

# Human Capital and Life-cycle Investing

Giovanna Nicodano

CeRP-Collegio Carlo Alberto and University of Turin

**OECD/IOPS GLOBAL FORUM ON PRIVATE PENSIONS**

Collegio Carlo Alberto



# Presentation Based on Two Chapters

- Life-Cycle Asset Allocation and Performance Evaluation
  - F. Bagliano, C.Fugazza, and G. Nicodano (CeRP-Collegio Carlo Alberto and University of Turin)
- Pension Fund Design in Developing Economies
  - L. Viceira (Harvard Business School)

# Motivation

- Performance Evaluation methods associate a higher return per unit of risk with better performance
- But a worker contributes to a pension fund also to stabilize consumption during retirement
- This paper proposes to evaluate the ability of pension funds in performing such function
  - Benchmark asset allocation: the one delivered by a life-cycle model - built on Campbell et al (2001)
  - Metric: worker's welfare under the DC fund returns relative to worker's welfare under the benchmark

# Benchmark asset allocation

- The optimal asset allocation trades off gains from investing in high risk premium assets with the need to hedge labor income shocks.
- It takes into account
  - asset return distribution
  - risk aversion parameter
  - pension transfer
    - Replacement ratio, indexation, life expectancy, retirement age
  - labour income distribution
    - Mean, variance of labor income shocks, correlation with asset returns

# Benchmark asset allocation

- Optimal asset allocation may involve too large costs of tailoring portfolios to labor income
  - Simpler portfolio rules may become the benchmark
  - Model indicates when this is likely to be the case
- Two candidates:
- Modified Age Rule (target date retirement funds, Premium Pensions)
  - risky portfolio shares are set at  $(100 - \text{age})\%$ , and equally allocated between stocks and bonds
- 1/3 for the each asset
  - This rule outperforms several portfolio strategies in ex post portfolio experiments (DeMiguel et al (2008))

# A Utility-based Performance Metric

- ratio of worker's ex-ante maximum welfare under the benchmark asset allocation to ex ante welfare under the pension fund actual return distribution
  - worse performance may derive from
    - lower return per unit of financial risk
    - worse matching between the pension fund portfolio and its members' labor income and pension risks.

# Pension Fund Performance Literature

- Do active p.f. obtain better risk-adjusted performance than passive benchmark?
- Benchmarks: single factor (Ippolito et al, 1987, Lakonishok et al., 1992); multifactor benchmarks and style indices (Coggin et al, 1993; Busse et al. 2008; Bauer and Frehen, 2008); MVE portfolio (Antolin, 2008)
  - Extra-performance deriving from market timing or security selection
  - Short run performance, but in Blake et al (1999)
- Metric: return based (alpha, Sharpe ratio..)

# Simple Life-Cycle Model

- **Two** risky assets and one riskless asset
  - calibration uses US stock index, bond index returns and T-Bills
  - any pair of assets can be accommodated, to the extent that their mean returns and (co)variances are precisely estimated
- Return on one risky asset **correlated** with labour income shocks
  - US estimates range from 0 (Cocco et al, 2005) to 0.33 for workers with no high-school education to 0.52 for college graduates (Campbell et al (2001), Campbell and Viceira (2002))
- Constant inflation and constant investment opportunities
- Worker maximizes expected life-time utility from consumption taking into consideration the risky labour income and pension income

# Model Produces

- Mean optimal portfolio shares as a function of age
  - for base-case parameters
  - sensitivity to labour income risk, correlation, risk aversion, replacement ratio..
- Distribution of optimal portfolio shares across agents with the same age
  - this indicates whether pension funds ought to use individual accounts
- Welfare gains relative to simpler portfolio rules
  - these are compared with added management costs to decide whether the optimal policy or the simpler rule is the benchmark

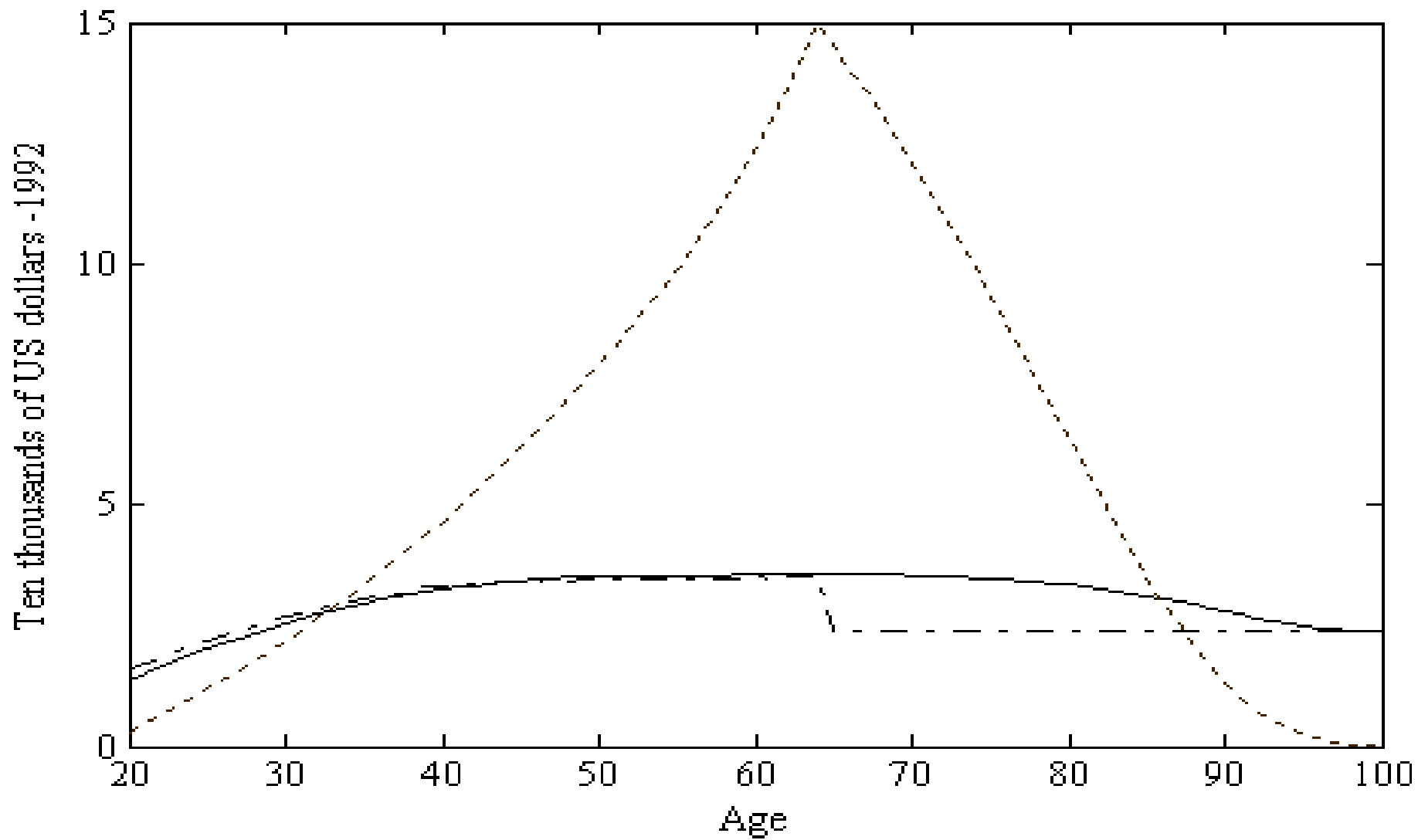
# Calibration

## Benchmark parameters

Working life (max)	20 -65
Retirement (max)	65 -100
Discount factor ( $\beta$ )	0.96
Risk aversion ( $\gamma$ )	5
Replacement ratio ( $\lambda$ )	0.68
Variance of permanent shocks to labour income ( $\sigma_\varepsilon^2$ )	0.0106
Variance of transitory shocks to labour income ( $\sigma_n^2$ )	0.0738
Riskless rate	2%
Excess returns on stocks ( $\mu^s$ )	4%
Excess returns on bonds ( $\mu^b$ )	2%
Variance of stock returns innovations ( $\sigma_s^2$ )	0.025
Variance of bond returns innovations ( $\sigma_b^2$ )	0.006
Stock/bond return correlation ( $\rho_{sb}$ )	0.2
Stock ret./permanent lab. Income shock correlation ( $\rho_{sY}$ )	0

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# The Role of DC Pension Funds in Helping Consumption Smoothing

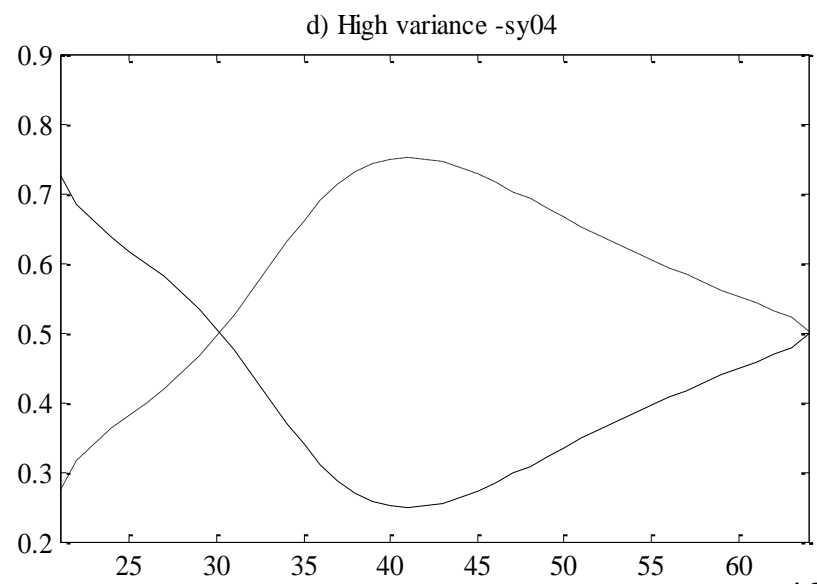
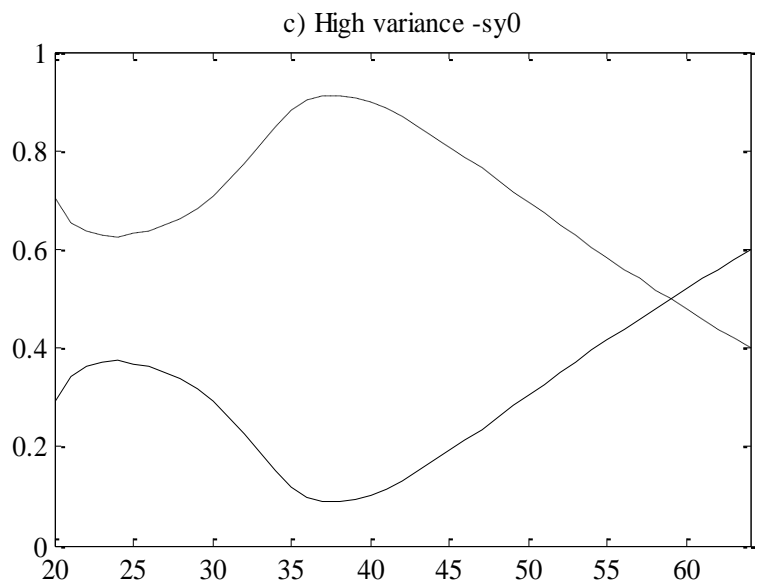
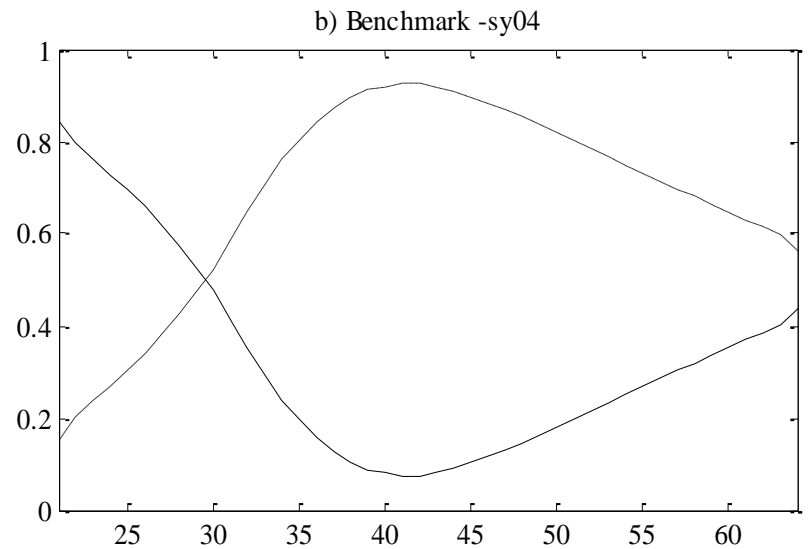
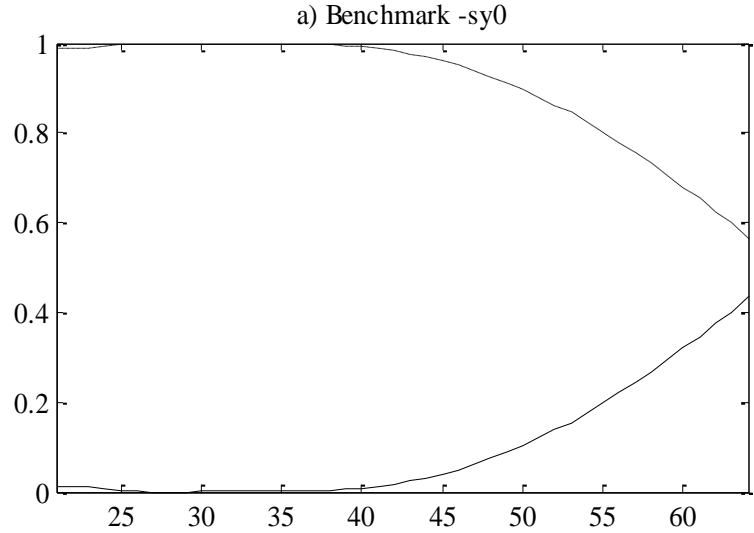


— Consumption    ..... Wealth    - - - Income

# Mean asset allocation, age and labour income risk

- When young the asset allocation is tilted towards riskier assets (stocks) whereas in the two decades before retirement it gradually shifts to safer assets (bonds)
  - As in Bodie et al. (1992), Cocco et al (2005)
- As the variance of labour income shocks increases, the optimal share in stocks at 65 drops to 40%

# Asset Allocation and Age, with Changing Income Risk



— stocks — bonds

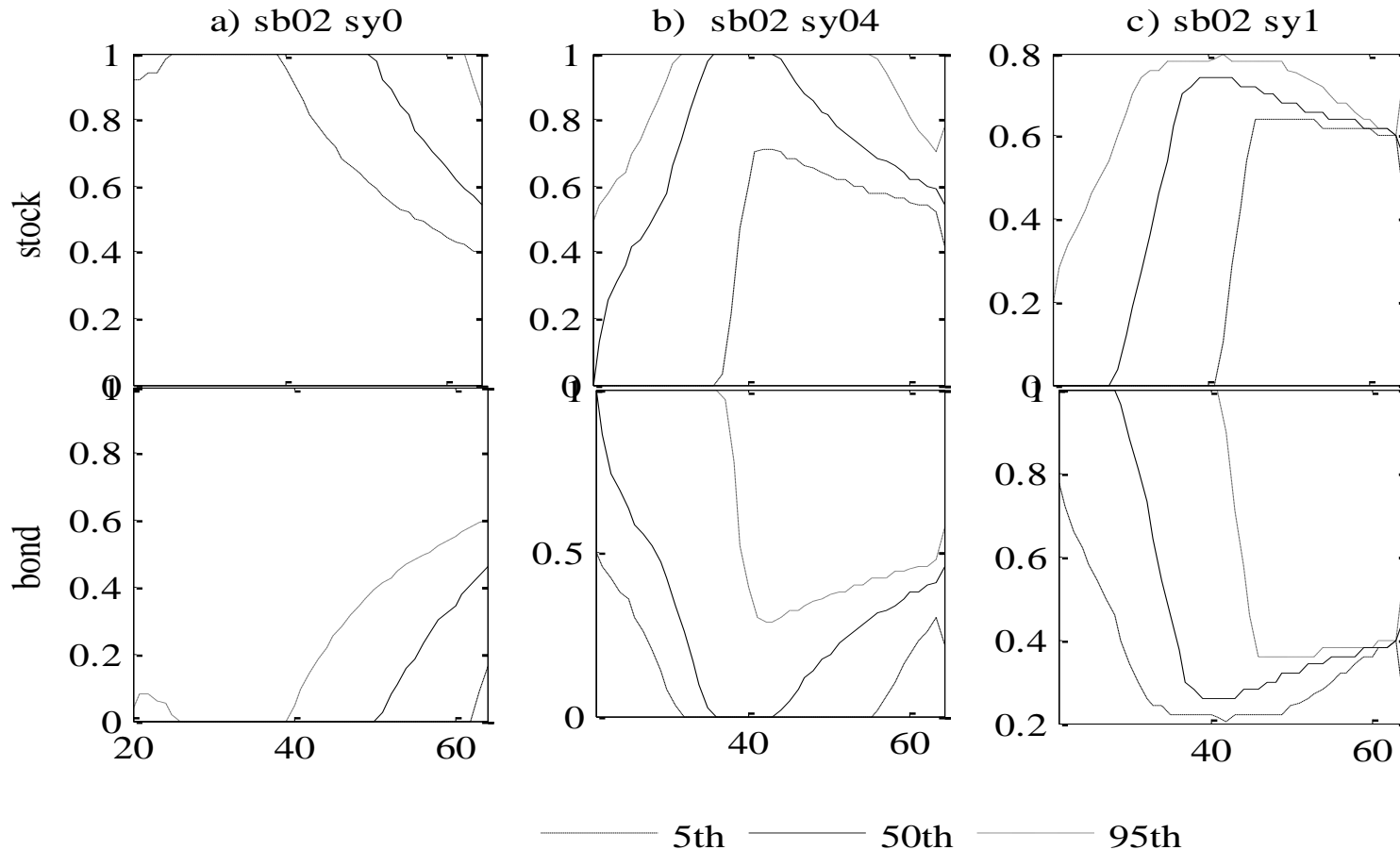
# Distribution of Optimal Portfolios

Heterogeneous portfolios due to individual-specific income shocks require individual accounts.

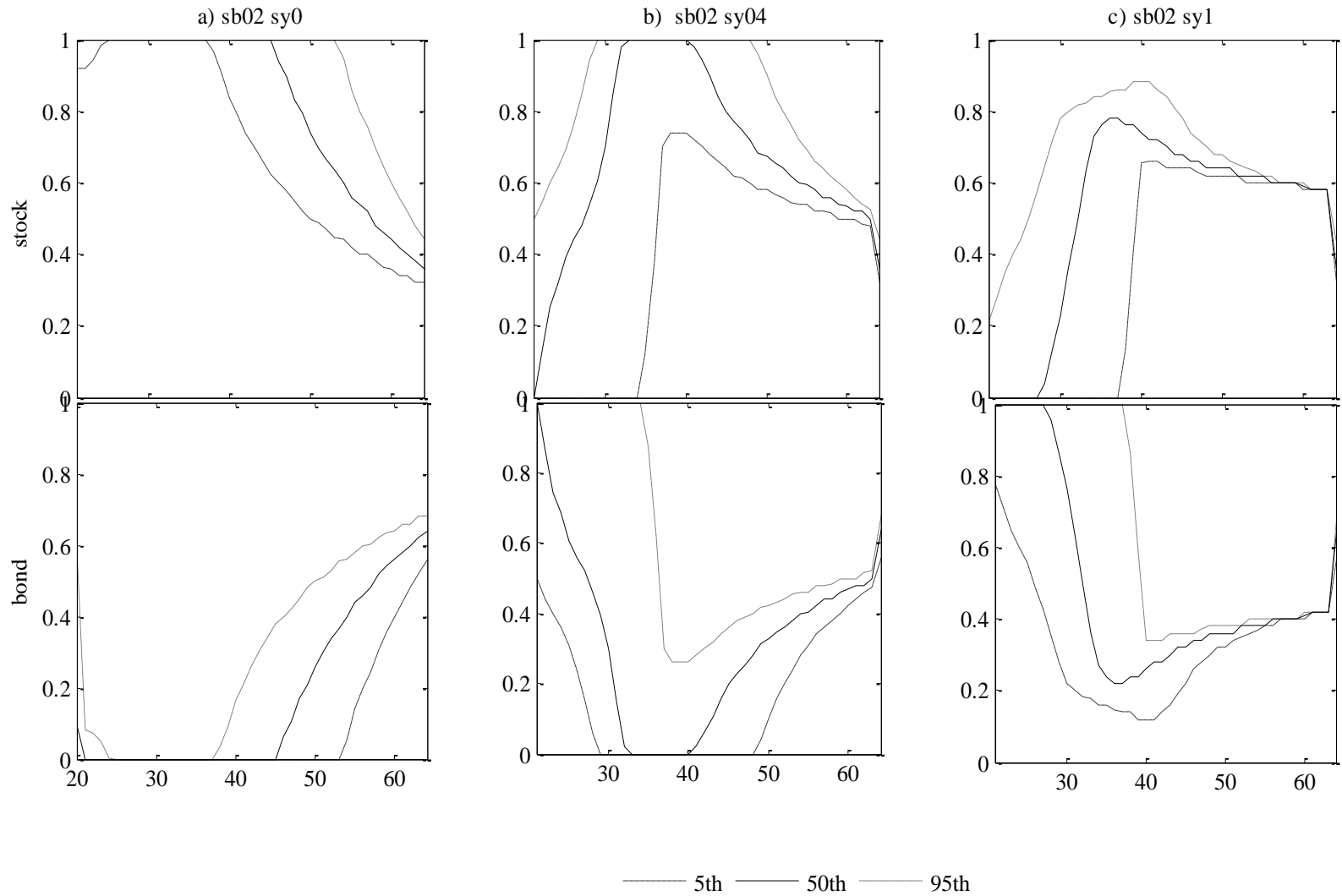
But dispersion decreases

- as retirement approaches, the more so the higher is the labor income-stock return correlation
  - The histories of labor incomes converge and so do portfolio choices
- with higher risk aversion and lower replacement ratio
  - They increase savings and financial wealth, which implies lower sensitivity of portfolio shares to human capital.
  - This insensitivity increases the closer is the worker to retirement age, when financial wealth is maximal
- Reduction in inflation indexation or healthcare coverage akin to reduction in replacement ratio

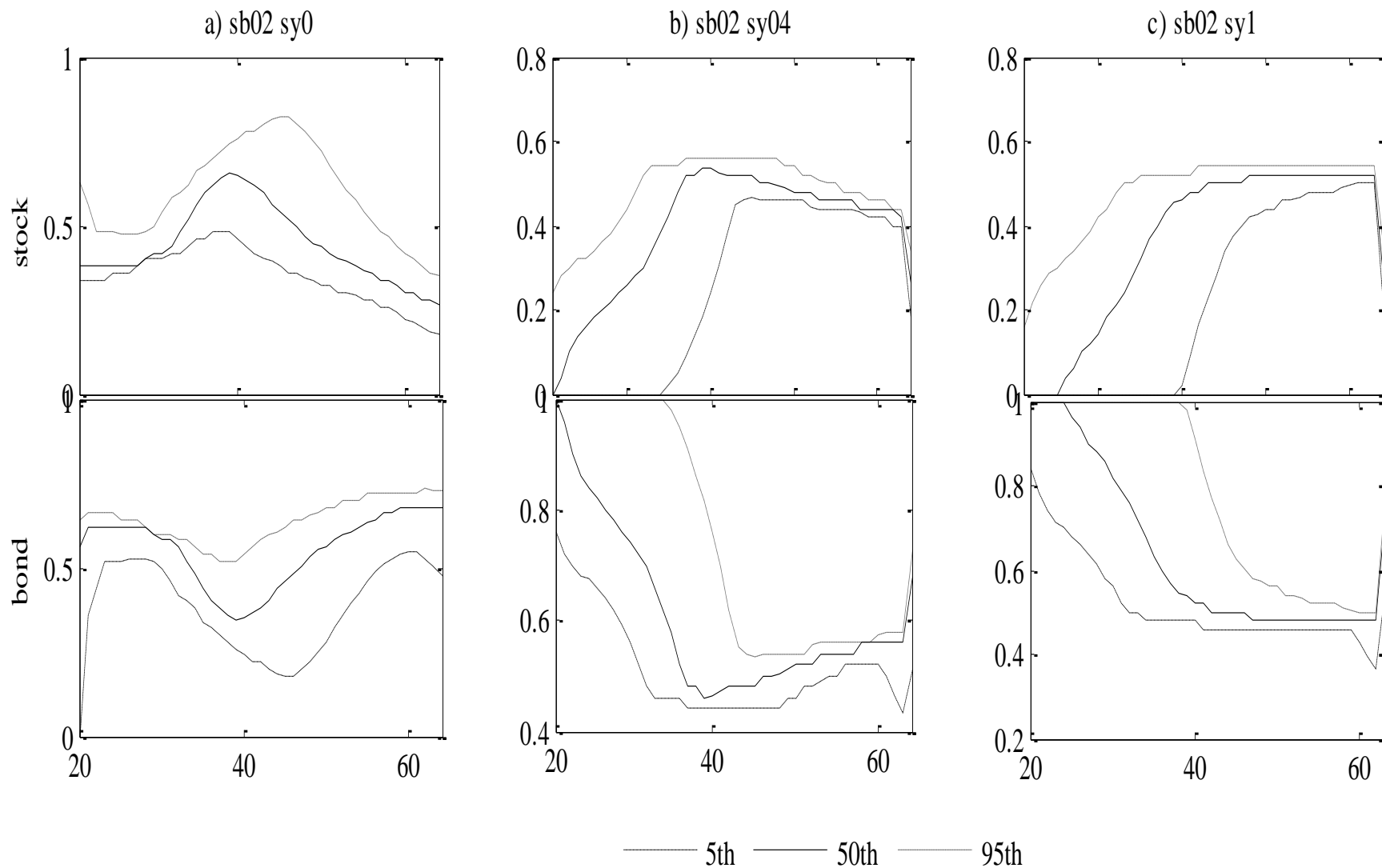
# Asset allocation and labor-stock correlation



# Lower replacement ratio (0.4)



# Asset allocation and labor-stock correlation with higher risk aversion (15)



# Welfare Costs of Simpler Portfolio Rules

- $1/N$  has lower welfare costs than  $(100-\text{age})/2$
- Imagine a 1% yearly fee
  - Benchmark asset allocation is  $1/N$  for high wealth workers and/or medium-to-high replacement ratios countries.
    - Otherwise, management fees exceed welfare gains
  - Optimal asset allocation remains the benchmark for low and medium wealth workers in low replacement ratios countries

# Welfare Costs – Replacement Ratios

Risk aversion 5					
Replacement ratio 0.40		Replacement ratio 0.80		Replacement ratio 0.68 Decreasing (implied by a decreasing annuity)	
<i>Welfare Costs</i>					
	<i>(100-age)/2</i>	<i>1/3</i>	<i>(100-age)/2</i>	<i>1/3</i>	<i>(100-age)/2</i>
<b>Mean</b>	0.031	0.026	0.018	0.015	0.027
<b>5th percentile</b>	0.063	0.055	0.023	0.019	0.053
<b>50th percentile</b>	0.029	0.020	0.020	0.017	0.023
<b>95th percentile</b>	0.0049	0.0026	0.0022	0.0019	0.0045

# Pension Fund Performance Evaluation

- Welfare Ratio captures
  - ability to smooth consumption, hedging labor income, pension income and financial risk
  - Numerator: welfare obtained under the optimal (or 1/N) asset allocation associated with given replacement ratio, members' labour income process, life expectancy
  - Denominator: welfare under the pf return distribution
    - Obtained by simulation of optimal consumption decisions for pf members, without optimizing for the asset allocation, given the pension fund return distribution
    - mgt fees can be subtracted from portfolio returns when computing workers wealth accumulation

# Properties of WR

- comparable across countries
  - pf is evaluated against appropriate benchmark for each country (and, within each country, for each occupation)
- numerator-denominator can be computed conditional on restricted asset menu, if there are regulatory constraints

# Welfare Ratio: an Example

- Assume pension fund follows age rule
- Age rule has higher Sharpe ratio than optimal asset allocation
  - Standard return based performance ranks fund higher
- Table reports  $WR$ 
  - $WR$  ranks optimal asset allocation (before management fees) higher than fund
  - The more so the less wealthy is the investor and the lower the replacement ratio

# Welfare Ratios

	Risk aversion 5		
Replacement ratio	0.68	0.4	0.8
Sharpe ratio	$\rho_{sy}=0$		
Optimal	0.260	0.286	0.244
Age rule	0.337	0.337	0.337
<b>Welfare Ratio</b>			
Mean	1.051	1.096	1.044
5th percentile	1.101	1.096	1.048
50thpercentile	1.056	1.074	1.057
95thpercentile	1.014	1.011	1.007

# Summary

- Quest for a shift in Performance Evaluation benchmark for pension funds: from beating the market to ability in hedging consumption risk
- Properties of this benchmark
  - requires individual accounts but for investors close to retirement, in low replacement ratio countries, with high risk aversion...
  - optimal asset allocation less welfare enhancing for higher income members and higher replacement ratios countries
    - It may do worse, net of management costs, than  $1/N$  in such cases
  - $1/N$  better than age rule

# PF Design in Developing Economies

Luis Viceira (HBS)

## Policy Challenges of DC Pension Systems

- voluntary participation in these plans is low
  - those who participate tend to choose relatively low contribution rates, even the plan sponsor offers matching contributions.
- plan participants appear to suffer from inertia in their investment decisions.
  - They tend to rebalance their portfolios very infrequently, and many simply let their contributions go into the investment default option in the plan, regardless of whether this investment option is appropriate for them or not.
- investment portfolios are often not adequately diversified

# Innovations in PF Design

- Pension Protection Act (2006) provides a legal umbrella for DC plans which adopt
- automatic enrollment clauses along the lines proposed by Thaler and Benartzi (2004)
- default investment options that provide investors with automatic rebalancing and diversification across asset classes (Viceira 2007b)
  - Balanced Funds: automatically rebalance their holdings towards a target asset mix that remains constant over time
  - Life Cycle Funds rebalance automatically towards a target asset mix, that becomes increasingly conservative over time until it reaches a certain target date, at which point the target asset mix remains constant.

# Diversification of PF Portfolios

- Composition of DC pension funds in developing economies (2007)
  - most funds have allocations to domestic (nominal) government bonds and cash - instruments well above 50%
  - In Uruguay and Slovakia allocations are 95% and 85%
  - Underweight of international equities

# Fixed Income Portfolios

- **Cash instruments** and stable value funds are not safe assets for long-term investors.
  - subject to reinvestment risk: long-term investors need to roll over these instruments as they mature.
    - real rates at which investors can reinvest their cash holdings move considerably and persistently over time (Campbell and Viceira 2001, 2002).
    - low real interest rate regimes can persist for long periods

# Fixed Income Portfolios

- **Long-term nominal bonds** protect investors from reinvestment risk
  - A fall in interest rates are compensated with capital gains in the value of the bond.
- But they are subject to long-term inflation risk
- **Long-term inflation-indexed bonds** (TIPS, OATi, BTPi..) are the riskless asset for long-term investors. They protect them from
  - inflation risk by providing a predictable stream of real income
  - falls in interest rates because their prices adjust inversely to movements in real interest rates.
  - they are not readily available in many economies
    - long tradition in Chile, where they are the most liquid government bonds
- They do not protect investors from longevity risk
  - inflation-indexed annuities

# Equity Allocations

- Why so few equities?
- limiting equity holdings make sense if the regulator wants to limit risk taking
  - it should never be an excuse to ease financing of domestic fiscal deficits by inducing pf to increase their holdings of government bonds
- limiting international equity exposure might not be in the best interest of plan participants
  - Dimson et al (2002). Campbell et al,(2009)  
Goetzmann et al (2004)

# Equity Allocations

- Especially for pf and investors based in developing economies.
  - they are typically characterized by small national stock markets subject to significant country-specific risk
  - many are heavily concentrated in specific industries or services.
- Equity allocations should be held in the form of internationally diversified portfolios
  - benchmarks oriented to reflect the world stock market portfolio rather than the local stock market

# Currency Hedging

- A conventional practice is to fully hedge the currency exposure of international holdings of equities.
  - This is optimal when equity excess returns are uncorrelated with currency excess returns (Solnik 1974).
- What if excess returns on foreign equities are negatively correlated with foreign currency returns? Then holding currency exposure helps reduce the volatility of their speculative portfolio
  - not hedging rather than hedging is what helps

# Currency Hedging

- reserve currencies (US dollar, Euro, Swiss franc) tend to be negatively correlated with global stock markets.
  - They tend to appreciate when global stock markets fall, and viceversa.
  - investors should not hedge their exposure
- commodity-based currencies (Australian or Canadian) tend to be positively correlated with stock returns
  - investors ought to go short these currencies
- pound and yen are largely uncorrelated with stocks
  - investors should fully hedge the exposure to those currencies
- global bond market returns are mostly uncorrelated with currency returns
  - holders of internationally diversified bond portfolios should fully hedge currency exposures

# Synthesis

- Life-cycle funds or Balanced Funds with automatic rebalancing as default investment options and as benchmarks for PF evaluation
  - Equally Weighted Balanced Funds
  - Life Cycle Funds tailored to workers' labour income risk, age, retirement age, replacement ratio
  - Automatic Enrolment
- Portfolio diversification
  - International benchmarks for bonds and equities with appropriate currency hedging
  - IIB as riskless asset rather than cash