The Introduction of a Private Wealth Module in CAPP_DYN

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The main modules of CAPP_DYN

Demography

- Mortality
- Fertility
- Net Migration
- Children leaving parental house
- (re)Marriage
- Separation/Divorce

Education and labour

- Education (three levels)
- Transition to the labour market
- Occupational status (employed PT/employed FT/ unemployed/Inactive)
- Sector of employment (dependent / self employed)
- Income generation (earnings)

Social Security

- Retirement decision
- Old age pension
- Survival pension
- Disability
- Social Assistance Pension

Modelling Population at time (t+1)

Next year (t = t+1)

Modelling Population at time t

Private wealth module in a DMSM: advantages & drawbacks

In the micro simulation literature only *few models* developed a module that analyses and projects the evolution of private wealth through time

(PENSIM2 in Great Britain, MINT3 in the United States, SESIM III...)

- Advantages
  - *allows to build more complete description of the evolution of households disposable income*
  - analyses the likely *long term redistributive effects of reforms in the public and in the private pension pillar*
- Drawbacks
  - increases the complexity of the model
  - put explicitly the question of the *choice between a probabilistic and a behavioural approach*

Our approach

We approximate *a structural form for modelling consumption/saving behaviour*, while relying on the traditional *reduced form-probabilistic approach when dealing with asset allocation* (i.e. investment decisions):

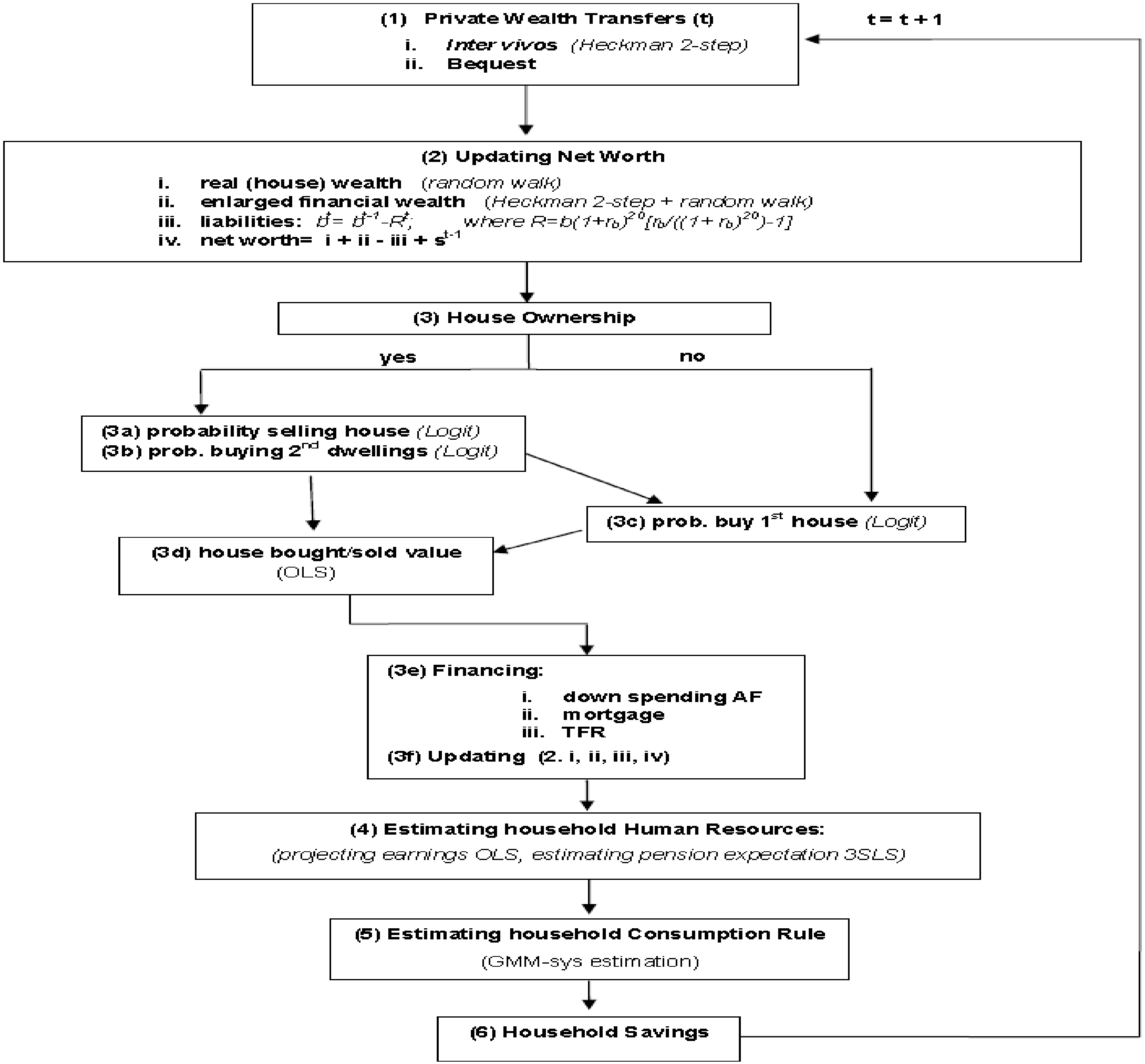
Combine a basic micro foundation of household behaviour and a DMSM with a high degree of institutional details:

1. real social security system
2. personal income taxation (IRPEF) sub-module accounting for progressivity.
3. modeling the role of TFR to relax liquidity constraint for 1° house purchaising

Stochastic processes accounting for *individual risk* in private accumulation.

Probabilistic sub-module for *modelling intergenerational transfers* (inter-vivos&bequests)

The Wealth Module



Here we try to highlight two focal points:

1. household savings/consumption behaviour
2. intergenerational transmission of wealth

1.
$$\underset{C^{t+i}}{Max} \quad \mathrm{E}_t \sum_{i=0}^{\infty} \phi^i \left[\mathrm{U}_a^{t+i}(C_a^{t+i}, C_a^{t+i-1};\ H^t) \right]$$

s.t.

$$A_a^t = (1 + r_a^t)\left[\frac{A_{a-1}^{t-1}}{1-\pi} + y_a^t - C_a^t\right]$$

Where:

a = age of household head

C_a^t = current consumption

C_a^{t-1} = last period consumption for the same household (internal habit)

A_a^t = non-human household wealth in year t when the age of household head is a

y_a^t = current household disposable income (earnings and pensions) in year t when the age of household head is a

π = period constant probability of household extinction[1]

H = household characteristics and type

r = real interest rate

The solution

Following Willman (2003) we can derive an algebraic expression for current consumption which in its implicit form is given by:

$$C_a^t(H) = f\left(C_a^{t-1}; a, \pi, H; A_{a-1}^{t-1}, y_a^t, HR^t(r, H, a)\right)$$

where HR represents the (expected) life-time human resources (or human wealth) given by the discounted future labour and pension income stream.

$$HR^t(i,H,a) = \left(\underbrace{\sum_{k=1}^{2} \left\{ \sum_{i=1}^{p_k - a_k} \underbrace{E_i \frac{\left[wL^t_{k,a_k+i}\right]}{(1+r)^i}}_{=0 \text{ if } p_k \le a_k} + \sum_{i=1}^{T_k - a_k - p_k} E_t \frac{\left[P^t_{k,a+i}\right]}{(1+r)^i} I_k \right\}}_{\textit{Spouses' human resources}} + \underbrace{\sum_{j=1}^{J} \left\{ \sum_{i=1}^{30-a_j} E_i \frac{\left[wL^t_{j,a_j+i}\right]}{(1+r)^i} \right\}}_{\textit{active children's projected resources up to 30}} \right)$$

Obtained, each period, as the projection -throw econometric models- of :

1. *individual earnings stream up to (planned) retirement and*
2. *expected pension incomes from retirement to death*

➔ relevance of expectations about *replacement rate* and *retirement age*.

Crucial role in HR of pension outcome expections: info available in SHIW ➔ *three-stage least square estimation* for systems of simultaneous equations & calibration

	B	Se	T	ci95
Planned Age of Retirement				
acontrib	-0.2105***	0.0039	-54.2148	-0.2181, -0.2028
age	0.1676***	0.0038	43.6939	0.1601, 0.1751
female	-2.1934***	0.0473	-46.3329	- .2862, -2.1006
NDC	*0.7855*	0.4597	1.7086	-0.1151, 1.6864
upper_secondary	0.4658***	0.0501	9.2942	0.3675, 0.5640
degree_or_more	1.1723***	0.0760	15.432	1 .02337, 1.3211
self_empl	1.2500***	0.0582	21.467	1.1358, 1.3641
public	-0.3074***	0.0574	-5.353	-0.4199, -0.1948
home_owner	-0.1268*	0.0503	-2.523	-0.2253, -0.0283
south	0.5597***	0.0526	10.637	0.4565, 0.6628
Single	0.7350***	0.0900	8.162	0.5585, 0.9114
tau2004	0.4969***	0.0540	9.198	0.3910, 0.6027
tau2006	0.4653***	0.0545	8.532	0.3583, 0.5721
Intercept	58.7778***	0.1175	500.310	58.54, 59.00
Expected Replacement Rate				
ret_age	0.0033**	0.0010	3.208	0.0013, 0.0053
age	-0.0100***	0.0005	-21.229	-0.0109, -0.0091
acontrib	0.0056***	0.0003	22.179	0.0050, 0.0060
NDC	*-0.0671***	0.0207	-3.233	-0.1076, -0.0264
single	0.0096*	0.0041	2.359	0.0016, 0.0176
upper_secondary	0.0133***	0.0023	5.864	0.0088, 0.0177
degree_or_more	0.0160***	0.0036	4.472	0.0089, 0.0230
self_empl	-0.1161***	0.0029	-39.842	-0.1218, -0.1104
public	0.0417***	0.0027	15.730	0.0365, 0.0468
partime	-0.0383***	0.0042	-9.034	-0.0466, -0.0300
center	0.0345***	0.0026	13.462	0.0294, 0.0395
south	0.0425***	0.0027	15.981	0.0372, 0.04765
coor_2	*-0.0831****	0.0130	-6.374	-0.1086, -0.0575
coor_3	*-0.1249****	0.0132	-9.449	-0.1507, -0.0989
coor_4	*-0.1530****	0.0138	-11.115	-0.1799, -0.1259
coor_5	*-0.1921****	0.0142	-13.513	-0.2199, -0.1642
coor_6	*-0.2248****	0.0150	-14.983	-0.2542,- 0.1954
coor_7	*-0.2599****	0.0161	-16.122	-0.2914, -0.2282
coor_8	*-0.2954****	0.0174	-16.957	-0.3295, -0.2612
coor_9	*-0.3280****	0.0189	-17.392	-0.3649, -0.2910
coor_10	*0.3750****	0.0204	18.353	0.4150, 0.3349

Endogenous variables:

1. Planned retirement age
2. Expected replacement rate

Workers falling under NDC system expect a replacement rate 7% lower than DB or mixed workers, despite they plan to retire later.

Significant cohort effects on expected replacement rate

From the theory …to the econometrics …to the simulation

For the estimation we chose an (empirical) specification which better fits our data and nicely describe the consumption/saving behavior of Italian household in our sample.

$$\frac{C^t}{HR^{t+1}} = \rho \frac{C^{t-1}}{HR^t} + f(a) + \beta_1 A^t + \beta_2 y^t + \sum_k \beta_k D_k^t(H)$$

In the dynamic simulation program we obtain from this equation a predicted value for the current level of consumption $\hat{C}^t$ and, in order to account for the role of liquidity constraints, we compute current simulated consumption as:

$$C^t = \min\left\{\hat{C}^t,\ y^t + (1-\varphi^t)A^t - R^t\right\}$$

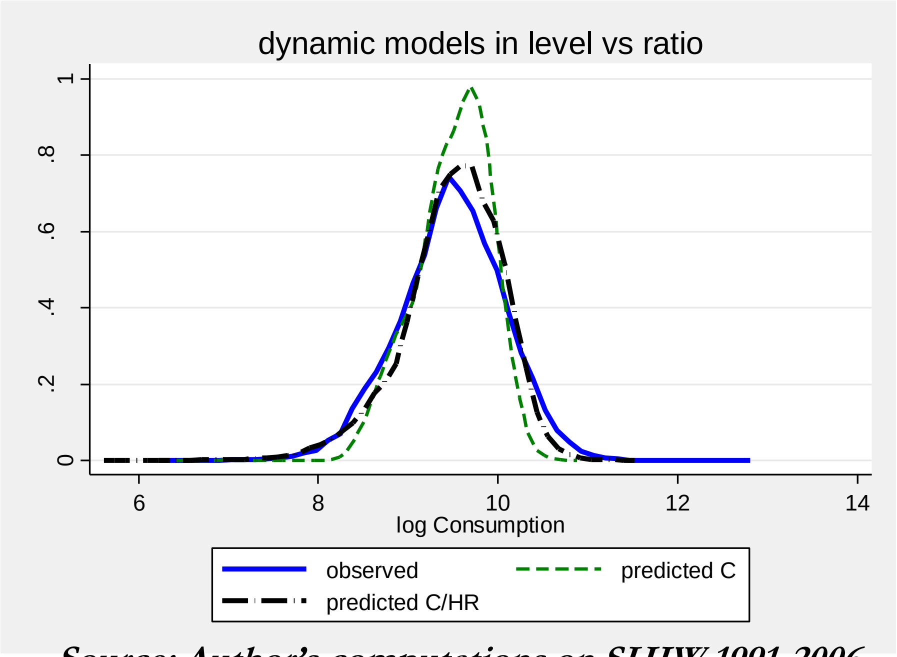
That is current household consumption can never exceed the sum of current disposable income plus the liquid share of enlarged financial wealth, net of the mortgage instalment (if any).

Each year of simulation the model re-program HR, update all the covariates and evaluate household consumption and, as a residual, savings

Why this empirical specification?

A dynamic specification in ratio (as in Ando&Nicoletti, 2004) instead of in level:

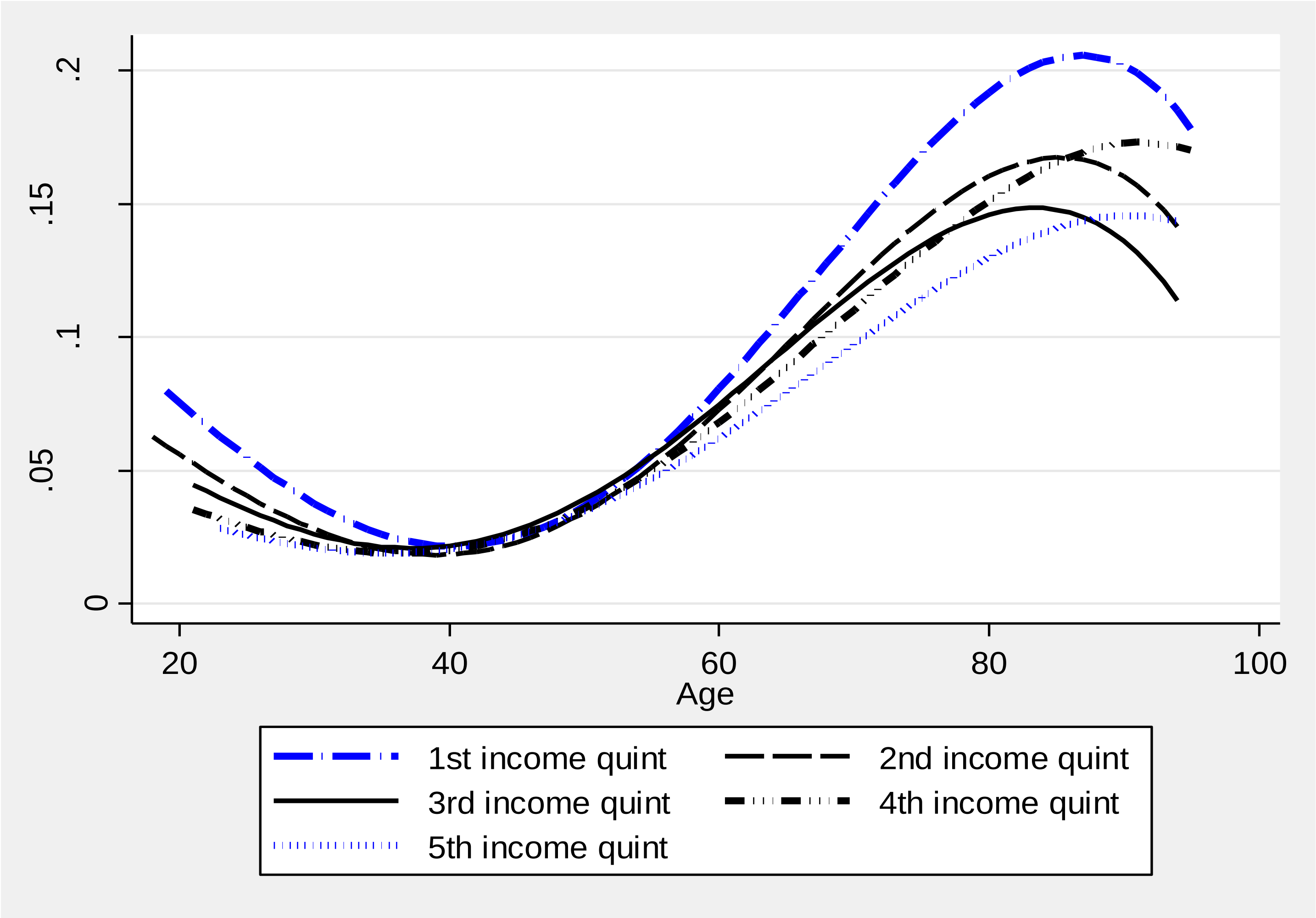
1. *Fit much more closely our panel dataset all over the distribution (very important for a micro simulation distributional model!)*



Source: Author's computations on SHIW 1991-2006

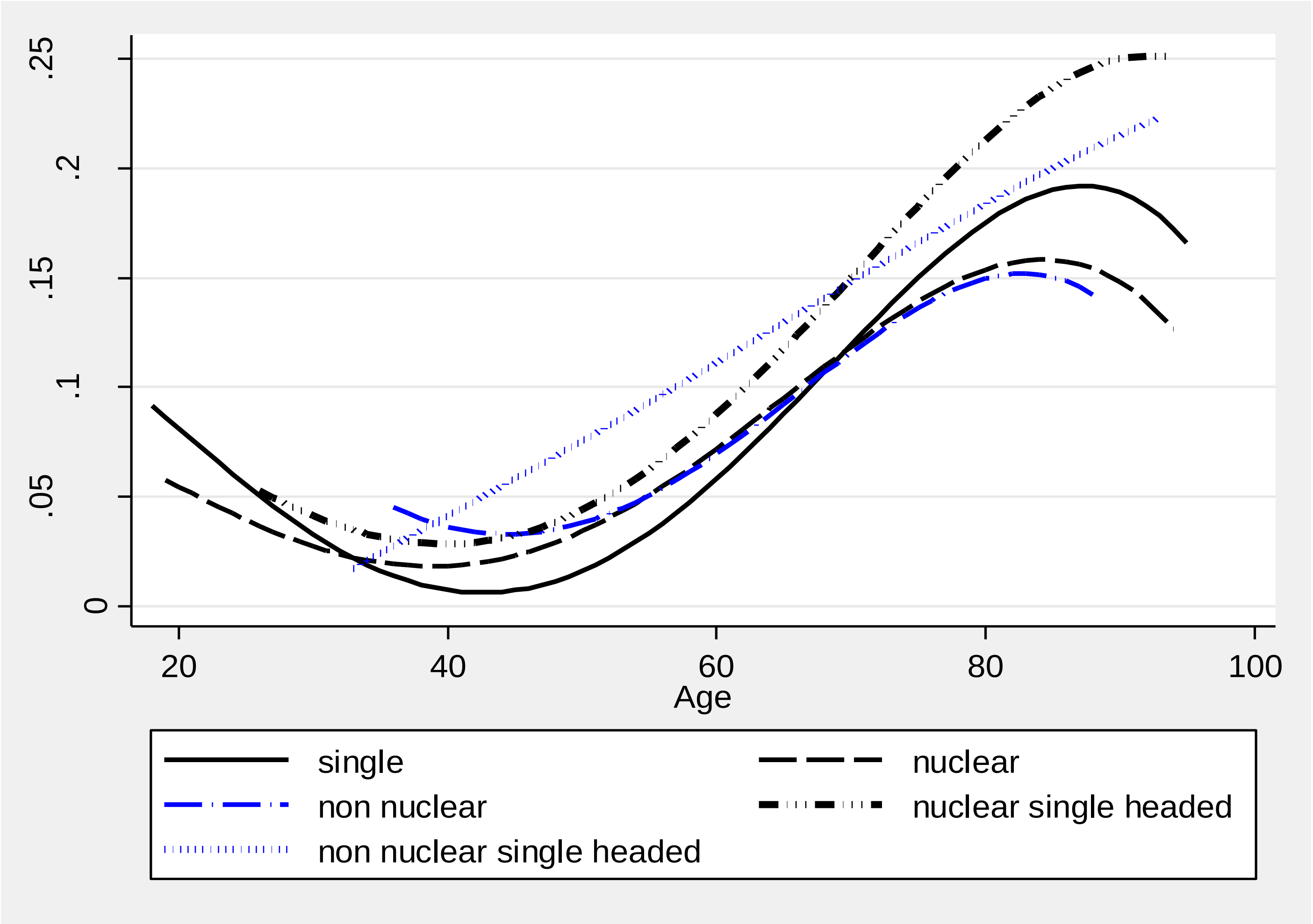
2. *We get rid of the necessity to make arbitrary assumption due to the nonstationarity of consumption*

Age profile of Consumption over Human Resources ratio, by income quintile (SHIW)



Source: Author's computations on SHIW 1991-2006, cubic fit.

Age profile of Consumption over Human Resources ratio, by household type (SHIW)



Source: Author's computations on SHIW 1991-2006, cubic fit.

Dynamic panel-data estimation of the consumption rule, Two-step system GMM

$$\ln\left(\frac{C^t}{HR^{t+1}}\right) = 0.1208\ln\left(\frac{C^{t-1}}{HR^t}\right)$$

$$+0.0128(af^t) - 0.1129(q1\_y^t) - 0.1527(q2\_y^t) - 0.2128(q3\_y^t) - 0.2616(q4\_y^t)$$

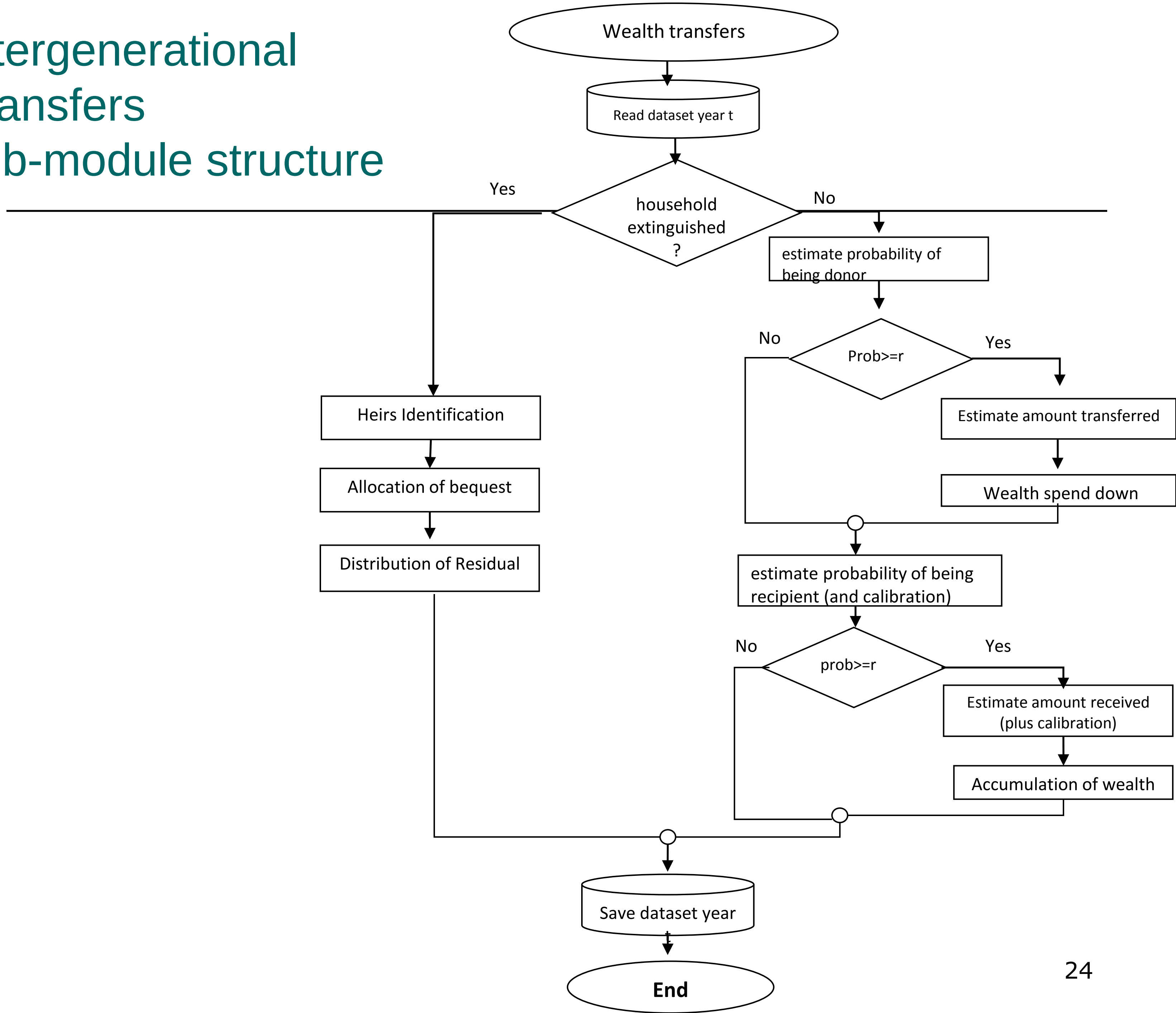
$$+\ 0.2147\text{age} - 0.0068\text{age}^2 + 0.0001\text{age}^3 + 0.00002\text{age}^4$$

$$+0.0211\text{single} + 0.1134\text{nusihehh} + 0.4021\text{non\_nusihehh} + 0.1763\text{non\_nuclfam}$$

$$+\sum_k \beta_k D_k^t(H) + \nu_i + \varepsilon_{it}$$

Number of obs	=	*21776*			
Number of groups	=	*10138*			
Number of instruments	=	*43*			
Wald chi2(27)	=	*19117.40*	*avg* =	*2.15*	
Prob > chi2	=	*0.000*	*max* =	*8*	

Intergenerational Transfers sub-module structure



MSMs & Integenerational Transfers

- precedent of the use of micro simulation is the WTMM developed by the Center on Wealth and Philanthropy of the Boston College which is focused and dedicated on the wealth transmission phenomenon
- the introduction of such processes in a "multitasking" dynamic population model is still limited
- dynamic micro simulation represents a powerful tool compared with other kind of methods since it provides a complete account of predicted transfers given and received each year which can be compared with actual data, incorporating any demographic transition and generating the future path of characteristics that determine choices. (Christelis, 2008).

SHARE data

- Collects information on representative sample of a cross country of populations for individuals aged over 50 with detailed info on their children➔ precious source to study intergenerational exchange relationships
- We use the 1st wave (2004), containing 32,000 individuals of which 3,100 Italians, to estimate inter-vivos monetary transfers toward children & grandchildren living outside the family of origin
- We reconstruct a correspondence between parents and children characteristics, providing a matching between donors and recipients.
- We estimate the two sides of the exchange separately, using mutual characteristics
- For estimating recipients we invert the dataset

The estimation:
Heckman 2-step, separately donor&recipient

Donor side

	beta	Std. Err.	z	P>|z|
log(ratio)				
age	-0.7666357	0.2406	-3.19	0.001
age2	0.0108139	0.0036	3.03	0.002
age3	-0.0000506	2E-05	-2.9	0.004
inwork	-0.3168297	0.0679	-4.66	0
married	-0.149661	0.0599	-2.5	0.012
upper_secondary	-0.3324848	0.0632	-5.26	0
degree	-0.3815539	0.0669	-5.7	0
Q3_wealth	-0.5916644	0.0752	-7.87	0
Q4_wealth	-0.9548991	0.0734	-13.01	0
Q5_wealth	-1.465867	0.0746	-19.66	0
ita	***0.6548956***	0.0965	6.78	0
Intercept	16.38053	5.339	3.07	0.002
Donor	beta	Std. Err.	z	P>|z|
age	0.0397562	0.0142	2.8	0.005
age2	-0.0003095	0.0001	-2.98	0.003
inwork	0.2015304	0.0321	6.29	0
upper_secondary	0.2794188	0.0279	10	0
degree	0.4238659	0.0309	13.74	0
buy_house	2.585779	0.0989	26.14	0
ch_unemp	0.2027923	0.0376	5.4	0
wedding	1.962113	0.0636	30.87	0
Q3_wealth	0.1980543	0.0321	6.17	0
Q4_wealth	0.3014082	0.0319	9.45	0
Q5_wealth	0.3591556	0.0321	11.18	0
ita	***-0.1493584***	0.0428	-3.49	0
Intercept	-2.504617	0.4807	-5.21	0
mills				
lambda	-0.0419012	0.0472	-0.89	0.374
rho	-0.02536			
sigma	1.6521305			
lambda	-0.04190119	0.0472		

Recipient side

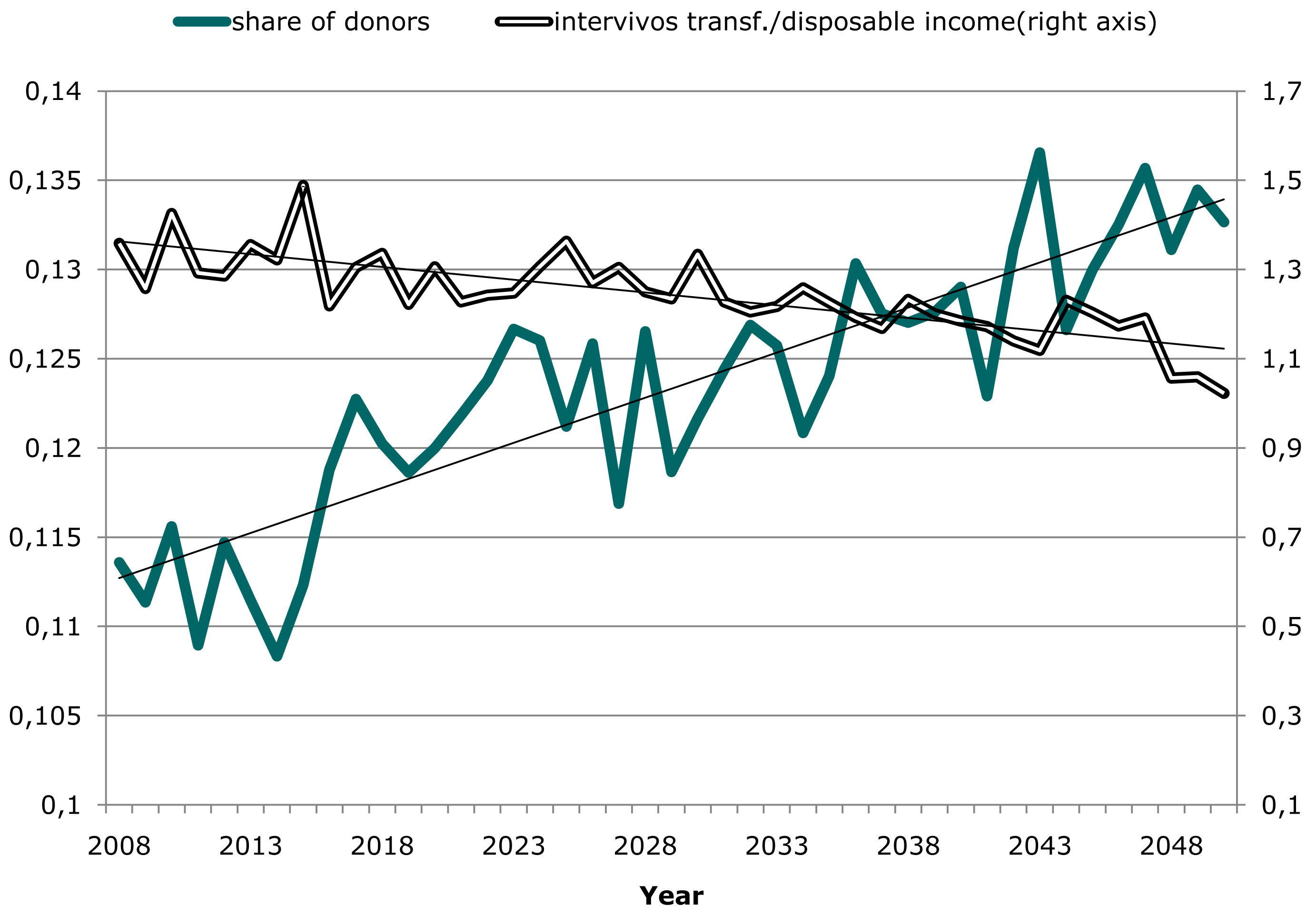
	beta	Std. Err.	z	P>|z|
log(amount)				
log(af parents)	***0.1053938***	*0.0142*	*7.45*	*0*
age	-0.0051044	0.0018	-2.83	0.01
grandchildren	-0.1938117	0.0516	-3.75	0
married	0.035819	0.0134	0.66	0.01
divor	0.1222913	0.0846	1.45	0.148
Intercept	6.25393	0.2939	21.28	0
Recipient				
log (af parents)	***0.0837514***	*0.0029*	*29.08*	*0*
age	-0.0518585	0.0059	-8.86	0
age2	0.000397	7E-05	5.58	0
married	0.1442751	0.0586	2.46	0.014
single	0.3446326	0.0597	5.77	0
divor	0.3363424	0.0683	4.92	0
inwork	-0.1407145	0.0227	-6.2	0
degree	0.1956938	0.0237	8.26	0
grandchildren	0.1651595	0.0246	6.71	0
ita	0.1069721	0.0382	2.8	0.005
Intercept	-0.6580214	0.1179	-5.58	0
mills				
lambda	0.0866149	0.1886	0.46	0.646
rho	0.07045			
sigma	1.2294872			
lambda	0.08661491	0.1886		

Some Preliminary Results…

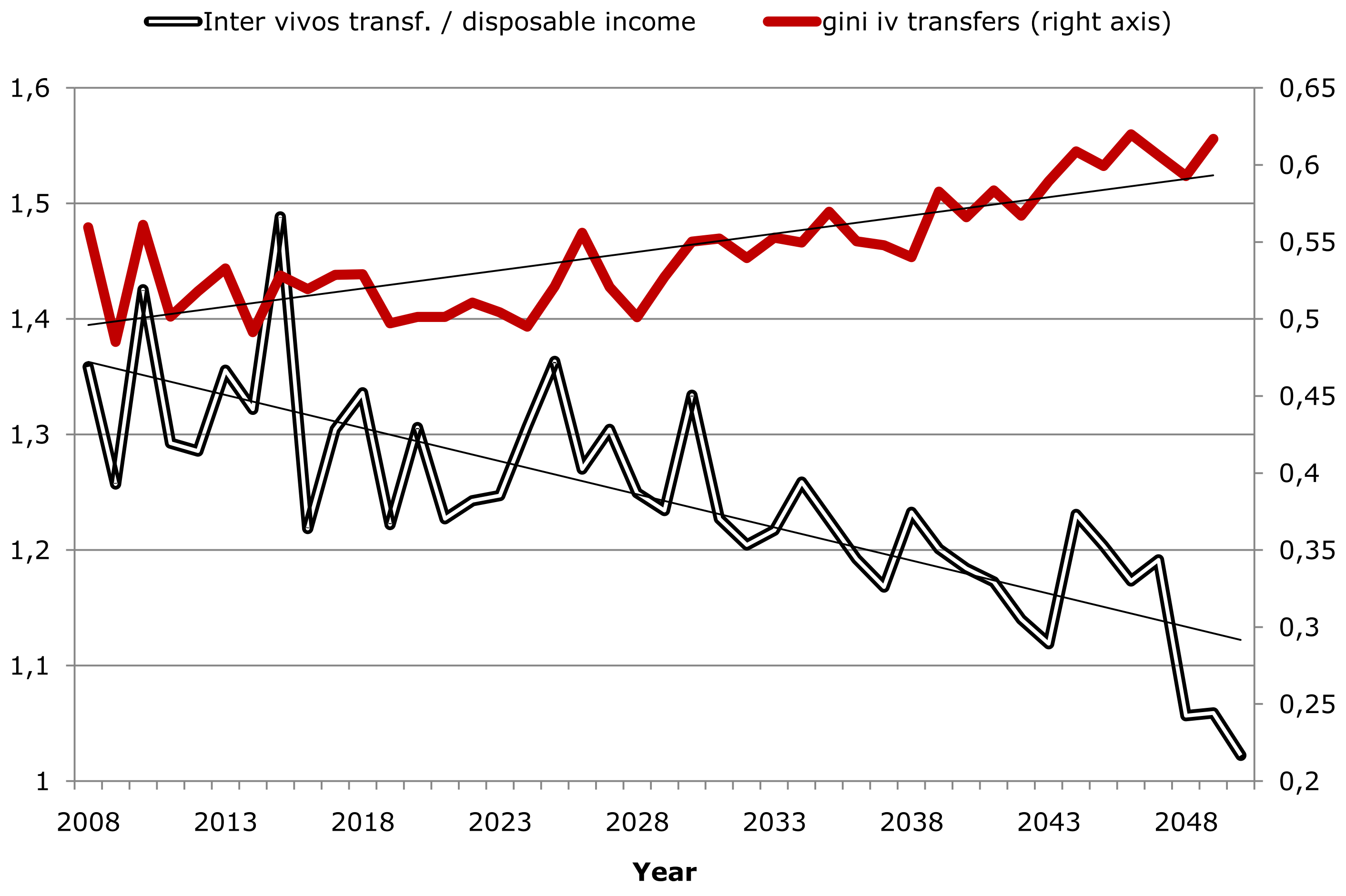
Two simulation scenarios according to the average stochastic returns we assume on assets and liabilities:

1. Benchmark: risky AF=3%, AR=2%, PF=3%
2. Low returns: risky AF=1%, AR=1%, PF=1%

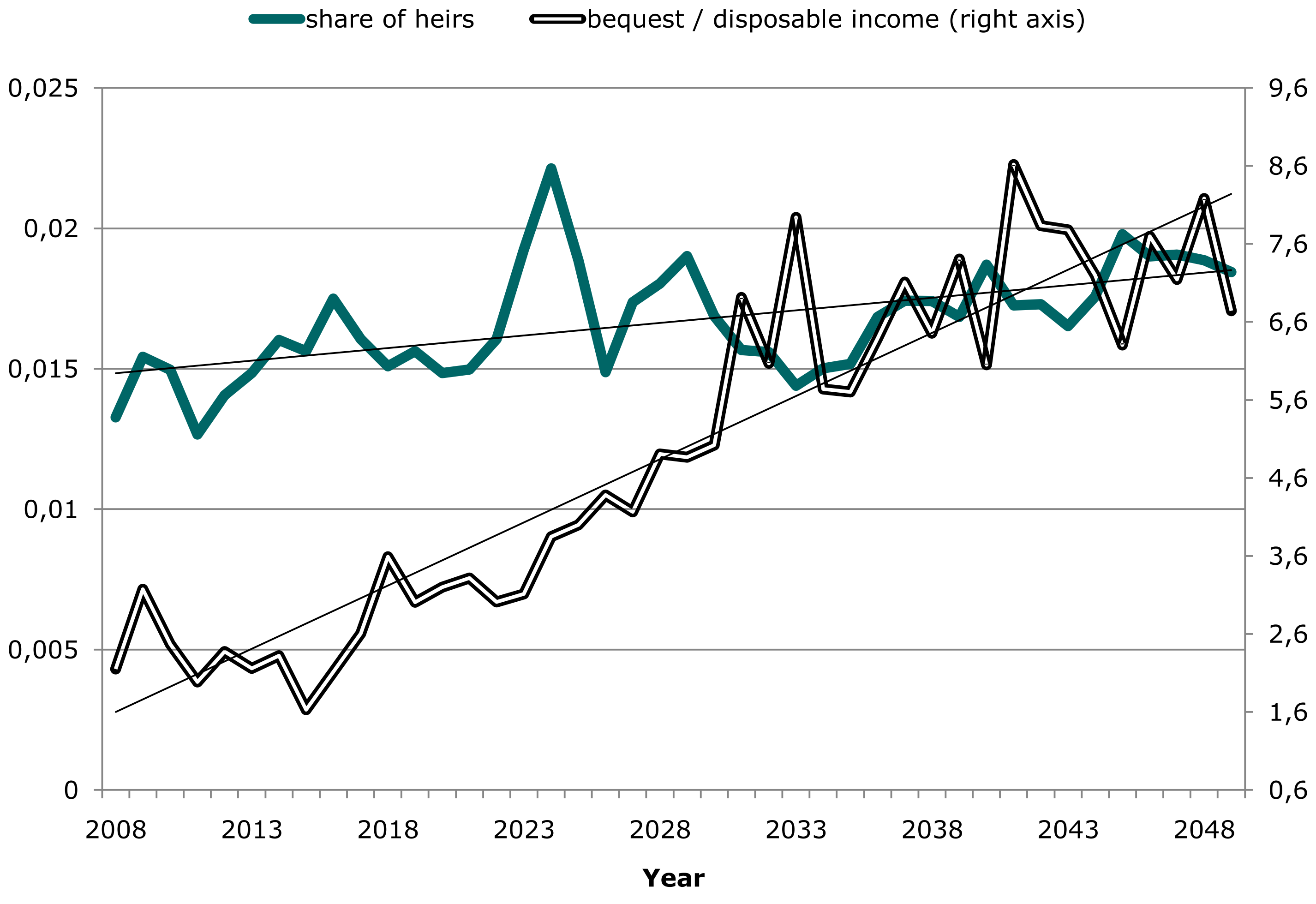
The average evolution of inter vivos transfers (2008-2050)



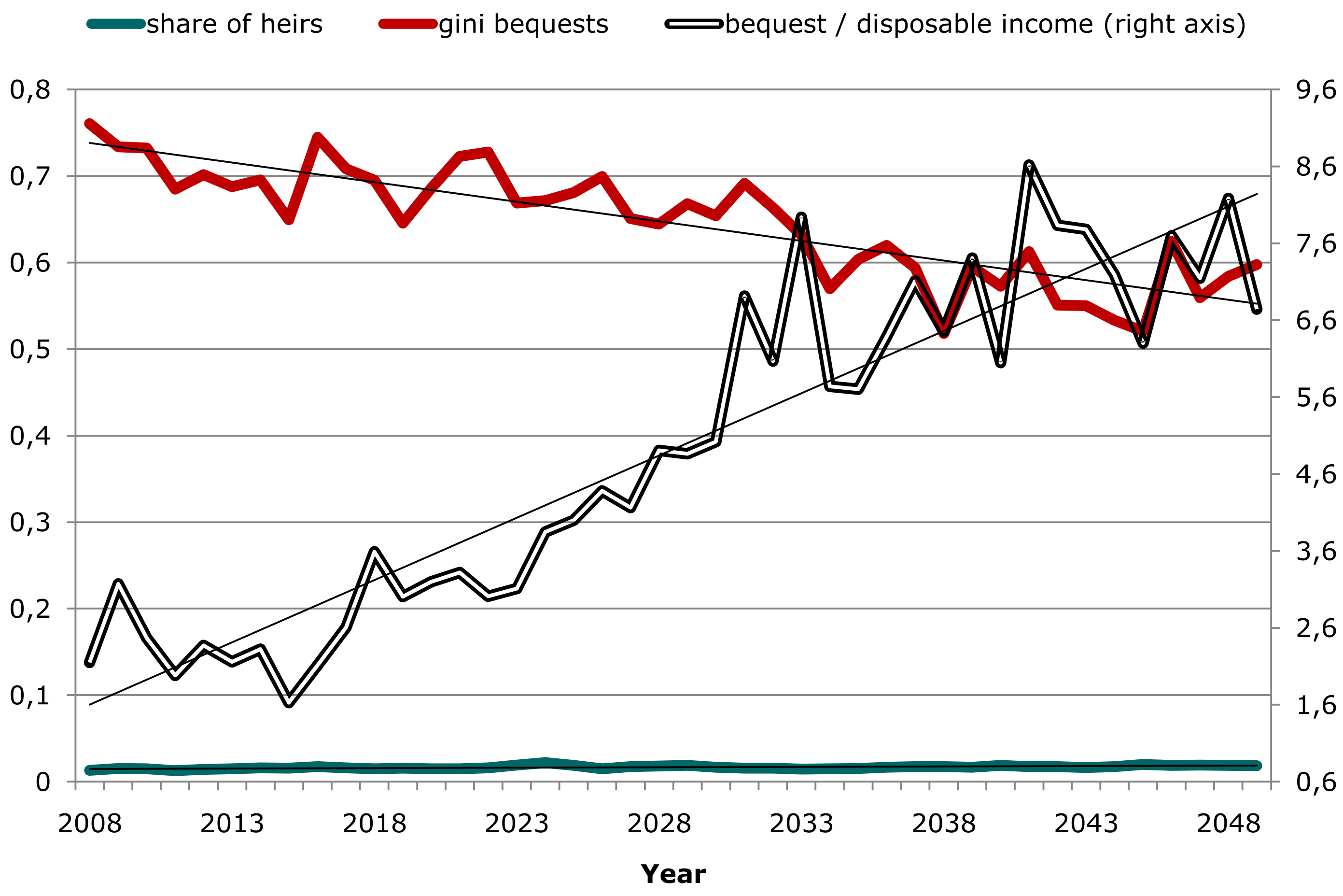
The evolution of the avg IV transfer and its dispersion (2008-2050, benchmark)



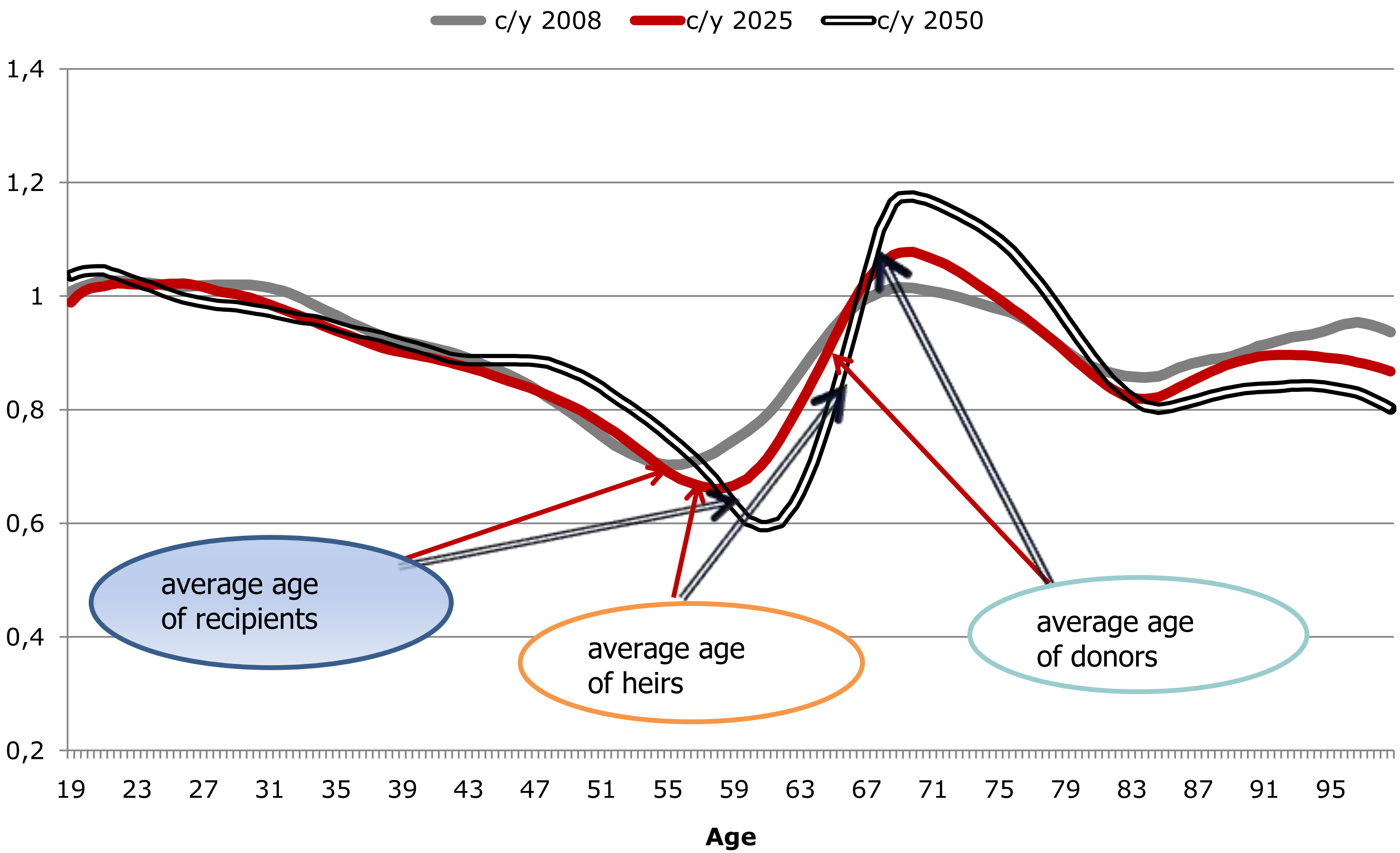
The average evolution of bequests(2008-2050, benchmark)



The evolution of the avg bequest and its dispersion (2008-2050, benchmark)

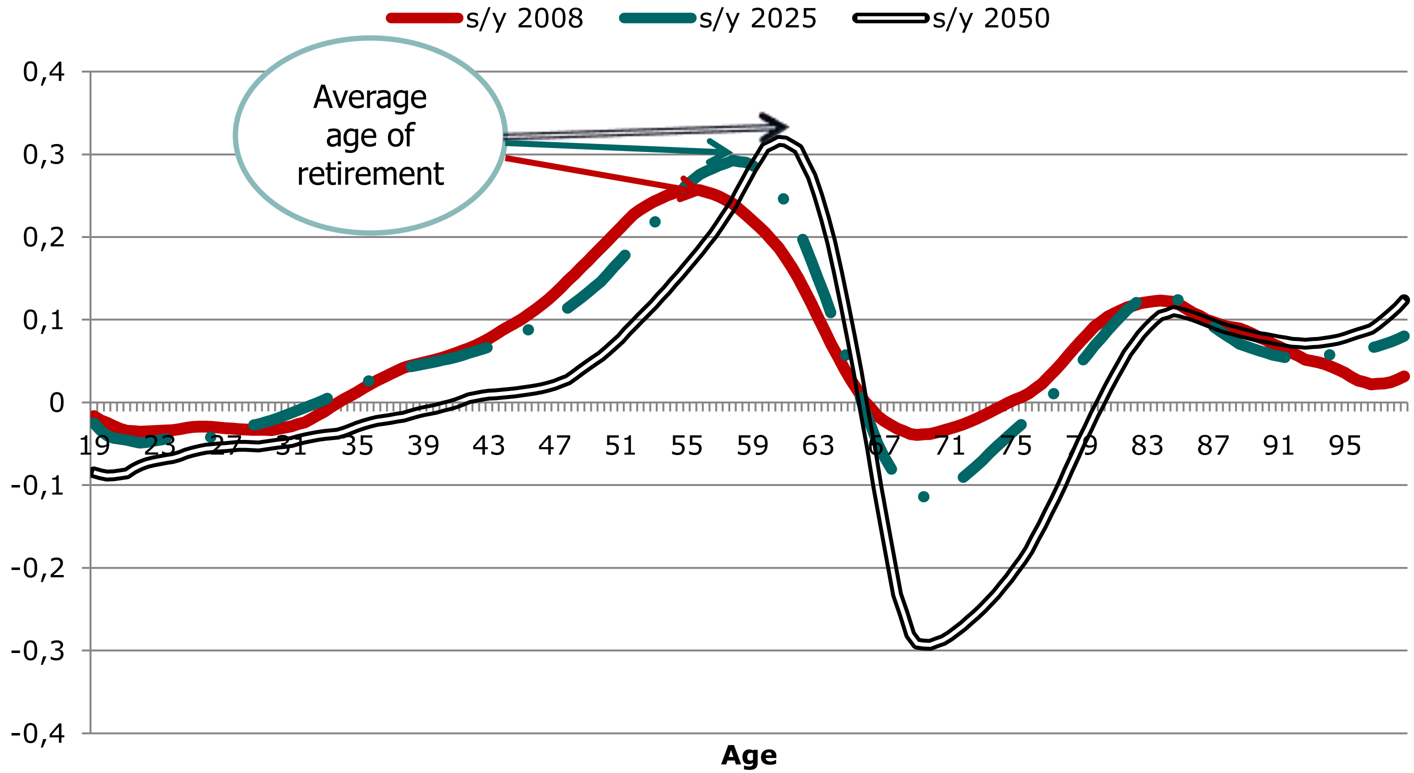


Equivalent propensity to consume vs HH age (2008, 2025, 2050)…



Nadaraya-Watson nonparametric regression (Kernel). OECD equivalence scale.

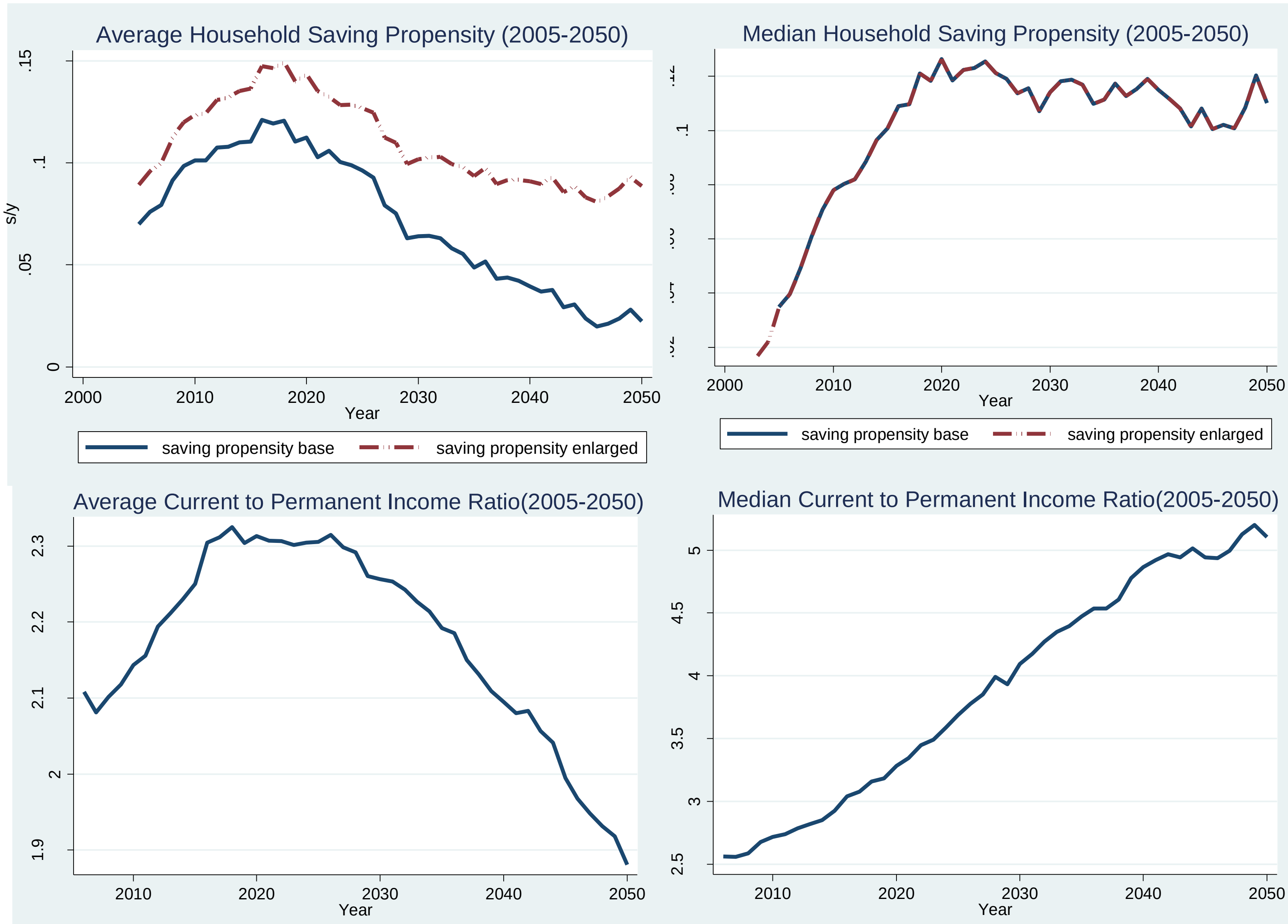
…and equivalent propensity to save



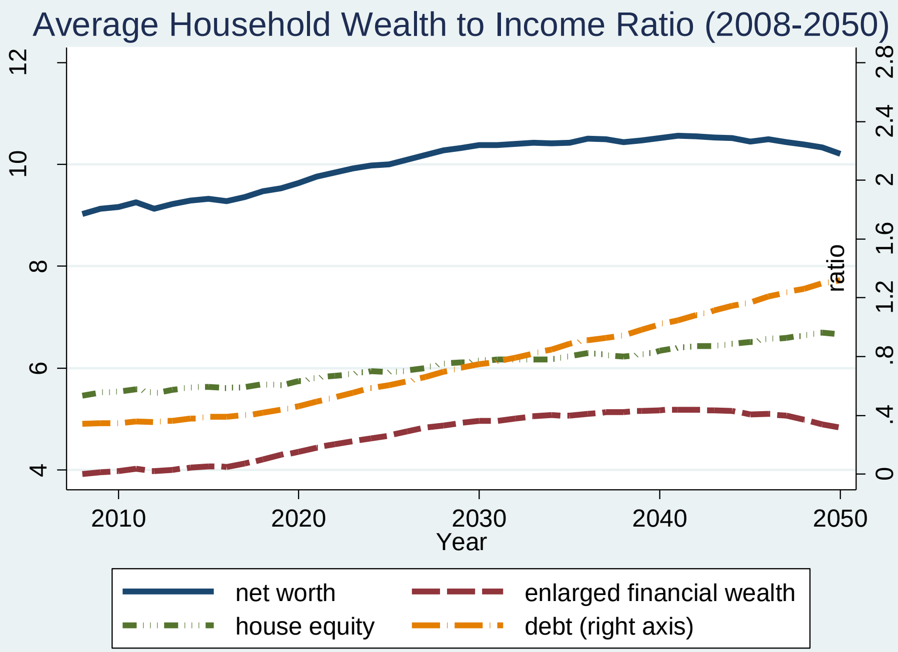
Nadaraya-Watson nonparametric regression (Kernel). OECD equivalence scale.

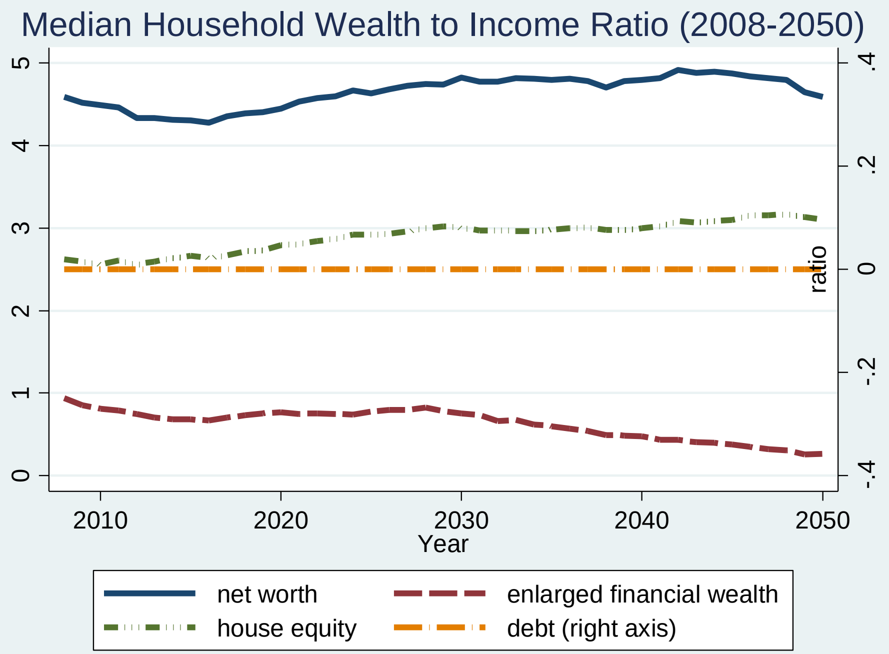
*In the long run, changing in both current and expected social security outcomes brings about a significant modification in the consumption/saving lifetime pattern of Italian families: **more saving before retirement, more dissaving after**.*

Mean vs Median
Household saving propensity (2005-2050) and the role of permanent income (=HR/residual life)

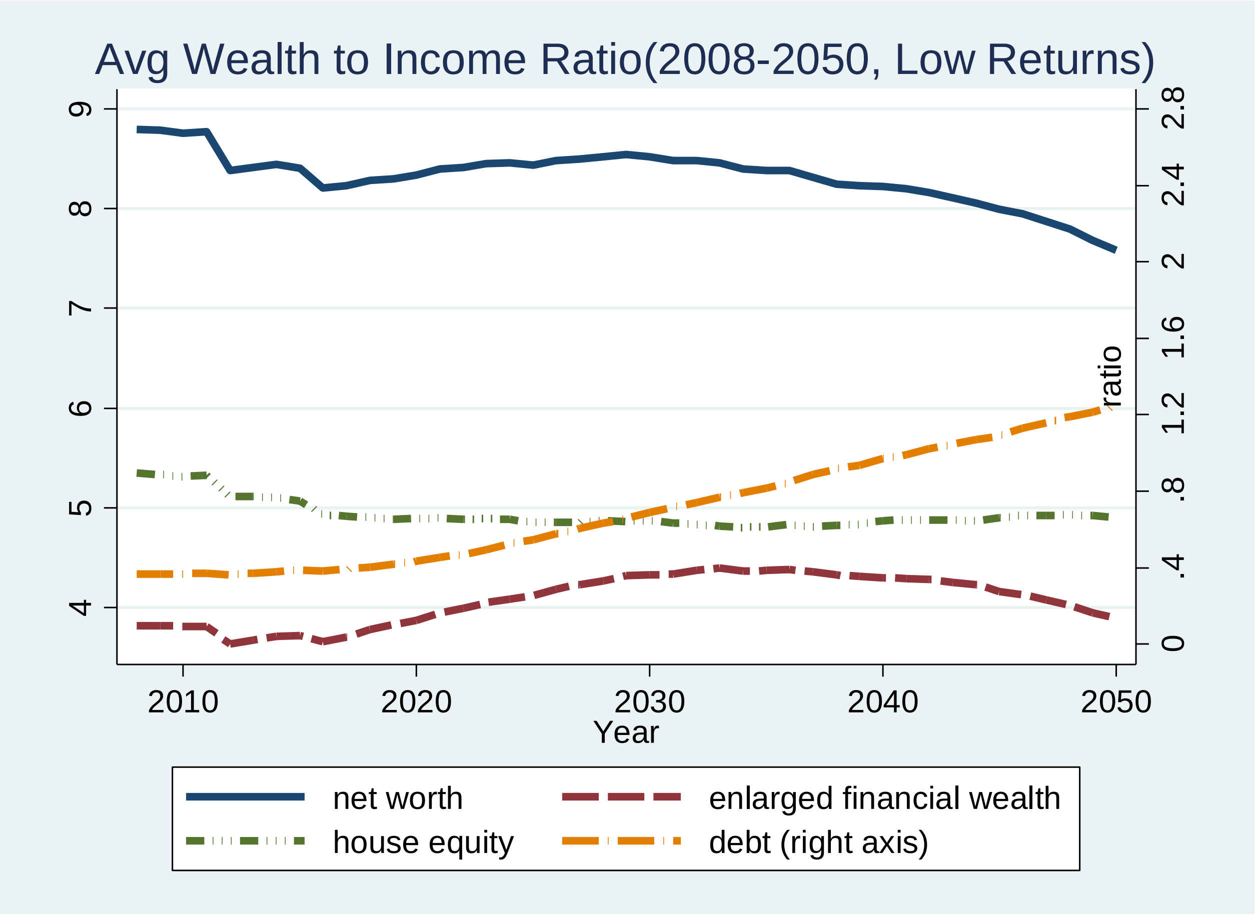


Mean vs Median
Household assets accumulation
(2005-2050, benchmark simulation)

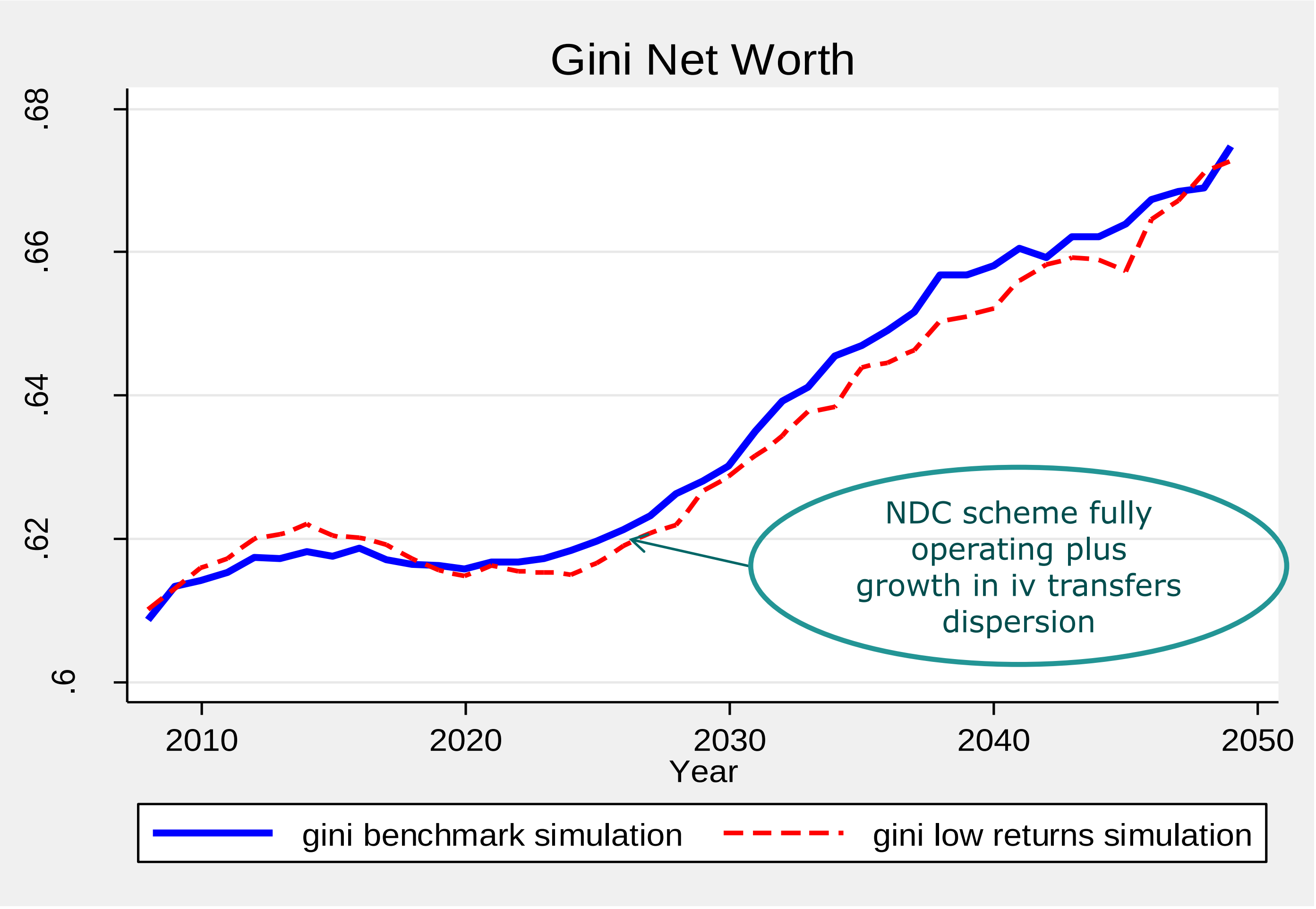




Avg assets accumulation (2005-2050, low returns scenario)



Net Wealth Inequality (2008-2050)



Next Improvements…

- Deeper -sequential- integration between CAPP_DYN and the Wealth Module
- Modelling the role of complementary –private- pension pillar, accounting for systemic risk
- *For interested people, details about the work will be soon available as a working paper by CAPP*

  www.capp.unimore.it

…Thanks