Do you have to win it to fix it? A longitudinal study of lottery winners and their health care demand

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7 October 2016

Abstract

We exploit lottery wins to investigate the effects of exogenous changes to individuals' income on the utilization of health care services, and the choice between private and public health care in the United Kingdom. Our empirical strategy focuses on lottery winners in an individual fixed effects framework and hence the variation of winnings arises from within-individual differences in small versus large winnings. The results indicate that lottery winners with larger wins are more likely to choose private health services than public health services from the National Health Service. The positive effect of wins on the choice of private care is driven largely by winners with medium to large winnings (win category > £500 (or US$750); mean = £1922.5 (US$2,893.5), median = £1058.2 (US$1592.7)). There is some evidence that the effect of winnings vary by whether individuals have private health insurance. We also find weak evidence that large winners are more likely to take up private medical insurance. Large winners are also more likely to drop private insurance coverage between approximately 9 and 10 months earlier than smaller winners, possibly after their winnings have been exhausted. Our estimates for the lottery income elasticities for public health care (relative to no care) are very small and are not statistically distinguishable from zero; those of private health care range from 0 – 0.26 for most of the health services considered, and 0.82 for cervical smear.

JEL classifications: H42; I11; D1;
Keywords: Lottery wins, Health care; Income elasticity; Public-private

Forthcoming in the *American Journal of Health Economics*

1 Introduction

A substantial empirical literature has emerged on the relationship between income and health care demand following the seminal work by Grossman (1972). The interest stems from an attempt to understand the determinants of health expenditure and its share of household or national incomes. A fundamental question is the nature of health care as an economic good: the expectation that health spending would increase disproportionately more as income increases if health care is a luxury good, and disproportionately less if it is a normal good. Numerous studies have examined this question by quantifying the income elasticity of health care (e.g., Gerdtham and Jönsson 2000; Getzen 2000; Costa-Font et al. 2011).

However, the empirical evidence remains subject to criticism. A main critique of the existing econometric work is that the estimates of the income–health spending relationship are not causal, because most studies are based on simple correlations between income, health expenditure, and health care use. The assumption that income is exogenous is likely to be violated as the income–health expenditure nexus is filtered by a variety of confounding effects. For example, the demand for health care is associated with health behaviors (e.g., smoking, exercise), which are affected by education, cognitive ability, and health knowledge (Cutler and Lleras-Muney 2010). These attributes are also correlated with income. Further endogeneity issues potentially arise when current income is used as a measure of household resources, because individuals in poor health may be less likely to participate actively in the labor market, but at the same time consume more health care. Omitted factors such as non-cognitive skills can further compound the endogeneity problem, for example, if individuals with higher perceived sense of control are more likely to seek health care services and earn higher incomes (Cobb-Clark et al. 2014).

A second critique is that the literature has largely been silent on the role of health care heterogeneity. Existing studies do not distinguish between preventive and curative health services, or between health care from the public and private sectors. It might be expected that the relationship between income and the demand for preventive care would be different from that of curative care. Preventive care is conceptualized as a human capital investment and is strongly influenced by education and income (Kenkel 2000; Wu 2003). Curative care behavior, in contrast, is driven by immediate need rather than choice, and hence income is less likely to be important. This is particularly true for public health systems where monetary barriers on access to health care, in principle, should not exist. However, access to health care in the private sector should be significantly determined by income, as with any other normal good.

This study addresses both issues simultaneously. First, to create a setting as close as possible to the idealized laboratory experiment, we use data of lottery winners to estimate the effect of income on the utilization of health care services in the United Kingdom, a country where 50 percent of the population play the lottery. Our empirical strategy focuses on lottery winners in an individual fixed effects framework and hence the variation of winnings arises from within-individual differences in small versus large winnings. This is similar to the testing strategy in Gardner and Oswald (2007) and Apouey and Clark (2015), who use the British Household Panel Survey (BHPS) to study the effect of lottery wins on mental and physical health.

Our study contributes to the literature by investigating the effect of exogenous income on health care use in an institutional context where a private health sector coexists alongside a National Health System, and is often intermediated by private insurance schemes. In these health systems, a windfall of income might simply lead individuals to switch from publicly funded health care to private health care. Our sample of lottery winners have received an average win amount of £157 (or US$236) – whilst these are not the large wins that dramatically change people's lives, such wins are sufficient to cover the cost of a private medical specialist visit (£200, US$300), a private dentist (£80, US$120), or paying the premiums for private medical insurance (£30 monthly, US$45) for a year.

Our paper complements a handful of related studies. A very recent paper by Cesarini et al. (2016) uses administrative data on lottery players in Sweden and finds that lottery wealth affects neither mortality nor health care utilization. Earlier evidence by Lindahl (2005) of a sample of Swedish lottery winners finds that winning the lottery improves general health status and reduces the probability of dying.[1] A handful of studies from the United States employ a variety of strategies to estimate causal effects of income on health care expenditures. For example, Acemoglu et al. (2013) use oil price shocks and variations in the dependency of economic subregions on oil to estimate the income elasticity of hospital spending. Three other studies exploit the Social Security benefit notch as a source of exogenous variation in incomes of senior

[1]This is consistent with evidence from the United Kingdom that higher lottery winnings leads to improved health status (Apouey and Clark 2015). On the contrary, evidence from a number of studies find higher rates of hospitalisation and mortality following the receipt of government transfer payments in the United States (e.g. Dobkin and Puller 2007; Evans and Moore 2011), potentially negating the positive benefits that income has on health.

citizens on prescription drug use (Moran and Simon 2006), long-term care services (Goda et al. 2011), and out-of-pocket medical expenditure (Tsai 2014).

Previewing our results, we find that lottery winners with larger wins are more likely to choose private health services as opposed to health services from the National Health Service. The positive effect of wins on the choice of private care is driven largely by winners with medium to large winnings (win category > £500 (or US$750); mean = £1922.5 (US$2,893.5), median = £1058.2 (US$1592.7)). There is some evidence that the effect of winnings vary by whether individuals have private health insurance. We also find weak evidence that large winners are more likely to take up private health insurance. Large winners are also more likely to drop private insurance coverage between approximately 9 and 10 months earlier than smaller winners, possibly after their winnings have been exhausted. We use our econometric estimates to calculate lottery income elasticities for a range of health care services that are publicly and privately provided. The elasticities for public health care (relative to no care) are very small in magnitude and are not statistically distinguishable from zero; those of private health care range from 0 − 0.26 for most of the health services considered, and 0.82 for cervical smear. The elasticities with respect to lottery wins are comparable in magnitude to the elasticities of household income from fixed effect models.

The remainder of the paper is organized as follows. In Section 2, we describe the institutional context of the health system in the United Kingdom, and motivate the study of lottery wins are an exogenous source of income. This is followed by a description of the data and the estimation strategy in Section 3. Section 4 presents and discusses the results from the empirical analysis. In Section 5, we present estimates of the implied income elasticities of health care. Finally, Section 6 concludes with a discussion of the key findings in the paper.

2 Background

In 2015, the United Kingdom spends about 8.5 percent of its GDP on health, slightly lower than the OECD average of 8.9 percent (OECD 2015). The health service is the responsibility of each of the devolved administrations in Scotland, Wales and Northern Ireland alongside England. Public health care is provided by a state monopoly provider, the National Health Service (NHS), which is tax funded and patients do not face prices except co-payments for medicines. For primary care, each General Practice (GP) have a geographical boundary (or catchment area) from which they register and see patients from, and the NHS contract directly with those practices. The latter serves as a gatekeeper to elective hospital care.

Over the last decade, reforms have been geared towards expanding the role of private providers in delivering health care services that are also funded by the NHS (Arora et al. 2013). The main source of revenue for private health care providers is privately insured patients. Emergency care, however, remains almost exclusively the preserve of the NHS. Although the system is primarily public, there has always existed private provision of hospital and other health services. In contrast, the provision of dental and eye care have had a much larger involvement by the private sector, as the NHS involvement on these services are limited to certain groups with special needs including children, students and individuals on low income. Although dental care is provided under the NHS, free dental check-ups are restricted as above, and user fees have risen over time.

Roughly 11-12.5 percent of the United Kingdom population had voluntary private health or medical insurance (PHI) (Arora et al. 2013; King's Fund 2014). PHI serves as a supplementary health insurance to entitlements under the NHS, and allows individuals to avoid waiting times and waiting lists for non-urgent medical conditions, and obtain amenities not offered by the NHS such as one's choice of treating doctor or consultant. PHI also pays for certain types of non-essential care (e.g., health screenings, psycho- and physiotherapy, cosmetic surgery) not available through the NHS. PHI policies can be purchased directly by individuals, or as a benefit through employers which is the most common way by which individuals have PHI (Arora et al. 2013). Premiums cost approximately $\pounds 250 - 325$ per year for a middle aged person, and $\pounds 700 - 1650$ per year for a family depending on generosity of coverage (e.g. benefits, excess). Coverage includes private inpatient and outpatient care, and it can include dental health care treatment.

2.1 Lottery wins as exogenous income

How does household consumption respond to transitory income such as lottery windfall? According to the Permanent Income Hypothesis (PIH), a person's consumption at a point in time is determined not just by their current income but also by their expected income over the lifetime (Friedman 1957; Hall et al. 1978). More specifically, the PIH predicts that changes in a person's permanent income (e.g., projected lifetime earnings) rather than changes in temporary income (e.g., lottery wins) are what drive changes in a consumer's patterns. What this means is that, assuming that an economic agent is forward-looking and knows that an unanticipated positive income shock is not long lasting (i.e., mean reverting), consumption is insensitive to the transitory income shock, while savings respond almost one-to-one to the unanticipated temporary income increase. In other words, the PIH model predicts that people are more likely to save the majority of their unanticipated positive transitory income shock for a "rainy day".

In contrast, psychologists and behavioral economists have argued that Friedman's assumption of economic agents being forward-looking in their responses to transitory income shocks may be too strong. For example, according to Laibson (1997), people are not forward-looking but rather have preferences that are time-inconsistent. In the case of transitory positive income shocks, what this means is that people will prefer instant gratification from an unexpected rise in income and always want to put off savings into the future.

Empirical evidence on how a person's consumption responds to an unanticipated positive transitory income shock is scarce. In a seminal study on the effect of lottery prize on labor supply, savings, and consumption by Imbens et al. (2001), the authors find that there is a small but highly significant positive effect of lottery prize on durable good purchases such as cars and housing. Excluding non-winners and the big winners ($> \$100K$) from the sample, Imbens et al. find the marginal propensity to consume on cars is around 0.014, meaning that out of the total amount won 1.4% is spent on cars. On the other hand, they find that out of the total amount won a higher amount of 15.8% is saved by the winner, which is consistent with the PIH model. More recently, Kuhn et al. (2011) show using the Dutch Postcode Lottery that winners tend to spend a significant proportion of their winnings on cars and other durables such as interior and exterior home renovations. However, they do not find a significant effect of winning the postcode lottery on most other components of consumption, including food at home, transportation, and total monthly outlays. According to Browning and Crossley (2009), an increase in the consumption of durables is consistent with the liquidity-constrained version of the PIH model in which households adjust the timing of durable purchases to smooth consumption over the lifecycle.

For individuals with liquidity and borrowing constraints, a transitory positive income shock has been shown to increase not only their propensity to save, but also their propensity to invest. For example, Blanchflower and Oswald (1998) show that the probability of self-employment depends positively and statistically significantly upon whether the individual ever received an inheritance or gift. Focusing specifically on lottery winnings, Lindh and Ohlsson (1996) use Swedish microdata to show that the probability of self-employment increases significantly with the size of lottery prize. A similar lottery effect on self-employment is also obtained using the British Household Panel Survey data (Taylor et al. 2001; Georgellis et al. 2005).

Given that lottery wins raise the probability of entering into a long-term investment (e.g., becoming an entrepreneur) for individuals with liquidity constrains, it seems natural to ask whether lottery winners are also more likely than others to invest more in human capital, such as education and health, that have long-run payoffs over the life-cycle. There is little empirical research in this area. One exception is the work by Lindahl (2005). Using the Swedish microdata, he shows that an increase in income through lottery winnings has a small but significant protective effect on winners' health; a 10 % increase in exogenous income is likely to generate 0.01-0.02 standard deviations of better health and life expectancy by 5-8 weeks. Gardner and Oswald (2007) show using longitudinal data for the UK that winners of medium-sized lottery prizes between $£1,000$ and $£120,000$ (or approximately \$165,000 today) go on to report a significant improvement in their mental health two years after winning.

Using the same data set as Gardner and Oswald (2007), a study by Apouey and Clark (2015) find that although there is a marked improvement in winners' mental health, lottery prize appears to have a statistically insignificant effect on their self-rated health. They explain this paradoxical finding by showing that lottery prize is associated positively with smoking and social drinking, which may have a negative effect on self-rated health but a positive effect on mental health via social interactions. But currently the economics literature is small and the extent of a protective effect of lottery winnings on health-related outcomes is imperfectly understood.

3 Data and Methods

3.1 Data

The main data source used in the analysis is the BHPS, which is a nationally representative random sample of households, containing over 25000 unique adult individuals. The survey is conducted between September and Christmas of each year from 1991 (see Taylor et al. 2001). Respondents are interviewed in successive waves; households who move to a new residence are interviewed at their new location; if an individual splits off from the original household, the adult members of their new household are also interviewed. Children are interviewed once they reach 11 years old. The sample has remained representative of the British population since the early 1990s.

We study the use of health care services of a panel of lottery winners in the BHPS. Data on lottery wins were collected for the first time in 1997 and are available for 12 waves (Waves 7–18). In the survey, respondents were asked to state whether they received windfall income from lottery wins and the amount of winnings. The actual questions in the survey are as follows: (1) "Have you received any lump sum payments from wins on football pools, national lottery, or other form of gambling?"; (2) "About how much in total did you receive?".

In Britain, the ratio of lottery players to those who play the football pools is approximately 50 to 1, hence winnings would overwhelmingly be represented by lottery wins.[2] In the 1990s, the National Lottery is drawn every Saturday. Each ticket costs £1, and one would need to be 16 years or over to purchase one. Players buy tickets with their choice of six different numbers between 1 and 59, and prizes are awarded based on the number of matched numbers.[3]

We focus on all lottery winners at the year of winning the lottery. The complete case sample for analysis consists of 14205 observations (6520 individuals). Of those, 94.8 percent are small wins (£1–£499), and 5.2 percent are medium to large wins (£500+). The average real lottery win (adjusted to consumer price index in 2000) is £157 (or US$236).[4] Many individuals won the lottery more than once in our panel. For example, from 1997, the average number of "years

[2] 600,000 a week play the pools whereas 30 million per week play the lottery. Source, for example, `http://www.bestfreebets.org/betting-articles/football-pools-explained.html`, assessed 25 May 2016.

[3] For example, matching 3 out of 6 numbers will win you £25, 4 numbers = Estimated £100, 5 numbers = Estimated £1000, 5 numbers + bonus ball = Estimated £50,000, and 6 numbers = Jackpot)

[4] The mean, and median, wins for each of the winning category are: £30.0, £18.9 (< £100); £163.1, £164.3 (£100–£250); £366.5, £369.3 (£250–£500); £1922.5, £1058.2 (> £500.)

of winning the lottery" for the same person is 2.17, with a standard deviation of approximately 1.8 years. This implies that there are likely to be some individuals who play repeatedly.

Data on health service utilization have been collected in the BHPS since 1991 (Wave 1). In each year of the survey, individuals were asked whether they had been admitted into hospital as an inpatient and whether they had health checkups. The recall period is the 1st of September of the preceding year. The list of health checkups includes checks for blood pressure, chest X-ray, cholesterol, dental care, eye test, and for females, breast exam and cervical smear. Individuals who reported having been hospitalized, or having had checkups, were asked if these were obtained through the National Health Service (NHS), the private sector, or both. For the purpose of analyzing the public or private type of the health service use, we combine the responses that indicate "use of private sector" and "use of both private and public sectors" into one category.

A summary of the proportion of individuals who have used health care, and the proportion that chose private (non-NHS) services conditional on having used health care is shown in Table 1. For example, 65 percent of lottery winners reported having used dental care, 9.3 percent had an overnight hospitalization, and 26 percent of all females received a cervical smear. Of those who had dental treatment, 29 percent obtained care from private providers; 8.3 percent of individuals who were hospitalized chose private hospital care.

The remaining explanatory variables that were used in the study can be classified into the following categories: demographic and socioeconomic characteristics (e.g., age, gender, education), household income, measures of health status (self-assessed health, presence of health problems), and metropolitan region identifiers. Of particular interest is whether individuals have PHI. Respondents who are covered by the insurance in their own name (as opposed to through a family member) were asked whether the coverage had been paid for directly, deducted from wages, or paid by employer. In our sample of lottery winners, 19.7 percent have PHI.

To assess whether lottery winners are representative of the general population in the United Kingdom, we examine the extent to which winners and non-winners differ are in terms of their use of health care utilization, key socioeconomic characteristics, and health status. These are shown in Table A.1 in the Appendix. Winners and non-winners are, on the whole, similar in the probability of using health care services except for female winners who are more likely to obtain a breast exam and cervical smear compared with non-winners.[5] Winners are more likely

[5]While the group means are statistically different in a number of cases, the differences are not economically

to have chosen private health care for most services; this is explained in part by higher PHI ownership (19.7 versus 14.8 percent) and winners having slightly higher real annual household income (difference of \$1,370). Lottery winners are also more likely to be male and report having certain health problems. Both winners and non-winners are on the whole similar in terms of their age, are equally likely to report to be in excellent or good health.

The differences in the characteristics of winners by winning category for a key subset of explanatory variables are shown in Table A.2. Comparing medium (£100 − £500) with small winners (< £100), medium winners are younger, more likely to be be male, be in paid employment or is self-employed and less likely to be retired (not shown in table), have higher household income, and are more likely to have PHI and be in excellent health. Comparing large (> £500) with medium winners, large winners are older, are more likely to be self-employed and less likely to be in paid employment, have slightly lower household income, and are more likely to have PHI. Both medium and large winners are similar in gender, and their health status.

In the analysis of the effect of lottery wins on health care use, it would be desirable to control for any unobserved heterogeneity in participating in the National Lottery. A key reason why we focus on lottery winners at the year of winning is because the BHPS does not contain information about the number of times (if any) the individual has played the lottery. Hence, we cannot distinguish non-players from unsuccessful players.[6] Nevertheless, in Britain, as opposed to a number of other countries, many people play lotteries; a recent survey-based estimate by Wardle (2007) places the proportion of lottery players at two-thirds of the British adult population, with 57 percent playing the National Lottery (and almost 60 percent of these playing at least once a week). This explains why there is a considerable number of repeated lottery winners in the BHPS data compared with any other nationally representative data set.

3.2 Econometric strategy

We model the utilization of health care by using a two-part model that has been extensively used in the empirical analysis on the demand for health care. The first part is a binary outcome model that distinguishes between users and non-users of a given health care service. The second

significant.

[6] The Swedish study by Cesarini et al. (2016) uses information on the number of lottery tickets lottery players bought where winners of a large prize are compared with similar individuals that did not win a large prize with an identical number of tickets.

part is a separate binary outcome model that describes the distinction between users of private (non-NHS) health care versus NHS health care, conditional on being a user. The model is specified as follows:

$$y_{it} = \beta w_{it} + \mathbf{x}'_{it}\delta + \alpha_i + \epsilon_{it} \quad (1)$$

where y_{it} represents the health care utilization measure; w_{it} denotes the amount of lottery winnings; $\mathbf{x}'_{it}$ represents a vector of covariates; and β and δ are coefficients to be estimated.

In our primary analysis of lottery wins and health care use, we focus on lottery winners at the year of the survey instead of winners and non-winners to minimize the presence of unobserved heterogeneity that influences both the decision to participate in lotteries and health care behaviors. However, this strategy does not account for potential unobserved heterogeneity among lottery winners, which may arise if large winners play more lotteries, and if the difference in playing behavior is systematically related to the intensity of health care use. For example, some individuals may have an inherent characteristic that leads them to spend an invariably large proportion of their income on lottery tickets every week, and are therefore more likely to accumulate higher windfalls within the 12 months period than others. This is manifested in the model where the individual-specific effect, α_i, is correlated with covariates w_{it} and $\mathbf{x}'$. To eliminate this effect, we apply "within" transformation to Equation (1), which yields:

$$\tilde{y}_{it} = \beta \tilde{w}_{it} + \tilde{\mathbf{x}}'_{it}\delta + \tilde{e}_{it} \quad (2)$$

where tilde denotes deviation from the sample averages. Equation (2) is commonly referred to as the fixed effects "within" estimator.[7]

In a secondary analysis, we investigate if lottery wins are systematically related to individuals propensity to take up PHI using the sample of lottery winners. We regress PHI status on various configurations of lottery wins among winners at the year of winning, namely large wins or "Wins $>$ £500," and lottery win categories ("$<$ £100," "£100 – £250," "£250 – £500," "$>$ £500"). We expect that the decision to purchase medical insurance is influenced by both observed characteristics (e.g. age, health status) and unobserved characteristics (e.g. risk aversion) and

[7] All of the paper's results can be replicated with limited dependent estimators. However, as a pedagogical device and for ease of reading, we use linear methods.

the latter aspect needs to be accommodated in the econometric modeling. As a result we estimate a model of insurance status among the sample of winners using within estimation. This estimates the within-individual variation in PHI status, and has the interpretation of a change in insurance status. Given that we use a fixed effects model, both winning and taking up PHI would have occurred within the same 12 months period.

As an auxiliary analysis we also examine whether lottery winners who take up PHI drop their insurance coverage more quickly. We discuss the findings of our econometric analyses in Section 4 below.

4 Results

4.1 Effect of lottery wins on utilization and private versus NHS care

The parameter estimates of lottery wins on whether lottery winners used health services in a given year, and whether users of health services chose to obtain private (non-NHS) or NHS services are presented in Table 2. The estimates are interpreted as percentage point changes in health service use and/or private versus NHS type for a 10 percent increase in lottery wins. We consider how our estimates on lottery winnings vary for different specifications of household income, which is added as a control variable, along with an extensive set of covariates described in Section 3. The different specifications are household income net winnings, lagged household income, and when household income is omitted from the regression. We also consider a specification with lottery winnings as the only regressor without other covariates.

The results in Table 2 indicate that lottery wins have little to no effect on the utilization of health care services. This is observed from columns (1), (3), and (5) where most of the estimates are not statistically significant from zero. These results indicate that winners with larger lottery wins are not more likely to use health services. Moving onto the effect of lottery wins and the choice between private versus NHS care (columns 2, 4 and 6), the results indicate that the probability of choosing private care is higher for individuals with larger wins. This is the case for health services such as dental care, blood pressure check, and cervical smear, where the estimates are statistically significant at conventional levels. For instance, a 10 percent increase in winnings increases the probability of obtaining a private dental service by 6.5–8.5 percentage points (from a mean of 29.4 percent), and increases the probability of a private blood pressure examination by 5.7–6.9 percentage points (from a mean of 6.7 percent). Comparing across columns, the estimates demonstrate considerable stability for different specifications of household income, and with and without other covariates.

We consider a different approach in which lottery wins enter the regression as separate dummy variables representing four win categories, with the reference category being a win of less than £100 (Table 3). The coefficients on the variable for the largest win category (> £500; mean = £1922.5, median = £1058.2) in the regression on private and public choice are large and statistically significant for blood pressure and cholesterol checks, and cervical smear. For these services, these results show that the positive effect of wins on the choice of private care is influenced to a great extent by winners with medium to large winnings. For health services such as dental care and breast exam, the effects of lottery wins arise from smaller wins of £100−£250. We also observe that the estimates on smaller wins of £100 − £250 is statistically significant in the utilization of any health care services for cervical smear, eye test, and overnight hospital care.

Our findings are to be treated with caution as the analysis involves making multiple hypotheses, and hence appropriate corrections should be applied to take this into account. There are several methods used to address this issue, and the most conservative approach is the Bonferroni correction which involves testing each individual hypothesis at a significance level of 1/8 times the conventional level (given the 8 different types of health services). For instance, hypothesis testing with an α value of 0.10, with Bonferroni correction, will involve testing at α = 0.10/8=0.0125. When Bonferroni correction is applied, none of the estimates in Tables 2 and 3 are statistically significant, as well as those in Table 4, which we discuss below.

As a sensitivity check to the above analyses, we estimate the regressions reported in Table 2 using random-effects estimation.[8] We observed that the probability of choosing private care is higher for individuals with larger wins for both inpatient care (overnight hospital) as well as outpatient care (e.g. dental, blood pressure). As noted in Table 2, when time-fixed unobserved characteristics of individuals are accounted for in the FE specification, the effect of lottery wins for the choice of private overnight hospitalisation becomes small and insignificant from zero, but this is not the case for outpatient care. This indicates the importance of time-invariant individual heterogeneity in influencing the choice of private hospital care, which appears to play

[8]These results are available from the authors upon request.

a smaller role for outpatient health services such as dental care or cervical smear. One plausible explanation may be individuals' risk aversion toward private hospital expenditure, which is larger and more uncertain than the cost of private health care in an outpatient setting.

4.2 Lottery wins, private medical insurance, and the choice of private versus NHS care

The effect of windfall income on health care behaviors is expected to differ depending on whether individuals have PHI. We investigate the effect of lottery wins on the choice between private and public health care by re-estimating the FE regression in Table 2, separating the sample into individuals with and without PHI. As it is possible that winners may take up PHI after winning the lottery, we distinguish individuals based on their insurance status in the first year of winning.[9] We focus on the choice between private and NHS care because lottery wins have little effect on the utilization of health services, consistent with the findings in Table 2.

There is some evidence that the effect of winnings vary by whether individuals have private health insurance. The estimates of lottery wins on the choice of public and private care by PHI status are shown in Table 4. For privately insured individuals, the results indicate that the larger the lottery wins, the higher the probability of individuals choosing private care for dental care. One mechanism underlying this result may be that lottery winners are using their winnings to pay the associated copayments, or the private expenses directly if their PHI contracts do not cover these services. On hospital care, the estimate of lottery wins on private overnight hospitalization is not statistically significant. This result is not unexpected for privately insured individuals given that expenditure on private hospital care is covered under PHI contracts, although the generosity of individual contracts may vary.

For individuals without PHI, the estimates indicate that lottery winners with larger wins are more likely to obtain a private cervical smear. We also further consider if health care behaviors differ by income in that those without insurance are more likely to self-fund private health services than those with lower income. We do so by separating the non-privately insured sample into two groups, namely individuals with above-median and below-median incomes. The

[9] We also considered identifying insured and non-insured sub-samples using individuals' insurance status in the period before their first win. Doing so however resulted in a significant number of missing observations, as many lottery winners had reported winning the lottery in the first year of filling in the survey.

estimates from both groups are not statistically significant from zero.[10]

4.3 Tests for exogeneity of lottery wins

Our study's identification relies on the assumption that the within-individual variation in lottery winnings, in a sample of lottery winners, is exogenous. We conduct a series of checks to assess the validity of this assumption. These are similar to the tests performed by Lindahl (2005). In a first set of tests, we use a sample of both winners and non-winners to separately estimate two models where we regress a binary indicator of whether individuals won a lottery (at time t) on a lagged (at $t-1$) lottery win indicator and lagged log winnings, and the usual set of covariates. If there are temporal correlations in lottery wins, we would expect that individuals who win this year, will be more likely to win a lottery in the following year. In a second test, we use the sample of winners and regress log winnings (at time t) on lagged log winnings. Again, we test the hypothesis that winners of larger wins are more likely to have larger wins in the future.

The results of these tests are presented in Table A.3 in the Appendix. Columns (1) to (4) show the estimates of lagged lottery wins and log winnings on the probability that an individual wins the lottery. The OLS estimates in columns (1) and (3) are positive and statistically significant, suggesting that winners in the last year or winners with larger wins are more likely to win in the next year. This positive temporal correlation in lottery wins could be explained by differences in playing behavior, in that winners are more likely to win if, for instance, they buy more lottery tickets. Controlling for individual fixed effects, the estimates become negative and remain statistically significant, indicating that individuals who win the lottery this year are less likely to win in the next year. This result suggests the presence of mean-reversion in the within-person likelihood of lottery wins, and supports the notion that the lottery wins we examine in this paper are random, and not serially correlated across waves. The estimates of lagged log winnings on current winnings in the sample of lottery winners are shown in Columns (5) and (6) of Table A.3. The results are similar to those discussed above, and the fixed effects estimate indicates that individuals with larger wins are more likely to have smaller winnings in the future.

It may be argued that the negative relationship between lagged and contemporaneous winnings is mechanical in a fixed effects model and may not fully demonstrate the exogeneity of

[10]These results are available from the authors upon request.

lottery winnings. We further run two sets of tests. Using the sample of lottery winners, we test whether the characteristics of winners explain the size of winnings by regressing log winnings at time $t + 1$ on the full set of winners' characteristics at time t. We estimate two separate regressions, using ordinary least squares (OLS) and fixed effects estimation. The results are shown in Table A.4 in the Appendix. For the OLS estimates, the size of lottery winnings are strongly predicted by age, educational attainment, household income, and employment status. Accounting for individual fixed effects, most of the characteristics do not have an effect on lottery wins except for being unemployed and having diabetes and anxiety/depression, which are weakly significant. The estimates on household income in the fixed effects model is also not statistically significant, suggesting that individuals with higher household income do not have larger lottery winnings, perhaps by buying more lottery tickets.

In a separate test we regress using fixed effects estimation log winnings at $t + 1$ on each health care use and private-NHS indicator variables individually, without controlling for any covariates. If the size of lottery winnings is exogenous, we should not expect that individuals' health care behaviors at t would explain winnings at $t + 1$, even when lottery winnings were to be found to influence health care use. The estimates of the tests are shown in Tables A.5 and A.6. Individuals' use of health care have no impact on the amount of lottery winnings for most health services, except for dental care (negatively related with winnings) and breast exam (positively related with winnings) which are both weakly significant. For all types of health services, individuals' choice of private versus NHS care have no impact on lottery winnings, although as discussed earlier in Section 4.1, we find that winners with larger wins are more likely to obtain private care for blood pressure checks, dental care, and cervical smear.

Jointly the series of tests detailed above provide a comprehensive investigation on the random nature of lottery wins. The results appear to support the assumption that the size of lottery winnings among lottery players is exogenously determined when individuals' unobserved characteristics have been accounted for in the estimation using fixed effects.

4.4 Lottery wins and private medical insurance

A potential mechanism by which lotteries may influence health care demand is if lottery wins are systematically related to individuals' propensity to have PHI or to switch into PHI. To investigate this more formally, we regress PHI status on lottery wins categories using FE estimation on the sample of lottery winners (Table 5).

Our result show that individuals with large wins (> £500) are 2.2 percent more likely to have PHI of all types compared with those with smaller wins although this effect is weakly significant in a statistical sense (p-value = 0.102). Our results are based on within-individual variation in PHI status and hence based on our sample of winners, winners with large wins are more likely to take-up PHI.[11]

4.5 Do lottery winners drop private medical insurance more quickly?

We consider the question of whether lottery winners who take up insurance coverage subsequently drop cover more quickly, and we investigate this by examining the relationship between lottery wins and the duration of insurance coverage. The principal outcome of interest is length of time (in years) that individuals maintain PHI from the year of insurance coverage commencement. Our sample consists of lottery winners who are observed to have taken up PHI at the year of winning the lottery. We accommodate the right censoring of the outcome variable by including a variable that measures the number of years that individuals remain in the sample, in addition to an extensive set of covariates as in Table 2.

The results of the regression analysis are presented in Table 6. Those shown in columns (1)–(4) indicate that of individuals with any type of private insurance coverage (employer, direct payment, as a deduction from wages), lottery winners winning more than £500 maintain coverage for a significantly shorter duration of time than non-winners and smaller winners. More specifically, large lottery winners drop private insurance coverage between approximately 9 and 10 months earlier, possibly after their winnings have been exhausted. The same result is observed for individuals who pay for their insurance directly or through deduction from wages (Columns 5–8).[12]

[11]We also perform the same set of analyses using a sample of individuals who have won the lottery at least once in the panel, i.e. "ever winners". The reference category consists of individuals who have won the lottery at least once in the panel and are non-winners in a given year. The results from the "ever winners" are qualitatively similar to those of winners, and are shown in the Appendix (Tables A.7 and A.8.)

[12]Using a sample consisting only of individuals who pay for their insurance directly, we obtain estimates that are of similar magnitudes compared to those of the former. However, these estimates are not statistically significant from zero, which is probably attributable to low statistical power because of the small sample size.

5 Implied elasticities of health care

One objective of the study is to derive estimates of lottery income elasticity of health care. To this end, we first estimate FE regressions where the dependent variables are binary and assume the value of 1 if an individual obtained public and private care and 0 if the individual did not obtain care for a given service. The estimates are then used to calculate the implied elasticities of public and private health care versus no care with respect to lottery wins.

The elasticity estimates of lottery wins are shown in columns (1) and (3) of Table 7 for public and private health care, respectively. For public care versus not using health care, the magnitudes of the estimated elasticities are very close to zero, and are not statistically significant for all the health services considered. In contrast, for private care versus not using health care, the elasticities range from 0 - 0.26 for most health services and 0.82 for a private cervical smear. The elasticities for private overnight hospitalization, chest X-ray, cholesterol test, and cervical smear are are statistically significant from zero. For example, a 1 percent increase in lottery wins raises the probability that an individual will choose private care rather than not obtain health care by 0.22 percent for an overnight hospitalization episode and by 0.82 percent for a private cervical smear.

For comparison, the elasticity estimates with respect to household income for the whole sample consisting of winners and non-winners using FE regression are presented in Table 7. For public versus not obtaining care (Columns 2 and 3), the elasticity estimates are positive for most outpatient services except dental care and negative for overnight hospitalization. For some health services (e.g. hospital, blood pressure), the estimates are statistically significant from zero. For private care versus no care, the elasticities are broadly positive and large in magnitude. On the whole, the income elasticities appear to be similar in magnitude and direction to the elasticity of lottery wins, particularly for blood pressure, cholesterol test, eye-test, and cervical smear. For all types of health services considered in this study, our elasticity estimates indicate that these health care services are normal goods as opposed to luxury goods.

5.1 Inheritance income

As an additional analysis, we estimate the implied income elasticities on health care with respect to inheritance or bequest income by using a sample of over 3100 individuals who have reported receiving these types of windfall incomes (Table A.9). The magnitude of the income elasticities for public health care versus no care lie in the range of 0 - 0.04, and are statistically insignificant from zero except for cervical smear. These results are consistent with the elasticity estimates obtained from lottery winnings, as shown in Table 7.

For private health care, the estimated elasticities are larger in magnitude (0.06 - 0.77) than those from public health care and are statistically significant for dental and eye examination services. Although there are some differences (e.g., chest X-ray, cervical) in the sizes of the elasticities compared with lottery wins, the estimates are generally consistent in both direction and magnitude.

6 Discussion

This study exploits lottery wins as a source of exogenous changes in individuals' income to obtain causal estimates of lottery income elasticities for health care. We examined a longitudinal sample of over 14000 lottery winners in the United Kingdom to investigate the impact of lottery wins on health care demand for a range of health care services in an institutional context in which health care is provided in both public and private sectors. The results show that, although lottery wins have little to no effect on the probability that individuals use health care services, lottery winners with relatively large wins are significantly more likely to choose health care from the private sector than from the public sector. We find strong evidence supporting this behavior for health services such as dental care, blood pressure checks, and cervical smear. These are areas where there is less NHS involvement, and where there are larger barrier to access among lower income groups.

The results also show that the effects of lottery wins differ depending on whether individuals have PHI. For individuals with PHI, larger winners are more likely to obtain private care for dental care, suggesting that winners are using their winnings to afford the associated copayments that are not covered under their PHI contracts. This result further strengthen the "access motive" to private health care of having PHI. For individuals without PHI, those with larger wins are more likely to obtain a private cervical smear.

We find that income shocks do not affect access to public NHS care, which is provided free of charge. Whilst income does not act as a rationing mechanism in the context of the UK, it may affect access to care by influencing the opportunity cost of waiting, and hence changing the valuation of private health care alternatives to NHS care. On the contrary, the demand for private health care responds positively to income – we obtained implied income elasticities that are in the range of 0 – 0.26 for most of the health services considered, and 0.82 for cervical smear. We also find that the FE estimates of household income elasticities are comparable to those from lottery income: they lie in the range of 0.03–0.15, and 0.51 for cervical examinations.

Our study's estimates improve upon estimates of income effects on health care that are based on measures of earned income. Such measures may be confounded, for instance, by the effect of education on health, given that earned income is a return on education. Lottery wins provides variation in income that is plausibly independent of education, allowing for the identification of true income effects. It is conceivable that studies using earned income may arrive at income elasticity estimates that are biased upwards, as this effect is expect to include returns on education and higher investments in health capital among higher income individuals. While a fair comparison of our estimates to those of studies using earned income is difficult (e.g. differences in institutional contexts; types of health care services), there appears to be some support for this conjecture. Our elasticity estimates are smaller in magnitude compared to those reviewed in a recent meta-analysis by Costa-Font, Gemmill, and Rubert (2011), which finds income elasticity estimates ranging between 0.4 and 0.8. Our estimates are somewhat similar to those in two US studies. The income elasticity from the RAND Health Insurance Experiment in the 1970s, in which families are randomized into insurance plans with different levels of cost sharing, is about 0.1 (Joseph P. Newhouse and Rand Corporation Insurance Experiment Group 1993). Kenkel (1994) finds an income elasticity of preventive care (breast examination, pap test) of 0.06.

A major criticism of lottery studies is the question of external validity – the extent to which we can generalize the findings from our sample of lottery winners to the British population. The first aspect is the representative of our sample of winners. We mentioned earlier that up to two-thirds of the British adult population play the lottery. We also find that winners and non-winners, are on the whole, similar on many dimensions except that winners are more likely to be male, have PHI, and having slightly higher household income. The second aspect is whether the sizes of lottery winnings that we analyze are large enough to invoke a response on individuals' health care consumption behaviors. Our results are driven predominantly by winners who win > £500 (mean = £1922.5 (US$2,893.5)). By reasonable measures these would not be considered as substantial wins although we argued earlier on that winnings of this magnitude are more than sufficient to pay for some private health care services (e.g. specialist, dental visits) and PHI premiums.

Particular mention should be made of recent work – done independently of our own – by David Cesairini, Erik Lindqvist, Robert Östling, and Björn Wallace (2016). In their paper, the author analyzed prizes in Swedish lotteries that are considerably larger than ours and of previous studies – prizes of magnitude that create variation in wealth comparable to wealth shocks that one would expect from major changes in real estate and capital income taxes. The study finds that wealth shocks have no effect on hospitalizations and drug prescriptions as well as mortality. Their findings on health care utilization is broadly consistent with ours although the study does not differentiate between private and public health care. The distinction between public and private care, where we find most of the effects, is crucial in the UK compared with Sweden which has a smaller reliance on private health sector and higher population homogeneity. Unlike Cesarini et al. (2016), we have not examined the effects on child health as evidence from England has shown the absence of wealth effects (Currie, Shields, and Price 2007).

While we approximate an idealized laboratory experiment through the use of lottery winnings, it may well be the case that such a setting is not ideal for studying income or wealth effects on reoccurring expenses. As reviewed earlier there are competing theories on how household consumption respond to transitory income, and the empirical evidence on transitory income on the consumption of one-off purchases (e.g. cars, houses) versus reoccurring expenses is scant. A companion Swedish study by Cesarini et al. (2015) sheds some light on this issue. The lottery prizes analyzed in the study consist of prizes that are paid in lump sums as well as through monthly installments. The authors find that the trajectory of net wealth over time is similar for winners of the two types of lotteries. This indicates that a wealth shock is followed by a modest increase in consumption that is sustained over time whether or not winners receive their winnings through lump sum or installments.

This paper's findings have important policy implications. Our study supports the view that health systems guided by providing 'equal access for equal need' tend to exhibit patterns of health care utilization that are not significantly influenced by income shocks. Our results are consistent with the notion that higher income does not necessarily lead to better access to publicly funded health care, and that there are limited income related inequalities in access to public care. We show, on the other hand, that the demand for health care provided by the private sector, one that exists alongside a publicly funded system, can be sensitive to income. Hence inequalities in access can be perpetuated through health care services that are not covered by the public system.

Consistent with evidence from microeconomic studies we find income elasticities that are indicative that health care is a normal good, rather than a luxury good. From a normative perspective, this lends weight to the argument for subsidizing health services not covered by the public system, or expanding public coverage to include these services, if markets are not able to ensure patients get access to the required health services in the event of need.

Overall the implications our findings point to the role of the public sector - through public provision of health care or publicly funded health insurance - in reducing inequalities of access to health care. This would mitigate the financial consequences of health shocks which in some industrialized countries such as the US still stands out as an important source of bankruptcy (or medical bankruptcy). A potential lesson for further insurance reform in developed countries is that the catalogue of services covered by the public sector (e.g. Medicare and Medicaid in the US) or public health insurance should be large. This is consistent with evidence from the US indicating that Medicaid expansion by 10 percentage points reduced bankruptcy by 8% (Gross and Notowidigdo 2011). Similarly, evidence from the Oregon experiment suggests that the expansion of Medicaid coverage nearly eliminate catastrophic out-of-pocket medical expenditures (Baicker et al. 2013). Our results are consistent with the evidence in the US that income stands out as a barrier to utilization, and that when income barriers are lowered (by extending insurance) this lead to increases in the utilization of health care services (Gold et al. 2014; Finkelstein et al. 2012).

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Table 1: Proportion using health care services and the choice of private (non-NHS) versus NHS service conditional on use.

	Overnight Hospital	Blood pressure	Chest X-ray	Cholesterol test	Dental	Eye test	Cervical exam	Breast exam
Whether used health services	0.093 (0.291)	0.492 (0.500)	0.140 (0.347)	0.181 (0.385)	0.650 (0.477)	0.408 (0.492)	0.260 (0.439)	0.124 (0.330)
N	14,205	14,205	14,205	14,205	14,205	14,205	6,146	6,146
Choice of private service conditional on use	0.083 (0.276)	0.067 (0.250)	0.069 (0.253)	0.076 (0.265)	0.294 (0.456)	0.373 (0.484)	0.015 (0.122)	0.037 (0.189)
N	1,309	6,960	1,987	2,558	9,205	5,758	1,599	755

Note: Standard deviation in parenthesis

Table 2: Estimates of lottery winnings on whether used health service, and the choice of private versus NHS service for different specifications of household income.

	HH Income Net Winnings		*HH Income: Omitted*		*Lagged HH Income*		*No Covariates*	
Outcome	Used Health Care (1)	Private Choice (2)	Used Health Care (3)	Private Choice (4)	Used Health Care (5)	Private Choice (6)	Used Health Care (7)	Private Choice (8)
Overnight hospital	-0.002	0.046	-0.002	0.047	0.001	0.025	-0.008	0.115
	(0.030)	(0.130)	(0.028)	(0.130)	(0.029)	(0.137)	(0.029)	(0.116)
Blood pressure	-0.036	0.069**	-0.036	0.069**	-0.039	0.057*	-0.030	0.070**
	(0.043)	(0.032)	(0.043)	(0.032)	(0.044)	(0.033)	(0.044)	(0.032)
Chest X-ray	0.012	0.021	0.011	0.023	0.013	0.032	0.014	0.027
	(0.033)	(0.079)	(0.033)	(0.079)	(0.034)	(0.084)	(0.034)	(0.075)
Cholesterol test	0.006	0.035	0.006	0.032	0.006	0.006	0.016	0.051
	0.032	(0.056)	0.032	(0.056)	0.033	(0.058)	0.034	(0.055)
Dental	-0.021	0.085*	-0.022	0.085*	-0.014	0.065	-0.019	0.112**
	(0.036)	(0.046)	(0.036)	(0.046)	(0.037)	(0.046)	(0.036)	(0.046)
Eye test	0.027	0.065	0.027	0.065	0.054	0.070	0.031	0.120
	(0.045)	(0.074)	(0.045)	(0.074)	(0.047)	(0.076)	(0.045)	(0.074)
Cervical exam	-0.021	0.093**	-0.021	0.094**	-0.071	0.103**	-0.025	0.102**
	(0.070)	(0.041)	(0.070)	(0.041)	(0.072)	(0.043)	(0.070)	(0.043)
Breast exam	0.028	0.023	0.028	0.041	0.036	0.053	0.036	0.071
	(0.052)	(0.069)	(0.052)	(0.069)	(0.054)	(0.070)	(0.051)	(0.062)

Note: Significance: *** 1%; ** 5%; * 10%. Models are estimated using individual fixed effects estimation, with robust standard errors in parenthesis. Coefficient estimates are interpreted as percentage point changes in health service use for a ten percent increase in lottery winnings and household income. Models in columns (1)-(6) include covariates: age and squared-age, education attainment, employment status, home ownership, marital status, self-assessed health, health problems, and region identifiers. Sample sizes for analyses of whether used health care: 14205 (6146 females). Sample sizes for public-private choice (in the order of outcomes as they appear): 1309, 6960, 1987, 2558, 9205, 5758, 1599, 755.

Table 3: Estimates of lottery winnings categories on health care use and the choice of private (non-NHS) versus NHS care

	Overnight Hospital	Blood pressure	Chest X-ray	Cholesterol test	Dental	Eye test	Cervical exam	Breast exam
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(A) Whether used health care								
Lottery wins categories (Reference £1-£100):								
£100 − £250	0.020*	0.002	0.001	-0.004	0.002	0.041**	0.048*	0.009
	(0.011)	(0.017)	(0.013)	(0.013)	(0.014)	(0.018)	(0.029)	(0.022)
£250 − £500	-0.003	-0.030	-0.007	-0.001	0.017	-0.008	0.024	0.033
	(0.015)	(0.023)	(0.018)	(0.017)	(0.019)	(0.024)	(0.039)	(0.029)
> £500	-0.006	-0.022	-0.005	0.007	-0.009	-0.014	0.034	0.027
	(0.016)	(0.025)	(0.019)	(0.018)	(0.021)	(0.026)	(0.042)	(0.031)
(B) Choice of private versus NHS care								
Lottery wins categories (Reference £1-£100):								
£100 − £250	-0.067	0.016	0.002	-0.005	0.039**	0.003	-0.015	0.066**
	(0.047)	(0.013)	(0.030)	(0.020)	(0.018)	(0.028)	(0.017)	(0.031)
£250 − £500	-0.070	0.011	-0.072	0.005	0.040	-0.039	0.001	-0.047
	(0.064)	(0.017)	(0.037)	(0.028)	(0.025)	(0.040)	(0.023)	(0.035)
> £500	0.080	0.040**	-0.008	0.074**	0.013	0.060	0.122***	-0.011
	(0.079)	(0.019)	(0.042)	(0.031)	(0.026)	(0.043)	(0.026)	(0.051)

Note: Significance: *** 1%; ** 5%; * 10%. Models are estimated using individual fixed effects estimation, with robust standard errors in parenthesis. Coefficient estimates are interpreted as percentage point changes in health service use for a 0-1 change in lottery winnings category, compared to the reference category. Other covariates include age and squared-age, education attainment, employment status, home ownership, household income net winnings, marital status, self-assessed health, health problems, and region identifiers. Sample sizes for analyses of whether used health care: 14205 (6146 females). Sample sizes for public-private choice (in the order of outcomes as they appear): 1309, 6960, 1987, 2558, 9205, 5758, 1599, 755.

Table 4: Estimates of lottery winnings on the choice of private versus NHS care by insurance status.

Outcome	Insurance = Yes	Insurance = No
Overnight hospital	0.013	-0.040
	(1.091)	(0.103)
Blood pressure	0.131	0.040
	(0.095)	(0.032)
Chest X-ray	0.089	-0.009
	(0.032)	(0.073)
Cholesterol test	0.085	-0.017
	(0.205)	(0.048)
Dental	0.162*	0.066
	(0.098)	(0.051)
Eye test	0.165	0.049
	(0.168)	(0.082)
Cervical exam	0.052	0.072*
	(0.162)	(0.037)
Breast exam	0.524	0.044
	(0.420)	(0.050)

Note: Significance: *** 1%; ** 5%; * 10%. Models are estimated using individual fixed effects estimation, with robust standard errors in parenthesis. Coefficient estimates are interpreted as percentage point changes in health service use for a ten percent increase in lottery winnings. Other covariates include age and squared-age, education attainment, employment status, home ownership, marital status, self-assessed health, health problems, and region identifiers. Sample sizes for non-insured (in the order of outcomes as they appear): 227, 1289, 326, 458, 2077, 1232, 275, 128. Sample sizes for non-insured: 1082, 5671, 1661, 2100, 7128, 4526, 1324, 627.

Table 5: Private medical insurance (PMI) status and lottery wins by insurance types

	All types	Direct payment & deduct from wages
	(1)	(2)
(A) Wins > £500	0.022	0.012
	(0.013)	(0.008)
(B) Lottery wins categories:		
(Reference: £1-£100)		
£100 − £250	-0.010	-0.005
	(0.010)	(0.007)
£250 − £500	-0.013	-0.007
	(0.013)	(0.010)
> £500	0.017	0.010
	(0.014)	(0.010)
Observations (N)	10,710	10,419

Note: Significance: *** 1%; ** 5%; * 10%. Results in columns (1) and (2) are estimated using individual fixed effects estimation. Private medical insurance types refer to how medical insurance is paid for. Covariates include age and squared-age, gender, education attainment, employment status, home ownership, marital status, self-assessed health, health problems, and region identifiers.

Table 6: Lottery wins and length of time individuals maintain private medical insurance coverage

	All Insurance Types (N=570)				Direct payment & deduct from wages (N=279)			
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(A) Wins > £500	-0.846**	-0.785**	-0.755**	-0.507	-0.935*	-0.805*	-0.667	-0.561
	(0.353)	(0.376)	(0.376)	(0.389)	(0.486)	(0.530)	(0.551)	(0.596)
(B) Lottery wins categories:								
(Reference: £1-£100)								
£100 – £250	-0.180	-0.203	-0.240	-0.136	0.096	0.202	0.141	0.154
	(0.249)	(0.256)	(0.257)	(0.276)	(0.395)	(0.428)	(0.438)	(0.462)
£250 – £500	-0.479	-0.375	-0.425	-0.501	0.335	0.446	0.309	-0.041
	(0.339)	(0.379)	(0.380)	(0.412)	(0.428)	(0.462)	(0.453)	(0.600)
> £500	-0.895**	-0.832**	-0.806**	-0.543	-0.902*	-0.750	-0.635	-0.548
	(0.357)	(0.380)	(0.379)	(0.392)	(0.492)	(0.536)	(0.554)	(0.595)
Time left in sample	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Income, wealth	No	No	Yes	Yes	No	No	Yes	Yes
Health, geography	No	No	No	Yes	No	No	No	Yes

Note: Significance: *** 1%; ** 5%; * 10%. Standard errors are clustered at the level of the individual hence parenthesis reflect robust standard errors. The outcome variable is the number of years individuals maintain private medical insurance coverage after taking up medical insurance. *Time left in sample*: the total number of waves that individuals remain in the survey in the year they take up medical insurance; *Demographic*: age and squared-age, gender, marital status, education attainment, employment status; *Income, wealth*: household income, home ownership; *Health, geography*: self-assessed health, health problems, and region identifiers.

Table 7: Implied income elasticities of health care with respect to lottery winnings and household income

	Public vs. No Care		Private vs. No Care	
	Elasticity of winnings	Elasticity of income	Elasticity of winnings	Elasticity of income
	(1)	(2)	(3)	(4)
Overnight hospital	-0.012	-0.036*	0.220*	0.106
Blood pressure	-0.009	0.017*	0.050	0.104***
Chest X-ray	-0.004	0.018	0.260**	-0.001
Cholesterol test	-0.007	0.012	0.179*	0.150***
Dental	-0.004	-0.011**	-0.002	0.027***
Eye-test	0.014	-0.009	0.012	0.056***
Cervical exam	-0.016	0.013	0.821*	0.511***
Breast exam	0.021	0.043*	0.122	0.146

Note: Significance: *** 1%; ** 5%; * 10%. Models are estimated using individual fixed effects estimation. Statistical significant refers to the regression coefficient estimates. Estimates of income elasticities are calculated as percentage change in the proportion of individuals obtaining public or private care versus no-care given a one-percent increase in lottery winnings or household income.

A Appendix

Table A.1: Descriptive statistics of winners and non-winners samples

	Winners (N=14,205)	Non-winners (N=134,176)	Diff.
Whether used health care			
Hospitalisation	9.3%	10.5%	***
Blood pressure	49.2%	47.6%	***
Chest X-ray	14.0%	13.3%	**
Cholesterol	18.1%	17.5%	*
Dental	64.0%	63.5%	***
Eye test	40.8%	40.2%	
Cervical	26.1%	22.8%	***
Breast	12.4%	10.9%	***
Chose private versus NHS care:			
Hospitalisation	8.3%	6.1%	***
Blood pressure	6.7%	4.7%	***
Chest X-ray	6.9%	5.8%	**
Cholesterol	7.6%	6.3%	**
Dental	29.4%	26.5%	***
Eye test	37.3%	31.0%	***
Cervical	15.0%	15.0%	
Breast	3.7%	3.7%	
Characteristics:			
Age (years)	45.3	45.7	**
Female	43.2%	55.8%	***
Log (real household income)	9.13	9.02	***
Private health insurance	19.7%	14.8%	***
Self-assessed health:			
Excellent	22.6%	23.4%	***
Good	48.1%	45.6%	***
Fair	20.5%	21.1%	
Poor	6.7%	7.8%	***
Very poor	2.1%	2.2%	
Health problems:			
Arms, Legs etc	29.4%	27.8%	***
Sight	5.0%	5.2%	
Hearing	9.2%	8.3%	***
Skin conditions	14.1%	11.7%	***
Chest	14.2%	13.5%	**
Heart/Blood pressure	18.2%	17.1%	***
Stomach	8.6%	8.1%	*
Diabetes	3.8%	3.8%	
Anxiety, depression	6.9%	8.7%	***
Alcohol, drugs	0.5%	0.6%	
Epilepsy	0.6%	0.9%	***
Migraine	8.4%	8.1%	
Other	5.0%	4.4%	***

Note: Test of difference in group means. Significance: *** 1%; ** 5%; * 10%. Other covariates not shown include education attainment, employment status, home ownership, marital status, and region identifiers.

Table A.2: Key descriptive statistics of winners by winning category

	(1) Small winners (< £100)	(2) Medium winners (£100 – £500)	(3) Large winners (> £500)	Diff. in Means (1) vs (2)	Diff. in Means (2) vs (3)
Log(real household income)	9.11	9.20	9.11	***	***
Private health insurance	18.9%	21.8%	25.3%	***	*
Age	45.68	43.34	45.37	***	***
Female	44.7%	36.7%	37.9%	***	
Self assessed health: Excellent	21.9%	25.2%	26.0%	***	
Good	48.4%	47.0%	45.5%		
Fair	20.7%	19.1%	20.0%	*	
Poor	6.7%	6.6%	6.7%		
Very poor	2.1%	2.1%	1.7%		
Health problems:					
Arms, Legs etc	29.9%	27.1%	28.1%	**	
Sight	5.0%	5.0%	5.0%		
Hearing	9.1%	9.6%	8.6%		
Skin conditions	14.4%	13.3%	12.2%		
Chest	14.5%	12.8%	12.6%	**	
Heart/Blood pressure	18.5%	17.0%	16.5%		
Stomach	8.7%	8.1%	8.3%		
Diabetes	3.8%	3.1%	5.4%		***
Anxiety, depression	7.0%	6.5%	6.3%		
Alcohol, drugs	0.5%	0.4%	0.8%		
Epilepsy	0.7%	0.6%	0.5%		
Migraine	8.3%	8.7%	0.9%		
Other	5.0%	4.8%	4.6%		

Note: Test of difference in group means. Significance: *** 1%; ** 5%; * 10%. Other covariates not shown, but included in the regression analyses are education attainment, employment status, home ownership, marital status, and region identifiers.

Table A.3: Estimates of lagged lottery winnings on contemporaneous lottery wins

	Whether win lottery (t)				Log lottery winnings (t)	
	(1)	(2)	(3)	(4)	(5)	(6)
Whether win lottery ($t-1$)	0.327***	-0.038***				
	(0.006)	(0.003)				
Lagged ($t-1$) log winnings			0.093***	-0.008***	0.530**	-0.056***
			(0.001)	(0.001)	(0.019)	(0.020)
Fixed effects	No	Yes	No	Yes	No	Yes

Note: Significance: *** 1%; ** 5%; * 10%. Models are estimated using linear OLS with robust standard errors, or individual fixed effects estimation. Samples in columns (1) to (4) comprise of both winners and non-winners. In column (3) and (4), lagged winnings for non-winners are coded as zero. Samples in columns (5) and (6) comprise only of winners. Other covariates include age and squared-age, education attainment, employment status, home ownership, marital status, self-assessed health, health problems, and region identifiers.

Table A.4: Coefficient estimates of log lottery winnings at t+1 on winners' characteristics at t

	(1) Fixed Effects	(2) OLS
Age	0.027	0.0031
	(0.024)	(0.012)
Age-squared	-0.00025	-0.00015
	(0.00025)	(0.00013)
Female		-0.213***
		(0.062)
Education (*Ref: Primary*)		
Education: Not defined	0.116	-0.538**
	(0.563)	(0.243)
Secondary	0.265	-0.610***
	(1.447)	(0.177)
Low-secondary, vocation	-0.201	-0.161*
	(0.454)	(0.094)
High-secondary, mid-vocation	-0.449	-0.248**
	(0.476)	(0.113)
High vocation	0.841	-0.269***
	(0.617)	(0.103)
First degree	-0.062	-0.520***
	(0.574)	(0.132)
High degree	-0.157	-0.326*
	(0.694)	(0.184)
Log income net winnings	0.084	0.185***
	(0.058)	(0.046)
Employment status (*Ref: Paid Employment*)		
Self employed	-0.201	0.461***
	(0.123)	(0.147)
Unemployed	0.294*	0.192
	(0.167)	(0.170)
Retired	-0.180	0.173
	(0.135)	(0.116)
Family care	0.119	0.150
	(0.311)	(0.344)
Fulltime student	0.204	0.080
	(0.147)	(0.119)
Long term sick/disabled	-0.164	-0.295*
	(0.221)	(0.160)
Maternity leave	0.213	0.214
	(0.223)	(0.167)
Government training	-0.488	-1.277***
	(0.869)	(0.338)
Other	-0.229	0.0513
	(0.342)	(0.347)
Owns home	0.066	-0.068
	(0.119)	(0.085)
Married or defacto	-0.098	-0.118
	(0.111)	(0.075)
Self-assessed health (*Ref: Excellent*)		
Very Good	-0.011	0.00175
	(0.060)	(0.061)
Good	-0.015	0.0049
	(0.081)	(0.082)

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Table A.4 – continued from previous page

	(1) Fixed Effects	(2) OLS
Fair	0.150	0.028
	(0.121)	(0.124)
Poor	0.035	-0.164
	(0.186)	(0.186)
Health Problems:		
Arms, Legs etc	0.053	0.026
	(0.064)	(0.066)
Sight	-0.098	-0.094
	(0.111)	(0.106)
Hearing	-0.091	0.074
	(0.110)	(0.090)
Skin conditions	-0.040	-0.034
	(0.087)	(0.081)
Chest	0.0400	0.025
	(0.101)	(0.078)
Heart/Blood pressure	-0.0065	-0.013
	(0.084)	(0.073)
Stomach	-0.033	0.021
	(0.095)	(0.097)
Diabetes	0.452*	0.160
	(0.243)	(0.155)
Anxiety, depression	-0.222*	-0.168
	(0.116)	(0.104)
Alcohol, drugs	-0.165	0.364
	(0.343)	(0.463)
Epilepsy	0.734	-0.196
	(0.630)	(0.224)
Migraine	-0.058	0.0030
	(0.100)	(0.090)
Other	0.285***	0.138
	(0.100)	(0.105)
Constant	2.303**	2.909***
	(0.905)	(0.558)
N	5,095	5,095
R-squared	0.026	0.049

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Models are estimated using individual fixed effects and ordinary least squares estimation. 19 indicator variables reflecting geographical location are included in the estimation but not presented in the tables for brevity.

Table A.5: Fixed effects estimates of health service use at t on log lottery winnings in t+1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Overnight hospital	0.067							
	(0.051)							
Blood pressure		0.044						
		(0.033)						
Chest X-ray			0.069					
			(0.043)					
Cholesterol test				-0.033				
				(0.042)				
Dental					-0.074*			
					(0.041)			
Eye test						0.034		
						(0.031)		
Cervical exam							0.037	
							(0.053)	
Breast exam								0.126*
								(0.068)
Constant	3.600***	3.584***	3.596***	3.612***	3.654***	3.592***	3.470***	3.463***
	(0.011)	(0.019)	(0.011)	(0.013)	(0.029)	(0.016)	(0.020)	(0.017)
N	11,718	11,718	11,718	11,718	11,718	11,718	5,117	5,117

Note: Significance: *** 1%; ** 5%; * 10%. Regression estimates of whether individuals used health service in time t on log lottery winnings in time *t+1*, without additional covariates. Models are estimated using individual fixed effects estimation.

Table A.6: Fixed effects estimates of the choice of private versus NHS care at t on log lottery winnings in t+1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Overnight hospital	-0.152							
	(0.454)							
Blood pressure		-0.071						
		(0.112)						
Chest X-ray			0.195					
			(0.363)					
Cholesterol test				-0.159				
				(0.183)				
Dental					0.053			
					(0.052)			
Eye test						-0.071		
						(0.063)		
Cervical exam							-0.297	
							(0.581)	
Breast exam								-0.540
								(0.810)
Constant	3.651***	3.600***	0.195***	3.645***	3.586***	3.626***	3.540***	3.647***
	(0.049)	(0.015)	(0.363)	(0.025)	(0.019)	(0.027)	(0.033)	(0.053)
N	1,043	5,740	1,587	2,162	7,628	4,751	1,288	676

Note: Significance: *** 1%; ** 5%; * 10%. Regression estimates of whether individuals chose private (non-NHS) care versus NHS care in time t on log lottery winnings in time $t+1$, without additional covariates. Models are estimated using individual fixed effects estimation.

Table A.7: Private medical insurance (PMI) status and lottery wins by insurance types: Ever-winners sample

	All types	Direct payment & deduct from wages
	(1)	(2)
(A) Any wins	0.003	0.003
	(0.003)	(0.002)
(B) Wins > £500	0.019*	0.005
	(0.010)	(0.008)
(C) Lottery wins categories:		
No wins (Ref)		
< £100	0.002	0.003
	(0.003)	(0.003)
£100 – £250	0.004	0.003
	(0.008)	(0.006)
£250 – £500	-0.003	-0.002
	(0.011)	(0.009)
> £500	0.019*	0.005
	(0.010)	(0.009)
Observations (N)	52,132	46,489

Note: Significance: *** 1%; ** 5%; * 10%. Results in columns (1) and (2) are estimated using individual fixed effects estimation. Private medical insurance types refer to how medical insurance is paid for. The sample comprises of individuals that won the lottery at least once in the panel, lottery players, and consist of both winners and non-winners in a given year. Covariates include age and squared-age, gender, education attainment, employment status, home ownership, marital status, self-assessed health, health problems, and region identifiers.

Table A.8: Lottery wins and length of time individuals maintain private medical insurance coverage: Ever-winners sample

	All Insurance Types (N=958)				Direct payment & deduct from wages (N=718)			
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(A) Wins > £500	-0.771**	-0.766**	-0.715**	-0.633	-0.869*	-0.809*	-0.678	-0.631
	(0.337)	(0.359)	(0.358)	(0.359)	(0.458)	(0.462)	(0.486)	(0.502)
(B) Lottery wins categories:								
No wins (Ref)								
< £100	0.159	0.182	0.201*	0.215*	0.020	0.0325	0.0655	0.111
	(0.119)	(0.118)	(0.118)	(0.119)	(0.146)	(0.150)	(0.149)	(0.152)
£100 – £250	-0.036	0.009	-0.009	0.031	0.114	0.159	0.143	0.248
	(0.229)	(0.231)	(0.229)	(0.231)	(0.376)	(0.387)	(0.389)	(0.381)
£250 – £500	-0.328	-0.215	-0.279	-0.329	0.350	0.400	0.282	0.150
	(0.320)	(0.329)	(0.334)	(0.343)	(0.411)	(0.410)	(0.408)	(0.438)
> £500	-0.739	-0.725**	-0.669*	-0.585	-0.854*	-0.788*	-0.653	-0.591
	(0.337)	(0.359)	(0.358)	(0.359)	(0.459)	(0.464)	(0.488)	(0.504)
Time left in sample	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Income, wealth	No	No	Yes	Yes	No	No	Yes	Yes
Health, geography	No	No	No	Yes	No	No	No	Yes

Note: Significance: *** 1%; ** 5%; * 10%. Standard errors are clustered at the level of the individual hence parenthesis reflect robust standard errors. The sample comprises of individuals that won the lottery at least once in the panel, lottery players, and consist of both winners and non-winners in a given year. The outcome variable is the number of years individuals maintain private medical insurance coverage after taking up medical insurance. *Time left in sample*: the total number of waves that individuals remain in the survey in the year they take up medical insurance; *Demographic*: age and squared-age, gender, marital status, education attainment, employment status; *Income, wealth*: household income, home ownership; *Health, geography*: self-assessed health, health problems, and region identifiers.

Table A.9: Implied income elasticities of health care with respect to inheritance income

Dependent variable	Public vs. No Care	Private vs. No Care
Overnight hospital	0.039	0.138
Blood pressure	0.013	0.082
Chest X-ray	-0.006	0.769
Cholesterol test	0.010	0.033
Dental	0.012	0.058**
Eye test	0.008	0.143***
Cervical exam	0.044*	0.224
Breast exam	0.033	0.171

Note: $^{-a}$ Significance: *** 1%; ** 5%; * 10%. Statistical significance refers to the regression coefficient estimates, which are estimated using OLS. Estimates of income elasticities are calculated as percentage change in the proportion of individuals obtaining public or private care versus no-care given a one-percent increase in bequest income.