never/almost never”.*

We recode this variable between 1 and 5 :

1 : Never/almost never

5 : At least once a week.

# Lottery wins

In order to identify the causal effect of income, we appeal to two questions on lottery wins which appear each year between 1997 and 2005 :

*“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)”*

→ We know both whether the individual won, and how much in total they received.

- Weaknesses of the lottery data (same as in Lindahl (2002)) :
  - No direct information about the number of times (if any) that the individual has played the lottery → we cannot distinguish non-players from unsuccessful players.
  - We do not know how much has been gambled.
- Advantages of the lottery data :
  - We can consider their receipt as being largely exogenous.
  - In Britain, as opposed to a number of other countries, many people play lotteries.

Lottery winnings are adjusted for inflation and expressed in 2005 pounds.  
We will use the logarithm of lottery winnings.



# Control variables

In our models, we include a number of controls :

- Lagged Log Household Income (but not always)
- Labour market status
- Education
- Marital status
- Gender
- Ethnicity
- Age groups
- Regions
- Wave

# Identifying Exogenous Income Effects

## Winners versus Non-Winners

Winners are observed ; Players aren't.

- One simple way of using lottery winnings : to compare the health of those who have not won the lottery (= non-players + unlucky players) to the health of players who have won.
- But these two groups may not be comparable.
- We regress a dummy variable (for having won the lottery) on a number of individual characteristics.

Findings : the probability of winning is significantly correlated with lagged income, ethnicity, education, labour market status, and number of children, lagged physical health problems.

→ Those who win and those who do not win are thus different in a number of **observable** ways.

- They may also be different in other **unobservable** ways.

Ex : non-players may well be more risk-averse.

→ This flaws the comparison of health between winners and non-winners. We therefore do not compare these two groups.

## Big versus Small Winners

- We restrict our analysis sample to winners. The exogenous effect of income will then be identified from the comparison of those who have won larger amounts of money to those who won smaller amounts.
- This distinction is more exogenous. We regress the amount won on the same right-hand side variables.  
→ No substantial problem of reverse causality.

**TABLE:** 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)
SAH=1 at $t - 1$	0.002 (0.143)					
SAH=2 at $t - 1$	0.074 (0.085)					
SAH=3 at $t - 1$	0.095 (0.048)**					
SAH=5 at $t - 1$	0.039 (0.050)					
GHQ=0 at $t - 1$		-0.137 (0.124)				
GHQ=1 at $t - 1$		0.049 (0.148)				
GHQ=2 at $t - 1$		-0.083 (0.114)				
GHQ=3 at $t - 1$		0.060 (0.118)				
GHQ=4 at $t - 1$		-0.199 (0.120)*				
GHQ=5 at $t - 1$		0.002 (0.122)				

	(1)	(2)	(3)	(4)	(5)	(6)
GHQ=6 at $t - 1$		-0.072 (0.089)				
GHQ=7 at $t - 1$		-0.157 (0.087)*				
GHQ=8 at $t - 1$		-0.148 (0.082)*				
GHQ=9 at $t - 1$		-0.016 (0.065)				
GHQ=10 at $t - 1$		0.056 (0.058)				
GHQ=11 at $t - 1$		0.030 (0.048)				
Pb Arms, legs, hands at $t - 1$			0.020 (0.043)			
Pb Sight at $t - 1$			-0.153 (0.078)**			
Pb Hearing at $t - 1$			0.072 (0.065)			
Pb Skin condi- tions/allergy at $t - 1$			-0.000 (0.059)			
Pb Chest/Brea- thing at $t - 1$			-0.058 (0.056)			
Pb Heart/Blood pressure at $t - 1$			-0.042 (0.055)			
Pb Stomach at $t - 1$			0.073 (0.069)			

	(1)	(2)	(3)	(4)	(5)	(6)
Pb Diabetes at $t - 1$			0.094 (0.139)			
Smoker at $t - 1$				0.066 (0.050)		
Cig=2 at $t - 1$					0.136 (0.097)	
Cig=3 at $t - 1$					0.085 (0.091)	
Cig=4 at $t - 1$					0.065 (0.225)	
Drink=2 at $t - 1$						0.068 (0.088)
Drink=3 at $t - 1$						0.011 (0.073)
Drink=4 at $t - 1$						0.107 (0.077)
Drink=5 at $t - 1$						0.255 (0.074)***

Reference health levels : SAH=4, GHQ=12, Cig=1, Drink=1.

Robust standard errors in parentheses.

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

Fewer observables than before are correlated with the amount won.  
The similarity in observables leads us to suspect an analogous similarity  
in unobservables.



# The Effect of Income on Health Outcomes

- We compare health for individuals with large and small lottery winnings. Lottery winnings are reported in year  $t$
- We imagine that any health investments may take time to bear fruit, and consider health at date  $t + 2$  (or  $t + 1$ ) as our dependent variable
- Controls :
  - On occasion the individual's lagged health status at  $t - 1$ , but the presence or absence of lagged health in our regressions made no qualitative difference ;
  - On occasion the log of equivalent household income, measured at  $t - 1$ . There is some evidence that individuals in richer households win larger prizes.
  - Other controls mentioned previously

We examine the effect of lottery winnings on health :

- SAH, GHQ and physical health problems at  $t + 2$  :

$$h_{it+2} = F[\alpha + \beta \cdot \text{Log}(\text{Prize})_{it} + \gamma \cdot x_{it+2}]$$

- Smoking and social drinking at  $t + 1$ , because of data availability :

$$h_{it+1} = F[\alpha + \beta \cdot \text{Log}(\text{Prize})_{it} + \gamma \cdot x_{it+2}]$$

$F$  is the cumulative normal distribution (probit, ordered probit).

# General health status

TABLE: Ordered probit regressions of self-assessed health at date  $t + 2$

	(1)	(2)
Log(Prize) at $t$	0.010 (0.010)	0.007 (0.011)
SAH=1 at $t - 1$		-1.703 (0.134)***
SAH=2 at $t - 1$		-1.234 (0.071)***
SAH=3 at $t - 1$		-0.567 (0.040)***
SAH=5 at $t - 1$		0.797 (0.045)***
Log(inc) at $t - 1$		0.088 (0.031)***
No. Observations	8343	5884

Reference health level : SAH=4 at  $t - 1$ .

Robust z statistics in parentheses.

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

# Positive income shocks improve mental health

TABLE: Probit regressions of mental score (GHQ) at  $t + 2$

	(1)	(2)
Log(Prize) at $t$	0.026 (0.010)**	0.025 (0.012)**
GHQ=0 at $t - 1$		-1.222 (0.136)***
GHQ=1 at $t - 1$		-1.342 (0.147)***
GHQ=2 at $t - 1$		-1.178 (0.125)***
GHQ=3 at $t - 1$		-1.323 (0.104)***
GHQ=4 at $t - 1$		-1.051 (0.109)***
GHQ=5 at $t - 1$		-1.009 (0.089)***
GHQ=6 at $t - 1$		-0.891 (0.088)***
...		
Log(inc) at $t - 1$		-0.004 (0.030)
No. Observations	9801	6993

Reference health level : GHQ=12 at  $t - 1$ .

Robust z statistics in parentheses.

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

- It may appear somewhat paradoxical that
  - income significantly improves mental health,
  - but a number of papers, including our own, fail to identify any significant exogenous effect of income on general health.
- The following subsections propose to resolve this paradox by suggesting that income does not reduce physical health problems, and may even lead to some worse physical health outcomes.

# Positive income shocks have no effect on health problems

- To investigate the relationship between income and physical health problems, we carry out analogous regressions for a series of physical health problems.
- The regression results systematically show no relationship between lottery winnings and these physical health problems.
- This result is unsurprising : higher income may well not improve individuals' sight, hearing, or skin conditions.
- However, one area where income might play a large role is in the specific behaviours that individuals undertake, and their ensuing health consequences.

## Positive income shocks lead to worse lifestyles

- Hypothesis : positive individual income shocks may have a detrimental effect on physical health because of changes in lifestyles.
- Findings : the probability of smoking and social drinking increases with exogenous income shock.

**TABLE:** Regressions of smoking variables and social drinking

	Smoker at $t + 2$		No. of cig at $t + 2$		Social drinking at $t + 1$	
	Probit (1)	(2)	Ordered probit (3)	(4)	Ordered probit (5)	(6)
Log(Prize) at $t$	0.029 (0.014)**	0.049 (0.021)**	0.038 (0.020)*	0.036 (0.022)*	0.059 (0.012)***	0.027 (0.013)**
Smoker at $t - 1$		2.878 (0.067)***				
Cig=2 at $t - 1$				1.161 (0.085)***		
Cig=3 at $t - 1$				2.314 (0.095)***		
Cig=4 at $t - 1$				4.137 (0.252)***		
Drink=2 at $t - 1$						0.460 (0.085)***
Drink=3 at $t - 1$						1.102 (0.069)***
Drink=4 at $t - 1$						1.751 (0.077)***
Drink=5 at $t - 1$						2.964 (0.088)***
Log(inc) at $t - 1$		-0.069 (0.052)		-0.069 (0.068)		0.024 (0.036)
No. Observations	8343	5886	2574	1861	6334	5034

Reference health behaviours : Non-Smoker at  $t - 1$ , Cig=1 at  $t - 1$ , Drink=1 at  $t - 1$ .

Robust z statistics in parentheses.

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



# Conclusion

- An important research question in health economics is whether increases in income make people healthier.  
To answer, one has to find an exogenous increase in income. The BHPS contains such an “experiment” : some Britons receive lottery wins.
- Findings :
  - A small or negligible effect of income on general health
  - A positive and significant effect of income on mental health.
- We have suggested resolving this apparent paradox by appealing to an entirely individual-level analogy of the well-known works of Ruhm, and distinguishing between physical and mental health.