House Price Volatility and Household Indebtedness in the U.S. and the U.K.

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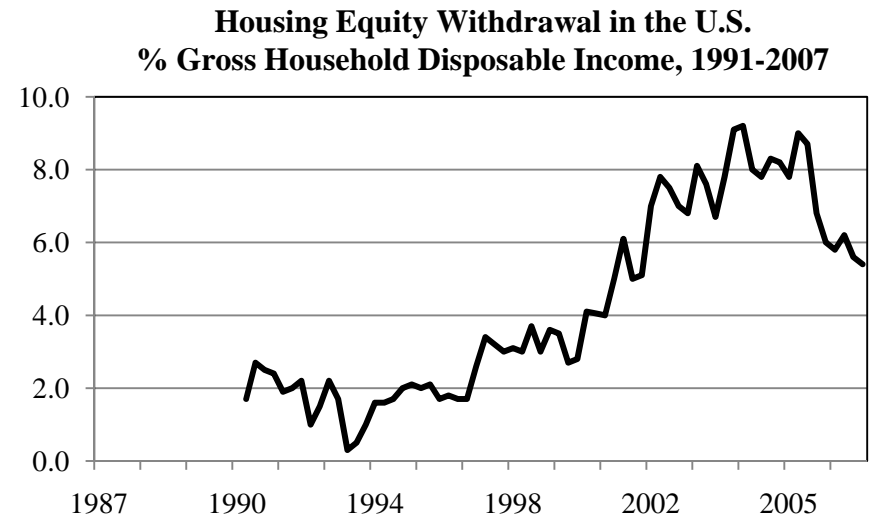[†]ESRC Postdoctoral Research Fellow, Centre for Finance and Credit Markets, School of Economics, University of Nottingham.
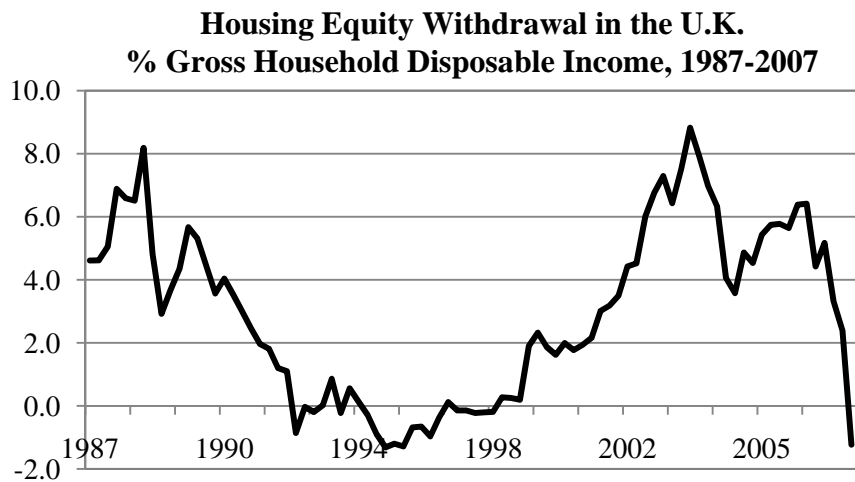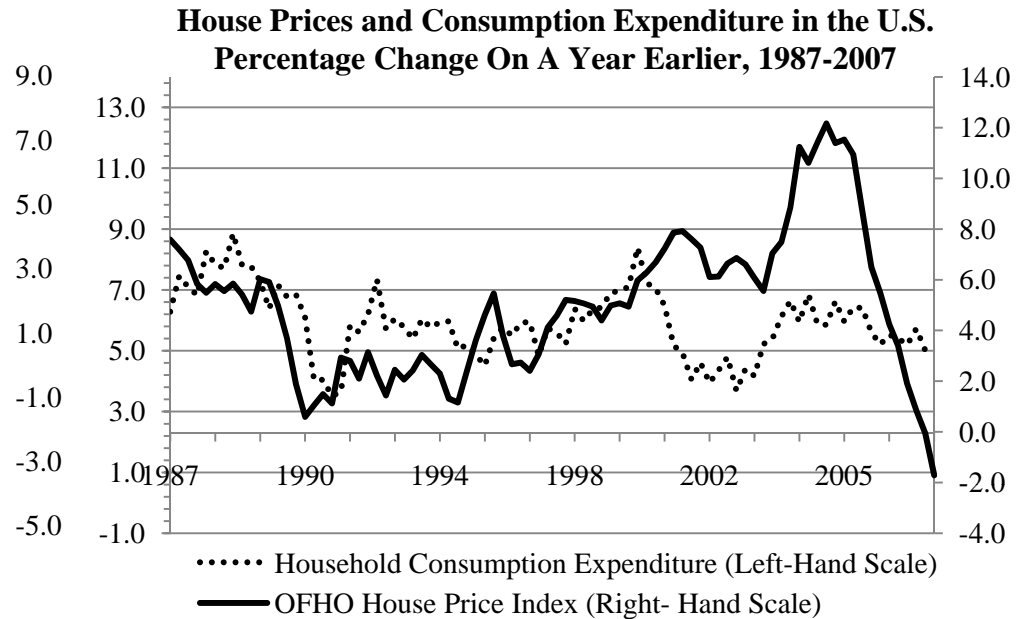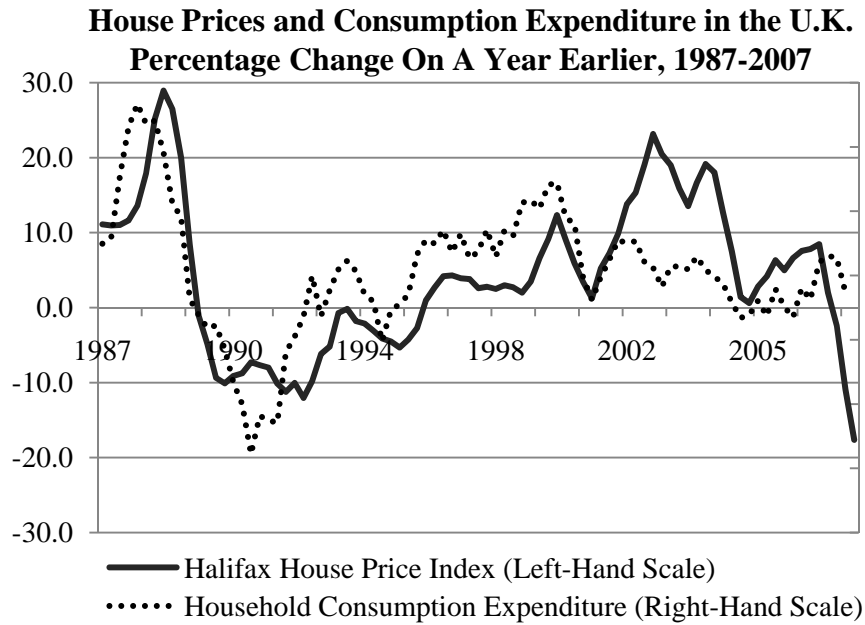
'...he [Mervyn King] said those who worried about the effect on consumer spending of rapidly rising house prices were peddling "mindless regressions" and should instead think about the economics. "Housing does not determine consumption; there are more fundamental influences on consumer spending," he insisted.'

Chris Giles, 'King's Faded Realm', *Financial Times*, 16/2/09

Outline

- How might house price changes affect consumption?
  - via impact on life cycle wealth
  - via impact on borrowing constraints – 'financial accelerator'

- If debt is secured on nominal collateral value, house price shocks amplify or accelerate changes in consumer spending during general inflation (Iacoviello, 2005, AER)

- Estimating this collateral effect using micro-data might reconcile results from macro vs micro studies.

- We test models on household data:
  - Existing studies use macroeconomic methods, e.g. VARs
  - We exploit household variation in (unbinding) collateral constraints

Table 1: Real House Price Growth, Real Consumption Growth and Housing Equity Withdrawal in the U.S. and the U.K., 1987-2007

House Prices and Consumption Expenditure in the U.K. Percentage Change On A Year Earlier, 1987-2007

——— Halifax House Price Index (Left-Hand Scale)

······ Household Consumption Expenditure (Right-Hand Scale)

House Prices and Consumption Expenditure in the U.S. Percentage Change On A Year Earlier, 1987-2007

······ Household Consumption Expenditure (Left-Hand Scale)

——— OFHO House Price Index (Right- Hand Scale)

Housing Equity Withdrawal in the U.K. % Gross Household Disposable Income, 1987-2007

Source: Halifax National House Price Index , Office for National Statistics, Bank of England. House price and consumption data deflated using RPI-X index.

Housing Equity Withdrawal in the U.S. % Gross Household Disposable Income, 1991-2007

Source: Federal Reserve Economic Data Service, Office of Federal Housing Oversight, Kennedy-Greenspan Housing Equity Withdrawal Estimates (Kennedy and Greenspan, 2007).

Wealth Effects

- Housing wealth effects typically estimated by impact of shocks /changes to values on consumption spending / saving. (Campbell and Cocco, 2007; Juster *et al.*, 2006)

- Wealth effects may, overall, be small in practice
  - effects for 'winners' and 'losers' in housing markets may net out in aggregate (Buiter, 2008; Michaelides *et al.*, 2009)
  - house prices and consumption spending may be driven by a common factor e.g. income expectations, which cause spurious correlations. (Attanasio *et al.*, 2009, Disney *et al.*, 2009)

- But changes in housing wealth might have larger impact on consumers facing liquidity constraints.

'Collateral Effects'

- The household financial accelerator model: changes in housing wealth relax liquidity constraints.

- Iacoviello (2005) Borrowing of impatient constrained by current income:
  - 'spender and saver' household types
  - current income limits purchase of housing and hence collateral

- House price rises unbind collateral (liquidity) constraint
  - Excess sensitivity of consumption to predictable changes in housing wealth due to this collateral role for housing.

- Aggregate data evidence suggests co-movement in asset values, measures of net debt acquisition and consumption
  - Lamont and Stein (1999): US regions; Almeida, Campello & Liu (2005): cross country data.

Household Panel Data

- Campbell and Cocco (2007) find consumption excess sensitivity to housing, consistent with collateral effect, but also other stories. Pseudo-panel so limited 'treatment'.

- Can we find 'direct' evidence for collateral effects in micro data?

- In practice, what proportion of households are 'collateral constrained' and how do we measure this?

- Typically do not observe asset / debt data alongside consumption data in household surveys.
  - PSID / BHPS long panels with housing, mortgage debt, other assets & debts, but little consumption data.
  - CEX/FES(EFS) detailed consumption data, but no asset/debt data or indication of collateral position.

Empirical Strategy

- Use PSID/BHPS household panels, and take Loan-to-Value Ratio (LVR) as indicator of collateral constraint.

- Examine relationship between house prices and mortgage debt

  – Rising mortgage debt is intermediate cause of consumption in financial accelerator model (material cause is house prices)

  – But of course changes in mortgage debt reflect purchases etc.

- By FA model, stronger effects for more highly leveraged households consistent with financial accelerator.

  – Observe LVR 'constraint', limited use as proxy for household type.

- Accommodate existence of unsecured debt in the data by treating it as a substitute for secured (mortgage) debt.

PSID / BHPS Data

- US/UK household panels provides detailed data on assets and debt, plus details of mortgage loans, moving activity.

- PSID wealth modules on a consistent basis 1999, 2001, 2003, 2005.

- BHPS has similar data in 1995, 2000, 2005.

- Construct balanced panel of households: non-retired, non-self employed, constant household head.

- 1582 PSID households, 1368 BHPS households.

## Table 2: Means of Financial Variables for PSID / BHPS Households

PSID (financial variables in U.S. dollars, 2001 prices)

Year	1999	2001	2003	2005
No. Households	1582	1582	1582	1582
Age	42.3	44.4	46.4	48.34
Income	72,000	83,000	82,000	88,000
Financial Wealth incl. IRAs	52,000	58,000	61,000	78,000
Auto-Debt	6,200	6.800	7,100	6,200
Non-Mortgage Debt	5,400	6,200	7,100	8,000
Value all Housing	138,000	169,000	200,000	256,000
Mortgage Debt	65,000	72,000	80,000	90,000
LVR	0.47	0.44	0.42	0.38

BHPS (financial variables in pounds, 2000 prices)

Year	1995	2000	2005
No. Households	1368	1368	1368
Age	40.4	44.9	49.8
Income	24,000	30,000	34,000
Financial Wealth	11,000	13,000	17,000
Non-Mortgage Debt	1,600	2,500	3,500
Value all Housing	75,000	119,000	236,000
Mortgage Debt	33,000	37,000	44,400
LVR	0.48	0.34	0.18

PSID / BHPS Data

- Cross-section variation in collateral positions (LVR) correlated with age
  - LVR typically falls with age as household repays mortgage
  - U.S. households more highly leveraged into middle-age.
- Approximately 20% households exhibit LVRs > 0.8
  - Might consider these 'constrained', at least at beginning of period.
- LVRs fall over period across all households, due to house price growth exceeding growth in mortgage debt.
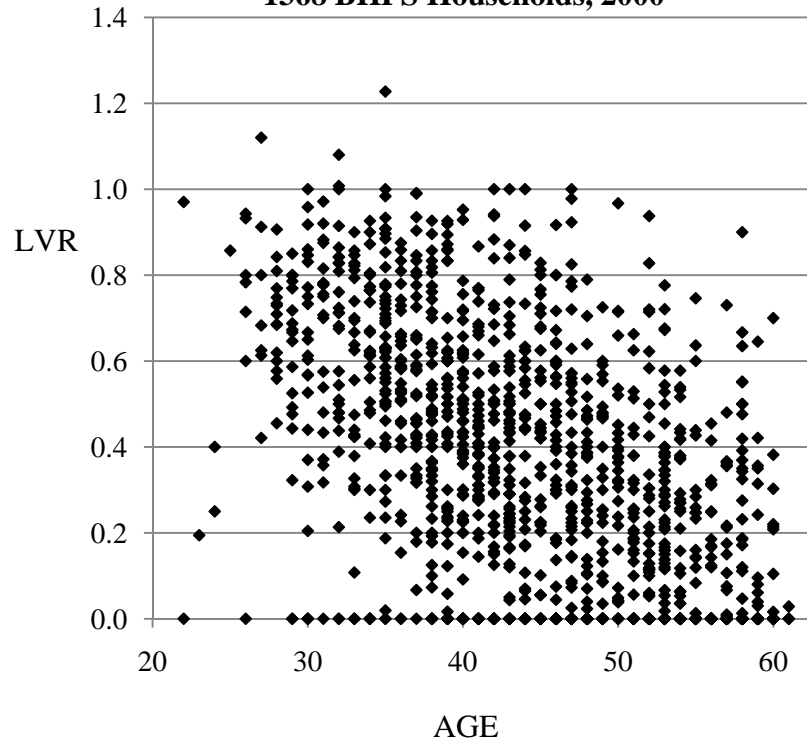- Plus increased housing equity major driver of rising net worth.

Correlation Between Household Age and Loan-to-Value Ratio (LVR)
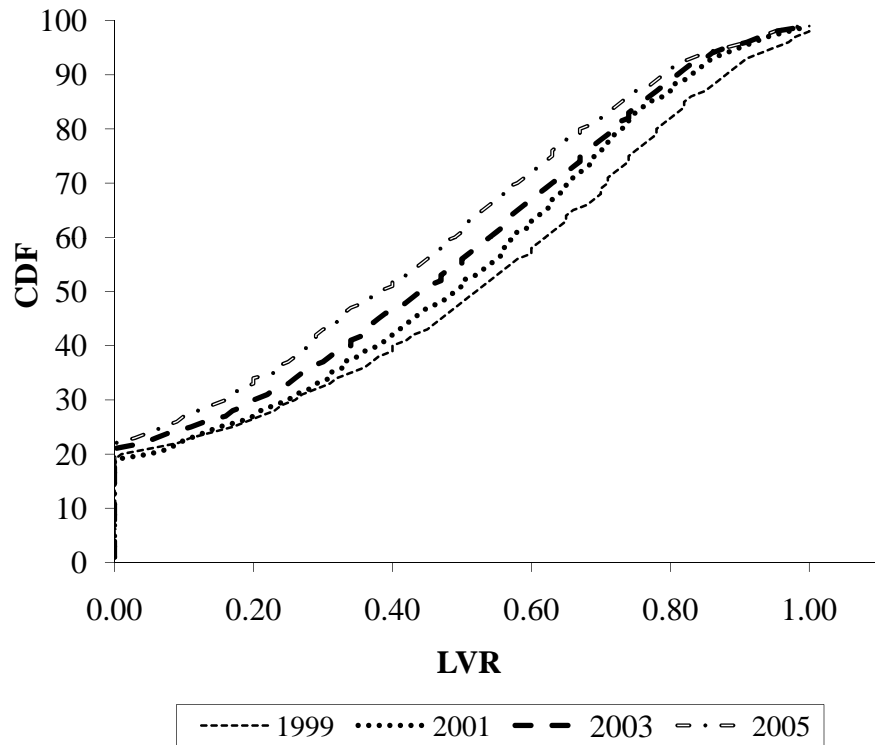**1582 PSID Households, 2001**
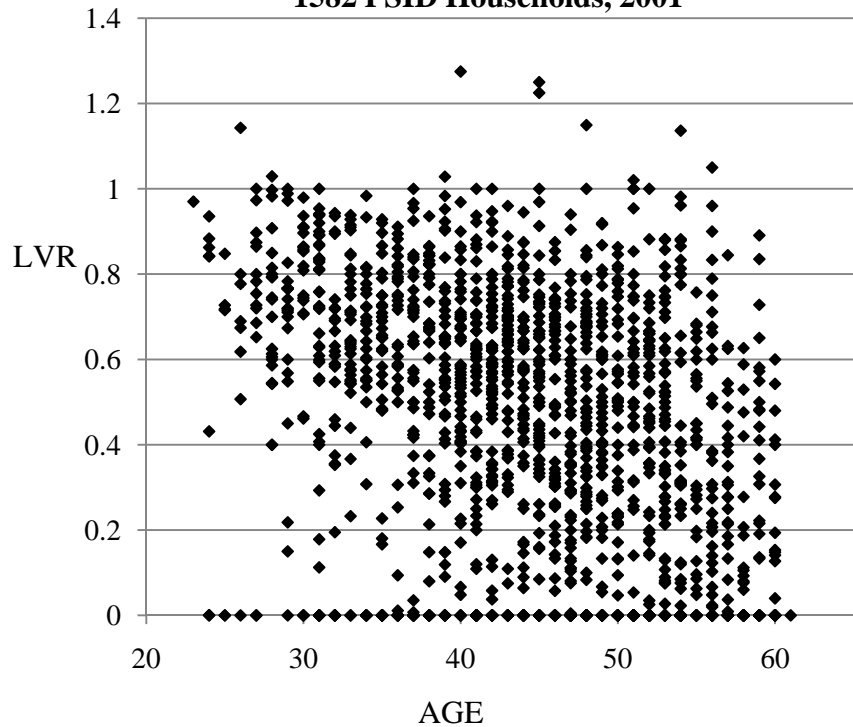
Correlation Between Household Age and Loan-to-Value Ratio (LVR)
1368 BHPS Households, 2000

Distribution of Loan-to-Value Ratio
1,582 PSID Households 1999-2005

CDF

LVR

------- 1999   ••••••• 2001   – – 2003   – · – 2005

Distribution of Loan-to-Value Ratio
1,368 BHPS Households 1995-2005

CDF

LVR

– – – – 1995   — – 2000   ••••••• 2005
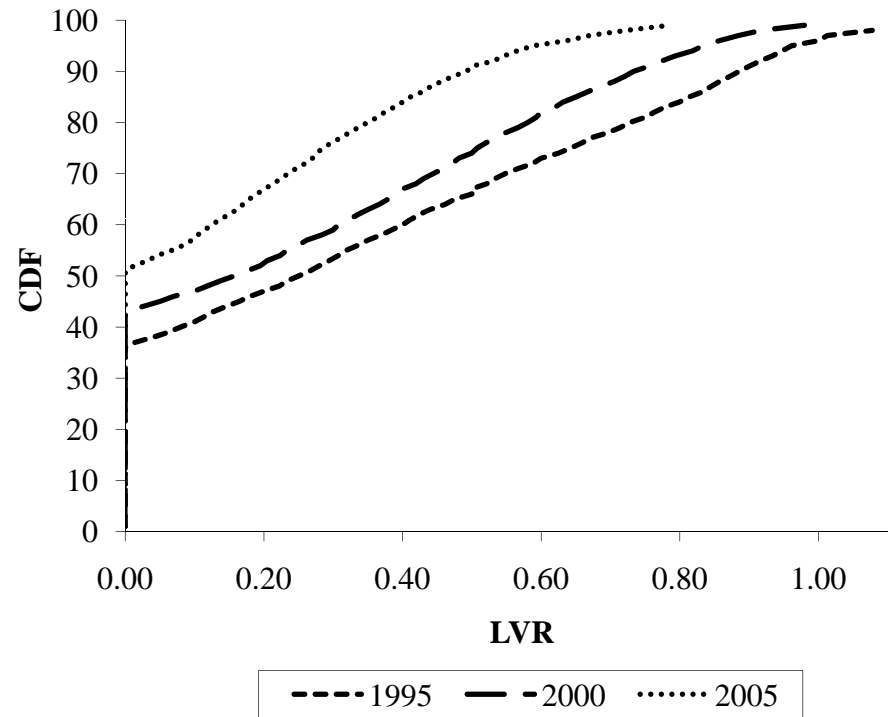
Distribution of Net Worth
1,582 PSID Households 1999-2005

CDF

Net Worth ($)

1999 — 2001 — 2003 2005
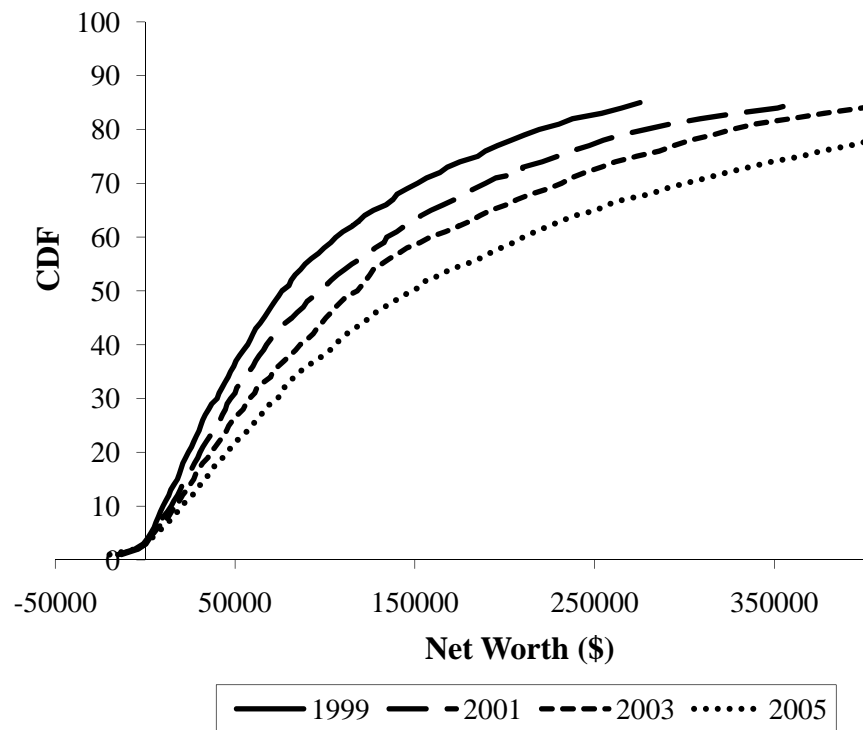
Distribution of Net Worth
1,368 BHPS Households 1995-2005

CDF

Net Worth (£)

1995 — 2000 — 2005
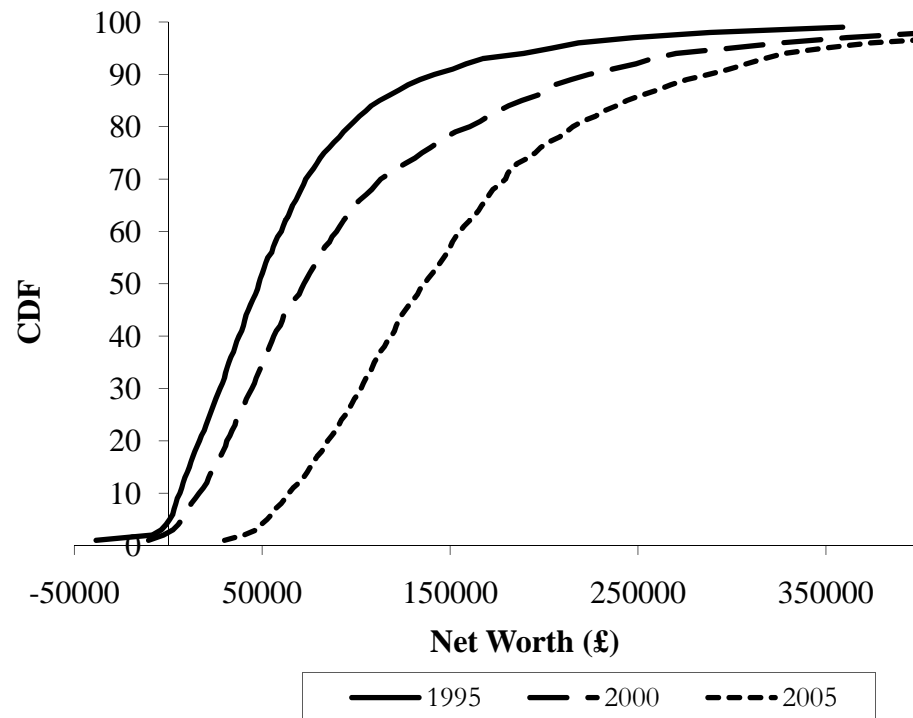
Unsecured Debt

- Financial accelerator model complicated by introduction of unsecured debt.
  - A complement to secured debt in a hierarchy of borrowing instruments (Attanasio *et al.*, 2008)
- Expect non-linear relation between LVR and unsecured debt: accumulate unsecured debt at higher values of LVR.
- Cross-section suggests that households accumulate unsecured debt at values of LVR where constraint binds.
  - Estimate random effects tobit model with LVR-splines for pooled samples of US & UK data.
  - Predict marginal effects for each spline-point, at means of other characteristics.

Specification: Random Effects Tobit Dependent Variable: Unsecured Debt	PSID (financial variables in US dollars)	
	(1) Pooled Random Effects Coefficients	(2) Marginal Effects
LVR	9343** (1361)	1493
Household Income	0.06** (0.01)	0.03
Financial Assets	-0.02** (0.003)	-0.01
Financial Assets Sq	6.61e-09** (1.23e-09)	3.03e-09
Auto Loans / Leases	0.07* (0.03)	0.03
Age	69.1 (410)	31.7
Male Head = 1	-3129 (1842)	-1493
Married = 1	4687** (1741)	2051
Years Education	455* (180)	208
No. Obs No. Groups	6328 1582	
Log L Wald/LR χ^2 (15) Prob > χ^2	-42845.31 174.14 0.0000	

PSID
Marginal Effects for Model with LVR Splines

Specification: *Random Effects Tobit* Dependent Variable: *Unsecured Debt*	*BHPS* *(financial variables in pounds)*	
	(3) Pooled Random Effects Coefficients	(4) Marginal Effects
LVR	3515** (454)	*1612*
Household Income	0.07** (0.009)	*0.03*
Financial Assets	-0.03** (0.006)	*-0.12*
Financial Assets Sq	0.00002 (0.00002)	*8.91e-06*
Age	230* (102)	*106*
Male Head = 1	224 (261)	*102*
Married = 1	932** (309)	*427*
Years Education	216* (123)	*108*
Smoker = 1	620* (266)	*291*
No. Obs No. Groups	4104 1368	
Log L Wald/LR χ^2 (15) Prob > χ^2	-7738.37 426.50 0.0000	

BHPS
Marginal Effects for Model with LVR Splines

Empirical Model

- Estimate a 'collateral effect' by regressing change in secured debt against change in house value.

- Financial , labour market and demographic controls.

- Prior is that will find significant relationship for 'constrained' households and not so for unconstrained.
  - Especially those with unsecured debts.

- Two main econometric issues:
  1. Movers: households increase mortgage debt to finance housing purchases / time equity extraction to correlate with moving due to transactions costs
  2. Reverse causality for non-movers e.g. households extend mortgage debt to fund home improvement work, hence increased debt causes house price appreciation

Instruments

- 1. For reverse causality, use local-level housing index as an instrument for self-reported change in house price
  - U.S. OFHO index applied to beginning-of-period house value, used as instrument for self-reported change in IV model.
  - U.K. change in Halifax index as instrument for self-reported change in IV model.
- 2. Exclude movers (approx. 15% of each sample) and control for predicted probability of moving
  - PSID / BHPS include moving intentions questions.
  - Estimate first-stage regression for moving on whole sample using this question, predict probability of moving for observe non-movers.
  - Include predicted probability as additional control in 2nd stage.

House Price Changes and Growth in Secured Debt – BHPS					
Specification: *I.V. Regression* Dependent Variable: *Change Secured Debt*	(1.)	(2.) 0.X=0.9	(3.) 0.X=0.8	(4.) 0.X=0.8 Y=1,000	(5.) 0.X=0.8 Y=1,500
Δ House Value (£,000s)	-0.01 (0.01)	-	-	-	-
Δ House Value (£,000s)* LVR_{t-1}>0.X	-	0.02 (0.02)	0.02 (0.02)	0.01 (0.01)	0.01 (0.01)
Δ House Value (£,000s)* LVR_{t-1}<0.X	-	-0.02 (0.01)	-0.02 (0.02)	-0.03 (0.02)	-0.03 (0.02)
Δ House Value (£,000s)* LVR_{t-1}>0.X* $Udebt_{t-1}$>£Y	-	-	-	0.31** (0.07)	0.42** (0.06)
Δ House Value (£,000s)* LVR_{t-1}<0.X* $Udebt_{t-1}$>£Y	-	-	-	0.05 (0.06)	0.04 (0.04)
Δ Household Income (£,000s)	0.07** (0.03)	0.09** (0.03)	0.09** (0.03)	0.07** (0.03)	0.07** (0.03)
Age	-0.57** (0.21)	-0.57** (0.20)	-0.57** (0.24)	-0.54** (0.22)	-0.55** (0.22)
Married	503 (732)	516 (746)	517 (749)	520 (758)	526 (576)
No. Children	128 (84)	126 (87)	123 (89)	127 (85)	124 (84)
No. Observations F Prob > F Adj. R-Sq	2316 15.84 0.0000 0.17	2316 14.45 0.0000 0.17	2316 14.53 0.0000 0.17	2316 15.42 0.0000 0.17	2316 15.46 0.0000 0.17

	(1.)	(2.)	(3.)	(4.)	(5.)
House Price Changes and Growth in Secured Debt - PSID					
Specification:					
I.V. Regression	(1.)	(2.)	(3.)	(4.)	(5.)
Dependent Variable:		0.X=0.9	0.X=0.8	0.X=0.8	O.X=0.8
Change Secured Debt				Y=2000	Y=3000
Δ House Value ($,000s)	0.11**	-	-	-	-
	(0.04)				
Δ House Value ($,000s)* $LVR_{t-1}>0.X$	-	0.36**	0.25**	0.42**	0.38**
		(0.13)	(0.09)	(0.13)	(0.12)
Δ House Value ($,000s)* $LVR_{t-1}<0.X$	-	0.09*	0.09	0.08	0.07
		(0.04)	(0.05)	(0.06)	(0.06)
Δ House Value ($,000s)* $LVR_{t-1}>0.X$* $Udebt_{t-1}>\$Y$	-	-	-	0.32*	0.28*
				(0.14)	(0.14)
Δ House Value ($,000s)* $LVR_{t-1}<0.X$* $Udebt_{t-1}>\$Y$	-	-	-	0.14**	0.16**
				(0.03)	(0.03)
Δ Household Income ($,000s)	0.02	0.02	0.02	0.00	0.00
	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
Δ Auto Loans / Leases ($,000s)	0.19**	0.22**	0.22**	0.21**	0.21**
	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)
Married	6648	7060	5512	6840	6854
	(2423)	(2627)	(2686)	(2616)	(2615)
No. Children	-224	-171	-177	-64.6	-52.7
	(649)	(962)	(692)	(690)	(690)
No. Observations	4143	4143	4143	4143	4143
F	18.20	20.59	20.92	20.38	20.53
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000
Adj. R-Sq	0.21	0.21	0.21	0.21	0.21

Results

- BHPS: variation in growth of household debt principally explained by income and age
  - Households with initially high LVR plus unsecured debt exhibit growth in secured debt not explained by income, age etc.
  - Effect appears limited to small subset of households (~10%)
  - To a magnitude of 0.31
- PSID: across all households, relationship between house prices and debt not explained by covariates
  - Average association is 0.11
  - Much higher for households with high LVR plus unsecured debt, who are more prevalent in the data (~20%)
  - To a magnitude of 0.75

Growth in House Prices and Indebtedness, PSID and BHPS Households

	PSID		BHPS	
LVR at beginning of period	**LVR≥0.7**	**LVR<0.7**	**LVR≥0.7**	**LVR<0.7**
Sample				
% total sample	27%	73%	18%	82%
N household-year observations	1119	3024	417	1899
N unique households	373	1008	257	901
Beginning of Period				
Age	37.2	47.8	36.4	50.1
Income ($,£)	62,400	97,100	27,100	38,200
Networth incl. housing ($,£)	64,600	278,200	17,000	74,000
Changes Over Following Period				
Δ house value ($,£)	27,700	46,400	60,100	103,300
Δ mortgage debt ($,£)	18,800	-2,500	5,000	-6,100
Δ unsecured debt ($,£)	1,100	100	1,000	2,100
Δ family income ($,£)	7,900	4,300	8,200	7,100
Δ auto loan debt ($,£)	3,700	-500	-	-
Refinanced mortgage loan (%)	0.51	0.15	0.31	0.21
Δ financial assets ($,£)	1,000	7,000	400	3,000
Home improvement spend previous year ($,£)	1,800	3,600	600	2,500

Results

- For U.S. indicate strong relationship between house price movements and equity withdrawal for consumption.

  - Studies based on aggregate data have found mpc out of housing wealth around 0.1 (Case *et al.*, 2005; Carroll *et al.*, 2006).

  - Micro-data on saving indicates much smaller effect (~0.01). Juster *et al.* (2006).

  - Difference might be explained by housing-consumption relationship primarily arising from equity withdrawal, in a manner consistent with a 'collateral effect' for constrained consumers.

- Much stronger effect for U.S. compared to U.K.

  - UK aggregate-data studies indicate weaker effects, ~0.04 (Aron & Muellbauer, 2008).

  - Results here consistent with this finding.

Conclusion

Further work:

- Are results driven by constraints, or something else?
  - High LVR doesn't imply constrained.
  - Arguably more likely to if future income path upward sloping (and more certain)
  - Proxy measure of future income / income expectations
- Much stronger effect for U.S. compared to U.K.
  - Explained by either of above (or impatience!)
  - Or by greater opportunity to access marginal housing equity gains in U.S. (sub-prime) and/or lower risk? (no-recourse loans)