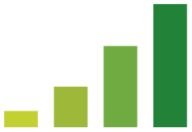

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# Do Consumers Gamble to Convexify?

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Preliminary

Thomas Crossley (Cambridge and IFS)

Hamish Low (Cambridge and IFS)

Sarah Smith (Bristol and IFS)

# The basic idea

"On Friday September 4th 1994, the freezer belonging to Gloria and Steve Kanoy of Weere's Cove suddenly and mysteriously broke down…..  Stopping for gas at Lake Raceway, 607 Main Avenue, they decided to buy a Lotto ticket…"

Virginia Lottery winner awareness campaign

quoted in Clotfelter and Cook (1990)

# Basic idea and preview

- Why do people take part in lotteries?
- One answer: discrete decisions generate local value function non-concavities….gamble to finance indivisible spending
- Proposed by Ng (1965) – but limited empirical evidence
- This paper:
  - Compare durable spending responses to lottery winnings to responses to other windfalls (inheritances)
  - Compared for two groups – those who are likely liquidity constrained and those who are not
- Evidence consistent with a model in which liquidity constrained consumers use lotteries to finance lumpy spending

# Why does this matter?

- For Economic Theory:
  - Empirical support for a theoretical model that can explain why risk-averse people would rationally choose to gamble
  - Support for a technical fix  used in dynamic models (Rogerson, 1988; Lentz and Traneas, 2004)

- For Economic Policy:
  - Can we use lotteries to estimate income effects (e.g. Imbens et al, 2001)?
  - Insights into the finances of low-income households

# Related literature

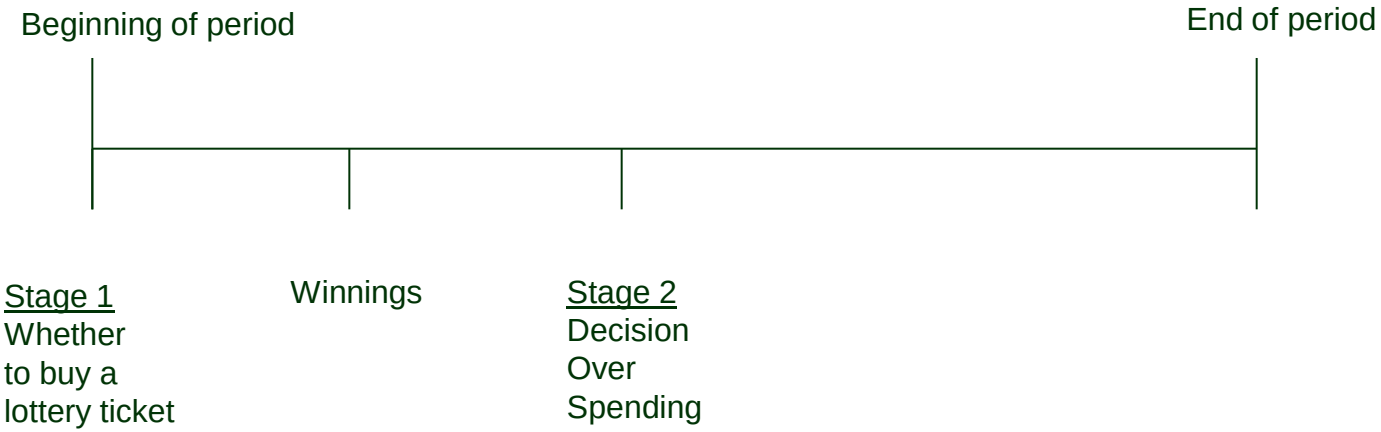
- Theory: Ng (1965), Bailey et al (1980), Hartley and Farrell (2002)

- Evidence:
  - Yuchtman (2005) – experiment showing that people were more prepared to gamble when the winnings are allocated to an indivisible good
  - Besley et al (1993) – case of Rotating Savings and Credit Associations (ROSCAs), a micro-finance initiative in which groups of people make regular contributions to a fund, the total amount of which is allocated to one member in each cycle via a lottery. Common in developing countries and in US. Frequently used as a vehicle to "save up" for purchase of indivisible goods.

# A model of lottery purchase and durable purchase

- One period model (no borrowing/ saving)

## Figure 1: Timing



# First Stage

- Agent with cash on hand $x_1$ buys at most one actuarially fair lottery ticket at price 1: $l \in 0,1$

| Action and Outcome | Probability | Net winnings | Cash on Hand |
|---|---|---|---|
| Don't Play | | $0$ | $x_2 = x_1$ |
| Play, Win | $q$ | $\frac{1-q}{q}$ | $x_2 = x_1 + \frac{1-q}{q}$ |
| Play, Lose | $1-q$ | $-1$ | $x_2 = x_1 - 1$ |

# Second Stage

- Buy at most one unit of an indivisible durable good at price $p$ :

$$d \in \{0,1\}$$

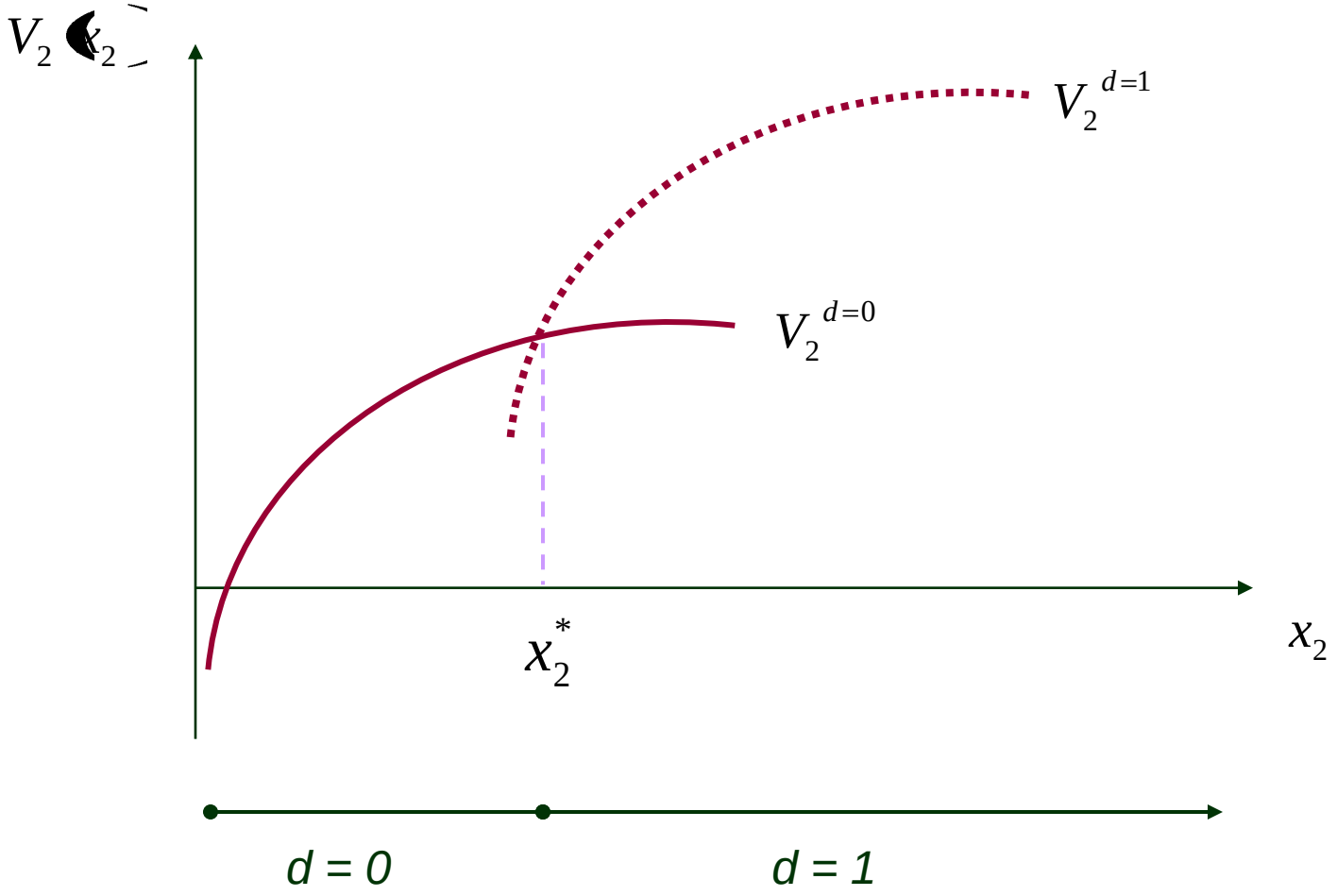
$$v(x_2 - dp, d; \eta) = u(x_2 - dp) + \eta d$$

$$u'(\cdot) > 0 \qquad u''(\cdot) < 0 \qquad u(0) + \eta < u(p)$$

***Result 1 (single-crossing):*** *There is a unique* $x_2^*$ *implicitly defined by*

$u(x_2^* - p) + \eta = u(x_2^*)$. *At* $x_2^*$, *or above, the durable is purchased.*

# Figure 2: Durable Purchase Decision



# Analysis

- A lottery ticket is purchased iff:

$$E\left[V^{l=1}(x_1)\right] - V^{l=0}(x_1) \geq 0$$

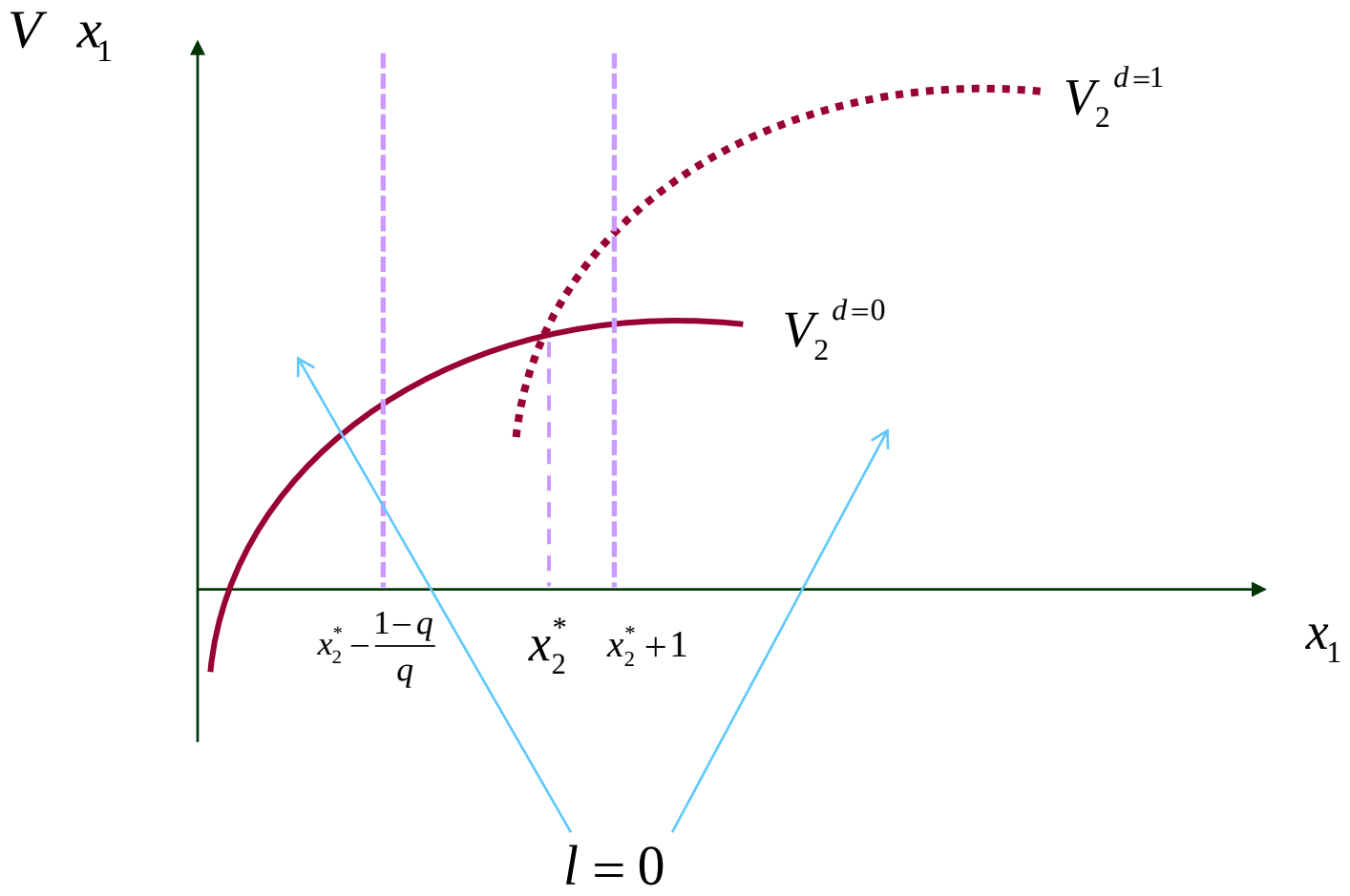
***Result 2:*** *Lottery tickets are not purchased outside the interval* $\left[x_2^* - \frac{1-q}{q}, x_2^* + 1\right]$

***Corollary 1:*** *A lottery winner always purchases a durable.*

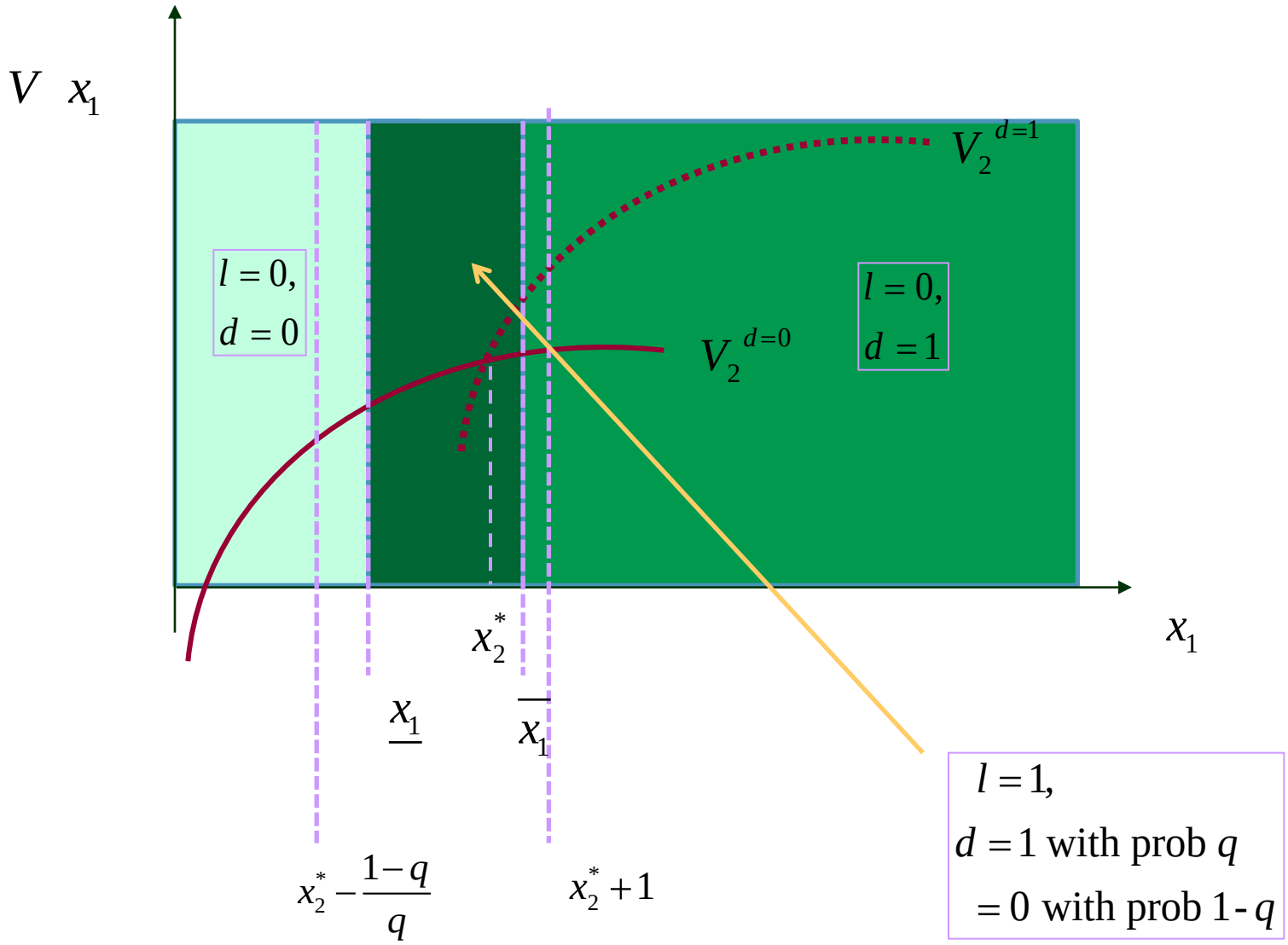
***Corollary 2:*** *A lottery winner that does not win does not purchase a durable.*

***Result 3:*** *There exists a region,* $x_1 \in \left[\underline{x_1}, \overline{x_1}\right]$, *which contains* $x_2^*$ $\left(\underline{x_1} < x_2^* < \overline{x_1}\right)$, *in which the agent will purchase a lottery ticket.*

## Figure 3: Lottery Decision, Bounds



# Figure 4: Lottery and Durable Purchase Decisions

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# Implications for Estimating Income Effects

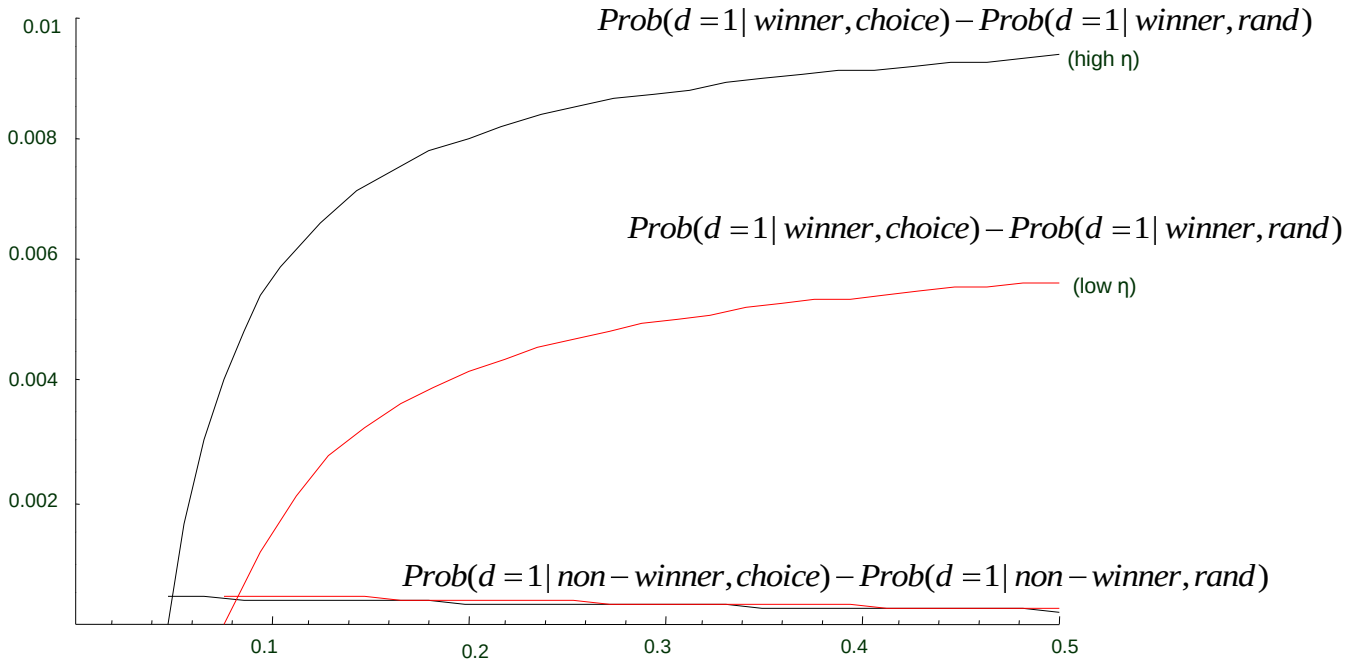
- Let $F(\cdot)$ be the cumulative distribution of cash-on-hand ($x_1$) (cash-on-hand not observed)
- We observe lottery winners and non-winners (those that don't play, and those that lose.)
- Thought experiment 1: lottery by choice, as in model
- Let $\lambda$ be the fraction of lottery players in the model
- Thought experiment 2: random compulsory lottery; fraction $\lambda$ of population

## Table 1: Chosen Lotteries versus Random Lotteries

| | | Outcome | |
|---|---|---|---|
| | | **Lottery Winner** $\text{Prob}\left(d=1 \middle\| winner\right)$ | **Non-winnner*** $\text{Prob}\left(d=1 \middle\| non\ winner\right)$ |
| **Thought Experiment** | **Lottery Chosen** | **1** | $\frac{1-F}{1-q\lambda}$ |
| | **Random compulsory lottery** | $1-F\left(x_2^* - \frac{1-q}{q}\right)$ | $\frac{(1-\lambda q)(1-F)}{1-\lambda q}$ |
| **Difference** | | $F\left(x_2^* - \frac{1-q}{q}\right) \geq 0$ | $\frac{\lambda q(1-F)}{1-\lambda q} \geq 0$ |
| **Approx Bias: (Diff in diff)** | | $\frac{F\left(x_2^* - \frac{1-q}{q}\right) - \lambda q\left(1-\left(F\left(x_2^*\right) - F\left(x_2^* - \frac{1-q}{q}\right)\right)\right)}{1-\lambda q}$ | |

# Figure 5: Chosen Lottery versus Random Lottery

Difference in probability of purchase




q: probability of lottery win

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# Incentives to gamble

- Are diminished if
  - There is uninsurable income risk
  - There are many durables
  - Households can borrow and save

- An empirical question
- We look for evidence of the effects highlighted by the model in the BHPS

# Empirical specification

$$d_{it} = (\alpha_1 + \alpha_2 D_{it})\widetilde{W}_{it} + (\beta_1 + \beta_2 D_{it})\widetilde{y}_{it} + z_{it}\delta + \mu_i + \nu_{it}$$

- $d_{it}$ = probability of durable purchase
- $W_{it}$ = lottery winnings
- $y_{it}$ = other windfall income (inheritance)
- $D_{it}$ =credit constrained
- $z_{it}$ = other characteristics
- $\mu_i$ = household fixed effect
- Prediction from the model $\alpha_2 \neq \beta_2$

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# The data

- British Household Panel Survey collected since 1991
- We use data from waves 7 – 16
- Select individuals in single/ couple households aged 20-70
- 6,430 households; 36,204 obs

# Durables

- *Would you look at this card and tell me if you have any of the items listed in your (part of the) accommodation?*
  - *Colour TV*
  - *Freezer or fridge-freezer*
  - *Washing machine*
  - *Tumble-drier*
  - *Dishwasher*
  - *Home computer*

- *For each item: was this (colour television) bought since September 1st last year?*

- *Since 1997: How much in total have you paid for this (Colour television), excluding any interest paid on loans?*

## Table 2: Consumer Durables Purchases (last 12 Months)

| | Proportion with durable | Proportion buying durable | Median Spending (>0) | Mean Spending (>0) | Minimum price John Lewis |
|---|---|---|---|---|---|
| Television | 0.987 | 0.129 | £300 | £486 | 179 |
| Fridge freezer | 0.948 | 0.084 | £250 | £293 | 159 |
| Washing machine | 0.953 | 0.093 | £300 | £312 | 199 |
| Tumbledrier | 0.599 | 0.046 | £280 | £289 | 159 |
| Dishwasher | 0.359 | 0.042 | £170 | £182 | 199 |
| Home computer | 0.602 | 0.111 | £800 | £855 | 400 |

## Are durables lumpy?

- Second-hand?
- Renting is possible, but more so for some durables (TVs) than others (fridges). Most companies have a minimum rental period of 12 or 18 months and require a credit check
- Similarly, hire purchase companies also require a credit check and may charge high APRs (30% over 30 months)
- Rental outlets targeted at those with no formal credit. Eg *Crazy Jacks* requires no formal credit checks, only five references. Advertised APR is 30%, but additional insurance typically increases the effective APR to >100% (Collard and Kempson (2005))

## Liquidity constraints

- In our sample, someone is liquidity constrained if there is no interest or dividend income accruing to the household (42% of the sample)
- Additional criteria
  - Not a home-owner (17% of the sample) OR
  - Bottom half of the household income distribution (26% of the sample)
- Young and Waldron (2008) 16% of the UK population is liquidity constrained according to an individual survey that asked people whether they felt constrained in the amount that they could borrow, including both *perceived* constraints that discouraged them from applying for credit, and *actual* constraints where the household was prevented from borrowing either by the unavailability of credit or its high price.
- Jappelli (1990) c. 20% of US households are credit constrained based on survey evidence that they have been refused credit, or put off applying for fear of refusal

# Windfalls

- Since 1997 the BHPS has included the following module about windfalls
  - *Since September [last year] have you received any payments, or payment in kind, from anything listed on this card?*
    - *Life insurance policy*
    - *Lump sum pension*
    - *Personal accident claim*
    - *Redundancy payment*
    - *Inheritance/ bequest*
    - *Win on football pools, national lottery or another form of gambling*
    - *Anything else*
  - *About how much did you receive?*
- Exclude any inheritances linked to widow(er)hood

## Table 3: Financial Windfalls

| | Proportion receiving in last 12 months | Median amount (>0) | Mean amount (>0) | Mean age, household head | Mean net household income, last month |
|---|---|---|---|---|---|
| Gambling win | 0.210 | £40 | £290 | 45.7 | £2835 |
| Inheritance | 0.046 | £5000 | £24949 | 45.6 | £3129 |
| Life insurance | 0.042 | £3000 | £7751 | 50.1 | £2816 |
| Pension lump sum | 0.019 | £10000 | £19062 | 56.4 | £2392 |
| Personal accident claim | 0.016 | £2000 | £3891 | 41.2 | £2959 |
| Redundancy payment | 0.024 | £4000 | £11948 | 45.2 | £2779 |

# Distribution of windfalls

- Distribution of windfalls from the Lottery is very different to that of inheritances

- Landsberger (1966) and Keeler, James and Abdel-Ghany (1983) show that size of windfall affects what people do with it: The smaller the windfall, the more likely people are to spend it

- Our approach is to focus on mid-range lottery wins/ inheritances of between £100 - £5,000
- Throw away big winners (>£5,000)

## Table 4: Average Financial Windfalls, by Band

| | Size of financial windfall | | | | |
|---|---|---|---|---|---|
| | <£100 | £100 - £5,000 | £100 - £1,000 | £1,001 - £5,000 | >£5,000 |
| Gambling wins | | | | | |
| Mean | £34 | £556 | £300 | £2,179 | £24,780 |
| No. obs | 5887 | 1618 | 1398 | 220 | 44 |
| Inheritances | | | | | |
| Mean | £66 | £1962 | £691 | £3,023 | £48,249 |
| No. obs | 45 | 677 | 308 | 369 | 716 |

**Table 5: Average financial windfalls, by band and whether liquidity constrained**

| | <£100 | £100 - £5,000 | >£5,000 |
|---|---|---|---|
| **Gambling wins** | | | |
| Not Liquidity constrained | | | |
| Mean | £35 | £538 | £11,131 |
| No. obs | 3753 | 1061 | 31 |
| Liquidity constrained | | | |
| Mean | £33 | £589 | £57,326 |
| No. obs | 2134 | 557 | 13 |
| **Inheritances** | | | |
| Not Liquidity constrained | | | |
| Mean | £68 | £2005 | £50,731 |
| No. obs | 33 | 465 | 570 |
| Liquidity constrained | | | |
| Mean | £31 | £1866 | £38,557 |
| No. obs | 12 | 212 | 146 |

# Anticipation and "Emotional Accounting"

- Differences-in-differences approach deals with the fact that other windfalls (inheritances) may be different in other ways
- Anticipation effects
- Emotional accounting
  - "Although all dollars are created equal, one may feel a pang of reluctance at spending grandma's inheritance on a new sports car, but little reluctance spending casino earnings doing the same." Epley and Gneezy (2007)
  - Described by Levav and McGraw, (2005) as *emotional accounting*. When a windfall has a negative association, consumers will avoid hedonic purchases in order not to exacerbate their negative feelings and, "when possible, they seek to use the money for relatively virtuous or utilitarian expenditures in order to alleviate or "launder" their negative feelings about the money."
  - Experiments with students showed that $200 from an ill uncle was less likely to be spent on a frivolous item than $200 from a rich uncle.

## Table 6: Are Windfalls Expected?

Dependent variable: (0/1), whether household head expects financial situation to improve over the next 12 months

| | Coefficient<br>(Standard error) |
|---|---|
| $(\text{Gambling win})_{t+1}$ | 0.0011<br>(0.0129) |
| $(\text{Inheritance})_{t+1}$ | -0.0068<br>(0.0216) |
| $(\text{Other windfall})_{t+1}$ | 0.0360<br>(0.0114) |
| N | 36,204 |

Note:
Results of fixed effects regression

## Table 7: Difference in Difference Results

| Dependent variable: number of durables in last 12 months | | |
|---|---|---|
| Gambling win (£'00) | .0077**<br>.0027 | .0031<br>.0036 |
| Gambling win * LiqCon | | .0106**<br>.0053 |
| Inheritance (£'00) | .0039**<br>.0015 | .0041**<br>.0018 |
| Inheritance * LiqCon | | -.0008<br>.0032 |
| P-value (Gamble = Inherit) | .2301 | .7837 |
| P-value (Gamble*LC = Inherit*LC) | | .0068 |

## Alternative specifications

- Findings are robust to:
  - Binary dependent variable
  - Alternative (narrower) measures of liquidity constraints
  - Inclusion of lead/ lag terms

## Further test

- Small lottery winnings (<£100) are not enough to finance durable spending, but are informative about whether someone plays the lottery (i.e. is in the region of the non-concavity)

- Someone who has small lottery winnings and inherits a medium-sized amount and is liquidity constrained should behave in the same way as someone who has medium-sized lottery winnings and is liquidity constrained.

- There aren't very many of these people in our sample (60 in total who win a small amount on the Lottery and inherit a medium-sized amount, of whom 20 are liquidity constrained), but the results are consistent.

# Conclusions

- Evidence consistent with a model in which individuals play lotteries to finance lumpy items of spending.
- Purchases of durables are more responsive to lottery wins than to other windfalls (inheritances)
- This is only the case for consumers who are liquidity constrained
- Also find a larger response among people who play the lottery (win small amounts) and inherit money