What explains cross-country differences in life-cycle consumption? A comparison between Italy and the United States[1]

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Abstract

Life-cycle consumption and saving profiles show striking differences across countries. The consumption age-profile is much more hump-shaped in the U.S. than in Italy. At the same time the U.S. age-profile for financial wealth shows both a higher indebtness at young ages and more wealth accumulation later in life than the Italian one. This paper investigates the role of credit market imperfections, transaction costs in the housing market, pension systems and individual income risk in generating such differences. Using a heterogeneous-agent overlapping-generation model with bequests, calibrated on micro data for Italy and the United States, we show how these factors interact with each other to produce the differences observed in the data.

JEL Classification Codes: E21, D1, D91.

Keywords: consumption over the life-cycle, international comparison

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1 Introduction

Life-cycle consumption and saving profiles show striking differences across countries. Using micro data from the U.S. Consumer Expenditure Survey, the Survey of Consumer Finances and the Italian Survey of Household Income and Wealth, we compute age profiles for consumption, income, saving and wealth in Italy and the United States. We show that U.S. consumption and income profiles are steeper than the Italian ones. The U.S. saving profile is also more hump-shaped. Besides we observe large differences in the profile for financial wealth, which decreases at the beginning of the life before increasing in the U.S. but monotonically rises in Italy.

Many reasons can explain those differences: differences in tax systems, pension policies, healthcare systems or unemployment insurance, credit markets or housing markets, to name a few. We provide empirical evidence for some of these reasons in Section 2. In particular we stress that public insurance mechanisms are much more developed in Italy than in the U.S., while financial markets offer more opportunities to self-insure in the U.S. These differences may explain the disparities we find in the proportion of households applying for credit in Italy and in the U.S., as well as differences in the share of those who are denied credit and are therefore borrowing constrained. We also document significant differences in mortgage and housing markets. Downpayment ratios are higher in Italy than in the U.S. while the average loan duration is shorter. Besides transaction costs are at least twice as high in Italy than in the U.S. We conjecture that these frictions affect households' consumption and saving decisions over the life-cycle, and provide a model that captures them and allows to carefully investigate their effect.

The model incorporates many features that have been shown in the literature to affect consumption and saving over the life-cycle. One can identify three main motives for saving over the life-cycle: a life-cycle motive, a precautionary motive and a bequest motive. The life-cycle motive comes from the hump-shape of the earnings age-profile and leads people to save during working life to support consumption after retirement (Modigliani, 1986). The presence of uncertainty surrounding future earnings implies an additional precautionary motive for saving (Hubbard, Skinner and Zeldes, 1994). Precautionary saving also arises from the existence of borrowing constraints which limit the ability of agents to self-insure (Deaton, 1991; Carroll and Kimball, 2005). Finally people may save in order to leave a bequest to their children and this bequest motive can account for some wealth accumulation after retirement (De Nardi, 2004).

Our model is an overlapping-generation model with idiosyncratic income uncertainty, bequests, and two types of capital: housing capital and non-housing capital. Housing capital can be owned or rented. We assume the existence of a borrowing constraint which takes the form of a downpayment constraint on the purchase of housing capital, and let the level of the downpayment requirement vary across countries. We consider a recursive stationary partial equilibrium, keeping prices fixed. The model is very successful at capturing the shape of the consumption and housing wealth profiles in both the U.S. and Italy, as well at accounting for the cross-country differences in these profiles. It however fails at replicating the age-profile for financial wealth in the U.S. On average the model does not generate enough borrowing at the beginning of life. This failure is the result of high precautionary saving due to high earnings uncertainty in the U.S. version of the model, when agents have the possibility to rent rather than to buy housing capital. In the face of high uncertainty regarding future earnings, agents indeed prefer to rent and accumulate some financial wealth at the beginning of life rather than to borrow to buy a house immediately. In the absence of rental markets, we get the right shape for the financial wealth profile which is reported in other papers without rental markets (Fernández-Villaverde and Krueger, 2005; Yang, 2006).

This paper relates to the large (mostly empirical) literature trying to account for observed cross-country differences in aggregate or life-cycle saving (e.g. Jappelli and Pagano, 1989; Poterba, 1994; Börsch-Supan, 2003). By its focus on two countries only, it however provides a much finer empirical analysis of the cross-country differences in saving and wealth that are reported. We are especially careful to ensure a consistent treatment of household data across the two countries and to use similar measures for consumption, income and wealth, and for instance often checked the precise wording of survey questions. More importantly this paper is, to our knowledge, the first one to use a rich micro-founded model to investigate the possible sources of cross-country consumption and saving differences.

The rest of the paper is organized as follows. Section 2 provides evidence on cross-country differences in life-cycle consumption and saving profiles and empirically documents some of the reasons that may account for the observed differences. The model is presented in Section 3. Section 4 discusses the calibration of the model's parameters. Quantitative results of the model calibrated on the Italian and U.S. economies are reported in Section 5. Section 6 investigates the effect of earnings uncertainty, social security, housing transaction costs and borrowing constraints in more details. Section 7 concludes.

2 Empirical evidence

This section presents evidence of cross-country differences in life-cycle consumption and saving profiles between Italy and the U.S. and documents institutional differences possibly accounting for them. We use microdata from the Italian Survey of Household Income and Wealth (SHIW), the United States Consumer Expenditure Survey (CEX) and Survey of Consumer Finances

(SCF). All data sources are described in more details in Appendix A.

2.1 Cross-country differences in life-cycle consumption and saving profiles

Consumption is computed as the sum of household out-of-pocket expenditures reported in the surveys. This measure of consumption includes the rents paid by tenant households. We also consider a measure that includes imputed rents for homeowners-occupiers. In none of the cases are other imputed services flows from the stock of durables included.

Imputed rents may also be added to income, as is the case in National Income and Product Accounts data (NIPA). Both profiles for income with and without imputed rents are reported.

Saving is defined as household disposable income minus consumption. This definition is similar to that of personal saving in NIPA data, and directly reflects an individivual's consumption/saving decision. We focus on discretionary saving. Mandatory contributions to public retirement schemes, such as social security contributions in the U.S., are considered as taxes rather than saving and therefore excluded from income. This treatment ensures consistency between the two datasets as the Italian data are lacking information on social security contributions paid (only net labor income is collected).

Following Fernández-Villaverde and Krueger (2004), we specify a partially linear model to disentangle age, cohort and time effects. The model is estimated using the two-step estimator described by Speckman (1988). See Appendix B for details.

The top plots in Figure 1 show the life-cycle average profiles for our two measures of consumption, with and without imputed rents, in Italy and the United States, controlling for cohort and time effects. The U.S. profile is clearly hump-shaped, although to a lesser extend when imputed rents are included. Consumption increases until about age 60 before declining. The decline in the second part of life is attenuated when imputed rents are added to consumption expenditures, as the profile for those is steadily increasing with age. The increase in the age-profile for imputed rents directly follows the increase of homeownership and housing wealth over the life-cycle (Figure 4).

The pattern in Italy looks strikingly different, with a consumption age-profile excluding imputed rents that seem to decline with age and a profile including imputed rents exhibiting just the opposite trend. The age-profile for imputed rents is however qualitatively similar to the U.S. one and again reflects the increase in homeownership and housing wealth over time. The discrepancy in the profiles for consumption with and without imputed rents hints at the potentially important role played by housing markets and households' tenure choice in shaping their life-cycle consumption profile.

The relative flatness of the Italian consumption profile can be related to the flatness of the

Italian income age-profile compared to the U.S. one (Figure 2). The inclusion of imputed rents has a significant impact on the shape of the Italian profile which then stabilizes after age 60. Adding imputed rents also reduces the drop in income after 60 in the U.S.

The inclusion or exclusion of imputed rents in both income and consumption is however neutral for the measure of saving. The shape of the saving age-profile reflects the difference between the income and consumption profiles. In the two countries, saving increases until age 60, then declines at retirement before stabilizing. The Italian saving profile is however much flatter than the U.S. one and hardly drops at retirement. At the peak, saving is equal to about twice the saving at age 20 in Italy. This ratio is three times larger in the United States.

The age-profile for the saving ratio slightly varies when imputed rents are added to disposable income in the denominator. For both measures, the U.S. profile is again clearly hump-shaped: starting close to zero, the saving rate increases over the working life until about age 60, then decreases sharply before stabilizing. The Italian profile looks much flatter. Starting well above zero at age 20, the Italian saving ratio increases steadily until age 65 before stabilizing.

Finally the differences in saving profiles are reflected in the wealth profiles plotted in Figures 4 and 5. The age-profile for financial wealth is very flat in Italy, while it goes negative at the beginning of the life before turning positive around age 40 in the U.S. Financial wealth accumulation is especially large in the second half of life in the U.S. and continues even after retirement. The fact that financial wealth accumulation continues at old ages in both countries is well-known and constitutes a puzzle for standard life-cycle models (De Nardi, French and Jones, 2006). Housing profiles look similar in both countries. The U.S. profile for homeownership rises however faster than the Italian one at the beginning of life. The U.S. profile for housing wealth is also steeper. As housing wealth makes a large part of households' total net wealth (which also includes individual and family business wealth besides financial wealth), the age-profiles for total wealth are qualitatively not very different between the two countries.

2.2 Institutional differences

We now turn to candidate explanations for the observed differences. Consumption and saving behaviors depend on a large set of determinants, many of them related to public policies (Börsch-Supan, 2003). We discuss some of them below and explain how they may affect the age-profiles previously estimated.

Pension systems Differences in pension policies are well documented in OECD (2001). The Italian pension system was reformed in 1995 from an earnings-related defined-benefit system with minimum pension to a notional defined-contribution system without minimum pension.

Given our sample period (1987-2004) and the progressive implementation of the new system, the relevant system to consider is the one in place before the reform. Under this system, retirement was possible at age 57 with 35 years of contribution or at any age with 38 years of contributions. Until the mid-1990s seniority pensions were thus a common pathway to retirement at early ages. It was frequent for people to retire around age 55 and by age 60-64 most people were pensioners.

The U.S. federal system is much less generous. The social security system is earnings-related and includes a redistributive component. Paid benefits are capped to a relatively low level (1,939 dollars for workers retiring in 2005 at the full retirement age), which explains why many Americans voluntary enroll in IRA or 401(k) programs, or carry on working after 60. According to the OECD, non-working pensioners are a minority among those aged 60 to 64. Using CEX data, we found that social security benefits still represent most of the pension benefits received by pensioners (about 80%).

We expect the higher level of public pensions to limit voluntary retirement saving and therefore financial wealth accumulation in Italy compared to the U.S. Everything else equal, by flattening the income age-profile, a higher pension replacement ratio should also limit the consumption decline after retirement, as is observed in Italy.

Public insurance systems for healthcare and unemployment While differences in pension systems affects the shape of the average income profile over the life-cycle, other social insurance policies regarding healthcare, maternity and unemployment will affect the variance of income around that average. Unlike the U.S. welfare system, the Italian system provides a good safety net for individuals. Since contributions to the system are mandatory, we did not include them in our measure of earnings. For consistency, we excluded health insurance premiums from consumption expenditures in the U.S.

We thus observe a much smaller volatility of the Italian earnings profile compared to the U.S. one (see Section 4 and Table 3). Everything else equal, this lower variance reduces the need for precautionary saving. However the ultimate effect of income uncertainty on consumption and saving also depends on the ability of people to self-insure, by borrowing in case of a bad shock for instance.

Credit markets Many papers (e.g. BIS, 2006; Catte, Girouard, Price and André, 2004; Chiuri and Jappelli, 2003) provide evidence of cross-country differences in credit market and particularly mortgage market characteristics. Some of these differences are summarized in Table 1. We observe that mortgage debt represents a much larger share of GDP in the U.S. than in Italy (64.5% versus 14.5% in 2004). Downpayment ratios (share of the value of a house that cannot be borrowed and must be paid upfront by the buyer) are higher in Italy than in the

United States (40% versus 11%). These two elements, along with other features of mortgage contracts, all point to an easier access to mortgage borrowing in the U.S. than in Italy.

Given the importance of housing in the median household portfolio, we guess these differences may have a significant impact on household saving behavior. Jappelli and Pagano (1989) provide econometric evidence of such a link between consumption or saving and various indicators of financial market development at a country level.

On the demand side, other features of credit markets may also affect borrowing decisions. Different bankrupcy provisions for instance provide different degrees of protection to borrowers. We see this as a possible explanation for the very different shares of households with debt or credit applicants in the population between Italy and the U.S. (Crook, 2006). Table 2 reports the proportion of credit applicants in the total population according to the SHIW and the SCF, the proportion of those who were rejected or not given as much credit as asked for, as well as the proportion of households that report they were deterred from applying for credit by fear of being rejected. These figures are computed from the answers to questions in both surveys. They refer to credit applications in the past year in the case of Italy and in the past five years in the case of the U.S. Even if we take this difference in the period of reference into account, the gap between the proportion of credit applicants in Italy and in the U.S. is huge. Assuming that the households applying for credit are different every year for five consecutive year, the share of credit applicants in the total population over five years in Italy is about one-third of the share in the U.S. While households applying for credit or considering to apply represent a smaller share of the total population in Italy than in the U.S., the proportion of those among them that is borrowing constrained, i.e. totally or partially denied credit or deterred from applying for fear of being so, is larger: 39.5% versus 30.1% in 2004.

Housing markets Besides the already described differences in mortgage markets, the Italian and U.S. housing markets differ by the level of transaction costs incurred by home traders. This difference is emphasized in Belot and Ederveen (2005), which report that housing transaction costs in Italy are more than twice their level in the U.S. (19% versus 9%).

Using CEX data, Gruber and Martin (2003) find that the median U.S. household pay costs of about 7% to sell its house and 2.5% to purchase. Studying the impact of such transaction costs in the framework of an Aiyagari economy, they also find that the level of precautionary savings is increasing in the transaction costs.

We conjecture that higher transaction costs combined with fewer borrowing opportunities can account for the slower increase in the homeownership profile in Italy than in the U.S.

3 An overlapping-generation model with bequests

We consider an overlapping-generation model with idiosyncratic income uncertainty, bequests, and two types of capital: housing capital and non-housing capital. This model is used to investigate the effect of different income processes, social security systems, borrowing constraints and transaction costs, on household life-cycle consumption. We follow a partial equilibrium approach by assuming that the interest rate is determined outside the model and equal to the world interest rate, and by fixing the rental rate of housing capital.

3.1 Demographics

One model period is equal to five years. Each agent lives for at most J periods. We denote age $j = 1$ as 20 years old. Agents live at most $J = 14$ periods (i.e. can't live longer than 90), have kids at $j = 3$ (age 30), survive for sure until $j = 9$ (age 60), then faces a survival probability $s_{j,j+1}$ every period until period J. Let $s_{j,j+1} = 1$ for all $j < 9$. $s_{J,J+1} = 0$. The unconditional probability of being alive at age $j \geq 10$ is $s^j = \prod_{i=9}^{j-1} s_{i,i+1}$.

The population grows at a constant rate n. Thus the demographic structure is stable over time. The economy is made stationary by normalizing the measure of newly born agents, ν_1, so that the total size of the population is constant and equal to 1:
$\nu_1 = \left(1 + \sum_{j=1}^{J-1} (1/n)^j \prod_{i=1}^{j} s_{i,i+1}\right)^{-1}$ and $\nu_{j+1} = (s_{j,j+1}/n)\nu_j$ for all $1 \leq j < J$.

Given this transformation and for notational convenience, the variables are indexed only by age j with no index for time.

3.2 Asset structure

There are two types of assets in the economy: a risk-free financial asset and housing capital. Housing capital can be either owned or rented, and generates dividends or service flows that enter the utility function of the agents.

3.3 Endowment

Each agent of age $j < j^R$ receives an endowment of w_j every period, which includes a deterministic life-cycle component $\bar{w}_j$ and an idiosyncratic stochastic element $\hat{w}_j$. The idiosyncratic part includes a permanent component ω, a persistent (autoregressive) component and a transitory component. The sum of these last two components is denoted by y. The endowment process is calibrated to replicate the average age-profile for earnings observed in the data for Italy and the United-States.

At birth, each agent learns about his or her parents' permanent shock. Based on this information, children can infer the size of bequests they are likely to receive.

Agents are assumed to be born with zero housing and financial assets.

3.4 Pension system

Agents are forced to retire at age j^R. Once retired, they receive constant social security benefits p_j equal to some fraction ϱ of the average total endowment of agents with the same permanent shock. Pension benefits are thus independent of the agent's endowment history, except for its permanent component. Benefits are financed by a proportional tax τ on endowment during working life.

3.5 Preferences

Preferences are defined over streams of consumption and services from housing.

$$U(\{c_j\},\{h_j\},\{t_j\}) = E_0 \left\{ \sum_{j=1}^{J} \beta^{j-1} u(c_j, h_j, t_j) \right\}, \tag{1}$$

with a constant relative risk aversion one-period utility function

$$u(c,h,t) = \frac{1}{1-\gamma} \left[\theta c^{1-\alpha} + (1-\theta)\left((1+\psi t)h\right)^{1-\alpha} \right]^{\frac{1-\gamma}{1-\alpha}}, \tag{2}$$

where $0 < \theta < 1$. $\gamma > 1$ is the coefficient of risk aversion and $1/\alpha$ is the elasticity of substitution between consumption and housing services. c denotes consumption and h the quantity of housing capital. t is a binary variable which takes the value one when the agent owns the house, and zero when he or she rents. Following Kiyotaki, Michaelides and Nikolov (2006) we assume that agents enjoy more utility from owning than renting ($\psi > 0$).

Agents facing a positive probability to die next period ($j \geq 9$) derive utility from the bequest they leave to their children. Let bq_j denote the bequest left by an agent of age j. The utility from bequest is given by $\phi(bq_j) = \phi_1(1+bq_j/\phi_2)^{1-\gamma}$ (De Nardi, 2004). The parameter ϕ_1 reflects a parent's willingness to leave a bequest to his or her children, while ϕ_2 measures the extent to which bequests are a luxury good.

3.6 Transaction costs

Changes in housing capital are subject to a transaction cost, if they exceed some fraction μ of the owned housing capital. This specification allows for costless depreciation or renovation of the owned house.

$$k(t_j h_j, t_{j+1} h_{j+1}) = \begin{cases} 0 \text{ if } |t_{j+1}h_{j+1} - t_j h_j| \leq \mu h_j \\ \kappa_1(1-\delta)t_j h_j + \kappa_2 t_{j+1} h_{j+1} \text{ otherwise} \end{cases}$$

where κ_1 and κ_2 represent the transaction costs paid as a fraction of the house's selling and purchasing values. δ denotes the depreciation rate of housing capital.

3.7 Information and timing

The value of each agent's permanent shock (or type) is assumed to be known only by the agent himself and his children. For computational reasons, we assume that children cannot directly observe the value of their parents' assets and so need to form expectations about this value based on their knowledge of their parents' type. All other information is public.

At the beginning of each period, agents learn about both their idiosyncratic income shock and the amount of bequest they receive if they receive one. They choose consumption, housing tenure, housing capital and asset holdings. Finally uncertainty about death is revealed. When the agent dies, his house is sold (in case he owns one) and the sale proceeds, minus the transaction costs, along with his financial wealth are bequested to his children at the end of the period.

3.8 Equilibrium

We define a stationary partial equilibrium, in which the economic environment is invariant and prices are exogenously fixed. The agent's problem is written recursively. The state variables for an agent are $x = (j, \omega, y, a, th, \omega^p))$, where a denotes asset holdings, th is owned housing capital and ω^p denotes the value of the parent's permanent shock ($\omega^p \neq 0$) if the agent hasn't inherited. Once the agent has inherited, ω^p is set equal to zero.
The recursive formulation of the agent's problem is as follows.

From $j = 1$ to $j = 8$ (from age 20 to 60), the agent survives for sure until the next period and may inherit from his or her parents. Let $I_{\omega^p>0}$ be the indicator function which takes the value one if $\omega^p > 0$ and zero otherwise.

$$V(j, \omega, y, a, th, \omega^p) = \max_{c', \tilde{a}, t', h'} \left\{ u(c', h', t') + \beta EV(j+1, \omega, y', a', t'h', \omega^{p\prime}) \right\} \tag{3}$$

subject to

$$c' + \tilde{a} + t'h' + r^h(1-t')h' + k(th, t'h') = \mathrm{w} + (1+r)a + (1-\delta)th \tag{4}$$

$$\tilde{a} \geq \bar{b}(j, w, t'h') \tag{5}$$

$$c' \geq 0, h' \geq 0 \tag{6}$$

$$a' = \tilde{a} + bq' I_{\omega^p>0} I_{\omega^{p\prime}=0} \tag{7}$$

where $\tilde{a}$ denotes the choice of financial assets before receiving bequests. w is equal to $(1-\tau)w(j,\omega,y)$ if $j<j^R$ and $p(\omega)$ if $j^R\leq j<J$. r^h is the rental rate of housing capital and r is the risk-free interest rate. The expectation in equation (3) is taken over all possible values for the non-permanent endowment shock y' if the agent is of working age, the possibility of receiving a bequest, and the size of that bequest. $\bar{b}(j,w,t'h')$ denotes the limit on short-sales of financial assets. We discuss several specifications of the borrowing constraint in the next paragraphs.

From $j=9$ to $j=14$ (from age 65 to age 90), the agent may not inherit anymore and faces a positive probability to die each period.

$$V(j,\omega,y,a,th,0)=\max_{c',a',t',h'}\left\{u(c',h',t')+\beta s_{j,j+1}EV(j+1,\omega,y',a',t'h',0)+(1-s_{j,j+1})\phi(bq)\right\} \tag{8}$$

subject to

$$c'+\tilde{a}+t'h'+r^h(1-t')h'+k(th,t'h')=\mathrm{w}+(1+r)a+(1-\delta)th \tag{9}$$

$$\tilde{a}\geq\bar{b}(j,w,t'h') \tag{10}$$

$$c'\geq 0,h'\geq 0 \tag{11}$$

$$bq=a'+t'h'-k(t'h',0) \tag{12}$$

In the simulations we consider different types of borrowing constraints. We start with an exogenous borrowing constraint. Each period an agent can borrow up to a certain fraction $0\geq(1-\lambda)\geq 1$ of the value of his or her owned housing capital which is used as collateral:

$$a'\geq-(1-\lambda)t'h' \tag{13}$$

When $\lambda=1$, this constraint implies no borrowing at all.[1] Given the budget constraint, we can rewrite the above constraint as:

$$\mathrm{w}+(1+r)a+(1-\delta)th-c'\geq\lambda t'h'. \tag{14}$$

Thus an agent can afford to buy h' only if his or her total wealth at the beginning of the period is at least λ times the price of the property he or she wants to acquire. This amount can be interpreted as the downpayment required from the agent when buying a house. We assume there is no cost of borrowing using housing as a collateral, i.e. the borrowing interest rate is equal to the deposit interest rate.

An alternative specification of the borrowing constraint is adapted from Kehoe and Levine (1993). In this case, the constraint is specified so that the agents always have an incentive

[1] Such a constraint is implicit in Gourinchas and Parker (2002). As agents are not allowed to die in debt and income can be zero, the Inada conditions on the agent's utility function imply that the agent will never find it optimal to borrow.

to repay their debt rather than to default and takes the form of an incentive compatibility constraint:

$$V(j+1,\omega,y',a',t'h',\omega^p) \geq V(j+1,\omega,y',0,0,\omega^{p\prime}),\ \text{for all } y',\omega^{p\prime} \tag{15}$$

Thus agents who default lose not only their debt but also all their housing capital. More severe punishments may be imposed by for example preventing agents from borrowing in some or all subsequent periods. The borrowing constraint then arises endogenously. Cross-country differences in bankruptcy provisions can be modeled by varying the severity of punishment.

Definition. *Given the stochastic process for endowment, the interest rate r and the rental rate of housing capital r^h, **a recursive stationary partial equilibrium** is defined as a value function $V(x)$, decision rules for the agent $c'(x), t'(x), h'(x), a'(x)$, a pension system ϱ and τ, a family of probability distributions for bequests $\mu_{bq}(x;:)$ and a measure of agents $m(x)$ such that:*

(i) Given the interest rate r, the rental rate of housing capital r^h, and the process for w, V solves the agent's problem and $c'(x)$, $t'(x)$, $h'(x)$, $a'(x)$ are the associated decision rules.

(ii) The pension system is balanced.

(iii) The family of expected bequests distributions is consistent with the bequests actually left by the parents.

(iv) The measure of agents $m(x)$ follows $m = T(m)$, where T is a transition function consistent with the optimal decision rules of the agents.

4 Calibration

We choose parameter values to capture certain properties of the Italian and U.S. economies over the sample period 1987-2004 for Italy and 1984-2003 for the United States. All parameter values are summarized in Table 3.

Demographics Survival probabilities are obtained from the Period Life Tables for the year 1990 in Bell and Miller (2005). These probabilities are used for both economies. Population growth rates come from the World Bank WDI database.

Technology The depreciation rate for housing capital is estimated from U.S. NIPA data: δ = residential investment/stock of residential assets $- n = 2.9\%$ per year on average over the sample period.

Endowment The average endowment process over the working life is estimated from SHIW and CEX data following the methodology decribed in Appendix B. We use data on earnings, including transfers, minus income taxes but including social security contributions. For Italy, we impute social security contributions paid following the method suggested by Brugiavini and Padula (2003). The logarithm of labor earnings for individual i of age $j < j^R$ in year t is given by:

$$\ln w^i_{j,t} = \bar{w}_{j,t} + \hat{w}^i_{j,t} \tag{16}$$

where $\bar{w}_{j,t}$ is the average age profile of the logarithm of earnings over the working life in year t, computed from a partially linear model controlling for cohort and time effects, and $\hat{w}^i_{j,t}$ is an idiosyncratic shock which can be decomposed into three independent components: a permanent, a persistent and a transitory component.

$$\hat{w}^i_{j,t} = \omega^i_t + z^i_{j,t} + \eta^i_{j,t} \tag{17}$$

$$z^i_{j,t} = \rho z^i_{j-1,t-1} + \epsilon^i_{j,t}, \tag{18}$$

where ω^i_t, $\epsilon^i_{j,t}$ and $\eta^i_{j,t}$ are independent, serially uncorrelated, normal random variables with mean zero and variances $\sigma^2_{\omega,t}$, $\sigma^2_{\epsilon,t}$ and $\sigma^2_{\eta,t}$ respectively.

Let $y^i_{j,t} = z^i_{j,t} + \eta^i_{j,t}$. We follow the strategy proposed by Perri and Krueger (2005) to calibrate $\sigma_{\omega,t}$, $\sigma_{\epsilon,t}$ and $\sigma_{\eta,t}$. $\sigma^2_{\omega,t}$ and $\sigma^2_{y,t}$ respectively denote the between-group and within-group variances of log-earnings of households of age j in year (cross-section) t. In each cross-section, $\sigma^2_{\omega,t}$ and $\sigma^2_{y,t}$ are computed by regressing log-earnings (after controlling for age effects) on the following characteristics of the head of household and spouse if present: sex, race, years of education, and a dummy variable for managerial/professional occupation. The cross-sectional variance explained by these characteristics is equal to $\sigma^2_{\omega,t}$ and the residual variance to $\sigma^2_{y,t}$.

We treat ρ as time invariant and set its annual value to 0.9989 for the U.S. (Storesletten, Telmer and Yaron, 2004). For Italy, ρ is estimated to 0.8782 using the panel dimension of the SHIW. We exploit the short panel dimension of the CEX and SHIW data to compute the cross-sectional within-group log-earnings autocovariance $Cov(y^i_{j,t}, y^i_{j+1,t+1})$. We can then identify the unobserved variances of the persistent component $\sigma^2_{\epsilon,t}$ and the transitory component $\sigma^2_{\eta,t}$ from the within-group variance $\sigma^2_{y,t}$ using the following equations:

$$Cov(y^i_{j,t}, y^i_{j+1,t+1}) = E((z^i_{j,t} + \eta^i_{j,t})(\rho z^i_{j,t} + \epsilon^i_{j+1,t+1} + \eta^i_{j+1,t+1}) = \frac{\rho}{1-\rho^2}\sigma^2_{\epsilon,t} \tag{19}$$

$$\sigma^2_{y,t} = \frac{1}{1-\rho^2}\sigma^2_{\epsilon,t} + \sigma^2_{\eta,t} \tag{20}$$

The values for ρ, $\sigma_{\omega,t}$, $\sigma_{\epsilon,t}$ and $\sigma_{\eta,t}$ are adjusted for the duration of a period in the model (5 years). We report and use average variances over the sample period.

Aggregate endowment is normalized to one in both economies.

Pension system The retirement age j^R is set to 60 in Italy and to 65 in the United States, which corresponds respectively to periods 9 and 10. The average replacement ratio ϱ is equal to 31% of average disposable earnings of working-age households (i.e. after taxes and mandatoty retirement contributions) in the United states and 58% in Italy. These figures are computed from 1995 survey data by relating average earnings of households with head aged 20 to 65 to average social security benefits received by households above 65. They are consistent with the values of replacement ratios usually found in the literature. The labor tax rate τ is set such that the tax proceeds are equal to the total amount of social security benefits paid. The implied tax rate is 5.58% in the U.S. which is not far from the actual social security tax rate (5.7% in 1984-1987, 6.06% in 1988-1989 and 6.2% since 1990). It is equal to 15.72% in Italy.

Preferences Preference parameters are assumed to be the same in both economies. The coefficient of risk aversion is set equal to 2, which is in the middle of the range of values commonly used in the literature. Following Fernández-Villaverde and Krueger (2005), we assume that the elasticity of substitution between consumption and housing services is one, in which case the one-period utility function takes the Cobb-Douglas form

$$u(c,h) = \frac{\left[c^{\theta}\left((1+\psi t)h\right)^{1-\theta}\right]^{1-\gamma}}{1-\gamma}. \tag{21}$$

θ is calibrated so that the ratio of paid rents plus imputed rents to total consumption expenditures including imputed rents is equal to the value of that ratio in the data (0.25 in both Italy and the U.S.). For the U.S. economy, this corresponds to $\theta = 0.74$. The same value is used for the Italian economy.

The parameter ψ which determines the additional utility gained from owning versus renting a house is adjusted along with the rental rate of housing r^h to match the aggregate homeownership ratio in the U.S. (65.5% on average between 1984 and 2003, source: U.S. Census Bureau, Housing Vacancies and Homeownership Survey). We discuss the calibration of ψ in more details below.

β is set to 0.946 per year and adjusted for the duration of a period in the model (5 years). This value is in the range of the ones found in the recent literature using similar models (Fernández-Villaverde and Krueger, 2005; Nakajima, 2005; Yang, 2006).

As regards the parameters in the utility function for bequests, we set ϕ_2, which only matters for the distribution of bequests - a topic outside the scope of this paper -, to one and calibrate ϕ_1 so that the aggregate amount of bequests in both economies equals to 20% of total wealth (Guiso and Jappelli (1999) for Italy and Gale and Scholz (1994) for the U.S.). We get $\phi_1 = -2$.

Transaction costs We fix μ to the depreciation rate of housing capital. This implies that homeowners can let their housing capital depreciate without having to sell the house and trade down. Transactions costs on housing sales and purchases κ_1 and κ_2 are set equal to respectively 7% and 2% for the U.S. economy (Gruber and Martin, 2003) and to 3% and 16% for Italy (Global Property Guide, 2007).

Borrowing constraint We adjust the downpayment requirement λ so that it reflects both the level of downpayment usually required from home buyers in each country as well as the usual duration of mortgage loans given the 5-year time periods of the model. We set λ equal to 0.6 in Italy and to 0.3 in the U.S.

Prices We set the annual net interest rate r to 4% in both countries (McGrattan and Prescott, 2001).

The calibration of the rental rate of housing capital r^h requires more attention. The value of r^h ultimately determines each household's choice of renting versus owning. In the absence of utility gain from owning versus renting, bequest motive, transaction costs and borrowing constraint, the rental rate of housing capital has to satisfy

$$r^h = \frac{r+\delta}{1+r} \tag{22}$$

for the agent to be indifferent between owning and renting. If we still forget about the utility gain from owning, the bequest motive and transaction costs, the fact that housing capital has a collateral value and relax the borrowing constraint of agents for which this constraint is binding makes owning more attractive than renting at least for these agents at this value of r^h. Introducing a utility gain from owning and a bequest motive increases the attractiveness of the owning option versus the renting one, while adding transaction costs when selling and buying has the opposite effect. The relative importance of these effects is however very difficult to pin down analytically.

We impose another constraint on the value of r^h. This cannot exceed that of the downpayment requirement λ: buying a house cannot be "cheaper" than renting. If $r^h > \lambda$, we might see poor agents borrowing to purchase a house which they cannot afford to rent.

The value of λ that captures the main features of mortgage contracts in the U.S. was set to 0.3. In the absence of any utility gain from owning ($\psi = 0$), we find that we need to set r^h to some higher value to match the average homeownership ratio in the U.S. over the sample period. To avoid that, we set r^h equal to $(r+\delta)/(1+r) = 0.292$ as in equation (22) and calibrate ψ to match the average homeownership ratio. We get $\psi = 0.064$, which seems a very reasonable value, about 3 percentage points below the one used in Kiyotaki et al. (2006). Given this value for ψ, we adjust r^h for Italy to match the average homeownership ratio in this country (73.6% over the period 1994-2001, source: Eurostat). We obtain an estimated r^h equal to 0.335 in Italy, which implies an annual return on housing of about 5.9%.

5 Results from the benchmark model

This section reports the results for the life-cycle profiles for consumption, saving, and housing and financial wealth generated by the model calibrated on the Italian and the U.S. economies.

The model is successful at capturing the main features of the age-profiles for consumption, housing wealth and homeownership in the two countries (Figures 7 and 8). For both Italy and the U.S., the model generates a hump-shape consumption profile and an increasing profile for homeownership which stabilizes after retirement. As in the data, the model-generated Italian consumption profile is flatter than the U.S. one at the beginning of life. Everything else equal, the higher rental rate of housing in Italy flattens the beginning-of-life age-profile for consumption expenditures including paid rents but not imputed rents, which can partly account for the differences we saw in the Italian profiles for our two measures of consumption, with and without imputed rents. However the model does not capture the stabilization of the Italian consumption profile (including imputed rents) after retirement.

Figure 6 compares the age-profiles for consumption and housing wealth in both model economies. The model is able to qualitatively capture the differences in the shapes of these profiles that we observed in the data. In particular, the U.S. age-profiles for consumption and housing wealth are steeper than the Italian one in both the data and the model.

The differences in consumption profiles are closely related to the differences in average earnings profiles, which are an input in the model. One reason is that in the presence of borrowing constraints and earnings uncertainty, risk averse consumers choose to postpone consumption until a larger part of uncertainty gets revealed. This results in positive financial saving at the very beginning of life and consumption increasing with income.

Table 4 provides a quantitative assessment of the performance of the model in accounting for the cross-country age-profile differences. In order to measure these differences, we compute the levels of consumption, income, housing wealth and financial wealth at age 50 (peak age for consumption in the model economy for Italy) relative to the levels at ages 25 and 75, for both the data and the two model economies. For homeownership, we relate the homeownership ratio at age 30 to that at age 25 (ages between which the difference in steepness between the Italian and the U.S. profiles is the most obvious). The last two lines summarize the size of the differences in these ratios between Italy and the U.S. in the data and the model. Results are strikingly good for consumption between ages 25 and 50, and very satisfactory for housing wealth between 25 and 50 and homeownership between 25 and 30. However they also highlight the failure of the model in matching the profiles for financial wealth in the U.S.

The problem is that there is too much accumulation of financial wealth early in life in the U.S. model economy. In particular, the estimated earnings process for the U.S. exhibits so much variability that it implies a lot of precautionary savings in the form of both housing capital and financial assets (the portfolio choice depends mostly on the relative value of the rental rate of housing compared to the interest rate). This result does not arise in models which ignore rental markets (e.g. Fernández-Villaverde and Krueger, 2005; Yang, 2006). Ignoring rental markets, and therefore forcing agents to buy a house to enjoy utility from it, lead more agents to borrow to purchase the amount of housing capital they want at the beginning of their life. Otherwise, as already mentionned, because of the uncertainty surrounding future earnings and the borrowing constraint, young risk-averse agents would rather rent and save part of their earnings in the form of liquid financial assets. In our model, if we set the rental rate for housing capital so high that everyone would prefer to own, we can generate borrowing of the magnitude that is observed in U.S. data at young ages (see top-left panel in Figure 9).

The shape of the saving profiles is also at odds with what is observed in the data, especially after retirement. The drop in saving we observe in period 9 or 10 (age 60 or 65), depending on the retirement age in the model, comes from the absence of any precautionary motive for saving after retirement (the only source of uncertainty after retirement is the uncertainty regarding the duration of life). In the absence of any bequest motive, it is optimal for old agents to run down their assets in order to smooth the effect of the drop in income on consumption after retirement. Hence a large drop in saving after retirement. The presence of a bequest motive in our model partially limits that effect. However this bequest motive is not as trong as to have agents maintain, even less carry on accumulating, financial wealth as they age. Reinforcing the bequest motive by decreasing the value of ϕ_1 can help fixing this (in comparison, De Nardi (2004) targets a transfer wealth share of 60% in the U.S. against 20% in our calibration, and sets ϕ_1 equal to -9.5), but the empirical evidence for such an adjustement looks weak (Hurd, 1987). An alternative, more realistic solution is to introduce health expenditure shocks to give agents a precautionary motive for saving when old, as in De Nardi et al. (2006).

6 Decomposition

Since the focus of the paper is on the comparison between Italy and the U.S., it is useful to investigate which ingredients in the model are crucial for the results reported in the previous section. The main results are summarized in Table 5. Our benchmark model is the U.S. model economy. From this benchmark, we change one element at a time to see how it affects the shape of the life-cycle profiles.

6.1 Income uncertainty

As hinted before, the degree of income uncertainty is crucial in shaping the age-profiles for saving and financial wealth. The basic result is that the higher the income uncertainty is, the more precautionary saving we see. This "unpleasant" effect seems to make it impossible for our model to capture the differences in the age-profiles for financial wealth between Italy and the U.S.

Reducing earnings uncertainty in the benchmark model at the same level as in the Italian economy implies a smoother consumption profile and reduces the accumulation of financial wealth at the beginning of life. Hence the higher ratio of financial wealth at age 50 over financial wealth at age 25 on the second line of Table 5, as agents still want to have accumulated a certain level of wealth for life-cycle motive before retirement, at which point there is no earnings uncertainty anymore since pension benefits are solely a function of the agent's permanent shock.

In the extreme case of a purely deterministic earnings profile in the U.S. model economy, thus in the absence of any motive for precautionary saving, we get an average age-profile for financial wealth which remains negative until after age 50 as agents borrow in anticipation of higher future earnings (see Figure 9).

6.2 Pension system

The generosity of the social security system has a limited impact on the shape of the consumption profile and a more noticeable one on the profile for financial wealth. We consider the impact of a large increase in the replacement ratio ϱ from 0.31 in the benchmark economy to 0.75. The result is a smaller consumption decline after retirement (the ratio of consumption at age 50 to consumption at 75 drops from 1.20 to 1.13) and a flatter age-profile for financial wealth, as is clear in the bottom-right panel of Figure 9. Financial wealth at age 50 relative to financial wealth at age 25 is twice as small in the model with high pension benefits as in the benchmark economy.

We conclude that the observed differences in pension systems between Italy and the U.S. may at least partially account for the observed differences in the life-cycle pattern of financial wealth accumulation.

6.3 Housing transaction costs

In a partial equilibrium model, given the rental rate of housing capital r^h, higher transaction costs limit the accumulation of housing capital. In fact, since the level of r^h at which an agent is indifferent between owning or renting depends on the level of the transaction costs, simply increasing these costs in the benchmark model without adjusting r^h leads all young agents to rent rather than to own. Housing wealth and the homeownership ratio stay close to zero until age 65, before jumping up for bequest reasons.

6.4 Borrowing constraints

Given the possibility that agents have to rent housing capital, downpayment constraints have hardly any impact on the life-cycle profile for consumption. However the tightness of the borrowing constraint obviously affects the life-cycle profiles for both financial and housing wealth. The bottom-right panel of Figure 9 compares the age-profiles for financial wealth in the U.S. model economy and in the same economy with no borrowing. Forbiding any borrowing shifts the beginning-of-life profile up but the magnitude of that shift looks small. Still the no-borrowing constraint has a strong impact on housing wealth accumulation at young ages, as nobody now buys a house in the first period, so that the ratio of housing wealth at age 50 over housing wealth at 25 goes to infinity.

Conversely relaxing the borrowing constraint by imposing a very loose exogenous borrowing limit does not affect much the financial wealth profile at beginning of life. We did not get much action out of the endogenous borrowing constraint arising from equation (15) either.

7 Conclusion

This paper documents some striking differences in consumption and wealth age-profiles between Italy and the U.S. We use a partial equilibrium model calibrated on both economies to investigate the sources of these differences. We find that differences in consumption profiles can be easily explained by differences in earnings variability and riskiness over the life-cycle. The lower income uncertainty in Italy along with a more generous social security system also partially accounts for less financial wealth accumulation over the life-cycle.

We find that the introduction of rental markets in the model, while making it more realistic, also prevents it from capturing the observed differences in the age-profiles for financial wealth. For reasonable parameters' values, the model does not generate any net financial debt on average at young ages. This inability of the model to generate enough borrowing leads to question the standard specification of the borrowing constraint as a downpayment constraint in models with housing and encourages us to consider reasons other than house purchase for borrowing at the beginning of life in the U.S., like college borrowing for instance.

From a purely technical point of view, considering Epstein-Zin preferences instead of additive preferences could allow us to keep risk-aversion very low without affecting intertemporal substitution. Assuming a very low risk aversion in the U.S. would keep precautionary saving low and might help to bring the model-generated profile for financial wealth closer to the one estimated from the data.

This last point raises the question of the calibration of preference parameters in our model. For the comparison between the two model economies to be truly instructive, we fixed the values of these parameters at the same level in both economies. An interesting extension might be to estimate these parameters using the micro data we have for each country, as is done for the U.S. and with a simpler model in Gourinchas and Parker (2002).

A Data sources

A.1 Italy

We use the last nine waves (1987, 1989, 1991, 1993, 1995, 1998, 2000, 2002 and 2004) of the Italian Survey of Household Income and Wealth (SHIW) conducted by the Bank of Italy. Although mostly cross-sectional, the survey includes a small panel component starting in 1989, as about 15% of the households interviewed in 1987 were again interviewed in 1989. This panel component is used for the calibration of the endowment process.

The survey provides detailed data on households' income, consumption and wealth. Data on financial income and wealth were not collected before 1987. We use data from the historical database for years 1987 to 2004, as well as more detailed data from the annual database for 2004.

The structured dataset *CONSXX* in the historical database provides a measure of total consumption (C) and net disposable income excluding taxes and social security contributions and including transfers and income from financial assets (Y2), as well as a measure of saving (S2) for each household. To be consistent with U.S. data, we exclude fringe benefits (YL2) from both consumption and income. When indicated, imputed rents from owned properties (YCA2) are included in both income and consumption. Saving is computed as the difference between income and consumption.

For the calibration of the endowment process, we consider only wages, income from self-employment and social security transfers, and impute social security contributions of 25% on wages and 15% on income from self-employment (Brugiavini and Padula, 2003).

Household level aggregate wealth data are available from the dataset *RICFXX*. We use data from the basic datasets *LINBXX* and *LINCDXX* to subtract trade credit (liabilities) and financial loans (debt) linked to the operation of family businesses from total household financial assets (liabilities).

All data are deflated using the aggregate consumer price index, including tobacco, not seasonally adjusted, computed by Istat. All figures are expressed in 2000 euros. We use the euro/lire fixed exchange rate (1 euro = 1936.27 Italian lire) to convert data before 2002.

Data are adjusted for family size using a square root equivalence scale. This scale is used in recent publications by the OECD (e.g. Förster and Mira d'Ercole, 2005) and appears very close to the "mean" equivalence scale used in Fernández-Villaverde and Krueger (2004) for U.S. data.

We exclude households whose head is below 20 or was born after 1975.

A.2 United States

A.2.1 The Consumer Expenditure Survey

The Consumer Expenditure Survey (CEX) is the only microdataset that contains comprehensive information on household expenditures in the United States. It also includes data on household income and household wealth. Wealth data are however very often missing and generally considered of poor quality, which is why we rely on the Survey of Consumer Finances for U.S. household portfolio analysis.

The sample unit is a consumer unit, which may include individuals who are not part of the same household but make expenditure decisions jointly.

The CEX is a rotating panel. Each consumer unit is interviewed four times over one year (plus one contact interview for which no data is publicly available). Every month, one twelfth of the sample is replaced. Income data are collected only in the first and last interviews (reported data for income relate to income received in the past twelve months).

Consumption expenditures include both expenditures on non-durables (food, alcoholic beverages, tobacco, personal care, utilities, household operations, public transportation, gas and motor oil, apparel, education, reading, health and miscellaneous expenditures) and expenditures on durables (owned dwellings, rented dwellings, other lodging expenses, vehicles, entertainment and housefurnishings and equipement). When indicated, we include imputed rents for home owners who live in their house, using the estimated market rent provided by respondents. For the two years in our sample for which this variable is missing (1993 and 1994), we use an imputation procedure similar to Perri and Krueger (2005). Using data for 1995, we regress the reported market rent on self-reported property values, quadratics in income and non-housing consumption expenditures and a set of household characteristics (age and education of the reference person, region of residence and family composition). We allow for different coefficient values in case property values are not reported. The R^2 is equal to 0.26 and 0.51 for the two regressions. We then use the estimated regression coefficients to predict the rent of owned properties for homeowners in 1993 and 1994.

Income is defined as after-tax income. We subtract mandatory retirement contributions (social security taxes and railroad retirement contributions) from income. The measure of saving is the same as before.

Expenditure data are deflated using specific price indices for each broad category of expenditures (BLS current series for all urban consumers, not seasonally adjusted). Income data are deflated using the aggregate consumer price index (all items). All figures are expressed in 2000 U.S. dollars. As for Italian data, the data are adjusted for family size using a square root scale.

The data we use cover the period 1984-2003. Households who are interviewed before June of year n are assigned to year $n-1$.

We exclude all households that are not interviewed four times or whose income responses are incomplete. We also exclude households whose head is below 20 or was born after 1980. See Attanasio (1994, 1998) for a detailed discussion of the use of CEX data in analyzing U.S. household saving behavior.

A.2.2 The Survey of Consumer Finances

The Survey of Consumer Finances is a triennial survey of the balance sheet, pension, income, and other demographic characteristics of U.S. households, conducted by the Federal Reserve Board of Governors. We use data from six waves: 1989, 1992, 1995, 1998, 2001 and 2004.

Financial assets are computed as the sum of checking accounts, saving accounts, call accounts at brokerages, certificates of deposit, mutual funds, stocks, bonds, savings bonds, cash value of whole life insurance, other managed assets and other financial assets (e.g. loans to other households). Financial liabilities include housing debt (mortgages), other residential debt, owed amounts on lines of credit, credit card debt, vehicle loans, education loans, consumer loans, other installment loans, margin loans and loans against life insurance. For consistency with Italian data and our definition of income, we do not include retirement accounts wealth from future pensions (IRAs and thrift-type accounts) in financial assets, nor loans against pensions in financial liabilities.

The data are adjusted for family size and deflated using the aggregate consumer price index and expressed in 2000 U.S. dollars.

B Estimation of life-cycle profiles

B.1 Construction of pseudopanels

The absence of a true panel dimension in the surveys prevents us from computing life-cycle profiles using standard panel data econometric techniques. We get around that difficulty by exploiting the repeated nature of the surveys and constructing pseudopanels, grouping households in 5-year cohorts according to the age of the reference person, computing averages of the variables of interest using survey-provided sample weights, and following them over time to generate a panel.

B.2 A partially linear model with cohort and time dummies

We consider the following partially linear model to control for age, cohort and time effects:

$$\bar{y}_{j,t} = \beta_{1,j} cohort_j + \beta_{2,t} time_t + m(age_{j,t}) + \varepsilon_{j,t} \tag{B-1}$$

where $\bar{y}_{j,t}$ denotes the average of the variable of interest (i.e. log-consumption, log-income, saving rate...) across households of cohort j in year t, $cohort_j$ is a dummy for cohort j and $time_t$ is a dummy for year t and $m(age_{j,t})$ is a smooth unparameterized function of the age of cohort j in year t. The error term $\varepsilon_{j,t}$ satisfies the classical assumptions.

Let $\boldsymbol{X}$ denote the matrix of cohort and time dummies. To avoid collinearity issues, we assume that time effects are orthogonal to a time trend and that their sum is normalized to zero as in Deaton (1997). Thus we drop the dummies for the first two years as well as the dummy for the youngest cohort. The time effects for the first two years are recovered using the orthogonalization and normalization conditions. Equation (B-1) can be rewritten as:

$$\bar{\boldsymbol{y}} = \boldsymbol{X}\boldsymbol{\beta} + m(\boldsymbol{age}) + \boldsymbol{\varepsilon} \tag{B-2}$$

This model is estimated using Speckman's two-step estimator (1988). In the first step, the coefficients $\boldsymbol{\beta}$ for the parametric component are estimated with OLS on partial residuals (i.e. residuals from kernel smoothing of both the design matrix $\boldsymbol{X}$ and the response vector $\bar{\boldsymbol{y}}$). In the second step, the nonparametric component is estimated by smoothing the residuals with respect to the parametric part. See Härdle, Müller, Sperlich and Werwatz (2004) for details.

For nonparametric fitting, we use a Nadaraya-Watson kernel weight function with Epanechnikov kernel. We follow Fernández-Villaverde and Krueger (2004) for the choice of the bandwith parameter and set it equal to 5. We check that changes in this parameter do not significantly modify our results.

The advantages of the semiparametric procedure over the traditional approach using age dummies are discussed in Fernández-Villaverde and Krueger (2004).

C Computation of the model

We exploit the recursive structure of the agent's decision problem and solve the model by backward induction using value function iteration, for a given interest rate r, a given rental rate of housing capital r^h and a given distribution of bequests. For each agent, the state variables are $(j, \omega, y, a, th, \omega^p)$.

The estimated labor earnings process is approximated using the procedure proposed by Tauchen (1986). We use $n_\omega = 2$ points for the permanent income shock and $n_z = n_\eta = 3$ points for both the persistent and transitory shocks.

The state vector includes two continuous variables: asset holdings a and owned housing capital $t.h$. We treat housing capital as a discrete variable and use a grid search to look for the optimal h'. We approximate the value functions with respect to asset holdings using two alternative interpolation schemes: linear and Schumaker shape-preserving spline interpolation (Judd, 1998).[2] We use an endogenous grid for asset holdings, whose lower bound is a function of j, w or $t'.h'$, depending on the specification of the borrowing constraint. Results are potentially very sensitive to the fineness of the grid for housing capital as the choice of housing is discrete. We construct the grid for housing capital so that points are more concentrated around low values of h and adjust the upper bound and the number of points to avoid big jumps in the grid. We set $n_h = 30$ and $n_a = 20$ gridpoints for housing capital and asset holdings respectively. Thus the total size of our state space is equal to 453,600 points (14 periods $\times$ 2 types $\times$ 3 possible persistent shocks $\times$ 3 possible transitory shocks $\times$ 30 points for housing capital $\times$ 20 points for asset holdings $\times$ (2+1) values for ω^p).

The treatment of the borrowing constraints deserves special attention. Introducing the downpayment constraint is fairly straightforward, since it assigns a lower bound on asset holdings to all gridpoints for housing, given by the right hand side of equation (13). Thus we can construct an endogenous grid for asset holdings for any possible choice of housing capital.

To implement the incentive compatibility constraint, we compute the state specific borrowing limit while solving the agent's problem. After solving for the value function in period $j+1$, we compute the agents' optimal choices of asset holdings and housing capital in period j. We solve then equation (15) with equality for the borrowing limit at age j.

Once all optimal decision rules for any point in the state-space are obtained, we compute the population stationary distribution assuming that agents are born with zero assets and no housing capital. This distribution along with optimal decision rules is used to update the bequest distribution. We iterate until convergence.

Finally we check that the distributions of housing capital and asset holdings do not have a large mass at the maximum. If so, we increase that maximum and start the whole solution algorithm again.

[2]The results obtained with the two methods are virtually identical if the number of grid points is high enough.

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Table 1: Cross-country differences in mortgage market characteristics

	Italy	U.S.
Mortgage debt as % of GDP	14.5	64.5
Contract features		
Down payment ratio	40	11
Usual contract length (years)	5-20	30
Home equity withdrawal	No	Yes
Use of mortgage-backed securities	No	Extensive
Mortgage enforcement procedures		
Usual time required (months)	60-84	8.4
Administrative costs (in % of loan)	14-18	11.5

Sources: European Mortgage Federation, OECD, BIS and Chiuri-Jappelli (2003).

Table 2: Demand for credit in 2004

	Italy	U.S.
Households with debt (% of population)	22.1	76.5
Households with mortgage debt (% of population)	11.9	45.9
Credit applicants[1] (% of population)	4.7	68.7
Rejected applicants[1] (% of population)	0.1	11.3
Partially granted applications[1] (% of population)	0.4	1.7
Deterred applicants[1] (% of population)	2.1	15.8
Borrowing constrained (% of effective or deterred applicants)	39.5	30.1

[1] figures refer to the past 12 months for Italy and the past five years for the U.S.

Sources: SWIH annual database and SCF.

Table 3: Calibrated parameter values

Parameters		Italy	United States
Demographics			
n	annual population growth rate	0.002	0.011
Technology			
δ	depreciation rate of housing capital	2.9% /year	2.9% /year
Endowment			
σ_γ^2	variance of permanent shock	0.1086	0.1523
ρ	AR(1) coefficient of persistent shock	0.8782	0.9989
σ_ϵ^2	variance of the innovation to the persistent shock	0.0714	0.0007
σ_η^2	variance of the transitory shock	0.0637	0.2065
Pension system			
j^R	retirement age	9 (age 60)	10 (age 65)
τ	pension tax rate	15.7%	5.6%
ϱ	replacement ratio	58%	31%
Preferences			
β	discount factor	0.946 /year	0.946 /year
γ	coefficient of risk aversion	2	2
$1/\alpha$	elasticity of substitution	1	1
θ	aggregation parameter	0.74	0.74
ψ	utility gain from owning	6.4%	6.4%
ϕ_1	utility weight of bequest	-2	-2
ϕ_2	shifter of bequest	1	1
Transaction costs			
μ	maximum depreciation/renovation	14%	14%
κ_1	transaction cost on sales	6%	7%
κ_2	transaction cost on purchases	16%	2%
Borrowing constraint			
λ	downpayment requirement	0.6	0.3
Prices			
r	annual interest rate	4%	4%
r^h	annual rental rate of housing	5.9%	5.3%

Table 4: Results for the U.S. and Italian economies

	$\frac{\text{consumption}_{50}}{\text{consumption}_{25}}$	$\frac{\text{consumption}_{50}}{\text{consumption}_{75}}$	$\frac{\text{income}_{50}}{\text{income}_{25}}$	$\frac{\text{income}_{50}}{\text{income}_{75}}$	$\frac{\text{homeownership}_{30}}{\text{homeownership}_{25}}$	$\frac{\text{housing wealth}_{50}}{\text{housing wealth}_{25}}$	$\frac{\text{housing wealth}_{50}}{\text{housing wealth}_{75}}$	$\frac{\text{financial wealth}_{50}}{\text{financial wealth}_{25}}$	$\frac{\text{financial wealth}_{50}}{\text{financial wealth}_{75}}$
Italy (data)	1.17	0.94	1.34	0.94	1.18	2.14	0.48	2.46	0.65
Italy (model)	1.48	1.29	1.43	2.04	1.80	4.47	0.89	10.55	2.35
United States (data)	1.55	1.01	2.00	1.08	1.48	5.24	0.59	-9.85	0.21
United States (model)	1.96	1.20	1.95	2.32	3.06	9.24	0.86	10.82	1.18
U.S./Italy (data)	**1.32**	**1.07**	**1.49**	**1.15**	**1.25**	**2.45**	**1.23**	-4.60	0.45
U.S./Italy (model)	**1.32**	**0.93**	**1.36**	**1.14**	**1.70**	**2.07**	**0.97**	1.03	0.50

Note: Consumption includes both paid and imputed rents. Imputed rents are included in income.

Table 5: Decomposition of the impact of institutional differences

	$\frac{\text{consumption}_{50}}{\text{consumption}_{25}}$	$\frac{\text{consumption}_{50}}{\text{consumption}_{75}}$	$\frac{\text{income}_{50}}{\text{income}_{25}}$	$\frac{\text{income}_{50}}{\text{income}_{75}}$	$\frac{\text{homeownership}_{30}}{\text{homeownership}_{25}}$	$\frac{\text{housing wealth}_{50}}{\text{housing wealth}_{25}}$	$\frac{\text{housing wealth}_{50}}{\text{housing wealth}_{75}}$	$\frac{\text{financial wealth}_{50}}{\text{financial wealth}_{25}}$	$\frac{\text{financial wealth}_{50}}{\text{financial wealth}_{75}}$
Benchmark (U.S. model)	1.96	1.20	1.95	2.32	3.06	9.24	0.86	10.82	1.18
Italian uncertainty level	1.78	1.25	1.95	2.39	2.04	11.62	0.89	13.30	1.03
Higher replacement ratio	2.01	1.13	1.90	1.64	5.64	27.29	0.76	5.07	2.22
Higher transaction costs	1.89	1.21	1.88	2.18	-	-	0	9.18	1.19
No borrowing	1.93	1.24	2.06	2.41	-	-	0.81	6.21	1.16

Note: Consumption includes both paid and imputed rents. Imputed rents are included in income.

Figure 1: Consumption age-profiles

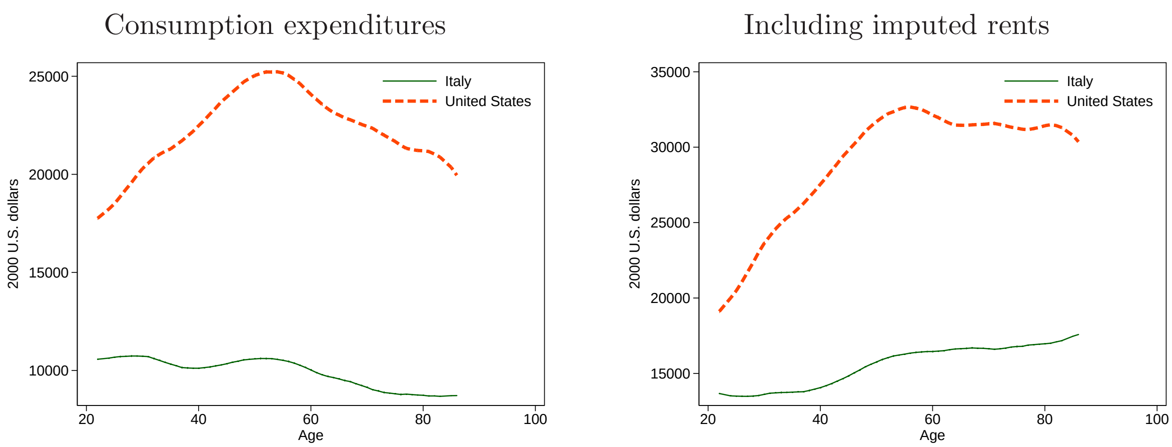

Figure 2: Income age-profiles

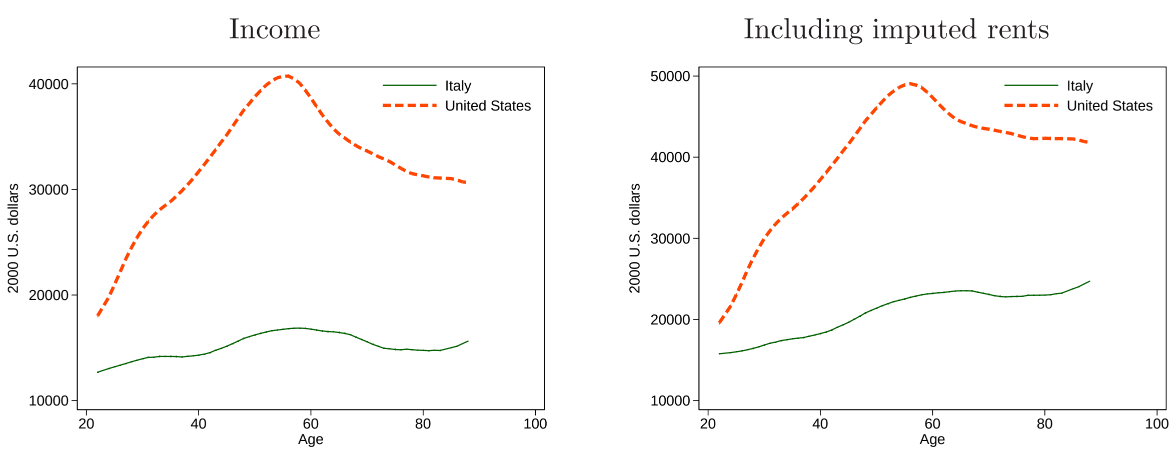

Figure 3: Saving age-profiles

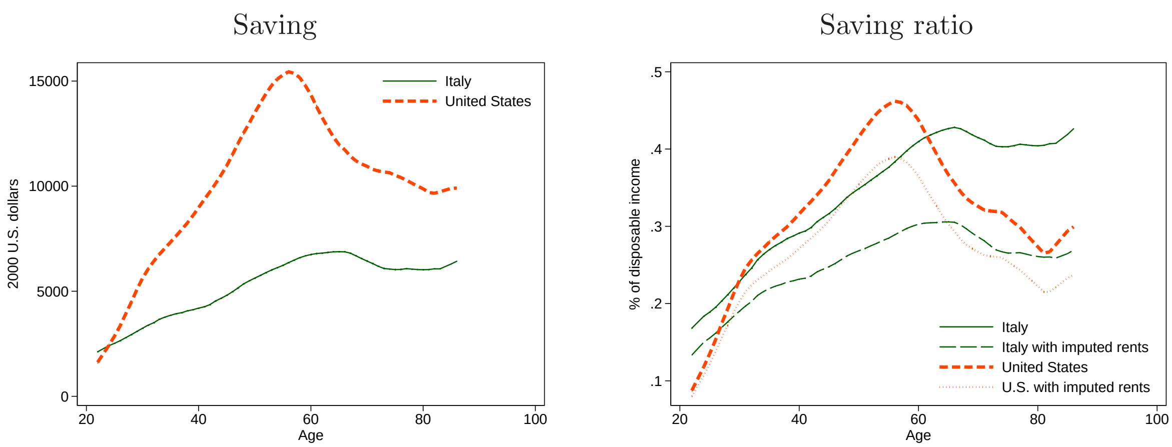

Figure 4: Housing age-profiles

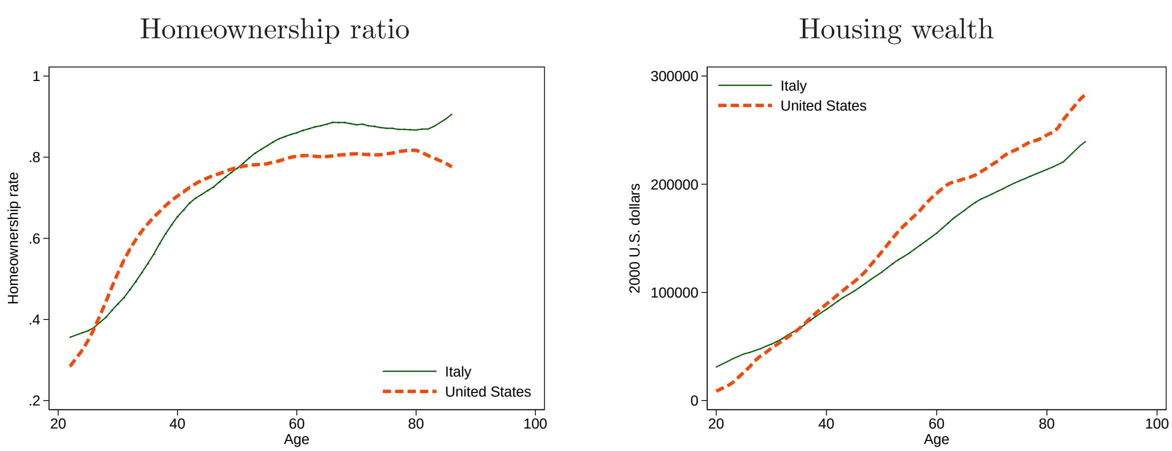

Figure 5: Wealth age-profiles

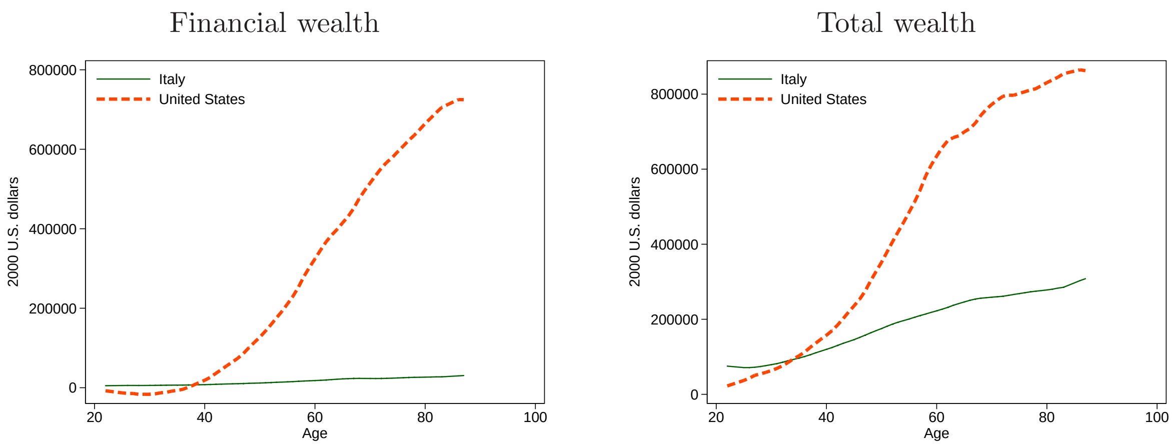

Figure 6: Comparison of age-profiles in the two model economies

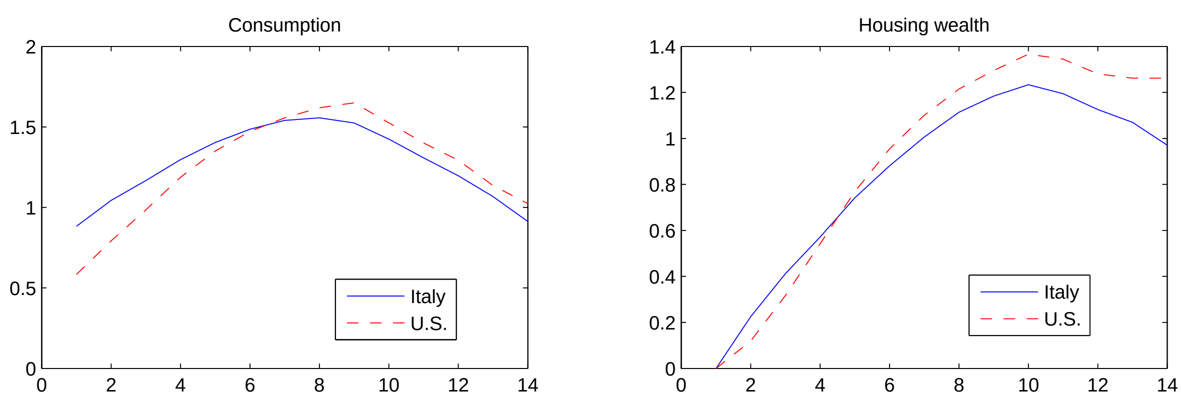

Figure 7: Average life-cycle profiles from the model - Italian economy

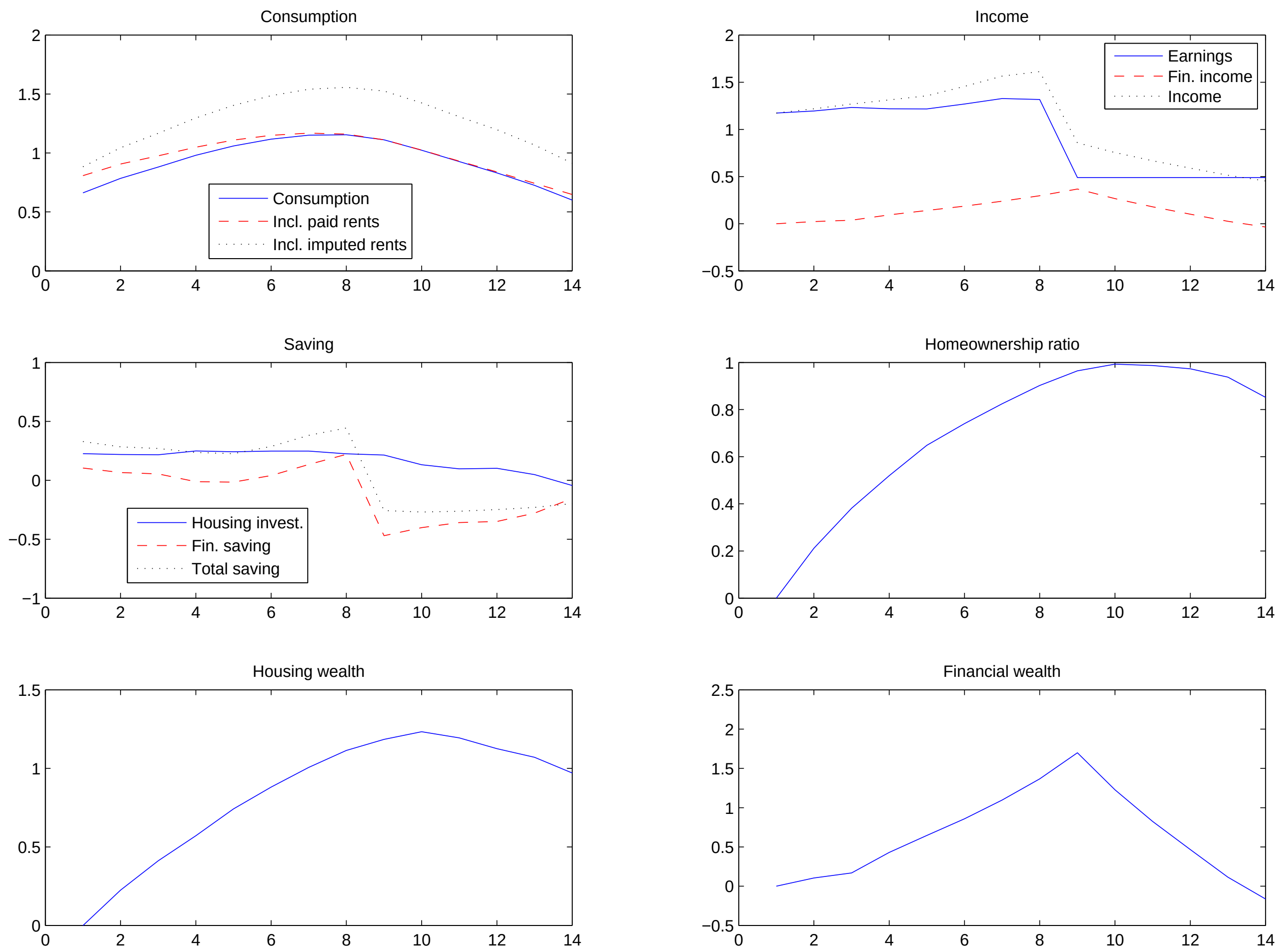

Figure 8: Average life-cycle profiles from the model - U.S. economy

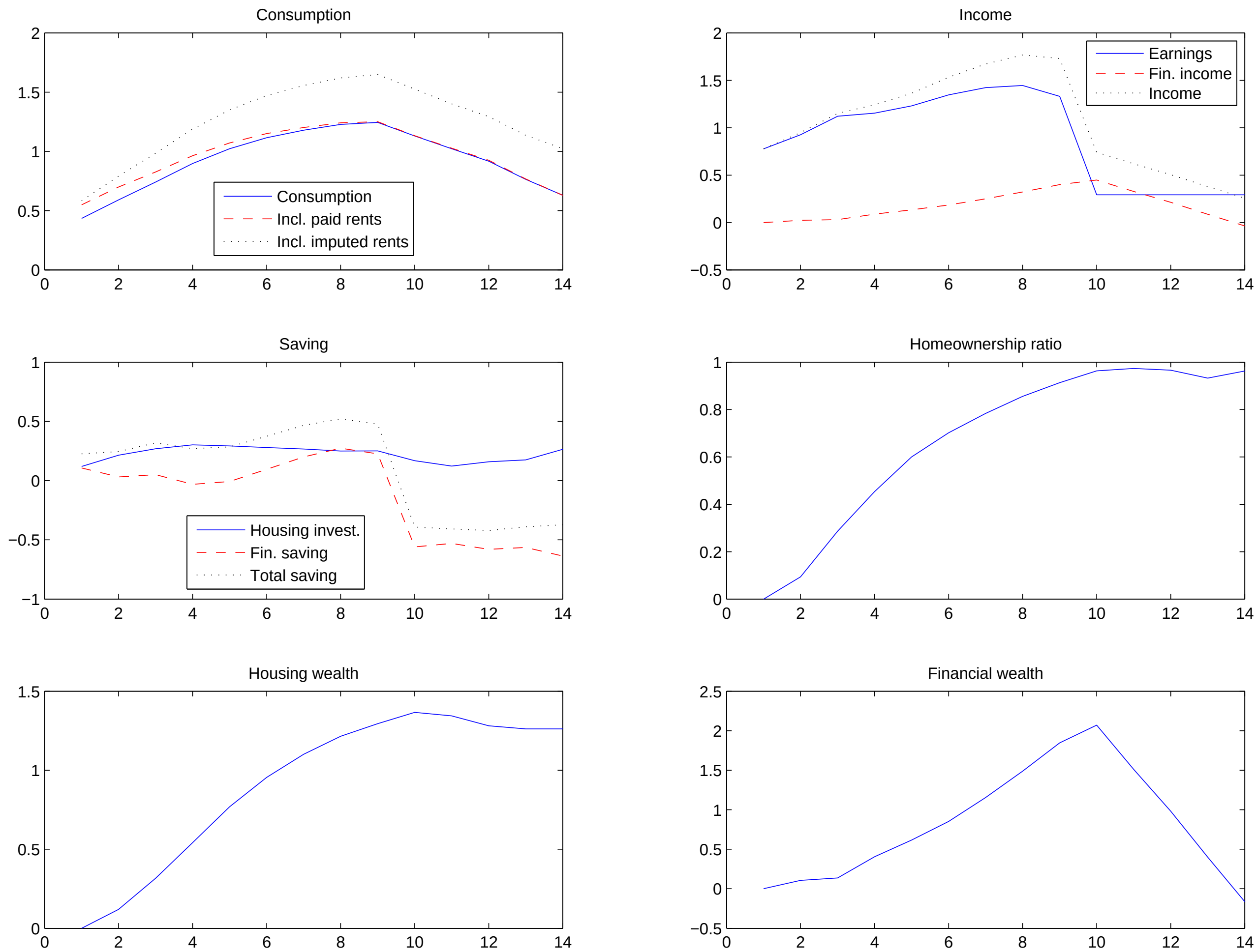

Figure 9: Financial wealth age-profiles