14.13 Economics and Psychology (Lecture 18)

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1 Consumption path experiment

Pick a consumption path (ages 31 to 60).

1. You are deciding at age 30 and face no uncertainty (e.g., health, demographics, etc).

2. Consumption represents consumption flows (e.g., consumption of housing is calculated on a flow basis).

3. The path that you pick will be your actual consumption path (i.e., you won't have access to asset markets to make inter-temporal reallocations).

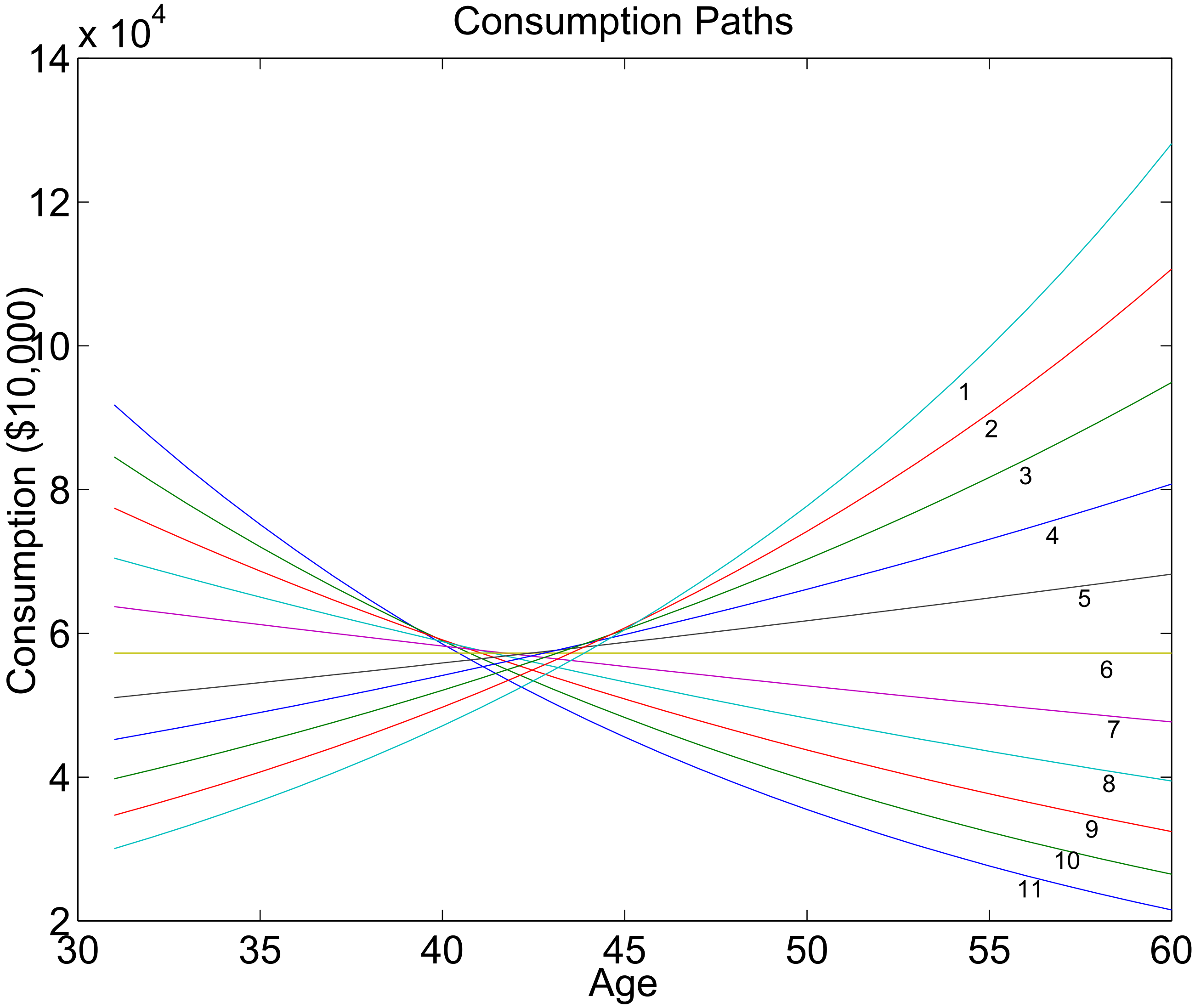
4. Your household needs will not change over the lifecycle (e.g., no kids to send to college)

5. You are guaranteed to survive until at least age 60.

6. All paths have the same net present value ($1,000,000) assuming a 4% discount rate.

7. The inflation rate is 0%.

I let you choose among 11 paths.


Consumption Paths
x 10^4
14
12
10
8
6
4
2
Consumption ($10,000)
30
35
40
45
50
55
60
Age
1
2
3
4
5
6
7
8
9
10
11

Distribution of choices:

Path Number	$\frac{\dot{c}}{c}$	Frequency
1	$+0.05$	1
2	$+0.04$	0
3	$+0.03$	1
4	$+0.02$	4
5	$+0.01$	4
6	$+0.00$	4
7	-0.01	1
8	-0.02	2
9	-0.03	0
10	-0.04	0
11	-0.05	0

Median choice: path 5, with implied growth rate $+.01$.

Other studies find similar result: under reasonable interest rate assumptions, subjects pick flat or rising consumption profiles.

2 Six facts about household consumption

% with $\frac{\text{liquid}}{Y} > \frac{1}{12}$	42%
mean $\frac{\text{liquid assets}}{\text{liquid} + \text{illiquid assets}}$	.08
% borrowing on "Visa"	70%
mean borrowing	\$5000
C-Y comovement	$\alpha = .23$
% C drop at retirement	12%

$$\Delta \ln(C_{it}) = \alpha E_{t-1} \Delta \ln(Y_{it}) + X_{it}\beta + \varepsilon_{it} \tag{1}$$

$$\Delta \ln(C_{it}) = I_{it}^{\mathsf{RETIRE}} \gamma + X_{it}\beta + \varepsilon_{it} \tag{2}$$

3 A simulation model

Today: empirical evidence for hyperbolic discounting.

- Write down the exponential and hyperbolic **lifecycle consumption problems**.

- Calibrate both models (to match the empirical level of wealth accumulation).

- Simulate both models.

- Compare simulation results to available empirical evidence.

- Angeletos, Laibson, Tobacman, Repetto and Weinberg, The Hyperbolic Buffer Stock Model: Calibration, Simulation, and Empirical Evaluation, Journal of Economic Perspectives, 15(3), Summer, 47-68

3.1 Demographics

- Mortality (US life tables)

- Retirement (timing calculated using PSID)

- Dependents (lifecycle profile calculated using PSID)

- Three levels of education for the household head:
  - No high school
  - High school

- College

- Stochastic labor income (PSID)

$$\ln Y_t = y_t = f(t) + u_t + v_t$$

$f(t)$ is a polynomial function of age, t; v_t is iid;

$$u_t = \alpha u_{t-1} + \varepsilon_t$$

ε_t is iid

3.2 Assets

- Real after-tax rate of return on liquid assets: 3.75%

- Real after-tax rate of return on illiquid investment: 5.00%

- Real credit card interest rate: 11.75%

- Credit card credit limit: (.30)($\bar{Y}_t$) (SCF)

3.3 Preferences

- Intertemporal utility function, with discount function $\Delta(i)$

$$U_t = u(c_t) + \sum_{i=1}^{\infty} \Delta(i) u(c_{t+i}).$$

- Constant relative risk aversion

$$u(c) = \frac{c^{1-\rho}}{1-\rho}$$

- Quasi-hyperbolic discounting (Laibson, 1997):
  $\{\Delta(i)\}_{i=0}^{\infty} = \{1,\ \beta\delta,\ \beta\delta^2,\ \beta\delta^3,\ \ldots\ \}$

- For exponentials: $\beta = 1$

- For hyperbolics: $\beta = 0.7$

- Calibration: Pick value of $\delta^{\text{Exponential}}$ that matches observed retirement wealth accumulation.

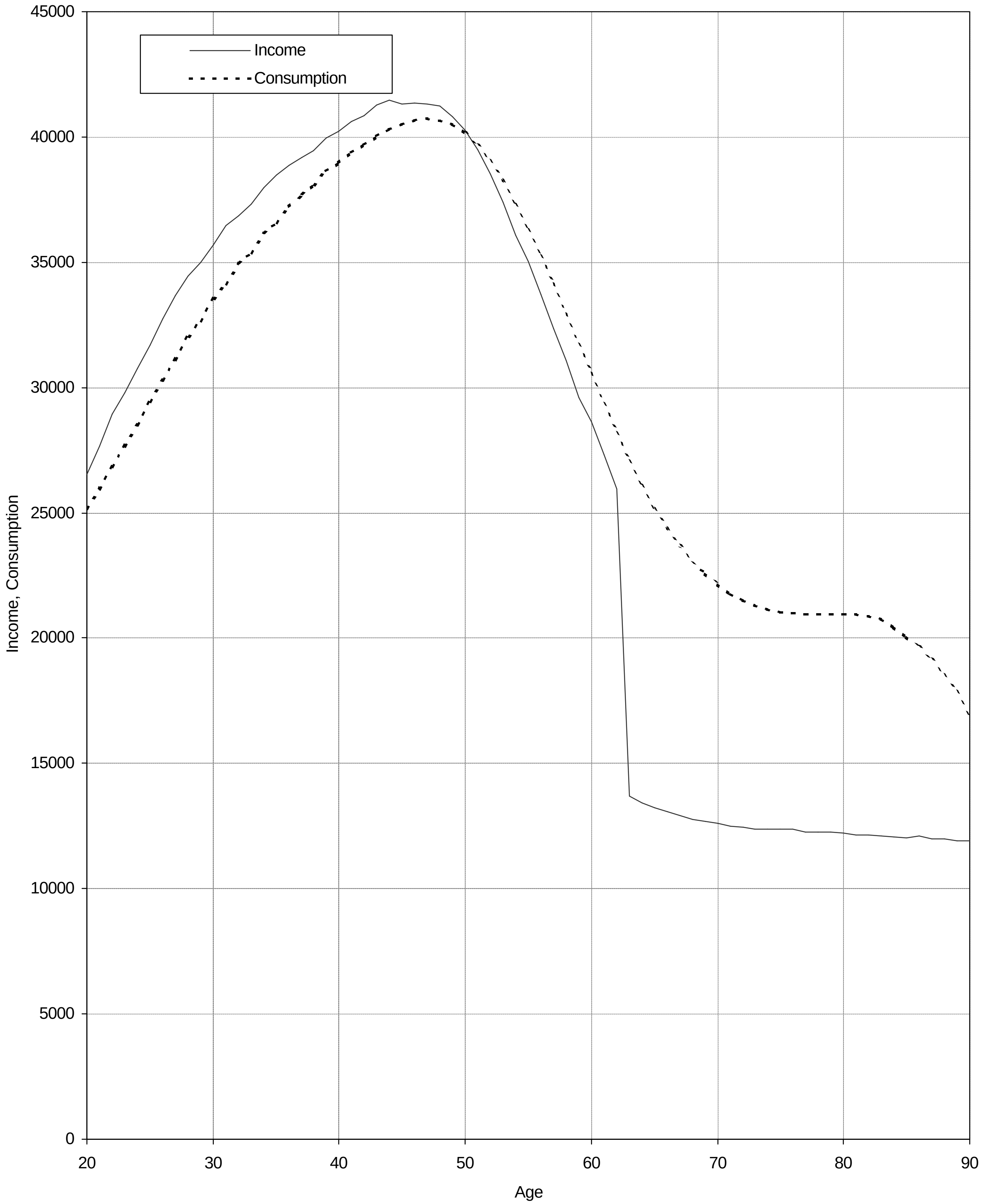
- Note that median wealth to income ratio from ages 50-59 is about 3.

- To match this median we set $\delta^{\text{Exponential}} = .95$.

- Do same for $\delta^{\text{Hyperbolic}}$.

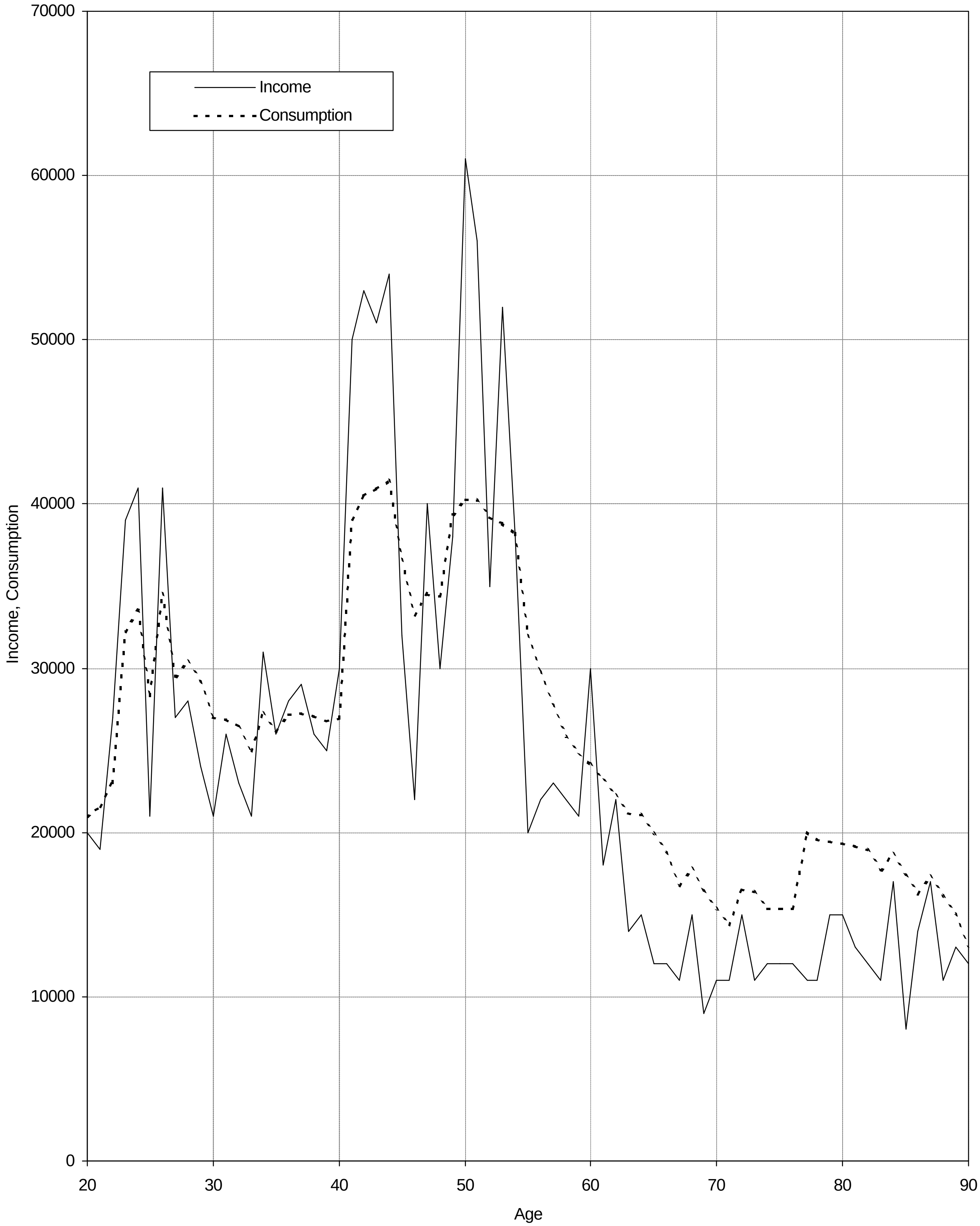
- So $\delta^{\mathsf{Hyperbolic}} = .96$.

Figure 2: Simulated Mean Income and Consumption of Exponential Households



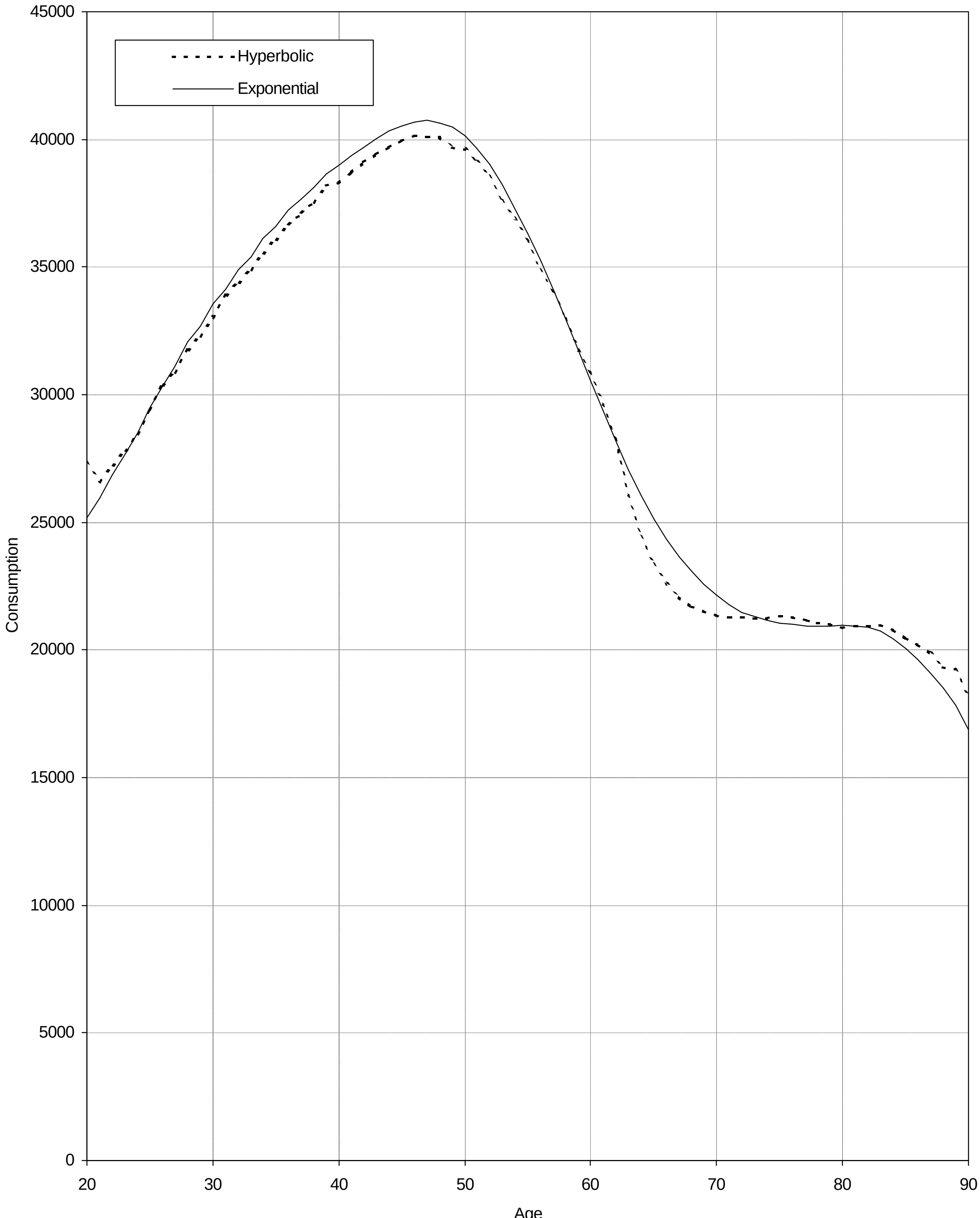
Source: Authors' simulations.
The figure plots the simulated average values of consumption and income for households with high school graduate heads.

Figure 3: Simulated Income and Consumption of a Typical Exponential Household



Source: Authors' simulations.
The figure plost the simulated life-cycle profiles of consumption and income for a typical household with a high school graduate head.

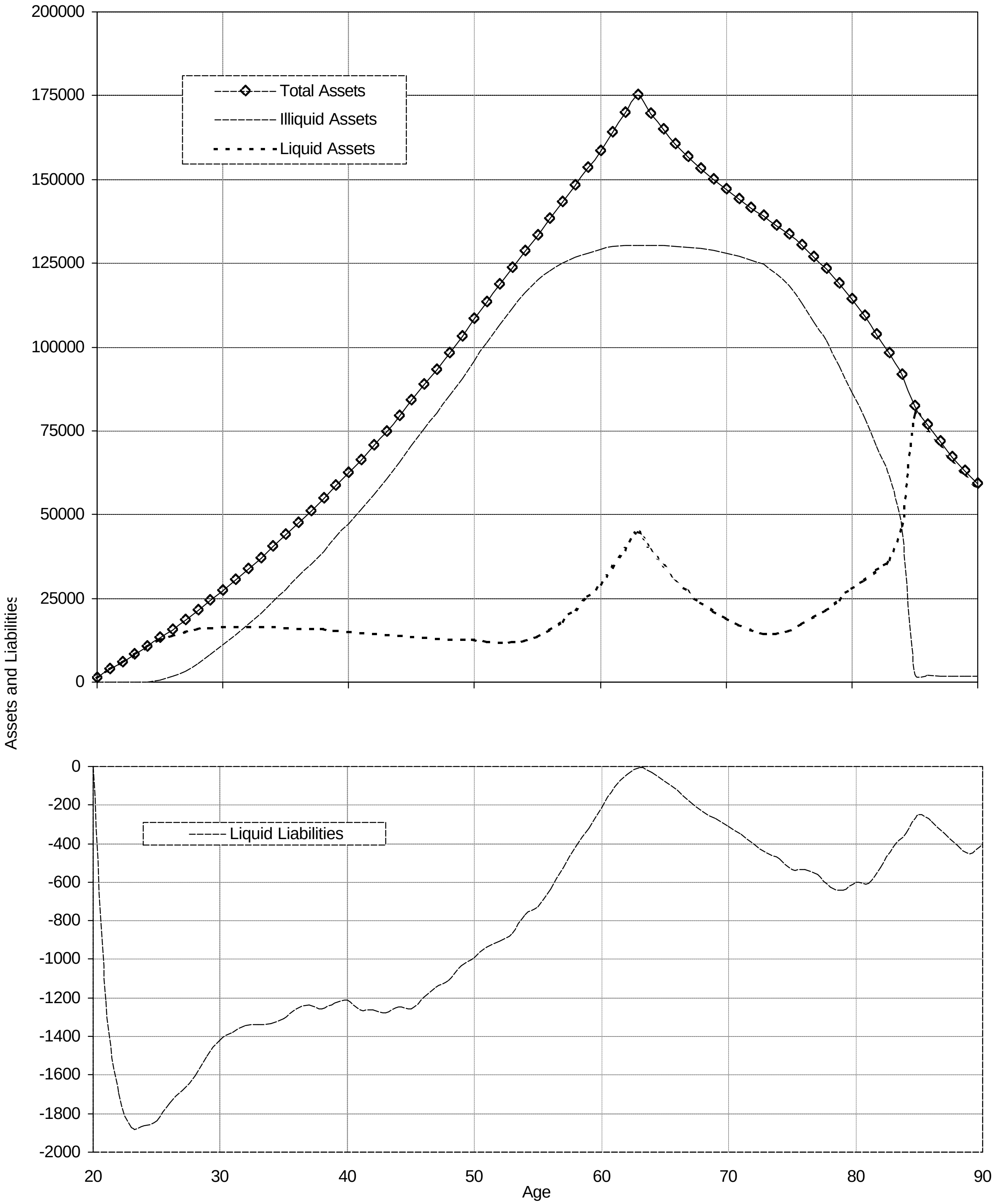
Figure 4: Mean Consumption of Exponential and Hyperbolic Households



Source: Author's simulations.

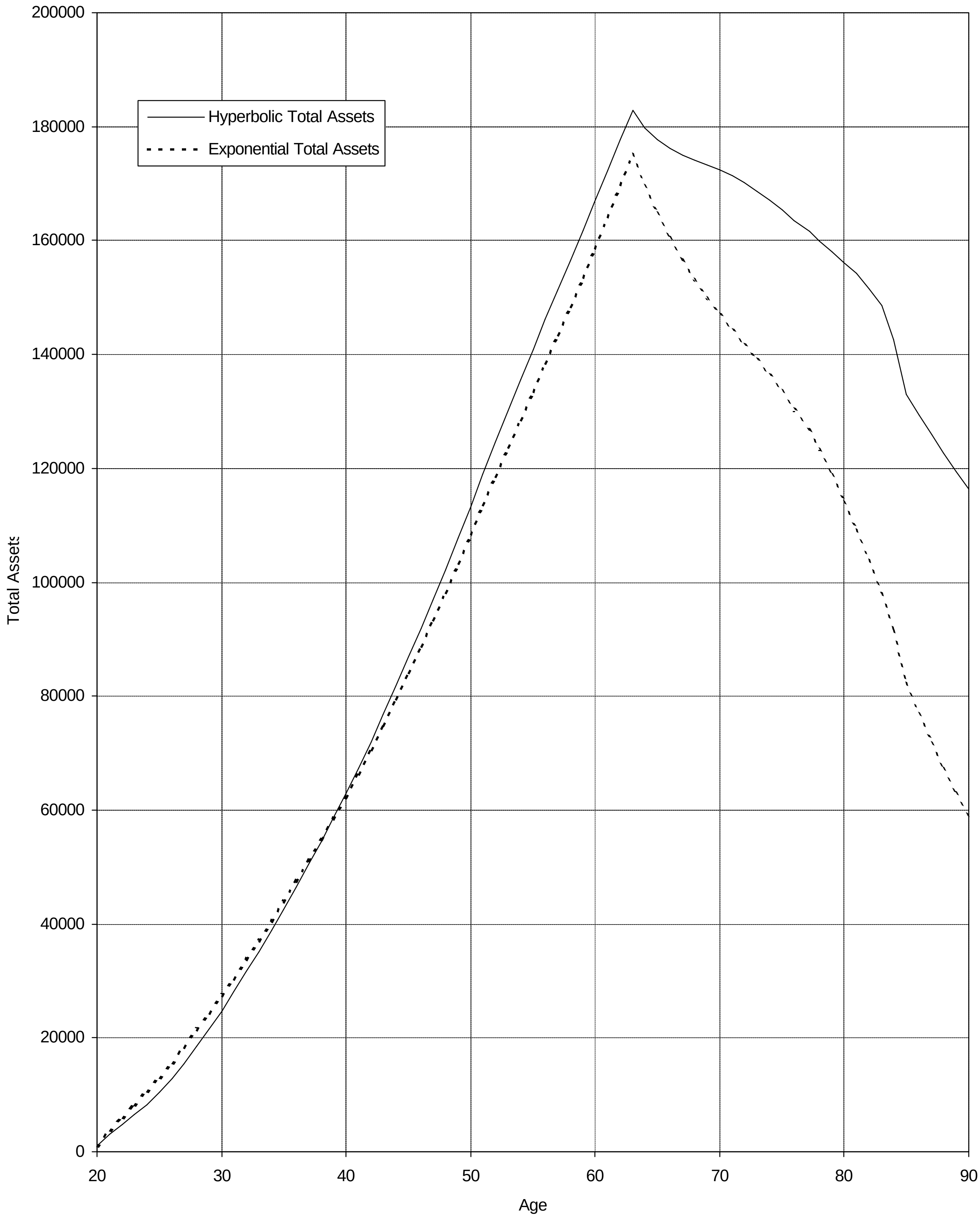
The figure plots average consumption over the life-cycle for simulated exponential and hyperbolic households with high-school graduate heads.

Figure 5: Simulated Total Assets, Illiquid Assets, Liquid Assets, and Liquid Liabilities for Exponential Consumers



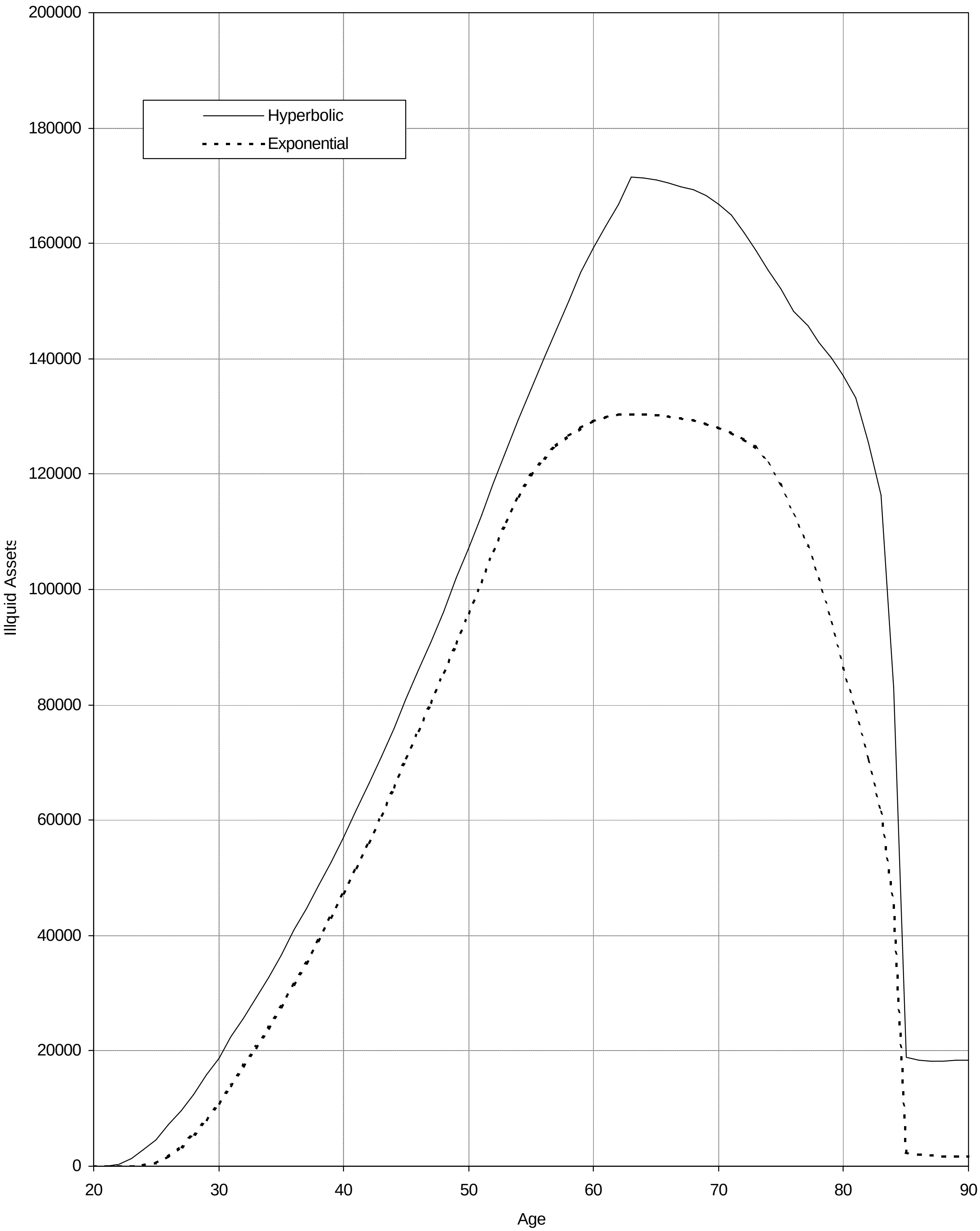
Source: Authors' simulations.
The figure plots the simulated mean level of liquid assets (excluding credit card debt), illiquid assets. total assets, and liquid liabilities for households with high school graduate heads.

Figure 6: Mean Total Assets of Exponential and Hyperbolic Households



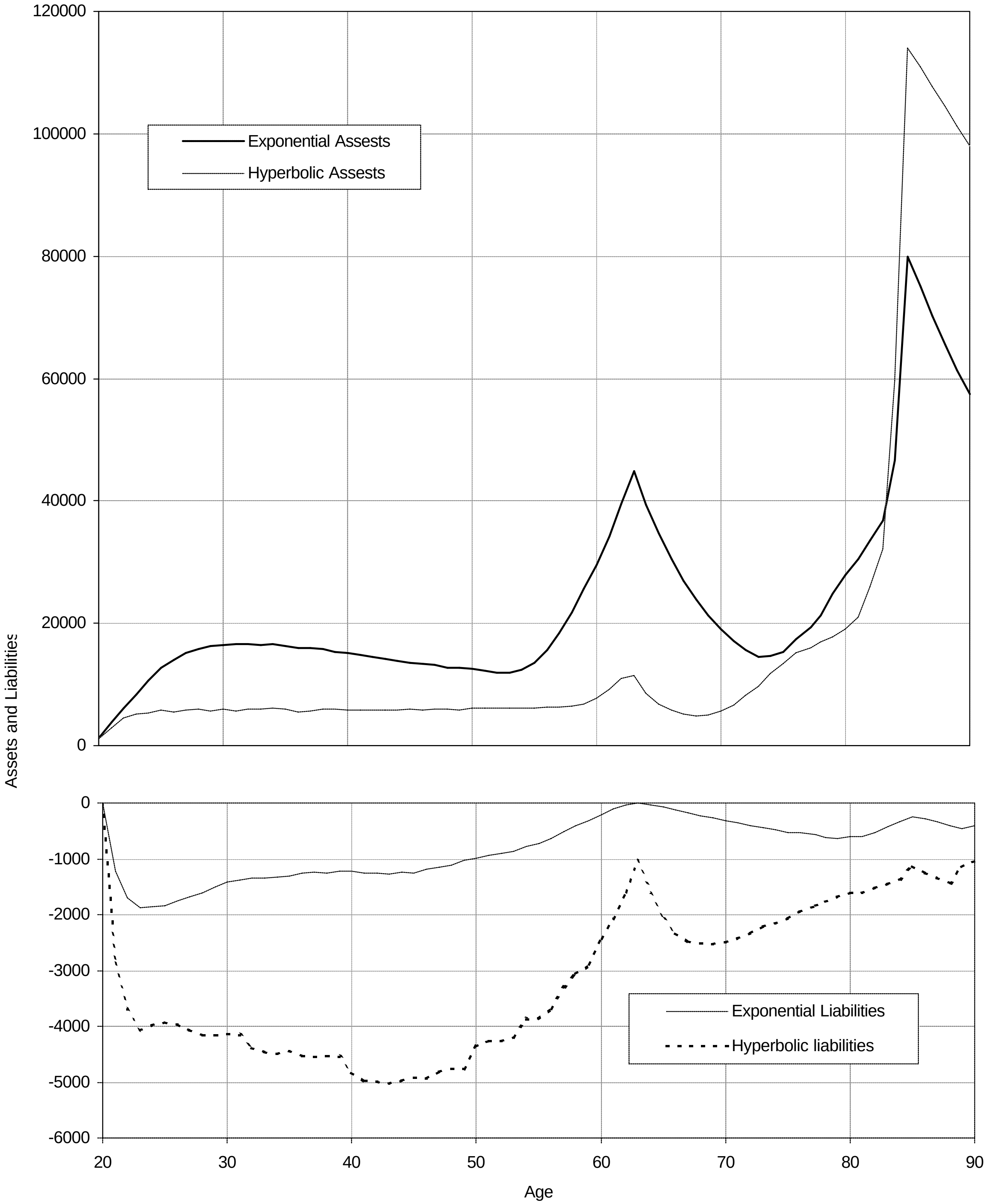
Source: Author's simulations.
The figure plots mean total assets, excluding credit card debt, over the life-cycle for simulated exponential and hyperbolic households with high school graduate heads.

Figure 7: Mean Illiquid Wealth of Exponential and Hyperbolic Households



Source: Authors' simulations.
The figure plots average illiquid wealth over the life-cycle for simulated exponential and hyperbolic households with high school graduate heads.

Figure 8: Mean Liquid Assets and Liabilities of Exponential and Hyperbolic Households



Source: Authors' simulations.
The figure plots average liquid assets (liquid wealth excluding credit card debt) and liabilities (credit card debt) over the life-cycle for simulated exponential and hyperbolic households with high school graduate heads.

If consumers are hyperbolic, they will exhibit...

1. low levels of liquid wealth (liquid/Y)
2. low liquid wealth shares (liquid/[liquid + illiquid])
3. frequent credit card borrowing
4. consumption-income comovement
5. consumption drops at retirement

We evaluate these predictions with available evidence on household balance sheets (Survey of Consumer Finances) and consumption (Panel Survey of Income Dynamics).

	EXP	HYP	$DATA$
% with $\frac{\text{liquid}}{Y} > \frac{1}{12}$	73%	40%	42%
mean $\frac{\text{liquid assets}}{\text{liquid + illiquid assets}}$	.50	.39	.08
% borrowing on "Visa"	19%	51%	70%
mean borrowing	\$900	\$3408	\$5000
C-Y comovement	.03	.17	.23
% C drop at retirement	3%	14%	12%

$$\Delta \ln(C_{it}) = \alpha E_{t-1} \Delta \ln(Y_{it}) + X_{it}\beta + \varepsilon_{it} \tag{3}$$

$$\Delta \ln(C_{it}) = I_{it}^{\mathsf{RETIRE}} \gamma + X_{it}\beta + \varepsilon_{it} \tag{4}$$

Method of simulated moments (MSM) estimation:

- $\beta \approx .6 \pm .05$ s.e.
- $\delta \approx .96 \pm .01$ s.e.

Summary

- In some respects, exponentials and hyperbolics are observationally similar.

- However, many differences do arise.

- Differences emphasized today:

1. low levels of liquid wealth (liquid/Y)

2. low liquid wealth shares (liquid/[liquid + illiquid])

3. frequent credit card borrowing

4. consumption-income comovement

5. consumption drops at retirement