Cash and pensions: Have English households saved optimally for retirement?

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Outline for section 1

Introduction

- Strong and robust feeling among policymakers that there is undersaving for retirement in the UK (and elsewhere)
- This is despite very large stocks of wealth held in the form of private pensions
- This paper assesses whether a particular cohort of households have undersaved for retirement
- We do this using a lifecycle model in which households have access to:
  - State provided pensions
  - Private non-pension saving
  - Private pension saving

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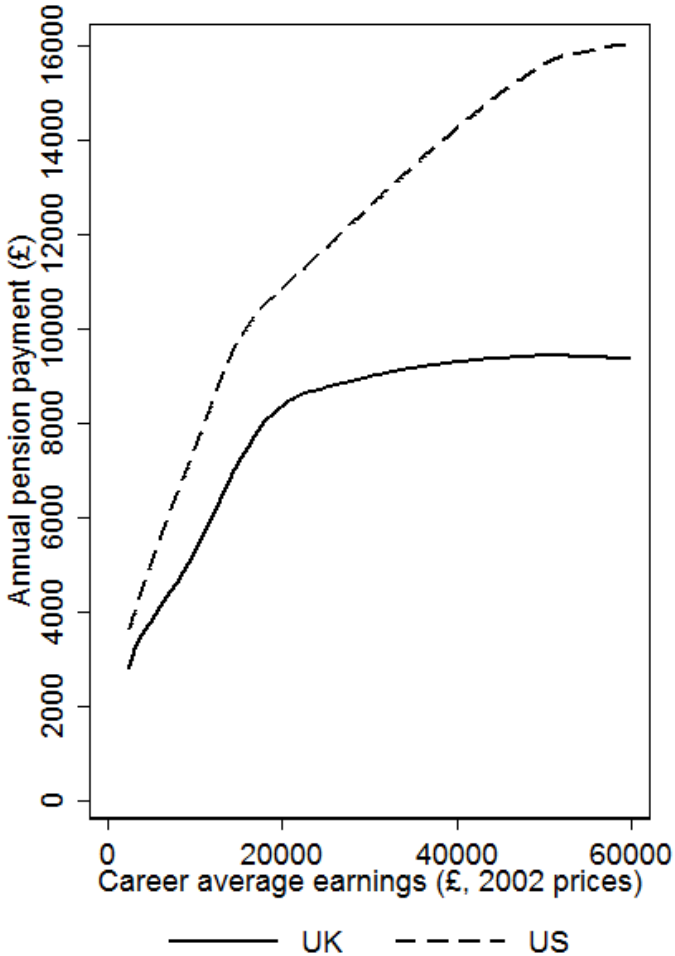

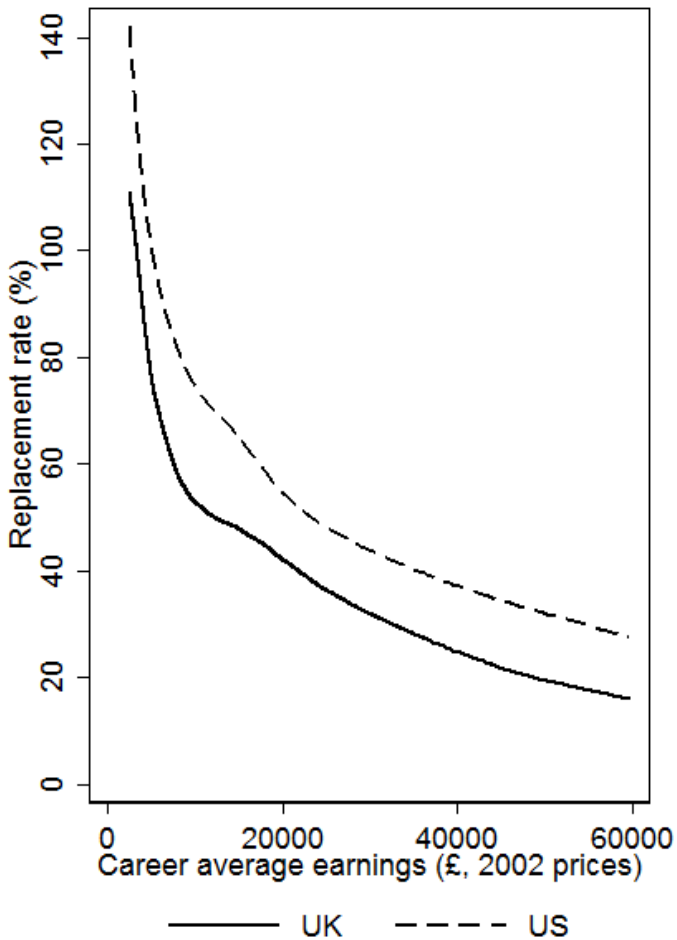

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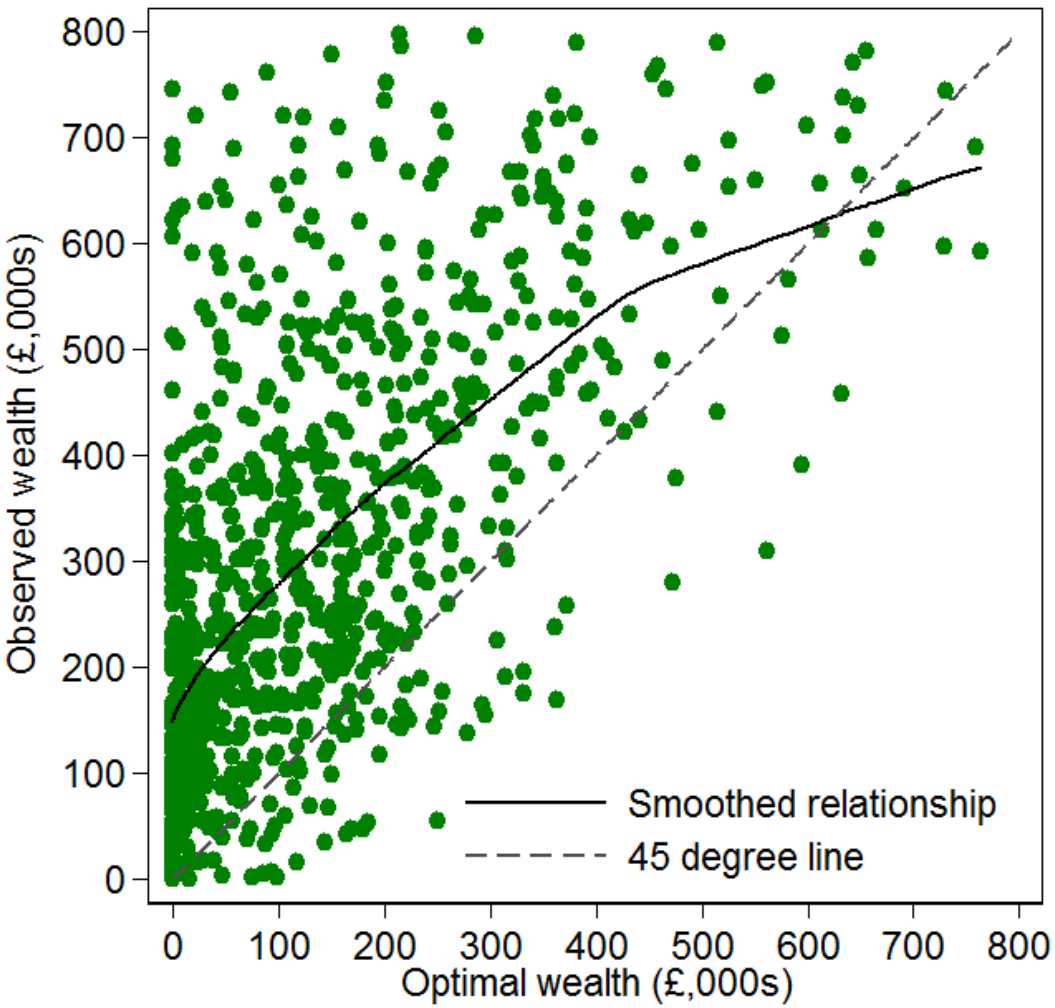

Outline for section 2

Literature

- Analysis of replacement rates
  - US: Munnell et al. (2007, 2012)
  - UK: Banks et al. (2005), Crawford & O'Dea (2012)
- Consumption changes around retirement
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Outline for section 3

Utility function

Household's maximise the discounted expected sum of the utility of (equivilised) consumption:

$$n_t^{eq} U\left(\frac{c_t}{n_t^{eq}}\right)$$

Utility function is standard constant relative risk aversion function

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Assets and choice variables

In addition to the state pension system, there are two assets:

1. Risk-free asset
2. Defined contribution pension (401k-style)

There are two choices to make each period:

1. How much to consume
2. How much to split savings between cash and the pension

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Uncertainty

There is uncertainty over:

- Employment
- Wages
- Return on private pension
- Survival

Wages and employment

- Wages:
  - Household log wages for each of three education types ed are the sum of a fixed effect, a quadratic in age and an persistent stochastic component

$$\begin{aligned} ln\tilde{e}_{it} &= \alpha_i + \beta_1^{ed} age_{it} + \beta_2^{ed} age_{it}^2 + u_{it} \\ u_{it} &= \rho_{ed} u_{it-1} + \xi_{it} \\ \xi &\sim N\left(0, \sigma_{ed}^2\right) \end{aligned}$$

- Employment occurs with probability π in each period:

$$e_{it} = \begin{array}{ll} \tilde{e_{it}} & w.p. \quad \pi_{ed} \\ 0 & w.p. \quad 1 - \pi_{ed} \end{array}$$

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Retirement

- Household retirement happens when the male reaches 65
- Retirement involves stopping work and drawing down DC pension
  - 25% of the pension in a tax free lump sum
  - 75% is annuitised at rates that are actuarially fair after a deduction for administrative costs

'Optimal consumption'

Optimal consumption allocation satisfies an Euler equation in *equivilised* consumption:

$$U'\left(\frac{c_t}{n_t^{eq}}\right) = \beta(1+r)E\left[U'\left(\frac{c_{t+1}}{n_t^{eq}}\right)\right]$$

We set $\beta = \frac{1}{1+r}$ such that households are no more impatient than they are compensated for in the return on risk-free saving:

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Outline for section 4

Data

Data source is English Longitudinal Study of Ageing (ELSA) linked with administrative data on National Insurance contributions

- English Longitudinal Study of Ageing
  - Interviewed every 2 years
  - Careful measurement of wealth (including pension wealth)
  - Similar in form and purpose to HRS (USA) and SHARE (Europe)
- National Insurance (Social Security) contributions
  - Respondents were asked for permission to link their survey data to NI records
  - Allows us obtain earnings histories (subject to some censoring)

▸ More

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Sample

Sample is:

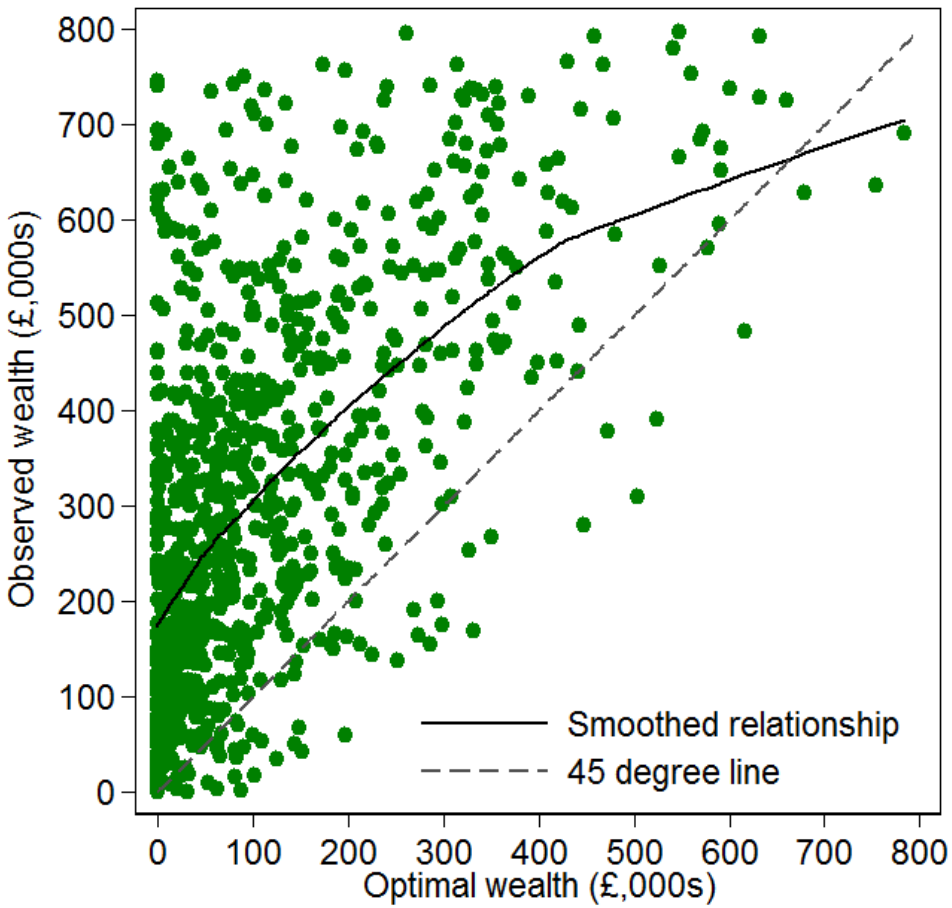
- Couples
- Man born in the 1940s
- Where we have NI records for both members of the couple

Parameterisation

Parameter	Symbol	Value/Source
Unemployment rate	π	6.2%
Return on safe asset	r	2.2%
Mean pension return	$\bar{\phi}$	4.0%
St. Dev. pension return	$\bar{\sigma}_{\phi}$	13.8%
Survival probabilities	s_t^m, s_t^f	ONS Life Tables
Administrative load on annuities	q	10%
Discount factor	β	$\frac{1}{1+r} = 0.978$
Coefficient of relative risk aversion	γ	1.5
Equivalence scale	n	Modified OECD scale

Outline for section 5

Summary of results from this paper



▸ Sensitivity ▸ By Quintile

Results - excluding housing

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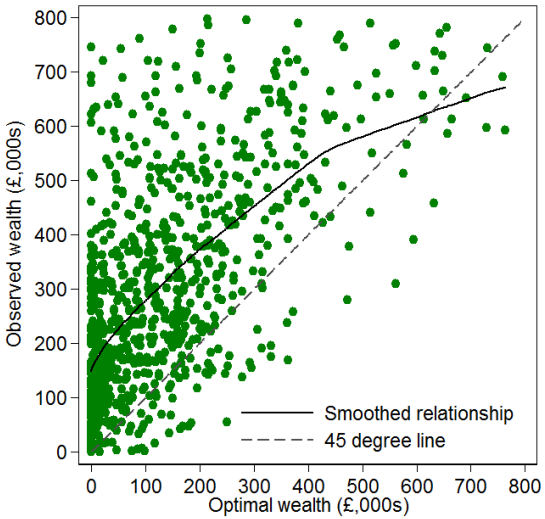
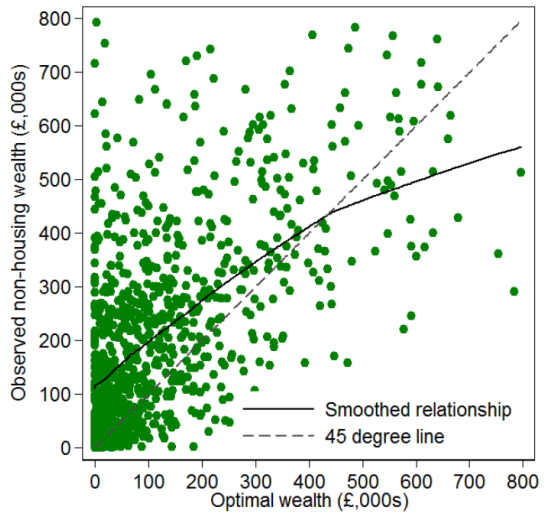
Baseline model:



Proportion undersaving: 7.9%
R-squared: 0.31

Excluding housing:



Proportion undersaving: 25.1% R-squared: 0.32

Building in (exogenous) housing wealth accumulation

We add to the baeline model:

- an exogenous consumption flow coming from holding housing wealth ($r^h H_t$)
- a deduction for mortgage payments (h_t) from available resources

Baseline

$$u(c) = n_t^{eq} U\left(\frac{C}{n_t^{eq}}\right)$$

$$a_{t+1} = (1+r)(a_t + y_t - c_t - p_t)$$

Adapted

$$u(c) = n_t^{eq} U\left(\frac{C}{n_t^{eq}} + r^h H_t\right)$$

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▸ More

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Results - exogenous housing

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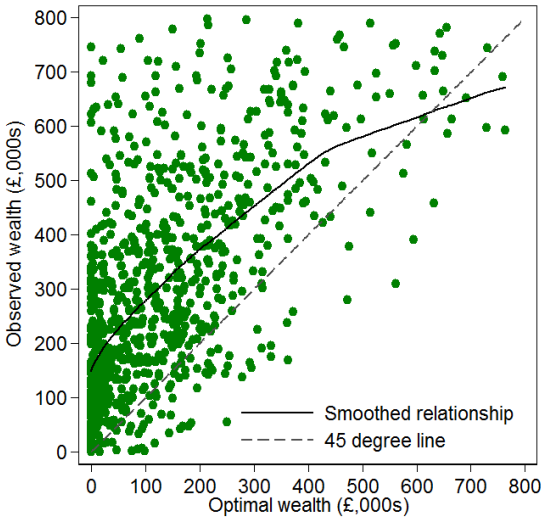

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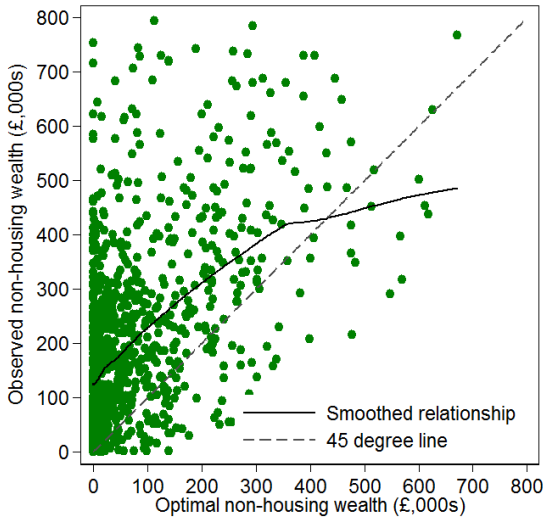

Proportion undersaving: 16.0% R-squared: 0.24

Discussion

What's missing from the model?

- Non-separabilities between consumption and leisure
- Home production
- Nursing home expenses
- Bequest motives

Replacement rates

Proportion of couples with retirement income replacing less than X% of average real (gross) earnings between the age of 20 and 50:

	Income coming from ...		
Replacement Rate	Pensions	Annuitised non-housing wealth	Annuitised housing wealth
<=67%			
<=80%			
<=100%			
>100%			

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<=100%	58.6		
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<=67%	19.6	10.0	
<=80%	35.0	19.9	
<=100%	58.6	41.0	
>100%	41.4	59.0	

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<=80%	35.0	19.9	5.3
<=100%	58.6	41.0	16.0
>100%	41.4	59.0	84.0

Outline for section 6

Conclusions

- 9 out of every 10 of those born in the 1940s have more than enough wealth to maintain living standards into retirement
- New concern is that younger cohorts are undersaving for retirement
- Maybe not such a concern if their parents have 'oversaved'?
- New work planned on younger cohorts with the Wealth and Assets Survey

Outline for section 7

Heterogeneity

The problem solved (and therefore the decision rules obtained) are different for each household in the sample in three dimensions

1. Their earnings process (fixed effect)
2. The number and timing of children
3. State pension entitlements

◂ Back

Optimal wealth and the proportion undersaving

	Median optimal wealth	Prop. undersaving	Median deficit (cond.)	Median surplus (cond.)	Median observed wealth
All	77	7.9%	39	226	324
L.E. Quint					
1					
2					
3					
4					
5					

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1	0.6	9.5%	8	126	119
2	29	4.5%	11	189	213
3	73	6.5%	28	232	293
4	152	8.5%	79	283	392
5	392	10.6%	94	329	690

◂ Back

Recursive formulation

Value function and consumer problem:

$$
\begin{aligned}
V_t(\mathbf{X}_t) &= \max_{c_t, dc_t} \Bigg(U(c_t) + \beta s^m_{t+1} s^f_{t+1} \int V_{t+1}(\mathbf{X}_{t+1}, h=1) dF(\mathbf{X}_{t+1}|\mathbf{X}_t) \\
&+ \beta s^m_{t+1}(1 - s^f_{t+1}) \int V_{t+1}(\mathbf{X}_{t+1}, h=2) dF(\mathbf{X}_{t+1}|\mathbf{X}_t) \\
&+ \beta (1 - s^m_{t+1})(s^f_{t+1}) \int V_{t+1}(\mathbf{X}_{t+1}, h=3) dF(\mathbf{X}_{t+1}|\mathbf{X}_t) \Bigg)
\end{aligned}
$$

X_t contains 6 state variables:

- Age; Wages; HH composition; Cash; DC wealth; Pension Income

Back

Intertemporal budget constraints

- Cash:

$$a_{t+1} = (1 + r)(a_t + y_t - c_t - dc_t)$$

Household income y_t is given by:

$$y_t = \tau(e, ra, pp, sp, h, k, dc, t)$$

- DC wealth

$$DC_{t+1} = (1 + \phi_t)(DC_t + dc_t)$$

$$\phi \sim N(\bar{\phi}, \sigma_\phi^2)$$

Back

Defined Benefit Pensions

Many in this cohort have wealth in older-style 'Defined Benefit' pensions

- Model does not contain DB pensions
- The question we are asking is what would these households had saved if given access only to the DC fund
- Much of observed wealth will have come from remittances by employers, not employees
- We augment household earnings to take account of this

▸ More

Summary statistics on wealth

Mean wealth holdings:	Mean £	Mean %
Total net wealth	574,048	100
of which:		
Financial	52,514	9.1
Prim. hous.	147,431	25.7
Other hous.	23,589	4.1
Physical	40,962	7.1
Priv. pen.	187,281	32.6
State pen.	122,271	21.3
Sample size	*996*	

Back

Table: State pension wealth, lifetime earnings, and implied average lifetime savings rates, by quintile of lifetime earnings

	Mean state pension wealth	Mean lifetime earnings	Mean priv. wealth / life. earn.	Mean (priv + state wealth) / life. earn.
All	122	1,090	13.5%	24.7%
Quintile				
1 (Lowest)	108	483	2.0%	24.3%
2	123	793	4.9%	20.4%
3	124	970	8.5%	21.3%
4	129	1,219	13.8%	24.4%
5 (Highest)	127	1,988	22.0%	28.4%

Housing

- Cost (h_t):
  - Households are assumed to only have owned their current property
  - They are assumed to have saved 1.5% of the purchase value from the age of 20 to the year of purchase
  - They take out a 25 year mortgage for the purchase price less the value of their deposit
  - Time series of mortgage interest rates taken from Bank of England
- Yield (r^h)
  - $r^h = 4.4\%$ (Bank of England (2007))
- House value (H_t)
  - Property value known at purchase and at survey date
  - Assumed to have grown at a constant rate between purchase date and survey date
  - Assumed to grow at the rate of return on riskless asset in the future (after the last survey)

Back

Sensitivity

	Median optimal wealth	Prop. under-saving	Median deficit (cond.)	Median surplus (cond.)	R squared
Baseline	77	7.9%	39	226	0.31
Early ret	81	10.2%	58	208	0.28
$\gamma = 3$	75	8.2%	34	223	0.30
$\beta = 1$	301	42.9%	94	138	0.38
Comp to age 64	154	28.8%	105	191	0.19
1 asset	53	4.5%	11	273	0.26

◂ Back

Administrative data

Our administrative data gives us:

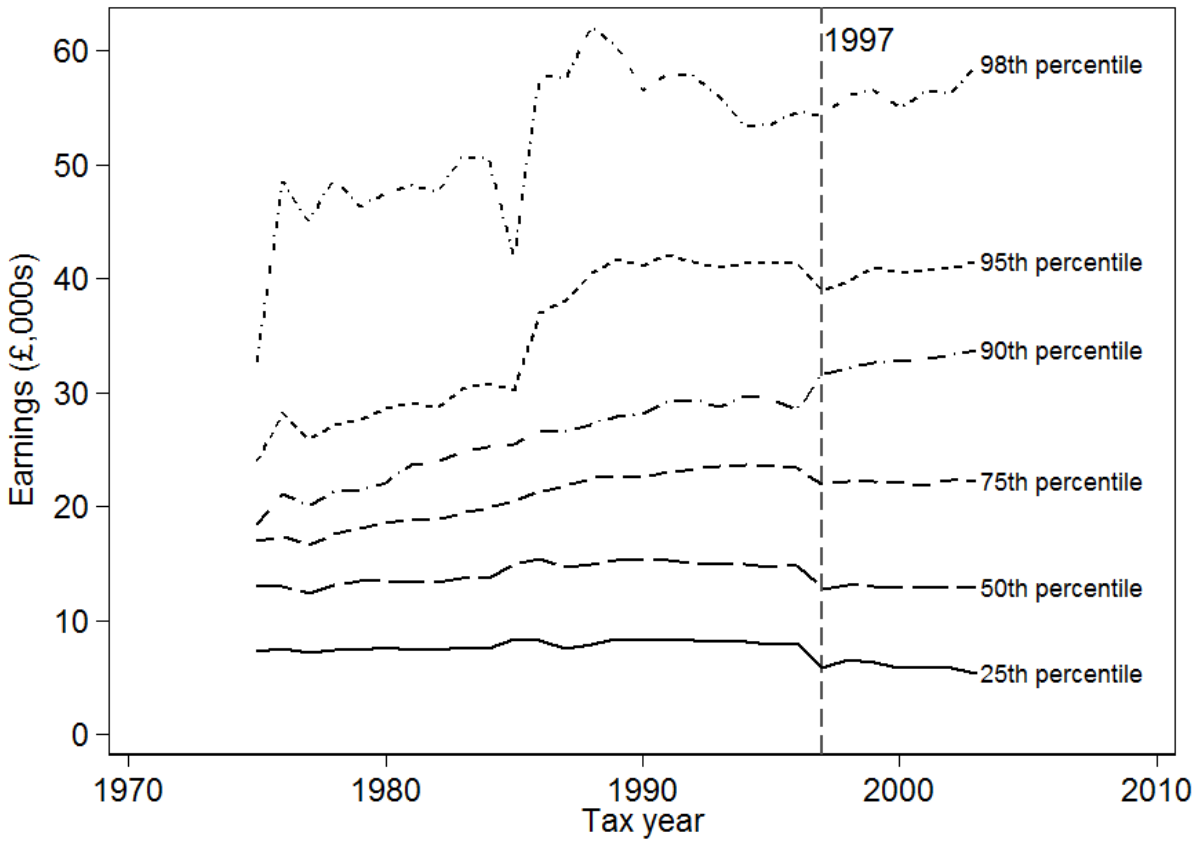
- Exact earnings 1997-2004
- Topcoded earnings 1975-1996 (top-coding affects 7.4% of year-individual observations)
- Number of weeks work prior to 1975

We impute data over the censoring point using a fixed-effects Tobit

- Biased
- Though Greene (2004) finds bias is minimal in panels even much shorter than ours ($T = 29$)
- Plot of quantiles before and after 1997 show only small discontinuities

Quantiles of earnings process

Figure: Selected quantiles of earnings



Back

Model solution

Solution is by backwards recursion from a final period where the decision rules and value function are known

Further details:

- Earnings, assets, stocks of DC assets and pension income are placed on a grid
- Integration is by quadrature
- Optimisation is by golden section search

Back

Components of the tax and benefit system

The tax and benefit function contains:

- Income tax
- National insurance
- Job-seekers allowance
- Child benefit
- Means-tested support in retirement

Back

Accounting for employer pension contributions

We inflate upwards our earnings data e_t^d by a proportion x:

$$x = \frac{\kappa P_S}{\sum_t^{S-1} e_t^d (\prod_t^S (1+\phi_t))}$$

where:

- κ is the proportion of earnings that the *employer* remits to the pension fund
- P_s is the pension wealth observed in survey period S
- ϕ_t is the return on DC funds in the year the particular household is of age t

Back

Estimates of earnings process parameters

	Education group		
	Low	Middle	High
ρ	0.8468	0.9727	0.9527
	(0.0838)	(0.0153)	(0.0025)
σ^2_ξ	0.0413	0.0417	0.0422
	(0.0026)	(0.0033)	(0.0026)
σ^2_m	0.0024	0.0029	0.0066
	(0.0021)	(0.0026)	(0.0016)

Results - 'optimal' replacement rates

Implied replacement rates of average lifetime earnings (between 20 and 50):