The Effect of Wealth on Household Labor Supply: Evidence from Swedish Lotteries

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[**PRELIMINARY AND INCOMPLETE**]

Abstract

We study the effect of wealth on individual and household labor supply using a large, newly-collected sample of lottery players in Sweden. Using high-quality administrative data for roughly 2.5 million lottery players, we find that winning a lottery prize modestly reduces labor earnings, with the effects roughly constant over time and persisting more than 10 years. We find both intensive and extensive margin responses and similar responses by age, gender, and education. We find no evidence of non-linear effects across any of our earnings measures. The reduction in household labor earnings is larger than the individual responses of winners, implying that spouses of winners reduce their labor earnings, as well; however, we find significantly larger labor earnings declines for winners than for their spouses, regardless of the gender of the winner. This is inconsistent with the pooling of exogenous unearned income within the household, which is a necessary condition of unitary models of household labor supply.

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I Introduction

One of the core questions in labor economics is what determines individuals' and households' labor supply decisions (Blundell and MaCurdy 2000; Pencavel 1986; Saez, Slemrod, and Giertz 2009; Keane 2011). The interest in labor supply in part reflects a desire to understand the consequences of economic policies on labor force participation, employment status, hours worked, and the age at which individuals choose to retire (Ashenfelter and Heckman 1974). These labor supply behaviors often have direct implications for tax policy, transfer programs, and a host of aggregate macroeconomic variables. For example, many policy proposals – such as changes to retirement systems, property taxes, or the lump-sum components of welfare payments – often involve implicit or explicit transfers of wealth (Moffitt 1992). In these cases, knowledge about the causal impact of wealth on labor supply decisions is directly relevant for predicting the consequences of such policies.

Additionally, since wealth effects provide the link between compensated and uncompensated wage elasticities, they also play a central role in the workhorse labor supply models used by economists (Keane 2011). As a result, credible estimates of wealth effects are valuable for estimating relevant elasticities that are critical ingredients in the evaluation of tax policy (Mirrlees 1971; Saez 2001) and the study of business cycle fluctuations (Rogerson and Wallenius 2009).

Unfortunately, despite a large empirical literature, there remains little consensus on the magnitude of the effect of wealth on individual and household labor supply. While there is arguably some agreement among labor economists that large, permanent differences in real wages induce relatively modest differences in labor supply, Kimball and Shapiro (2008) write that "there is much less agreement about whether the income and substitution effects are both large or both small." The lack of consensus likely stems in part from the substantial practical challenges associated with isolating plausibly exogenous variation in unearned income or wealth, which is necessary to

produce credible wealth effect estimates.

In this paper, we confront these challenges by studying the effect of wealth on the labor earnings of individuals and households using a large, newly-constructed sample of lottery participants in Sweden. We exploit the random variation in wealth induced by the lottery prizes in order to identify the causal effect of wealth on labor earnings. Our analysis uses three separate samples of Swedish lottery players – comprising roughly 2.5 million individuals in total – matched to administrative data on labor earnings of lottery participants, labor earnings of their spouses, and a large number of socioeconomic and demographic variables. The unusually rich and high-quality data has minimal attrition and very long panels, allowing us to study the longer run effects of shocks to wealth. Moreover, the large sample size allows us to test for important nonlinearities in the responses across prize sizes. Finally, the representativeness of the lottery participants allows us to estimate heterogeneous wealth effects across a wide range of demographics.

Overall, we find that winning a lottery prize immediately and permanently reduces labor earnings for individuals and households, with effects roughly constant over time and lasting more than 10 years. In our main specification, winning a prize of 1 million Swedish krona (SEK) – about $160,000 US – reduces total labor earnings of the winner over 10 years by roughly 100,000 SEK, or approximately one-half of the average annual real income during our sample period

We find both intensive and extensive margin responses to the prizes, with less than one-half of the overall earnings response accounted for by extensive margin adjustments. When we investigate heterogeneous wealth effects, we find similar effects across genders, age groups, and levels of education. Perhaps surprisingly, we find no evidence of nonlinear effects across any of our earnings measures, and we have sufficient statistical power to rule out relatively modest nonlinear effects.

Turning to households, we find that the reduction in household labor earnings is larger than the responses of winners individually, suggesting that spouses of winners reduce their labor earnings,

as well. Looking within households, we find larger labor earnings declines for winners than for their spouses, regardless of gender. We interpret the household results through lens of a unitary model of household labor supply (Kimball and Shapiro 2008; Blundell, Pistaferri, and Saporta-Eksten 2012). To our knowledge, we are the first to use random shocks to wealth from lotteries to directly test the "exogenous income pooling" prediction of unitary household labor supply models. Such models have the strong prediction that the observed labor supply responses should not depend on the identity of the lottery winner, a prediction that we can strongly reject in our data. We discuss atlternative models that are consistent with our results below, but we leave a detailed investigation of these alternative models for future work.

Our work is broadly related to previous research that uses natural experiments such as policy changes or bequests to obtain credible estimates the causal effect of wealth (Bodkin 1959; Holtz-Eakin, Joulfaian, and Rosen 1993; Joulfaian and Wilhelm 1994; Krueger and Pischke 1992). Most closely related to our work is Imbens et al. (2001), who administered surveys to two groups of Massachusetts Lottery players: winners of a major prize between 1984 and 1988, and a control group of individuals with season tickets who won a small prize during the same time period. They found that around 5-10 percent of an exogenous increase in unearned income is spent on reducing labor earnings. Their estimated effects appear to be highly non-linear and somewhat sensitive to the small number of individuals in the sample who won prizes exceeding $2 million USD.[2]

While past studies of lottery winners have provided valuable information about the effect of wealth on labor supply (and many other outcomes of interest to economists), because of important data limitations, they fall short of achieving the experimental ideal of random assignment of wealth. There are two reasons for this. The first is that in most lotteries, prizes are only

[2]Though not always their primary focus, qualitative papers by sociologists have also reported information obtained from surveys about the labor supply of lottery winners following positive wealth shocks (Arvey et al., 2004; Furåker & Hedenus, 2007; Hedenus, 2009, 2011; Kaplan, 1997; Larsson, 2011). These papers report findings that are broadly consistent with those in Imbens et al. (2001).

assigned randomly conditional on a number of factors that researchers may not observe perfectly, such as the number of lottery tickets an individual owns. For example, a regression of labor supply on prize money that fails to control for the number of tickets will deliver biased estimates if the number of lottery tickets a person owns is unobserved and also associated with other unobserved factors influencing labor supply decisions.

A second limitation of previous studies is that the samples used have relied on data from surveys that have fairly high rates of (possibly non-random) attrition and non-response. Systematic non-response may introduce selection problems that can impact estimates in unpredictable ways. For example, Imbens et al. (2001) test for random assignment by asking whether variables determined before the lottery have any incremental explanatory power when added to a regression of prize amount on a crude proxy for the number of tickets an individual owns. With the exception of a subsample of winners who won moderate amounts of money, the null hypothesis of (conditional) random assignment is strongly rejected in their data. This rejection likely reflects a combination of non-random attrition (winners and non-winners have different response rates in the study) as well as the imperfect ability to control for the expected prize money (as the number of tickets variable is measured with error).

Our work addresses these limitations and is also distinguished in several other important ways. First, in each of our three lottery samples, biases arising due to attrition are likely negligible. By contrast, in Imbens et al. (2001) the effective non-response rate was roughly 50 percent. In our setting, all of the lottery samples contain information on players' social security numbers, which allow us to match individuals to administrative records with a very high degree of accuracy and minimal attrition.

Second, we have detailed data on both the number of lottery tickets owned as well as the specific rules of the lottery. This allows us to estimate wealth effects in an ideal experimental setting using the framework of a randomized control trial. Our specifications exploit the strict

(conditional) exogeneity of lottery prizes, conditioning on the observed variables that predict both probability of winning and the prize amount conditional on winning. Importantly, we present several randomization tests which show evidence consistent with strict (conditional) exogeneity of both lottery prizes and prize amounts (conditional on winning). In particular, once we control for the relevant lottery variables, we find no evidence that any pre-determined socioeconomic or demographic variable predicts either the probability of winning or the prize amount conditional on winning. We also demonstrate that our substantive empirical findings are not particularly sensitive to including the controls needed to achieve (conditional) random assignment of wealth, even over longer time periods. When we ignore the exact number of lottery tickets and the specific details of the lotteries in our empirical model, we find broadly similar results.

Lastly, our rich data set has several other unique advantages. We are able to follow lottery winners for an unusually long period of time – more than 10 years after winning for more than 90% of the lottery winners. This allows us to study the persistence and dynamics of the labor supply responses. Additionally, our pooled lottery sample is unusually large (more than 280,000 lottery winners) and has considerable variation in the size of prices. This allows us to test for nonlinear wealth effects. Lastly, the rich population registry data allow us to study household-level responses (as well as responses within the household across spouses).

The remainder of this paper is structured as follows. Section II gives some additional details on the construction of the three datasets, investigates their representativeness, and reports the results from several randomization tests. Section III discusses our empirical framework and issues of identification. Section IV reports our empirical results for individuals and households. Section V discusses implications of our results for unitary household labor supply models. Section VI concludes.

II Data

II.A Lottery Samples

We study three samples of lottery winners who have been matched to administrative records. The first sample we use is a panel of ∼2 million Swedish individuals who held "prize-linked savings" (PLS) accounts in the 1980s and 1990s. PLS accounts incorporate a lottery element by randomly awarding prizes to some accounts rather than paying interest (Kearney et al., 2010). The second sample consists of individuals who participated in a monthly Swedish subscription lottery called Kombilotteriet between 1998 and 2011. The final sample contains scratch lottery ticket winners who qualified for a televised draw at some point between 1994 and 2010 where they could win substantial amounts of money. The three samples comprise a total of ∼2.5 million individuals, ∼13,000 won medium prizes (defined as 100,000 SEK) and ∼1,700 won large prizes (defined as 1 million SEK or more). The total value of the prize money disbursed to the winners in our samples exceeds ∼8 billion SEK and the prizes vary in size from close to zero up to 11 million SEK.

II.A.i PLS Sample Description

In the summer of 2009, we discovered, in the archives of the Swedish Financial Supervisory Authority, individual-level account data from a Swedish PLS program that was very popular in the 1980s and 1990s. The program, known as the "Winner Accounts" ("Vinnarkonton"), was introduced in 1986. The original data were in the form of ∼14,000 microfiche cards and ∼10,000 sheets of paper with prize lists that were digitized over the past two years. The final data set is an unbalanced monthly panel of 3 million individuals, where each individual is observed at least once between December 1986 and June 1994 (and most individuals are of course observed for the full period). The panel contains information on the individual's social security number, account balance and lottery outcome in each month. It is important that the account data have been

preserved because each account was given 1 lottery ticket for each 100 SEK that was deposited. The quality of these data, which comprises 2 million individuals, is excellent.

PLS account holders could win two types of prizes: fixed and odds prizes. Fixed prizes were prizes whose magnitude was not determined by the account balance of the winning account. Each ticket had the same probability of being drawn, so the probability of winning was proportional account balance. The odds prizes, intended to be an incentive to accumulate substantial account balances, were prizes that paid a multiple of 1, 10 or 100 of the account balance to the winner (with the prize capped at one million SEK). The probability of winning an odds prize was also proportional to the account balance. Conditional on winning, accounts with larger balances thus received larger odds prize. In both cases, each 100 SEK held in the account was equal to one lottery ticket, and each lottery ticket had the same probability of being drawn.

II.A.ii Kombi Sample

Our second sample is an unbalanced panel of ∼500,000 individuals who participated in a monthly ticket-subscription lottery called Kombilotteriet between 1998 and 2010. Kombi is a lottery whose proceeds go to the Swedish Social Democratic Party and its youth movement. Subscribers choose their desired number of subscription tickets and are billed monthly, usually by direct debit. Kombi provided us with a dataset containing participants' social security numbers, number of subscription tickets held every month and prize amounts for those who won more than one million SEK. A small number of observations are missing ($\sim 1\%$) because Kombi did not have the social security number of the account holder available on file. However, whether or not an individual's social security number is available is determined when the individual enrolls and is not endogenous to the lottery outcome.

II.A.iii Triss Sample

TRISS is a scratch-ticket lottery run since 1986 by Svenska Spel, the Swedish government-owned gaming operator. The sample we have access to consists of two categories of scratch-ticket winners: TV-Triss and Clover-prize winners. Winners of either type of prize are invited to participate in a morning TV show. At the show, participants are asked to draw a second ticket from a stack of lottery tickets with a known distribution (one stack is for TV-Triss winners and one for Clover winners). All tickets look identical and no strategic element or element of skill is involved in the draw. Clover prizes are paid out as monthly installments for at least a decade and at most 25 years. The present value of a Clover-prize ranges from 1.2 million SEK and 11.9 million SEK. TV Triss participants win a fixed prize whose prize ranges from 50,000 to 5 million SEK. Whereas there are around five Clover winner in a typical month, there are around 20 Triss TV winners.

We have information on all individuals who participated in the TV show between 1994 and 2010 (the Clover prize was not introduced until 1997). With the help of Statistics Sweden, we tried to identify the social security numbers of these individuals using information about their names, age, address, phone numbers and some additional biographic information from Svenska Spel. We applied extremely strict quality control filters in the matching process and nevertheless successfully identified the social security numbers of 99% of the individuals in the sample. The data also contains detailed information about a small number of instances where the winning ticket was co-owned or where the winner preferred to send a representative to the show rather than attend in person.

Table 3 provides information about the distribution of prizes in the three samples. To facilitate comparisons, all prizes are deflated by the official consumer price index normalized to equal 1 in 2010. The table shows the number of prizes in several categories. The total value of the prize money disbursed to the winners in our samples exceeds $\sim$8 billion SEK and the prizes vary in size from zero up to 11 million SEK (1 SEK $\approx$ 0.15 USD). In the PLS and TRISS samples, there

is significant prize variation, whereas all prizes in the Kombi sample are large. Overall, the wide range of prize sizes provides us with ability to test for important non-linear effects.

II.B Measures of Labor Earnings

Our data is assembled using information from a number of population-based registers maintained by Statistics Sweden, including the Income and Taxation Register, The Occupational Register, the Total Population Register, The Business Register and several Population Censuses. This section provides an overview of the key variables used in the analyses. For expositional clarity, we omit some nuances in the discussion of the variables. Detailed information on variable definitions is provided in Appendix D and the references cited therein. Table 1 provides detailed information on the sample restrictions. Most of the attrition is due to inconsistencies or suspected problems with the social security numbers used to match to administrative records

To measure earnings, we use annual data on an individual's gross earnings. This variable is constructed from information that employers are required to supply to tax authorities. The variable does not include income derived from unemployment insurance, disability insurance or compensation from other insurance systems that are often included in broader income measures. The earnings measure we use is available from 1979 and onward.

We also obtain data on educational attainment, country of birth, marital status and region of residency using information in the registers. These data also allow us to match individuals to spouses and unmarried partners, which we utilize in our household-level analysis below.

II.C Summary Statistics

A natural concern about lottery studies is that they lack external validity because lottery players are an exotic group of individuals. Table 4 provides information on the demographic characteristics of all adult individuals in each lottery sample. To evaluate how representative the samples

are, we also report descriptive statistics for a random population sample drawn by Statistics Sweden from the 1990 and 2000 populations.

Overall, the results from this comparison suggest that at least on observables, there are no large differences between the players we study and a representative sample of Swedes. This was expected a priori given the high rates of participation across the population. On average, lottery winners are slightly wealthier, slightly older, and have slightly larger labor earnings and capital income than the general population.

III Empirical Framework

The key assumption in any study of lottery winners is that prizes are randomly assigned conditional on some set of observable characteristics. As we explain in this section, our identification strategy uses the available data and knowledge about the institutional details of the lottery to define subsamples/cells within which wealth is assigned independently of potential outcomes. In our analyses, we then condition on the cell that each individual belongs to by including cell fixed effects. The fact that we have data on number of tickets is critical for the identification strategy in two of the lotteries.[3] We begin by providing a justification for the set of cells used in our analysis and then report a comprehensive set of tests for random assignment. Because the identification strategy varies somewhat by sample, we discuss the samples separately.

[3]In some cases, controlling for the number of tickets may not suffice either. For example, consider a lottery where each player must choose one combination of N digits and the prize is divided evenly between all individuals who selected the winning digit combination. If all digits have the same probability of being drawn, rare digit combinations have a greater expected prize. If the individuals who succeed in picking unique number combinations are systematically different, then even conditioning on the number of tickets, correlation with the error term may remain.

III.A PLS Sample

III.A.i Fixed Prizes

For fixed-prize winners, our identification exploits the fact that in the population of players who won the same number of fixed prize in a particular month, the actual prize amount is independent of account balances (and therefore potential outcomes). For each draw, we define a unique cell comprising all individuals who won exactly one fixed prize in the draw (see also Imbens et al. (2001), Hankins and Hoestra (2011), and Hankins et al. (2011)).

III.A.ii Odds Prizes

To define the cells for the odds prizes, we match winners to controls with an identical account balance at the time of the event (exact matching). The matching ensures odds-prize winners are being compared to controls who faced exactly the same distribution of possible treatments before the lottery.

III.B Kombi Sample

We define a unique cell for each month and possible ticket balance, and include dummy variables for each distinct cell. The analysis thus only uses variation within groups of individuals who faced identical distributions of treatments before the lottery. We successfully matched each winner to 20 non-winners with an identical number of tickets in the same draw. Each cell contains a relatively large number of individuals because all individuals own one, two, or three tickets. A small number of observations are missing ($\sim$1%) because Kombi did not have the social security number available on file. However, missingness is not impacted by the outcome of the lottery; whether or not an individual's social security number is available is determined when the player signs up for the lottery and therefore missingness does not depend on lottery outcomes.

III.C Triss Sample

The TRISS sample consists of two categories of scratch-ticket winners: TV-Triss and Clover prize winners. Winners of either type of prize are invited to participate in a morning TV show. At the show, participants are asked to draw a TV-Triss or Clover ticket (whichever they won) from a fixed stack of 100 lottery tickets with a known distribution. All tickets look identical and there is no strategic element or element of skill involved in the draw. There is one prize distribution for Clover winners and one for Triss winners. Conditioning on the type or prize won, the prizes are therefore randomly assigned. Because we observe 17 years of data - from 1994 to 2010 - there are occasional changes to the distribution. We restrict the sample to individuals who won exactly once between 1994 and 2010 and elected to participate in the live TV draw. Two individuals therefore share a cell if they won the same type of prize - TV-Triss or Clover - in the same year. Individuals who won twice (there are three such individuals in the data) are dropped from the sample because there is no good control group for them.

III.D Randomization

If the identifying assumptions described informally in the previous section are correct, no covariates determined before the lottery should have any predictive power for the lottery outcome once we include the cell fixed effects as covariates. The identifying assumptions may fail to hold in a sample even if they are satisfied at the population level. For example, there could be attrition from the sample that is correlated with prize amount or there could be assigned to the wrong cells because there is measurement error in the number of tickets. To test for violation of conditional random assignment, we run regressions of the following form:

$$L_{i,0} = Z_i\gamma + X_i\delta + \varepsilon_i,$$

where $L_{i,0}$ is prize money at the time of the event, X_i is a matrix of cell fixed effects, Z_i is a vector of covariates determined before the lottery draw such as lagged labor earnings and capital income as well as demographic variable such as age and education. We also explore specifications using $(L_{i,0})^2$ as the dependent variable. As shown in Table 5, we are unable to reject the null hypothesis that the variables jointly predict the prize amount in the pooled sample (column 1) or in any of the three lottery samples considered in isolation: an omnibus F-test of the joint significance of parameters within γ fails to reject the null at the ten percent level across a wide range of specifications. The results are identical when $(L_{i,0})^2$ is the dependent variable. This table also reports results which exclude the cell fixed effects; these results show that controlling for the cell fixed effects is necessary in order to produce a well-behaved randomization test and demonstrate that we have sufficient power to detect violations of random assignment in situations when we expect to detect them. For example, the F-statistic in specifications which omit the cell fixed effects omitted is statistically significant at conventional levels for the pooled sample.

III.E Empirical Framework

We begin with a reduced form analysis in which we examine average effects for the pooled sample (pooling across all of the lotteries and across demographic subsamples). Normalizing the time of the lottery to $t = 0$, our basic estimating equation is the following:

$$y_{i,t} = \beta_t L_{i,0} + Z_{i,t}\gamma_t + X_i\delta_t + \varepsilon_{i,t} \quad (t = 0, 1, ...10), \tag{1}$$

where $y_{i,t}$ is individual i's outcome of interest at time t, $Z_{i,t}$ is a vector of covariates determined before the lottery draw, and X_i is a matrix of cell fixed effects which ensure conditional random assignment of $L_{i,0}$. In our preferred specifications, we control for the lagged dependent variable the year preceding the event, $y_{i,-1}$, an indicator variable for gender, a quintic in age (at time of

lottery win), lagged labor earnings, lagged capital income, and the level of educational attainment at the time of the event. The key coefficients of interest are the estimated coefficients on $L_{i,0}$; i.e., $\hat{\beta}_0, \hat{\beta}_1, ..., \hat{\beta}_{10}$. These coefficients flexibly capture the dynamic effect of wealth shock in time $t = 0$.

The OLS estimates of Equation (1) restricting the coefficients to be homogenous across all samples will capture the mean effect of wealth, averaging heterogeneous treatment effects across the population. Since small average effects could mask large effects in certain subpopulations, in the heterogeneity analyses below we will estimate this equation separately within different subpopulations, so that the effect of wealth is not restricted to be homogenous across all individuals and households..

IV Empirical Results

IV.A Individual-Level Results

Our main set of regression estimates reported in Table 6 the pooled lottery sample, combining all three of the lotteries. In the Table 7, we report estimates for each lottery population separately, and we find that we generally cannot reject that the wealth effects are the same in each lottery sample. We therefore will pool all lotteries together in our main results to maximize statistical power. The estimates in column 1 and 2 show that on average, the gross labor earnings of lottery winners declines by roughly 1,000 SEK each year for each 100,000 SEK of prize money.

Figure 1 shows graphically how the coefficient estimates for the first ten years after the event evolve, and also report coefficient estimates for the five years prior to the event. As should be the case if the prize money is randomly assigned, we find that there are no systematic differences in the pre-event trends of winners and non-winners. The year of the event, labor earnings decline immediately and appear to stabilize permanently at a level roughly equal to one percent of the

prize amount per year. These longer run effects are estimated on a very large share of the sample. Appendix Figure A1 investigates the attrition in sample, and shows that we can follow more than 90 percent of the winners for more than 10 years.

Columns 3-5 of Table 6 show estimates from specifications with earnings aggregated over multiple years. These estimates aggregate the extensive and intensive margin responses into one summary measure. Columns 6 and 7 show that winning 1 million SEK causes a 1.7 percentage point increase in the likelihood of not being in the workforce (operationalized as having earnings below an extensive margin threshold set at 25,000 SEK). This is a significant response, but the magnitude implies that most of the adjustment must be taking place along the intensive margin. If the combined response in column (1) came entirely from extensive margin responses by winners with average earnings (180,000 SEK), then the actual change in the probability of being employed would need to be three times larger.

We next investigate the substantive importance of including the cell fixed effects that are needed to achieve conditional random assignment of the lottery prizes. In Figure 2, we compare the results in Figure 1 to these estimates which exclude cell fixed effects. These results are similar to the results reported in Imbens et al. (2001) in that they include a wide range of pre-determined demographics but do not precisely control for variables needed to strictly achieve conditional random assignment of the lottery prizes. As shown in Table 5 (and discussed above), when we exclude cell fixed effects, pre-determined socioeconomic and demographic variables significantly predict both probability of winning and the prize amount (conditional on winning).

Figure 2 shows that these "event-study" estimates that exploit timing of lottery prize show no evidence of pre-existing trends. This pattern is similar to the results in Imbens et al. (2001), and they (as in many other papers) interpret this as evidence that even though the lottery prizes are not strictly exogenous, the identification assumptions are plausible and therefore post-lottery-win estimates may not be significantly biased. Figure 2 shows that the estimates excluding cell fixed

effects are fairly similar over time. When we quantify this bias, we find that three years after the prize is awarded, there is at most a small bias in estimated wealth effect. These results provide important evidence that the wealth effect estimates using "naive" event-study regressions may be highly reliable. It would appear that restricting attention only to winners and exploiting variation in size of the lottery is satisfactory in approximating estimates that are recovered when exploiting the strict conditional random assignment of the lottery prizes.

We next turn to the possibility that the effects of wealth are non-linear, as would be likely if workers who wish to change the number of hours they work face a fixed adjustment cost. Table 8 shows the estimates from two specifications that allow earnings to respond more flexibly to prize amount than in the simple linear specification. The upper panel shows the estimates from baseline specification augmented to also include a quadratic in prize amount. Overall, this specification provides little evidence of non-linear effects. The lower panel shows the estimates from a model estimated using a flexible linear spline with a knot at 1M SEK. As above, there is no evidence of any non-linear effects, and the estimated coefficients from this specification are very similar to the baseline estimate. Therefore, perhaps surprisingly, neither specification provides compelling evidence that the effects of wealth are non-linear.

Our next set of analyses are designed to further explore whether the relatively small (but precisely estimated) main effects mask heterogeneity in the treatment effects. We look for heterogeneity by age, gender, education and initial earnings. Table 9 shows the results from the heterogeneity analyses by age, gender and education. To test for age differences, we estimate separate wealth coefficients for those above the age of fifty and those below the age of fifty. The results are shown in the top panel of Table 9. Surprisingly, we find no significant differences by age group. These results are difficult to reconcile with a standard lifecycle labor supply model, which would typically predict larger effects for workers closer to retirement. The middle panel reports estimates from a model with separate coefficients for men and women. These estimates suggest

similar effects by gender. The bottom panel of Table 9 shows heterogeneity by educational attainment, where again we find not significant differences by education: individuals without any college education tend to exhibit similar responses to college-educated individuals.

Lastly, Table 10 shows the heterogeneity analysis by initial earnings, allowing the coefficients to vary by four categories of earnings. There is a tendency for the estimated coefficients to be increasing in initial earnings, although the effects over the longer run appear to be non-monotonic, with the largest effects among those with average initial earnings.

IV.B Household-Level Results

When focusing on changes in labor earnings for winners individually, we find that winning a lottery prize modestly reduces labor earnings, with effects roughly constant over time and lasting more than 10 years. For these individuals, we find both intensive and extensive margin responses, similar responses by gender, age, and education. Additionally (and perhaps surprisingly), we find no evidence of nonlinear effects across any of our earnings measures. We next turn our attention to household-level analysis, estimating wealth effects for total household earnings as well as estimating wealth effects within households across spouses.

Table 10 reports the individual labor earnings responses for winners (with spouses) and responses for their spouses. The results show significantly larger responses for winners, and Appendix Table A1 shows that these differences are similar regardless of the gender of the winner. These results imply that the largest individual labor earnings response within a household is typically the winner of the lottery. However, there is suggestive evidence that labor earnings decline for both winners and their spouses, as Table 10 also shows that total household labor earnings appear to decline by more than the individual labor earnings.

There are several important caveats to keep in mind when interpreting these results. First, all of the results in Table 10 use the same cell fixed effects and controls that are used when analyzing

the individual labor earnings responses of the winners. Therefore, these results currently do not directly address the potential concern that spouses of winners are systematically different from the winners themselves in a way that would be correlated with labor supply responses to a wealth shock. Given the broad similarity in the results across genders in Appendix Table A1, we strongly suspect that these results are not simply an artifact of unobserved heterogeneity. Nevertheless, in ongoing work, we are investigating this concern more directly by estimating the extent to which spouses of winners are equally likely to participate in the various lotteries, and also controlling for variables needed to ensure conditional random assignment of spousal prizes, as well.

We next interpret these within-household results through the lens of a standard unitary model of household labor supply in the next section.

V Wealth Effects in Unitary Models of Household Labor Supply

A well-known prediction of unitary models of household labor supply is that only the sum of exogenous unearned income should matter for household labor supply decisions (Chiappori and Donni 2009). To make this claim explicit, we present a simplified, static version of the unitary model of household labor supply that is estimated in Blundell et al. (2012). Households jointly solve the following static labor supply problem:

$$\max_{C,H^1,H^2} U(C, H^1, H^2; z, z^1, z^2)$$
$$s.t.\ C = A^1 + A^2 + H^1 w^1 + H^2 w^2$$

where C is total household consumption, H^i is labor supply of individual i, w^i is the wage of individual i, and A^i is unearned income (assets) of individual i. The remaining parameters are preference shifters: z is a preference shifter that affects household, while z^i is a preference shifter specific to each individual within the household.

Formally, the "exogenous income pooling" condition corresponds to the following:

$$\frac{dH^i}{d(A = A^1 + A^2)} = \frac{dH^i}{dA^1} = \frac{dH^i}{dA^2}$$

This condition implies that the identity of lottery winner should not affect the labor earnings responses of each individual within the household. The results in Table 10 appear to be inconsistent with this prediction because lottery winners reduce their labor earnings by more than their spouses, regardless of the gender of the winner.

This result complements the large empirical literature using labor supply data to test the exogenous income pooling restriction of unitary models of household (see Chiappori and Donni 2009 for a survey of the literature). Relative to this previous work, to our knowledge we are the first to use a random lottery that is distributed to each member of the household with positive probability. For example, Lechene and Attanassio (2002) also exploit exogenous variation in unearned income, but in their setting there is no randomization over which member of household received the transfer income. Specifically, they note that "it would have been more useful if the randomization was over who, within the beneficiaries' households, would receive the transfer: the husband or the wife." By testing exogenous income pooling in a setting whether either member of the household can receive lottery prize, we provide additional credible evidence against the income pooling prediction of the unitary model of household labor supply.

Following Chiappori and Donni (2009), a simple alternative model that is consistent with our results is one in which the weights on each household member's individual utility function are endogenous to the distribution of assets and unearned income within the household:

$$\max_{C,H^1,H^2} \mu(A^1, A^2)U^1(C, H^1; z, z^1) + (1 - \mu(A^1, A^2))U^2(C, H^2; z, z^2)$$
$$s.t.\ C = A^1 + A^2 + H^1 w^1 + H^2 w^2$$

In this model, the household collectively maximizes a utilitarian social welfare function with social welfare weights given by $\mu()$. The welfare weights are affected by the lottery outcome, and the identity of lottery winner matters because individual lottery winnings change the relative social welfare weights through the $\mu()$ function. In ongoing work, we are working to estimate simple versions of this model using our lottery data.

VI Conclusion

A fundamental challenge when estimating the effect of wealth on behavior is that it is not feasible to randomly assign substantial amounts of wealth to people. As a result, researchers are usually confined to studying observational data, where the possibility of omitted variable bias and reverse causation looms large. This paper addresses this identification challenge by exploiting the random assignment of wealth in three different samples of Swedish lottery players who have been matched to high-quality administrative data. In all three samples, we pass comprehensive randomization tests. Moreover, the long panels within the administrative data allow us to characterize the labor supply responses to exogenous wealth shocks over long time periods.

Our main empirical finding is that there is an immediate and permanent change in labor earnings in response to an exogenous wealth shock. The magnitude of the response is modest – approximately 1% of the exogenous wealth shock is spent on reducing hours worked in each of the ten years following the win. Interestingly, we find no evidence of non-linearities in prize amount. Taken together with the limited role of extensive margin responses, our results provide surprisingly little evidence that workers face large, costly barriers to adjusting their labor supply in our setting

Perhaps the most striking finding of the heterogeneity analyses is the absence of heterogeneity across many interesting subgroups. Imbens et al. (2001) find no significant differences in the responses of men and women and notice that this is at odds with a large literature on the labor

supply of women that finds that women are systematically more responsive to price and wealth changes. We find a similar result in our data with substantially more power to detect important diffences in labor supply responses by gender. Perhaps even more surprising is the lack of heterogeneity in wealth effects by age. A standard lifecycle labor supply model (as in Imbens et al. (2001)) suggests larger wealth effects as retirement approaches.

When we analyze household-level data, we find larger reductions in total household labor earnings, suggesting that spouses of winners reduce their labor earnings, as well. However, we find strong evidence that lottery winners reduce their labor earnings more than their spouses, regardless of the gender of the winner. This provides unusually strong evidence against the testable prediction of unitary models of household labor supply that exogenous unearned income is "pooled". In ongoing work, we are working to estimate and assess which specific alternative collective models of household labor supply are most consistent with our results.

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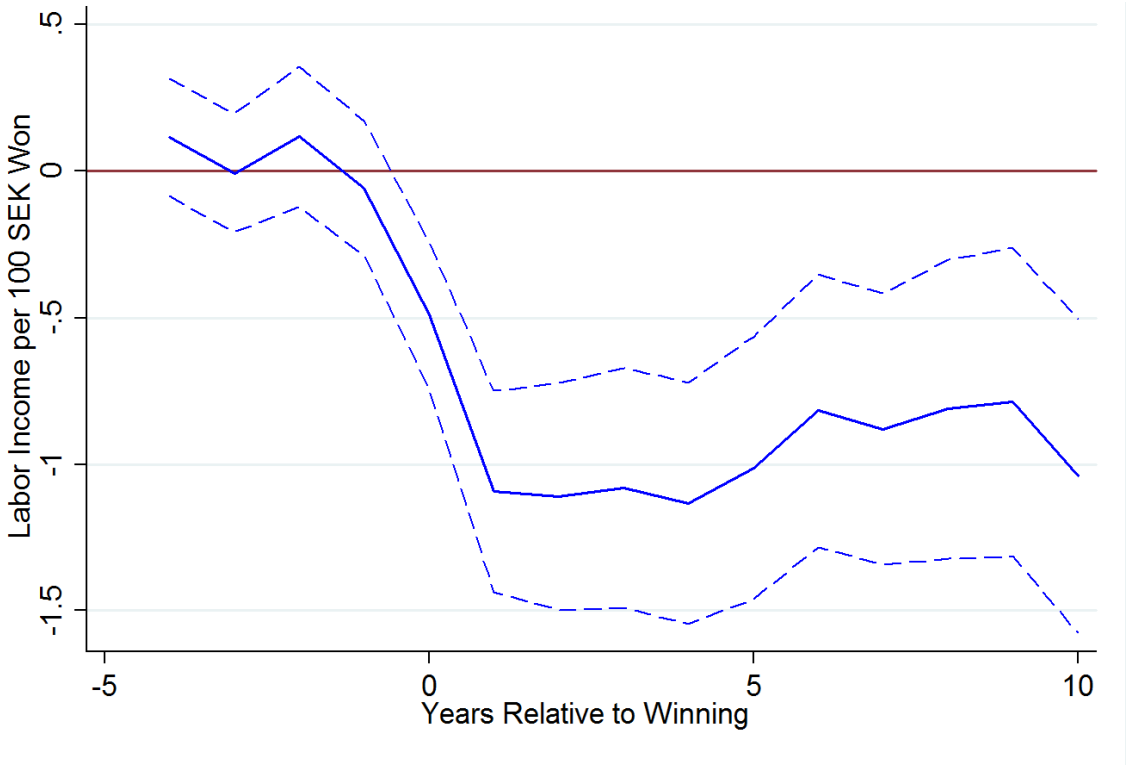
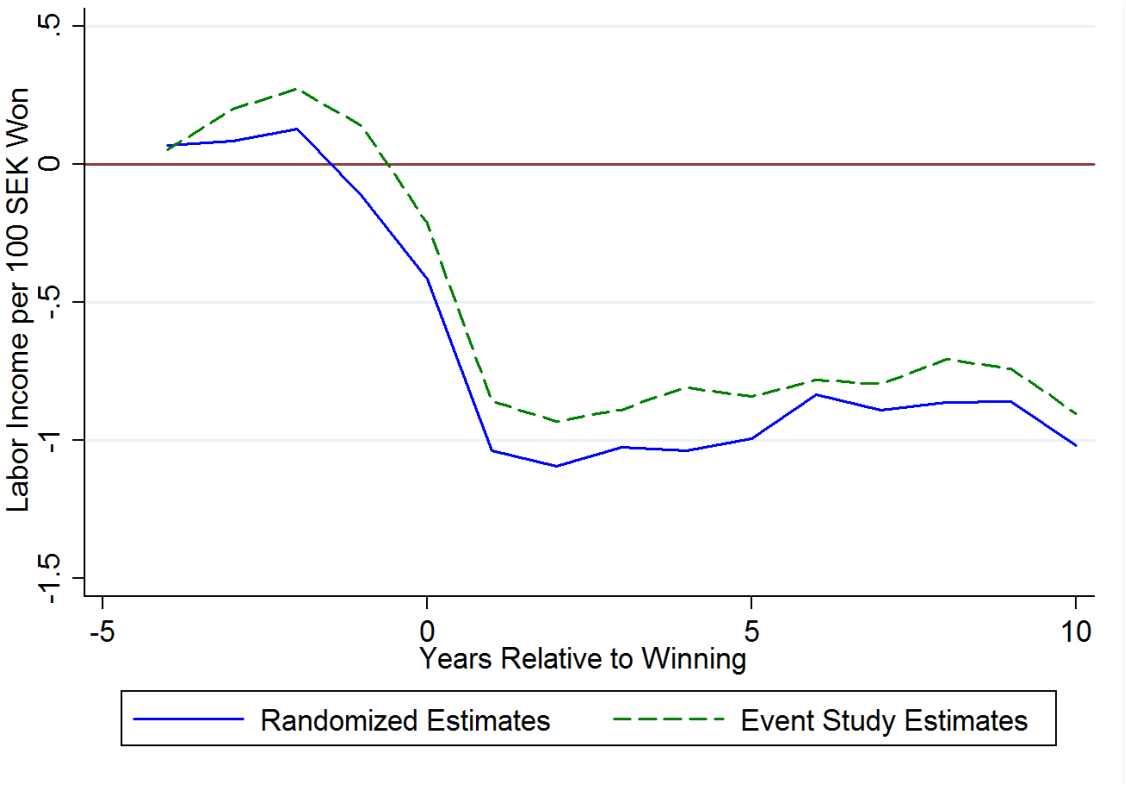
Figure 1: The Effect of Wealth on (Individual) Labor Earnings Over Time, Pooled Lottery Sample



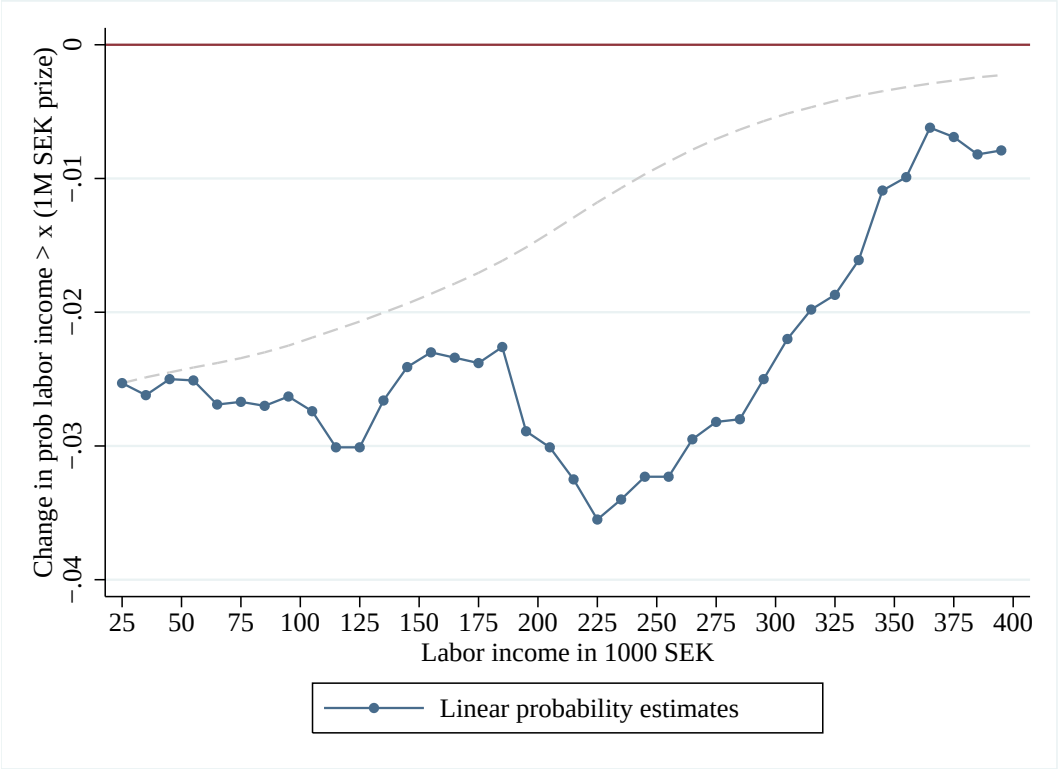
Notes: This figure reports results from regressions using labor income as dependent variable for the pooled sample of lottery winners. The figure reports coefficients and standard errors on each year before and after winning the prize. The sample is restricted to lottery winners who won between the ages of 21 and 64.

Figure 2: Wealth Effect Estimates Over Time, Pooled Lottery Sample, Observational (Event-Study) Estimates



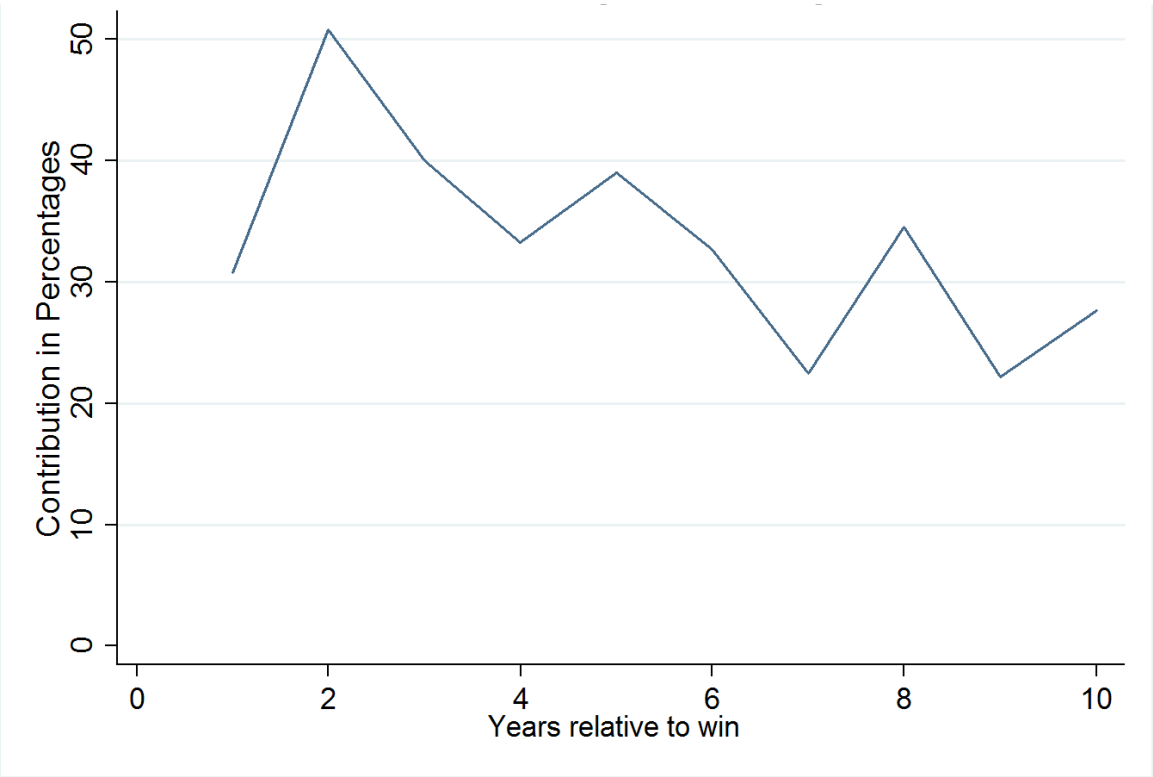
Notes: This figure reports results from regressions using labor income as dependent variable for the pooled sample of lottery winners. The figure reports coefficients and standard errors on each year before and after winning the prize. The sample is restricted to lottery winners who won between the ages of 21 and 64. The solid line reproduces the estimates from Figure 1, while the dashed line reports estimates which replace cell fixed effects (needed to ensure conditional random assignment of lottery prize) with year fixed effects and lottery type fixed effects.

Figure 3: Distributional Effects, Pooled Lottery Sample



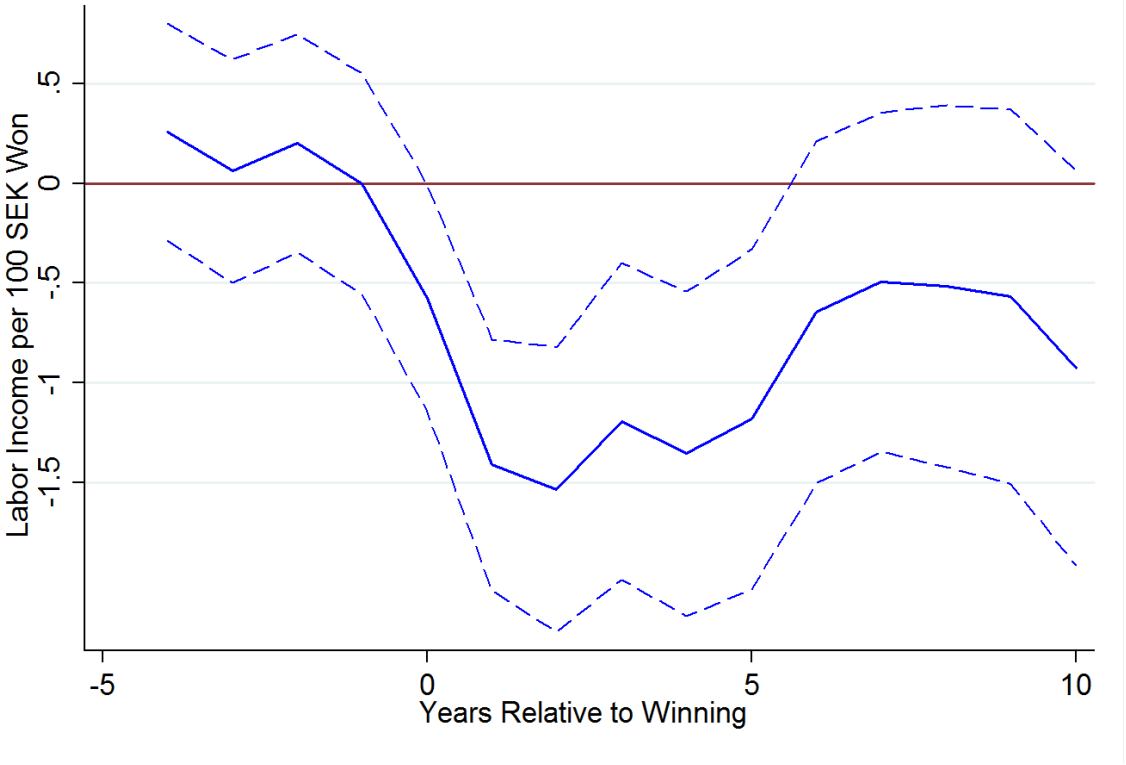
Notes: This figure reports results from a series of linear probability model regressions. Each point on the solid line is from a separate regression which estimates the effect of lottery prize on whether individual reports income above threshold indicated on the horizontal axis. The sample is restricted to lottery winners who won between the ages of 21 and 64. The dashed line indicates the pattern that would arise if the extensive margin effect (column (3), Table 6) was evenly distributed througout the population.

Figure 4: Share of Overall Labor Earnings Response Due To Extensive Margin Over Time



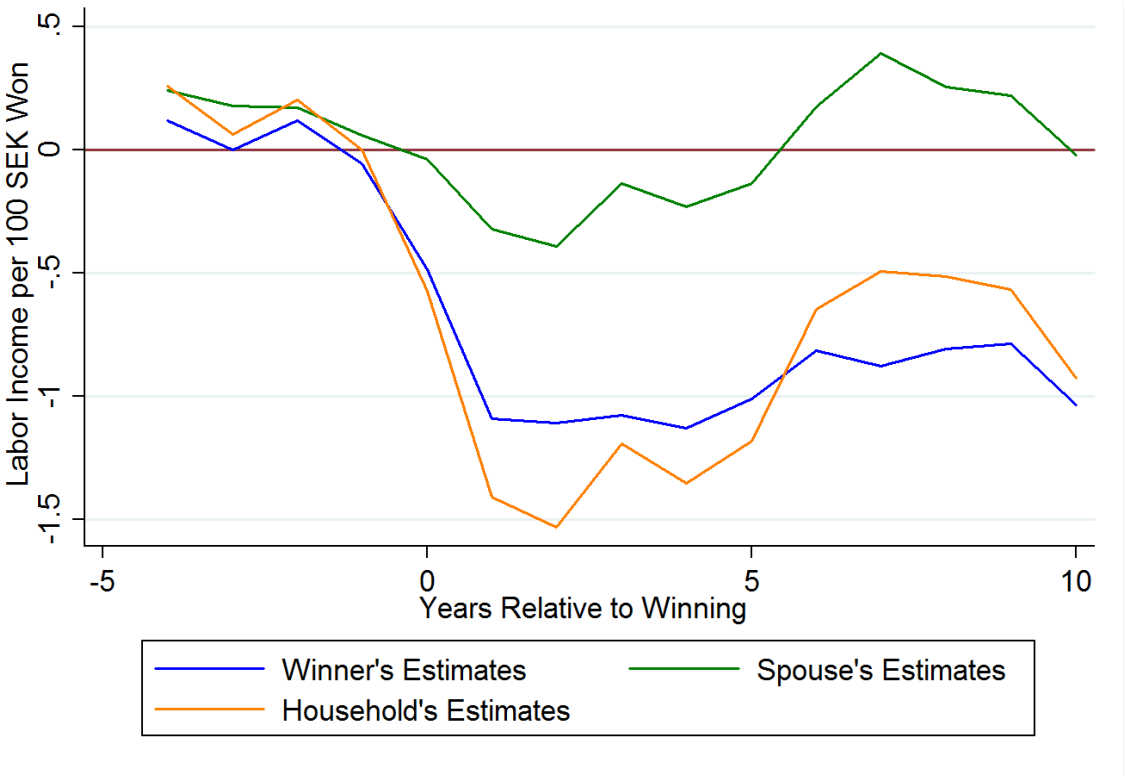
Notes: This figure reports the share of overall labor earnings response that is accounted for by extensive margin adjustments (where extensive margin is defined as less than 25k SEK in earnings). The sample is restricted to lottery winners who won between the ages of 21 and 64.

Figure 5: The Effect of Wealth on Household Labor Earnings



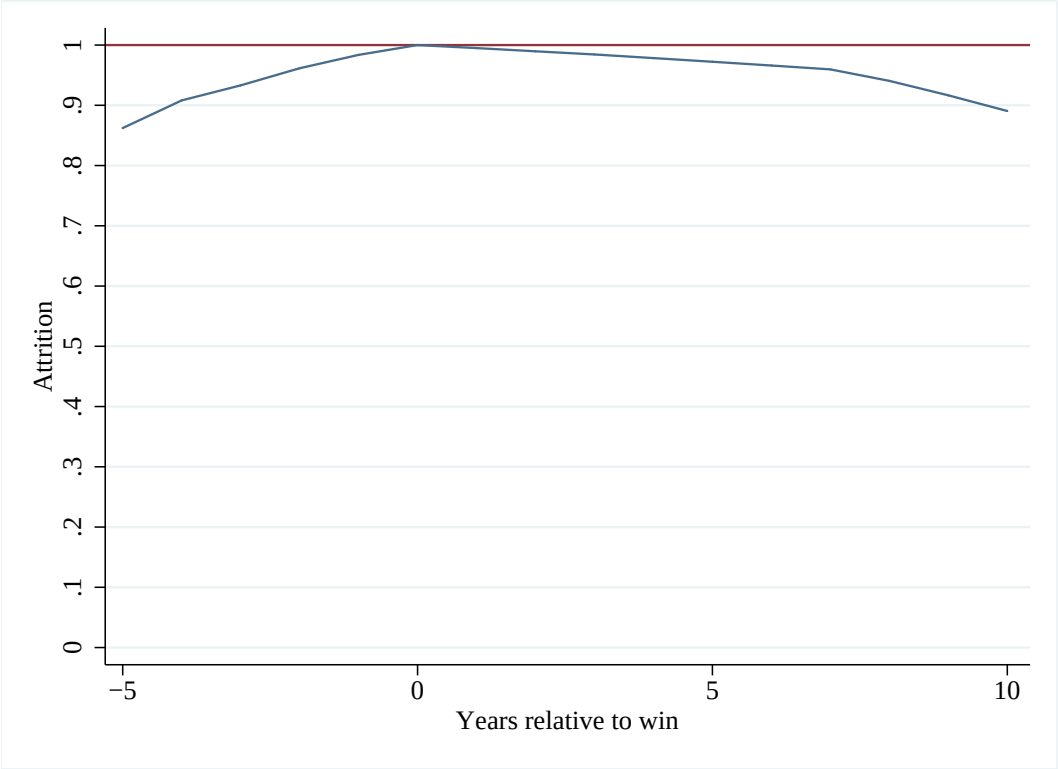
Notes: This figure reports results from regressions using total household labor earnings as dependent variable for the pooled sample of lottery winners. The figure reports coefficients and standard errors on each year before and after winning the prize. The sample is restricted to lottery winners who won between the ages of 21 and 64.

Figure 6: Decomposing Household Earnings Wealth Effects Across Spouses



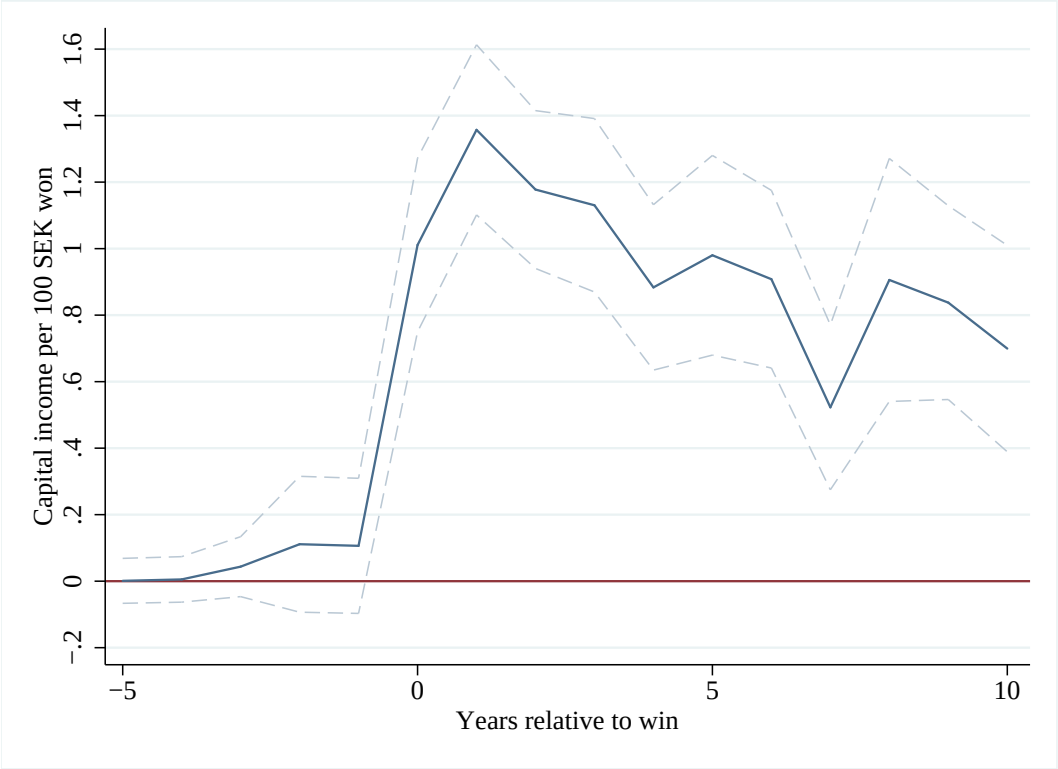
Notes: This figure reports results from regressions using individual labor earnings (for individual lottery winner and spouse separately) as dependent variable for the pooled sample of lottery winners. These results are then compared to results that are based on the total household labor earnings (summed across the two spouses). The figure reports coefficients and standard errors on each year before and after winning the prize. The sample is restricted to lottery winners who won between the ages of 21 and 64.

Appendix Figure A1: Attrition Over Time, Pooled Lottery Sample



Notes: This figure reports the share of the pooled lottery winner sample available each year, for years before and after the prize event. This figure is based on the restricted sample of lottery winners who won between the ages of 21 and 64.

Appendix Figure A2: Lottery Prizes and Capital Income, Pooled Lottery Sample



Notes: This figure reports the dynamic effects of winning lottery prize on capital income. This figure is based on the restricted sample of lottery winners who won between the ages of 21 and 64.

Table 1
Description of Sample Restrictions

	PLS		Kombi		Triss		Klöver	
	Total	Change	Total	Change	Total	Change	Total	Change
Original Population								
Sample Delivered to Statistics Sweden								
Sample Returned from Statistics Sweden			[TO BE COMPLETED]					
Sample after Quality Control								
Final Estimation Sample Unique								
Final Estimation Sample								

Notes: This table describes the construction of the final estimation sample. The top row is the number of players in each of the four original lottery populations. The original PLS population comprises all individuals who owned at least one ticket in the draws conducted between December 1986 and June 1994. The Kombi population comprises individuals who owned at least one ticket in one of the draws conducted between November 1998 and December 2010. The Triss population comprises all individuals who won a prize in the televised Triss lottery between 1994 and 2010 and did not share ownership of the winning ticket. The Klöver comprises all individuals who won a prize in the televised Klöver lottery conducted between 1997 and 2010 and did not share ownership of the winning ticket. For each of the four lotteries, we constructed a dataset with individual-level data (the exact variables vary by lottery) and players' social security numbers. For details, see appendices A through C. Statistics Sweden used the social security numbers to match the individuals to administrative records. The third row gives the number of social security numbers successfully matched. The fourth row gives the sample size after dropping observations with suspicious social security numbers. A security number is suspicious if at least one of the following holds: (1) the social security number is a duplicate and can therefore not be uniquely linked to an individual, or (2) according to the date of birth or recorded date of death (or both) are inconsistent with the dates on which the observation appears in the lottery data. The fifth row is the number of unique individuals in the final estimation sample. The bottom row gives the number of observations in the final estimation sample.

Table 2
Overview of Identification Strategies

	Time Period	Treatment Variable	Cell Definition for Identification
PLS: Fixed prizes	1979-2003	Prize	Prize Draw x Number of prizes
PLS: Odds prizes	1986-1994	Prize	Prize Draw x Account balance
Kombi	1997-2010	Prize	Prize Draw x Balance
Triss	1994-2010	Prize	Year
Klöver	1997-2010	NPV of Prize	Year

Notes: This table provides an overview of the identification strategy used in our baseline regressions. The final column lists the variables that are used to construct the fixed effects that we control for in the specifications in order to achieve conditional random assignment of lottery prize. For Kobmi sample, all account holders except non-winners not successfully matched are included. For Triss sample, multiple winners are not included. NPV of prize computed assuming annual discount rate of 2%.

Table 3
Distribution of Prizes

	Pooled Sample of All Lotteries		Individual Lottery Samples							
			PLS		Kombi		Triss		Klöver	
	Count	Share	Count	Share	Count	Share	Count	Share	Count	Share
0 to 1K SEK	5,264	0.015	12	0.000	5,252	0.952	0	0.000	0	0.000
1K to 10K SEK	300,734	0.865	300,734	0.890	0	0.000	0	0.000	0	0.000
10K to 100K SEK	34,493	0.099	33,472	0.099	0	0.000	1,021	0.268	0	0.000
100K to 500K SEK	5,093	0.015	2,698	0.008	0	0.000	2,395	0.628	0	0.000
500K to 1M SEK	476	0.001	279	0.001	0	0.000	197	0.052	0	0.000
≥1M SEK	1,684	0.005	567	0.002	264	0.048	201	0.053	652	1.000
TOTAL	347,744		337,762		5,516		3,814		652	

Notes: This table reports the distribution of the lottery prizes for our overall sample and across each individual lottery sample. The sample is restricted to those aged 21-64 at time of win, and the prize ranges reported in the rows is inclusive from below and exclusive from above.

Table 4
Demographics of Lottery Winners Compared to the General Population

	PLS				Kombi				Triss				Klöver			
	Unweighted Sample		Prize Reweighted		Unweighted Sample		Prize Reweighted		Unweighted Sample		Prize Reweighted		Unweighted Sample		Prize Reweighted	
	Mean	σ	Mean	σ	Mean	σ	Mean	σ	Mean	σ	Mean	σ	Mean	σ	Mean	σ
Birth year	1943.6	12.3	1941.5	12.2	1950.1	8.7	1950.4	9.1	1956.9	12.8	1955.4	12.9	1958.4	12.2	1957.8	12.1
1 if Female	0.51	0.50	0.51	0.50	0.44	0.50	0.38	0.49	0.51	0.50	0.52	0.50	0.49	0.50	0.50	0.50
1 if College	0.16	0.37	0.15	0.36	0.10	0.29	0.09	0.29	0.12	0.33	0.14	0.34	0.13	0.34	0.13	0.34
1 if Spouse	0.64	0.48	0.65	0.48	0.63	0.48	0.55	0.50	0.59	0.49	0.63	0.48	0.61	0.49	0.62	0.49
Labor Income	186.8	138.7	183.3	130.1	225.0	158.5	222.9	151.4	197.0	149.8	191.9	143.2	218.8	153.6	215.9	156.1
1 if Labor Income >25k	0.83	0.38	0.83	0.37	0.81	0.39	0.82	0.39	0.80	0.40	0.80	0.40	0.82	0.39	0.81	0.39
Capital Income	7.1	42.6	8.3	35.5	-3.9	45.8	-3.4	43.8	-6.8	46.2	-5.4	50.7	-5.6	44.2	-4.1	50.5
Spousal Labor Income	175.9	153.5	172.1	146.4	206.0	157.0	191.5	145.3	201.7	162.5	187.3	169.2	221.8	165.2	220.0	164.7
Spousal Capital Income	3.5	42.9	4.1	31.9	-3.3	44.8	-3.7	48.2	-7.3	51.1	-6.0	53.9	-7.0	45.8	-6.6	44.0
Spousal Labor Income >25k	0.85	0.36	0.85	0.35	0.84	0.37	0.84	0.37	0.86	0.35	0.82	0.38	0.87	0.34	0.87	0.34
Household Income	301.0	219.7	296.0	203.6	354.3	239.7	328.6	221.7	317.0	234.8	310.1	233.5	354.5	249.4	353.8	249.8

	Representative Sample 1990		Matched on Sex and Age		Representative Sample 2000		Matched on Sex and Age		Representative Sample 2000		Matched on Sex and Age		Representative Sample 2000		Matched on Sex and Age	
	Mean	σ	Mean	σ	Mean	σ	Mean	σ	Mean	σ	Mean	σ	Mean	σ	Mean	σ
Birth year	1949.1	12.2	1943.6	12.3	1957.8	12.2	1950.1	8.7	1957.8	12.2	1956.9	12.8	1957.8	12.2	1958.4	12.2
1 if Female	0.49	0.50	0.51	0.50	0.50	0.50	0.44	0.50	0.50	0.50	0.51	0.50	0.50	0.50	0.49	0.50
1 if College	0.16	0.36	0.14	0.35	0.21	0.41	0.17	0.38	0.21	0.41	0.20	0.40	0.21	0.41	0.21	0.41
1 if Spouse	0.53	0.50	0.63	0.48	0.53	0.50	0.62	0.49	0.53	0.50	0.56	0.50	0.53	0.50	0.56	0.50
Labor Income	167.5	126.3	163.3	134.7	182.5	154.5	212.5	179.6	182.5	154.5	195.7	163.7	182.5	154.5	209.6	170.6
1 if Labor Income >25k	0.82	0.38	0.77	0.42	0.76	0.43	0.74	0.44	0.76	0.43	0.77	0.42	0.76	0.43	0.77	0.42
Capital Income	2.8	12.8	-1.1	35.3	1.5	52.9	2.7	61.9	1.5	52.9	-2.5	51.2	1.5	52.9	-0.7	55.0
Spousal Labor Income	179.5	140.6	169.1	144.5	203.7	167.5	213.2	179.9	203.7	167.5	209.9	175.9	203.7	167.5	225.4	183.4
Spousal Capital Income	3.0	14.4	-2.2	37.7	-1.1	55.7	1.2	59.1	-1.1	55.7	-4.9	54.8	-1.1	55.7	-2.1	59.3
Spousal Labor Income >25k	0.89	0.31	0.84	0.37	0.85	0.35	0.82	0.38	0.85	0.35	0.85	0.36	0.85	0.35	0.86	0.35
Household Income	262.4	197.6	272.1	212.2	292.8	244.4	348.8	279.2	292.8	244.4	316.6	259.3	292.8	244.4	339.0	270.5

Notes: This table compares the lottery players in the four samples to the general population. The upper panel gives descriptive statistics for the sample of winners. The first column under each lottery name provides summary statistics for the sample of winners (Unweighted Sample). To eliminate the possibility that the descriptive statistics reflect the outcome of the lottery, each variable is measured the year before the individual in question won. The second column is analogous except that the sample has been reweighted with a set of weights proportional to the prize amount (Prize Reweighted). The lower panel shows descriptive characteristics for a representative sample. For each lottery, we draw a representative sample in a particular year and report the descriptive statistics for the variables measured in that same year. We compare the PLS winners to a representative sample drawn in 1990 (Representative Sample 1990). The Kombi, Triss and Klöver samples are compared to a random population sample drawn in 2000 (Representative Sample 2000). The second column (Matched on Year of Birth and Sex) reports the summary statistics for the random population sample reweighted so that its age and birth-year distribution exactly matches the distribution of winners in each of the lotteries. We match each winner to all members of the representative sample with the exact same year of birth and sex. We measure the covariates of the successfully matched members of the representative sample the year before the winner to whom they were matched won the prize. All samples are restricted to individuals aged 21-64 the year that the variable is measured.

Table 5
Pseudo-Randomization and Placebo Tests

Sample:	Pooled Sample		Individual Lottery Samples							
			PLS		Kombi		Triss		Klöver	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Omnibus p-value	[0.646]	[0.000]	[0.736]	[0.013]	[0.450]	[0.000]	[0.343]	[0.527]	[0.319]	[0.000]
Baseline controls:										
1 if Female	0.154	0.434	0.082	0.035	-15.972	-16.373	-0.302	-1.253	188.975	146.610
	(0.468)	(0.683)	(0.260)	(0.280)	(8.121)	(7.654)	(24.554)	(24.285)	(121.451)	(126.313)
	[0.742]	[0.525]	[0.751]	[0.902]	[0.049]	[0.032]	[0.990]	[0.959]	[0.120]	[0.246]
Age	0.060	-0.585	-0.005	0.014	0.231	-0.496	-6.839	-5.807	36.424	47.108
	(0.158)	(0.231)	(0.086)	(0.093)	(4.399)	(4.241)	(8.940)	(8.932)	(39.988)	(40.970)
	[0.704]	[0.012]	[0.955]	[0.881]	[0.958]	[0.907]	[0.444]	[0.516]	[0.363]	[0.251]
Age^2	-0.000	0.006	-0.000	-0.001	-0.006	0.003	0.109	0.094	-0.433	-0.602
	(0.002)	(0.003)	(0.001)	(0.001)	(0.045)	(0.043)	(0.105)	(0.105)	(0.458)	(0.463)
	[0.812]	[0.018]	[0.934]	[0.610]	[0.898]	[0.942]	[0.295]	[0.367]	[0.345]	[0.194]
Labor income in previous year	0.000	0.011	0.000	-0.000	-0.013	-0.018	-0.023	-0.079	0.406	-0.158
	(0.002)	(0.003)	(0.001)	(0.001)	(0.024)	(0.023)	(0.081)	(0.082)	(0.483)	(0.490)
	[0.851]	[0.000]	[0.901]	[0.743]	[0.589]	[0.435]	[0.774]	[0.336]	[0.401]	[0.747]
Capital income in previous year	0.008	-0.050	-0.001	0.006	0.028	0.020	0.156	0.104	3.122	2.571
	(0.009)	(0.011)	(0.002)	(0.003)	(0.074)	(0.070)	(0.381)	(0.382)	(3.005)	(2.758)
	[0.374]	[0.000]	[0.645]	[0.019]	[0.702]	[0.777]	[0.681]	[0.785]	[0.299]	[0.352]
Education FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cell FEs	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
N	342,444	342,484	332,474	332,514	5,513	5,513	3,805	3,805	652	652

Notes: This table reports results from tests for random assignment of lottery prizes. The omnibus p-value is from the test of the joint significant of age, age squared, sex, lagged labor income and lagged capital income. The first column shows the specification that includes the controls for the cell fixed effects which achieve conditional random assignment of lottery prizes. The second column under each heading shows the p-value from a specification where the cell fixed effects are not included.

Table 6
The Effect of Wealth on Labor Earnings

	Labor earnings (1k)		Labor earnings > 25k SEK		Longer run labor earnings (1k)		
	1 year after win	2 years after win	1 year after win	2 years after win	3-year total	5-year total	10-year total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Prize amount (in 100k SEK)	-1.036	-1.093	-0.0017	-0.0025	-2.966	-4.582	-9.436
	(0.133)	(0.169)	(0.0005)	(0.0006)	(0.449)	(0.714)	(1.523)
	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]
N	340,053	338,179	340,053	338,179	336,105	331,409	311,756
R^2	0.756	0.687	0.393	.4078489	0.737	0.714	0.679

Notes: The sample is restricted to lottery participants who were between the age of 21 and 64 at the time of winning the lottery or being assigned to the control group. All earnings and prize amounts are in 2010 Swedish Krona (SEK). The baseline controls include an indicator variable for gender, a quintic in age, educational attainment and controls for last year's labor earnings. Standard errors are clustered by individual and are reported in parentheses, and p-values are in brackets.

Table 7
The Effect of Wealth on Labor Earnings: Heterogeneity by Lottery

	Labor earnings		Labor earnings		Longer-run labor earnings		
	1 year after win	2 years after win	1 year after win	2 years after win	3-year total	5-year total	10-year total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Prize amount	-0.866	-1.069	-0.0008	-0.0020	-3.389	-5.730	-9.302
[PLS lottery is omitted category]	(0.182)	(0.211)	(0.0008)	(0.0009)	(0.560)	(0.973)	(2.072)
	[0.000]	[0.000]	[0.333]	[0.026]	[0.000]	[0.000]	[0.000]
Prize amount × Kombi	-0.428	0.115	0.0001	0.0006	-0.433	-0.811	4.285
	(0.548)	(0.622)	(0.0021)	(0.0022)	(1.789)	(3.539)	(10.796)
	0.435	[0.853]	[0.949]	[0.776]	[0.809]	[0.819]	[0.691]
Prize amount × Triss	-0.171	0.323	-0.0019	-0.0004	1.090	2.733	0.297
	(0.319)	(0.384)	(0.0014)	(0.0015)	(1.053)	(1.800)	(3.741)
	[0.593]	[0.400]	[0.151]	[0.774]	[0.300]	[0.129]	[0.937]
Prize amount × Klover	-0.367	-0.654	-0.0010	-0.0019	0.353	1.717	-3.450
	(0.416)	(0.552)	(0.0015)	(0.0019)	(1.655)	(2.621)	(7.272)
	[0.377]	[0.237]	[0.528]	[0.320]	[0.831]	[0.513]	[0.635]
F-tests of equality of effects by type of lottery							
p-value of test of (2) = (3) = (4) = 0	[0.753]	[0.403]	[0.502]	[0.735]	[0.728]	[0.442]	[0.934]
p-value of test of (1) + (2) = 0	[0.011]	[0.099]	[0.713]	[0.492]	[0.023]	[0.052]	[0.634]
p-value of test of (1) + (3) = 0	[0.000]	[0.012]	[0.005]	[0.019]	[0.005]	[0.030]	[0.002]
p-value of test of (1) + (4) = 0	[0.001]	[0.001]	[0.143]	[0.015]	[0.045]	[0.092]	[0.063]
N	340,053	338,179	340,053	338,179	336,105	331,409	311,756
R^2	0.756	0.687	0.393	0.408	0.737	0.714	0.679

Notes: This table reports results of estimating equation (1) on the baseline sample of lottery winners. All earnings and prize amounts are in 2010 Swedish Krona (SEK). Panel A investigates nonlinear treatment effects directly by estimating a quadratic in prize amount, while Panel B allows for a linear spline with a knot at 1M SEK. The baseline controls include an indicator variable for gender, a quintic in age, and controls for last year's labor earnings and capital income. Standard errors are clustered by individual and are reported in parentheses, and p-values are in brackets.

Table 8
The Effect of Wealth on Labor Earnings: Testing for Nonlinear Effects

	Labor earnings		Labor earnings > 25k SEK		Longer-run labor earnings		
	1 year after win	2 years after win	1 year after win	2 years after win	3-year total	5-year total	10-year total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Panel A: Quadratic specification				
Prize amount (in 100k SEK)	-0.826	-0.663	-0.001	-0.001	-2.823	-5.977	-8.996
	(0.191)	(0.258)	(0.001)	(0.001)	(0.839)	(1.039)	(2.282)
	[0.000]	[0.010]	[0.081]	[0.286]	[0.001]	[0.000]	[0.000]
$(\text{Prize amount})^2$	-0.006	-0.013	0.000	0.000	-0.005	0.051	-0.020
	(0.005)	(0.008)	(0.000)	(0.000)	(0.031)	(0.037)	(0.087)
	[0.269]	[0.131]	[0.568]	[0.055]	[0.882]	[0.167]	[0.821]
R^2	0.756	0.687	0.393	0.408	0.737	0.714	0.679
			Panel B: Splines				
Prize amount (in 100k SEK)	-1.027	-0.984	-0.001	-0.002	-3.470	-5.910	-8.790
	(0.179)	(0.207)	(0.001)	(0.001)	(0.549)	(0.939)	(2.044)
	[0.000]	[0.000]	[0.093]	[0.034]	[0.000]	[0.000]	[0.000]
Prize amount ×	-0.016	-0.221	-0.001	-0.002	1.081	3.131	-1.892
1{Prize $\geq$ 1M SEK}	(0.354)	(0.459)	(0.001)	(0.002)	(1.269)	(2.008)	(4.624)
	[0.963]	[0.631]	[0.543]	[0.303]	[0.394]	[0.119]	[0.682]
R^2	0.756	0.687	0.393	0.408	0.737	0.714	0.679
N	340,053	338,179	340,053	338,179	336,105	331,409	311,756
Include baseline controls	y	y	y	y	y	y	y

Notes: This table reports results of estimating equation (1) on the baseline sample of lottery winners. All earnings and prize amounts are in 2010 Swedish Krona (SEK). Panel A investigates nonlinear treatment effects directly by estimating a quadratic in prize amount, while Panel B allows for a linear spline with a knot at 1M SEK. The baseline controls include an indicator variable for gender, a quintic in age, and controls for last year's labor earnings and capital income. Standard errors are clustered by individual and are reported in parentheses, and p-values are in brackets.

Table 9
The Effect of Wealth on Labor Earnings: Heterogeneity by Demographics

	Labor earnings		Labor earnings > 25k SEK		Longer-run labor earnings		
	1 year after win	2 years after win	1 year after win	2 years after win	3-year total	5-year total	10-year total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Panel A: Age				
Prize amount (in 100k SEK)	-0.848	-0.891	-0.002	-0.002	-2.402	-3.992	-9.293
	(0.235)	(0.269)	(0.001)	(0.001)	(0.710)	(1.263)	(2.971)
	[0.000]	[0.001]	[0.142]	[0.115]	[0.001]	[0.002]	[0.002]
Prize amount ×	-0.201	-0.222	-0.001	-0.001	-0.640	-0.885	-0.918
1{35 ≤ Age ≤ 54}	(0.261)	(0.306)	(0.001)	(0.001)	(0.829)	(1.470)	(3.352)
	[0.441]	[0.468]	[0.527]	[0.369]	[0.440]	[0.547]	[0.784]
Prize amount ×	-0.240	-0.254	0.001	-0.001	-0.697	-0.440	0.985
1{55 ≤ Age ≤ 64}	(0.276)	(0.316)	(0.001)	(0.001)	(0.856)	(1.550)	(3.757)
	[0.384]	[0.421]	[0.616]	[0.513]	[0.416]	[0.777]	[0.793]
R^2	0.756	0.687	0.393	0.408	0.737	0.714	0.679
			Panel B: Gender				
Prize amount (in 100k SEK)	-1.214	-1.260	-0.001	-0.002	-3.428	-4.748	-9.075
	(0.179)	(0.232)	(0.001)	(0.001)	(0.624)	(0.946)	(2.075)
	[0.000]	[0.000]	[0.081]	[0.002]	[0.000]	[0.000]	[0.000]
Prize amount × Female	0.345	0.318	-0.001	0.000	0.869	0.316	-0.718
	(0.197)	(0.245)	(0.001)	(0.001)	(0.666)	(1.116)	(2.511)
	[0.079]	[0.196]	[0.115]	[0.724]	[0.192]	[0.777]	[0.775]
R^2	0.756	0.687	0.393	0.408	0.737	0.714	0.679
			Panel C: Education				
Prize amount (in 100k SEK)	-1.008	-0.986	-0.001	-0.002	-2.653	-3.838	-8.951
	(0.146)	(0.181)	(0.001)	(0.001)	(0.488)	(0.746)	(1.721)
	[0.000]	[0.000]	[0.010]	[0.000]	[0.000]	[0.000]	[0.000]
Prize amount ×	-0.103	-0.402	-0.001	0.000	-1.188	-2.880	-1.753
1{College education}	(0.247)	(0.302)	(0.001)	(0.001)	(0.847)	(1.519)	(3.346)
	[0.676]	[0.184]	[0.374]	[0.682]	[0.161]	[0.058]	[0.600]
R^2	0.756	0.687	0.393	0.408	0.737	0.714	0.679
N	340,053	338,179	340,053	338,179	336,105	331,409	311,756
Include baseline controls	y	y	y	y	y	y	y

Notes: This table reports results of estimating equation (1) on the baseline sample of lottery winners. All earnings and prize amounts are in 2010 Swedish Krona (SEK). The baseline controls include an indicator variable for gender, a quintic in age, and controls for last year's labor earnings and capital income. Standard errors are clustered by individual and are reported in parentheses, and p-values are in brackets.

Table 10

The Effect of Wealth on Labor Earnings: Heterogeneity by Previous Earnings

	Labor earnings		Labor earnings > 25k SEK		Longer-run labor earnings		
	1 year after win	2 years after win	1 year after win	2 years after win	3-year total	5-year total	10-year total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Prize amount	-0.066	-0.023	-0.014	-0.012	-0.123	0.147	-0.288
[earnings$_{t-1}$ < 25k SEK omitted category]	(0.142)	(0.191)	(0.001)	(0.001)	(0.478)	(0.872)	(2.337)
	[0.641]	[0.904]	[0.000]	[0.000]	[0.797]	[0.866]	[0.902]
Prize amount ×	-0.509	-0.245	0.016	0.014	-0.696	-0.389	-3.057
25k SEK $\leq$ earnings$_{t-1}$ < 100k SEK	(0.238)	(0.317)	(0.002)	(0.002)	(0.830)	(1.665)	(4.664)
	[0.033]	[0.440]	[0.000]	[0.000]	[0.401]	[0.815]	[0.512]
Prize amount ×	-1.066	-1.422	0.020	0.016	-3.999	-8.077	-18.591
100k SEK $\leq$ earnings$_{t-1}$ < 200k SEK	(0.214)	(0.258)	(0.002)	(0.001)	(0.684)	(1.237)	(3.004)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Prize amount ×	-1.373	-1.371	0.016	0.014	-3.582	-5.832	-12.025
200k SEK $\leq$ earnings$_{t-1}$ < 300k SEK	(0.200)	(0.240)	(0.001)	(0.001)	(0.633)	(1.080)	(2.963)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Prize amount ×	-1.370	-1.645	0.008	0.005	-4.471	-6.219	-3.294
300k SEK $\leq$ earnings$_{t-1}$	(0.317)	(0.432)	(0.001)	(0.001)	(1.228)	(2.246)	(5.439)
	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]	[0.006]	[0.545]
F-tests of equality of effects by previous earnings							
p-value of test of (2) = (3) = (4) = (5) = 0	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
p-value of test of (1) + (2) = 0	[0.010]	[0.350]	[0.221]	[0.268]	[0.287]	[0.876]	[0.434]
p-value of test of (1) + (3) = 0	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
p-value of test of (1) + (4) = 0	[0.000]	[0.000]	[0.001]	[0.091]	[0.000]	[0.000]	[0.000]
p-value of test of (1) + (5) = 0	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.007]	[0.488]
N	340,053	338,179	340,053	338,179	336,105	331,409	311,756
R^2	0.756	0.687	0.394	0.408	0.737	0.714	0.679

Notes: This table reports results of estimating equation (1) on the baseline sample of lottery winners. All earnings and prize amounts are in 2010 Swedish Krona (SEK). The baseline controls include an indicator variable for gender, a quintic in age, and controls for last year's labor earnings and capital income. Standard errors are clustered by individual and are reported in parentheses, and p-values are in brackets.

Table 11
The Effect of Wealth on Household Labor Earnings

	Labor earnings		Labor earnings > 25k SEK		Longer-run labor earnings		
	1 year after win	2 years after win	1 year after win	2 years after win	3-year total	5-year total	10-year total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Labor Earnings of Winners and Spouses							
Winners							
Prize amount (in 100k SEK)	-1.112	-1.088	-0.001	-0.003	-2.808	-4.485	-9.438
	(0.180)	(0.206)	(0.001)	(0.001)	(0.537)	(0.921)	(2.007)
	[0.000]	[0.000]	[0.043]	[0.001]	[0.000]	[0.000]	[0.000]
Spouses							
Prize amount (in 100k SEK)	-0.236	-0.400	0.000	-0.001	-0.607	-1.846	-1.599
	(0.166)	(0.239)	(0.001)	(0.001)	(0.604)	(1.134)	(2.748)
	[0.155]	[0.094]	[0.870]	[0.349]	[0.316]	[0.104]	[0.561]
p-value of test of equal effects	[0.001]	[0.024]	[0.103]	[0.040]	[0.007]	[0.061]	[0.018]
Panel B: Total Labor Earnings of Household							
Prize amount (in 100k SEK)	-1.407	-1.531	-0.0003	-0.0016	-3.568	-5.667	-8.407
	(0.326)	(0.362)	(0.0005)	(0.0006)	(1.053)	(1.811)	(3.759)
	[0.000]	[0.000]	[0.597]	[0.009]	[0.001]	[0.002]	[0.025]
N	221,973	220,868	221,973	220,868	219,695	216,949	205,115
Include baseline controls	y	y	y	y	y	y	y

Notes: This table reports results of estimating equation (1) on the baseline sample of lottery winners. All earnings and prize amounts are in 2010 Swedish Krona (SEK). Panel A investigates nonlinear treatment effects directly by estimating a quadratic in prize amount, while Panel B allows for a linear spline with a knot at 1M SEK. The baseline controls include an indicator variable for gender, a quintic in age, and controls for last year's labor earnings and capital income. Standard errors are clustered by individual and are reported in parentheses, and p-values are in brackets.

Table 12:
Labor Earnings Response to Winning the Sweepstakes: Comparison to Kimball-Shapiro (2008)

	Household		Single		Single Married		Dual-Earned Married	
Change in Earnings	KS	CLNO	KS	CLNO	KS	CLNO	KS	CLNO
0 to 10%		0.018		0.009		0.111		0.029
		(0.011)		(0.008)		(0.150)		(0.034)
		[0.104]		[0.275]		[0.459]		[0.392]
10-25%		-0.007		-0.003		-0.013		0.009
		(0.006)		(0.005)		(0.022)		(0.032)
		[0.251]		[0.558]		[0.571]		[0.777]
26-49%	[TBD]	0.025	[TBD]	0.015	[TBD]	-0.024	[TBD]	0.130
		(0.012)		(0.010)		(0.022)		(0.035)
		[0.047]		[0.140]		[0.279]		[0.000]
50-90%		0.024		0.017		-0.008		0.075
		(0.013)		(0.014)		(0.041)		(0.027)
		[0.058]		[0.218]		[0.847]		[0.005]
>90%		0.024		0.024		-0.088		-0.002
		(0.011)		(0.013)		(0.081)		(0.001)
		[0.028]		[0.068]		[0.279]		[0.205]

Notes: This table compares our results to those of Kimball and Shapiro (2008) – henceforth K&S. K&S asked Health and Retirement Study respondents how they would change their hours worked in response to winning a "sweepstakes" that would guarantee them their current family income for as long as they live. For comparability with K&S, we rescale our prizes so that they are in units of "sweepstakes". We approximate the number of sweepstakes won by household i by $S_i=P_i/(0.5\times(65-[Age]_i)\times[Inc]_i)$, where P_i is the prize amount, [Inc]_i is the average yearly earnings in household i in the five years preceding the event, and (65-[Age]_i) is the number of years remaining until retirement. We multiply by 0.5 to adjust for the fact that the prize amount is measured net of taxes. In the household analyses, we restrict the sample to household where both spouses were in the labor force in the past five years (earnings >25k). In the individual analyses, we similarly restrict the sample to individuals with an income exceeding 25k in the five years preceding the lottery. Following K&S, we estimate the effect of winning a sweepstake on the probability of cutting down earnings by less than 10%, 10-25%, 26-49%, 50-90%, and more than 90%.

Appendix Table A1
The Effect of Wealth on Household Labor Earnings: Testing for Gender Differences

	Labor earnings		Labor earnings > 25k SEK		Longer-run labor earnings		
	1 year after win	2 years after win	1 year after win	2 years after win	3-year total	5-year total	10-year total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Labor Earnings of Winners and Spouses							
Winners							
Prize amount (in 100k SEK)	-0.863	-0.778	-0.002	-0.003	-1.903	-3.318	-7.457
	(0.198)	(0.233)	(0.001)	(0.001)	(0.550)	(0.969)	(2.316)
	[0.000]	[0.001]	[0.007]	[0.001]	[0.001]	[0.001]	[0.001]
Prize amount ×	-0.508	-0.657	0.002	0.001	-1.900	-2.364	-3.888
1{Husband wins}	(0.265)	(0.310)	(0.001)	(0.001)	(0.847)	(1.512)	(3.475)
	[0.056]	[0.034]	[0.053]	[0.505]	[0.025]	[0.118]	[0.263]
Spouses							
Prize amount (in 100k SEK)	-0.210	-0.371	0.000	-0.001	-0.619	-2.329	-1.153
	(0.238)	(0.310)	(0.001)	(0.001)	(0.826)	(1.593)	(4.277)
	[0.377]	[0.232]	[0.583]	[0.461]	[0.454]	[0.144]	[0.788]
Prize amount ×	-0.054	-0.063	-0.001	0.000	0.026	0.978	-0.877
1{Husband wins}	(0.244)	(0.308)	(0.001)	(0.001)	(0.785)	(1.477)	(4.077)
	[0.826]	[0.838]	[0.485]	[0.907]	[0.974]	[0.508]	[0.830]
Panel B: Total Labor Earnings of Household							
Prize amount (in 100k SEK)	-1.092	-1.132	0.0000	-0.0010	-2.457	-5.493	-8.472
	(0.303)	(0.398)	(0.0010)	(0.0010)	(1.028)	(1.963)	(5.262)
	[0.000]	[0.004]	[0.470]	[0.043]	[0.017]	[0.005]	[0.107]
Prize amount ×	-0.507	-0.701	0.0010	0.0000	-1.727	-1.375	-4.433
1{Husband wins}	(0.363)	(0.467)	(0.0010)	(0.0010)	(1.173)	(2.216)	(5.617)
	[0.163]	[0.134]	[0.150]	[0.752]	[0.141]	[0.535]	[0.430]
N	221,973	220,868	221,973	220,868	219,695	216,949	205,115
Include baseline controls	y	y	y	y	y	y	y

Notes: This table reports results of estimating equation (1) on the baseline sample of lottery winners. All earnings and prize amounts are in 2010 Swedish Krona (SEK). Panel A investigates nonlinear treatment effects directly by estimating a quadratic in prize amount, while Panel B allows for a linear spline with a knot at 1M SEK. The baseline controls include an indicator variable for gender, a quintic in age, and controls for last year's labor earnings and capital income. Standard errors are clustered by individual and are reported in parentheses, and p-values are in brackets.