A Direct Test of the Buffer-Stock Model of Saving

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Outline

- Motivation
- Previous evidence
- Our test
- The data: 2002-04 SHIW
- Results

Motivation

- Intertemporal consumption models with impatient consumers and income risk: buffer stock saving arises in Carroll (1992,1997) and Deaton (1991).

- We focus on Carroll's buffer stock model. The test applies equally well to Deaton's.

- Evidence is based on reduced form regressions, simulations, C-Y tracking.

Previous evidence

- **Reduced forms** of saving / wealth on income risk: Skinner (1988), Guiso, Jappelli, Terlizzese (1992), Carroll, Samwick (1997), Hurst et al (2005), etc.
- Mixed findings.

- **Structural estimation**: Attanasio, Banks et al (1999), Gourinchas, Parker (2002), Cagetti (2003).

- Findings: **Tracking of C and Y for the young**.

Target wealth in the buffer stock model

- Target wealth emerges from tension between prudence and impatience.

- In the buffer stock model there is a unique and stable wealth-permanent income ratio.

If we could observe target wealth…

- … we could distinguish buffer stock models from other models with income risk and precautionary saving, but more patient consumers (Hubbard, Skinner, Zeldes).

- But target wealth is seldom observed.

- Two exceptions:
  1995-98 US SCF;
  2002-04 Italian SHIW.

The buffer stock model

$$\max E_0 \sum_{t=0}^{T} \beta^t \frac{c_t^{1-\rho}}{1-\rho}$$

$$W_{t+1} = R(W_t + Y_t - C_t)$$

$$Y_{t+1} = P_{t+1} V_{t+1} \qquad P_{t+1} = G P_t N_{t+1}$$

P_t= permanent income, V_t= transitory income
N_t and V_t : income shocks Small p that V_t=0

Deaton's model is similar, but with liquidity constraints and p=0.

Implications: The target wealth-income ratio

There is a unique and stable cash-on-hand-to-permanent income ratio x*

$$x_t = \frac{Y_t + W_t}{P_t}$$

- If $x > x^*$, impatience outweighs prudence, and the consumer tries to reduce wealth, $E(x_{t+1}-x_t)$ falls.
- If $x < x^*$, the precautionary saving motive outweighs impatience and $E(x_{t+1}-x_t)$ increases.

Cross-sectional implications

Households differ in preferences, income process, income shocks.

$$\operatorname{cov}\left(x_{ht} - x_h^*, E_{ht}\left(x_{ht+1} - x_{ht}\right)\right) < 0$$

$$\frac{\operatorname{cov}(x_{ht} - x_h^*, c_{ht})}{\operatorname{cov}(x_{ht} - x_h^*, x_{ht})} > 1 - \frac{G}{R\gamma}$$

$$\gamma = \exp(\sigma_n^2)$$

Test interpretation

We recover the sample analog of the covariance ratio

$$\frac{\operatorname{cov}(x_h - x_h^*, c_h)}{\operatorname{cov}(x_h - x_h^*, x_h)}$$

Running the regression $c_h = \eta + \theta x_h + u_h$

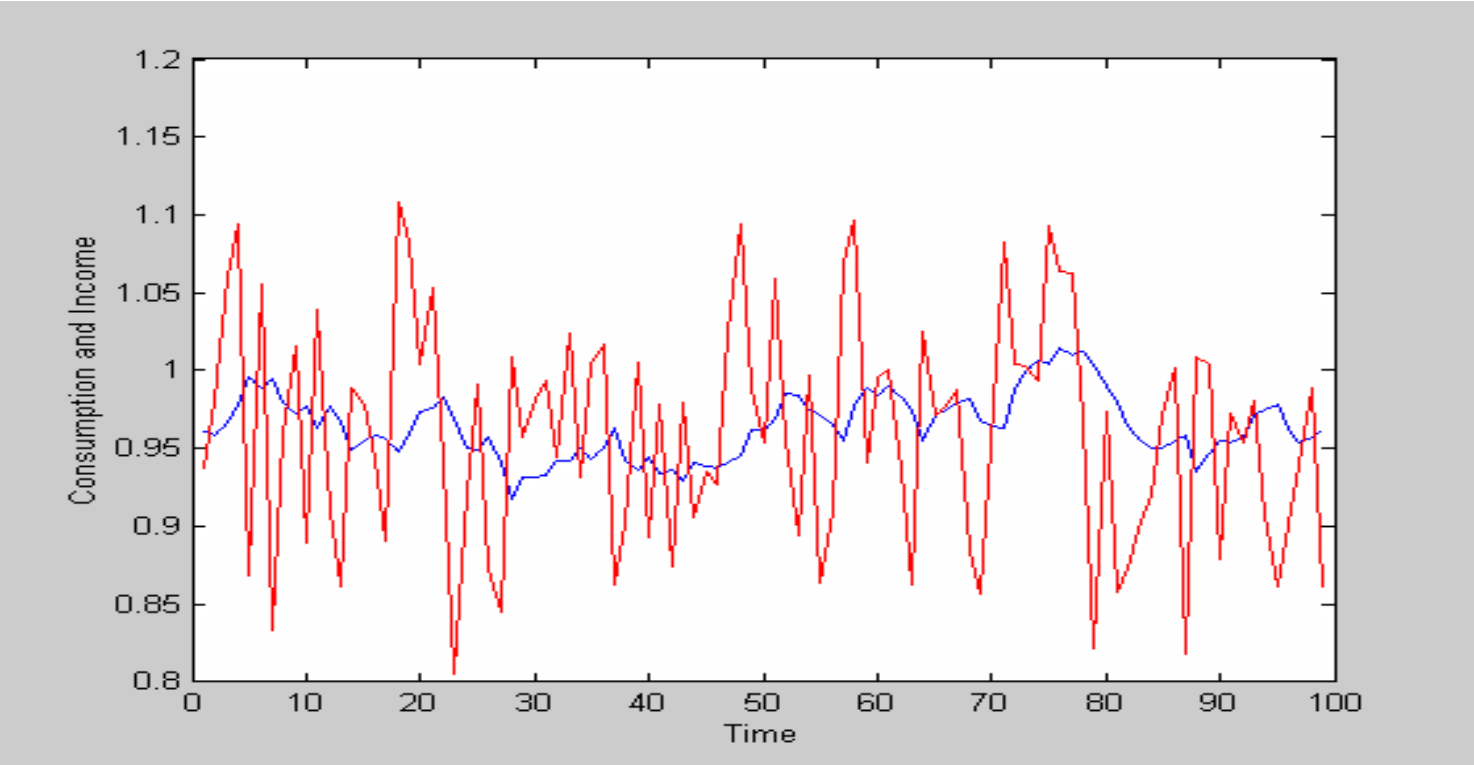
and using $\left(x_h - x_h^*\right)$ as instrument.

Lower bound for θ = 3.6%.

Benchmarking. How large should θ be in a buffer stock model?

- Simulations with two sources of heterogeneity:
- Different discount factors, uniformly distributed [0.86-0.96]. Each consumer has a different target wealth.
- Income process is the same, but consumers are hit by different realizations.

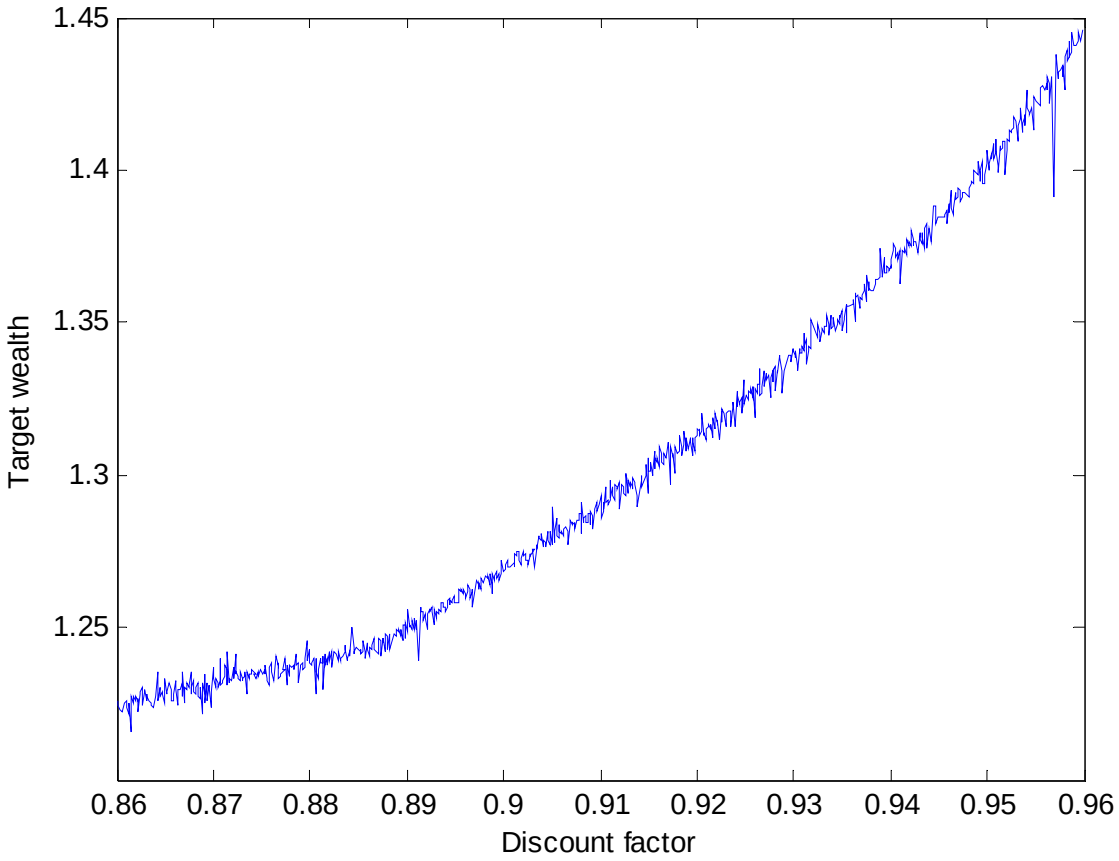
R=1.04 **G**=1.03 ρ=2 **p**=0.005
S.d. of perm. shocks=0.1
S.d. of trans. shocks=0.1



Simulated income and consumption in the buffer stock model.

1000, Households, 100 periods; zero initial assets

We compute, for each consumer, target wealth



We then compute the cross-sectional covariance ratios θ for each of the 100 periods. **We find median θ=0.62.**

Simulated θ under alternative parameterization

Growth factor	**θ**	**Interest rate factor**	**θ**
G=1.025	0.60	R=1.035	0.63
G=1.035	0.64	R=1.045	0.61
G=[1.025-1.035]	0.63	R=[1.035-1.045]	0.61
S.d perm. shocks	**θ**	**S.d transitory shocks**	**θ**
σ_N=0.04	0.66	σ_V=0.04	0.69
σ_N=0.14	0.52	σ_V=0.14	0.59
σ_N=[0.04-0.014]	0.56	σ_V=[0.04-0.014]	0.59

We also consider variability in risk aversion and probability of zero income.

The data

- 2002-04 SHIW, representative sample.
- Data on C, Y, W (seldom available).
- Panel section: address **unobserved heterogeneity**.
- Give buffer stock model a chance: select **age 20-50.**
- 5911 observations, merging 2002-04.
- Question on target wealth, same framing as in SCF.

A proxy for target wealth

People save in various ways and for different reasons.

A first reason is to prepare for a planned event, such as the purchase of a house, children's education, etc. Another reason is to protect against contingencies, such as uncertainty about future earnings or unexpected outlays (owing to health problems or other emergencies).

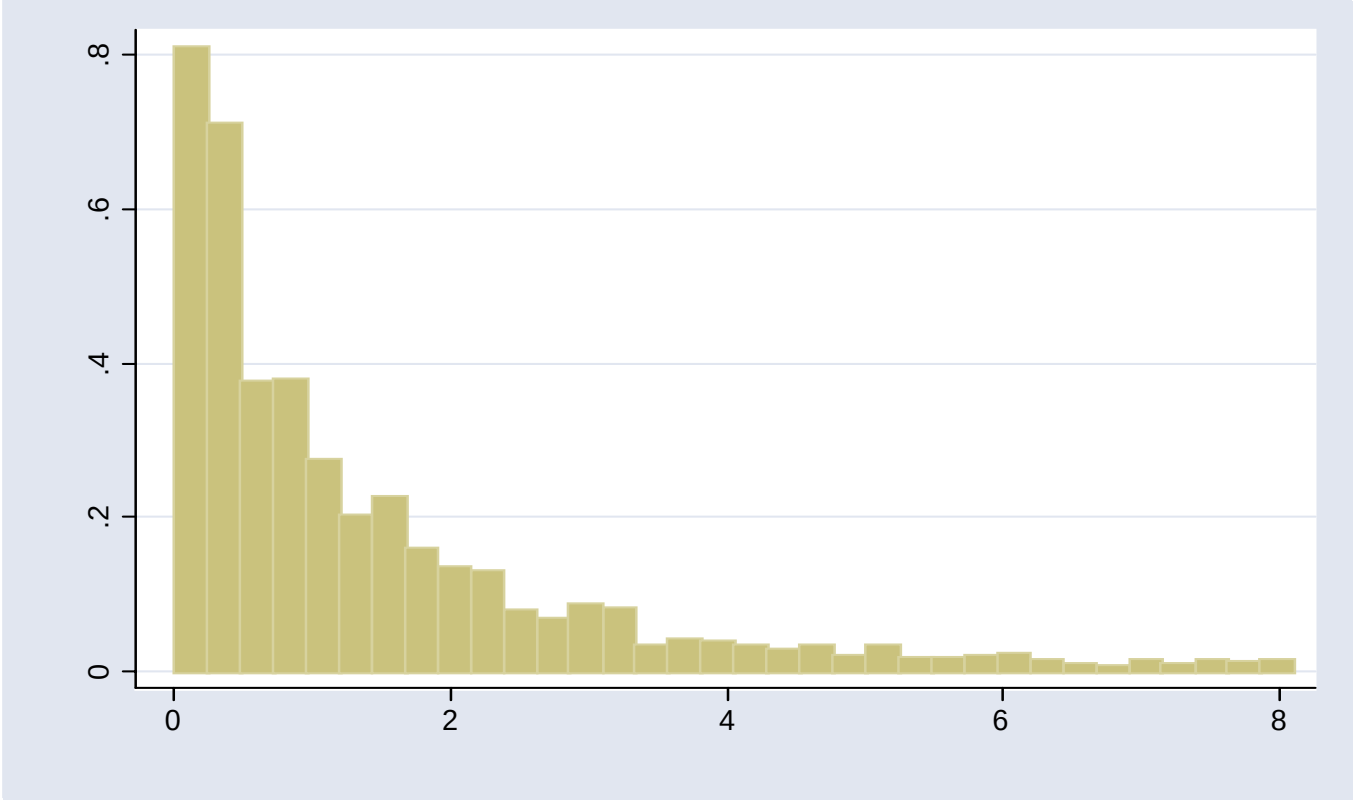
About how much do you think you and your family need to have in savings to meet such unexpected events?

Statistics on target wealth

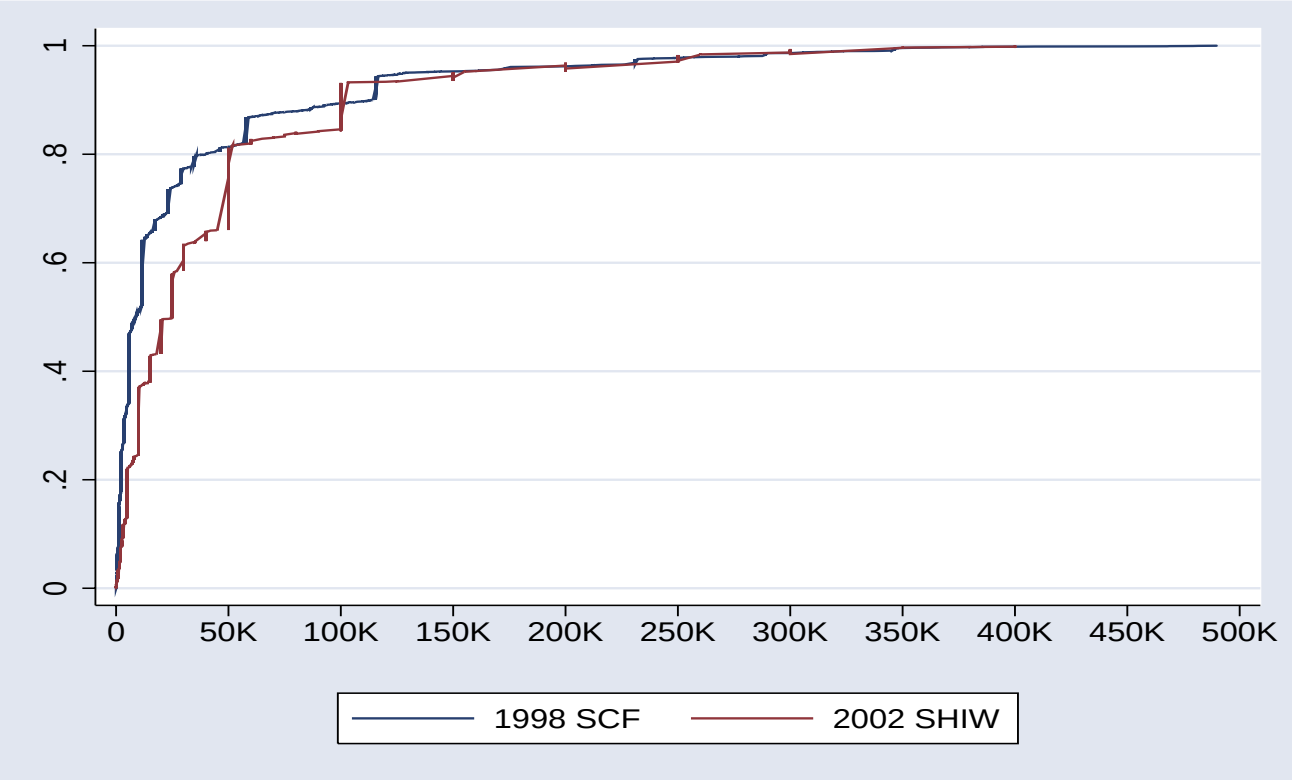
Median target wealth is 25,000 euro, higher than in the US (Kennickel and Lusardi, 2004).

Ratio of target wealth to permanent income: **2 years of earnings**, stable across socio-economic groups.

The ratio of Target Wealth to Permanent Income



Empirical CDF of target wealth-income ratio in Italy and the US



Target wealth-income ratio: sample statistics

	Mean	*First quartile*	*Median*	*Third quartile*	*Observations*
Age<40	2.485	0.412	1.143	2.626	2,860
Age≥40	2.384	0.446	1.178	2.626	3,051
Self-employed	2.368	0.496	1.324	2.614	1,078
Employee	2.452	0.419	1.127	2.664	4,833
Single earner	2.869	0.496	1.324	2.946	2,683
Multiple earners	2.014	0.395	1.019	2.161	3,228
North-Center	2.417	0.487	1.219	2.682	3,977
South	2.484	0.322	1.011	2.582	1,934
Entrepreneurs	2.432	0.499	1.307	2.710	1,209
Non-entrepreneurs	2.438	0.417	1.132	2.579	4,702
Low education	2.509	0.452	1.200	2.778	2,665
High education	2.374	0.417	1.110	2.483	3,246
Total sample	**2.437**	**0.430**	**1.164**	**2.626**	**5,911**

Baseline results

- **Consumption:** non-durable expenditures.

- **Permanent income:** estimated by reduced form of non-financial income on age, education, occupation, region, gender, number of earners (same using full sample: 1984-2004).

- **Cash-on-hand:** depends on liquidity of real assets and transaction costs:

$$Y+W_f+\lambda W_r$$

- θ **between 0.011 and 0.015**, depending on measure of cash-on-hand.

Group estimates

- Buffer stock behavior should arise more strongly in some population groups (e.g. self-employed).

- Split the sample according to age, employment, number of earners, region, entrepreneurship.

- θ **= [0.008-0.023]**

- Differences among groups are at variance with the model.

Estimating θ: baseline and group estimates

	$Y+W_f+W_r$	$Y+W_f+0.25W_r$
Total sample	**0.012**	**0.015**
	(0.001)	**(0.001)**
Age <40	0.012	0.010
	(0.001)	(0.003)
Age >40	0.012	0.017
	(0.001)	(0.002)
Self-employed	**0.008**	**0.015**
	(0.001)	**(0.002)**
Employees	**0.017**	**0.017**
	(0.001)	**(0.002)**
Entrepreneurs	0.009	0.015
	(0.001)	(0.002)
Non-entrepreneurs	0.016	0.015
	(0.001)	(0.002)

Splits by education

S.d. of permanent shocks differ by education.

	S.d. permanent shocks	Simulated θ	$Y+W_f+W_r$	$Y+W_f+0.25W_r$
Low education	0.17	0.45	0.009 (0.001)	0.009 (0.001)
High education	0.14	0.52	0.014 (0.001)	0.018 (0.003)

Buffer stock savers are impatient

Question on impatience in 2000 SHIW: Suppose that you win €5,000, payable for certain in a year 's time. What is the maximum amount that you are willing to pay to have the €5,000 immediately? [**problems with interpretation** of this question]

θ **still small in group** with $\delta>3\%$

	$Y+W_f+W_r$	$Y+W_f+0.25W_r$
High impatience $\delta>3\%$	0.011	0.025
	(0.001)	(0.006)
Low impatience $\delta<3\%$	0.012	0.011
	(0.001)	(0.006)

Panel estimates

We estimate θ running the regression: $c_h = \eta + \theta x_h + u_h$ and using $\left(x_h - x_h^*\right)$ as instrument.

u_h might be correlated with target wealth x^* because of omitted variables, leading to bias estimates of θ.

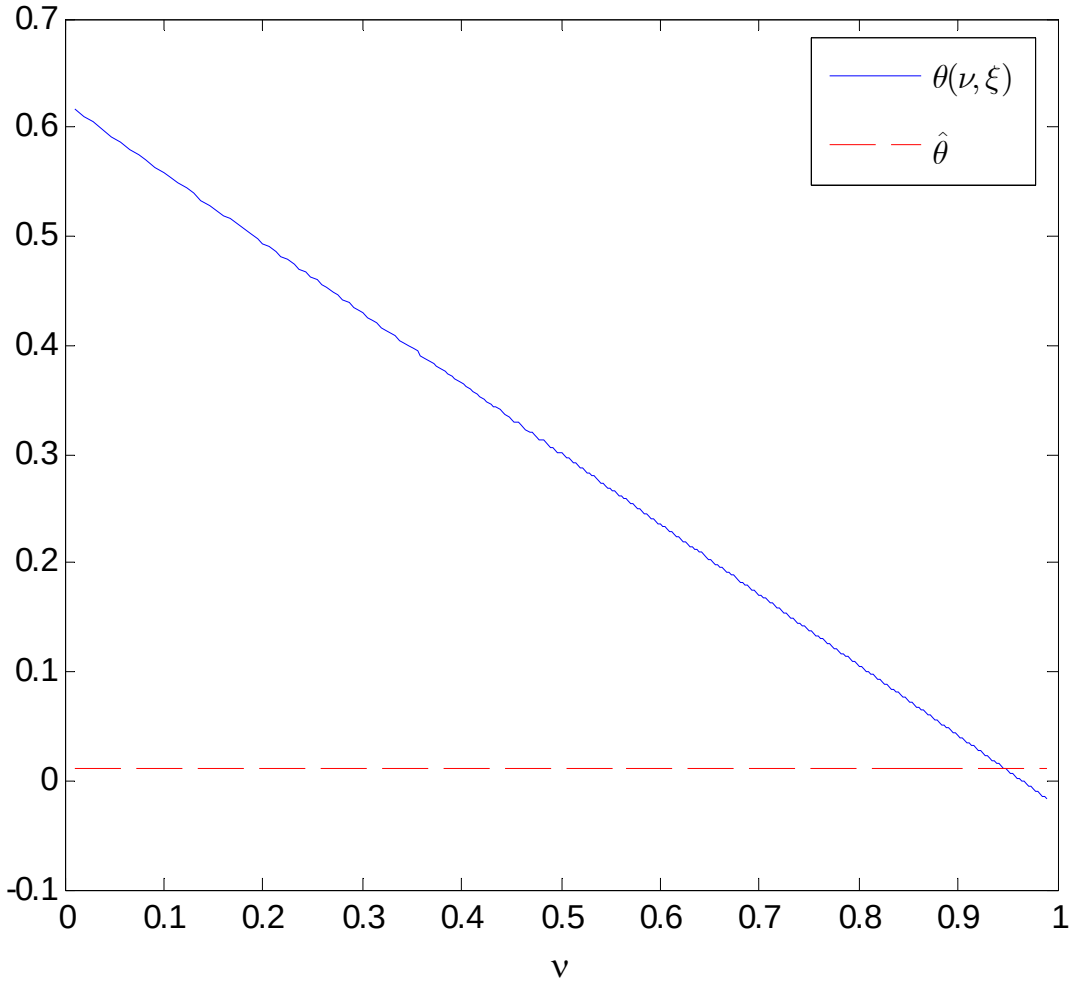
Fixed effects IV panel estimates

	$Y+ W_f +W_r$	$Y+W_f+0.25W_r$	Observations
Total sample	0.007	0.006	2,174
	(0.001)	(0.003)	
Self-employed	0.006	0.008	410
	(0.002)	(0.005)	
Employee	0.005	0.004	1,764
	(0.002)	(0.003)	
Entrepreneurs	0.007	-0.001	468
	(0.002)	(0.005)	
Non-entrepreneurs	0.004	0.003	1,706
	(0.002)	(0.003)	

Can measurement error explain the rejection?

- What is the amount of measurement error that can reconcile the model with the estimated θ?
- Suppose c, w, w* are all measured with error.
- We find that only extremely large (>95%) measurement error can reconcile the **estimated** θ **(0.012) with the simulated** θ **(0.62).**
- In SHIW reliability of W and Y is about 80%.

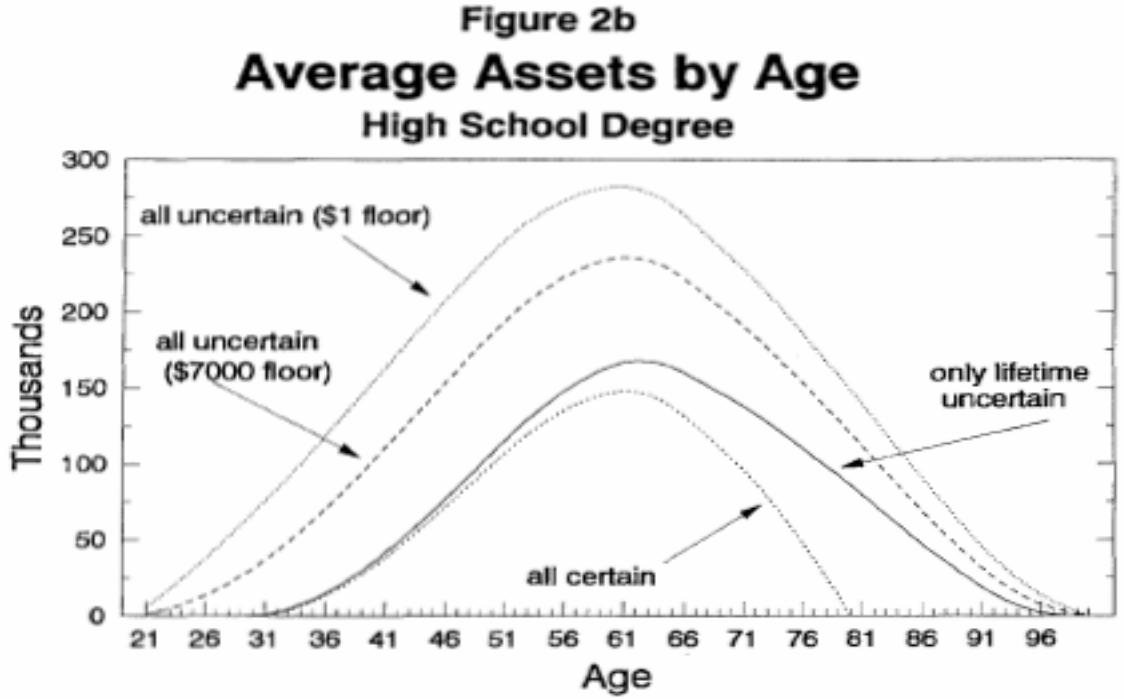
The Covariance Ratio with Measurement Error



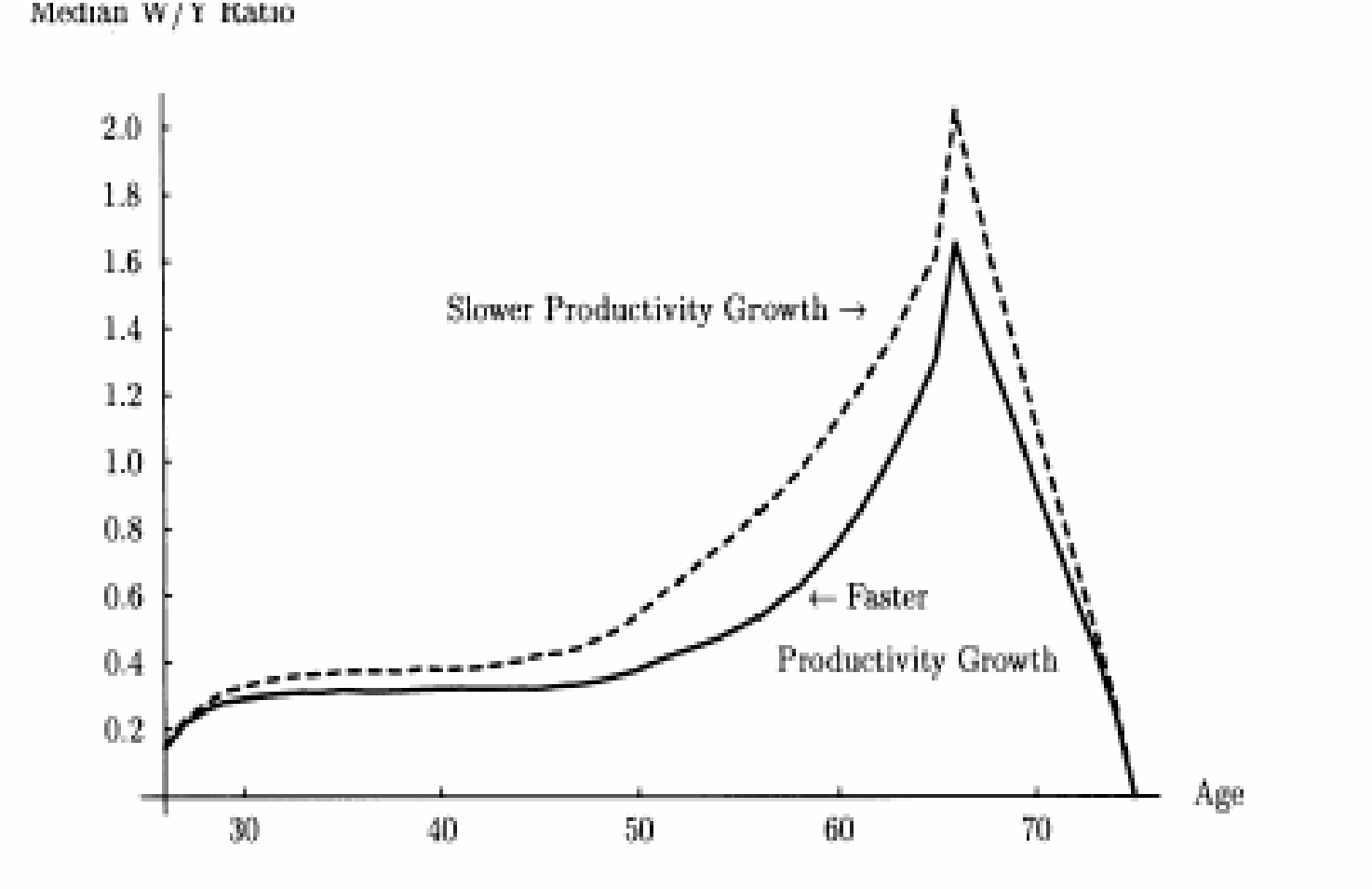
What, then, explains the saving decisions of young households?

- Different saving models predict different shapes of the age-profile of the wealth-income ratio of the young.
- In buffer stock models (Carroll, Deaton) impatience balances prudence: flat profile.
- Life-cycle models with income risk (Hubbard, Skinner, Zeldes): prudence > impatience: increasing profile
- The age-wealth profile of the young is key to discriminate between models.

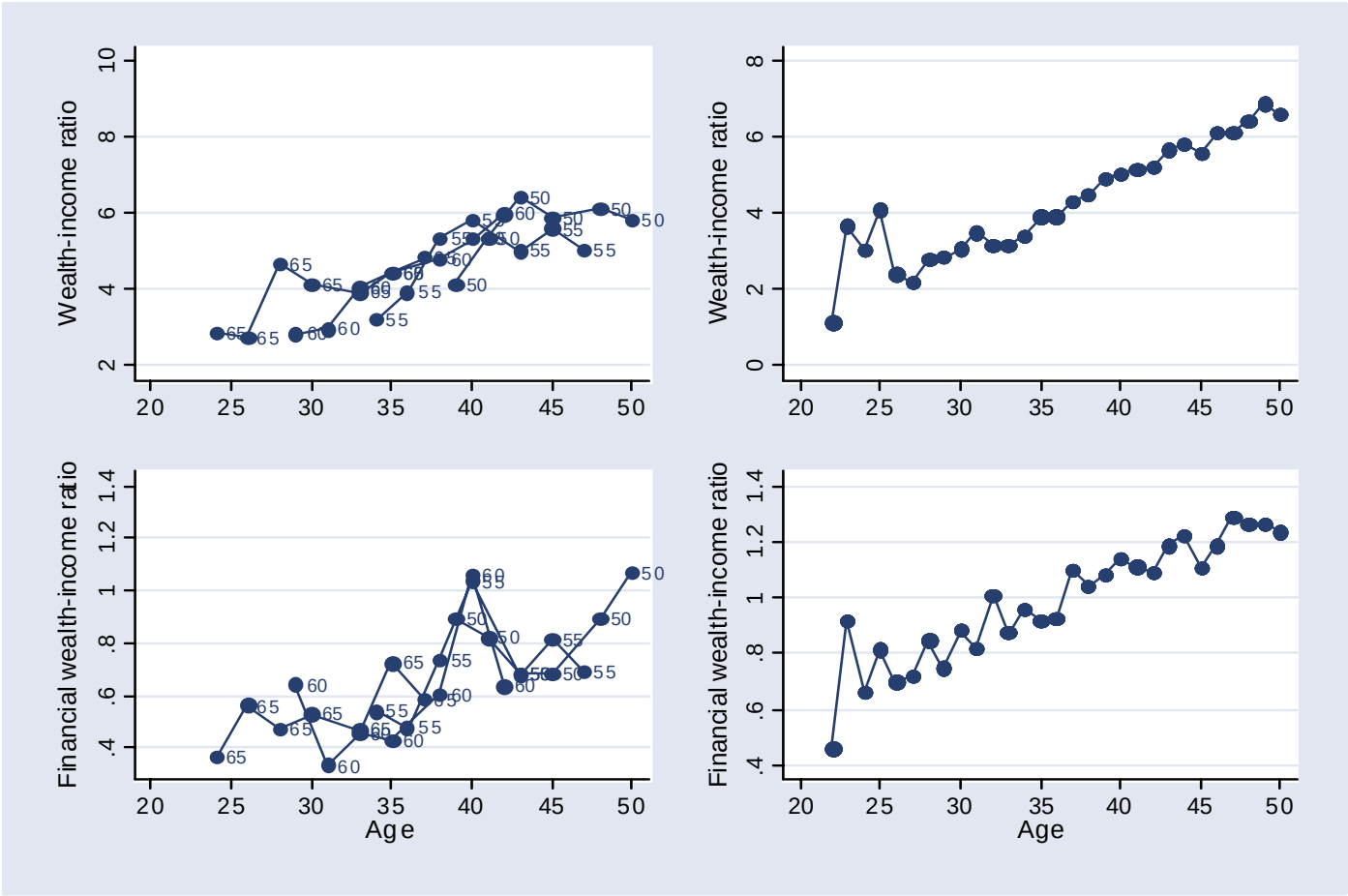
The predicted age-wealth profile in the LC-PIH (from Hubbard-Skinner Zeldes



The predicted age-wealth profile in the buffer stock model of saving (from Carroll)



The Age-Profile of the Wealth-Income Ratio, 1989-2004 SHIW, selected cohorts



Summary

- Buffer stock behavior is not supported by the data.
- Focus on groups where buffer stock behavior is more likely to arise does not help.
- Results appear robust to the presence of measurement error.

- In Italy the saving behavior of the young is more consistent with models in which people are not as impatient (relative to prudence) as in buffer stock models.