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Kuhn, P.J.; Kooreman, P.; Soetevent, A.R.; Kapteyn, A.

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The Own and Social Effects of an Unexpected Income Shock:

Evidence from the Dutch Postcode Lottery

Peter Kuhn*
University of California at Santa Barbara

Peter Kooreman
Tilburg University

Adriaan R. Soetevent
University of Amsterdam (ASE).

Arie Kapteyn
RAND and Tilburg University

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In the Dutch Postcode Lottery a postal code (19 households on average) is randomly selected weekly, and prizes – cash and a new BMW – are awarded to lottery participants in that postal code. On average, this generates a temporary, unexpected income shock equal to about eight months of income for about one third of the households in a winning code, while leaving the incomes of non-winning, neighboring households unaffected. We find that the 'own' effects of winnings are largely confined to cars and other durables; the social effects are confined to cars and highly localized. Relative to the modest effects of the lottery wins on households' own consumption choices (consistent with the life-cycle hypothesis), the social effects are substantial.

JEL classifications: D12, C21. *Keywords*: social interactions, quasi-experiments.

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1. Introduction

Economic theory offers a rich set of predictions concerning the effects of exogenous income shocks on households' consumption behavior. These include the permanent income hypothesis (PIH), (liquidity-unconstrained households should save the lion's share of an income shock); the Easterlin hypothesis (positive shocks to neighbors' incomes can reduce one's happiness); Veblen effects (shocks to neighbors' incomes might generate conspicuous changes in consumption); and the theory of in-kind transfers, which asserts that households who receive an in-kind transfer (such as food stamps) should in most cases convert it into cash.

To date, empirical testing of all the above hypotheses has been hampered by the lack of credibly exogenous variation in either a household's own income, or in the income or consumption of its neighbors. Recently, however, progress on testing the PIH has been made by using the random timing of income tax rebates (Agarwal, Liu and Souleles 2007). A number of recent studies have also used plausibly exogenous variation to study social and neighborhood effects, including Sacerdote (2001), Cipollone and Rosolia (2007) and the Moving to Opportunity (MTO) studies (Katz et al. 2001, Ludwig et al. 2001, Kling et al. 2005). With one recent exception, however (Angelucci and De Giorgi, forthcoming), these studies do not focus on consumption behavior. Gardner and Oswald (2007) study the effects of lottery winnings on 'own' but not neighbors' measures of psychological wellbeing. We are aware of no quasi-experimental evidence concerning the effects of in-kind transfers on consumption decisions.

In this paper we contribute to all the above research questions using data from the Dutch Postcode Lottery (PCL). Each week, this lottery allocates a prize to participants in a randomly chosen postcode (containing 19 households on average). About one third of the Dutch population participates in the lottery. A participant wins €12,500 per ticket. In addition, one household receives a significant part of their transfer in the form of a new BMW. From an experimental design perspective, the lottery provides PCL participants in the winning code with an unexpected temporary income shock equal on average to about eight months of income, while leaving all other households' incomes unchanged.

Our survey data includes information on consumption and happiness for four groups of households: lottery participants and non-participants in winning and in nearby non-winning postcodes. Given the inherent randomness in the prize draws and absent externalities between winning and non-winning postcodes, non-participants in non-winning postcodes constitute a

valid counterfactual for non-participants in winning postcodes. This allows us to test for social effects of unexpected, temporary income shocks (both cash and in kind) on non-participating households' consumption (and, incidentally, happiness) under quite general conditions. In addition, estimates of own effects can be derived from the behavior of lottery participants.

Compared to existing evidence on the own effects of income shocks, our approach has the following advantages. Relative to Agarwal et al (2007), the income shocks we observe are much larger; in addition we have significant detail about the distribution of expenditures across types of consumption and (self-reported) information on other household income, which allows us to compare the consumption effects of permanent and transitory income.[1] A distinction (relevant to the interpretation of the results) is that the income shocks in our experiment were almost surely unexpected by their recipients. Relative to Imbens et al.'s (2001) study of lottery winners, we have a larger sample and more detail on types of consumption expenditures. In contrast to their data, randomization in our lottery is over postcodes instead of tickets; as a result our subsamples of winning and non-winning postcodes are very similar. Our income shocks are for the most part smaller than theirs, and temporary, which leads to different predicted effects. Unlike Imbens et al., we do not have information about our households later than six months after the lottery win.

A noteworthy feature of our analysis of social effects is its partial-population design, in which a subset of the members of a fixed peer group receives an exogenous shock. Unlike what Moffitt (2001) calls group-changing interventions (where subjects are moved to a new peer group), partial population designs are not contaminated by the causal effects of mobility itself. Partial population designs have recently been used to estimate the extent of information dissemination and learning among neighbors and friends (Duflo and Saez, 2003; Duflo *et al.*, 2004; Miguel and Kremer, 2004) and peer effects in school participation (Bobonis and Finan, forthcoming; Lalive and Cattaneo, forthcoming). Most related to our current study is Angelucci and De Giorgi (forthcoming), which is to our knowledge the first study of social effects in household consumption using a partial-population design. Using data from a program that targets poor households in small rural communities in Mexico with bimonthly conditional grants to improve education, health and nutrition, they find strong evidence of positive program externalities to non-eligible households through changes in the insurance and credit markets.

[1] Limitations relative to Agarwal et al.'s data are a smaller sample size and less information on the timing of expenditure responses to income shocks.

Our study complements their analysis by studying spillovers in consumption in a context of urban areas with developed credit markets. Moreover, our lottery prizes are unconditional, one-time cash transfers involving relatively large amounts of money.

In essence, we identify the own and social effects of income shocks by comparing household consumption patterns in winning versus non-winning postcodes. Among non-participants, this provides a test for the presence of social effects under quite general conditions. (The PCL randomly exposes nonparticipants who live in winning codes to income shocks totalling an average of €201,628 *among their neighbors*.) As long as a household's postcode-mates are more likely to belong to its consumption reference group than are residents of other postcodes, this allows for a clean test of peer effects in consumption. Among lottery participants, the comparison between winning and non-winning codes estimates a direct treatment effect that is a combination of own and social effects; additional assumptions allow us to separate out the own effect. In addition to these simple comparisons between winning and nonwinning codes, we also present estimates from a regression-based approach that accounts for differences in treatment intensity (i.e. *amounts* won, both in the household and in its vicinity), and explores the sensitivity of our results to a wide range of alternative specifications of a household's social comparison group, such as its two and four nearest neighbors and the set of other households within 25 meters.

Consistent with theories of in-kind transfers (e.g. Moffitt 1984, 1989), we find that the vast majority of BMW winners convert their BMW into cash. Consistent with a simple life-cycle model of consumption, we do not detect any own effect of winning the postcode lottery on most components of households' expenditures, including food at home, transportation, and total monthly outlays. Own effects are, however, detected for car consumption and other durable expenditures. These effects are consistent with life-cydle models in which households use durables expenditures to smooth consumption (Browning and Crossley forthcoming), but also with self-imposed borrowing prohibitions (Shefrin and Thaler 1988). Turning to social effects, we detect statistically significant effects of neighbors' lottery winnings on car consumption. For example, all else equal, the main car of a PCL nonparticipant whose neighbor won will be six months younger than the main car of a PCL nonparticipant whose neighbor did not win. Non-winning households who live next door to PCL winners are also more likely to purchase a car in the six months after the lottery than non-winning households located elsewhere. We discuss a number of mechanisms that might account for social effects of this nature.

2. The Dutch Postcode Lottery and the Street Prize

The *Nationale Postcode Loterij* (PCL) is the second largest national lottery in the Netherlands, with a revenue market share of 26.6 percent in 2005.[2] Contrary to the *Staatsloterij* (State Lottery), the largest Dutch lottery (market share 42.6 percent in 2005), the PCL is a charity lottery: A condition for its license is that at least 50 percent of revenues must be donated to approved charities. Since its inception in 1990 the PCL has grown steadily. In 2005 about 30 percent of the Dutch population participated in the PCL, with an estimated annual expenditure per participant of €175.[3]

In the PCL the lottery ticket number is the participant's 6-digit postcode. Thus, conditional on purchasing a ticket, a household's probability of winning the PCL in any given week is approximately equal to one divided by the number of postcodes in the Netherlands (about 430,000). The popularity of the PCL is sometimes attributed to its potential to induce regret among nonparticipants (Zeelenberg and Pieters, 2004); non-participants living in a winning code know for sure that they would have won had they purchased a ticket. Moreover, the weekly award of prizes is widely publicized in the media, including – in most cases – a broadcast on national television around 10 pm on Sunday evenings. This five-minute program features happy winners and, occasionally, less happy non-winners.

During our sample period, participants paid from €6.25 to €6.75 per ticket (the price increased during the sample period), which is debited monthly from their bank account. There are no restrictions on the number of lottery tickets that can be purchased per participant. The PCL awards several prizes, ranging from very large ones (around €10 million, once or twice a year) to very small ones.[4] In this paper we focus on one specific prize, the weekly Street Prize. If a postcode is selected as the winning code, a prize of €12,500 per lottery ticket is awarded to participants living in that postcode. Net of the 25% lottery tax, which is applied to all lottery prizes larger than €454, this amounts to €9,375 during our sample period. Because randomization is over postcodes instead of tickets, the number of tickets owned does not affect the probability of winning, only the amount won conditional on winning.

In addition to the monetary prizes, one of the Street-Prize winners wins a new BMW. The

[2] Source: *College van toezicht op de kansspelen* (government agency for lottery supervision; www.toezichtkansspelen.nl).
[3] Estimate based on the sample described in Section 4.
[4] Eligibility for the large 'jackpot' prize requires households to pay an extra monthly fee (which increased from €1.25 to €1.50 during our sample period).

BMW winner is chosen by randomly selecting one of the winning lottery tickets. In contrast to the monetary prizes, the probability of winning the BMW does increase with the number of tickets held. BMW winners have the option of receiving the cash value of the BMW in lieu of the car itself. This however involves a substantial tax penalty, since the PCL authority pays the 25% lottery tax for winners who accept the BMW in kind, but not for those who choose the cash equivalent (about €25,000). Of course, winners also have the option of selling their new BMW, and incurring any associated transactions costs.[5]

3. Econometric Framework

This section describes a simple statistical model of the own and social effects of lottery winnings on household consumption. Throughout our discussion, we refer to a winning postcode plus all the non-winning nearby codes associated with it as a "codegroup". All of our regression analyses condition on a full set of codegroup fixed effects.

In addition to being part of a codegroup $G(i)$ and a postcode $P(i)$ (with $P(i) \subseteq G(i)$), we define for each household i its assumed social comparison group $N(i)$. A natural candidate is the other households in the postcode: $N(i) = P(i) \backslash \{i\}$. For expositional reasons, we will focus on this case throughout this section, but our empirical analysis will also use alternative definitions of $N(i)$, like a household's two (four) immediate neighbors and the set of other households within 25 meters distance. Let T_i denote the number of tickets held by household i, D^W_i be a dummy for household i living in a winning postcode and C_i the household's consumption of the item of interest. If prizes are awarded randomly, and if non-winning postcodes are not affected by the prize award, non-participants in non-winning postcodes provide a valid counterfactual for non-participants in winning postcodes. This allows us to estimate what Angelucci and De Giorgi (forthcoming) call the Indirect Treatment Effect (ITE): the impact of an income shock on lottery non-participants living in the direct neighborhood of winning households.

Let D^P_i be a dummy for lottery participation – that is, $D^P_i = 1$ if and only if $T_i > 0$. Define C^W_i as the consumption of a non-participating household if a prize would fall in her postcode; similarly, C^{NW}_i is the consumption of a non-participant if no prize would fall in her postcode. Observed consumption equals $C_i = C^{NW}_i + D^W_i(C^W_i - C^{NW}_i)$. Our treatment consists of lottery prizes being awarded to participants ($D^P_i = 1$) in winning postcodes ($D^W_i = 1$). The ITE is

[5] We have observed a small number of ads for BMWs won in the PCL on the Dutch equivalent of eBay.

the average effect of the lottery prize on non-participating households:

(1) $ITE = E(C^W_i - C^{NW}_i \mid D^W_i = 1, D^P_i = 0)$

$= E(C^W_i \mid D^W_i = 1, D^P_i = 0) - E(C^{NW}_i \mid D^W_i = 1, D^P_i = 0)$

The data do not reveal the potential consumption in the absence of the treatment for non-participants in winning postcodes, $E(C^{NW}_i \mid D^W_i = 1, D^P_i = 0)$. For this reason, we assume that the value of this expectation is the same as the potential consumption in the absence of prizes for non-participants in non-winning postcodes:

Assumption 1: $E(C^{NW}_i \mid D^W_i = 1, D^P_i = 0) = E(C^{NW}_i \mid D^W_i = 0, D^P_i = 0)$.

Under Assumption 1, the difference

(2) $E(C_i \mid D^W_i = 1, D^P_i = 0) - E(C_i \mid D^W_i = 0, D^P_i = 0)$

identifies the ITE. Assumption 1 shows the two opposing objectives in selecting the non-winning postcodes. First, to control as well as possible for any unobserved household characteristics that vary smoothly over space, households in non-winning codes should not live too far away from households in winning postcodes. This maximizes the credibility of Assumption 1. On the other hand, non-participants in non-winning postcodes should on average live farther away from winners than do non-participants in winning postcodes to ensure that consumption by non-participants in non-winning codes is not affected by the prize draw.[6] Importantly, in that case, it is likely that the indirect effects on non-participants in non-winning postcodes are of the same sign as for non-participants in winning postcodes in which case the difference $E(C_i \mid D^W_i = 1, D^P_i = 0) - E(C_i \mid D^W_i = 0, D^P_i = 0)$ can be interpreted as a lower bound for the ITE.

Next we consider the effect of living in a winning postcode on the consumption of lottery participants. The average treatment effect on participants is given by:

(3) $ATE = E[C^W_i - C^{NW}_i \mid D^W_i = 1, D^P_i = 1]$

$= E[C^W_i \mid D^W_i = 1, D^P_i = 1] - E[C^{NW}_i \mid D^W_i = 1, D^P_i = 1]$

Analogous to the case for nonparticipants, under

Assumption 2: $E(C^{NW}_i \mid D^W_i = 1, D^P_i = 1) = E(C^{NW}_i \mid D^W_i = 0, D^P_i = 1)$,

the difference

(4) $E(C_i \mid D^W_i = 1, D^P_i = 1) - E(C_i \mid D^W_i = 0, D^P_i = 1)$

identifies the ATE.

[6] This would amount to a violation of the stable unit treatment value assumption (SUTVA) commonly made in the treatment literature (e.g. Wooldridge, 2002, p. 604). The SUTVA says that treatment of unit *i* should affect only the outcome of unit *i*, with in our case postcodes acting as units.

Interpreting the treatment effects and accounting for intensity

Under Assumptions 1 and 2, the simple differences in (2) and (4) identify the causal effects of a household's postcode being selected as a winner on the household's consumption, for lottery nonparticipants and participants respectively. To understand the implications of these estimated treatment effects for the magnitude of own and social effects of lottery winnings, assume that a household's consumption of the item of interest is given by:

(5) $C_i = \alpha + \beta W_i + \gamma W_{N(i)} + \mu_i$

where W_i is the household's own lottery winnings, $W_{N(i)}$ measures the amount won by its comparison group, *N(i)*, and μ_i represents other (observed and unobserved) determinants of consumption.[7] Since each winning ticket pays 12.5 (thousand) Euro, winnings and ticket holdings T_i are related as follows: $W_i = 12.5 \cdot T_i \cdot D^W{}_i$ and $W_{N(i)} = 12.5 \cdot T_{N(i)} \cdot D^W{}_i$ (for simplicity, we ignore taxes).

Substituting (5) into (2) and (4) reveals that, under Assumptions 1 and 2, the ITE and ATE can be interpreted, respectively, as:

(6) ITE = $12.5\gamma\overline{T}_{N(i)}$

(7) ATE = $12.5\beta\overline{T}_i + 12.5\gamma\overline{T}_{N(i)}$

where $\overline{T}_i$ and $\overline{T}_{N(i)}$ respectively are the mean number of own and neighbors' tickets for a representative household in the sample. Thus, the consumption difference between winning and nonwinning codes among lottery nonparticipants identifies the social effect of lottery winnings, γ, scaled by the mean amount won per household (12.5 times the mean number of tickets held). The consumption difference between winning and nonwinning codes among lottery participants, on the other hand, identifies a combination of own and social effects; the own effect, β, can, in principle, be recovered by subtraction once γ has been estimated from (6).

Equation (5) also suggests a more direct way to estimate own and social effects; namely

[7] An alternative specification of social effects, of course, has own consumption depend not on neighbors' income but on neighbors' *consumption*. In this paper we focus on the effects of shocks to neighbors' incomes, for three reasons. Most obviously, shocks to neighbors' income are exogenous in our context; changes in consumption are not. Second, households' consumption is highly multidimensional, which makes it far from clear how to best model consumption interdependencies. (Does my propensity to buy a car depend on your purchase of a specific model and quality of car, on your decision to purchase any car, on the fact that you recently made a visible purchase of any kind, or simply on the fact that you won some money?). Third (and related), effects of neighbors' consumption and income on a household's own consumption are, in general, not separately identified by a neighbor's-income instrument.

to estimate (5) as a regression model; this approach also allows us to add controls for measurable determinants of income and preferences (including own non-lottery income, for example), and codegroup fixed effects. Rationales for these controls include improved efficiency, and to absorb any possible nonrandomness in D^W_i that might be generated by response and recall bias. Equation (5) also allows us to experiment explicitly with alternative definitions of a household's social comparison group, and uses information in our data on the intensity of treatment (amount of winnings) that is discarded by the simpler approach. Thus we implement this approach as well.

Balancing these advantages, the regression-based approach also has some potential drawbacks. Note first that whereas D^W_i is randomly determined, individual ticket holdings T_i may be correlated with unobserved household tastes or constraints that may affect its consumption of all items, including lottery purchases. For example, risk-loving households may buy more PCL tickets, and will also have different consumption patterns for other items than risk-averse households. Fortunately, we can account for this kind of bias by including controls for the number of tickets T_i held by the household at the time of the win in our vector of covariates, X_i: absent recall and response bias, all variation in W_i must be random after we condition on T_i. Thus, we include in all of our regressions a quadratic in number of tickets purchased plus a fixed-effect for participation in the PCL.[8]

If both C_i and T_i are dependent on some unobserved variable Y_i and, in addition, ticket holdings themselves are subject to social effects at the postcode level, the estimates of γ in (5) will be biased. Suppose for example that:

$$T_i = a + bY_i + g\overline{T}_{N(i)} + \nu_i, \tag{8}$$

in which case average peer group ticket holdings $\overline{T}_{N(i)}$ (and thereby $\overline{W}_{N(i)}$) depend on $\overline{Y}_{N(i)}$ and are correlated with the error term ε_i. Ideally, we would like to capture this by including controls for $\overline{T}_{N(i)}$ in equation (8). Unfortunately, in most cases we do not have measures of $\overline{T}_{N(i)}$ because we do not know ticket purchases for those households who did not respond to our survey.[9] For this reason, our regression-based estimates require a third identifying assumption implying ignorability of average postcode ticket holdings in a conditional mean independence sense:

[8] The results are very similar if we include a fixed effect for each integer number of tickets purchased.
[9] The information on winners provided by the lottery administration identifies all ticket purchasers in winning codes; unfortunately such administrative information is not available for nonwinning codes.

Assumption 3: $E(C_i \mid T_i, D_i^W, \bar{T}_{N(i)}) = E(C_i \mid T_i, D_i^W)$.

For several reasons, this assumption is less stringent than one might infer at first sight. First, most of our estimates condition on codegroup fixed effects. Thus, Assumption 3 holds as long as average ticket holdings are the same for different postcodes within the same codegroup. The validity of this approach is strengthened by the circumstance that, unlike most other lotteries, randomization in the PCL is over postcodes instead of lottery tickets. This carries the important advantage that even when there are social interactions in ticket holdings, average ticket ownership in winning and non-winning postcodes should by and large be similar.[10] We show that the observable household characteristics for winning versus nonwinning postcodes in the same codegroup are very similar, which suggests that individual ticket holdings will also be similar. Finally, for some definitions of a household's social comparison group, we observe the number of PCL tickets purchased by the comparison group using our own survey data; we report the results of these exercises near the end of the Section 6.[11]

4. Data

From September 2003 until July 2006 we sent out written surveys to all addresses in PCL-winning postcodes, six months after the prize was won. Moreover, for each winning postcode, we selected one or more neighboring postcodes as control group, and sent out the same written survey in those postcodes. In all, we surveyed households in 419 postcodes. An average postcode contains 19 households; the smallest postcode surveyed contained 4 households and the largest 105. Very few Dutch postcodes (8/419 = 2.1% in our sample) contain more than 45 households. The survey contains questions on household composition, demographic variables (age, gender, ethnicity, family relationships and marital status), education, labor supply, happiness, car ownership, large expenditures, income, and lottery participation. For some of the

[10] By construction, winning codes must contain at least one household that purchased a PCL ticket; non-winning codes do not have so satisfy this criterion to be in our sample. This may induce an underrepresentation of small postcodes in the sample of winning postcodes. To see if this might affect our results, the paper's website replicates our main estimates of social effects after excluding all postcodes containing fewer than 19 households from our sample. (If the true share of households buying tickets is .25 and buyers are independently distributed over space, this reduces the probability that a code will contain zero buyers to less than .004). The estimated social effects are similar, and if anything, slightly larger in magnitude.

[11] Another remedy for possible unobserved differences in neighbors' ticket holdings is to time-difference our consumption measures within households; this is possible for some of our consumption indicators where we have

questions respondents provided information on both current behavior (i.e. six months after the prize) and, retrospectively, behavior a year earlier (i.e. six months before the prize).

At the beginning of the survey, households were invited to participate in "scientific research on expenditures and income of Dutch households", without any reference to social interactions or the PCL. Questions about lottery participation were asked after the consumption questions, near the end of the survey. Households were offered €7.50 (€10.00 in a small number of cases) to complete the survey. Respondents could choose among a number of charities to receive this fee, or could provide any bank account number (including their own) to which the token was to be credited. If households did not respond within two weeks, a reminder was sent to households whose phone number was not known. Other non-respondents were called and asked to complete the questionnaire by telephone with the assistance of a survey agency employee. The response rate was 32.1 percent in winning postcodes, 33.0 percent in non-winning codes, and 32.7 percent overall. This overall rate is close to the average response percentage of Statistics Netherlands for similar surveys. Our final sample contains 2011 observations, 510 of which were completed by telephone.

Since our sampling frame is based on addresses six months after the lottery, our sample would be nonrepresentative if households' propensity to move out of a postcode depends on whether that code (or household) won the PCL. We examined this question directly using the Cadastre and Public Register Agency data on house sales, finding no significant difference in the number of home sales after the PCL prize draw between winning and nonwinning addresses.[12]

The street addresses of all respondents to our survey are known. Identification of social effects is however facilitated if we know the location of all lottery winners in the winning codes surveyed, including those winners who did not respond to our survey. The PCL administration provided us with the street addresses of all winners, plus information on winnings for every winning postcode in our survey. We subsequently linked each address with its geographical (*x, y*) coordinates provided to us by a company (*Bridgis*) that obtains the data from municipal land registry offices.

From these addresses and coordinates, we compute two alternative classes of social

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(retrospective) information referring to the period before the lottery win. While recall bias is a concern with these estimates, they are largely similar to our main results. See the previous version of this paper (Kuhn et al, 2008).

[12] These results are available on the paper's website.

comparison groups for a typical household. The first defines a household's two immediate neighbors as those addresses in the same postcode with house numbers (or unit numbers in the case of multi-unit addresses) immediately below and above its own house number (houses in a postcode all share the same street name); its nearest four neighbors are defined analogously. A second class of proximity measures uses the (*x, y*) coordinates (in meters) for all addresses in all postcodes in our sample, plus those of all the lottery winners as reported by the PCL administrators. In this data, addresses within the same building have the same (*x, y*) coordinates. Thus, within buildings, our 'neighbor' variable based on the unit number might be a superior measure of proximity to winners than that based on (*x, y*) coordinates. One might argue that physical visibility or social distance is more relevant to peer effects than Euclidian distance. Our choice of the latter is guided by data availability.

Tables 1 and 2 report descriptive statistics for the households in our survey. In addition to providing a statistical portrait of our respondents before the 'treatment', Table 1 provides a test of the exogeneity of the lottery win by comparing lottery participants and non-participants in winning versus non-winning postcodes. If winning postcodes are randomly selected, if the decision to respond to our survey is independent of whether the code was a winning one, and if households' reporting of their own consumption behavior is not affected by living in a winning postcode, there should be no statistically significant differences between the two columns of Table 1.

Table 1 shows that participants in winning codes only differ (at the 10 percent significance level) from those in non-winning codes with regard to higher education level, age and the amount spent on food away from home. For non-participants, only the share of two-headed households is somewhat larger in winning codes. Overall, the message of Table 1 is one of consistency with random selection of winning codes and absence of response or recall bias.[13]

Table 2 presents descriptive statistics on awareness of and participation in the postcode lottery and on amounts won. Awareness by residents of the fact that their postcode won the PCL is high, even six months after the win. In both winning and non-winning postcodes, all participating households say they remember that a PCL Street Prize was awarded in that code 6 months after the fact. Awareness among non-participants is significantly higher in winning

postcodes. Both for participants and non-participants, those living in the winning postcode do recall the number of households who won, and report house numbers of at least some of these winners significantly more often than their counterparts in the neighboring non-winning codes do (for example, for non-participants the numbers are 42 vs. 17 percent and 20 vs. 4 percent, respectively). Such high awareness levels would seem to be conducive to social effects.

The next two sections of Table 2 provide information on PCL ticket ownership and winnings. The average PCL participant held about 1.8 tickets; the average amount won was €18,596. After the 25% lottery tax, these winnings correspond to about €13,947, or about 7 months of post-tax income for a typical Dutch household. 11.2 percent of ticket owners in winning codes won a BMW. Adding in the expected value of this BMW (we value the BMW at €25,000), the average amount won by a household in the PCL rises to €13,947 + .112(€25,000) = €16,047, or about 8 months of income for an average family in our sample.[14]

The remainder of Table 2 presents a variety of indicators of the amount of lottery winnings that took place in the geographical vicinity of a typical household in our data. According to our data, in winning codes, just under half of PCL nonparticipants lived next door to a PCL winner.[15] The average amount won by a PCL nonparticipant's two immediate neighbors (combined) was €12,578. Both of these numbers were somewhat higher among PCL participants; this may reflect social interactions in ticket holdings. For an average nonwinning household living in a winning code, 2.36 winning households lived in the same building (and were thus assigned the same (x, y) location) and 2.86 winning households lived within 25 meters of an average survey household. A typical nonwinning household in a winning code shared that code with 7.8 winning households who won a total of €201,628 between them.

5. Simple treatment effect estimates

Table 3 presents descriptive statistics for a list of outcome variables that are possibly affected either by winning the lottery, or by living close to lottery winners. The difference between the entries in columns (4) and (2) provides the empirical analogue to the ITE described

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[13] The statistics in Table 1 are also consistent with national means from Statistics Netherlands. See this paper's webpage for details.

[14] The BMW awarded in the PCL is a model 116i. Between 2005 and 2007 we found advertised new prices for this vehicle ranging from €25,400 to €28,500. We apply the lottery tax to the BMW as well as to the cash winnings in this calculation.

by equation (2) and likewise, the difference between the entries in columns (3) and (1) provides the empirical analogue to the ATE described by equation (4).

For PCL participants in winning and non-winning codes we find statistically significant post-lottery differences in expenditures on food away from home, other monthly items and total monthly expenditures.[16] Participants in winning codes spend about 1181 – 995 = €186 more on monthly items 6 months after the win than participants in nonwinning codes; while this appears to be a large increase (186/996 ≈ 19%) in expenditures on nondurables, we note that €186 is only one percent of the average amount won by PCL participants, and (as discussed in Section 3) this difference represents the sum of own and social effects of a PCL win. We also find significant differences for several indicators of major expenditures that refer to the entire six-month period between the lottery and survey dates. Participants in winning codes were four times as likely (4.5 versus 1.0 percent) to initiate major exterior home renovations during this period and spent over €500 more on noncar durables than participants in nonwinning codes.[17] Table 3 also shows a number of significant differences in car ownership between winning and non-winning codes six months after the lottery date. For example, compared to PCL participants in non-winning codes, the main car of participating households in winning codes is on average thirteen months newer. To avoid the possibility that this is simply the mechanical consequence of the fact that cars (specifically BMWs) were a prize in the PCL, all BMW winners have been excluded from this sample. It thus seems that households who won only cash increase their car consumption after a lottery win. Finally, PCL winners are more likely than non-winners to donate the fee they receive for completing our survey to charity.

A comparison of non-participants in winning and non-winning codes does not show significant differences in consumption for any of the monthly or non-car durable expenditures. Among non-participants, those who live in winning codes are less likely to play the PCL six months later. Witnessing one's postcode-mates win the PCL does not make non-winning

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[15] In principle, a household in (but at the boundary of) a non-winning code could live next door to a PCL winner; our method of identifying neighbors will not capture these households. Households living in non-winning codes but close to winners are, however, included in our Euclidean-distance-based measures of proximity to winners.

[16] All of these consumption items are asked in the sixth month after winning the survey and refer to the previous month. We also examined differences in post-lottery labor market behavior, including whether household heads work and their hours of work. No effects were found, either in the Table 3 specifications or the regression-based analyses undertaken later in this paper.

[17] The 'occasional' expenditure amounts (including vacations and non-car durables) in Table 3 are not directly comparable to the pre-lottery levels in Table 1 because the latter refer to the 18-month period preceding the lottery date in one's codegroup.

households any less happy six months after the fact. However, Table 3 also shows that non-participants in winning codes are significantly more likely (11.0 versus 15.9 percent) to buy a car in the six months after the lottery date, to own more cars at the survey date, and to own more total car efficiency units at the survey date.[18]

Since BMWs are a prize in the PCL, it is of interest to look specifically at BMW ownership six months after the lottery. The results for BMW ownership are both clear and, perhaps, surprising: six months after the lottery, participating households in winning codes are statistically no more likely to own a BMW than participating households in non-winning codes. Thus it appears that most BMW winners either elected to receive the cash prize in lieu of the BMW or sold their BMWs shortly after they received them. To explore this result further, the bottom panel of Table 3 provides additional details on post-PCL BMW ownership. It shows that 25 BMW winners responded to our survey. Of these, only four, or 16 percent, still owned a BMW at the survey date.[19] While this percentage of BMWs is more than one would expect in a random sample of Dutch households, overall the behavior of the BMW winners in our sample is remarkably consistent with simple models of in-kind transfers (see for example Moffitt 1984, 1989): whenever a gift in kind would induce a suboptimal consumption mix (as a new BMW is likely to do for the vast majority of Dutch households), that gift should, if possible, be converted into its cash equivalent and spent on other items or saved.

In sum, in addition to confirming simple models of in-kind transfers, Table 3 provides preliminary evidence of social consumption effects for only one type of good, which is arguably the most highly visible consumption item to one's residential neighbors: cars. The results for PCL participants suggest the presence of own effects for a number of expenditure categories, including cars but also other durables and possibly total monthly expenditures. We comment on the magnitude of these effects in the following two sections.

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[18] Our efficiency units measure combines information on both the number and quality of cars owned by the household at the survey date. A car that is less than one year old is defined as one efficiency unit; all other cars owned by the household are depreciated by 15% per year.

[19] Our survey collects information on a maximum of two cars per household. Could a significant number of BMW winners still own a BMW as their third, or higher-order car? For 18 of the 25 BMW winners, this is impossible, since they own either zero or one car at the survey date. Of the remaining 7 households, two report owning a BMW

6. Own Effects of Lottery Winnings

Column 1 of Table 4 reports our estimated effects of lottery income on a household's own consumption, based on equation (5). Coefficients in this column represent the effects of winning €10,000 on the outcome variable in question; each row of the table corresponds to a different regression. Each of these regressions controls for a quadratic for the number of tickets purchased, a dummy for residence in a winning postcode, household demographic variables, and a full set of codegroup fixed effects. Also included are the household's own nonlottery income 6 months before the lottery date (whose coefficient is reported in column 2), and a dummy for owning any PCL tickets (coefficient in column 3). As discussed, our identification strategy is based on the notion that, conditional on the number of lottery tickets purchased by a household (including zero), income shocks are randomly assigned by the random event of a household's postcode being drawn as a winner.

According to Table 4, winning the PCL –now controlling for neighbors' winnings-- has no detectable effects on several expenditure categories, including food at home, transportation expenditures, other monthly expenditures, and total monthly expenditures. Own effects are, however, suggested for various aspects of car consumption. For example, winning €10,000 appears to reduce the average age of a household's main car by about 0.4 years six months after the lottery date. Since the average age of a main car is about 7 years, this is about a six percent decline; the 90% confidence interval surrounding this estimate runs from .11 to .76 years. Another effect of winning the lottery is on food away from home. This effect however seems to be driven by the fact that pre-lottery expenditures on food away from home were already higher among participants in winning codes (see Table 1). Winning €10,000 is estimated to raise expenditures on non-car durables expenditures by €308, or 38 percent, with a 95% confidence interval running from €62 to €570, or 8 to 70 percent. Such large responses are consistent with liquidity-constrained versions of the life cycle consumption model (e.g. Browning and Crossley, forthcoming), or from 'mental accounting' models with self-imposed borrowing constraints (Shefrin and Thaler 1988). Winning the PCL has no effect on a household's reported happiness six months after the event; more precisely, with 95% confidence we can rule out declines in happiness of more than .12 units and increases of more than .08 units on a scale of 1 to 10. Respectively, these limits correspond to .07 and .05 of the cross-sectional standard deviation of

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at the survey date. Thus at the very most, 5 BMWs could be missing from our sample for this reason. Since owning more than two cars is very rare in the Netherlands, the true number is likely much smaller.

happiness (1.75) in our sample. Contrary to the simple results for winners in Table 3 (which combine own and social effects), greater lottery winnings do not raise the likelihood that a household will donate its fee for completing our survey to charity.

Own winnings and non-lottery income

In order to shed additional light on the estimated effects of lottery winnings in column 1 of Table 4, we compare them to the coefficients on the household's own pre-lottery income, reported in column 2. Compared to lottery winnings – which are temporary and unexpected –, cross-sectional income differences should have a substantially larger permanent component. According to the life-cycle model of consumption, they should therefore be more strongly related to current expenditures than are lottery winnings, at least for non-durables. While this is true for most of our point estimates, the only statistically significant differences between the effects of lottery and nonlottery income are for whether the household donated its survey fee to charity (at 10%) and for happiness (at 1%); this happiness result is discussed in more detail below.

Two other implications of the life cycle model are that the effects of lottery winnings on expenditures should be greater for older households, and for lower-income households, since in both these cases a 10,000-euro PCL prize has a larger proportional effect on the present value of lifetime income. To explore these predictions we re-estimated Table 4 separately for low- and high-education groups, and for households whose heads are above and below the median age of 50. While interesting, the results may reveal more about the distinction between luxuries and necessities and age-related variation in a household's consumption priorities than the life cycle hypothesis *per se*: low-education households spend more of their lottery winnings on cars, and less on vacations than high-education households. Young households also spend more of their lottery winnings on cars than older households, but older households' non-car durables consumption is much more responsive to lottery income than younger households'.

The one outcome on which lottery and nonlottery income have the most dramatically different effects in Table 4 is happiness. Indeed, in contrast to our results for lottery winnings, and consistent with both Easterlin (1974) and Stevenson and Wolfers (2008), higher total income is very strongly associated with happiness in a cross-section of households. One interpretation of these contrasting results is that the six-month lag between the PCL win and the survey date is too long: lottery winnings could affect own happiness, but the effects are very transitory, as argued by both Easterlin and Kahneman et al. (2006). Alternatively, the results of Gardner and Oswald

(2007) suggest that six months might be too short: In their analysis of Britons who receive lottery wins between £1000 and £200,000 they find that in the year a prize is won, mental stress goes up, while in subsequent years lottery winners show less stress than non-winners. Finally, it is possible that happiness is simply more linked to long-run personal income than short-run fluctuations, both because permanent income differences enable the household to take more happiness-improving actions, and perhaps because long-term income differences are more likely to be seen as earned and thus "legitimate".[20]

7. Social Effects of Lottery Winnings

We estimated social effects using all the indicators of neighbors' winnings summarized in Table 2, but report only the results using four representative indicators in columns 3-6 of Table 4. As already noted, the estimate in column (3) is taken from the same regression as the coefficients in columns (1) and (2), which uses residence in a winning postcode (i.e. D^W_i as specified in equations 1-4) as our indicator of neighbors' winnings, $\overline{W}_{N(i)}$. Each of the remaining columns re-runs this regression, *replacing* D^W_i by a different alternative indicator of neighbors' winnings. (The estimated coefficients on own winnings and own nonlottery income did not change much when we did this, and are not reported to save space.) One pattern is immediately evident: for most consumption items, no social effects are detected. In particular, with a few apparently random exceptions, Table 4's indicators of neighbors' lottery winnings have no statistically significant effects on any category of monthly expenditures, vacations, or non-car durables.

An outcome of particular interest is happiness. According to column (3) in Table 4, living in a winning postcode (not winning oneself) has no effect on household's happiness; more precisely we say with 95% confidence that living in a winning postcode (but not winning oneself) reduces happiness by no more than .11 of a standard deviation, and that it raises happiness by no more than .07 of a standard deviation. This result contrasts with Luttmer's (2005). However, his result refers to effects of neighbors' *earnings* on happiness, which have a bigger permanent component than lottery winnings, and neighbors' earnings are not randomly assigned in his analysis. The absence of an effect of exogenous changes in neighbors' incomes

[20] Another interpretation of our own-happiness results is of course the possibility that the cross-sectional correlation between income and happiness is driven by reverse causation (happier people are more successful in the labor

on own happiness in our data is also consistent with Stevenson and Wolfers' (2008) claim that relative incomes do not have large effects on happiness.

In contrast to the above results, Table 4 provides quite robust evidence of social effects for PCL participation and disposition of the survey fee. The former are negative-- in other words, lottery nonparticipants who are surrounded by households who won the PCL six months ago are less likely to play the PCL today than nonparticipants who are not surrounded by winners.[21] On the other hand, living in close proximity to winners increases the likelihood that the respondent will donate his/her survey fee to charity (even though we detect no own effects of winning on this outcome).[22]

Finally, Table 4 suggests the presence of social effects for two aspects of consumption that are arguably most visible to one's neighbors: exterior home renovations and cars. While the evidence for the former is confined to one regression specification, the evidence for cars is more robust. Statistically significant effects are found for all for of four indicators of car consumption, and for two our four measures of neighbors' winnings. These estimates of social effects on car consumption are substantial in size. For example, having an immediate neighbor win the PCL raises the probability that a household will buy a car in the next six months by close to 5 percentage points and reduces the mean age of its main car at the survey date by about half a year (about a 7 percent decline). For two car consumption indicators (total car efficiency units and the age of the main car), the estimated effects of an immediate neighbor winning the PCL are very similar in size to the estimated own effects of winning €10,000; for the incidence of car purchases in the past six months it is actually greater than the own effect.

In sum, with the exception of car consumption and of two items closely associated with our survey and the PCL itself (current PCL participation and the disposition of the survey fee), the analysis reported in Table 5 does not detect any statistically significant social effects of the PCL. However, relative to the fact that the one-time lottery win has only a modest effect on households' *own* consumption choices (consistent with the life-cycle hypothesis), the effects we do detect are substantial in magnitude.

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market). This interpretation would, however, be at odds with Stevenson and Wolfers' recent claim that economic growth promotes happiness.

[21] The regret-minimization aspect of the PCL combined with a "lightning never strikes (the same postcode) twice" misperception might provide an explanation: Having observed the "losers" in their neighboring winning postcode, non-participants in non-winning codes may feel a strong urge to 'insure' against non-winning through participation.

A Closer Look at Social Effects in Car Consumption

In the remainder of this section we conduct a more detailed analysis of social effects of lottery winnings on car consumption. Our motivation is that, of all our consumption indicators, cars are (a) likely to be the most visible to one's residential neighbors, and (b) durable. Unlike an expensive party or vacation which only happens once, a household's neighbors are continuously reminded of one's new car after it has been purchased.

Table 5 presents estimated effects of a much larger variety of neighbors' winnings measures on our four indicators of car consumption. The specification is identical to Table 4; for convenience we reproduce Table 4's estimates in row 1. Two patterns are evident. First, none of the indicators of neighbors' winnings based on Euclidean distance have statistically significant effects on any measure of car consumption. We conjecture that these measures do not discriminate sufficiently among the very large share (81 percent) of Dutch households who live in multi-unit dwellings.[23] Second, while we detect a number of effects at the level of the entire postcode, statistically significant social effects are most consistently observed for measures of neighbors' winnings based on a household's two or four nearest neighbors. This suggests that social effects on car consumption are highly localized.

If these social effects are genuine, they should also be visible in simple comparisons that take the best possible advantage of the exogenous assignment of lottery winnings in our sample. Focusing, as suggested by Table 5, on a household's two and four nearest neighbors, Table 6 restricts attention to PCL non-participants (like the simple comparison in Table 3, this holds own winnings constant) and presents simple means of our three car consumption indicators for three subgroups: those who live in non-winning codes, those who live in winning codes but do not live next door to a PCL winner (these households will be affected by any postcode-wide social effects on car consumption), and those who do live next door to a PCL winner (who are affected both by post-code-wide social effects and those stemming from their immediate neighbors). In addition to our car consumption measures, the second row 2 of Table 6 asks – as a falsification test – whether a household acquired one of its currently-owned vehicles in the six months before

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[22] Since the main purpose of the PCL is to raise funds for charity, it may be that participants view their participation as a charitable contribution. It has been suggested that the publicity associated with a local win induces non-participants to make charitable donations as well, for example via their survey fee.

[23] Throughout this paper, households are defined as living in a multi-unit dwelling if their address shares a Bridgis (x,y) location with at least one other address.

(rather than after) the lottery. Clearly, all indicators of car consumption in Table 6 except row two are largest for households living next door to PCL winners. To the extent that, within postcodes, living next door to a PCL ticket holder is exogenous, Table 6 provides convincing evidence that (a) social effects of winning the PCL do exist, but (b) they are highly localized, restricted in large part to a household's nearest neighbors.

Table 7 extends the analysis of Table 6 by addressing the possible endogeneity of living within one or two doors of a PCL winner. As already discussed, if unobserved household characteristics are correlated *within* postcodes at the extremely detailed level of next-door neighbors, households who live next door to ticket buyers may differ from other households in unobserved ways that could contaminate Table 6's estimates. To address this concern, Table 7 uses information from our survey to construct an indicator of whether a household lives next door to a PCL buyer. As already noted, this indicator is necessarily incomplete because it is survey-derived. In particular, to be in the sample for columns 1 and 2 of Table 7, a survey household must have had at least one of its two nearest neighbors respond to the PCL survey *and* at least one of those neighbors must report holding a PCL ticket in our survey. That said, by construction, all the households in the Table 7 sample live next door to a known PCL ticket owner; the only variation in whether their neighbors have PCL winnings is generated by the random selection of winning codes. As the Table makes clear, all indicators of current car consumption with the exception of the 'placebo' measure in row 2 are higher for those households who were exposed to the treatment of having a next-door neighbor win the PCL. Sample sizes are small, however, and only one of the comparisons is statistically significant (and that at 10%). In columns 3 and 4 we replicate this analysis, expanding the sample to nonparticipating households who live within two doors of a known PCL participant. Both sample size and statistical significance now increase.

6. Conclusion

We have used the natural experiment associated with the Dutch postcode lottery (PCL) to study both the own and social effects of a temporary, unexpected income shock equal to about eight months of income on households' consumption behavior and self-reported happiness. The natural experiment provided by the PCL has a number of advantages, including exogeneity of the income shock to a household's residential neighbors and the absence of direct causal effects of household mobility. One possible concern with our design is that social effects of a

PCL win spill might over to neighboring codes; however our evidence suggests that social effects are highly localized. Further, if there are any spillovers to neighboring codes, our estimated social effects are biased towards zero, making our test for their presence a conservative one.

According to our estimates, the own effects of winning the PCL are confined largely to cars and other consumer durables. This finding is consistent with a permanent income model in which households use durable expenditures to smooth consumption, or with mental accounting models in which households are reluctant to borrow from accounts viewed as 'assets'. In addition, as predicted by simple models of transfers in kind, the vast majority of households who exogenously receive a large, in-kind transfer (a new BMW) converted that prize into other goods or savings, despite the transactions cost and/or tax penalty associated with doing so.

We do find robust evidence for social effects of lottery winnings, but only for one good -- car consumption-- which is likely to be easily, and repeatedly, visible to a household's neighbors. While we observe a strong cross-sectional association between (non-lottery) income and self-reported happiness in our data, lottery winnings do not make households happier, nor do they make neighboring households less happy. These happiness results are consistent with a scenario in which (a) happiness is more linked to permanent than to short-term increases in income, and (b) at least in the short term, income comparisons with one's residential neighbors do not affect happiness.

What models of consumer behavior might explain the social effects estimated in our data? While it is tempting to interpret our estimates as reflective of a psychological need to "keep up with the van den Bergs"[24], we note that they could also be driven by other factors. For example, social spillovers in car consumption could be driven by information-sharing about cars and/or dealers (see for example Grinblatt et al., 2008); by something as simple as households passing money to immediate neighbors, who might be family members; or by households selling their used car (though not the BMW awarded in the PCL) to neighbors. It is noteworthy that intrafamily income transfers were indeed the main channel responsible for the social effects detected by Angelucci and De Giorgi (forthcoming) in Mexican villages; while it seems less likely to be operative in Dutch postcodes we cannot rule it out. Also, it is worth re-emphasizing that our estimates do not distinguish 'imitative' consumption patterns (I buy a car because you buy one) from more general effects of neighbors' incomes on a household's consumption. Still,

we find that households' consumption of visible, durable goods (and *only* such goods) is affected by exogenous shocks to their neighbors' incomes.

Finally, we note that, despite the lack of detectable own spending responses for most consumption items, our results contain some encouraging news for fiscal policies such as unexpected tax rebates designed to stimulate consumer spending in developed economies: To the extent that such 'stimulus' policies aim specifically at "big-ticket" items (mostly durables) – where consumer spending is most cyclically sensitive to begin with – our results suggest that they may have substantial own effects, as well as significant social multiplier effects (Glaeser *et al*., 2003). These social multipliers are distinct from, and would presumably operate in addition to, the usual Keynesian multipliers that have been studied in this context.

[24] Parallel to "Jones", van den Berg is the fourth most common surname in the Netherlands, according to Wikipedia.

References

Agarwal, Sumit, Chunlin Liu, and Nicholas S. Souleles. (2007). "The Reaction of Consumer Spending and Debt to Tax Rebates—Evidence from Consumer Credit Data," *Journal of Political Economy* 115(6) (December): 986-1019.

Angelucci, M., and G. De Giorgi (forthcoming)."Indirect Effects of an Aid Program: The Case of Progresa and Consumption," *American Economic Review*.

Bobonis, G. J., and F. Finan (forthcoming). "Endogenous Peer Effects in School Participation," *Review of Economics & Statistics*.

Browning, M. and T. Crossley (forthcoming). "Shocks, stocks and socks: smoothing consumption over a temporary income loss," *Journal of the European Economic Association*, available at: http://www.econ.cam.ac.uk/faculty/crossley/research/socks_jeea_v3.pdf

Cipollone, P., and A. Rosolia (2007). "Social Interactions in High School: Lessons from an Earthquake," *American Economic Review*, vol. 97(3), pp. 948-965.

Duflo, E., M. Kremer, and J. Robinson (2004). "Understanding Technology Adoption: Fertilizer in Western Kenya – Preliminary Results from Field Experiments," Unpublished manuscript, Massachusetts Institute of Technology.

Duflo, E., and E. Saez (2003). "The Role of Information and Social Interactions in Retirement Plan Decisions: Evidence from a Randomized Experiment," *Quarterly Journal of Economics*, 118(3), 815–842.

Easterlin, Richard A. (1974). "Does Economic Growth Improve the Human Lot? Some Empirical Evidence". In *Nations and Households in Economic Growth: Essays in Honor of Moses Abramowits*, Paul A. David and Melvin Reder, eds. New York: Academic Press.

Gardner, Jonathan and Andrew J. Oswald (2007). "Money and mental wellbeing: A longitudinal study of medium-sized lottery wins" *Journal of Health Economics* 26 (2007) 49–60

Glaeser,Edward L., Bruce I. Sacerdote and Jose A. Scheinkman (2003). "The Social Multiplier". *Journal of the European Economic Association*1(2-3) (April-May): 345-53

Grinblatt, Mark, Matti Keloharju and Seppo Ikaheimo (2008). "Social Influence and Consumption: Evidence from the Automobile Purchases of Neighbors", *Review of Economics and Statistics*, Vol. 90, No. 4: 735–753.

Imbens, G., D. Rubin, and B. Sacerdote (2001). "Estimating the Effect of Unearned Income on Labor Earnings, Savings and Consumption: Evidence from a Survey of Lottery Players" *American Economic Review* 91(4) (September): 778-794.

Kahneman, Daniel, Alan Krueger, David Schkade, Norbert Schwarz, and Arthur Stone (2006). "Would You Be Happier If You Were Richer? A Focusing Illusion": Princeton University, Department of Economics, Center for Economic Policy Studies, Working Paper.

Katz, L. F., J. R. Kling, and J. B. Liebman (2001). "Moving To Opportunity in Boston: Early Results of a Randomized Mobility Experiment," *Quarterly Journal of Economics*, 116, 607–654.

Kling, J. R., J. Ludwig, and L. F. Katz (2005). "Neighborhood Effects on Crime for Female and Male Youth: Evidence from a Randomized Housing Voucher Experiment," *Quarterly Journal of Economics*, pp. 87– 130.

Kuhn, Peter J., Peter Kooreman, Adriaan R. Soetevent and Arie Kapteyn (2008). "The Own and Social Effects of an Unexpected Income Shock: Evidence from the Dutch Postcode Lottery" NBER working paper no. 14305 (May).

Lalive, R., and Alejandra Cattaneo (forthcoming). "Social Interactions and Schooling Decisions," *Review of Economics & Statistics.*

Ludwig, J., G. J. Duncan, and P. Hirschfield (2001). "Urban Poverty and Juvenile Crime: Evidence from a Randomized Housing-Mobility Experiment," *Quarterly Journal of Economics*, CXVI, 655–679.

Luttmer, Erzo. (2005). "Neighbors as Negatives: Relative Earnings and Well-Being" *Quarterly Journal of Economics*, 120(3) (August): 963-1002.

Miguel, E. and Kremer, M. (2004). Worms: identifying impacts on education and health in the presence of treatment externalities. *Econometrica* 72(1): 159-217.

Moffitt, R. A. (1984). The effects of grants-in-aid on state and local expenditures: The case of AFDC. *Journal of Public Economics*, *23*, 279-305.

Moffitt, R. A. (1989). Estimating the value of an in-kind transfer: The case of food stamps. *Econometrica*, *57*(*2*), 385-409.

Moffitt, R. A. (2001). "Policy Interventions, Low-Level Equilibria, and Social Interactions," in Social Dynamics, ed. by S. N. Durlauf, and H. P. Young, pp. 45–82. MIT Press.

Sacerdote, Bruce, (2001). "Peer Effects with Random Assignment: Results for Dartmouth Roommates," *Quarterly Journal of Economics*, 116(2), 681-704.

Shefrin, Hersh M. and Richard H. Thaler, Richard H. (1988). "The Behavioral Life-Cycle Hypothesis" *Economic Inquiry* 26(4) (October): 609-43

Stevenson, Betsey and Justin Wolfers (2008). "Economic Growth and Subjective Well-Being: Reassessing the Easterlin Paradox" unpublished manuscript, Wharton, University of Pennsylvania, April 16.

Wooldridge, Jeffrey M. (2002). "Econometric analysis of cross section and panel data." MIT Press, Cambridge, Massachusetts.

Zeelenberg, M. and Pieters, F.G.M. (2004). "Consequences of regret aversion in real life: The case of the Dutch postcode lottery". *Organization Behavior and Human Decision Processes*, 93, 155-168

Table 1: Descriptive Statistics, Pre-Lottery Characteristics

Permanent or pre-lottery characteristic:	Non-winning postcodes		Winning postcodes	
	(1) Participants	(2) Non-participants	(3) Participants	(4) Non-participants
Number of persons in household [1]	2.74	2.12	2.72	2.18
Two-headed household? [1]	0.767	**0.581**	0.780	**0.638**
Secondary education?[2]	0.940	0.906	0.941	0.918
Higher vocational training or university? [2]	***0.326***	0.342	***0.256***	0.332
Age[3]	**49.60**	50.00	**52.49**	49.78
Number of children in household	0.664	0.461	0.668	0.513
For single-headed households:				
Head works?	0.514	0.418	0.510	0.468
Head's hours[4]	14.94	14.19	19.22	15.90
For two-headed households:				
Husband works?	0.723	0.639	0.655	0.633
Husbands' hours[4]	28.21	23.87	24.85	23.83
Wife works?	0.623	0.549	0.569	0.548
Wife's hours[4]	17.46	15.32	15.57	15.39
Monthly expenditures: (euro, one year before survey date)				
Food at home	426.28	438.58	460.24	412.70
Food away from home	**83.84**	100.74	**119.63**	84.50
Transportation	177.43	178.03	178.90	193.99
Other monthly	239.07	240.10	290.82	247.35
Total monthly	936.46	951.79	1057.51	908.82
Occasional Expenditures:				
Exterior home renovations before lottery (any?) [5]	0.090	0.040	0.063	0.042
Other home renovations before lottery (any?) [5,6]	0.183	0.167	0.148	0.151
Vacation expenditures before lottery (euro) [5]	307.48	349.24	486.12	463.41
Non-car durables expenditures before lottery (euro) [5]	1737.37	1574.20	1971.67	1516.56
Total Annual Household Income (euro, post tax, pre lottery)	25341	22679	27322	22517
Happiness[7]	6.87	6.68	6.92	6.78
Sample size[8]	301	878	223	478

Notes: Statistically significant differences between columns (1) and (3) and between columns (2) and (4) at 5% in **bold,** at 10% in ***italics***.

1. Refers to one year before the survey date.
2. For single-headed households, indicates whether the head has at least the level of education indicated. For two-headed households, indicates whether at least one head has this level of education.
3. For single-headed households, age in years. For two-headed households, a simple average of the husband's and wife's ages.
4. Usual weekly hours one year before the survey date. Equals zero for non-workers.
5. Refers to the 18 month period preceding the lottery date.
6. Includes interior renovations and those whose type could not be determined.
7. Self assessed on a scale from 1 to 10 (refers to one year before the survey date)
8. Gives the number of observations in winning and non-winning codes. Sample sizes vary across rows of the table due to missing values and sample restrictions.

Table 2: Descriptive Statistics, Lottery Characteristics

	Non-winning postcodes		Winning postcodes	
	(1) Participants	(2) Non-participants	(3) Participants	(4) Non-participants
Awareness of lottery:				
Remember PCL Street Prize?	1.000	**0.534**	1.000	**0.816**
Recall number of winning households	**0.369**	**0.170**	**0.776**	**0.421**
Recall winners' house numbers	**0.086**	**0.042**	**0.363**	**0.195**
Lottery participation and winnings:				
Number of tickets held	1.853	0	1.782	0
Amount of cash won (euro)	**0**	0	**18596**	0
Won BMW?	**0**	0	**0.112**	0
Indicators of neighbors' winnings:				
Had an immediate neighbor who won?	**0**	**0**	**0.596**	**0.490**
Number of immediate neighbors who won (0, 1, 2)	**0**	**0**	**0.744**	**0.584**
Total amount won by immediate neighbors (incl. value BMW)	**0**	**0**	**15134**	**12578**
Number of winning households:				
In same building	**0.299**	**0.473**	**2.685**	**2.359**
Within 25 meters	**0.385**	**0.536**	**3.329**	**2.861**
Within 100 meters	**4.336**	**3.991**	**5.455**	**6.582**
In your postcode	**0**	**0**	**9.946**	**7.813**
Total amount won:				
In same building	**8056**	**12414**	**65597**	**62631**
Within 25 meters	**10257**	**13874**	**82489**	**75604**
Within 100 meters	**108555**	**100315**	**204448**	**167726**
In your postcode	**0**	**0**	**256869**	**201628**

Notes: Statistically significant differences between columns (1) and (3) and between columns (2) and (4) at 5% in **bold**. See Table 1 for sample sizes.

Table 3: Descriptive Statistics, Outcome Variables

Post-lottery characteristic:	**Non-winning postcodes**		**Winning postcodes**	
	(1) Participants	**(2) Non-participants**	**(3) Participants**	**(4) Non-participants**
Monthly expenditures: (euro, at the survey date)				
Food at home	464.91	471.40	494.55	450.50
Food away from home	**83.64**	97.87	**124.5**	90.96
Transportation	189.89	192.34	213.87	218.26
Other monthly	**254.50**	255.32	**335.71**	281.12
Total monthly[1]	**995.12**	1002.48	**1180.88**	1035.85
Occasional expenditures:				
Exterior home renovations since lottery (any?)	**0.010**	0.017	**0.045**	0.023
Other home renovations since lottery (any?)	0.083	0.072	0.072	0.065
Vacation expenditures since lottery (euro)[2]	449.67	195.31	482.96	177.31
Non-car durables expenditures since lottery (euro)[2]	**658.90**	805.69	**1191.80**	748.00
Total annual household income (euro, post tax, pre lottery)	26662	23337	28444	24194
Other outcomes:				
Happiness[5]	7.02	6.82	7.05	6.87
PCL participant at survey date?	0.924	**0.131**	0.933	**0.094**
Donate survey fee to charity?	***0.442***	0.418	***0.525***	0.439
Car variables (non-BMW winners only):				
Acquired car since lottery date?[3]	0.113	**0.110**	0.121	**0.159**
Number of cars (up to 2)	1.202	**0.929**	1.212	**1.023**
Age of main car (years)	**6.502**	7.139	**5.387**	6.786
Total car efficiency units[4]	**0.484**	**0.350**	**0.562**	**0.406**
BMW ownership six months after lottery (incl. BMW winners):				
share respondents owning BMW	0.037	0.015	0.031	0.008
among cash winners (198 obs.)			0.015	
among BMW winners (25 obs.)			0.160	

Notes: Statistically significant differences between columns (1) and (3) and between columns (2) and (4) at 5% in **bold,** at 10% in ***italics***. See Table 1 for sample sizes.

1. Sum of food at home, food away from home, transportation plus other expenditures.
2. Refers to the 6 month period between the lottery and survey dates.
3. Equals one if the household acquired any of the autos it currently owns after the lottery date.
4. A car that is less than one year old counts as one unit. All other cars are depreciated at 15 percent per year.
5. Self assessed on a scale from 1 to 10 (refers to the survey date)

Table 4: Own and Social Effects of Lottery Winnings

Outcome	Own effect	Household non-lottery income	Social effect			
	(1)	(2)	(3) Winning postcode?	(4) # winning households in postcode	(5) Total winnings within 25m	(6) Neighbor won?
CAR OWNERSHIP (excluding BMW winners from the sample)						
Acquired car since lottery date?	.0101 (.0169)	.0029 (.0069)	.0282 (.0171)	**.0032 (.0016)**	.0012 (.0015)	**.0484 (.0241)**
Number of cars at survey (up to two)	.0165 (.0252)	**.0334 (.0082)**	.0003 (.0272)	***.0040 (.0024)***	-.0003 (.0024)	.0029 (.0323)
Age of main car (years)	***-.4019 (.2086)***	-.1170 (.0801)	-.3857 (.2454)	**-.0464 (.0180)**	-.0241 (.0213)	***-.4996 (.2788)***
Total car efficiency units	***.0382 (.0210)***	**.0245 (.0065)**	.0197 (.0163)	**.0043 (.0014)**	.0001 (.0013)	***.0407 (.0237)***
MONTHLY EXPENDITURES						
Food at home: (euros)	13.73 (16.05)	8.91 (11.28)	-33.29 (38.21)	-1.28 (2.70)	-1.09 (1.89)	-44.31 (37.30)
Food away from home: (euros)	**17.22 (7.85)**	**15.48 (6.01)**	-10.16 (12.91)	-0.96 (1.03)	0.56 (0.76)	-9.18 (11.45)
Transportation expenditures: (euros)	6.82 (12.08)	-8.88 (12.08)	25.75 (21.66)	1.06 (1.71)	1.45 (2.07)	55.84 (35.80)
Other monthly: (euros)	19.25 (18.47)	***15.67 (9.28)***	2.21 (25.77)	0.24 (3.63)	-0.88 (2.62)	-1.57 (40.01)
Total monthly (euros):	62.70 (41.04)	***42.44 (24.94)***	-11.06 (71.87)	-1.24 (6.53)	-0.21 (4.66)	18.51 (96.05)
OCCASIONAL EXPENDITURES						
Home renovations: (any exterior?)	.0038 (.0032)	.0007 (.0033)	.0088 (.0076)	**.0014 (.0006)**	-.0006 (.0005)	-.0078 (.0113)
(any other?)	.0088 (.0091)	***.0076 (.0041)***	***-.0199 (.0120)***	-.0008 (.0011)	.0005 (.0011)	.0078 (.0171)
Vacation expenditures: (euros)	-6.09 (61.99)	90.84 (74.46)	-53.08 (94.95)	***9.44 (5.42)***	6.89 (5.26)	-26.02 (97.87)
Non-car durable expenditures: (euros)	**307.95 (131.21)**	**199.78 (79.40)**	-27.51 (176.39)	-4.25 (18.89)	17.07 (12.47)	-132.72 (244.93)
OTHER OUTCOMES						
Happiness	-.0225 (.0499)	**.1244*** (.0249)**	-.0323 (.0793)	.0008 (.0087)	-.0069 .0077	.1722 (.1054)
Participate in PCL at Survey Date?	.0067 (.0083)	***.0086 (.0046)***	**-.0326 (.0138)**	**-.0022 (.0011)**	**-.0021 (.0010)**	.0119 (.0193)
Donate Survey Fee to Charity?	-.0134 (.0141)	***.0140** (.0077)***	**.0711 (.0235)**	**.0082 (.0018)**	.0031 (.0025)	**.0840 (.0302)**

Notes: Columns (1), (2) and (3) show coefficients on own winnings, own non-lottery income and a winning postcode dummy, all included in the same regression. Columns (4)-(6) show the coefficients on alternative measures of neighbors' winnings when they are substituted for the winning postcode dummy in the regression underlying columns (1)-(2) (coefficients on own winnings and nonlottery income do not change much when different indicators of neighbors' winnings are used). All specifications also include a fixed effect for lottery participation, a quadratic in the number of tickets purchased, and controls for the presence of a partner, number of children and its square, age and its square, education, and a full set of codegroup fixed effects. **Bold** indicates significant at 5%; ***italic*** at 10%; standard errors clustered on postcodes. Total winnings (after tax) are measured in euros/10000 and include BMW values. ***; ** and * indicate effect of nonlottery income differs significantly from lottery income at 1%, 5% and 10% respectively.

Table 5: Effects of Alternative Indicators of Winner Density on Four Measures of Car Consumption

Winner Density Indicator	**(1) Bought Car?**	**(2) Number of Cars**	**(3) Age of main car (years)**	**(4) Total Car Efficiency Units**
Had an immediate neighbor who won?	**.0484** **(.0241)**	.0029 (.0323)	***-.4996*** ***(.2788)***	***.0370*** ***(.0199)***
Number of immediate neighbors who won (0,1 or 2)	.0215 (.0176)	.0043 (.0235)	***-.3715*** ***(.2026)***	***.0300*** ***(.0179)***
Total winnings of immediate neighbors (incl. value of BMW)	.0075 (.0063)	-.0007 (.0076)	**-.1306** **(.0581)**	.0067 (.0065)
Number of neighbors within two doors who won (0 to 4)	.0145 (.0106)	.0173 (.0162)	**-.2740** **(.1302)**	**.0274** **(.0126)**
Total Winnings of neighbors within two doors	.0072 (.0050)	.0085 (.0057)	**-.1019** **(.0418)**	**.0093** **(.0045)**
Number of winning households:				
At same *(x,y)* location	.0052 (.0045)	.0031 (.0078)	-.0564 (.0685)	.0013 (.0035)
Within 25 meters	.0043 (.0042)	.0010 (.0073)	-.0598 (.0609)	.0013 (.0035)
Total Amount Won:				
At same *(x,y)* location	.0007 (.0015)	.0005 (.0027)	-.0256 (.0229)	-.0001 (.0013)
Within 25 meters	.0012 (.0015)	-.0003 (.0024)	-.0241 (.0213)	.0001 (.0013)
Live in a Winning Postcode?	.0282 (.0171)	.0003 (.0272)	-.3857 (.2454)	.0197 (.0163)
Number of winning households in your postcode	**.0032** **(.0016)**	.0040 (.0024)	**-.0464** **(.0180)**	**.0043** **(.0014)**
Total amount won in postcode	.0009 (.0006)	.0013 (.0009)	**-.0139** **(.0069)**	**.0013** **(.0005)**
Share of households that won in postcode	.0668 (.0514)	.0170 (.0805)	**-1.4856** **(.6246)**	**.1040** **(.0458)**
Amount won per household in postcode	.0145 (.0205)	.0043 (.0312)	-.3552 (.2420)	.0258 (.0175)

Notes: Total winnings are measured in euros/10000, and equal zero for non-winners. All estimates exclude BMW-winning households, but monetary value of BMW (valued at €25,000) is included in neighbors' winnings. See previous tables for other variable definitions. All regressions include a control for own winnings, a fixed effect for lottery participation, a quadratic in number of tickets purchased, a vector of socioeconomic characteristics, and a full set of codegroup fixed effects. Standard errors are in parentheses and are clustered at the postcode level. **Bold** indicates significant at 5%; ***italic*** indicates significant at 10%.

Table 6: Car Consumption Indicators for PCL Non-Participants

	(1)	(2)	(3)	(4)
	Non-Winning Codes	Winning Codes		
		More than 2 doors from a PCL Winner	Within 2 doors of a PCL Winner	Next door to a PCL Winner
Bought a car since lottery date?	.110 (878)	.153 (137)	.161** (341)	.183*** (234)
Bought a car between 6 and 12 months ago	.121 (647)	.116 (95)	.131 (274)	.122 (189)
Number of cars at survey date	.929 (877)	.920 (137)	1.067***†† (341)	1.077***†† (234)
Age of main car (years)	7.139 (660)	6.978 (93)	6.706 (282)	6.492* (197)
Car efficiency units	.350 (851)	.353 (131)	.430† (329)	.447†† (226)

*, **, ***: statistically different from column 1 at 10, 5 and 1 percent respectively
†, ††, †††: statistically different from column 2 at at 10, 5 and 1 percent respectively
Sample sizes in parentheses.

Table 7: Car Consumption Indicators for PCL Non-Participants who are Neighbors of Participants

	(1)	(2)	(3)	(4)
	Next-door neighbors of PCL Participants		Live within two doors of a PCL Participant	
	Living in Nonwinning Codes	Living in Winning Codes	Living in Nonwinning Codes	Living in Winning Codes
Bought a car since lottery date?	.102 (88)	.145 (55)	.108 (157)	.117 (103)
Bought a car between 6 and 12 months ago?	.121 (66)	.087 (46)	.131 (122)	.126 (87)
Number of cars at survey date	.955 (88)	1.073 (55)	.994 (157)	1.155** (103)
Age of main car (years)	7.386 (70)	6.298 (47)	7.133 (128)	6.449 (89)
Car efficiency units	.352 (83)	.451* (55)	.376 (152)	.492** (101)

*, **, ***: Differs from nonwinning codes at 10%, 5% and 1% respectively.