Labor Supply Effects of Winning a Lottery

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June 10, 2015

Abstract

This paper investigates how winning a substantial lottery prize affects labor supply. Analyzing data from Dutch State Lottery winners, we find that earnings are affected but not employment. Lottery prize winners reduce their hours of work but they do not withdraw from the labor force. We also find that effects of lottery prizes last for several years and materialize predominantly among young single individuals without children.

Keywords: Labor supply, income effects, wealth shocks, lottery players.
JEL classification codes: J29

The authors thank the Dutch State Lottery and Statistics Netherlands (CBS) for making their data available for analysis through a remote access facility by Statistics Netherlands.

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1 Introduction

Income and wage affect the labor supply of individuals. Unless leisure is an inferior good, a change in wages has ambiguous effects on the preferred hours of work because the income effect and substitution effect work in opposite direction. A large part of the empirical literature on labor supply is focused on how a change in wages affects preferences for hours of work, disentangling the income effect from the substitution effect. However, the estimation of labor supply elasticities faces a number of problems (see Keane, 2011, for a discussion). The main problems are related to measurement errors in wages and non-labor income, endogeneity of wages and non-labor income arising from simultaneity or correlation with tastes for work, and unobservability of wages for non-workers. Labor supply changes due to changes in non-labor income may be informative about the income effect but such changes may be endogenous. Individuals with a strong preference for work and weak preferences for leisure may accumulate more assets and therefore have more non-labor income.

Our study presents an analysis of the effects of non-labor income on labor supply using information about lottery prize winners in the Netherlands. Data from lottery prize winners are informative on how labor supply is affected by an exogenous non-labor income shock.[1] The psychology literature reports about a number of surveys of lottery winners. These suggest that lottery prizes tend to reduce labor supply for some individuals but not for the majority of prize winners. Kaplan (1987) analyzes a survey of 576 US lottery winners of whom 139 won 1 million dollar or more. Although the majority of the prize winners did not change their work behavior, of the million dollar winners, 1 in 4 stopped working. Not surprisingly, of the winners of less than 50.000 dollars none stop working. This is in line with Arvey et al. (2004) who survey 117 US lottery winners finding that most winners continue working while only some quit their job or start working part-time. Similar conclusions are drawn in a series of studies based on a survey of 420 Swedish lottery winners. Hedenus (2012) concludes that the majority did not make any adjustment to their working life. Of the others some stopped working, took unpaid full-time leave several times, or reduced their working hours for a shorter or longer period. Furaker and Hedenus (2009) find that few prize winners stopped working, some of them took unpaid full-time leave, but for the vast majority this is less than a month. Some prize winners reduced their working hours, but on average less than 10 hours per week. Hedenus (2009) concludes that young winners living alone take periods of unpaid leave while

[1] Alternatively, the issue of potential endogeneity of non-labor income may be addressed by focusing on labor supply effects of unanticipated inheritances. See for example Joulfaian and Wilhelm (1994) on earnings, and Goodstein (2008) and Brown et al. (2010) on the probability of retirement. In addition, changes in labor supply have also been linked to booms and busts in stock markets, assuming that at least part of these booms and busts are unforeseen. See for example, Hurd et al. (2009) on retirement.

female prize winners without children at home reduce their hours of work.

There are also a few studies in the economics literature that exploit information about lottery prize winners to study labor supply effects. Imbens et al. (2001) use data from the Megabucks lottery in Massachusetts, played in the 1980s, where major prizes are paid out in yearly installments over twenty years, to estimate labor supply effects. They contacted prize winners and asked them questions concerning labor earnings, and an authorization of the release of their Social Security earnings. They find significant income effects, and report a marginal propensity to consume leisure of about 0.11, indicating that an increase on non-labor income of $100,000 would reduce earnings with $11,000. Kuhn et al. (2011) survey winners from the Dutch Postcode Lottery to measure labor market participation and do not find significant effects on earnings.[2] Jacob and Ludwig (2012) study the effects of a housing voucher lottery on labor supply of low-income families in Chicago in the late 1990s. Given that supply of housing vouchers far exceeded demand, a lottery was installed to randomly allocate the vouchers. Families who received the voucher, experienced an increase in permanent income, but also a reduction in their wages through an increase in their marginal tax rate. The authors compare employment and earnings in families who applied and were not offered a voucher with families who applied and were offered a voucher. They find that the housing vouchers reduce both the employment and earnings, and calibrate an income elasticity of -0.09. They also report that the housing vouchers reduced the employment rate of women by 6%, whereas there is no effect on employment of men. Most closely related to our study is Cesarini et al. (2013), who study the effect of lottery prizes on individual and household labor supply in a panel data set of Swedish lottery players. They find significant responses at the intensive and extensive margin, and do not find significant differences according to age or gender.

In our paper, we use panel data from winners of lottery prizes in the Dutch State Lottery and match these with data on individual-level labor supply and with household-level administrative data.[3] Studying the Dutch labor market is particularly interesting. Whereas in many countries adjusting weekly working hours is not easy, in the Netherlands it is usually no problem for workers to adjust their working hours. In the last twenty years, the Dutch government has indeed implemented some policies aimed at removing barriers to part-time work, culminating in 2000 with the possibility for workers to flexibility adjust upward of downward the number of working hours within their current job, unless the request is in conflict with employers' business interest. As a matter of fact, in the Netherlands both among females and males there

[2]This result is not surprising given that the size of the prize is either €12,500 or a BMW-car, so likely not sufficiently high to induce changes in labor market behavior.

[3]Note that once a person enters a lottery, winning the lottery is a random event, exogenous to labor supply. However, participation in a lottery is not a random event. Individuals with a strong preference for leisure may be more likely to participate in the lottery. We return to this issue below when we discuss our econometric model.

are many part-time workers.[4]

We track lottery players and winners over a number of years and study their labor supply responses focusing on employment and earnings. Labor market information from lottery prize winners is an ideal source for estimating the effect of income shocks on labor supply. For one, they come from a random draw, and are thus as close as one can get to an unforeseen, random shock in permanent income. Moreover, lottery prizes are unearned and potentially substantial in size. Our main findings are the following. Winning a substantial lottery prize affects the intensive margin of labor supply but not the extensive margin of labor supply. The lottery prize effects last for several years which suggests that the unexpected non-labor income is used for intertemporal smoothing of labor supply. We also find that the labor supply responses materialize predominantly among younger single individuals without children.

Our contribution to the labor supply literature is threefold. First, we add to the small literature that exploits lottery data to analyze how exogenous shocks to non-labor income affect earnings and employment. Second, as indicated before, we analyze labor supply behavior in a labor market in which workers can easily adjust their labor supply at the intensive margin. Third, our data allow us to explore the heterogeneity of the labor supply effects and indeed we find that this is important.

Our paper is set up as follows. In Section 2 we describe the different data sets and provide descriptive statistics. In Section 3 we present the econometric results. Section 4 concludes.

2 The data

Our empirical analysis is based on datasets from two sources. The first source of data is the State Lottery in The Netherlands (www.staatsloterij.nl). The State Lottery dataset contains information of the State Lottery subscribers in the time window 2005–2008. The second data source is Statistics Netherlands. From Statistics Netherlands we use two datasets also spanning the period from 2005 until 2008: the Municipal Personal Records Database (GBA), containing demographic, family, and residence information of all the people registered in a Dutch municipality and the Social Statistical Database of Jobs (SSB Jobs), containing information on salaried jobs.

In order to guarantee anonymity and confidentiality, the lottery dataset and the GBA dataset were merged by Statistics Netherlands on the basis of the day of birth and address of individuals. Specifically, Statistics Netherlands was provided with a sample of lottery players with

[4] In the Netherlands, in 2013 the average fraction of part-time workers on total employment (15–64 years) was 26.2% for men and 77.0% for women. In the European Union (15 countries), the same statistics were 9.7% for men and 38.2% for women (Eurostat, Labour Force Survey, http://ec.europa.eu/eurostat/web/lfs/data/database).

information on their day of birth, address, lottery prizes, and expenditures in lottery tickets by year. Statistics Netherlands matched this sample with the GBA dataset, and then gave us permission to work with the linked dataset on a terminal located in the Department of Economics of Tilburg University and connected via internet to their servers through a secure connection. In what follows, we describe more in detail the datasets used in this study, and the steps taken to come to the final sample used in the main analysis.

2.1 The lottery data

The Dutch State Lottery sells lottery tickets and organizes monthly draws of a number of winning tickets. Additional draws (maximum three) are organized at special occasions throughout the year, for example, at the end of the year ("Eindejaarstrekking") and at Queen's day ("Koninginnedag").[5] Each ticket consists of a combination of two letters and six numbers. Whether an individual wins a prize and the amount of the prize depend on the degree of correspondence between the letters and numbers on the individual's ticket and those on the tickets drawn. The prize amount also depends on the type of ticket: people can choose between "full" tickets and "partial" tickets. A full ticket costs €15 and pays the full amount if it is a winning ticket. A partial ticket costs €3 and pays one fifth of the full prize if it is a winning ticket. The full prizes in each draw vary from €5 to €1 million. In each draw, the main prize of €1 million (or one fifth of it) is guaranteed for one of the tickets. Draws are repeated until someone wins the main prize. In each draw, also 10 prizes of €100,000, 10 prizes of €25,000, and 20 prizes of €10,000 are allocated to winning tickets. Each draw also has a number of smaller prizes, ranging from €5 to €1,000, which are allocated to tickets in which only part of the numbers overlap with the ones on the winning tickets. For example, in each draw a winning "end number" is drawn. Tickets with codes ending with this number pay a €5 prize. Finally, for an additional amount of money (about 15% extra), players can also play for the so-called "jackpot".[6] The jackpot is an additional large prize, of which the amount is decided by the State Lottery. The jackpot is not guaranteed in each draw and, if there is no ticket that wins the jackpot in a certain draw, the full amount is transferred to the next one.[7]

About half of the individuals who bet in the State Lottery in The Netherlands do so through a subscription. Each month an amount of money is automatically transferred from their bank account to the State Lottery's bank account. For each subscriber, we have information about

[5] In the period of study, there were 55 draws in total (13 in 2005, 14 in 2006, 2007 and 2008).

[6] Unfortunately, we do not have information about which players pay the extra 15% to play for the jackpot.

[7] Table A.1 in Appendix A provides details about the current prize structure. Each year the State Lottery slightly changes the prize structure. In 2005 a main change took place: the jackpot was introduced and the relative number of large prizes was reduced.

their date of birth, address of residence, the amount of prizes they won for each draw in the period 2005–2008, and the amount they spent on lottery tickets in each of these years.[8] The dataset consists of 1,975,665 individuals who subscribed for at least one draw of the State Lottery between 2005 and 2008. In total, 1,913,901 individuals won a strictly positive (but possibly very small) prize. Out of these, we draw a sample of individuals that consists of two subsamples. The first subsample includes all individuals who won more than €1,000 in the sample period, which amounts to 7,663 individuals in total. The second subsample consists of a 1% sample of the remaining individuals, in total 22,070 individuals. The total sample of State Lottery winners, before being matched with the administrative datasets of Statistics Netherlands, thus consisted of 29,733 individuals. For these individuals, we know how much they spent on lottery tickets in each year and how much prize money they win in each year.[9]

2.2 The demographic and labor market data

The data on demographics are in the GBA database and the data on salaried jobs are in the SSB Jobs database. Both databases contain an individual identifier, which allows the data from both sources to be linked. The GBA database includes the date of birth and the address of residence of the individuals, as well as identifiers of other members of the individual's household. The latter information makes it possible to study the impact of lottery prizes at the family level as well, next to the effects at the individual level. The SSB Jobs database contains the following information at the level of each single job by individuals employed by an employer located in the Netherlands. In a first step, Statistics Netherlands merged our lottery dataset with the GBA database on the basis of the date of birth and the address of residence of the lottery players. Statistics Netherlands was able to match about 62% of the individuals of our State Lottery dataset to the GBA database.

In a second step, we linked the merged dataset that resulted from the first step with the SSB Jobs database.[10] In order to calculate the annual labor earnings we summed up all earnings on a yearly basis across the different jobs held by each employee during the year. After this second step, we are left with a sample of 60,601 lottery prize observations covering 18,390 individuals, for whom we have information about the yearly gross salaries from 2005 until 2008.

[8] To be more precise, the information about the amount spent by players by draw we have is the expected yearly amount the player would spend on lottery tickets if he/she would continue his/her subscription for one additional year at the moment of the draw.

[9] We calculated the yearly expenditures by taking the average of the expected yearly expenditures across all draws in each year.

[10] Roughly all individuals who are in the SSB Jobs database can be linked to the GBA database. Exceptions are individuals who work in the Netherlands and live outside the Netherlands, but this is a negligible fraction of the labor market population, and irrelevant for the sample of State Lottery players.

In a third step, we restricted the sample to the working-age population, namely to those individuals who are above 17 and below 65 years of age at the time of the lottery win. This left us with 45,328 lottery prize observations covering 13,391 individuals.[11] In our main analysis, we focus on those individuals who are at work in a salaried job in the year of the prize win. The reason is that we expect a decrease in earnings or employment caused by winning a high lottery prize to occur only for those individuals who have a job in the first place. Our main analysis is based on 35,525 observations, corresponding to 10,871 individuals. In order to check for the robustness of our results, we also report the results from regressions including people who do not have a salaried job in the year of the lottery win. Table 1 gives an overview of the distribution of prizes (a) in the original State Lottery dataset, (b) after merging of the lottery, demographic and labor market data, and (c) in the final sample of players who have a job in the year of winning a lottery prize. As is shown in the table, the distribution of the prizes is very similar in the three samples.

Table 1: Distributions of prizes

	2005	2006	2007	2008	Total
(a) Original State Lottery dataset					
[0, €10,000]	29,365	29,435	29,441	29,473	117,714
(€10,000; €100,000]	262	265	262	229	1,018
>€100,000	106	33	30	31	200
Total	29,733	29,733	29,733	29,733	118,932
(b) After merging with demographic and labor market data					
[0, €10,000]	18,158	18,205	18,208	18,236	72,807
(10,000; €100,000]	163	161	164	135	623
>€100,000	69	24	17	19	129
Total	18,390	18,390	18,390	18,390	73,560
(c) Final sample					
[0, €10,000]	8,953	8,566	8,727	8,836	35,082
(€10,000; €100,000]	100	93	95	72	360
>€100,000	46	18	7	12	83
Total	9,099	8,677	8,829	8,920	35,525

Notes: The table shows the number of lottery prizes below €10,000, between €10,000 and €100,000 and above €100,000 for each year in our sample, and in total. Prizes are in nominal terms (percentages in parentheses).

2.3 Summary statistics

Our aim is to study the effect of lottery winnings on yearly labor earnings and employment in the year of the lottery winning and in subsequent years. Our observed time window covers

[11] Also, since we focus on "standard" individuals, we removed observations related to individuals who are not single, nor living in a couple. These observations come, for example, from young individuals who live with their parents, or from individuals who live in a large family, which is very uncommon. In addition, we removed the observations covering winners of the jackpot lottery prizes larger than €10 million (2 observations). Finally, in order to avoid biases due to observations with uncommon earnings or uncommon time variation in earnings, we also removed those observations lying in the first or last percentiles of the earnings or change in earnings distribution.

four years, from 2005 until 2008. Our main analysis will be based on the estimation of four equations, each characterized by a different moment in which the employment outcomes are measured after lottery participation. More in detail, we estimate the impact of the lottery prize on labor earnings or employment status in the year of the lottery win and one, two and three calendar years later. The more we look ahead, the smaller the number of observations.

Table 2 reports the number of observations and the summary statistics of the variables used in the empirical analysis. The first column displays summary statistics of the sample we used to study the impact of lottery prizes on *current* yearly earnings ($T = 0$). This is the largest sample, as it covers all four years. The subsequent three columns report descriptive statistics for later years ($T = 1, 2, 3$). In the extreme case in which we study the effect three years ahead, we are left with a cross-section: individuals winning a prize in 2005 whose earnings are observed in 2008. The explanatory variables can be split into time-constant and time-varying covariates. Gender and nationality (whether Dutch or not) are the time-constant regressors. The time-varying covariates (age, the number of children in the household, and being single or not) are measured at the time t of lottery winning, with $t = 2005, \cdots, 2008$. The average yearly gross earnings in the full sample are €37,647. In a year, lottery subscribers spend on average €2,664 and win €1,823. The average age of players is 45 years, 31% of the players is female, and 21% is single (the remaining 79% lives in a couple). People with Dutch nationality are over-represented: they represent almost 97% of the sample, whilst they represent about 80% in the Dutch population. Finally, on average, there is one child in lottery players' household. Table 3 reports mean labor earnings and employment rates in the three categories of lottery

Table 2: Summary statistics

	$T=0$		$T=1$		$T=2$		$T=3$	
	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Labor earnings in $t+T$ (€)	37,647	22,174	38,501	27,446	38,145	27,613	37,762	28,393
Lottery winnings in t (€)	1,823	123,772	876	17,541	1,041	20,268	1,223	22,113
Lottery expenditures in t (€)	2,664	3,571	2,593	3,371	2,521	3,014	2,371	2,771
Age in t (years)	45.4	9.5	44.9	9.5	44.7	9.5	44.5	9.5
# children in t	0.94	1.05	0.95	1.06	0.95	1.06	0.95	1.06
Single in t	0.205	0.404	0.203	0.402	0.201	0.401	0.200	0.400
Dutch	0.968	0.176	0.967	0.178	0.968	0.175	0.969	0.172
Female	0.309	0.462	0.309	0.462	0.306	0.461	0.303	0.459
2005	0.256	0.437	–		–		–	
2006	0.244	0.430	0.327	0.469	–		–	
2007	0.249	0.432	0.332	0.471	0.497	0.500	–	
2008	0.251	0.434	0.341	0.474	0.503	0.500	1.000	0.000
Observations	35,525		28,062		18,499		9,182	

Notes: Labor earnings are gross earnings. # Children stands for the number of children in the household. Sample weights are used to take into account that individuals winning less than €1,000 are a 1% random draw from the population of small-prize lottery winners. The time varying covariates are measured at the time t of lottery win, with $t = 2005, \cdots, 2008$. All the monetary values are in real terms (CPI in 2005 = 100).

prizes: small (smaller than €10,000), medium (between €10,000 and €100,000), and large (more than €100,000). This table provides a raw indication of the presence of a relationship

between lottery prizes and labor supply, unconditional on individual characteristics. For example, three years after lottery participation ($T = 3$), large-prize winners earn about €1,100 less than small-prize winners. Also, the employment rate of large-prize winners is about 5 percentage points lower than the employment rate of small-prize winners. The differences one year after participation ($T = 1$) are about €300 and 0.6 percentage points. If we look at $T = 0$, we see that large-prize winners earn about €2,300 less than small-prize winners, suggesting that they work less in the year of winning the large prize. These statistics suggest that lottery prizes might induce some labor supply response, either immediately or after a while. There is

Table 3: Labor supply in T by size of lottery prize (standard errors in parenthesis)

	$T = 0$	$T = 1$	$T = 2$	$T = 3$
		Labor earnings (€)		
[0, €10,000]	37,639 (118.0)	38,466 (164.1)	38,114 (203.7)	37,747 (298.8)
(€10,000, €100,000]	39,876 (1,874.0)	44,248 (2,674.0)	42,713 (2,707.5)	39,609 (2,678.6)
>€100,000	35,305 (2,481.2)	38,158 (4653.0)	35,755 (4,303.2)	36,832 (4,480.3)
		Employment rate		
[0, €10,000]	1.000 (0.000)	0.967 (0.001)	0.944 (0.002)	0.919 (0.003)
(€10,000, €100,000]	1.000 (0.000)	0.977 (0.011)	0.966 (0.015)	0.920 (0.027)
>€100,000	1.000 (0.000)	0.961 (0.027)	0.940 (0.034)	0.870 (0.050)
		Observations		
[0, €10,000]	35,277	27,835	18,301	9,036
(€10,000, €100,000]	188	176	148	100
>€100,000	58	51	50	46

Notes: Standard errors are in parentheses. Labor earnings are yearly gross labor earnings. Sample weights are used to take into account that individuals winning less than €1,000 are a 1% random draw from the population of small-prize lottery winners. Since we focus on individuals who are employed in the year they win the lottery prize, the employment rate at $T = 0$ is equal to 1 by construction. All the monetary values are in real terms (CPI in 2005 = 100).

also quite some variation in the data that seems to be unrelated to prize winning. For example, average labor earnings in each of the categories is higher in $T = 1$ than in $T = 0$. Furthermore, the unconditional relations might be biased due to the presence of omitted variables, especially ticket expenditures. The ticket expenditures might indeed be correlated to both earnings at the time of winning – those who are richer might buy more (or less tickets) – and the probability of winning small and medium prizes. However, the number of tickets bought and the probability of winning a large prize are uncorrelated. In the empirical analysis, we will control for ticket expenditures to solve for the omitted variables problem, as well as for a set of individual and family characteristics potentially affecting labor earnings and employment.

3 Econometric analysis

3.1 Model

We are interested in quantifying the impact of income shocks on the extensive margin and the intensive margin of labor supply. In order to quantify the impact at the intensive margin of labor supply, we study the effect of winning lottery prizes on yearly salaried earnings. At the extensive margin of labor supply, we focus on whether or not the individual's earnings become zero (i.e. the individual disappears from the SSB Jobs database) in the years after the lottery participation.

Under the assumption that leisure time is not an inferior good, we expect a negative impact of winning the lottery on labor supply only for individuals who are employed at the time of winning, and not so for individuals who are not employed at the time of winning. This is the main reason why in our benchmark model, we focus on individuals who are employed at the time of winning a prize. We denote by t the year in which individuals participate in the lottery, with $t = 2005, \ldots, 2008$. Furthermore, we denote by p_{it} the lottery prize of individual i in year t. Finally, we denote by y_{it+T} the outcome variable, where T indicates how many years after the lottery win the outcome variable is measured. When we study the impact at the intensive margin, y_{it+T} will indicate the yearly salaried gross earnings T years after lottery participation, with $T = 0, 1, 2, 3$. When we look at the effect at the extensive margin, y_{it+T} will be a dummy indicator equal to one if individual i was an employee in year $t + T$, and zero otherwise. At the extensive margin, T does not take value 0, since in the year of lottery participation everybody is in salaried employment by sample construction. Our main equation for labor market outcome y_{it+T} is:

$$y_{it+T} = \mathbf{x}'_{it}\boldsymbol{\beta}_T + p_{it}\delta_T + u_{it+T}, \tag{1}$$

where u_{it+T} is the error term, $\mathbf{x}_{it}$ is a set of predetermined regressors measured at the time of the lottery win, and δ_T is the linear effect of the lottery prize on the labor market outcome T years ahead.[12] Ordinary Least Squares (OLS) estimation of Eq. (1) returns unbiased estimates of $\boldsymbol{\delta}_T$ if the individual lottery win is uncorrelated to the error term conditional on $\mathbf{x}_{it}$. This is the case if there are no other relevant variables correlated with the labor market outcome variable and lottery prizes. Among the set of control variables we have ticket expenditures,

[12]The impact of lottery prizes on labor market outcomes is assumed to be linear. In a sensitivity analysis we depart from the linear assumption and we assume that lottery prizes enter the labor market outcome equation through a piecewise continuous spline function with two knots, respectively at €10,000 (which is about the 99th percentile of the lottery prize distribution) and at €100,000. Since we could not reject the null hypothesis of no slope change at the knots both when using the full sample and when splitting the sample in men and women, in what follows we only report parameter estimates based on the linear specification of Eq. (1).

age, squared age, number of children in the household, nationality, gender, whether single or living in a couple, year dummies, and the constant.

As indicated in the introduction, for lottery participants winning the lottery is a random event. However, participating in the lottery and the amount of money individuals spend on buying lottery tickets might be non-random events. Therefore, controlling for ticket expenditures is very important. The probability of winning prizes (especially small prizes) can be affected by the number of purchased lottery tickets and, hence, by the expenditure in lottery tickets. The expenditure in lottery tickets can be in turn (positively) correlated with earnings. So, if we do not control for expenditures in lottery tickets and if there is positive correlation between earnings and tickets expenditures, OLS will overestimate the impact of lottery winning on employment earnings. Luckily, we have information on individual yearly expenditures in lottery tickets and we can include it in the model specification.

As said, we select employed individuals at the time of lottery participation and, therefore, we estimate the impact of lottery wins on future labor market outcomes conditional on being at work in the year of lottery earnings. In a sensitivity analysis, we also estimate the unconditional effect by enlarging the sample to individuals who did not have labor earnings at the time of lottery participation.

3.2 Main results

Table 4 presents the main parameter estimates.[13] The table shows that already in the year of winning the prize there is a significant negative effect on labor earnings. The magnitude of -0.005 implies that if an individual wins €100,000, earnings go down by an amount of €500. In later years, the effect is larger in size. This makes sense, because about half of the individuals won the lottery in the second half of the year. In addition, it may be that if individuals react to winning the lottery they need some time to do that. In the first year after winning a lottery prize of €100,000 ($T = 1$) earnings go down by an amount of €1140, 2 years later this is €1602, and after 3 years it is €1770. The earnings effects thus seem to persist.

The bottom part of Table 4 shows that there is no significant effect of winning a lottery prize on the probability to be employed. The parameter estimate of -0.075 implies that a lottery prize of €100,000 reduces the probability to be employed with 0.75 percentage points, but this is not significantly different from zero. Apparently, individuals adjust their labor supply in response to winning a lottery but they do not withdraw from the labor market. We conclude that lottery prizes affect earnings but not employment status. This suggests that lottery prizes affect the intense margin of labor supply and not the extensive margin. Table 5 reports the

[13] Appendix B give an overview of all parameter estimates, including the control variables.

Table 4: Lottery prize effects conditional on labor market participation at the time of lottery win

	$T=0$		$T=1$		$T=2$		$T=3$	
Dependent variable: Labor earnings								
Prize amount/10	−0.005	(0.002)**	−0.114	(0.007)*	−0.162	(0.058)***	−0.177	(0.062)***
Dependent variable: Employment status								
Prize amount	–	–	−0.075	(0.108)	−0.063	(0.125)	−0.189	(0.202)
Number of observations	35,525		28,062		18,499		9,182	

Notes: Sample weights are used to take into account that individuals winning less than €1,000 are a 1% random draw from the population of small lottery winners. Standard errors are reported in parenthesis and are robust to heteroskedasticity and serial correlation. Coefficients and standard errors in the regressions of employment status are multiplied by 1.0e+06 for the sake of readability. The full set of estimation results are reported in Appendix B, Table B.1.

results from unconditional regressions, that is, from regressions where individuals are no longer required to be employed in the year of winning a lottery prize. We expected that including these individuals would decrease potential effects of winning a lottery prize, because individuals who initially are without a job may enter the labor market. This is indeed what we find. The (absolute) magnitudes of the parameter estimate are smaller and no longer significant in the year of winning the prize or in the first year thereafter. The effects remain highly significant, however, in the second and third year after winning a lottery prize.

Table 5: Lottery prize effects unconditional on labor market participation at the time of lottery win

	$T=0$		$T=1$		$T=2$		$T=3$	
Dependent variable: Labor earnings								
Prize amount/10	−0.001	(0.003)	−0.068	(0.051)	−0.111	(0.042)***	−0.118	(0.044)***
Dependent variable: Employment status								
Prize amount	–	–	−0.104	(0.106)	−0.119	(0.100)	−0.195	(0.122)
Number of observations	45,328		35,245		23,357		11,644	

Notes: Sample weights are used to take into account that individuals winning less than €1,000 are a 1% random draw from the population of small lottery winners. Standard errors are reported in parenthesis and are robust to heteroskedasticity and serial correlation. Coefficients and standard errors in the regressions of employment status are multiplied by 1.0e+06 for the sake of readability. The full set of estimation results are reported in Appendix B, Table B.2.

3.3 Heterogeneity

In this section, we slice up the data in several ways, and focus on the effect of lottery prizes on labor market behavior of different types of individuals. In particular, we investigate to what extent there is heterogeneity in effects according to gender, age (up to 50 versus older than 50), family status (non-single versus single), earnings (below versus above the median), and parental status (no children versus children). Results of regressions for these subgroups are presented in Table 6. We first discuss the results related to labor earnings, reported in the upper

part of the table.

First, Table 6 shows that although labor earnings of male players tend to go down more when winning a lottery prize than earnings of female players, gender differences are not significant. Second, Table 6 shows that the negative effects of lottery prizes on labor earnings are driven by individuals who are below age 50. That is, only for individuals below age 50 are the effects significant, and not so for individuals who are older than 50. To illustrate, a prize of €100,000 reduces annual earnings of individuals below age 50 with about €2000, on average. With annual earnings of about €40,000 this implies that working hours are reduced with about 2 hours per week or about 2 to 3 weeks per year. Alternatively, we might conclude that an increase of unearned income of €100,000 reduces earnings with a short-run marginal propensity to consume leisure of approximately 2 percent. However, the effect of a one-time positive shock to non-labor income affects earnings for several years, so the long-run marginal propensity to consume leisure is substantially higher than the short-run marginal propensity to consume leisure. Apparently, to be able to smooth labor supply, individuals and households save a substantial part of their lottery winnings. Third, Table 6 shows the parameter estimates depending on the family statu, obtained by introducing an interaction term between lottery prize and a dummy variable for being single. The main effect is negative but never significantly different from zero. The interaction term is also negative, but except in $T = 2$ not significantly different from zero. Wald tests for the sum of the parameter estimates, however, indicate that the overall effect is significantly negative. So, the negative earnings effect of winning a lottery prize is located among singles and is not significantly different from zero for individuals who live together with a partner. Fourth, results are reported from regressions that include an interaction term between the lottery prize and a dummy variable that indicates whether the individual earns more than the median income. Here, results are somewhat mixed. In years $T = 0$ and $T = 3$, the negative effect of lottery prizes on labor earnings is mostly driven by high-income individuals, but not so in the other two years. Finally, results are reported from regressions that include an interaction term between lottery prize and a dummy variable indicating the presence of children. In all four specifications, the parameter of the interaction term is positive with a magnitude that is about the same as the negative main effect. And in all four cases, the sum of the two parameter is not significantly different from zero. Compared to the other estimates, the parameter estimate of individuals without children is the largest in magnitude, and most consistent across the four specifications. This suggests that the negative effects of lottery prizes on labor earnings are fully driven by individuals without children.

The lower part of Table 6 reports the results from regressions where the dependent variable refers to being employed or not. Overall, we do not find an effect of lottery prizes on employ-

Table 6: Heterogeneity of lottery prizes effects

	$T=0$		$T=1$		$T=2$		$T=3$	
Dependent variable: Labor earnings								
a. By gender								
Prize amount/10 if male	−0.012	(0.012)	−0.138	(0.084)	−0.183	(0.073)**	−0.204	(0.105)*
Prize amount/10 if female	−0.002	(0.001)**	−0.116	(0.087)	−0.163	(0.098)*	−0.153	(0.097)
Wald test difference, p-value	0.412		0.861		0.870		0.723	
b. By age								
Prize amount/10	−0.007	(0.004)*	−0.219	(0.077)***	−0.225	(0.058)***	−0.019	(0.006)***
Prize amount/10 × Older than 50	0.006	(0.005)	0.699	(0.406)*	0.384	(0.245)	0.341	(0.689)
Wald test sum of coeff., p-value	0.882		0.212		0.482		0.8252	
c. By family status								
Prize amount/10	−0.004	(0.007)	−0.012	(0.092)	−0.077	(0.087)	−0.107	(0.090)
Prize amount/10 × Single	−0.001	(0.007)	−0.410	(0.289)	−0.301	(0.167) *	−0.150	(0.126)
Wald test sum of coeff., p-value	0.012		0.100		0.003		0.001	
d. By earnings								
Prize amount/10	−0.002	(0.003)	−0.176	(0.081)**	−0.179	(0.061)***	−0.051	(0.045)
Prize amount/10 × high earnings	−0.007	(0.004)	0.164	(0.151)	0.066	(0.157)	−0.309	(0.169)*
Wald test sum of coeff., p-value	0.001		0.916		0.417		0.002	
e. By parental status								
Prize amount/10	−0.224	(0.107)**	−0.336	(0.180)*	−0.254	(0.125)**	−0.275	(0.113)**
Prize amount/10 × presence of children	0.221	(0.108)**	0.365	(0.228)	0.165	(0.178)	0.207	(0.174)
Wald test sum of coeff., p-value	0.157		0.802		0.409		0.587	
Dependent variable: Employment status								
a. By gender								
Prize amount if male	–	–	−0.123	(0.140)	0.052	(0.034)	−0.025	(0.112)
Prize amount if female	–	–	0.066	(0.039)*	−0.363	(0.334)	−0.367	(0.336)
Wald test difference, p-value			0.193		0.217		0.334	
b. By age								
Prize amount			−0.133	(0.126)	−0.118	(0.142)	−0.212	(0.202)
Prize amount × Older than 50			0.393	(0.266)	0.329	(0.254)	0.603	(0.839)
Wald test sum of coeff., p-value	–		0.255		0.301		0.628	
c. By family status								
Prize amount			0.059	(0.039)	0.083	(0.045)*	0.045	(0.105)
Prize amount × Single			−0.535	(0.341)	−0.517	(0.347)	−0.504	(0.371)
Wald test sum of coeff., p-value	–		0.153		0.203		0.190	
d. By earnings								
Prize amount			−0.115	(0.204)	0.150	(0.060)	0.066	(0.065)
Prize amount × high earnings			0.087	(0.210)	−0.481	(0.258)*	−0.863	(0.218)***
Wald test sum of coeff., p-value	–		0.395		0.184		0.000	
e. By parental status								
Prize amount			−0.259	(0.244)	0.070	(0.052)	0.043	(0.079)
Prize amount × presence of children			0.302	(0.248)	−0.236	(0.215)	−0.461	(0.347)
Wald test sum of coeff., p-value	–		0.155		0.418		0.211	
Number of observations	35,525		28,062		18,499		9,182	

Notes: We report p-values related to Wald tests that to the significance of either the difference in estimated coefficient between male and female players, or to the sum of the coefficients: * significant at 10%; ** significant at 5%; *** significant at 1%. Sample weights are used to take into account that individuals winning less than €1,000 are a 1% random draw from the population of small lottery winners. Standard errors are reported in parenthesis and are robust to heteroskedasticity and serial correlation. Coefficients and standard errors in the regressions of employment status are multiplied by 1.0e+06 for the sake of readability

ment for any of the subgroups. The only effect that turns out to be significant, is the effect for high-income individuals. For them we find a negative effect on employment status after 3 years. According to the parameter estimates, for each prize of €100,000 won, the employment rate is reduced by 8 percentage points.[14]

3.4 Family spillovers

In this section we investigate whether there are 'spillover effects' from the spouse in a family winning a prize. In particular, the question is whether if an individual wins a lottery prize the partner reduced his or her earnings. The upper part of Table 7 presents the parameter estimates.[15] We find no lasting effects from lottery prizes won by the spouse on individuals' labor earnings. Apart from a small significant effect in the year in which the lottery prize was won none of the parameter estimates differs significantly from zero. This is in line with our earlier finding that only singles seem to respond to lottery prize winnings.

Next, we sum the amount of lottery prizes won in each individual's family, that is, by oneself and the spouse, and study whether there is an effect on labor earnings of the individual. The expectation was that the results would be very similar to our main results, given that the prize won in an individual's family consists for a large part by the prize personally won by the indvidual (and for singles, these two prize amount are, of course, equal). The lower part of Table 7 presents the regression results. As expected, the findings are much in line with our earlier findings that the effect of lottery prizes is significantly negative in subsequent years.

Table 7: Family lottery prize effects

	$T=0$	$T=1$	$T=2$	$T=3$
a. Effect of spouse's prize	−0.007 (0.003)***	0.002 (0.055)	0.019 (0.053)	0.059 (0.096)
Number of observations	22,324	16,029	9,882	4,661
b. Effect on family earnings	−0.008 (0.004)**	−0.225 (0.109)**	−0.237 (0.117)**	−0.155 (0.117)
Number of observations	35,605	27,246	17,417	8,376

Notes: The dependent variable is the amount of labor earnings. * significant at 10%; ** significant at 5%; *** significant at 1%. Sample weights are used to take into account that individuals winning less than €1,000 are a 1% random draw from the population of small lottery winners. Standard errors are reported in parenthesis and are robust to heteroskedasticity and serial correlation.

4 Conclusions

When interpreting the results of our empirical analysis, the labor market situation in the Netherlands needs to be taken into account. In a labor market with high unemployment, employed

[14] High-earnings individuals may have high savings so that, when when winning a prize of €100,000, some of them stop working at least for a while.

[15] Given that effects at the extensive margin are not significant, we only report results on labor earnings.

individuals might not want to take the risk to temporary withdraw from the labor market for fear of having great difficulties to find a job later on. This is not the case in the Netherlands where during the period of analysis unemployment rates were low. According to OECD statistics, over the period of analysis the average unemployment rate in the Netherlands ranged from 3 to 5 percent, well below the OECD average. And, as discussed in the introduction, in the Netherlands it is not so difficult to adjust labor supply along the intensive margin. Part-time work is quite common.

We find that winning a lottery prize affects the intensive margin of labor supply and not the extensive margin. We also find that the effect is heterogeneous, i.e. for some groups of individuals the effects are present while other individuals do not seem to change their labor market position even after winning a substantial lottery prize. Specifically, the lottery prize effects materialize among younger single individuals without children. We can only speculate about the reasons why this is the case. Older workers would have been likely to respond since the lottery prize could have made it possible for them to retire early. But we find no such effect. Perhaps even a substantial lottery prize is insufficient to cover the earnings loss of withdrawal from the labor force. In other words, too few winners of a substantial lottery prize were sufficiently close to the retirement age to identify the effect. Another explanation could be that to receive full pension benefits one needs to work at least 40 years. Therefore, retiring early comes at a cost of forgone retirement benefits and the incentive to work less is not so strong at the end of one's working life.

Parents with young children might have seized the opportunity to reduce working hours and spend more time with their children. We find no such effect. It could be that they organized work and care efficiently. It could also be that the parents want to save money to finance a better education for their children later on in life. We note that conditional on the lottery prize, partnered individuals with children have a lower per capita prize than singles. For young, single individuals without children winning a lottery prize would make it possible to temporarily leave the labor force for example to travel. This would have caused earnings and employment rates to go down shortly after winning a prize. We find that this is not the case. We find an effect on earnings but not on employment status.

The effect of winning a lottery prize on earnings is present for several years. The long-run marginal propensity to consume leisure is substantially larger than the short-run marginal propensity. Most likely, to be able to smooth labor supply individuals and households save a substantial part of their lottery winnings. Apparently, lottery winners on average decide to benefit from their prizes for several years in a row. They seem to reduce working hours but only by a few hours per week, or alternatively by taking more days off and taking longer holidays.

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Appendix

A Prize structure of the State Lottery

Table A.1: Prize structure of the State Lottery

Prize amount	Correct letters/numbers	Number of combinations
€7,500,000	8	1
€1,000,000	8	1
€100,000	8	10
€25,000	8	10
€10,000	8	20
€1,000	5	5
€450	5	7
€250	5	7
€100	5	8
€30	2	3
€20	1	1
€10	1	1
€7.5	1	2
€5	1	1

Notes: This table gives an overview of the current prize structure in the State Lottery. This prize structure has been relatively constant since 2005.

B Full parameter estimates

Table B.1: Full set of estimation results of the effect of lottery prizes on earnings conditional on labor market participation at the time of lottery win

	$T=0$			$T=1$			$T=2$			$T=3$		
	Coeff.		Std. Err.	Coeff.		Std. Err.	Coeff.		Std. Err.	Coeff.		Std. Err.
Dependent variable: Labor earnings												
Prize amount	-0.0005	**	0.0002	-0.0114	*	0.0069	-0.0162	***	0.0058	-0.0177	***	0.0062
Ticket expenditure	1.0831	***	0.2187	1.1754	***	0.2675	1.2813	***	0.3093	1.0042	***	0.3252
Female	-17,491.7900	***	466.3903	-18,822.4500	***	530.8541	-18,581.1300	***	559.1574	-18,576.1400	***	605.6606
Age	3,397.3320	***	214.3714	4,208.2380	***	255.2346	4,899.0830	***	268.6968	5,404.3550	***	293.4588
Age squared	-3,744.9140	***	246.4116	-4,784.7770	***	301.8467	-5,731.3150	***	314.8243	-6,490.2370	***	341.1067
# children	-97.5972		264.5337	194.1761		334.9935	209.6335		345.5627	272.9508		375.5471
Dutch	225.6682		1,424.8130	78.7679		1,648.5090	508.6642		1,735.6650	-297.6902		1,942.1980
Single	-1,494.0930	***	551.1467	-2,099.3030	***	646.4310	-2,164.1220	***	683.7829	-1,913.2930	**	772.5419
Time dummies												
2006	1,480.6110	***	187.2051	–		–	–		–	–		–
2007	2,084.5880	***	223.5929	885.6378	***	247.9555	664.2742	**	270.0768	–		–
2008	2,836.2220	***	242.0265	1,564.2060	***	282.2912	–		–	–		–
Constant	-34,695.1700	***	4,653.9470	-47,386.0500	***	5,393.0190	-59,151.6200	***	5,672.7890	-64,892.9100	***	6,252.1760
R^2		0.1798			0.1465			0.1513			0.1642	
Dependent variable: Employment status												
Prize amount	–		–	-7.45e-08		1.08e-07	-6.30e-08		1.25e-07	-1.89e-07		2.02e-07
Ticket expenditure	–		–	-5.63e-07		1.34e-06	-8.26e-07		1.87e-06	-1.68e-06		3.61e-06
Female	–		–	-0.0046		0.0030	-0.0068		0.0053	-0.0091		0.0075
Age	–		–	0.0212	***	0.0017	0.0356	***	0.0030	0.0520	***	0.0042
Age squared	–		–	-0.0266	***	0.0020	-0.0450	***	0.0036	-0.0662	***	0.0050
# children	–		–	-0.0028	**	0.0014	-0.0040		0.0026	-0.0040		0.0034
Dutch	–		–	0.0152	*	0.0084	0.0293	*	0.0155	0.0353		0.0219
Single	–		–	-0.0102	***	0.0039	-0.0128	*	0.0069	-0.0107		0.0096
Time dummies												
2006	–		–	–		–	–		–	–		–
2007	–		–	0.0085	**	0.0033	0.0040		0.0033	–		–
2008	–		–	0.0050		0.0034	–		–	–		–
Constant	–		–	0.5633	***	0.0364	0.2720	***	0.0633	-0.0467		0.0865
R^2		–			0.0342			0.0617			0.0986	
Observations		35,525			24,548			18,499			9,182	

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Sample weights are used to take into account that individuals winning less than €1,000 are a 1% random draw from the population of small lottery winners. Standard errors are robust to heteroskedasticity and serial correlation.

Table B.2: Full set of estimation results of the effect of lottery prizes on earnings unconditional on labor market participation at the time of lottery win

	$T=0$			$T=1$			$T=2$			$T=3$		
	Coeff.		Std. Err.	Coeff.		Std. Err.	Coeff.		Std. Err.	Coeff.		Std. Err.
Dependent variable: Labor earnings												
Prize amount	-0.0001		0.0003	-0.0068		0.0051	-0.0111	***	0.0042	-0.0118	***	0.0044
Ticket expenditure	0.7805	***	0.1984	0.9159	***	0.2229	1.0830	***	0.2659	0.8782	***	0.2858
Female	-16,358.6000	***	465.6249	-17,753.5100	***	511.9415	-17,578.6700	***	523.8925	-17,623.0800	***	552.2048
Age	4,546.0160	***	197.8190	4,702.8440	***	221.0842	5,004.0080	***	229.7249	5,119.1580	***	243.6238
Age squared	-5,390.3560	***	219.3945	-5,655.8820	***	252.3284	-6,108.8350	***	259.1202	-6,364.8060	***	272.6558
# children	-839.2833	***	275.5539	-496.5649		321.5585	-470.6668		327.9540	-142.7552		363.4288
Dutch	2,152.2400		1,435.9080	1,762.4290		1,570.1180	1,503.4160		1,590.9700	791.4118		1,694.7850
Single	-1,579.3720	***	558.5221	-1,907.7340	***	624.3235	-1,959.4930	***	641.6545	-1,394.0330	**	692.9729
Time dummies												
2006	1,425.9950	***	158.7325	–		–	–		–	–		–
2007	2,376.4080	***	206.2815	1,012.5960	***	198.2923	500.2092	**	215.1366	–		–
2008	3,079.8740	***	229.4717	1,833.4350	***	237.7038	–		–	–		–
Constant	-59,115.9000	***	4,396.9740	-58,522.9600	***	4,794.8020	-62,083.1800	***	4,988.5550	-61,091.9300	***	5,339.4790
R^2		0.1724			0.1512			0.1650			0.1814	
Dependent variable: Employment status												
Prize amount	–		–	-1.04e-07		1.06e-07	-1.19e-07		1.00e-07	-1.95e-07		1.22e-07
Ticket expenditure	–		–	-8.82e-07		2.28e-06	1.60e-07		2.598e-06	-4.91e-07		3.73e-06
Female	–		–	-0.0838	***	0.0092	-0.0835	***	0.0096	-0.0812	***	0.0101
Age	–		–	0.0545	***	0.0037	0.0626	***	0.0040	0.0704	***	0.0044
Age squared	–		–	-0.0740	***	0.0042	-0.0843	***	0.0046	-0.0946	***	0.0050
# children	–		–	-0.0194	***	0.0045	-0.0159	***	0.0047	-0.0121	**	0.0051
Dutch	–		–	0.0452	**	0.0228	0.0352		0.0245	0.0347		0.0262
Single	–		–	-0.0131		0.0105	-0.0091		0.0113	-0.0063		0.0123
Time dummies												
2006	–		–	–		–	–		–	–		–
2007	–		–	0.0148	***	0.0030	0.0038		0.0029	–		–
2008	–		–	0.0194	***	0.0038	–		–	–		–
Constant	–		–	-0.0874		0.0793	-0.2334	***	0.0872	-0.3844	***	0.0958
R^2		–			0.1204			0.1404			0.1654	
Observations		45,328			35,245			23,357			11,644	

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Sample weights are used to take into account that individuals winning less than €1,000 are a 1% random draw from the population of small lottery winners. Standard errors are robust to heteroskedasticity and serial correlation.