

# **Annuities and Life Cycle Asset Allocation**

presented by

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## Our Questions

- How to help workers and retirees manage their money up to and through retirement?
  - ↳ Portfolio choice across stocks, bonds, (variable) **fixed payout life annuities**
- In view of...
  - ↳ Uncertain labor income
  - ↳ Uncertain capital market returns
  - ↳ Uncertain time of death (longevity risk)
  - ↳ Asymmetric mortality beliefs
  - ↳ Preexisting DB-Pension-Income (e.g. Public Pension)
  - ↳ Different Preferences (Bequest, Risk Aversion, ...)
  - ↳ etc.

# Annuity Mechanics I: Survival Credit

- *Simple 1-period example:*
  - ↳ *Alternative 1: direct bond investment*
  - ↳ *Alternative 2: invest in bonds through annuity*
  
- *Interest rate:  $r = 2\%$ , survival prob.:  $p = 80\%$*

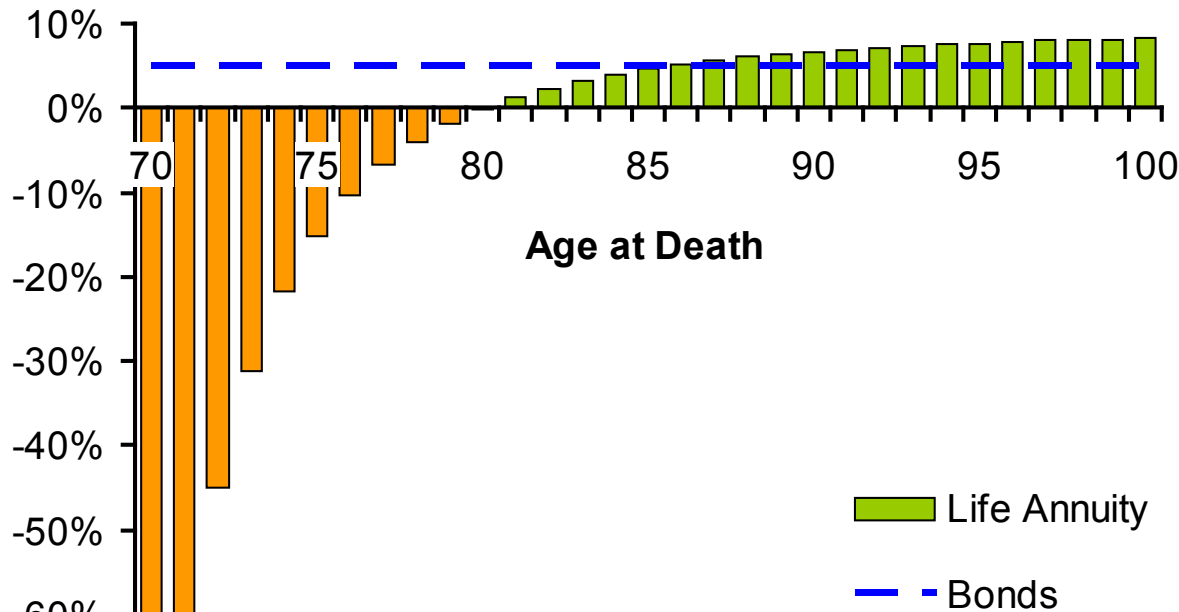
<b>Initial Investment</b>	<b>End-of-year payoff (RoI)</b>	
	<b>Alive</b>	<b>Dead</b>
<b>(1) 100 (in bond)</b>	<b><math>100(1+r) = 102</math> (RoI = 2%)</b>	<b><math>100(1+r) = 102</math> (RoI = 2%)</b>
<b>(2) 100 (in annuity)</b>	<b><math>100(1+r)/p = 127.5</math> (RoI = 27.5%)</b>	<b>0 (RoI = -100%)</b>

**Survival Credit = 25.5 (compensation for no bequest)**

# Annuity Mechanics II - Life Annuity vs. Bond Investment

Return on Investment  
(Conditional on Death)

Current Yield p.a.  
(Conditional on Surv.)



Payout Bonds = \$ 5.5 p.a.  
Payout Annuity = \$ 8.5 p.a.

Survival Credit = \$ 3 p.a.

→  $\$ 8.5 / \$ 5.5 - 1 = 54\%$

Assumptions:

- 70 year old male
- Initial Investment \$ 100
- 5% Interest Rate
- Annuitant Mort. Table

# The Multi-Period Life-Cycle Model

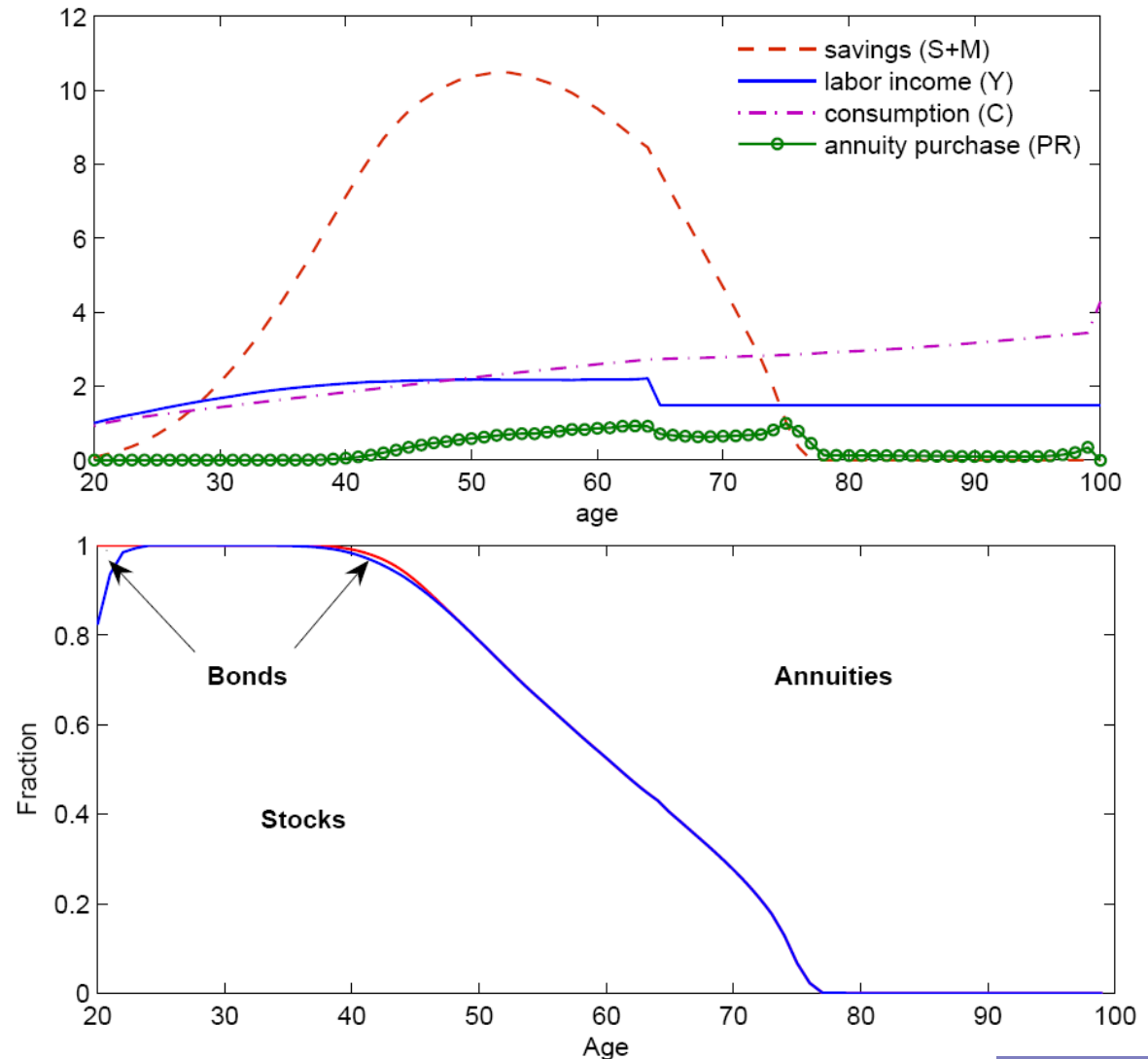
- Household: Rational dynamic utility optimizer (female)
  - ↪ **Uncertain labor income** (profile: high school education)
  - ↪ Retirement from age 65 on (public pension fraction of last salary)
  - ↪ **Uncertain time of death**: age 20-100 based on empirical mortality
  - ↪ **Borrowing restrictions**
- Capital & Insurance markets
  - ↪ Riskless bonds: 2% p.a. (real terms)
  - ↪ **Risky stocks**: expected return 6% p.a. with standard deviation 18%
  - ↪ Life-annuity with immediate fixed payments, **purchase irreversible**
- Derive optimal consumption, investment, and decumulation plan (stocks, bonds, and annuities) over the life cycle by numerical dynamic optimization

# Expected Life-Cycle Profile – Base Case

## ➤ Asset allocation:

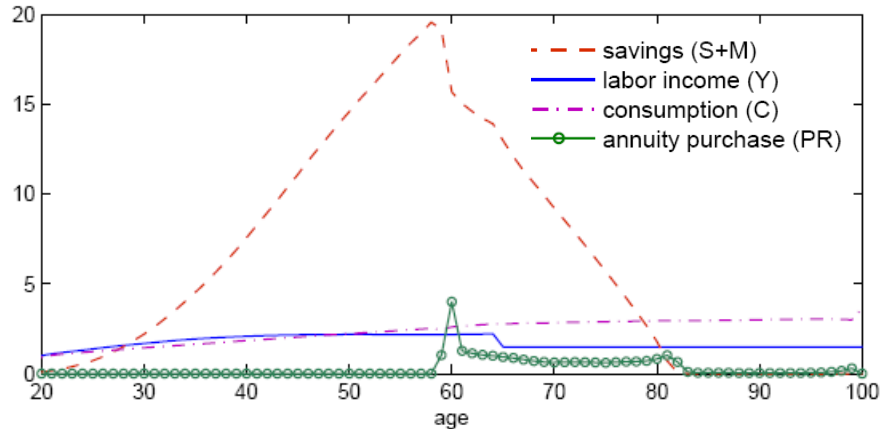
- **Gradual** shift from liquid savings to illiquid annuities
- Start to buy annuities at age 43
- First crowding out of bonds then of stocks
- Full annuitization at age 78

## No Costs / No Bequest Motive

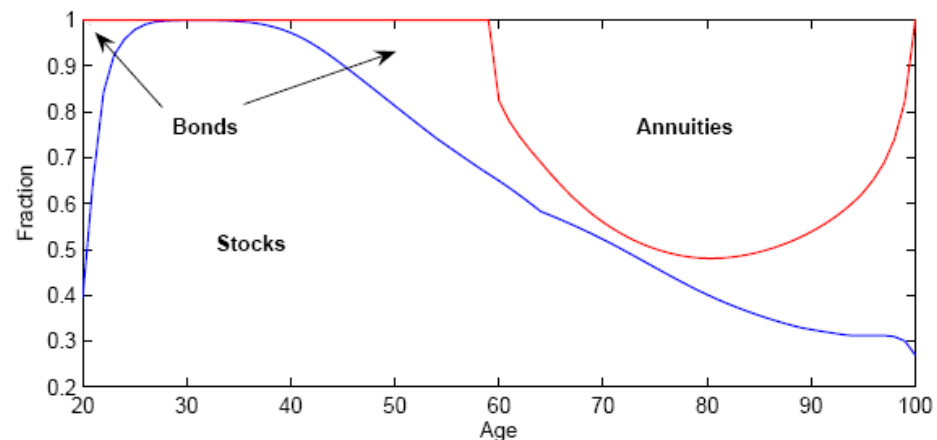
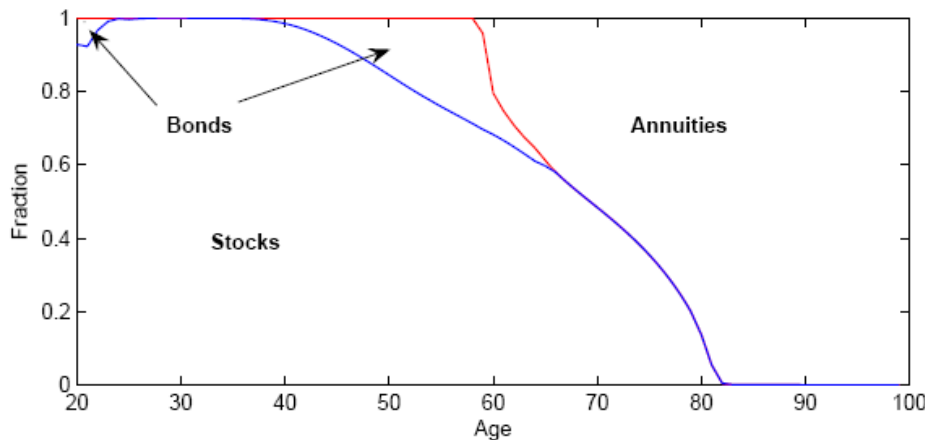
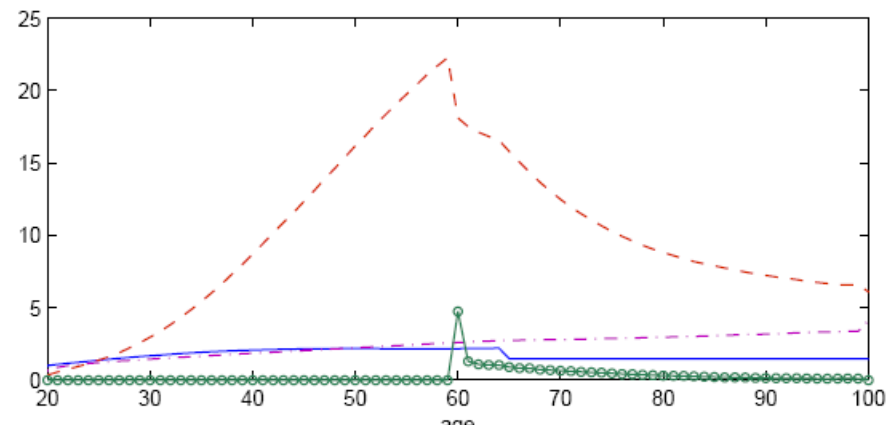


# Expected Life-Cycle Profile

## With costs (7.3%) no bequest



## With costs and bequest



Cost effect: annuitization postponed to age 59, full annuitization at age 82

Bequest effect: additional liquid wealth motive, but still substantial annuity demand

# Robustness Analysis of Annuity Demand

Case	Annuity fraction (%)			
	Age			
	30	45	60	75
Stylized case	0.0	7.8	47.6	93.3
With costs	0.0	0.0	20.1	64.2
With bequest	0.0	0.0	17.7	50.0
Males	0.0	0.1	38.3	51.5
Bad health	0.0	0.0	8.2	32.9
Low IES ( $\psi = 0.1$ )	0.0	0.0	9.0	37.5
High IES ( $\psi = 0.3$ )	0.0	0.0	26.2	58.7
Low RRA ( $\rho = 2$ )	0.0	0.0	0.0	0.0
Low pension income ( $\lambda = 0.5$ )	0.0	0.0	35.0	59.0
High pension income ( $\lambda = 1$ )	0.0	0.0	3.2	30.8

Sensitivity of annuity demand regarding to factors can explain the low (voluntarily) demand for annuity (so called **annuity puzzle**):

→ costs, bequest, bad health, low risk aversion, high pension income



# Conclusions: Annuities and Life Cycle Asset Allocation

- Endogenizing the annuitization strategy within a life-cycle model shows
  - ↪ Gradual purchase optimal
  - ↪ Timing of annuity purchase crucial (Age effect, Wealth effect)
  - ↪ Model is able to predict empirically found timing of annuity purchase
- Survival credit high enough to compensate for illiquidity and lack of equity premium
- Welfare increase equivalent to 10-30% more cash on hand -> annuities finance extra consumption
- **Interactions** between insurance products and investment portfolios are beneficial to retirement security.
- Outlook for the Model:
  - ↪ Allow for variable (equity linked) payout annuities
  - ↪ Model could be used to add behavioral explanations: e.g. informational costs
  - ↪ Housing, Health & Consumption Shocks, Taxes, Impact of So.Sec .....

## Policy/Regulatory Relevance – Some Questions

- ↳ Should Tax Supported Retirement Savings be used to generate bequest over many generations?
  
- ↳ Should Government protect people for making “bad” spending and investment decision? (Paternalistic Role of Government)
  
- ↳ One Possible Policy Instrument:
  - Mandatory Annuitization of Tax Supported Retirement Assets
    - At a certain age after retirement
    - As a certain percentage of retirement assets

## Policy/Regulatory Relevance – International Evidence

- UK: accumulated occupational pension assets has to be annuitized by age 75
- Germany's "Riester" plans: compulsory switching of asset into annuities at age 85
- Italy, France, Switzerland, Sweden also requirements for mandatory annuitization of tax supported retirement savings
- In the US, annuitization not compulsory for 401(k) / IRA plans
  - ↳ Low annuity demand
  - ↳ tax laws require minimum distributions to start at age 70½



# Thank You for Your Attention!

*For more information see MRRC-WP*

- *Life Cycle Asset Allocation with Annuity Markets: Is Longevity Insurance a Good Deal? – Horneff/Maurer/Stamos MRRC 2007 - 152*
- **Money in Motion: Dynamic Portfolio Choice in Retirement – Horneff/ Maurer/ Mitchell/ Stamos MRRC 2007 – 152**
- **Optimizing the Retirement Portfolio: Asset Allocation, Annuitization, and Risk Aversion - Horneff/Maurer/Mitchell/Dus MRRC 2006 - 124**

# Backup

# Annuity Quotes and Mortality Credit

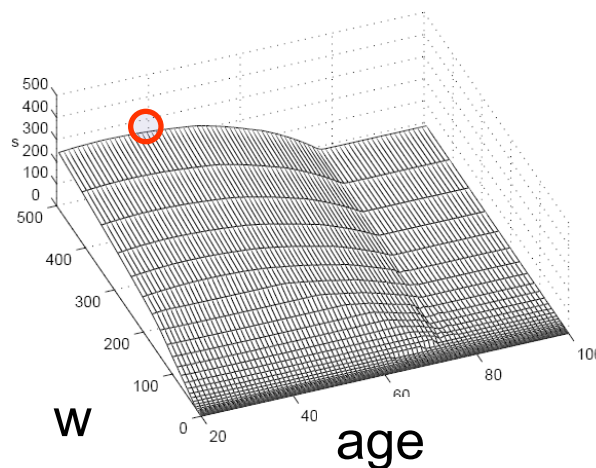
Period Certain	Age 50		Age 65		Age 70		Age 80	
	M	F	M	F	M	F	M	F
<b>0-year</b>	\$514	\$492	\$655	\$605	\$747	\$677	\$1073	\$961
<b>10-year</b>	\$509	\$490	\$630	\$592	\$694	\$649	\$841	\$812
<b>20-year</b>	\$498	\$484	\$569	\$555	\$591	\$583	\$585	\$585

➤ Monthly Income from \$100,000 premium single-life pension annuity

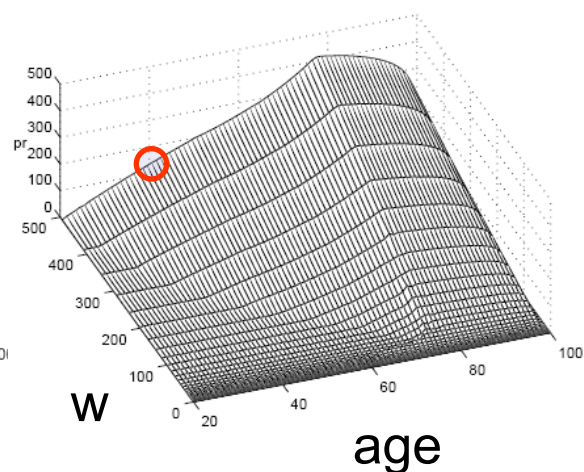
Source: Milevsky (2006)

# Stylized Case without Administration Costs and Bequest (Figure 1)

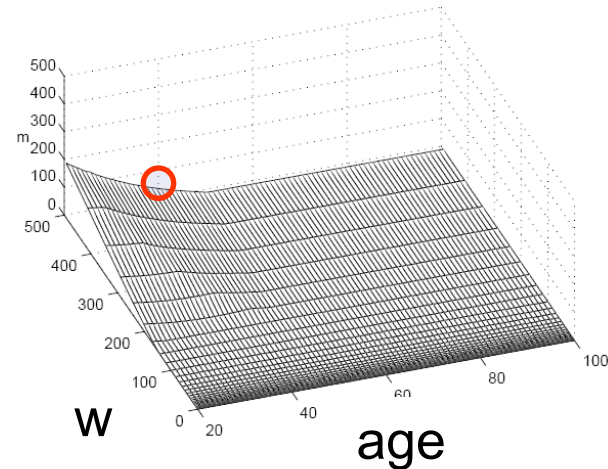
Stocks  $s(w, l=0, t)$



Annuities  $pr(w, l=0, t)$



Bonds  $m(w, l=0, t)$



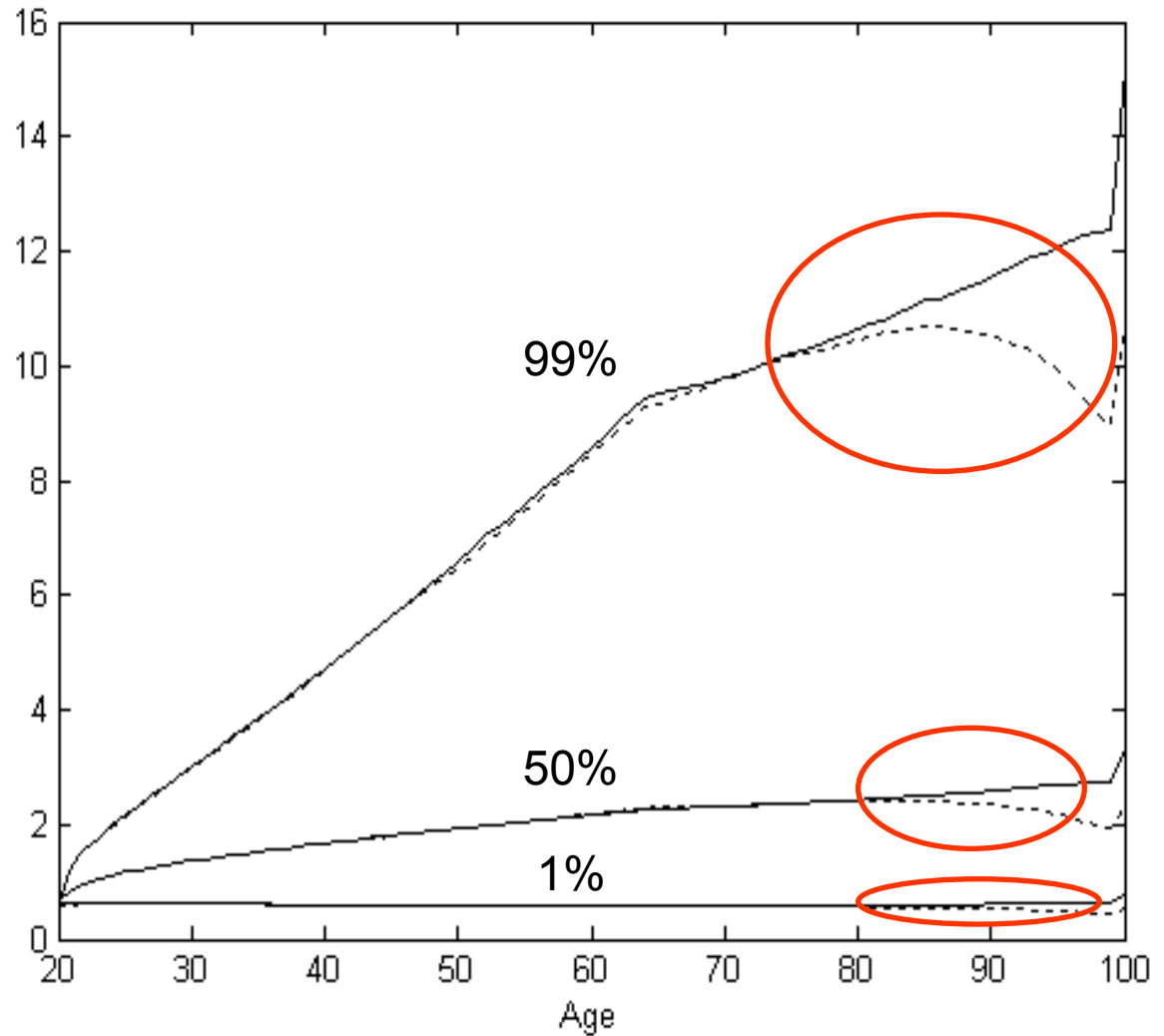
**Motives** to hold liquid wealth: (1) equity premium, (2) buffer stock savings

**Age effect:** (1) increasing mortality credit (mortality risk), (2) decreasing human capital, and (3) labor income uncertainty

**Wealth effect:** the higher wealth on hand compared to bond-like human capital, the lower is the stock demand

# Consumption Percentiles with and without Annuity Markets

- „Consumption shortfall” without annuity markets
- With annuity markets: constant level of consumption possible
- Increase in individual welfare



Dotted line: consumption without annuities  
Solid line: consumption with annuities



## Welfare Analysis: Table III

Equivalent Increase in Financial Wealth: additional financial wealth needed to compensate for the utility loss if no annuities available.

<i>Case</i>	<i>Age</i>			
	60	70	80	90
Stylized case	14.41	16.00	23.75	49.83
With costs	9.54	12.79	16.51	31.16
With bequest	5.69	8.43	14.14	30.07
Males	5.35	8.95	18.75	41.31
Bad health	0.96	2.62	6.73	21.74
Low IES ( $\psi = 0.1$ )	0.40	1.18	3.68	14.70
High IES ( $\psi = 0.3$ )	8.34	11.87	21.30	43.80
Low RRA ( $\rho = 2$ )	0.00	0.00	0.42	0.10
Low pension income ( $\lambda = 0.5$ )	6.87	8.75	14.18	30.19
High pension income ( $\lambda = 1$ )	0.90	2.19	7.64	24.38