

# Money in Motion: Dynamic Portfolio Choice in Retirement

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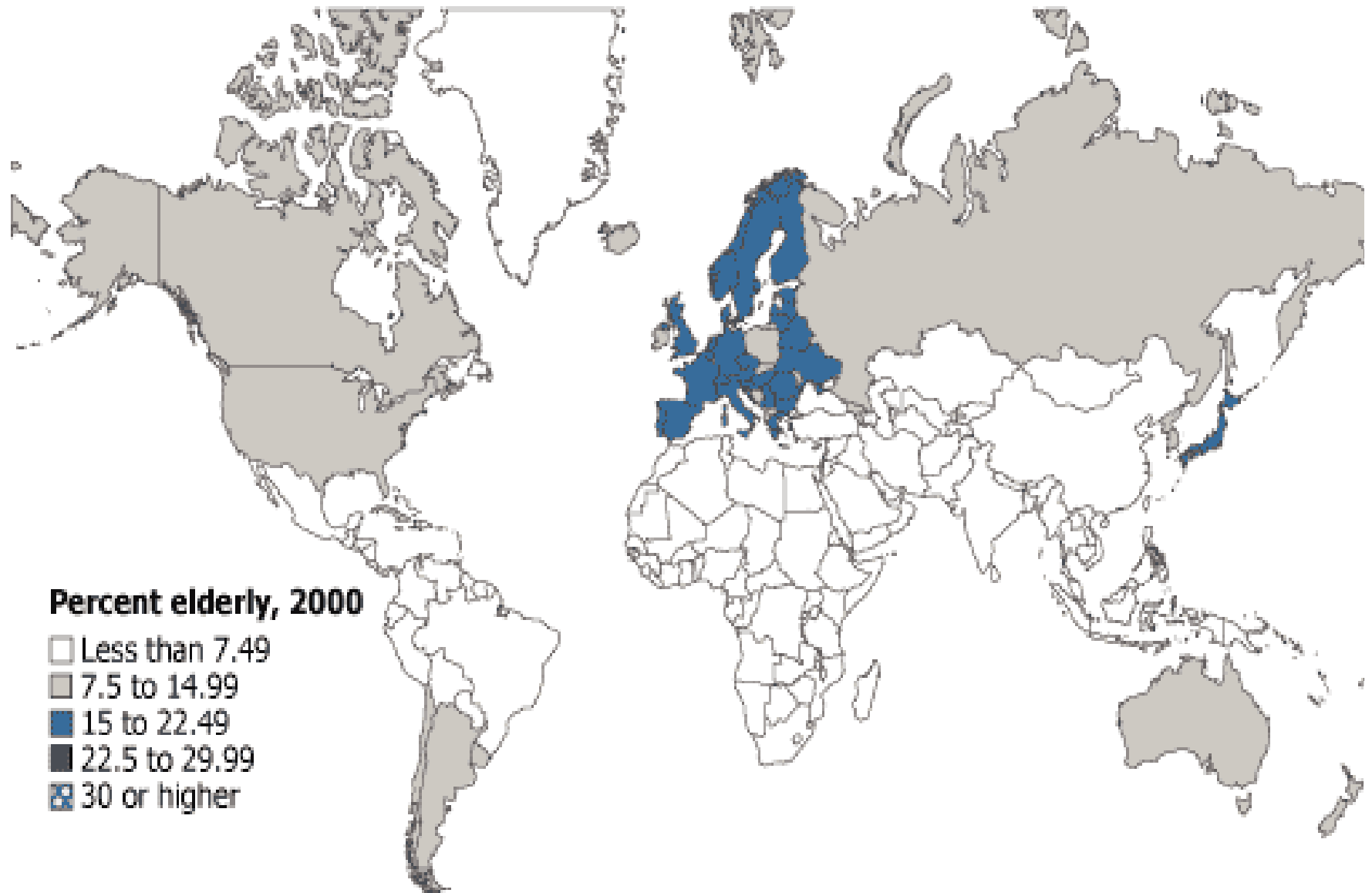
# Motivation:

With \$13 trillions invested in self-directed pension plans, “many retirees face the daunting task of determining an appropriate spending and investment strategy for their accumulated savings”. **Prof. William Sharpe** *2007 Meeting of the Wharton Pension Research Council.*

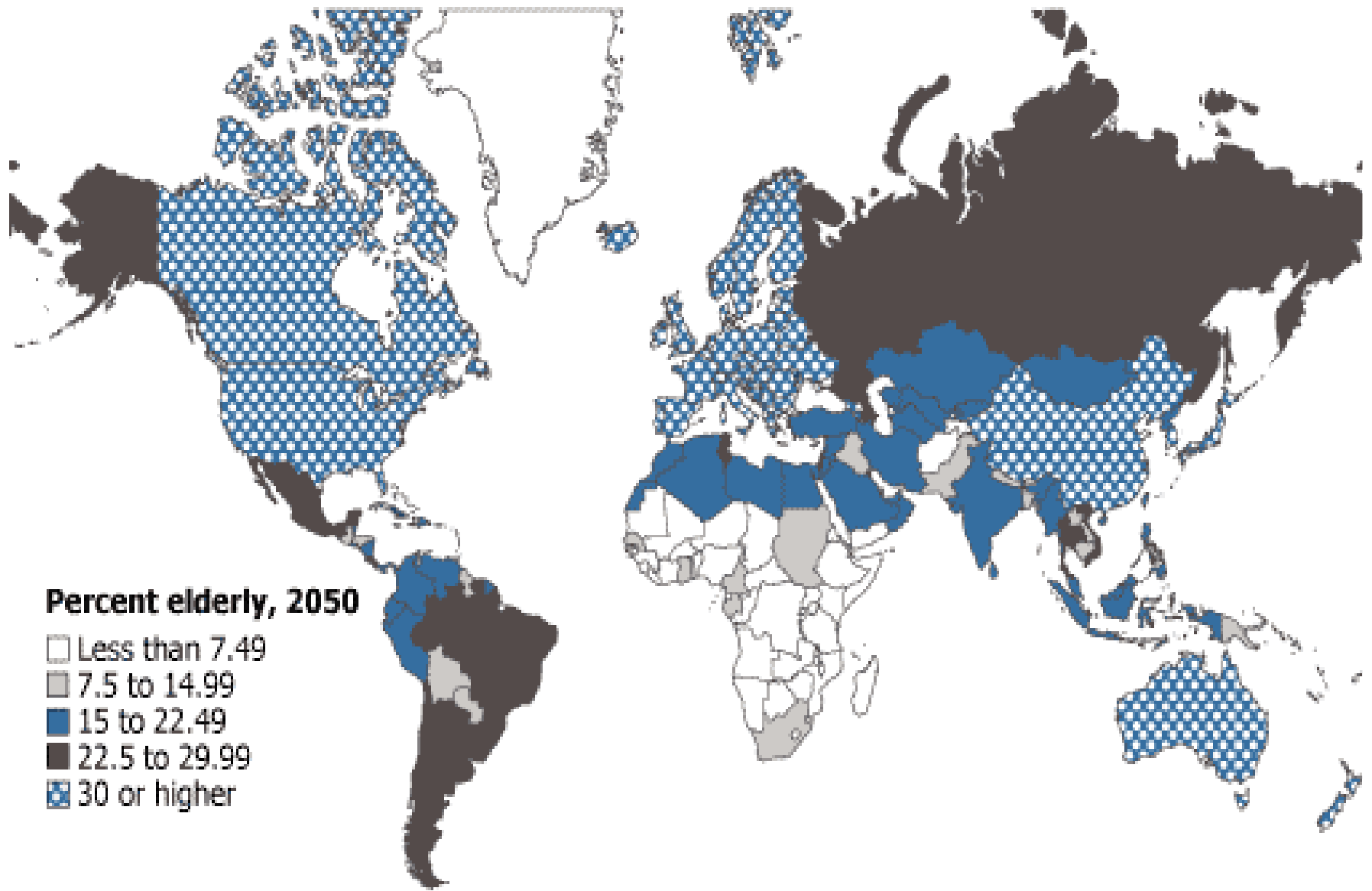
## *Who stands to gain?*

- Insurance companies offering payout annuities;
- Money managers offering phased withdrawal;
- Both?

# Percent 65+, 2000



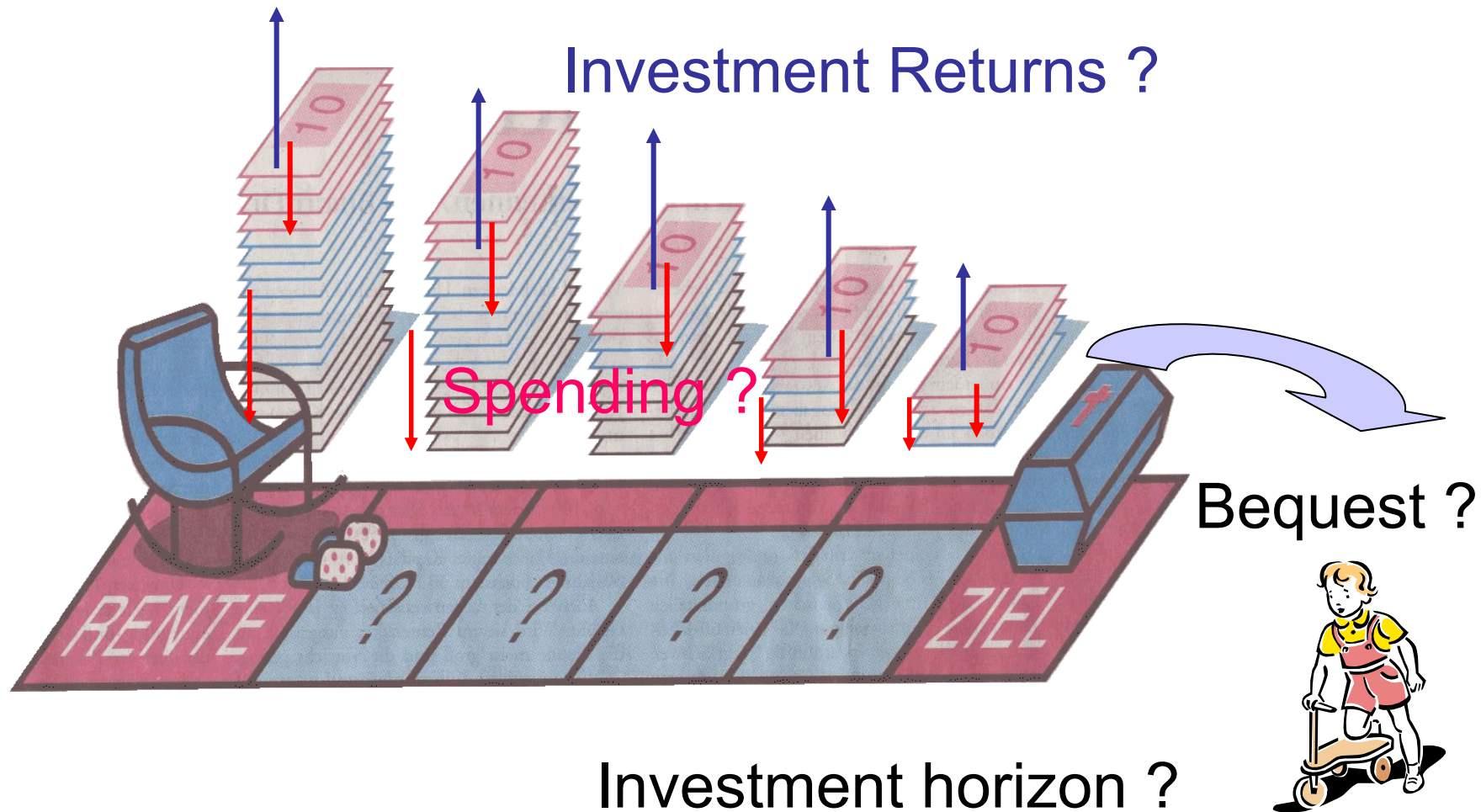
# Percent 65+, 2050



## Percent elderly, 2050

- Less than 7.49
- 7.5 to 14.99
- 15 to 22.49
- 22.5 to 29.99
- 30 or higher

# The tension in retirement:



Goal of our Model: to help retirees secure lifelong income and investment opportunity

→ *Asset Location:*

- How much to annuitize now vs later?
- When would full annuitization occur?

→ *Asset Allocation:*

- How much of the portfolio to allocate to equity vs bonds?
- How will equity exposure change with age?

# Traditional Insurance Solution: Payout Life Annuity

- Long Tradition

- 1308: Convent of St. Denis sold Archbishop of Cologne a life annuity paying 400 Livres p.a. for a single premium of 2.400.
- Important financial instrument during the Middle Ages

- Characteristics

- Offered by commercial insurers
- Pooling of longevity risk
- No bequest potential, low flexibility
- Conventionally, constant payments for life; no participation in equity markets.

# Asset Management Solution: Phased Withdrawal Plans

- ✓ Asset Allocation: Retirement assets invested
- ✓ Withdrawal Pattern: Retiree consumes from retirement assets.

## Advantages vs traditional Life Annuity

- High flexibility, liquidity
- Bequest potential
- Access to equity market so possibly higher benefits

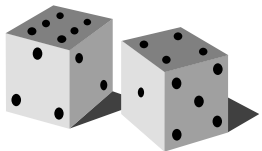
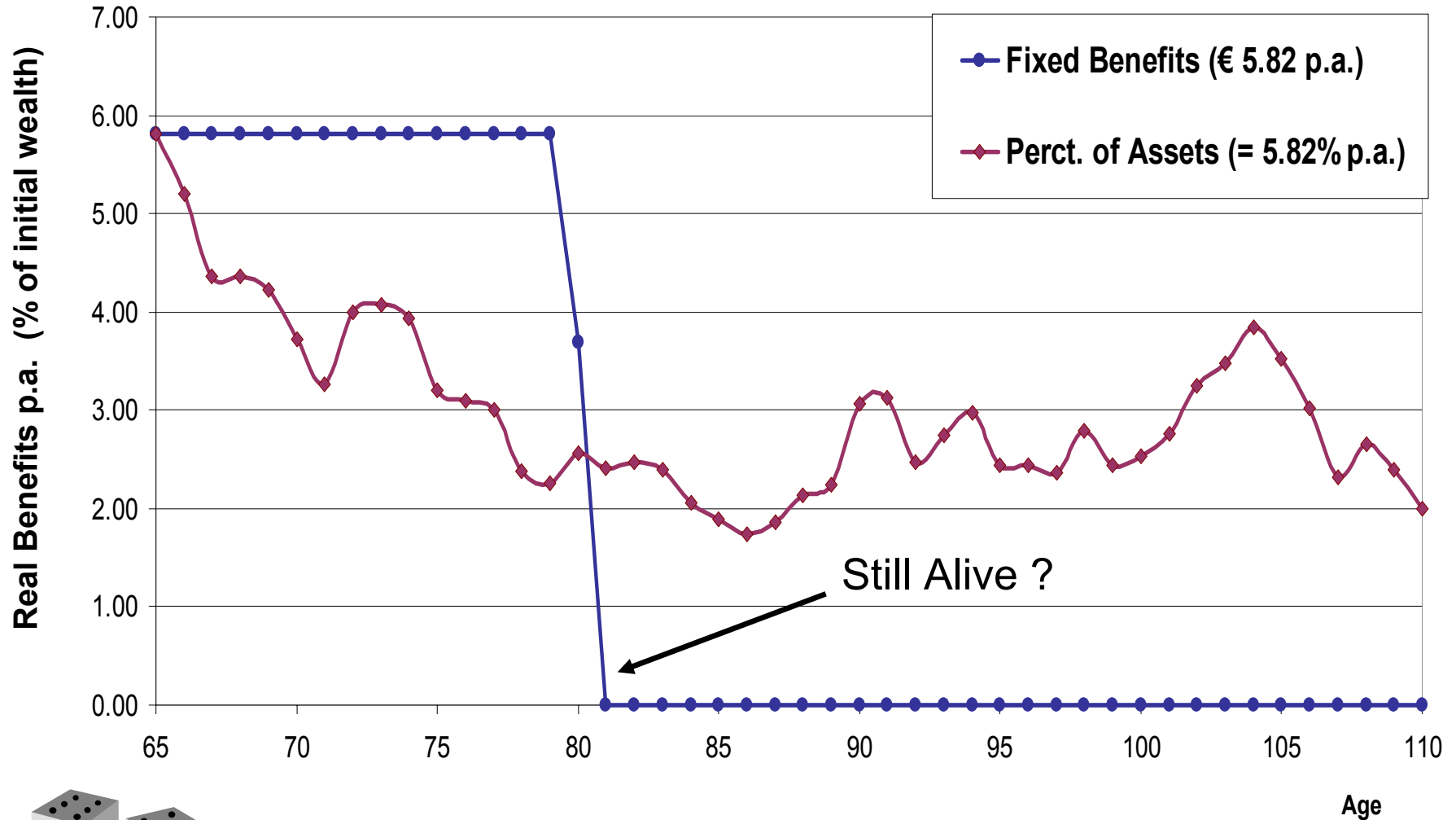
## Risks of Phased Withdrawal Plans

- Lower benefits than Life Annuity
- Longevity risk (no risk pooling)
- Capital market risk



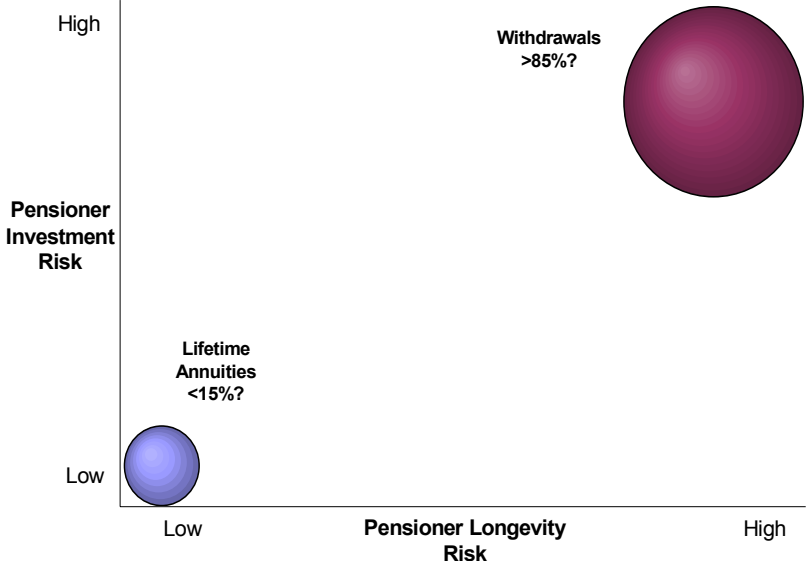
# Longevity & Investment Risk

Retirement in 1961: 50% Stocks / 50% Bonds Germany



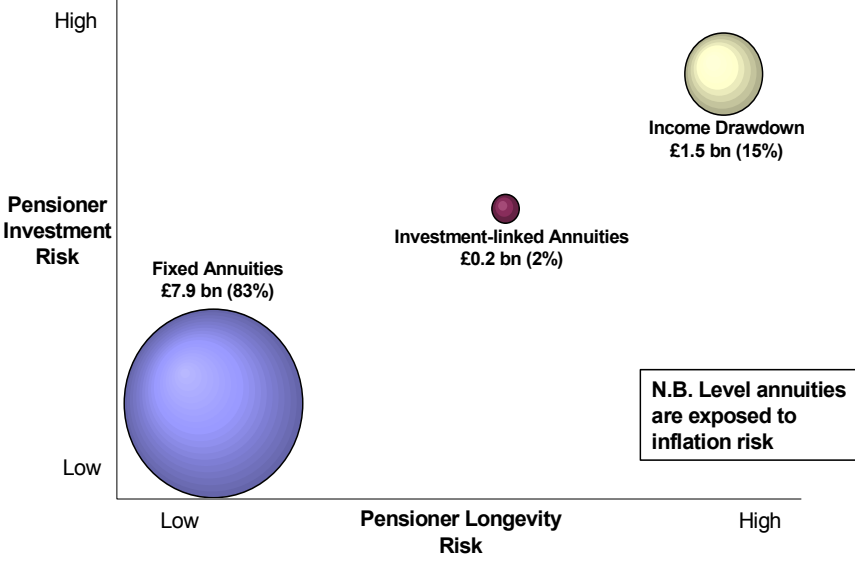
# Annuity Demand in UK and USA: Mandatory versus Voluntary Annuitization

## US Retirement Income Market 2001



Source: 2001 Survey of Consumer Finance – IAB Research, Boardman 2006.

## UK Retirement Income Market 2005



Source: ABI Data 12 Months to December 2005, Boardman 2006.

# Annuity Mechanics (1)

## ➤ *Simple 1-period example:*

↳ Alternative 1: direct bond investment.

↳ Alternative 2: invests in bonds through annuity.

## ➤ *Real interest rate: $r = 2\%$ , survival prob.*

$$p = 80\%$$

Initial Investment	End-of-year payoff	
	Alive	Dead
(1) 100 (in bond)	$100(1+r)$ =102	$100(1+r)$ =102
(2) 100 (in annuity)	$100(1+r)/p$ =127.5	0

**Survival credit = 25.5**

# Annuity Mechanics (2)

## ➤ *Simple 1-period example:*

↳ Alternative 1: direct stock investment.

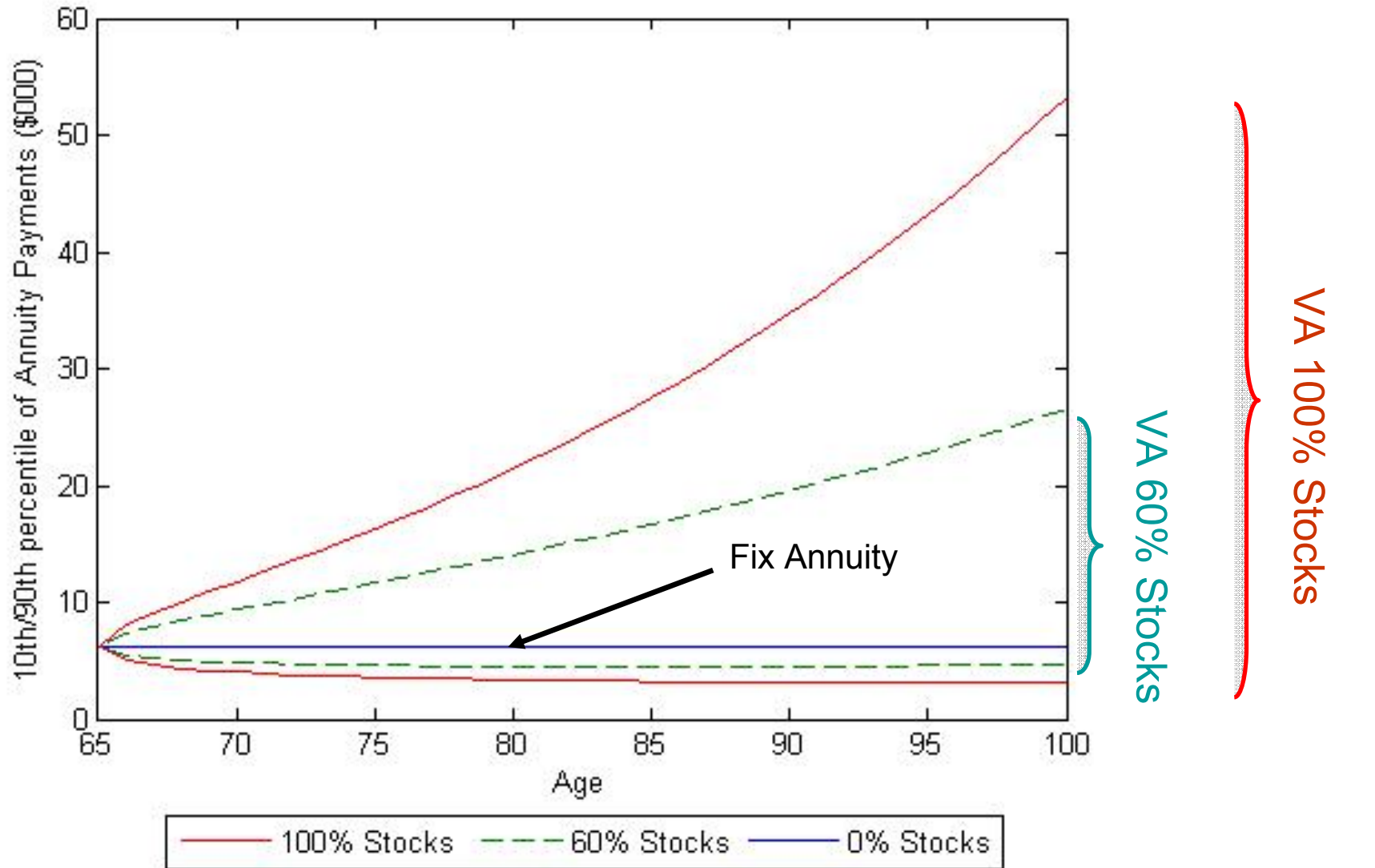
↳ Alternative 2: invests in stocks through variable annuity.

Initial Investment	End-of-year payoff		
	Alive	Dead	
(1) 100 (in stocks)	$100(1+r)$ =98	$100(1+r)$ =98	Bust
	$100(1+r)$ =106	$100(1+r)$ =106	Boom
(2) 100 (in variable annuity)	$100(1+r)/p$ =122.5	0	Bust
	$100(1+r)/p$ =132.5	0	Boom

# The Model

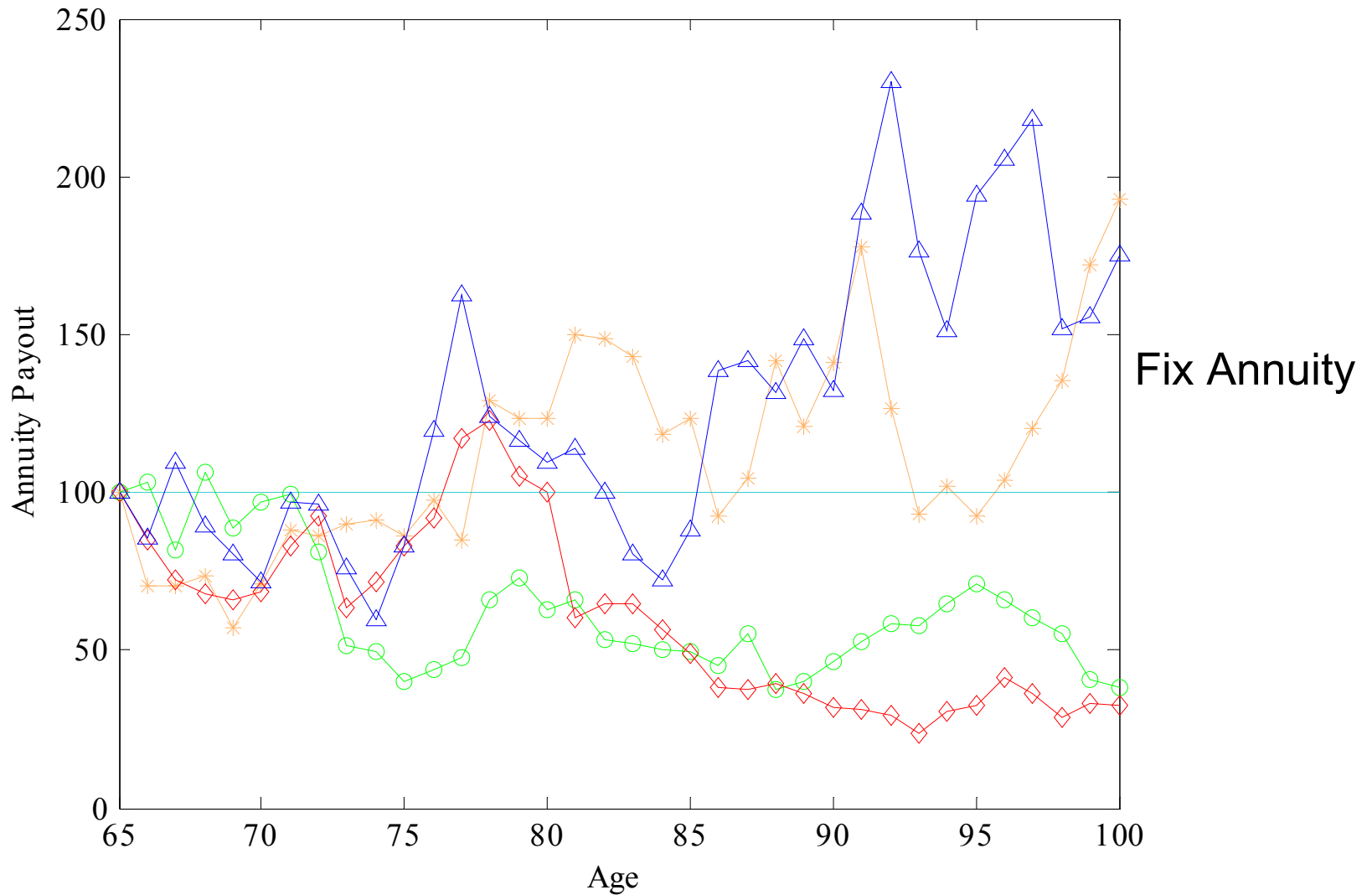
- *Capital market:*
  - ↪ Riskless bond: 2% real
  - ↪ Risky stock: expected return 6% (STD 18%). ( $\sim N$  i.i.d).
- *Insurance market:*
  - ↪ Variable Payout life annuity (riskless bond/risky stock).
  - ↪ Priced with annuitant mortality table, zero load.
  - ↪ AIR 4% (standard + market); robustness checks.
- *Female retiree: dynamic utility optimizer*
  - ↪ Age 65; moderate risk aversion
  - ↪ Financial wealth and (annuity) income from Social Security
  - ↪ Rate of time preference (beta = 0.96).
  - ↪ No/moderate bequest motive
- *Numerical solution by dynamic optimization*

# Payout Profiles for Alternative Asset Allocations (90%-10% quantile of payouts)



AIR = 2%

# Simulated Profiles of Variable Annuities (100% Risky Stocks vs. 100% Riskless Bonds)



AIR = 2%

# The Optimization Problem:

Retiree seeks to maximize discounted lifetime consumption by selecting:

- Per period consumption (and saving);
- % of income to put into annuities and direct investments (*LOCATION*);
- and % of balances to invest in equities/bonds (*ALLOCATION*).

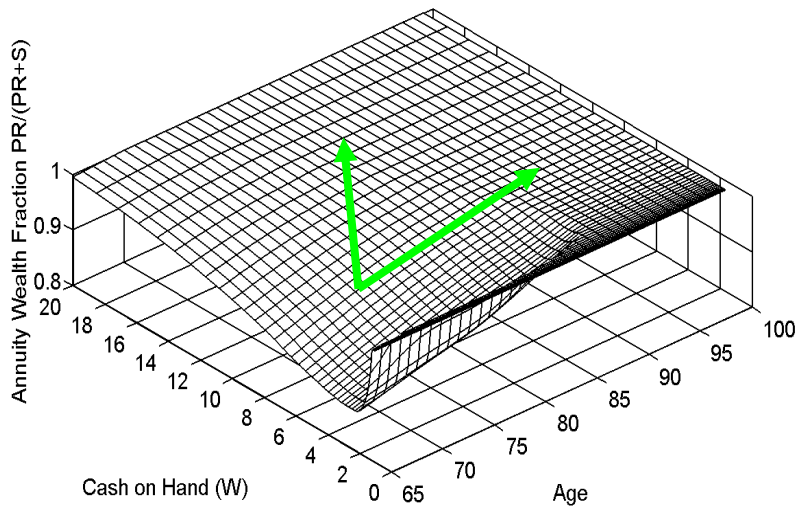
→ Constraints include:

- Payout from pre-existing annuities  $L$  (annuities irreversible);
- Cash on hand  $W$  (multiple of pension income);
- Age  $t$  (start at age 65).

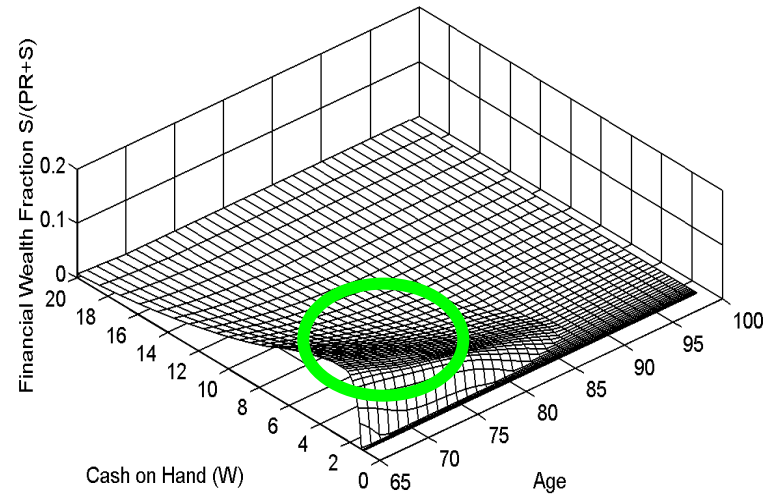


# Optimal Asset Location

Annuity Wealth Fraction



Financial Wealth Fraction

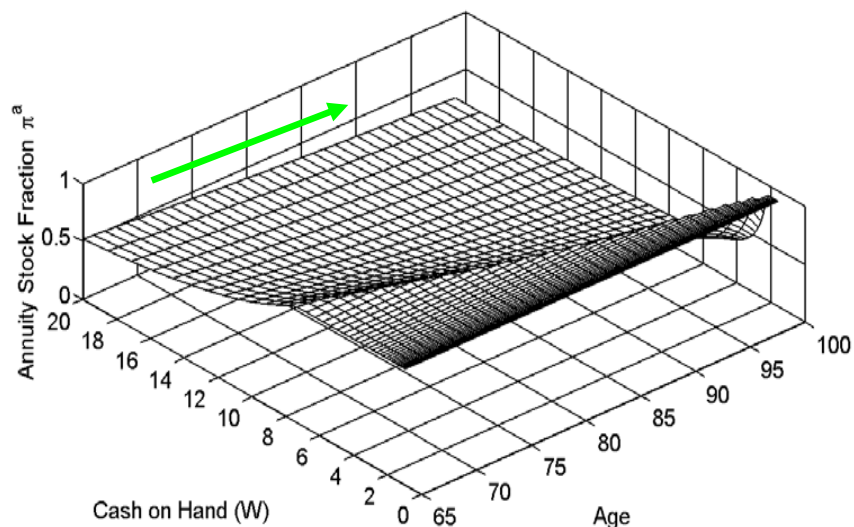


- Up to 20 percent in financial wealth early on (even w/o bequest motive).
- Gradual annuitization → full in the 80's.

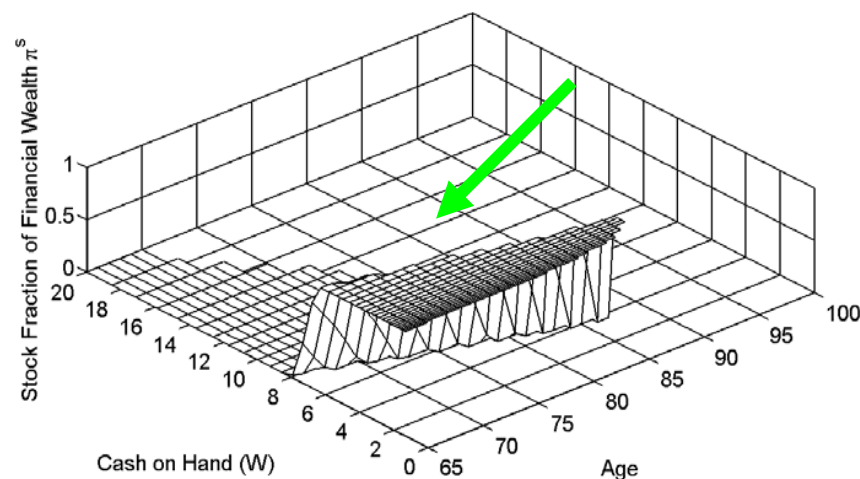
No bequest motive,  $L=0$

# Optimal Asset Allocation

Annuity Stock Fraction



Stock Fraction Financial Wealth



- Inside annuity: Stock % decreases with age but remains substantial ( $>25\%$ ).
- In financial wealth: sharp shift from 100% equity to 0% bonds as age rises.

*No bequest motive,  $L=0$*

# Utility Gains: Wealth Equivalent Value (% pts)

		<i>Initial Financial Wealth</i>		
		<i>Low</i> <i>(<math>S_0 = 2</math>)</i>	<i>Moderate</i> <i>(<math>S_0 = 5</math>)</i>	<i>High</i> <i>(<math>S_0 = 10</math>)</i>
<b>Preferences</b>	<b><i>Investible Assets</i></b>	<i>(1)</i>	<i>(2)</i>	<i>(3)</i>
<b>Low Risk Aversion</b>  <i>(<math>r = 2, k = 0</math>)</i>	<i>(1)</i> Bonds	19.8	30.5	36.8
	<i>(2)</i> Bonds, Stocks	6.3	9.6	12.5
<b>High Risk Aversion</b>  <i>(<math>r = 10, k = 0</math>)</i>	<i>(5)</i> Bonds	29.1	36.1	40.6
	<i>(6)</i> Bonds, Stocks	12.1	19.8	27.6

Utility gains higher for those with higher saving and for more risk averse.

# Conclusions:

- We solve retiree asset allocation and location problem:
  - ↳ She initially holds 20% of financial wealth in liquid form (nonannuitized);
  - ↳ Full annuitization occurs by her 80s;
  - ↳ Equity premium and survival credit important for retiree welfare;
  - ↳ Otherwise retiree gives up 40% of her financial wealth.
  - ↳ Substantial portion of wealth held in equities.

# Practical Implications:

- The VA can be an appealing product: get capital market access AND survival credit.
- A 60/40 stock/bond rule is pretty good for a wide spectrum of retirees (even to very old ages).
- Interactions between “collective” insurance products and “individual” investment portfolios are beneficial to retirement security.

# Implications for Regulation

- In contrast to the USA, in many European Countries regulation requires for tax supported and funded pension schemes a mandatory annuitization in the payout phase using fix life annuities (Germany, UK, Swiss, etc.)
- Paternalistic viewpoint, i.e. protect individual with respect to investment risk and longevity risk
- However: What are the welfare losses compared to a more liberal regulation regime?
  - ↳ Investment Risk: Fix annuity do not allow a participation in the equity market during the payout phase!
  - ↳ Longevity Risk: Annuitization do not allow a bequest!

“The secret to living well is to die without a cent in your pocket”

“But I seem to have miscalculated”

## *Jorge Guinle, 88, a Playboy Who Outlived His Millions*

By LARRY ROHTER

BUENOS AIRES, March 5 — Jorge Guinle, one of the last of the millionaire playboys whose free-spending ways and romantic exploits made them global celebrities from the 1930's onward, died early Friday in Rio de Janeiro. He was 88 years old and died in a suite at the luxurious Copacabana Palace Hotel, which his family built and owned for more than half a century.

Mr. Guinle had been at a hospital awaiting surgery for an aortic aneurysm. But on Thursday he insisted on being released, and checked in at the hotel where he had spent much of his gilded childhood, choosing to dine on chicken stroganoff, raspberry sherbet and tea for what turned out to be his final meal.

“He died as he lived, in grand style and with his eyes shining,” said Clau-



John Maier/Image Works, for The New York Times  
Jorge Guinle in 2003.

# Thank you!

*For more information:*

Money in Motion: Dynamic Portfolio Choice in Retirement - Horneff/ Maurer/ Mitchell/ Stamos

<http://www.pensionresearchcouncil.org/publications/document.php?file=298>

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