

# Looking behind the financial cycle: the neglected role of demographics

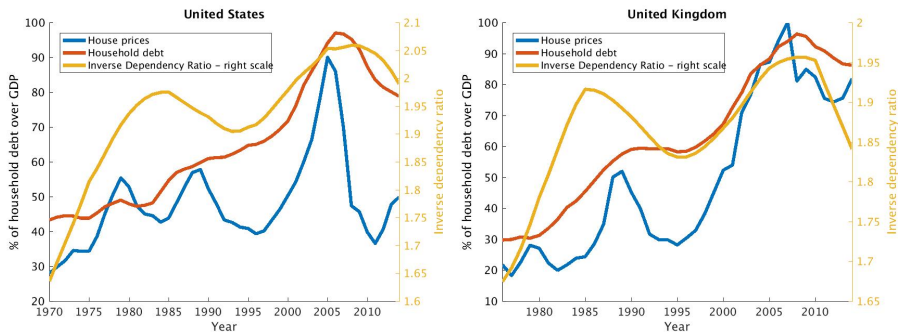
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CEPR-Bank of Finland  
Conference on Demographics and the Macroeconomy  
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<sup>1</sup>The views expressed in this presentation are solely the responsibility of the author and should not be interpreted as reflecting the views of the Eurosystem or Banca d'Italia.

# Inverse dependency ratio, household debt and housing prices



Source: BIS, IMF, WB

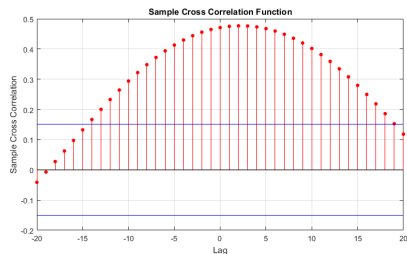
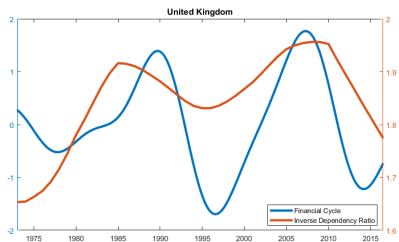
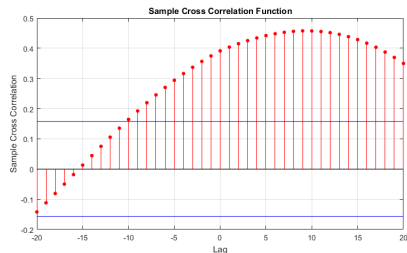
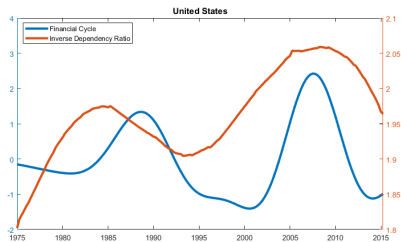
Correlogram US

Correlogram UK

# Motivation

- Household debt and housing price cycles are correlated with dependency ratio (Nishimura, 2011 & 2013)
  - Housing prices are driven by population dimension and demographic structure (Saita et al. (2013))
  - Correlation between private debt, mortgages and housing (land) prices (Piazzesi and Schneider, 2016; Knoll et al., 2017)
- Fertility in the 20<sup>th</sup> century has been characterized by booms and busts (Geanakoplos, 2004; Jones and Schoonbrodt, 2016) Figure

# Financial and "demographic cycle"



Source: author's elaboration of Borio et al. (2012)

# This paper

## Research question

Can the demographic cycle explain the financial cycle?

- Construct an OLG model with debt, housing and exogenous demographic shocks
- Study the effect of a transitory baby-boom on agents choices of consumption and savings
- Effects on the income life-cycle and relative-dimension of supply and demand of the credit market trigger financial cycle: credit-to-GDP and house prices co-moves with inverse dependency ratio

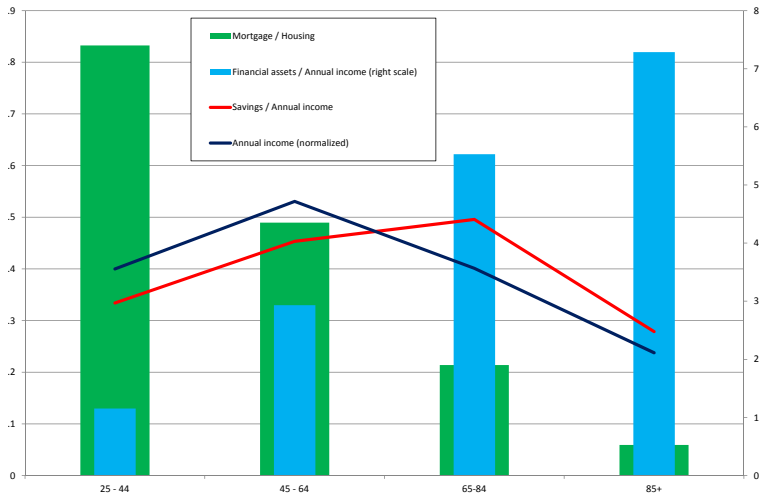
## Related literature

- The role of demographic structure on financial markets: Favero et al. (2015), Carvalho et al. (2016), Gagnon et al. (2016), Eggertsson et al. (2017), Lisack et al. (2017)
- Debt super-cycle: Rogoff (2015), Borio (2017)
- This paper: channel of fertility shocks + role of housing

# From macro to micro: stylized facts on households life-cycle

- Households face a life-cycle profile of income: they are more productive and earn more in later stages of lives
- Income profile and tastes determine a life-cycle profile also for savings and wealth
- A change in population structure affects the demand and the supply of credit and housing (non-durable good): keeping individual preferences unchanged in general equilibrium has an effect on prices.

# Stylized facts on life-cycle profiles (US 2013)



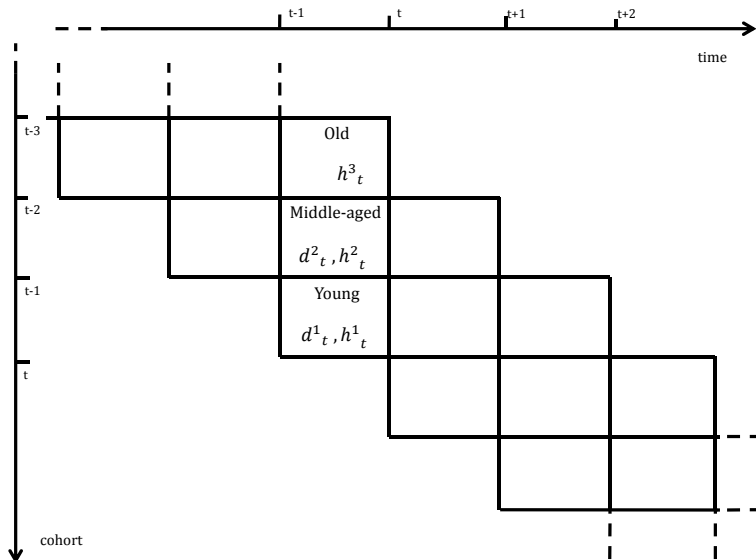
Source: SCF, CE Italy



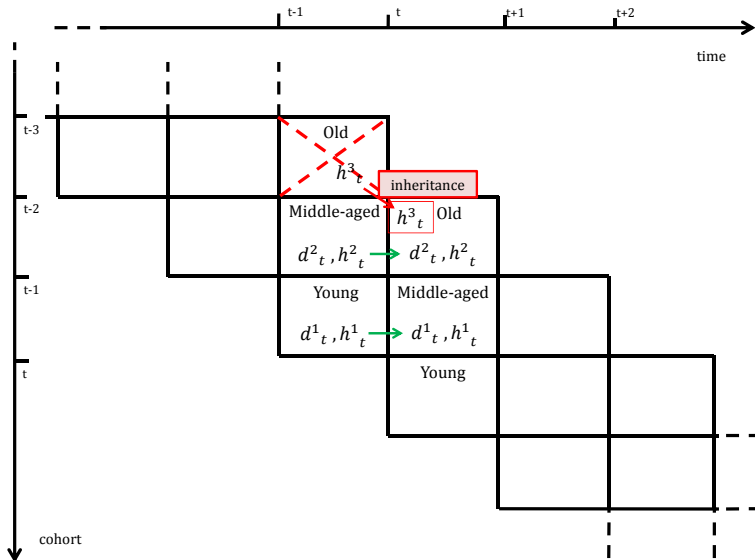
# The Model

- OLG: agents live three periods and then die with certainty
- In the first two periods supply labor and earn labor income
- In any period they consume housing and consumption good
- Housing is in fixed supply
- The first and the second cohort participates to financial markets
- Solution: third order perturbation

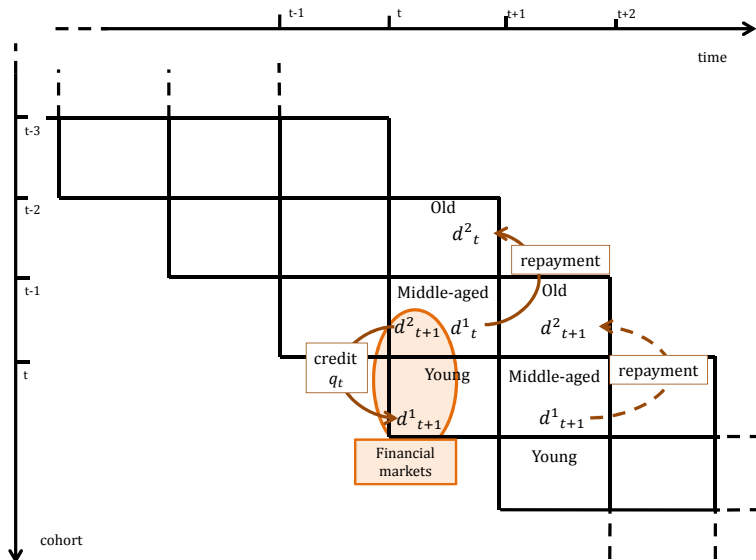
[More on preferences](#)

Beginning of period  $t$ 

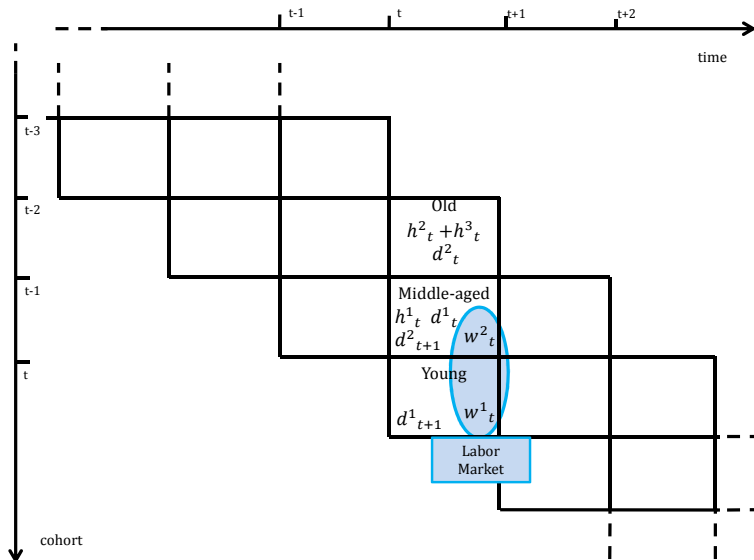
# State variables



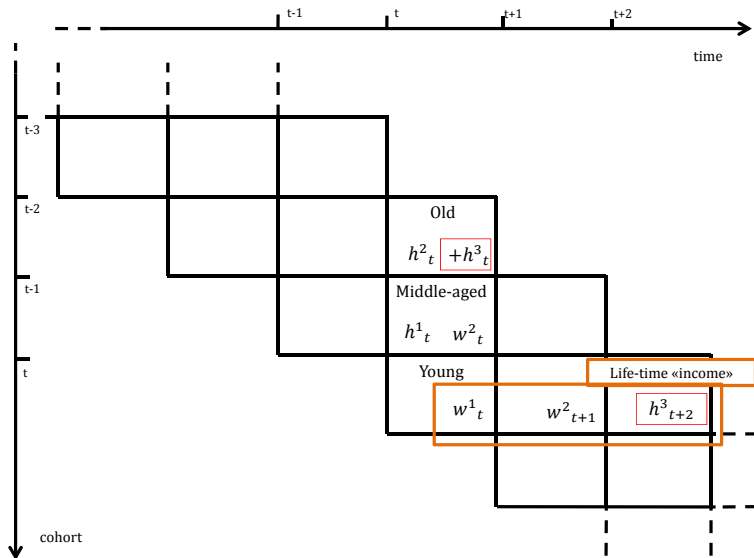
# Financial markets



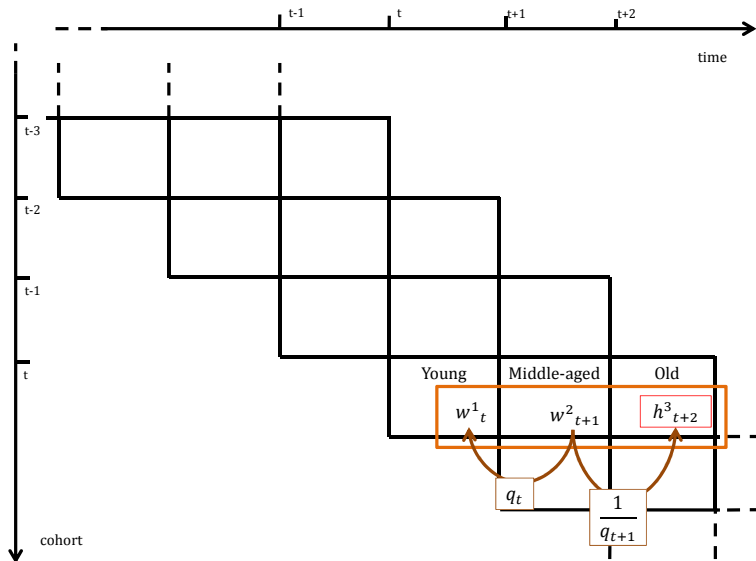
# Labor market



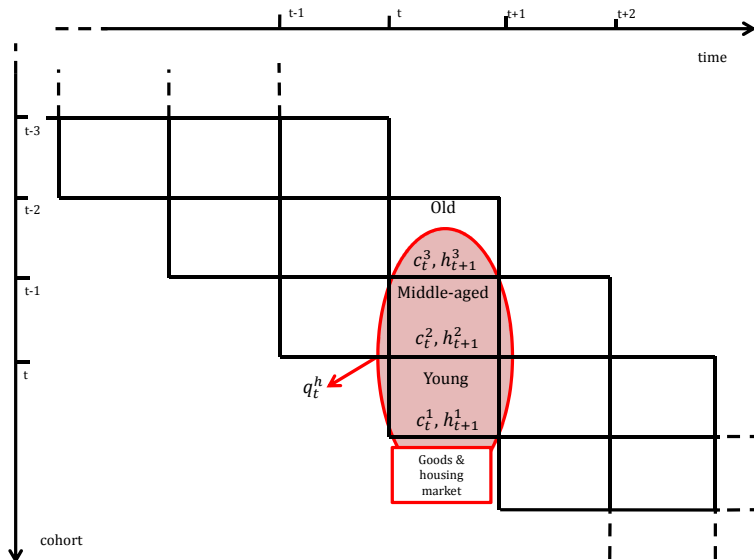
# Life-time "income"



# The role of financial markets



# Housing and goods market

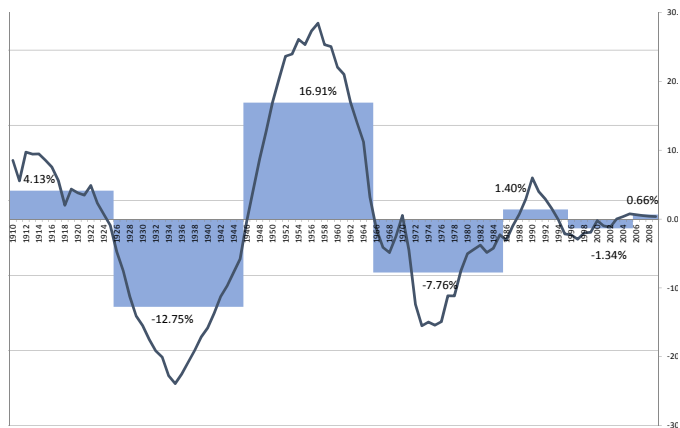




# Calibration: crucial elements

- Agents get the highest level of labor income when they are middle-aged, i.e.  $w^1 < w^2$  (consistent with empirical data)
- The discount factors are calibrated to match life-cycle profile of consumption and savings ( $\beta_1 > \beta_2$ )  
Calibrated profiles of consumption, housing and debt
- The cross-elasticity of substitution between housing and consumption is less than 1 (0.50 in line with Borri and Reichlin (2016))

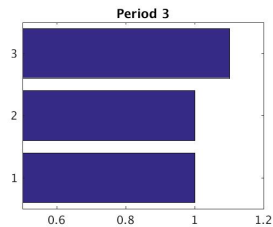
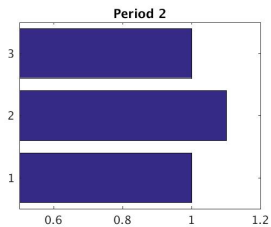
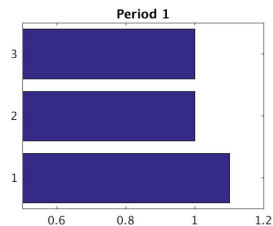
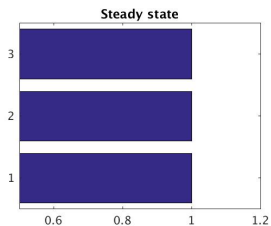
# Demographic booms and busts



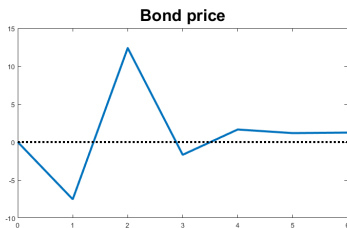
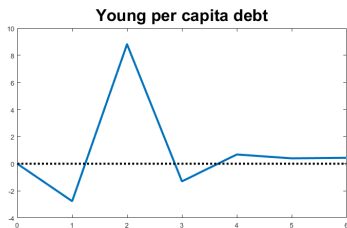
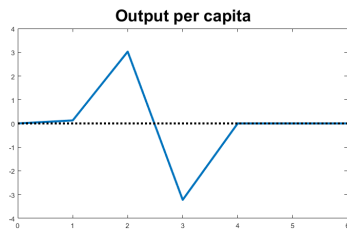
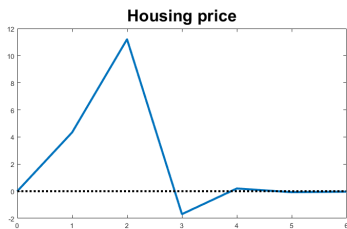
Detrended fertility rate adjusted for child mortality

Live births

# A transitory "baby boom": population pyramids



# "Baby boom" responses of main variables

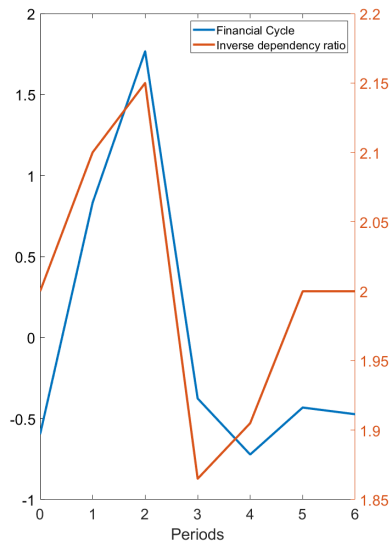
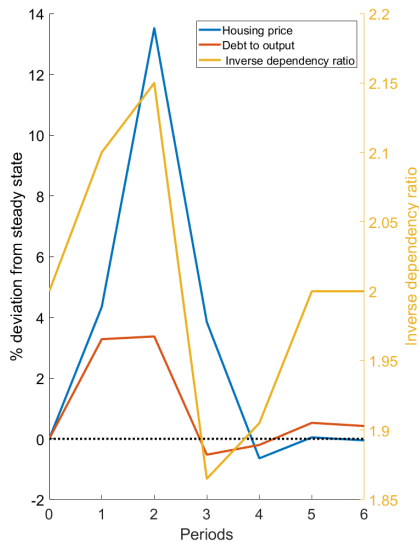


All variables

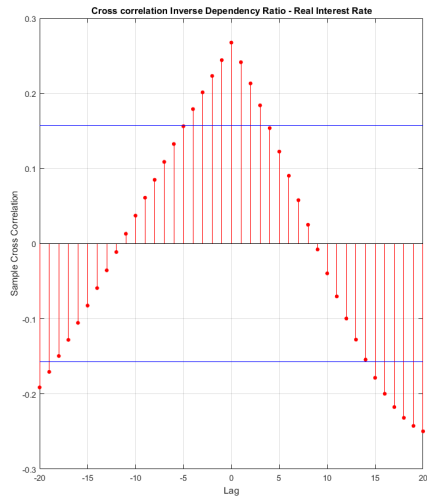
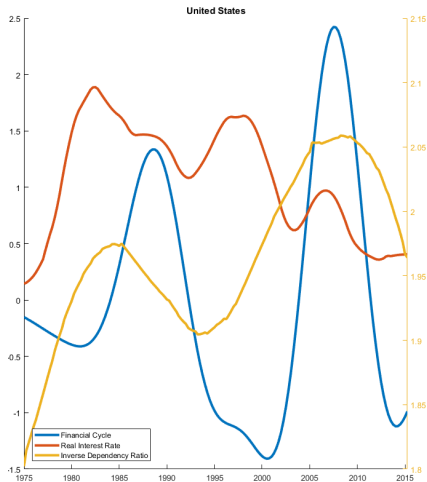
# Main mechanism

- Co-movement between housing and demographics determined by complementarity between consumption and housing goods
- Baby boomers enters the model:
  - Negative wealth effect on the first cohort, positive wealth effect on second and third cohort [Figure](#)
  - Reduces consumption smoothing desire of the young [Figure](#), reduces saving needs of the middle aged
  - Together with different relative size the second effect prevails and the interest rate rise (+ "sort of" no-arbitrage with housing)
- Baby boomers become middle aged: increase in credit supply and negative expectations on house prices leads to a decrease in the interest rate, the newborn are richer and takes more credit
  - The debt-to-GDP increases while the interest rate decreases  $\implies$  demographic cycle (not financial cycle)

# Aggregate variables and financial cycle



# The effect on interest rate - US

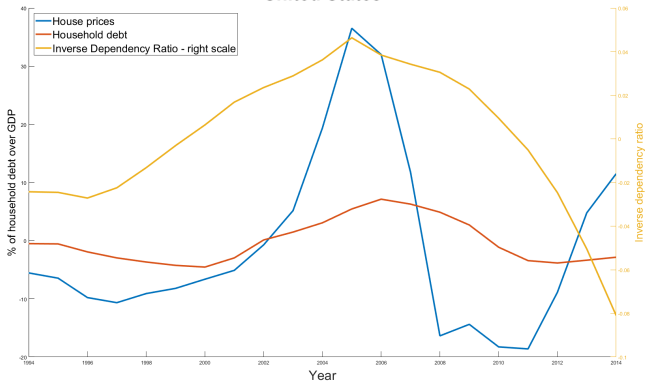


# Conclusions

- In a OLG model with individual life-cycle and housing a demographic shock determines the financial cycle
- Medium frequency cycle that will revert in the near future
- Financial cycle vs secular stagnation:
  - "Financial cycle" is related to structural factors but...
  - Structural factors are cyclical (at the medium frequencies)!
- Future research agenda:
  - OLG as in Gertler (1999): higher frequency  $\implies$  empirical estimation
  - Rational bubbles triggered from demographic shocks?

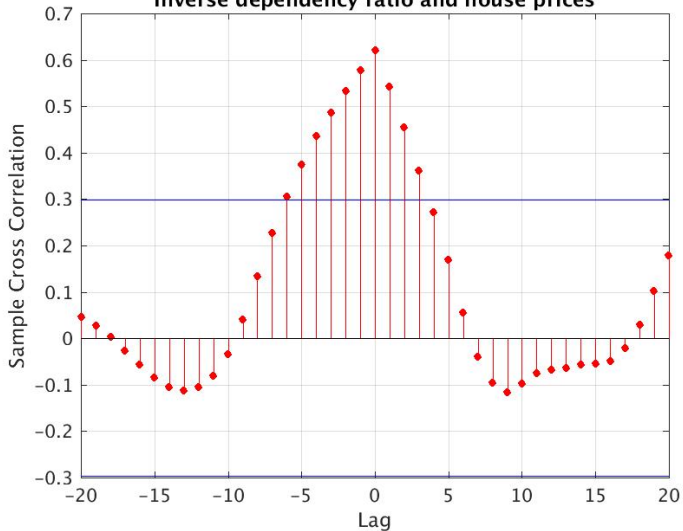


## United States

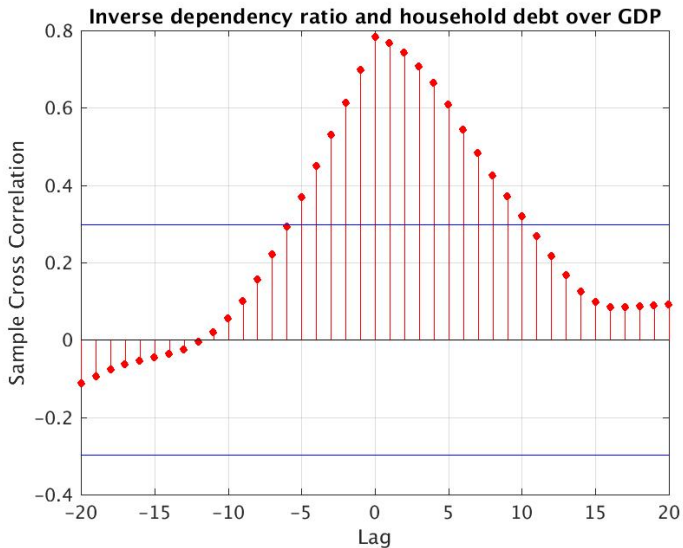


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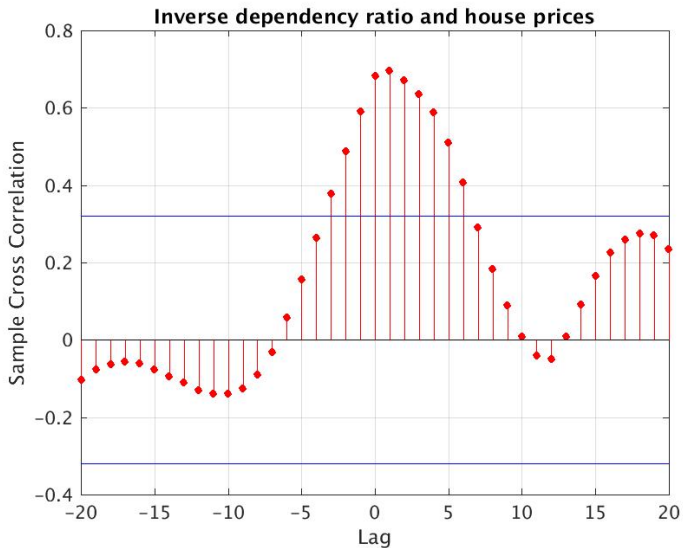
## Inverse dependency ratio and house prices



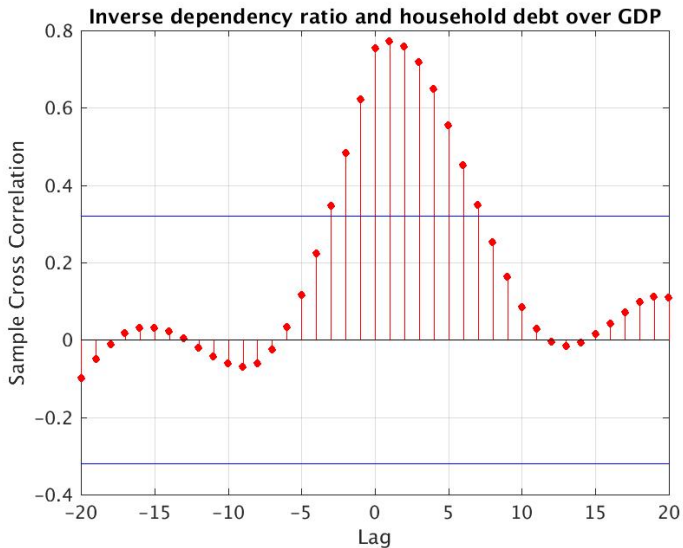
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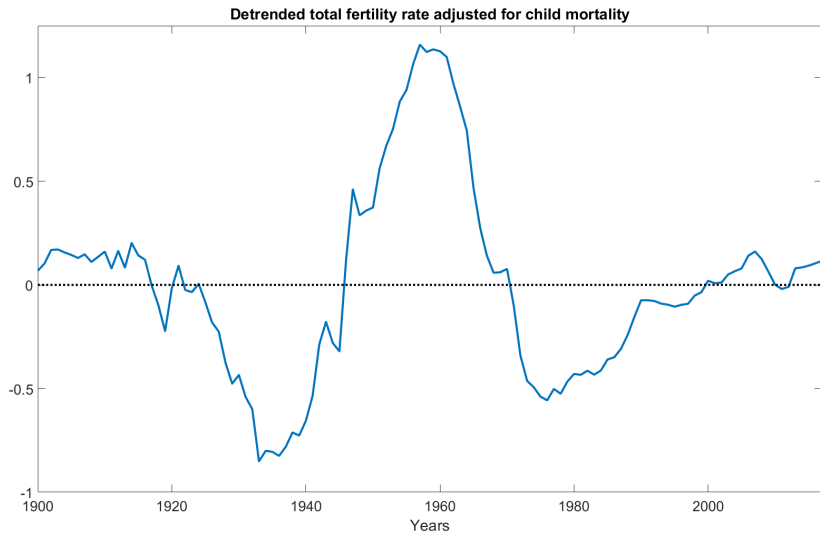


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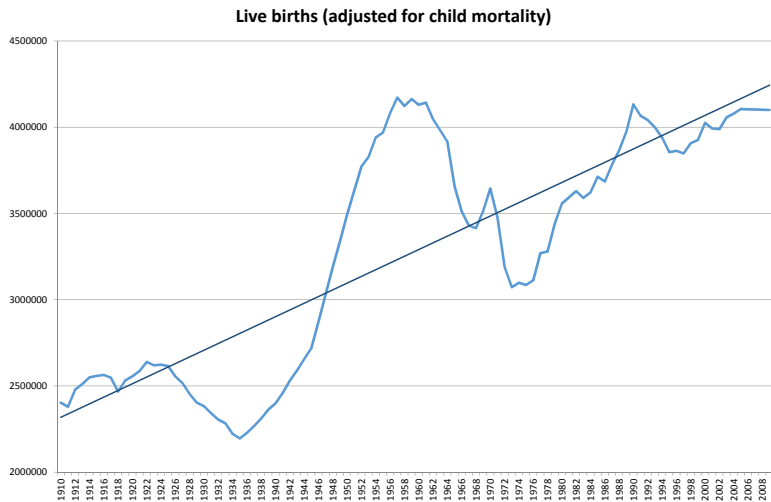


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# Demographic medium-frequency cycle

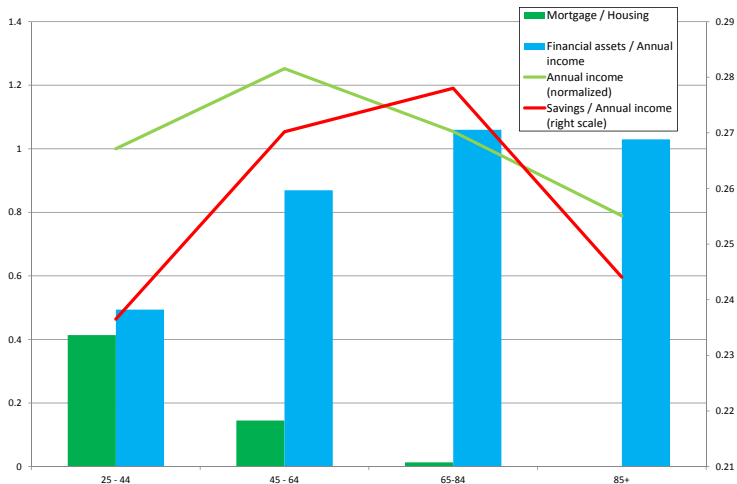


# Live births



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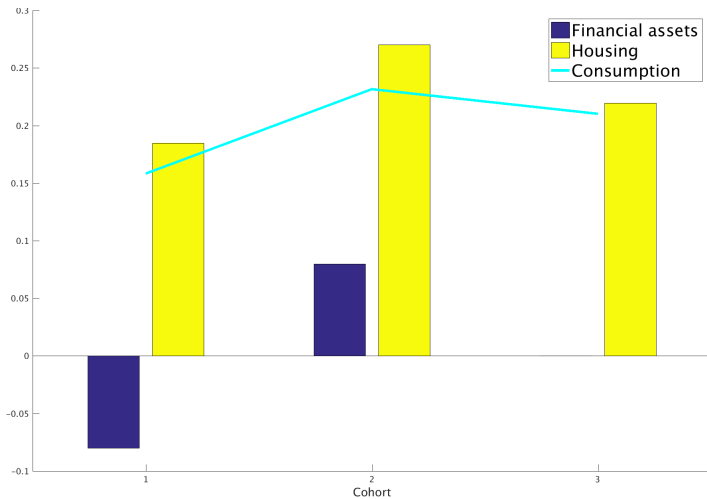
# Stylized facts on life-cycle profiles (Italy 2014)



Source: SHIW [Back](#)



# Calibration of income, credit, and housing



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## Households' problem

- The intra-period utility of cohort  $i$  is given by  $u^i(c_t^i, h_{t+1}^i) \equiv U^i(g(c_t, h_{t+1}))$  where:

$$g(h_{t+1}, c_t) = \left[ (1 - \omega^h) (c_t)^{\frac{\eta-1}{\eta}} + \omega^h (h_{t+1})^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}$$

And:

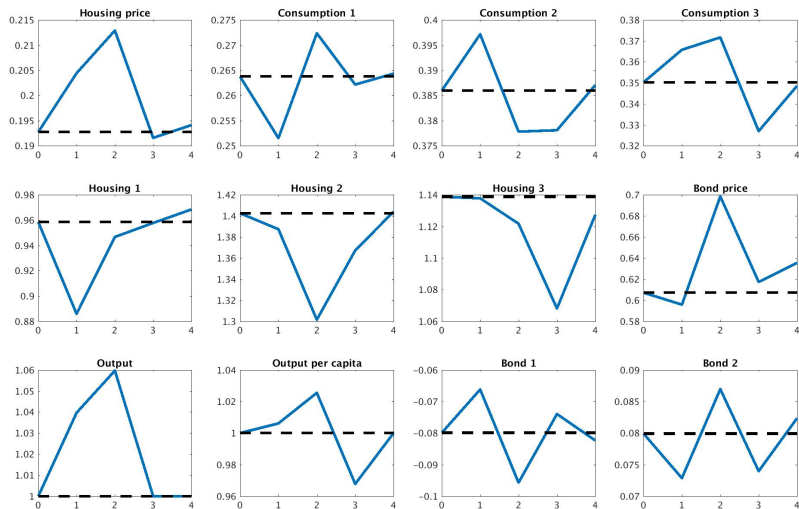
$$U^i(x) = \frac{x^{1-\sigma}}{1-\sigma}$$

- The intra-period budget constraint is:

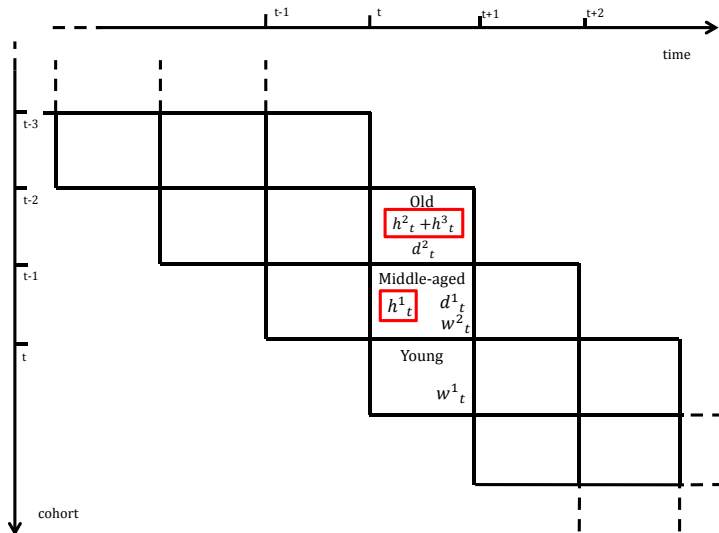
$$c_t^i + q_t^h (h_{t+1}^i - h_t^{i-1}) + q_t^b d_{t+1}^i \leq w_t^i + d_t^{i-1}$$

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# Individual responses

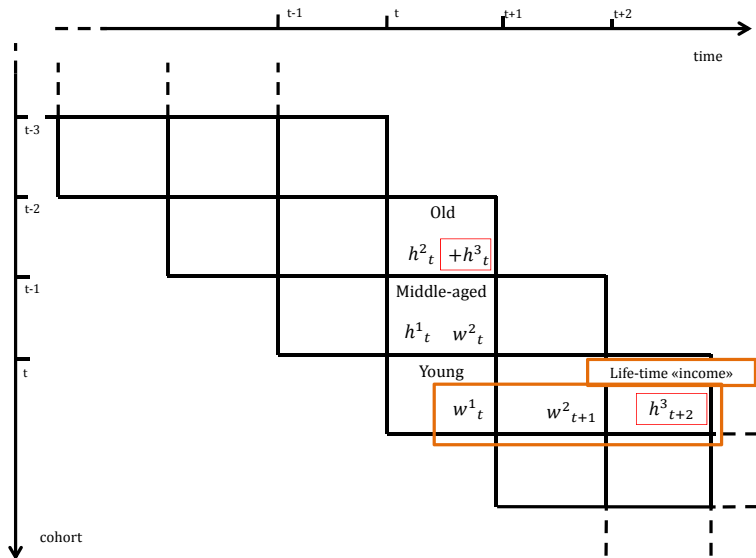


# Cohort's wealth



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# Life-time "income"



# The effect on interest rate - UK

