

# Macro modelling and the financial accounts: the household sector

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*How financial systems work: evidence from financial accounts*

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- What kind of macro policy models do central banks need?
- The end of representative agent models.
- Asymmetric information, liquidity constraints, income uncertainty.
- The implications of the revolution in credit market architecture and why debt matters.
- A consumption function relevant for understanding the financial accelerator.
- Modelling joint consumption and portfolio decisions – towards better econometric macro models. Evidence from US, France and Germany.



## New Keynesian Dynamic Stochastic General Equilibrium models

- **Not new**, based on ideas made redundant by the asymmetric information revolution of Stiglitz, Akerlof, Spence.
- **Not Keynesian**, ignoring co-ordination failures, especially between real economy and finance.
- **Not dynamic** enough, misleading on real world lag structures.
- **Hardly stochastic** missing both radical uncertainty (time dimension) and heterogeneity (cross-section dimension) of statistical distributions.
- **Hardly GE**, missing most of system feedbacks.
- **Not 'structural'** in Cowles Commission sense.

- Buiter (2009) [voxeu.org/article/macroeconomics-crisis-irrelevance](https://voxeu.org/article/macroeconomics-crisis-irrelevance) attacked complete markets paradigm: no insolvency or illiquidity.
- Muellbauer (2016) [voxeu.org](https://voxeu.org)
- 1) the choice of the **wrong micro-foundations**, ignoring the asymmetric information revolution of the 1970s, and Deaton-Carroll research on buffer-stock saving when households face idiosyncratic uncertainty and liquidity constraints;
- 2) the flawed basis of rational expectations and inter-temporal optimization when **structural breaks and radical uncertainty** are endemic, Hendry & Mizon, VOXEU 2015;
- 3) the **failure to allow for the major changes in financial architecture and to link balance sheets and flow of funds to spending**.

- In the fashionable New Keynesian ‘science of monetary policy’ (Clarida, Gali and Gertler, 1999) credit sectors, money and asset prices were thought **irrelevant**.
- Blanchard (2017) <https://piie.com/blogs/realtime-economic-issues-watch/need-least-five-classes-macro-models>, and OXREP forthcoming, favours major repairs of central bank policy models:
  - less imperialistic attitude so that alternative GE models, closer to the data, can flourish.
  - Many (BOC, DNB, **ECB**, even BOE) have realised the need for non-DSGE macro models.



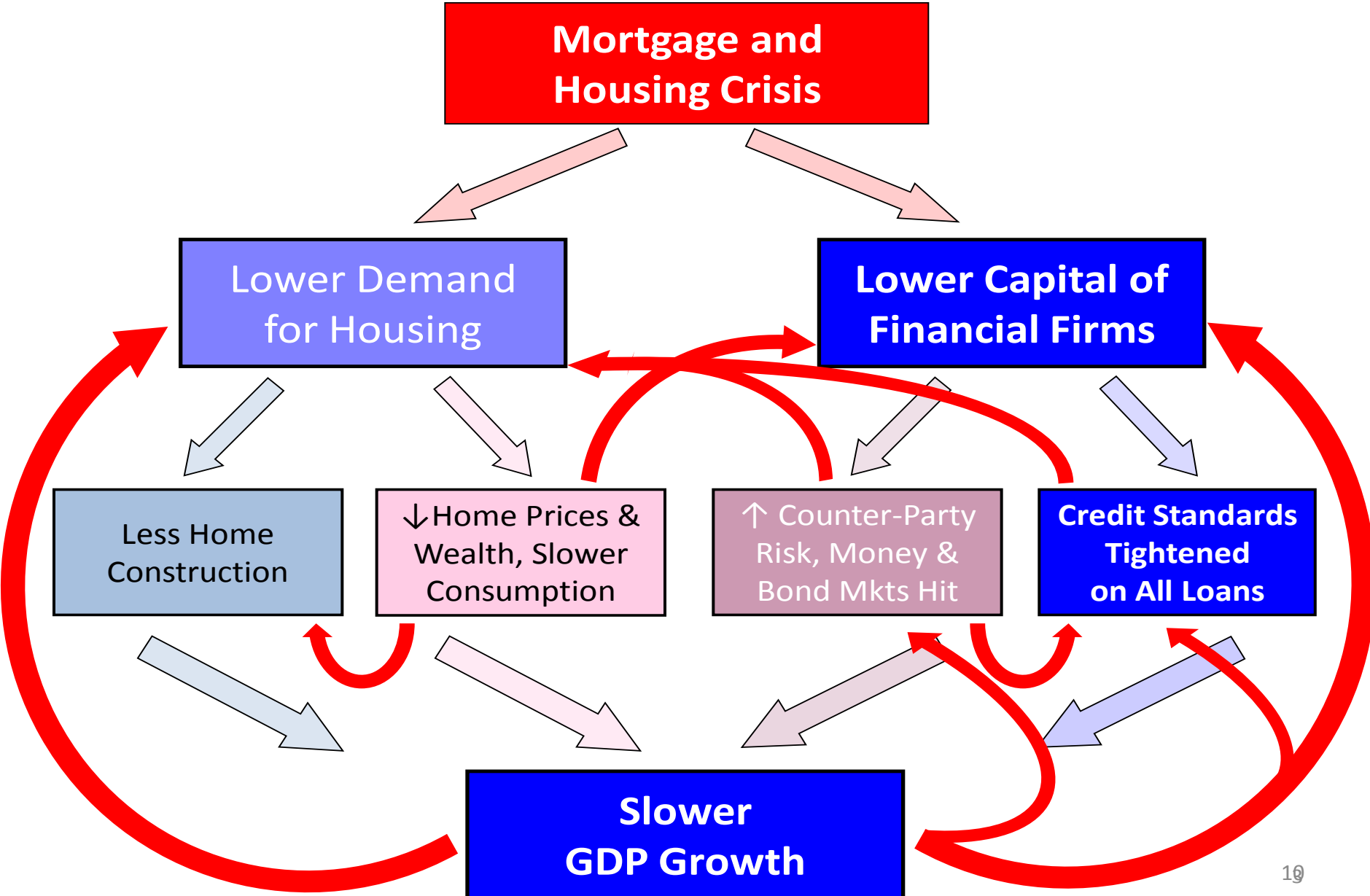
- Post crisis, central banks have studied the flow of funds and financial balance sheets much more carefully.
- New attention to old ideas of Tobin, resurrected in **stock flow consistent** (SCF) approaches of Godley and Lavoie (2012), Burgess et al (2016), BOE, Staff Working Paper No. 614.
- But **behavioural links** with spending and hence the real economy are still **weak** in all these models, **including FRB/US**. So miss business cycle feedback loops and understanding of risks to financial stability.
- **FRB/US failed acid test in crisis**: in 2007 Jackson Hole symposium, Mishkin reported FRB/US simulations of a 20% decline in real house prices for 2007-2008: GDP lower than baseline by at most 0.25% in early 2009!

- Empirical evidence vs. New Keynesian DSGE models:
- 1) **failure** of aggregate consumption **Euler equation**;
- 2) mountains of **new micro-evidence** on heterogeneity, credit constraints, buffer stock behaviour, influence of house prices on consumption in liberal credit economies.
- **Macro-evidence is not allowed to 'speak'** in top journals: pincer movement between Lucas (1976) critique and Sims (1980) 'incredible restrictions critique' led to ban on macro-evidence outside **DSGE and Bayesian VARs**, where **compromised by strong priors** and calibration, see Muellbauer and Hendry, forthcoming OXREP on future of macro.  
<https://ideas.repec.org/p/oxf/wpaper/832.html>

- **Unemployment risk varies greatly** by occupation and education, making nonsense of RBC representative agent model of unemployment.
- Credit constraints, mortgage defaults, negative equity **vary**.
- **Stochastic aggregation** - working with means and distributional parameters- suggests we can still **make great progress with aggregate data**, including unemployment rate.
- Houthakker (1956) showed fixed coefficient technology (no substitution) at the micro-level implied high degree of capital-labour substitution for macro, given Pareto coefficient distribution.
- **Hence need more flexible micro-to-macro thinking.**
- Aron & Muellbauer (J. Urb. Econ. *July 2016*) track aggregate incidence of UK negative equity given stable distribution of mortgage debt/equity. Driver of arrears and repossessions.



- Irving Fisher's 1933 **debt-deflation theory of great depressions** and book on Booms and Depressions:
  - credit availability expands, pushes up spending, debt and asset prices, irrational exuberance raises prices to vulnerable levels, negative shocks can then cause falls in asset prices, bad debt, credit crunch, rise in unemployment, deflation.
- Explaining the collapse in UK personal saving (Muellbauer and Murphy, 1990):
  - (unsustainable) credit-liberalisation-driven house price boom: find mpc for debt is close to negative of mpc on liquid deposits, higher than on illiquid assets: **debt really matters**.
- Hence crucial to control for the **shift in credit conditions!**
- Adair Turner (2015) *Between Debt and the Devil: Money, Credit and Fixing Global Finance*
- Mian and Sufi (2014) *House of Debt*.
- Jorda, Schularick and Taylor *Economic Policy* Jan 2016 on role of real estate collateral.



### 3. A relevant consumption fn.



- We need a more general consumption function plus an income forecasting model to capture the consumption channel in the financial accelerator.
- Unlike Euler equation, it *does not throw away* long-run information on income and assets.
- Consumption function is conditional on end of previous period **portfolios and on asset prices, so need to endogenise** these in a full macro model.

1. Log-linearizing gives the basic aggregate life-cycle/permanent income consumption function:

$$\log c_t = \alpha_0 + \log(\text{yperm} / y_t) + \gamma A_{t-1} / y_t + \log y_t \quad (1)$$

- **A/y gives better approx. than log A**; it preserves additive feature of budgets, and allows splitting into small and negative components.

2. Add habits (partial adjustment) for a dynamic model.

3. Add risk premium to discount future uncertain income more heavily and a fixed proportion of rule of thumb hhs.

FRB/US model, designed in 1996, picked up points 1.-3. from Muellbauer & Lattimore survey (1995 Handbk Appl. Ectrics).

FRB/US has flexible models for expected income growth and polynomial adjustment costs instead of habits.

**BUT** ignored our evidence that **mpc is higher for liquid assets**, theory explanation of why **housing wealth effect is different** (p.268-271) and “**Financial liberalization**, by making asset backed credit more easily available, made these illiquid assets **more spendable**” (p.281) and “...improved access to... home loans, and **reduced down payment** to house price **ratios**”(p.289).

- Theory-based models make simplifying assumptions.
- We generally **do not know** which model is correct.
- For applied work, formulate a model which encompasses or **'nests' rival models, each being a special case** (imposing parameter restrictions) **of the encompassing model**.
- David Hendry and co-authors proposed this approach in the 1970s, Davidson et al (1978), see Birner (2002) for the history of thought context.
- The permanent income formulation consumption function (1) can be generalised:

- a) split net worth into **key elements with different coefficients** – e.g. to reflect notion that cash is more spendable than pension wealth, and that housing wealth differs from financial wealth according to inter-temporal choice theory.
- b) allow coefficient on  $\log(y_{perm}/y_t)$  to differ from 1 - e.g. to allow for the possibility that some households are myopic.
- c) allow **intercept  $\alpha_0$  to be time-varying**: if down-payments required for mortgage and other loans fall, saving for a down-payment declines so that  $\alpha_0$  rises.
- d) allow **time-variation in house price/income effect and/or housing collateral effect** which shifts with access to home equity loans.



- *Restrictive (conservative) credit markets* suggest aggregate consumption falls when house prices rise:
  - (e.g. Germany or Japan)
  - future first time buyers (and renters) save more for a deposit (or higher future rents), though aggregate negative effect should be lower where proportion of owner-occupiers is high (Italy).
  - home-owners have limited access to home equity loans.
- *Liberal mortgage markets* imply the **opposite**:
  - a lower ratio of down-payments to value applies, so future first time buyers will save little and not respond much to higher house prices;
  - Greater access to home equity loans *raises mpc of housing collateral*.

- Many studies of housing wealth effects suffer from *poor controls*, but *not* this one, with long-run solution:

$$\ln(c_t/y_t) = \alpha_{0t} + \alpha_{1t}r_t + \alpha_2\vartheta_t + \alpha_{3t}\ln(y_t^p/y_t) + \gamma_1NLA_{t-1}/y_t + \gamma_2IFA_{t-1}/y_t + \gamma_{3t}\ln(hp_{t-1}/y_t) + \gamma_{4t}HA_{t-1}/y_t + \gamma_5demog_t \quad (2)$$

- NLA is liq. assets –debt, IFA is illiq. financial, HA is housing
- Short-run dynamics also potentially includes growth in income, change in interest rate and **change in the unemployment rate** as uncertainty proxy.
- **Time varying parameters are made functions of credit conditions.**
- Heterogeneous underlying micro-structure.



- Corroborating findings for UK, Australia (M. & Williams, BIS 2012) , South Africa (Aron & M., RoIW, 2013), Canada (M., St. Amant & Williams, BOC wp 2015), Germany (Geiger et al ECB wp 2016), France (Chauvin and M. 2017)
  - aggregate housing ‘wealth’ effects zero or negative before mortgage credit liberalisation,
  - mpc for net liquid assets between 0.08 and 0.16, for illiquid financial assets between 0.015 and 0.03,
  - speeds of adjustment typically 0.4-0.7 for aggregate consumption, bit lower for non-durables.
  - Some **other studies** (e.g. Case, Quigley, Shiller, 2009, 2013) **exaggerate ‘housing wealth effect’**, confusing it with shifts in credit conditions.

$$\log(y_{perm}_t / y_t) = E_t \left( \frac{\sum_1^k \delta^{s-1} \log y_{t+s}}{\sum_1^k \delta^{s-1}} \right) - \log y_t$$

- Measures per capita income growth expectations. We use  $\delta=0.95$  for quarterly data (20% pa discount), include labour force/pop ratio, real exchange rate, real oil prices, real stock market index and some (unanticipated) split trends, with gradual learning about breaks.
- **High average discount rate and buffer-stock role for balance sheets are two key conclusions from incomplete markets and undiversifiable idiosyncratic income uncertainty.**
- Has important macro implications, e.g. for **expenditure multiplier**.

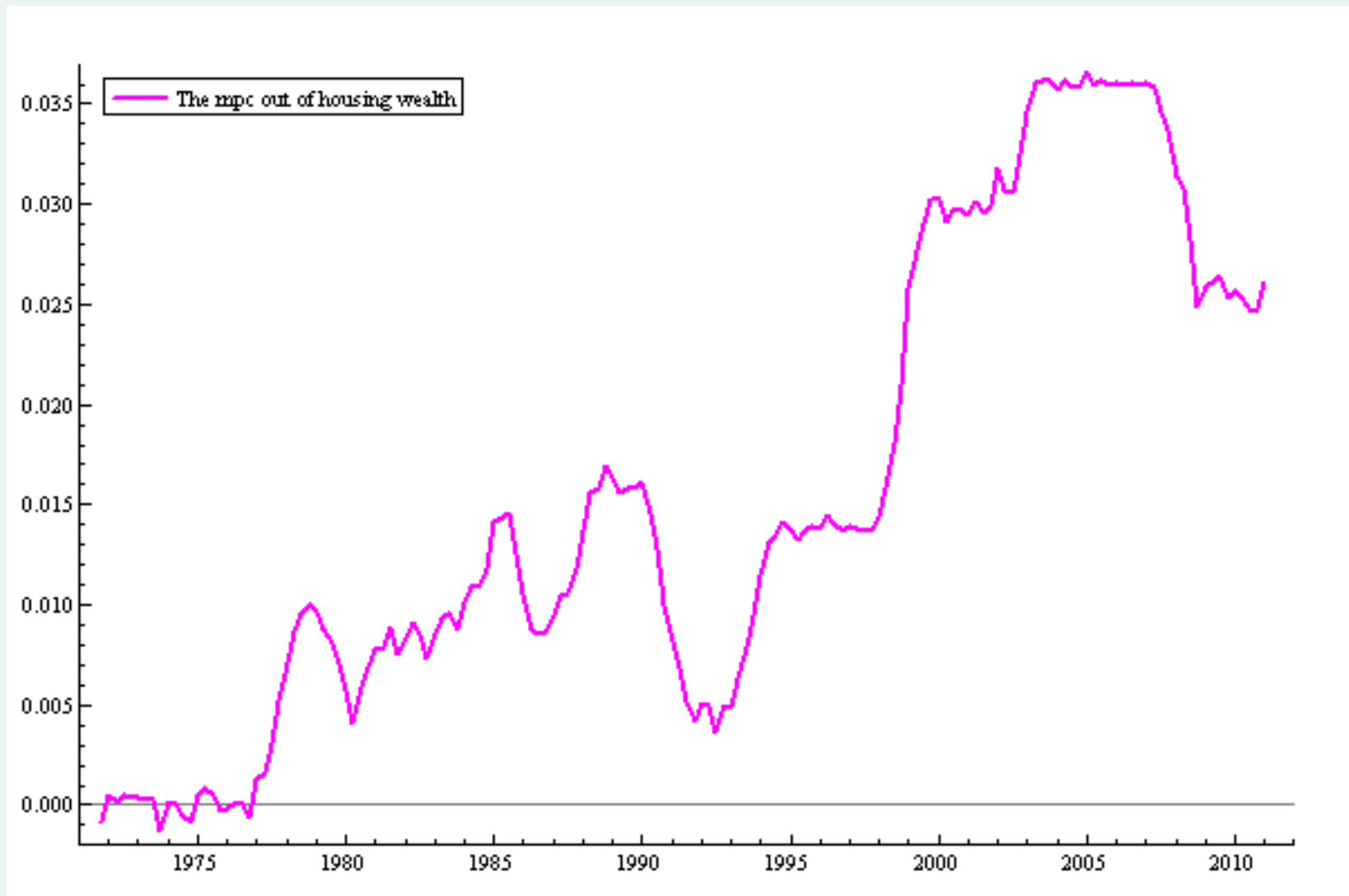


## **Asymmetric information also suggests important role for credit channel,** which features through:

- The *different mpcs* for net liquid assets, illiquid financial assets and for housing
  - larger for net liquid assets, Otsuka (2006)
- Possible short-term cash flow effects for borrowers;
- The possibility of parameter shifts with credit market liberalisation:
  - US credit conditions index *CCI* from SLO survey for unsecured credit

- Housing liquidity index, **HLI, latent variable defining access to home equity loans** in the US study, a common, unobserved, evolving structural influence.
- NOT a principal component or ‘factor analysis’, but measure of otherwise EXCLUDED effects.
- Latent interactive variable equation system:
- Duca and Muellbauer (ECB wp1581, 2013, ed. Winkler et al, 2014 [link.springer.com/chapter/10.1057%2F9781137353016\\_2](http://link.springer.com/chapter/10.1057%2F9781137353016_2))
- For US: system of 4 equilibrium correction models:
  - consumption, refinance rate, housing equity withdrawal (=change in mortgage stock minus acquisition of housing), mortgage stock.
  - Quarterly data, 1971(4) – 2011(1)

# HHI is time varying mpc of US housing

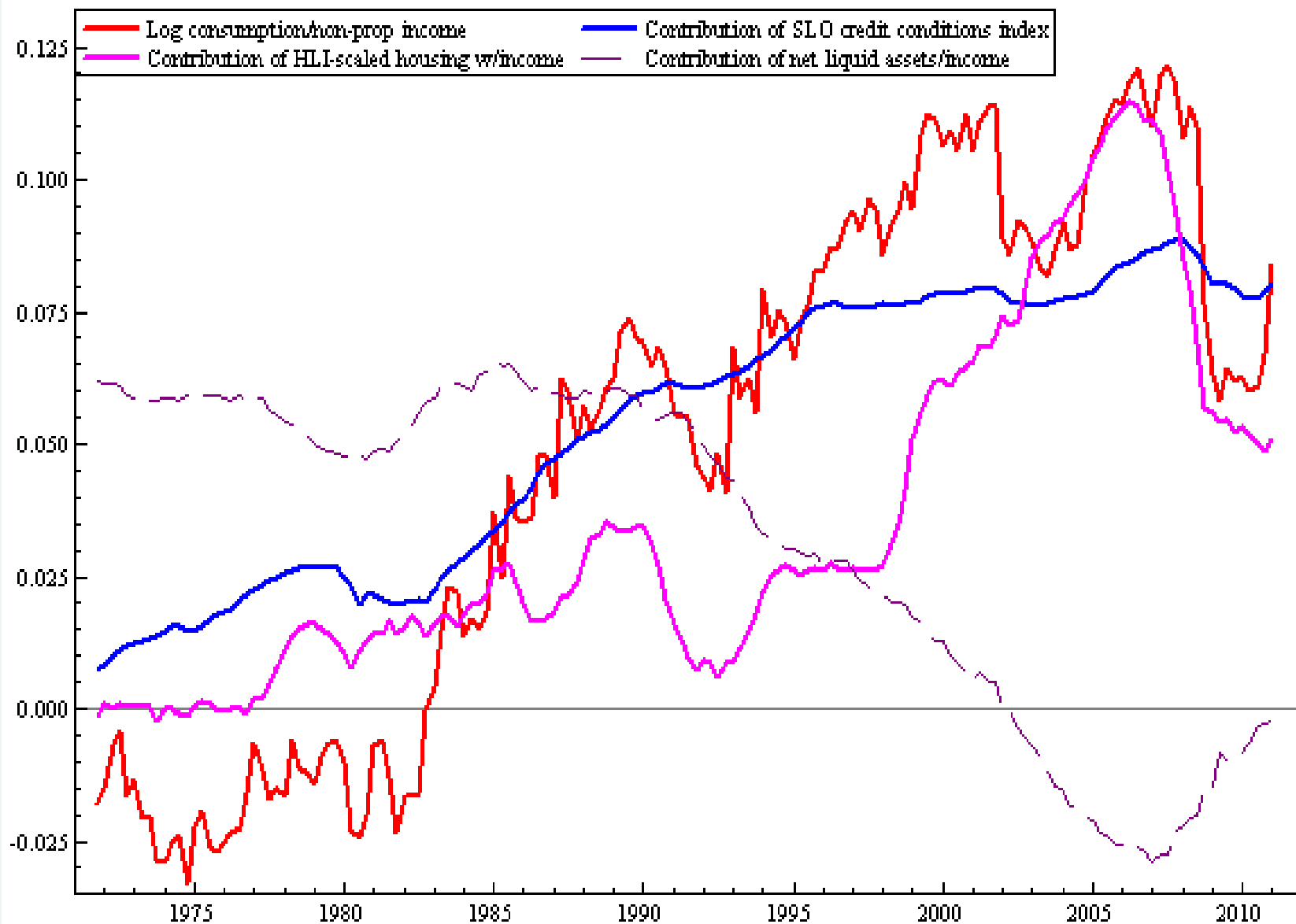


- 5 or 6 variables integrated of order 1

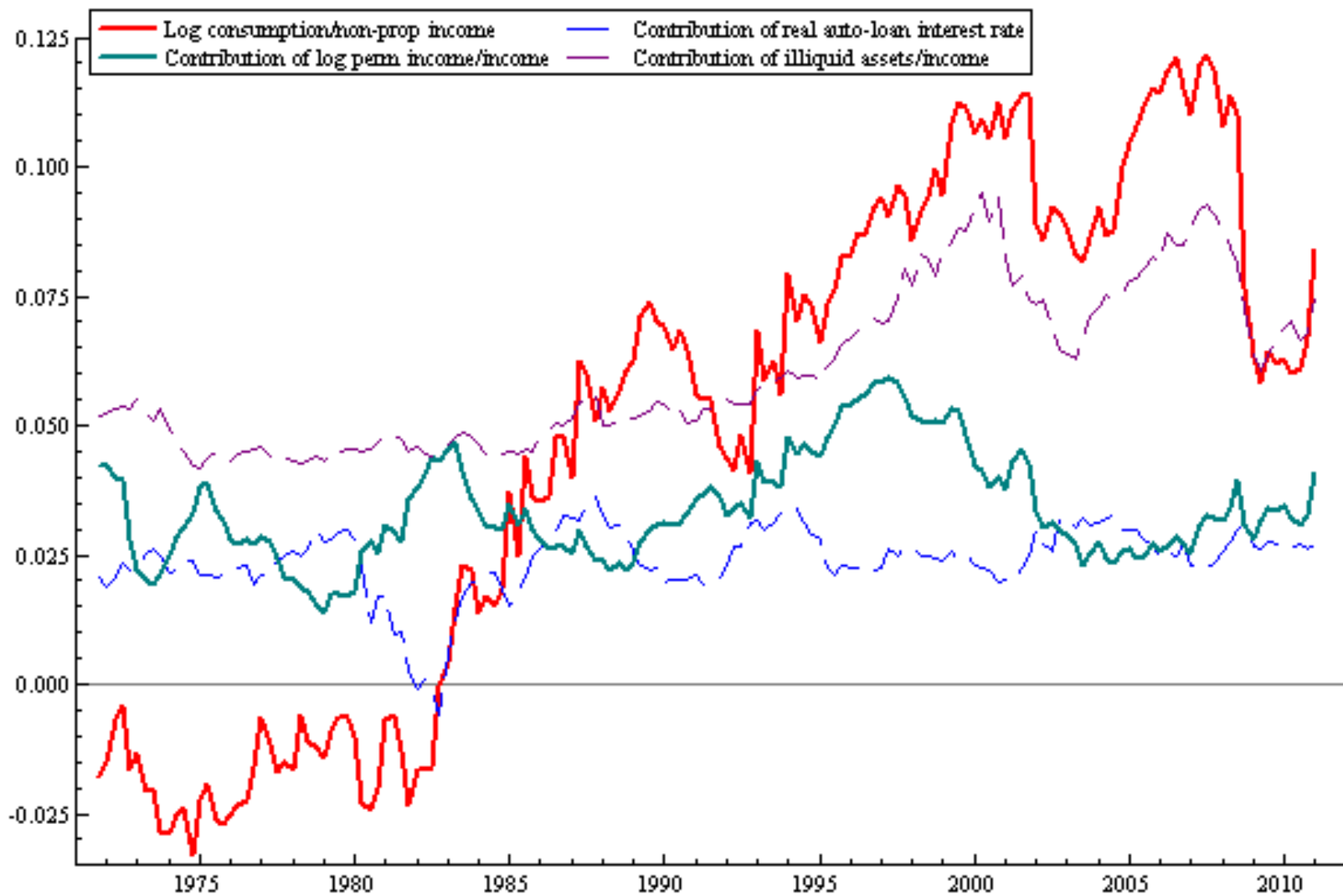
$$\log(c_t / y_t), CCI_t, E_t \log(yperm / y)_t \text{ (-borderline I(1))}, \\ NLA_t / y_t, IFA_t / y_t, (HLI_t)HA_t / y_t.$$

- Only 1 co-integrating vector.
- **Only 1 significant adjustment coeff. – that for consumption.**
- **Reverses Lettau & Ludvigson (2001, 2004, 2013) claim** that wealth, rather than consumption adjusts to the co-integrating relationship.
- *Given credit conditions, parameter stability and international evidence* (UK, S. Africa, Australia, Canada, France, Germany, Japan) suggests consumption function is a structural equation in the Cowles Commission sense.

# Decompose US long-run soln (a)



# Decompose US long-run soln (b)







- On how US consumption/income behaved over the long-run, in the build-up to the financial crisis and during the crisis.
- Note **build up of debt obligation during long period of credit liberalisation and rises in asset prices.**
- Insights into role of **debt and shifting correlations with economic growth**: negative role for level of debt, positive for growth of debt noticed by many observers.
- **Reconciled** by shifts in credit supply and continuous negative implications of level of debt for consumption.
  - i.e. omitted credit supply explains shifting bivariate correlations of debt with growth.

- FRB/US model allows for permanent labour, transfer and property income but imposes net worth constraint as the **only** way asset price, liquidity and credit shocks can affect consumption, given income.
- $\text{mpc for net worth} = 0.0315$  ( $t=10$ )
  - debt has trivial role relative to housing and stock market wealth.
- **Amplifying feedback loops** via financial system's ability to extend credit are **missing**, failing 2007 acid test.
- **Unstable parameters**: speed of adjustment for non-durables 0.18 in 2009, 0.10 now, inconsistent with folk-wisdom about timing of real economy effects of monetary policy.
- Though **claimed to be 'micro-founded', not a 'structural equation'** in the Cowles Commission sense.



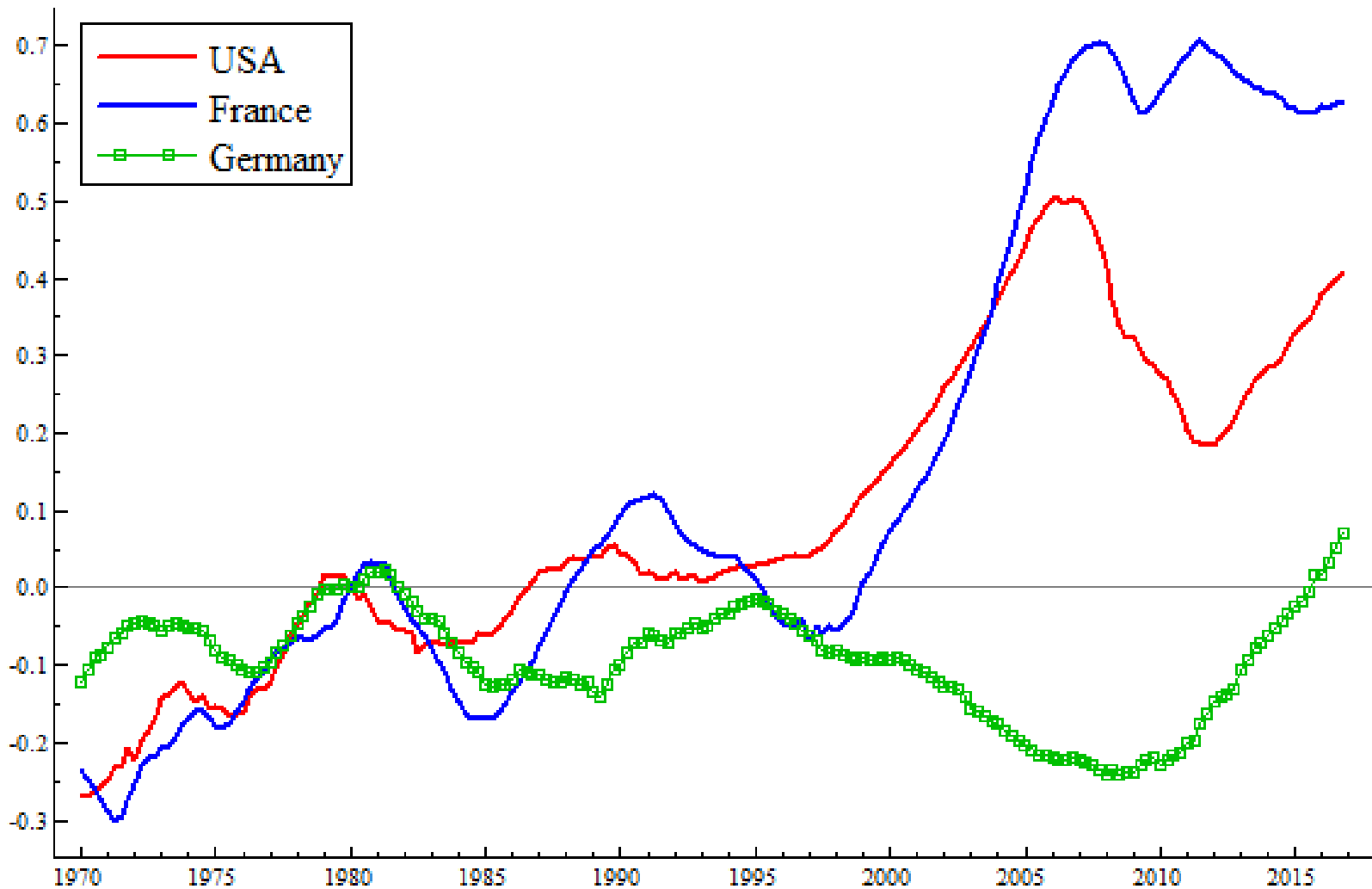
### Need consumption-portfolio-asset price system

- To plug consumption function with disaggregation of wealth into a macro model, we need equations for assets and debt.
- Extract **credit conditions as latent variables from same system** (CCIs are functions of smooth transition 0/1 dummies plus economic factors, e.g. disinflation in France).
- *ECB w. paper 1904 on Germany* with Felix Geiger and Manuel Rupperecht of BuBa; draft paper with Valerie Chauvin, BdeFrance
  - estimate 6-equation system for consumption, unsecured debt, mortgage debt, liquid assets, house prices and yperm. Still need price model for IFA and net acquisitions for IFA and HA.
- Estimated unsecured and mortgage CCIs imply **small effects on German consumption** compared to UK or France.
- **Solves puzzle of divergent real house prices and hh saving rates.**



- **Mistaken focus on net worth** as a constraint on aggregate household spending and asset accumulation.
- Demand for asset  $i$ , as function of net worth and mean and variance of relative returns, **ignores credit constraints, buffer stock and liquidity aspects of asset demands, and unique place of housing**, which is consumption good also.
- **Micro-theory**: Otsuka(2004) buffer stock model with illiquid asset s.t. trading cost, Kaplan et al (2016) heterogeneous agent model with credit constraints and illiquid asset, Hedlund et al (2016) heterogeneous agent model with housing, all **contradict net worth constraint**.
- Godley, Lavoie, Tobin treatment of debt is not satisfactory.
- **Ignores shifts in behaviour as credit conditions alter.**
- **Weakness in asset pricing, especially of housing.**

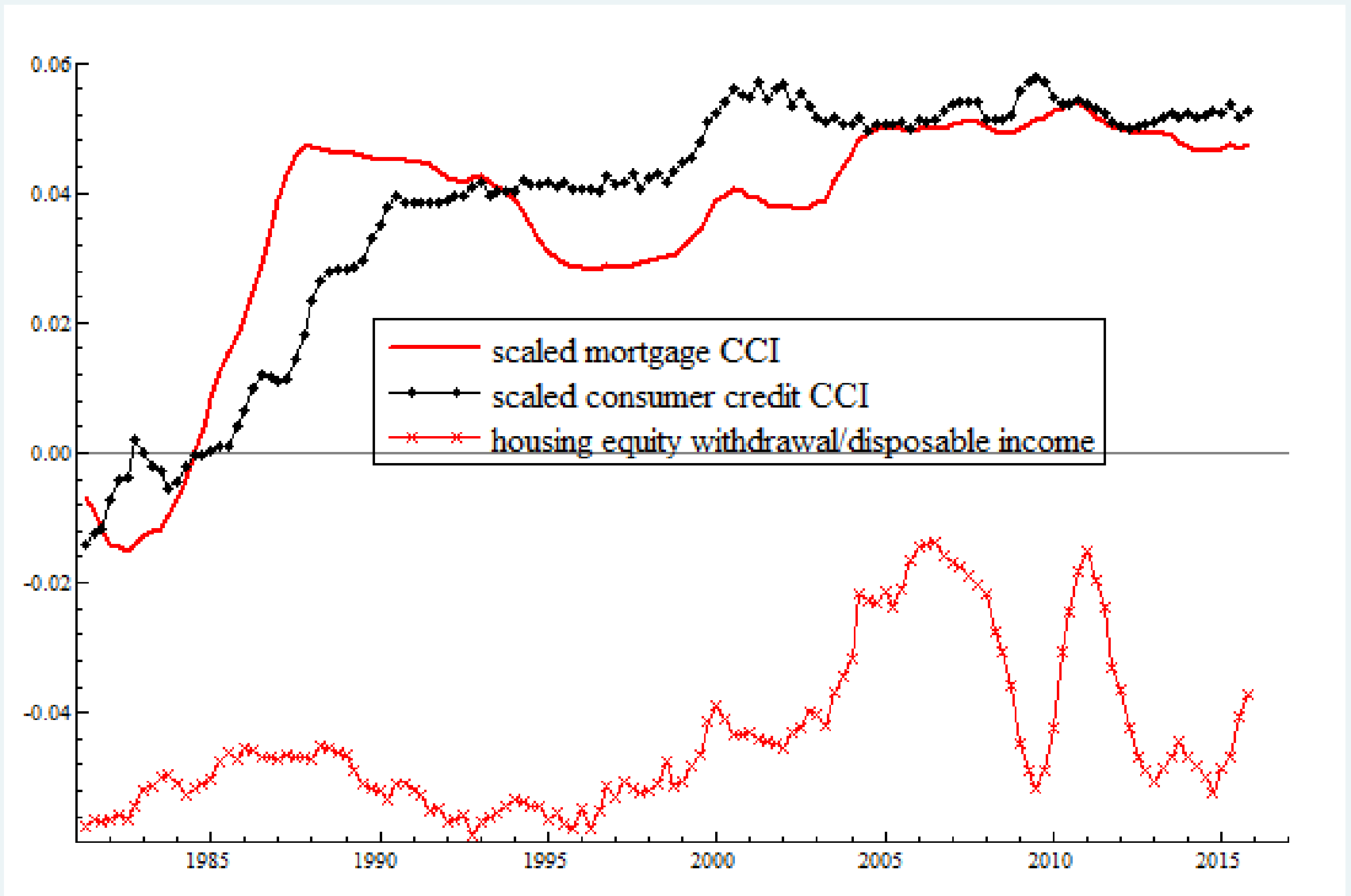
# Log real house prices diverge





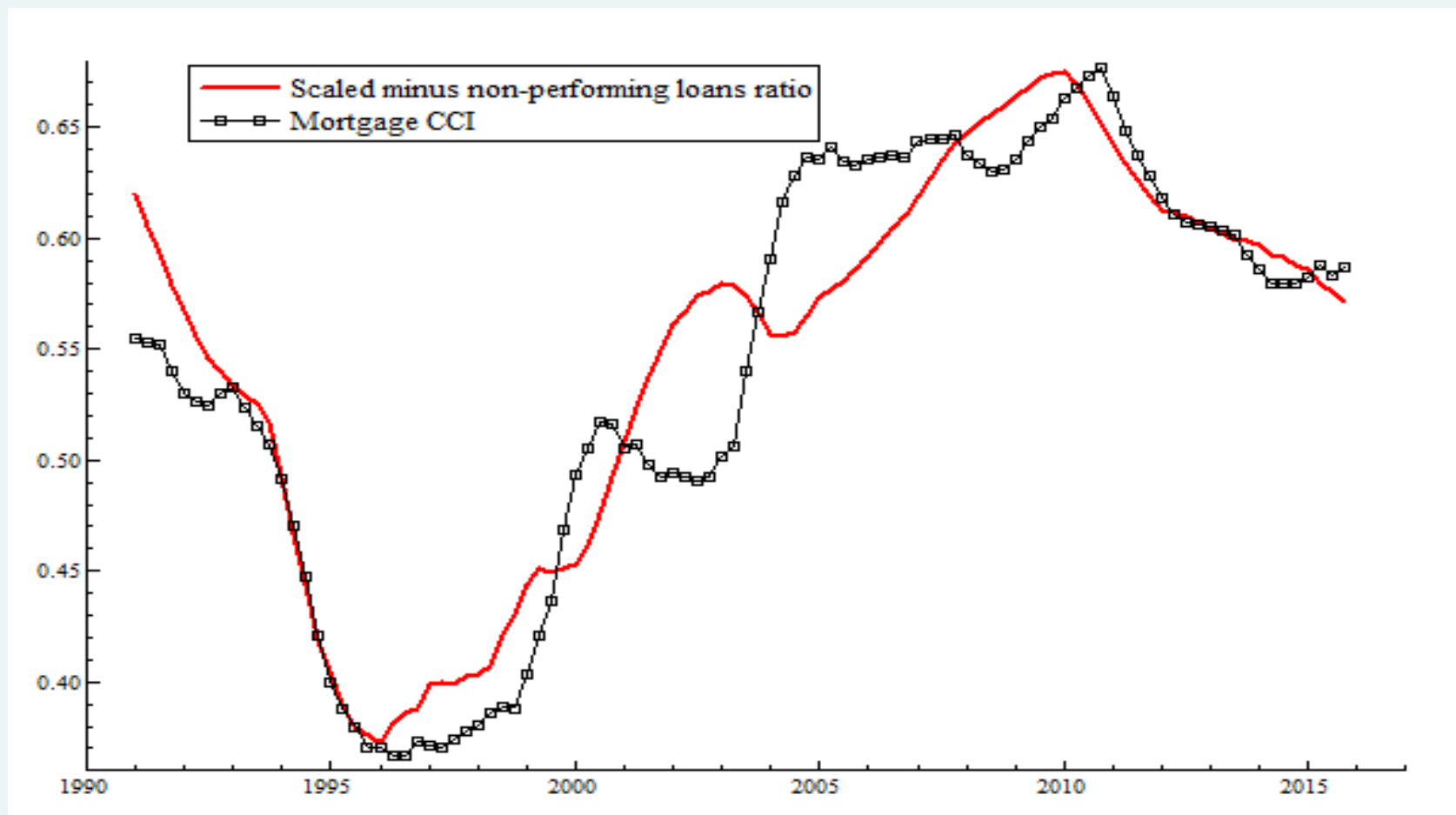
- Since housing stock adjusts very slowly, **invert demand equation to find real house price index as function of demand shifters and lagged housing stock.**
- Key factors are log nominal mortgage rate, mortgage credit conditions, income per house, user cost and momentum spill-over effects from other countries, and demography.
- Since income elasticity of demand for housing is approx 1, elasticity of aggregate real hp w.r.t. income per house, around 1.8 in France, near 1.3 in Germany, = -inverse of price elasticity.
- **Previous** aggregate house price models for France have **unstable** and often absurd **parameter estimates.**

# French credit conditions estimates and housing equity withdrawal





- Lagged ratio of French non-performing loans/total bank loans to private sector is negatively correlated with MCCI, **role for bank balance sheets.**



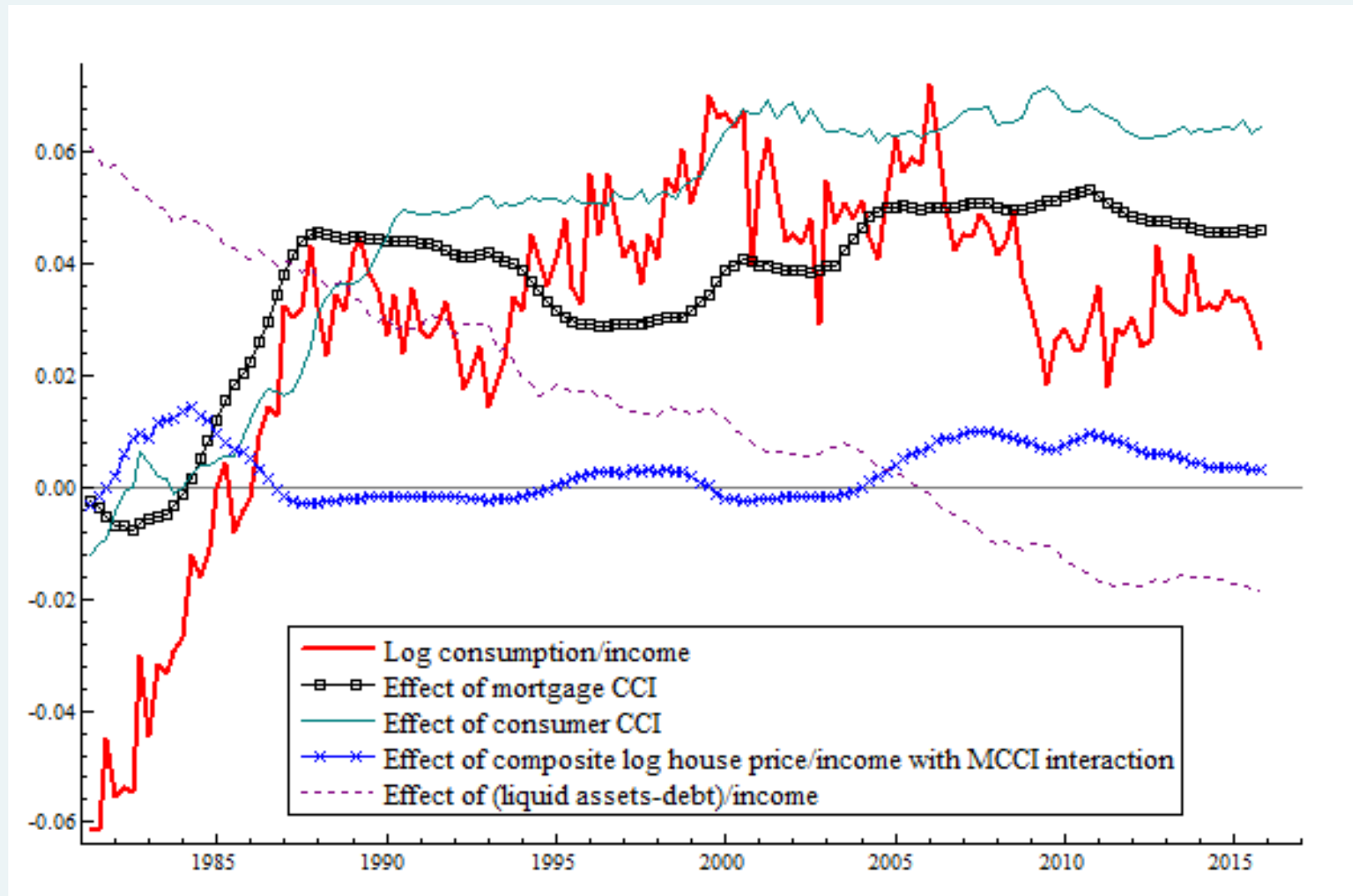


- Between 1981 and 2012, French log real hp rose over 0.8 more than German (real hp up 120% more).
- Our models suggest that, if anything, effects of demography and income per house, were more negative in France (though more positive in 1997-2007).
- So key explanation is **far greater shift in mortgage credit conditions in France and greater fall in nominal mortgage rate, together with greater responsiveness of house prices in France to nominal mortgage rate** (elasticity = -0.38  $t=-8.6$ )
- Disinflation in France was much more pronounced.
- **Regulation** of French banks **limits mortgage debt service ratio**, (mortgage rate x loan)/income, to 33% max. Fall in nominal rate lifts this credit constraint.

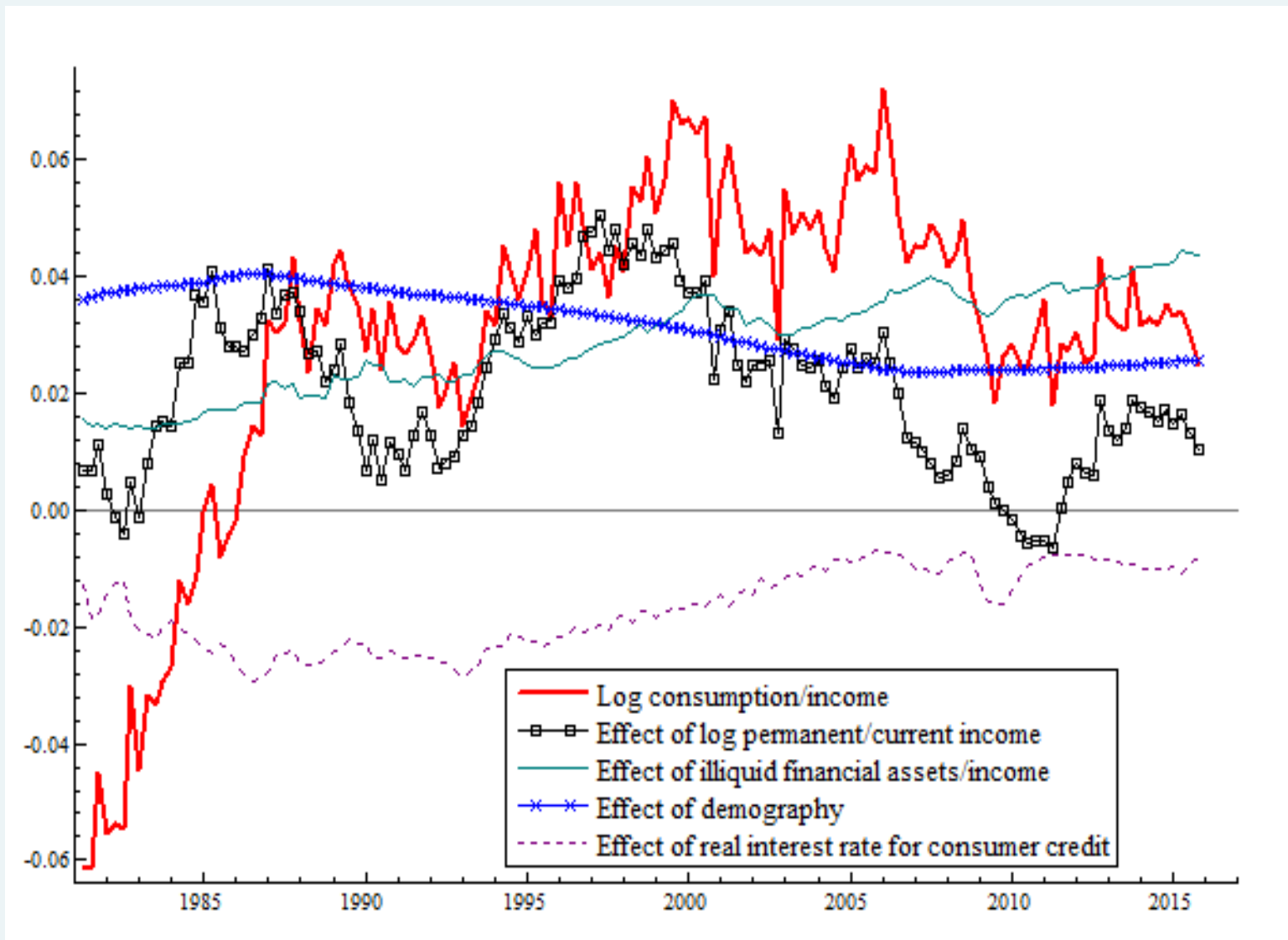


- **Stable parameters** estimating 1981-2015Q4, 1984-2015Q4, 1981-2008Q3. (Note instability found in previous literature).
- **Speed of adjustment collapses** from 0.67 to 0.10 **if no CCI**s; for Germany, omission of CCI is much less damaging.
- Mpc for liquid assets is around 7 times larger than for illiquid financial assets.
- Can accept restriction that mpc for debt is **minus** that on liquid assets: debt really matters.
- **Log house price/income has significant negative coefficient** but less negative as access to mortgage credit eases.
- Roughly 0.4 weight on current income, 0.6 on permanent income even with 5% per quarter discount rate, **rejects textbook permanent income** story.

# Long-run drivers of log cons/income in France (a)



# Long-run drivers of log cons/income (b)





- In both France and Germany, house price/income has negative effect on aggregate cons/income, but **negative effect eases as mortgage credit availability increases**.
- By 2010, net effect is slightly positive in France, still negative for Germany.
- In Germany mortgage credit conditions rose far less from 1981 to the present: rose around unification in 1990, but contracted after 1996 as bad loans on lending to former E. Germany rose.
- In **Germany, post 2001 pension reform** and 2003 Hartz reforms of labour market reduced log cons/income by resp'y about 0.025 and 0.015: i.e. hh saving rate rose 2.5% plus 1.5%.
- **Helps explain weakness of German domestic demand**.

- Suggests that **monetary transmission in Germany is very different from the US and UK**, and somewhat different from France.
- **Macro-shifts in credit conditions and asset prices have macro effects** that should not be ignored.
- Though spatial heterogeneity can be exploited (e.g. Mian and Sufi, NBER 2016, Favara & Imbs, AER 2015).
- **Micro-evidence IS important**: test behaviour hypotheses, help calibrate effects of demography and distributional changes.
- Changing demography is much more important for composition for aggregate hh portfolios than for consumption, **conditional on** those portfolios.
- Estimating LIVES models is **not easy, esp'y robust identification of demographic effects** – need long samples, X-country support, X-equation consistency.

- Some remarkable empirical insights not available from micro-cross-sections or short panels:
- Contrary to text-book view, major role for **NOMINAL** interest rate in driving house prices (and mortgage stock).
- Role of user cost increases where leverage is higher.
- **Increased access to unsecured credit reduces demand for liquid assets** – ignored by previous research on hh demand for money.
- Strong evidence for **buffer-stock role** of liquid assets and unsecured consumer credit: change in unemployment rate has – (liq. assets), + (consumer credit) effect.
- Moderates negative consumption effect of higher unemployment.
- **Larger** unemployment effects on US and UK consumption consistent with **weaker** safety net/automatic stabilisers.