On the Asset Allocation of a Default Pension Fund

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Motivation and question

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  $\Rightarrow$ Importance of the default asset allocation
- Question
  - How to set the asset allocation of a default fund, taking into account investors' (diverse) needs?

▸ DC vs DB US

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- Build a life-cycle portfolio-choice model
  - Model exhibits heterogeneity in age, income, wealth, and participation
  - Financial decisions on pension account and wealth outside the pension
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  - Financial decisions on pension account and wealth outside the pension
  - Calibrate model to Sweden
- Use the model to:
  - Characterize the optimal allocation of default investors
  - Suggest a simple rule of thumb to capture heterogeneity in allocation

    Goes beyond current frontier of age-dependance

Sweden

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- Premium pension:
  - 2.5% of income, fully-funded defined contribution (DC) account
  - Return depends on equity choices
  - Choose among 900+ private funds or a government default$\sim$ 100-minus-age

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  - Choose among 900+ private funds or a government default$\sim$ 100-minus-age
- Additional 4.5% (Occupational pension) with similar characteristics

Literature

Limitations to the optimal allocation:

- Inertia: Madrian and Shea (2001), Chetty, Friedman, Leth-Petersen Nielsen and Olsen (2014)
- Lack of financial literacy: Lusardi and Mitchell (2014)
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Design of pension:

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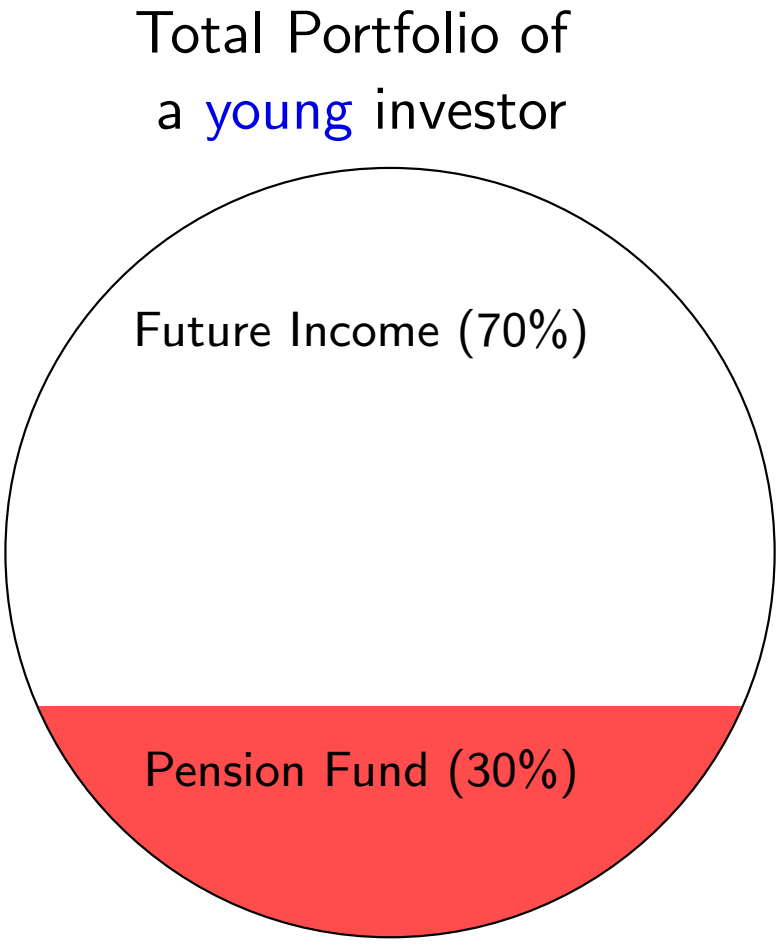
Life-cycle portfolio-choice models:

- *The Fallacy of the Law of Large Numbers*: Samuelson (1963)
- Introducing labor income: Cocco, Gomes and Maenhout (2005)

Portfolio decisions - the role of age

Total Portfolio of
a young investor

Portfolio decisions - the role of age



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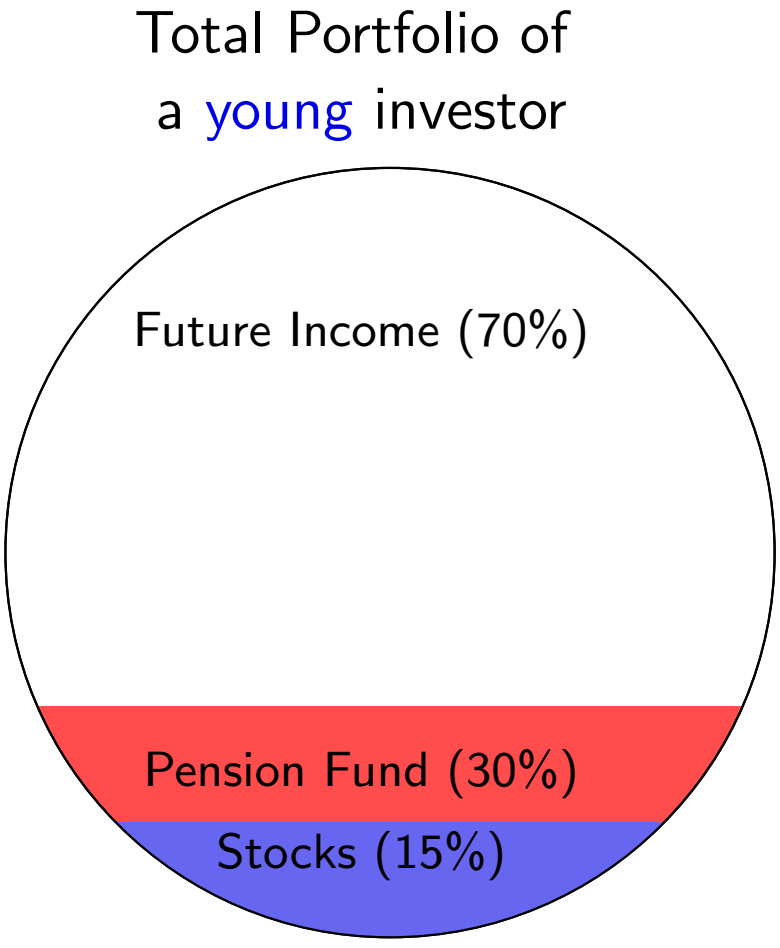

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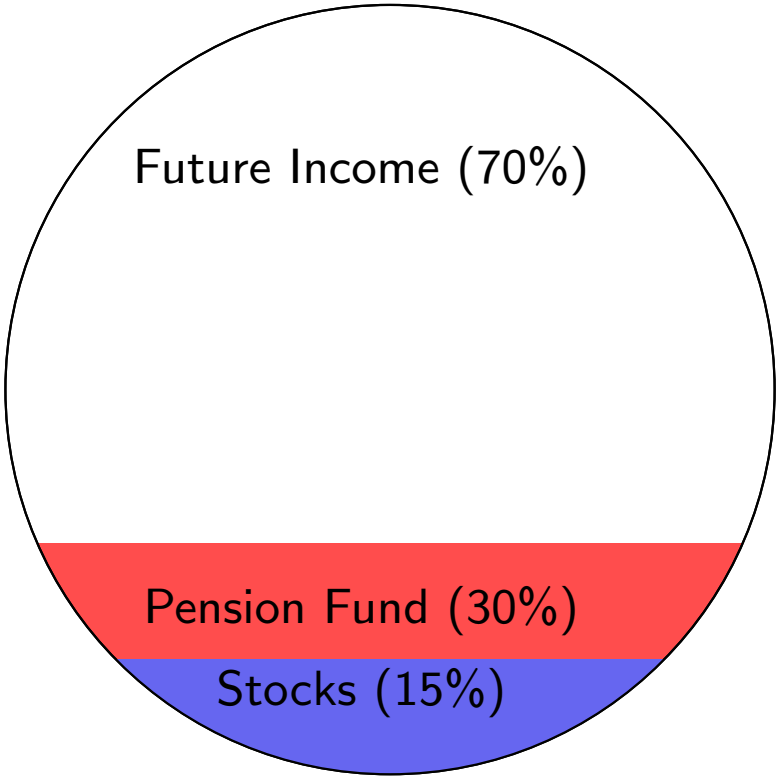

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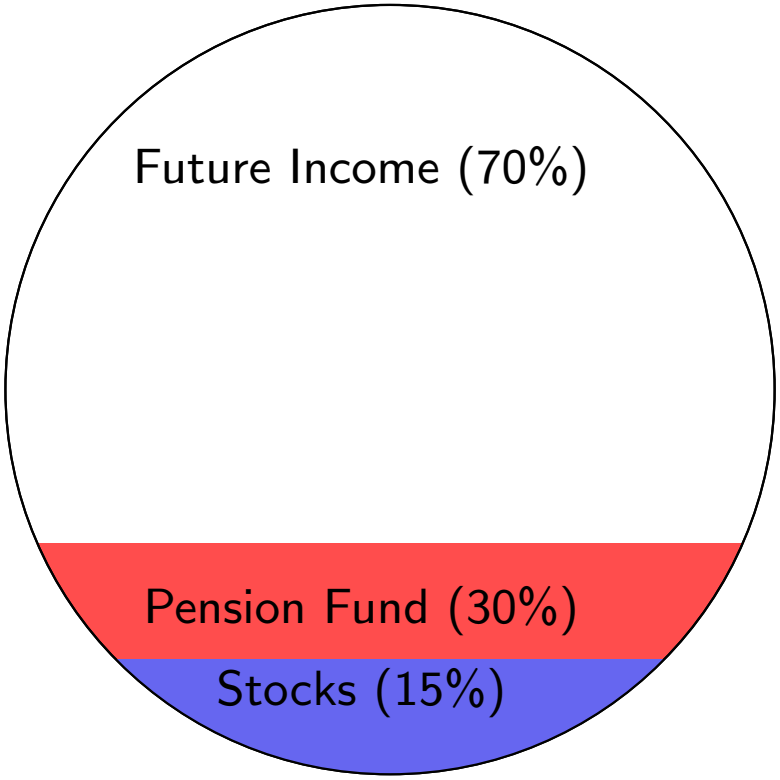

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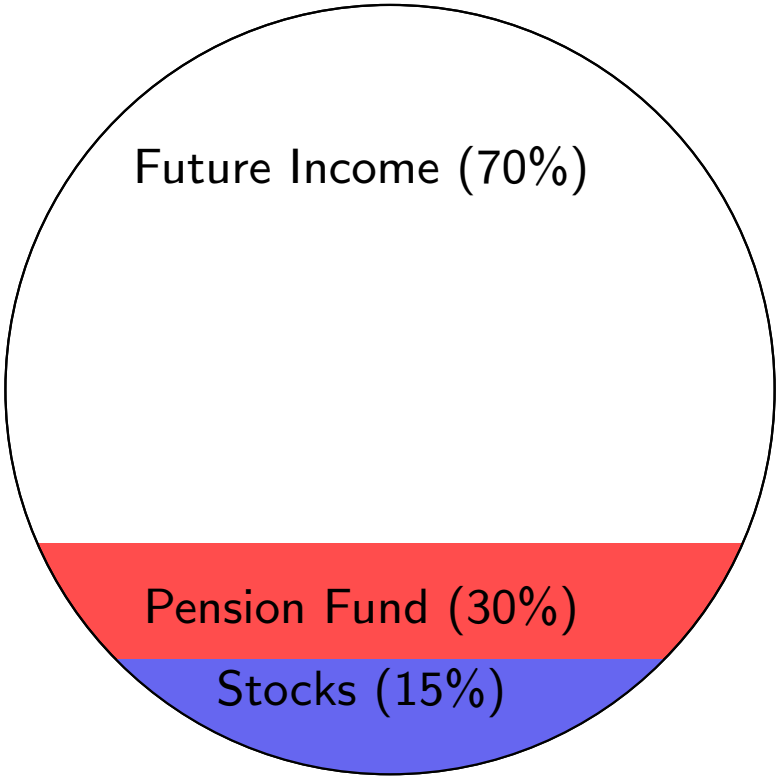

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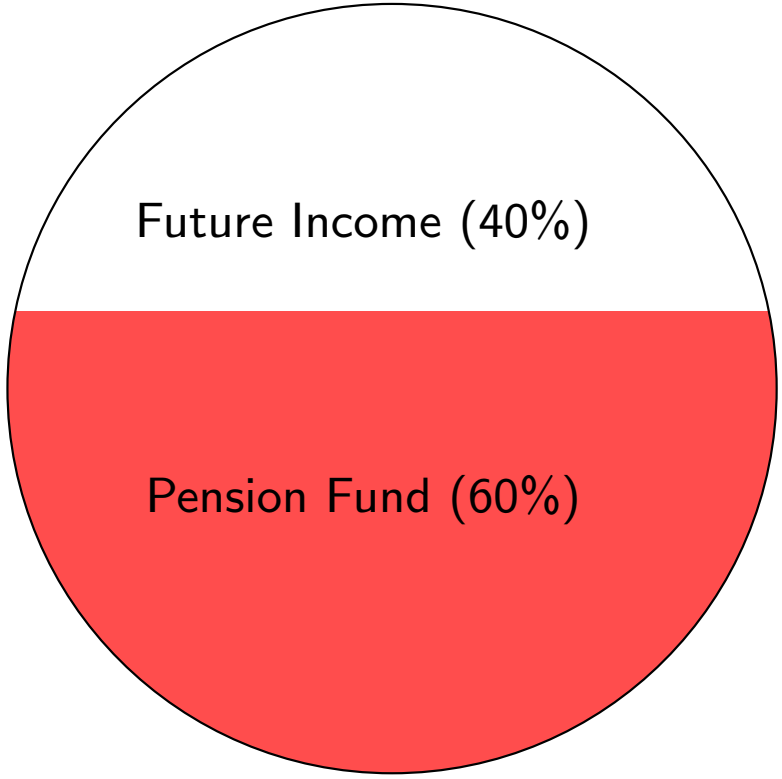

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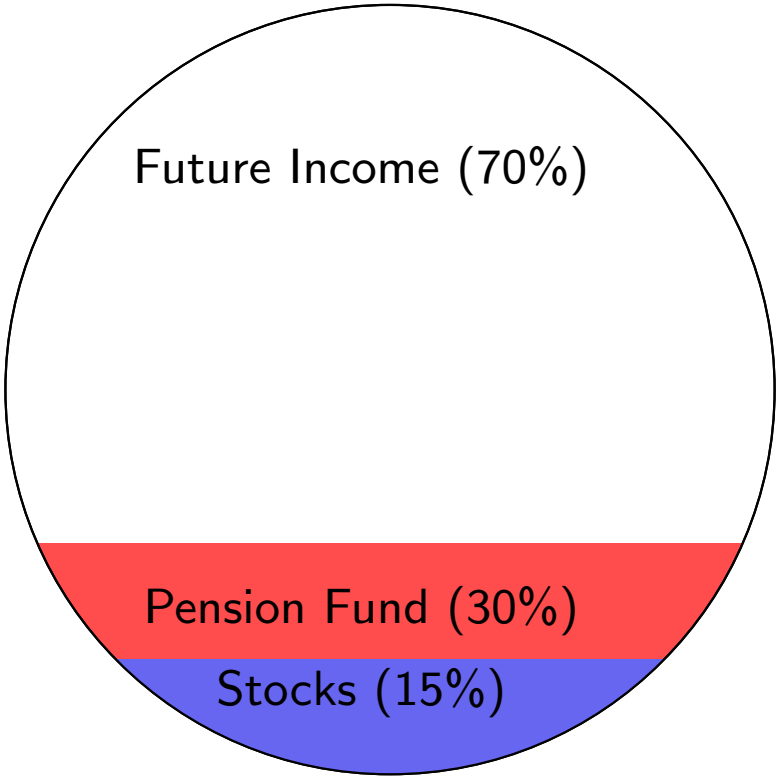

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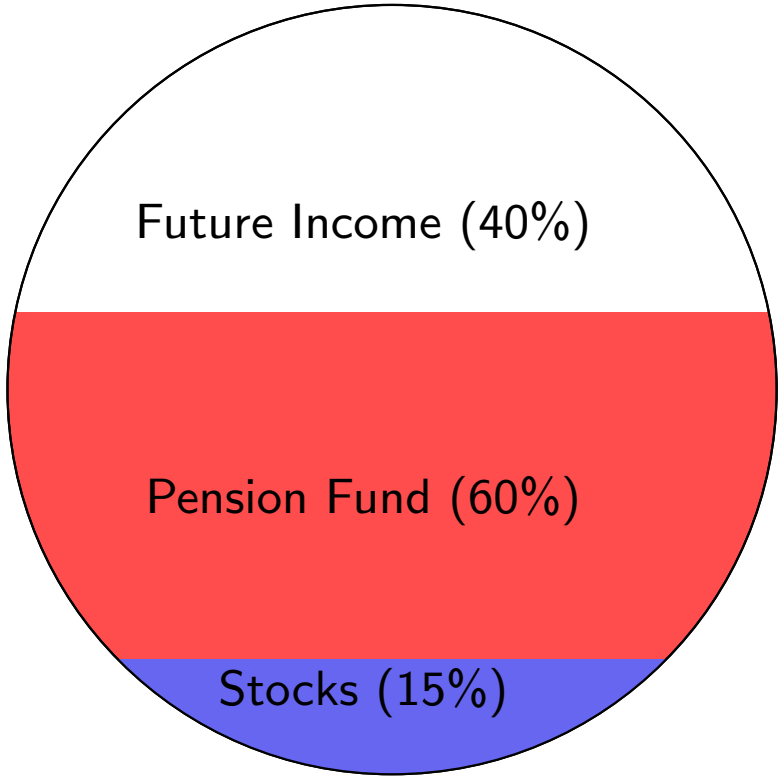

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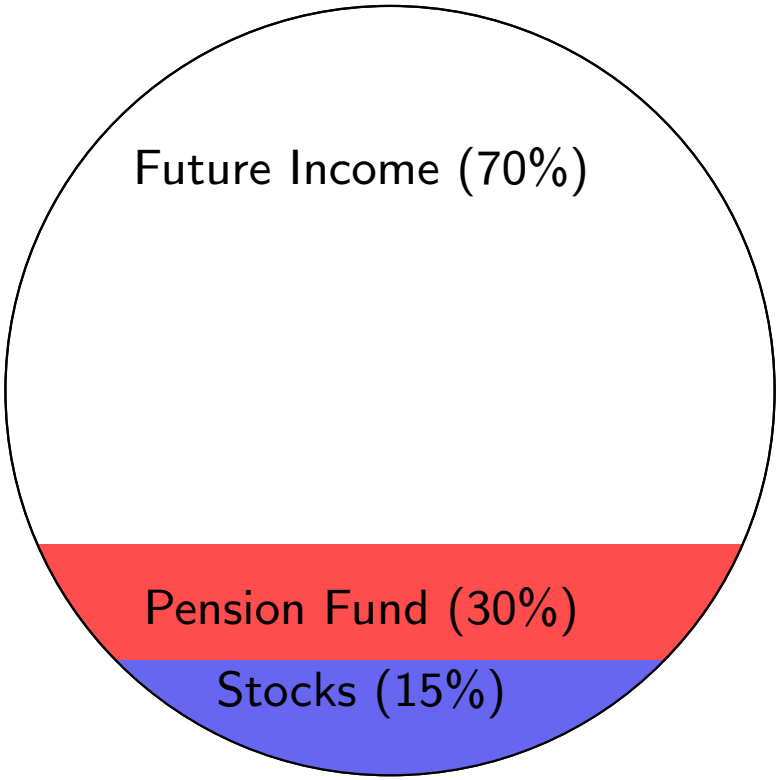

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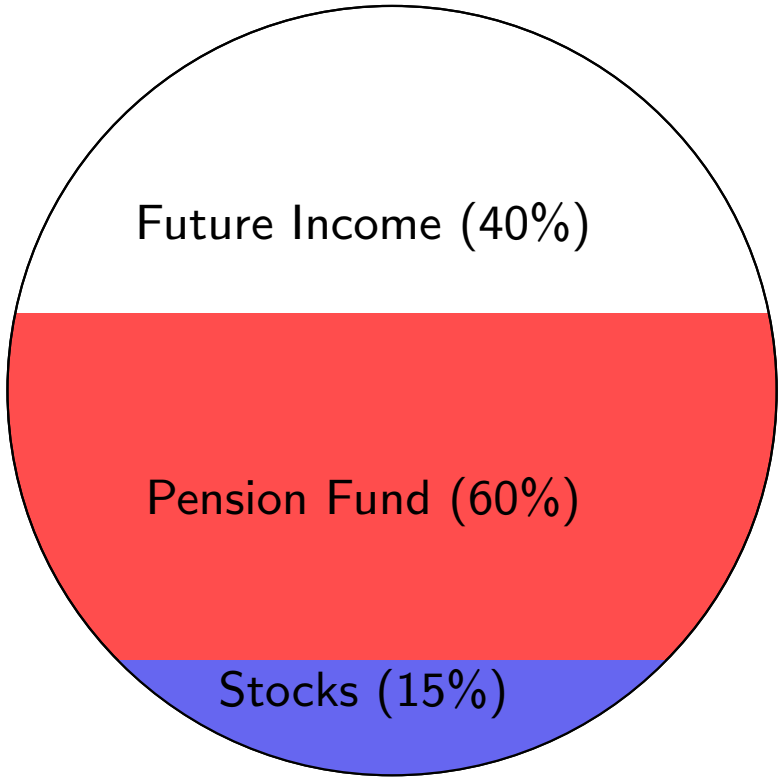

Equity share $= \frac{15\%}{60\%} = 0.25$

▸ Back to DC equity share average

Active vs Passive investors

	Active	Passive	All
Investors			
Number of investors	119,145	182,487	301,632
Fraction of investors	0.395	0.605	1.000
State variables			
Age	47.0	46.6	46.8
Financial wealth	294,284	217,846	248,039
Labor income	285,017	224,526	248,420
Educational dummies			
Elementary school	0.116	0.184	0.157
High school	0.551	0.539	0.544
College	0.320	0.267	0.288
PhD	0.013	0.010	0.011
Stock market exposure			
Participation dummy	0.619	0.455	0.520
Equity share (conditional)	0.469	0.432	0.449
Equity share (unconditional)	0.290	0.196	0.234

Nominal values are in SEK (SEK 8=$US 1)

▸ Activity and stock market participation ▸ Real estate ▸ Opt out profile

Heterogeneity within passive investors

Percentiles:	10%	25%	50%	75%	90%	Mean
All passive investors						
Age	30	38	46	56	64	46.6
Labor income	0	99,911	225,373	303,797	401,252	224,526
Financial wealth	7,135	17,116	68,580	218,505	560,981	217,846
Equity share	0.000	0.000	0.000	0.401	0.634	0.196

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$\Rightarrow$ Makes you question a one-fund-fits-all approach

▸ Breakdown by participation ▸ Age variation

Model

Model components

- A life-cycle model with incomplete markets
  - Individuals live from age 25 up to at most age 100
  - Retire at 65; Face survival rates
  - Epstein-Zin preferences allow separating between risk and smoothing
- Working phase:
  - Receive (stochastic) labor income, linked to stock market returns
  - Face shocks to labor income and to return process on risky assets (stocks)
  - Make consumption-savings decisions
- A mandated defined contribution pension account (DC) $\rightarrow$ annuity
- Financial wealth (FW) outside the pension system
- Choose their consumption–savings allocation

Financial decisions

- Assets allocated into either a Risk-free bond or Stock market equity
- DC account,(wealth *inside* the pension system)
  - Use a default allocation or pay a cost to opt out and choose optimally
  - Heterogeneity in the opt-out cost
    - Stands for heterogeneity in financial literacy and financial sophistication
    - Also captures irrational behavior
- Financial wealth, A_{t+1} (wealth *outside* the pension system)
  - Invest exclusively in bonds or pay a cost to participate and choose optimally
  - Heterogeneity in that cost exists as well

Calibration

Exogenous parameters

	Notation	Value
Preferences		
Elasticity of intertemporal substitution	$1/\rho$	0.50
Returns		
Gross risk-free rate	R_f	1.00
Equity premium	μ	0.04
Standard deviation of stock market return	σ_ε	0.18
Pension accounts contribution rates and equity share		
DC account (fully funded)	λ^{DC}	7%
Notional account (pay-as-you-go)	λ^{N}	16%
DC's default equity share	$\alpha_{it}^{DC_{Actual}}$	100-minus-age
Labor income and financial wealth (default)		
Standard deviation idiosyncratic income shock	σ_η	0.072
Weight of stock market shock in labor income	θ	0.040
Standard deviation of initial labor income	σ_z	0.366
Standard deviation of initial financial wealth	σ_A	1.392
Mean of initial financial wealth	**	76,800
Floor for notional pension	$\underline{Y}$	10,729

Nominal values are in SEK (SEK 8=$US 1)

Endogenous parameters

Calibrate discount factor ($\beta = 0.932$) and relative risk aversion ($\gamma = 14$) to match moments:

Moment	Data	Model
Financial wealth to labor income ratio	0.92	0.92
Financial wealth's (conditional) equity share	0.45	0.52

Key links between parameters and moments:

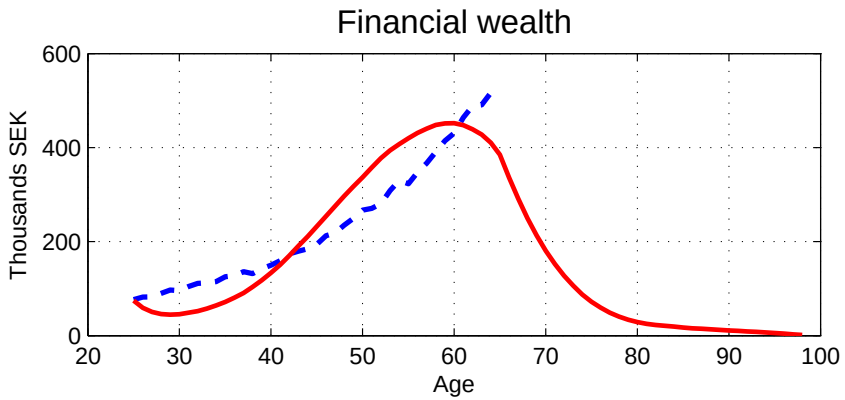
- FW (to labor income ratio) affected by the discount factor ($\beta = 0.932$)
- Equity share affected by the relative risk aversion coefficient ($\gamma = 12$)

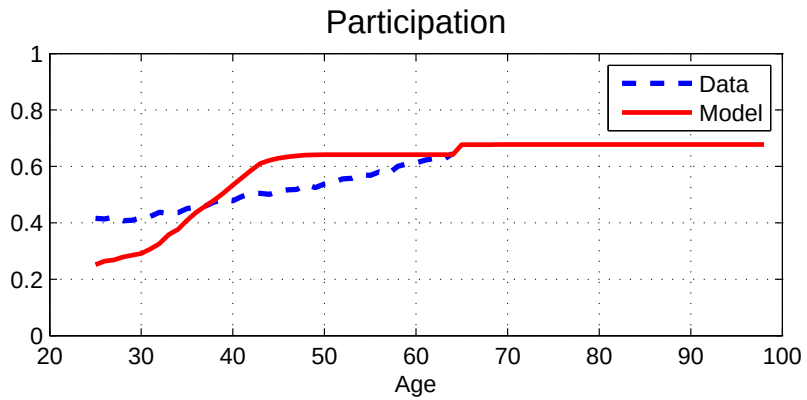
Match the joint distribution of opt-out and participation decisions by setting:

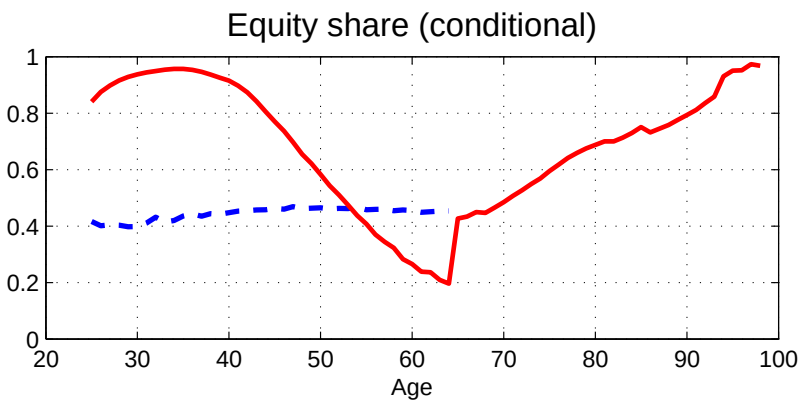
- Cap on opt-out cost ($\overline{\kappa^{DC}}$) affects the opt-out decision, $\kappa^{DC} \sim U(0, 3600)$
- Cap on participation ($\overline{\kappa}$) affects participation decision, $\kappa \sim U(0, 15600)$
- Distribution of costs (introducing a mild correlation)

▸ More details

Model fit - all



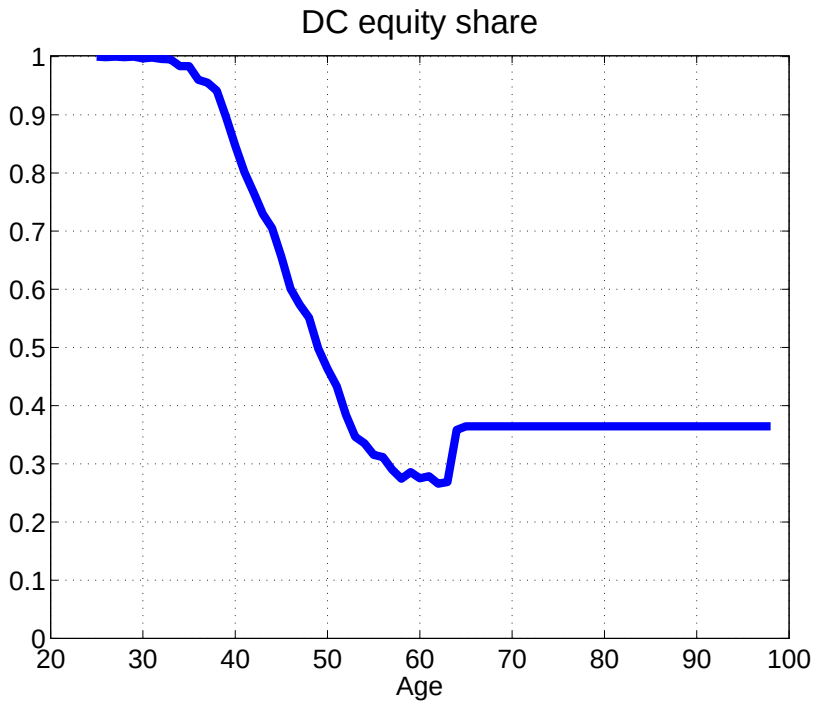




▸ Alternative model specification ▸ Three accounts figure ▸ Model fit II

Results

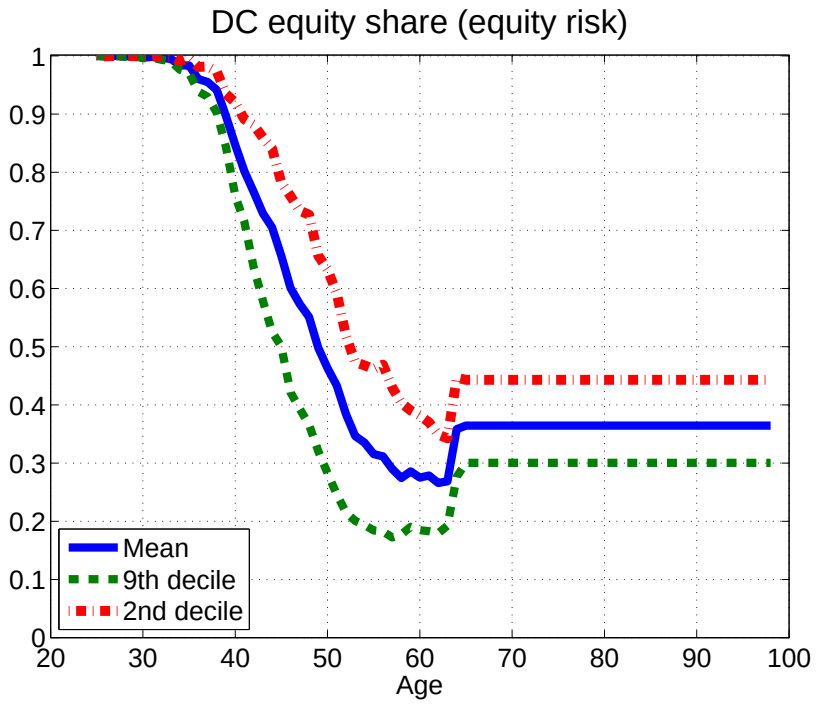
DC equity share: Average



- Investors are in a corner solution for about 10 years
- Strong life cycle decrease in the equity share $\sim$ 2 p.p. a year
  - Stronger than *100-minus-age*

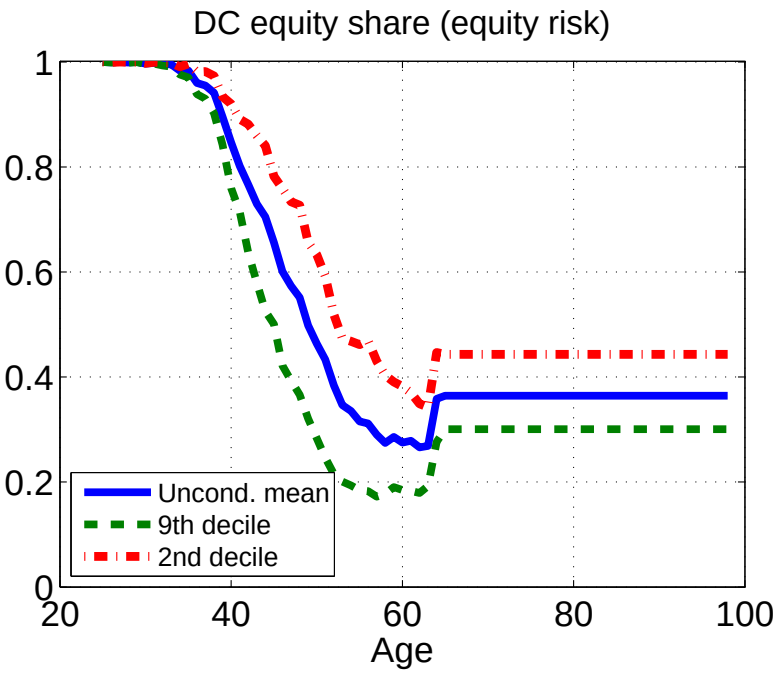
▸ Illustration ▸ Simulation details ▸ Who opts out?

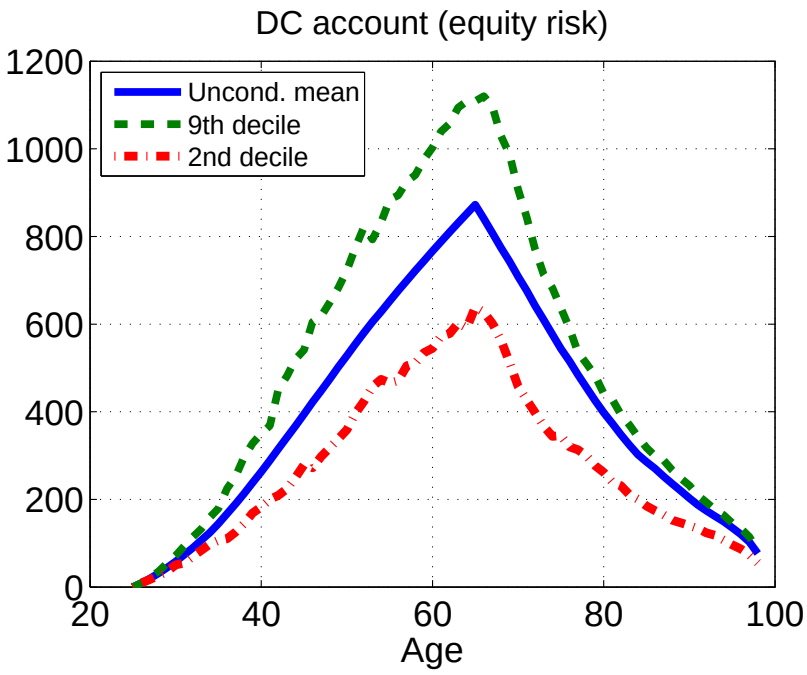
DC EQUITY SHARE: **EQUITY RISK**



- Substantial heterogeneity across economies
- What's the driving force?

DC EQUITY SHARE VS. DC ACCOUNT: **EQUITY RISK**

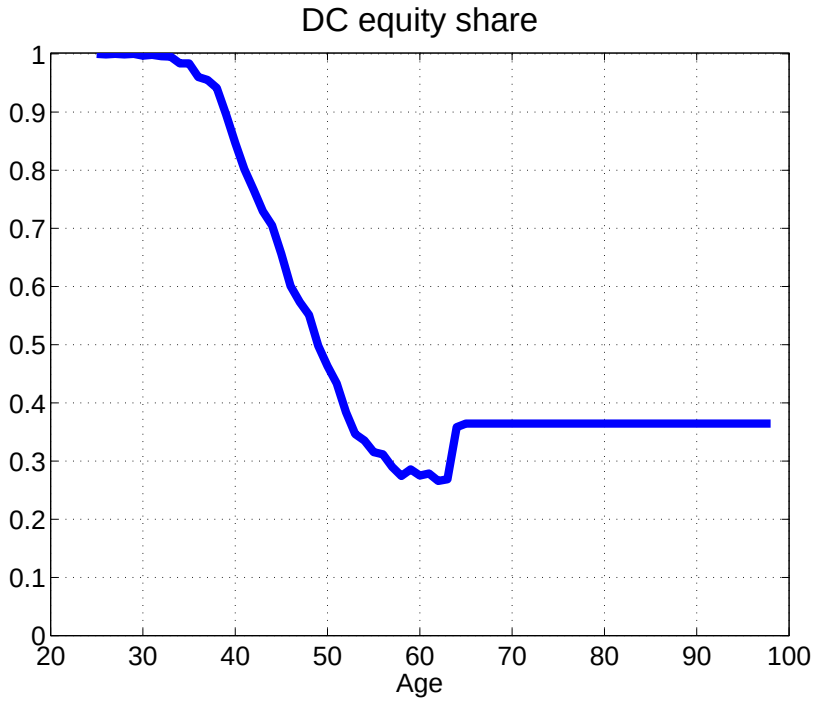




- Labor income and participation hardly change across economies
- Mechanically, high returns increases the DC account
- DC account $\uparrow \Rightarrow \frac{Wealth}{Income} \uparrow \Rightarrow$ DC equity $\downarrow$ ▸ Illustration
- Compression of pension income

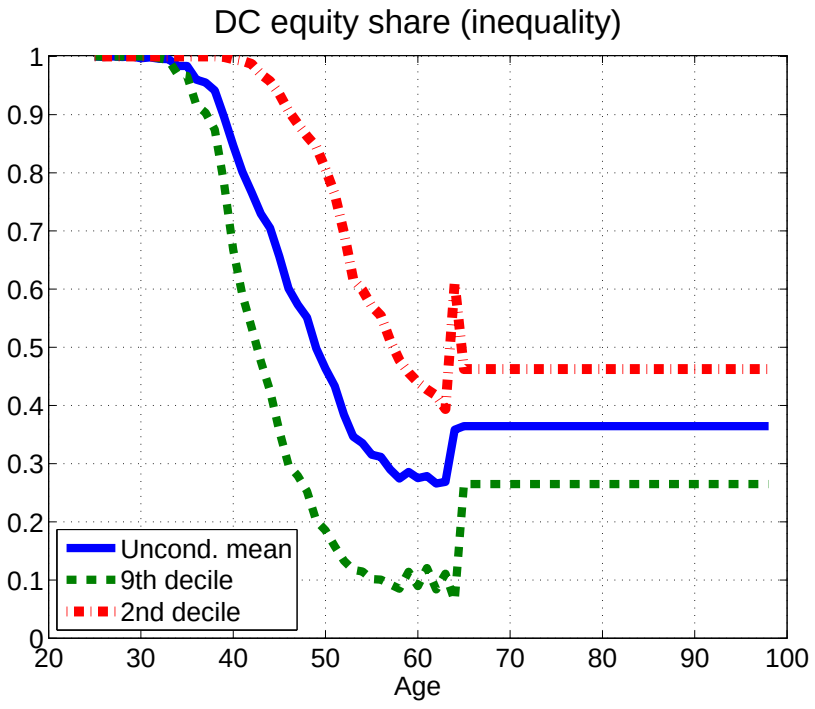
▸ DC equity share versus participation equity risk

DC EQUITY SHARE: AVERAGE



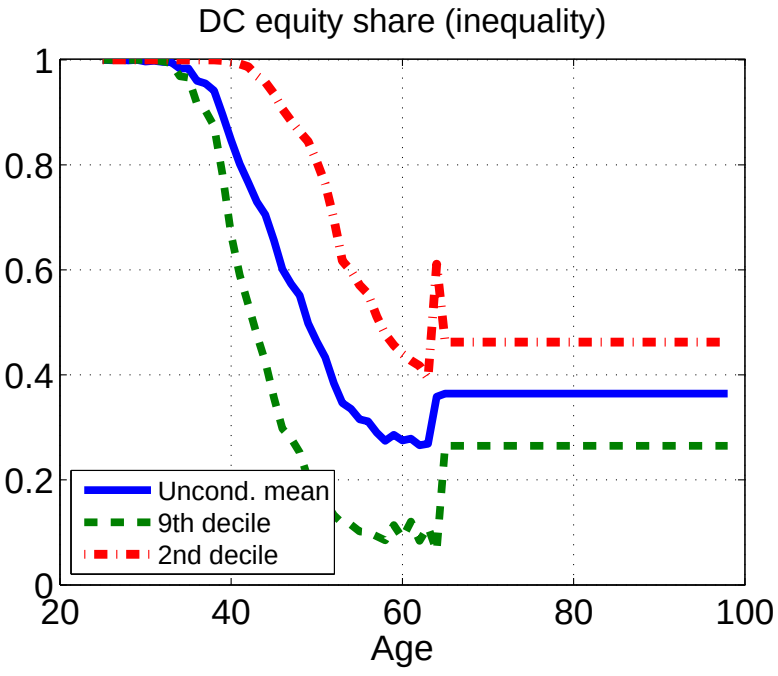
- Same average as before

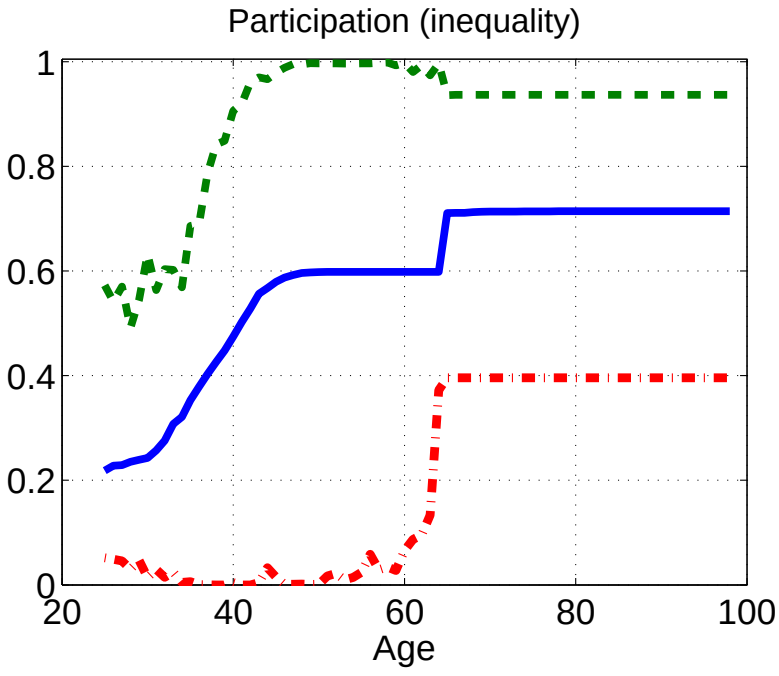
DC EQUITY SHARE: **INEQUALITY**



- Substantial dispersion across deciles of **investors**
- But again - what drives this?

DC EQUITY SHARE VS. PARTICIPATION: **INEQUALITY**





- Participation levels that correspond to the equity share deciles
- Participation $\uparrow \Rightarrow$ Exposure in (liquid) financial wealth $\uparrow \Rightarrow$ DC equity $\downarrow$

Rule of thumb for asset allocation

- Use the relationship in the (simulated) data that the model generates between α_{it}^{DC} and all state variables
- Regression-based approximation of the optimal DC equity share, α_{it}^{DC}:

$$\alpha_{it}^{DC} = \beta_0 + \underbrace{\beta_1 t}_{\text{Age}} + \underbrace{\beta_2 A_{it}}_{\text{Wealth}} + \underbrace{\beta_3 A_{it}^{DC}}_{\text{DC account}} + \underbrace{\beta_4 Y_{it}}_{\text{Income}} + \underbrace{\beta_5 I_{it}}_{\text{Participation}} + \varepsilon_{it}$$

- To be clear: all the data is from the model

Regressions on simulated data

	I	II	III	IV	V	VI	VII
Constant	1.746***	1.873***	1.585***	1.738***	1.313***	1.347***	1.266***
	(0.016)	(0.015)	(0.018)	(0.016)	(0.013)	(0.011)	(0.012)
Age	–0.024***	–0.023***	–0.018***	–0.022***	–0.009***	–0.008***	–0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Labor income		–0.760***					0.262***
		(0.039)					(0.025)
Financial wealth			–0.565***				–0.096***
			(0.041)				(0.032)
Participation dummy				–0.233***		–0.196***	–0.198***
				(0.006)		(0.003)	(0.004)
DC account balance					–0.666***	–0.603***	–0.618***
					(0.026)	(0.022)	(0.017)
R-squared	0.630	0.687	0.740	0.730	0.786	0.855	0.859

Rule of thumb for asset allocation

- Age-dependent rule for equity share:

$$\alpha_{it}^{DC} = \min\left\{1.746 - \underbrace{0.024 \cdot t}_{\text{Age}}, 1\right\}$$

- Rule of thumb for equity share:

$$\alpha_{it}^{DC} = \min\left\{1.347 - \underbrace{0.008 \cdot t}_{\text{Age}} - \underbrace{0.603 \cdot A_{it}^{DC}}_{\text{DC account}} - \underbrace{0.196 \cdot I_{it}}_{\text{Participation}}, 1\right\}$$

Welfare analysis

From *Optimal flat* to *Optimal individual*:

	Optimal flat	Actual age	Optimal age	Rule of thumb	Optimal individual
Cumulated welfare gain	—	0.1%	0.4%	1.0%	1.6%
Incremental welfare gain	—	0.1%	0.3%	0.6%	0.6%
Share of default investors	0.54	0.59	0.68	0.75	1.00

Welfare analysis - robustness

	Main	Fixed allocation outside	Random allocation outside	Left-skewed equity returns	Low equity premium	Low share of default investors
Gain relative to optimal flat						
Optimal individual	1.6%	2.2%	2.4%	1.6%	1.7%	1.8%
Optimal age	0.4%	0.4%	0.4%	0.4%	0.6%	0.5%
Rule of thumb (incremental)	0.6%	0.7%	0.7%	0.6%	0.5%	0.7%
Share default investors						
under actual age	0.59	0.60	0.60	0.61	0.59	0.33
under Rule of thumb	0.75	0.73	0.74	0.77	0.76	0.62

▸ More details

In a nutshell

- Statistical facts:
  - Passive and active investors differ across key characteristics
  - Large heterogeneity among passive investors

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  - Passive and active investors differ across key characteristics
  - Large heterogeneity among passive investors
- Structural analysis:
  - Large dispersion in optimal DC equity share, even within age groups:

    - Equity risk (aggregate shocks): DC balance $\uparrow \Rightarrow$ DC equity share $\downarrow$

    - Inequality (idiosyncratic shocks): Participation $\uparrow \Rightarrow$ DC equity share $\downarrow$
  - A simple (linear) rule of thumb captures much of this heterogeneity

    - Incremental welfare gain is larger than age dependence

    - (Endogenous) opt-out rate decreases by about 40% (from 41% to 25%)
  - Results are robust to various model specifications

Research agenda - household finance

- Design:
  - Should *deposits* differ across age and other characteristics?
  - Add more heterogeneity - real estate, risk aversion...

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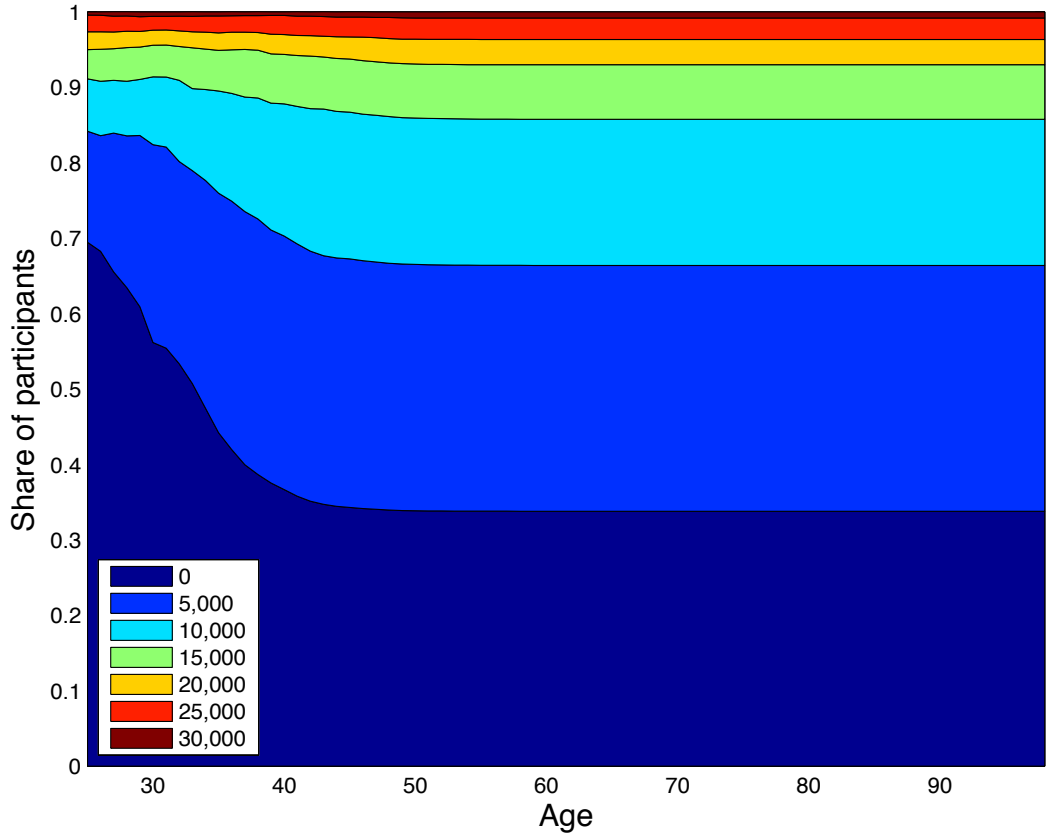
  - Should *deposits* differ across age and other characteristics?
  - Add more heterogeneity - real estate, risk aversion...
- Empirical micro
  - Interaction between portfolio choice in and out the pension
  - Heterogeneity in portfolio choice with respect to age, real estate, ...

Thank you

Extra slides

Details on Sweden's statistics, pension and opt out

Fraction of each type among participants



Passive vs active investors + real estate

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PhD	0.013	0.010	0.011
Real estate ownership and net worth			
Real estate dummy	0.793	0.652	0.708
Real estate wealth	1,009,899	817,972	893,784
Net worth	847,993	665,790	737,760

Nominal values are in SEK (SEK 8=$US 1)

▸ Back to active vs passive statistics

Heterogeneity within passive investors

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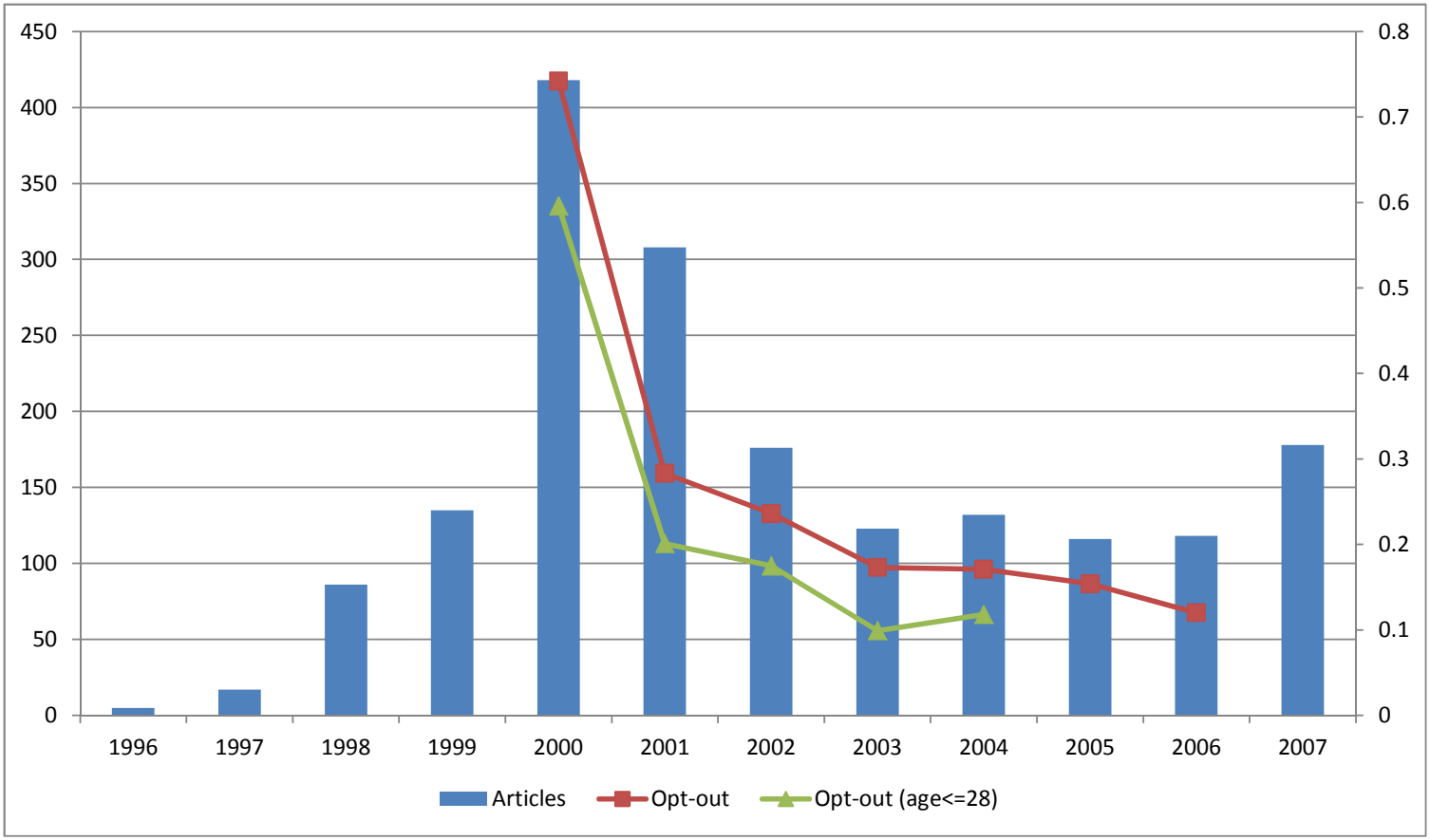
B. Participants						
Age	32	39	48	58	65	48.3
Labor income	0	137,245	250,315	336,004	460,812	258,714
Financial wealth	26,272	68,468	176,367	432,910	934,804	374,888
Equity share	0.088	0.234	0.438	0.609	0.764	0.432
C. Non-participants						
Age	30	36	44	54	62	45.2
Labor income	0	72,964	205,647	277,920	350,952	195,969
Financial wealth	7,135	7,135	26,996	83,589	207,063	86,676
Equity share	0.000	0.000	0.000	0.000	0.000	0.000

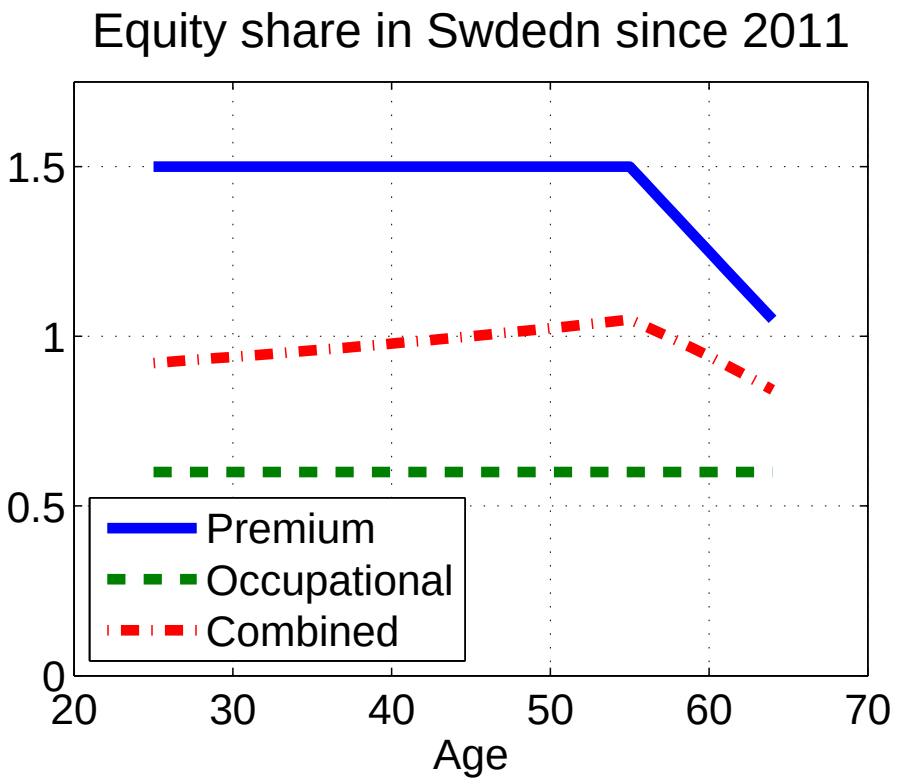
▸ Back to heterogeneity within passive investors

Opt out profile



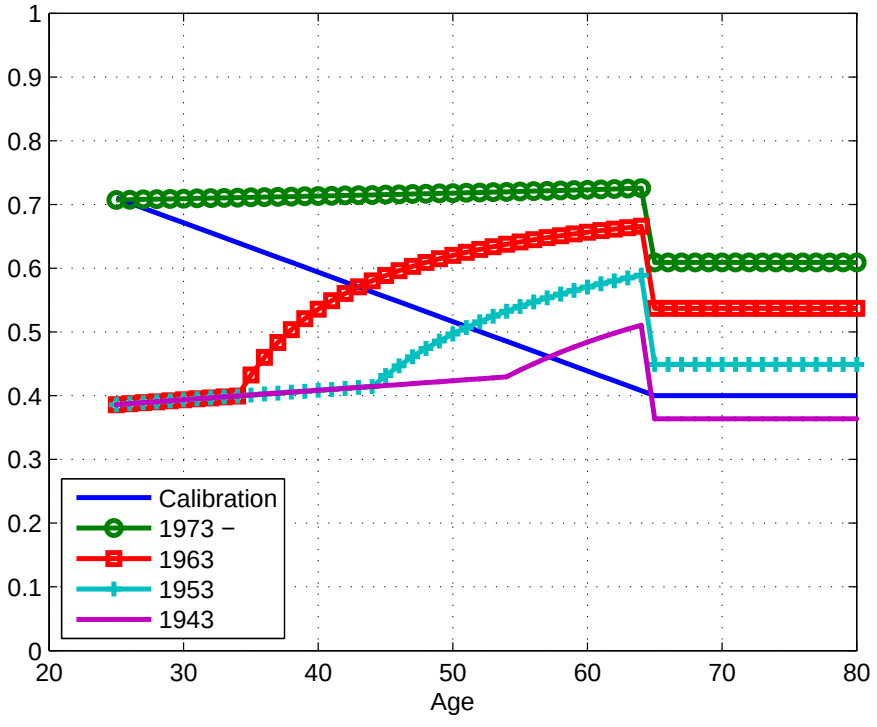
Back to active vs passive statistics

Equity share since 2011



Back

Calibration: Composition of cohorts



Back

Stock market participation

	I	II	III	IV
Default investor dummy		–0.133***	–0.087***	–0.087***
		(0.002)	(0.002)	(0.003)
Initially active dummy		–0.055***	–0.037***	–0.038***
		(0.002)	(0.002)	(0.002)
Age	0.080***	0.022***	—	—
	(0.007)	(0.007)		
Labor income	0.153***	0.119***	—	—
	(0.004)	(0.004)		
Financial wealth	0.293***	0.289***	—	—
	(0.002)	(0.002)		
Real estate dummy	0.149***	0.127***	0.063***	0.054***
	(0.002)	(0.002)	(0.002)	(0.002)
Educational dummies	Yes	Yes	Yes	Yes
Geographical dummies	Yes	Yes	Yes	Yes
Industry & occupational dummies	No	No	No	Yes
Age/income/wealth splines	No	No	Yes	Yes
R-squared	0.141	0.153	0.295	0.283
Number of observations	318,345	318,345	318,345	186,651

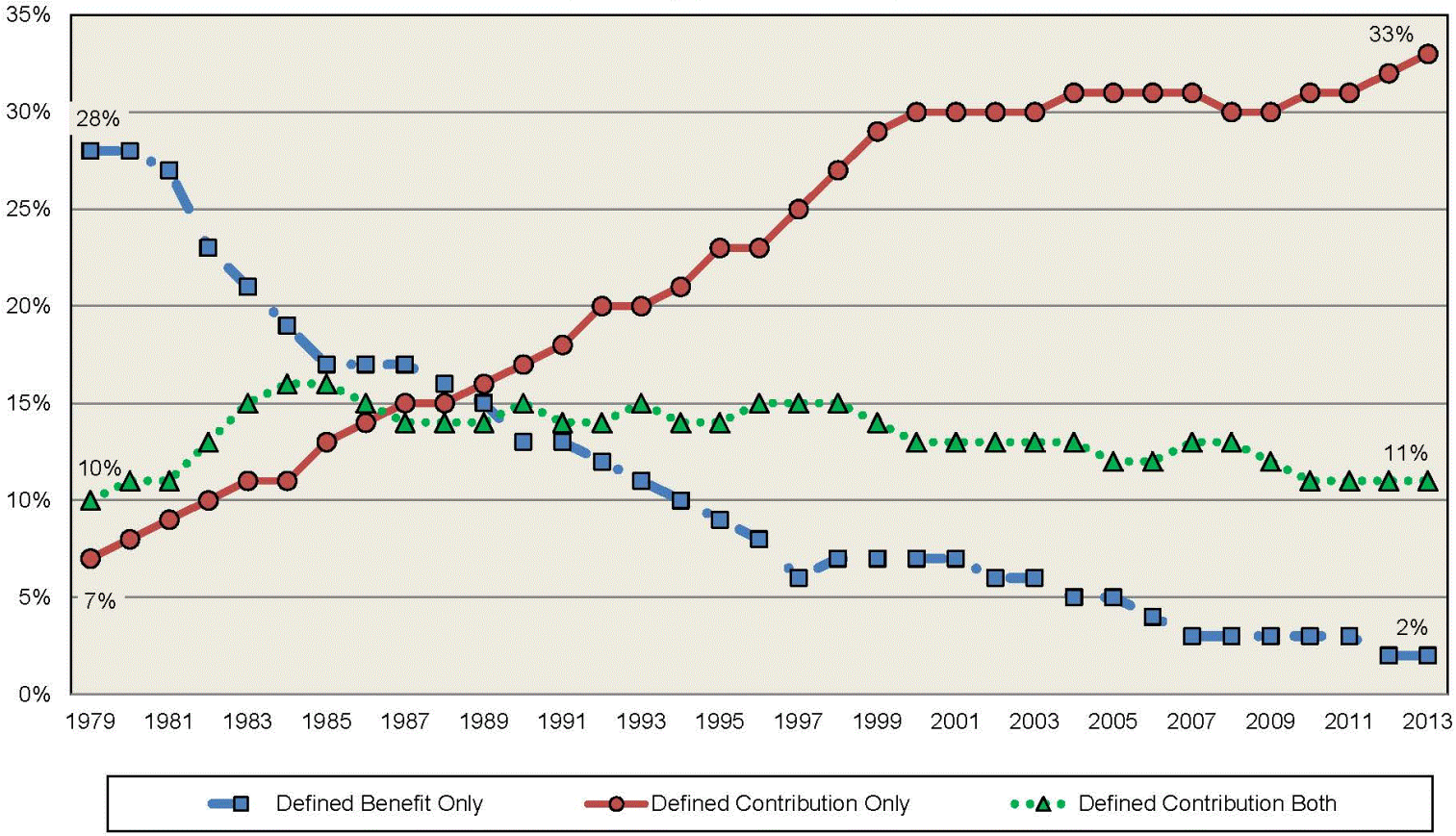
Back

DC vs DB US

Figure 1

Private-Sector Workers Participating in Employment-Based Retirement Plans, by Plan Type, 1979–2013

(*Among All Workers*)



Source: U.S. Department of Labor Form 5500 Summaries 1979–1998, Pension Benefit Guaranty Corporation,

Back to motivation

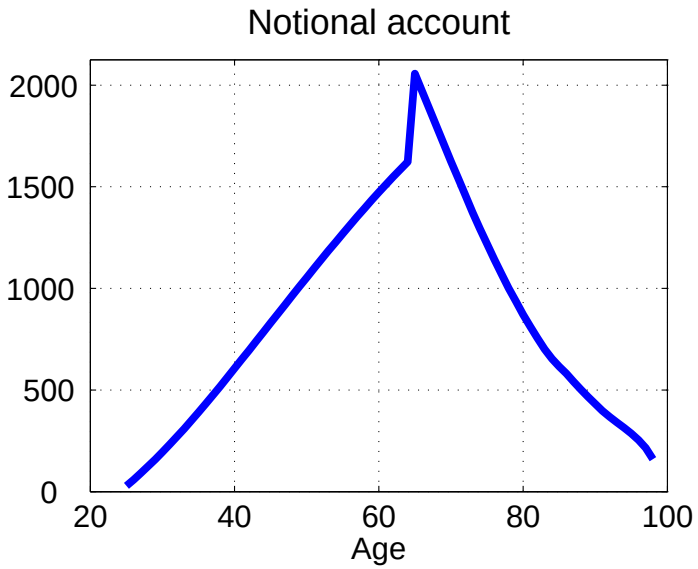
Activity and stock market participation

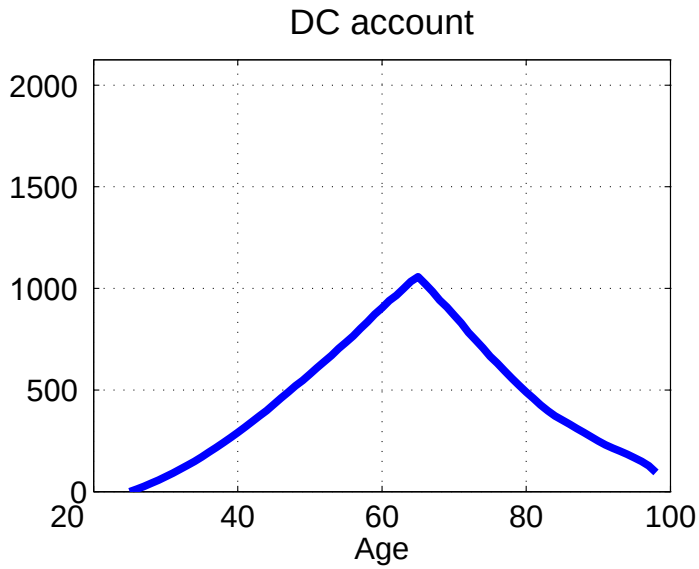
	Activity dummy		Participation dummy	
	I	II	III	IV
A. Main regressions				
Age	0.038*** (0.008)	—	0.220*** (0.008)	—
Labor income	0.216*** (0.004)	—	0.173*** (0.004)	—
Financial wealth	0.049*** (0.002)	—	0.281*** (0.002)	—
Real estate dummy	0.122*** (0.002)	0.068*** (0.002)	0.167*** (0.002)	0.074*** (0.002)
Educational dummies	Yes	Yes	Yes	Yes
Geographical dummies	Yes	Yes	Yes	Yes
Age/income/wealth splines	No	Yes	No	Yes
R-squared	0.044	0.067	0.150	0.291
Number of observations	301,632	301,632	301,632	301,632
B. Residual regressions				
Activity			0.101*** (0.002)	0.060*** (0.002)
R-squared			0.011	0.005
Number of observations			301,632	301,632

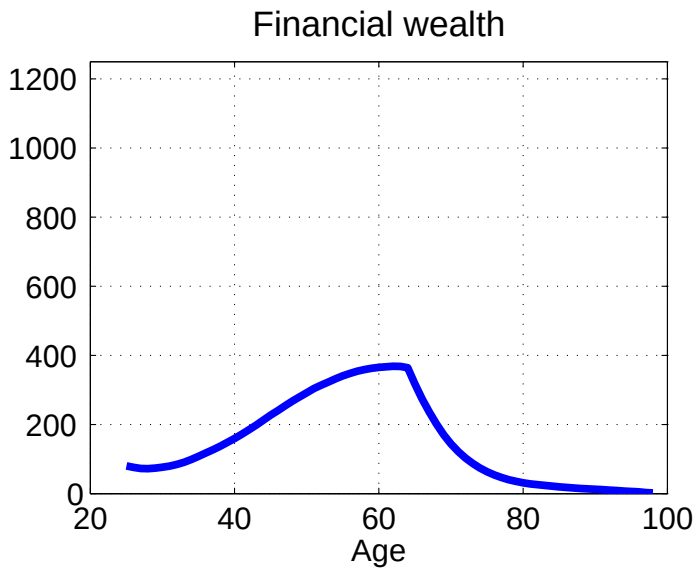
▸ Back to active vs passive statistics

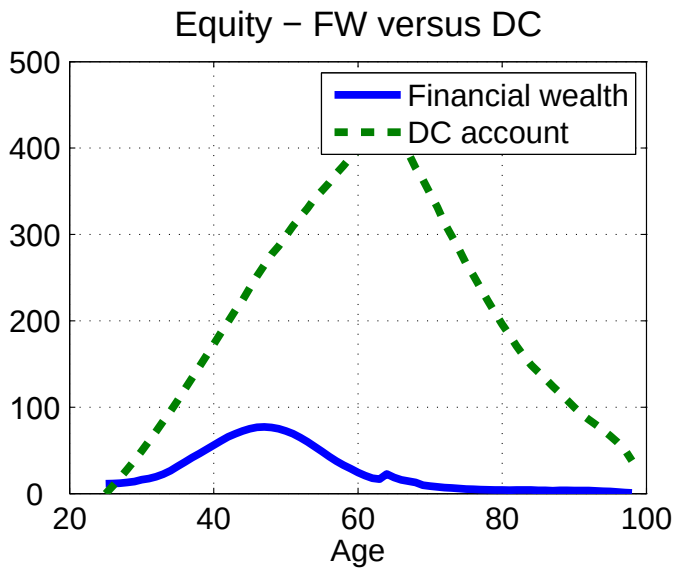
Model - additional figures

THREE ACCOUNTS



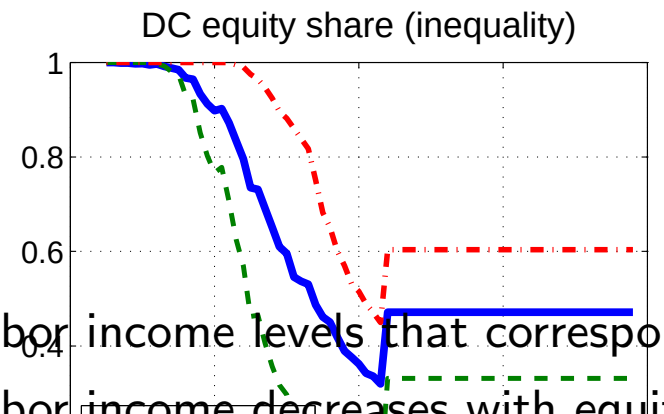


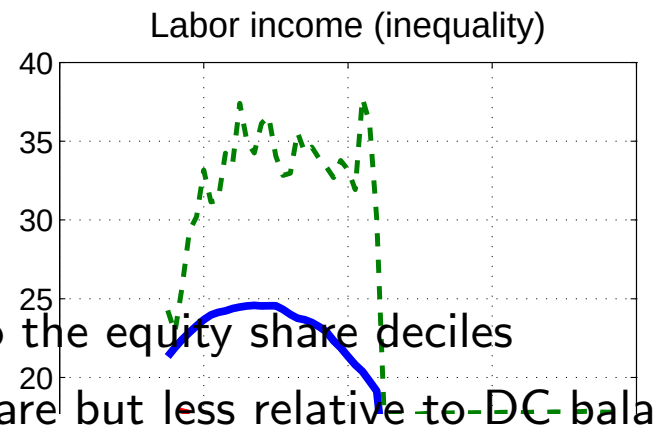




Back

Driving forces - labor income

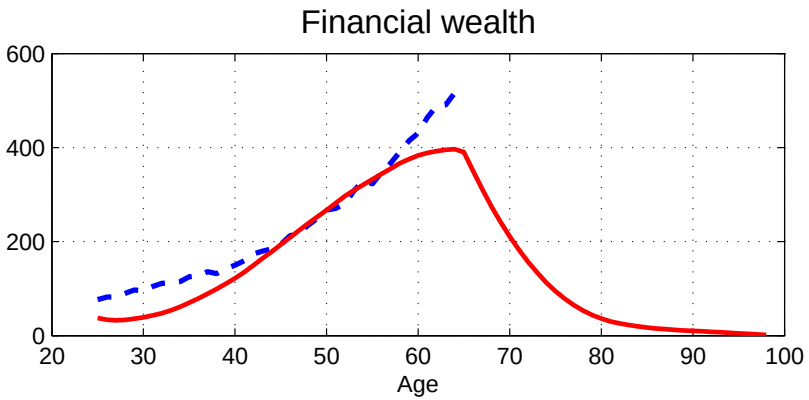


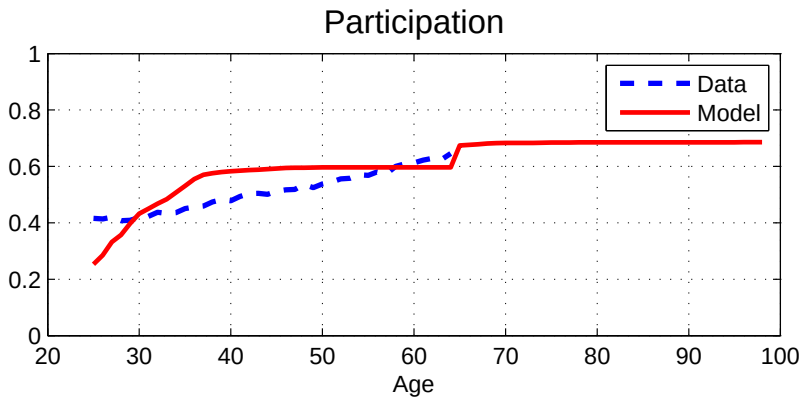


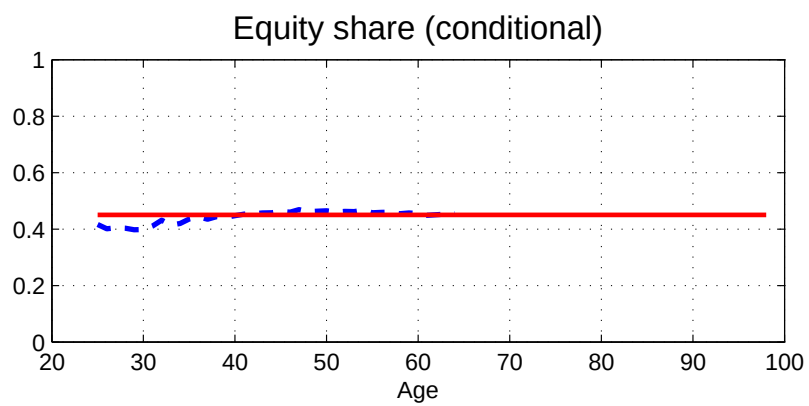
- Labor income levels that correspond to the equity share deciles
- Labor income decreases with equity share but less relative to DC balance
- Investors with low income are relatively wealth-poor
- Investors rebalance by increasing the equity share

Back to DC wealth

Calibration: Model fit

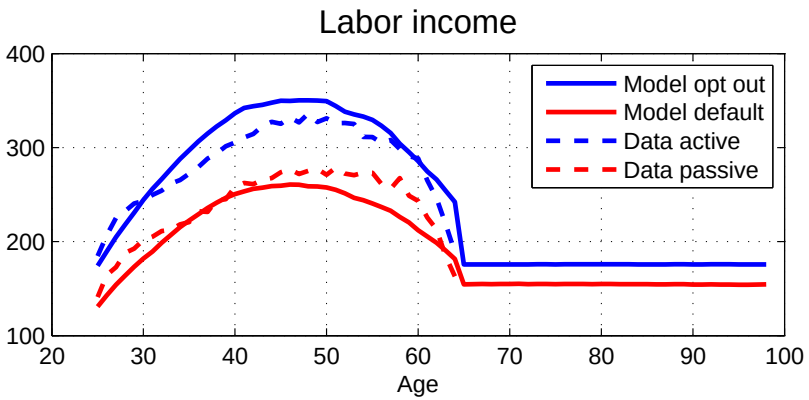


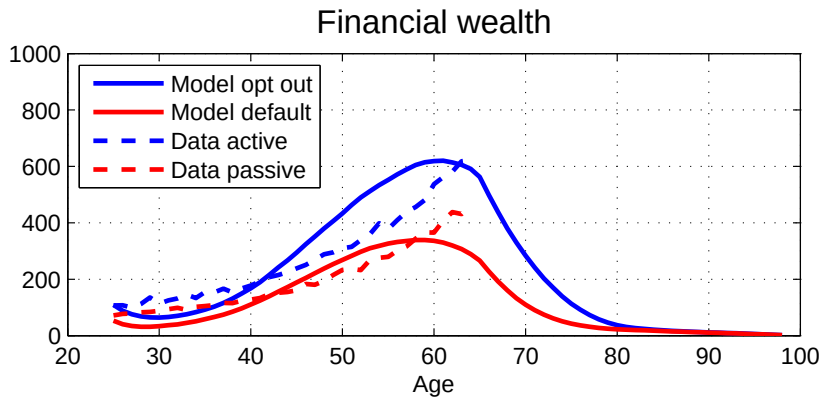


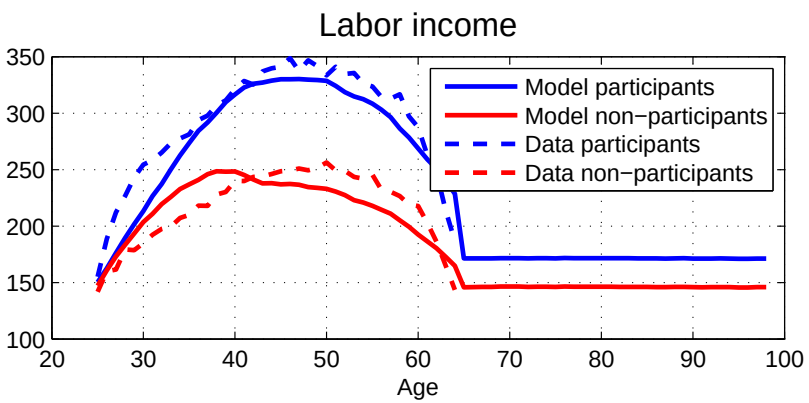


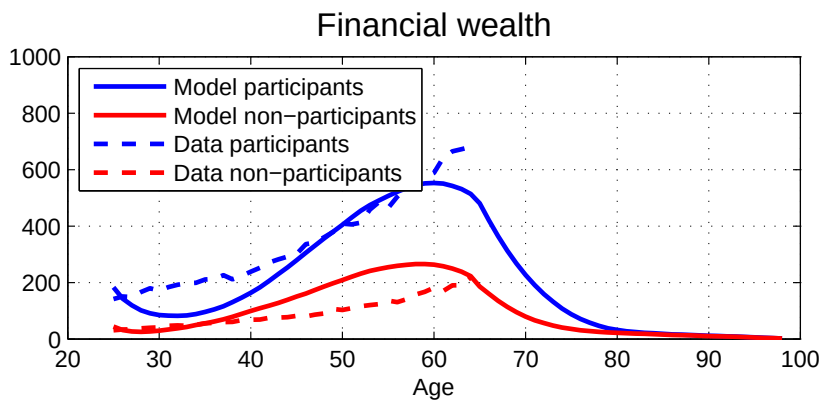
Back to model fit

Calibration: Model fit II



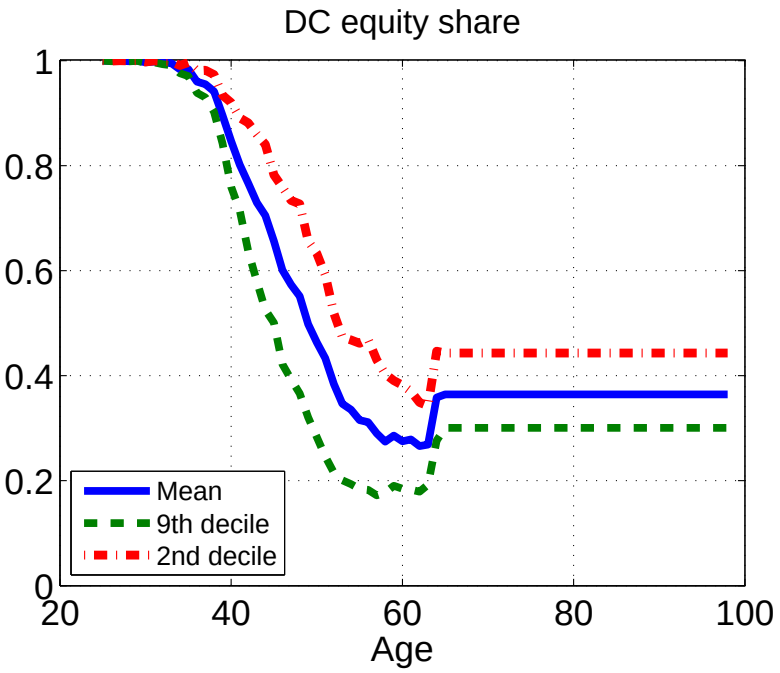


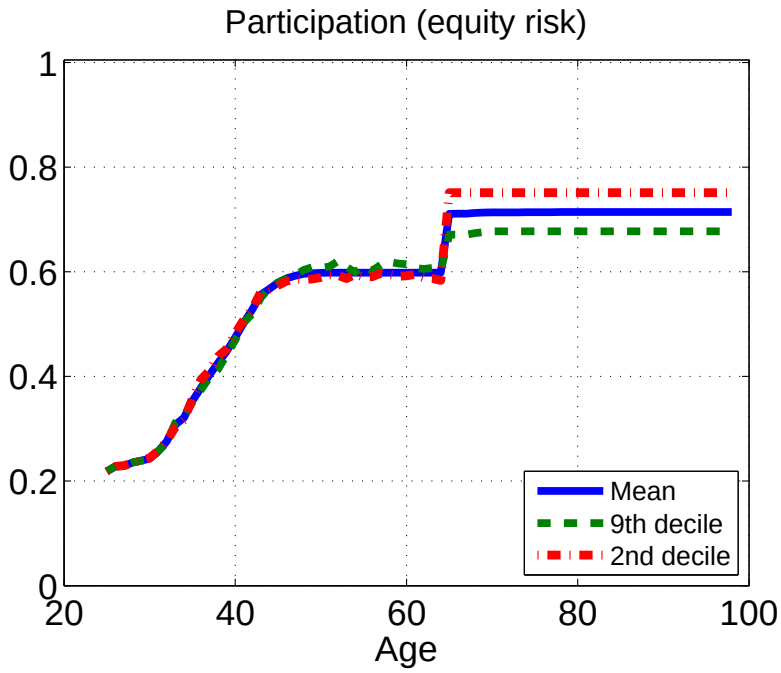




▸ Back to model fit II

DC EQUITY SHARE VERSUS PARTICIPATION





- A much weaker link between participation and DC equity share (relative to inequality)

▸ Back to DC equity share versus balance equity risk

Thought experiment

- Default choice may be rational, rational inattention or irrational
- Once the default choice had been made - treat investor as rational
- Three options for life-cycle asset allocation of default:
  - A representative agent
  - Aggregation of heterogenous agents
  - Full characterization and partial customization for investors – This paper!
- Asset allocation is based on age and additional observable variables

Back (Methodology)

THREE SAVING ACCOUNTS

1. Financial wealth (liquid)
   - Access to stocks via the one-time participation shock

$$A_{it+1} = A_{it}\left(R_f + \alpha_{it}(R_{t+1} - R_f)\right) + Y_{it+1} - C_{it}$$

$$X_{it+1} \equiv A_{it}\left(R_f + \alpha_{it}(R_{t+1} - R_f)\right) + Y_{it+1}$$

2. A fully-funded (FF) DC account in the pension system
   - Income based, investors choose bonds and stocks allocation
   - Corresponds to the default fund we wish to design

$$A^{DC}_{it+1} = A^{DC}_{it}(R_f + \alpha^{DC}_{it}(R_{t+1} - R_f)) + \lambda^{DC} Y_{it}$$

3. A notional account belonging to the pension system
   - Income based, evolves at the rate of the risk-free bond

$$A^{N}_{it+1} = A^{N}_{it} R_f + \lambda^{N} \min\{Y_{it}, \overline{Y}\}$$

   - Together with FF becomes an annuity at retirement with longevity insurance

Back to investor problems

Who opts out?

Probability (in percent) of opting out for each type:

κ^{DC}						
	3,600	—	2.6	2.6	2.8	3.0
	2,700	9.4	9.8	1.0	11.4	15.8
	1,800	28.0	28.2	30.2	31.8	34.2
	900	43.2	46.2	78.4	80.6	82.6
	0	100.0	100.0	100.0	100.0	—
		0	3,900	7,800	11,700	15,600
				κ		

Back to who opts out

Primer on asset allocation over the life cycle

- Conventional wisdom: equity share should decrease with age
- Another conventional wisdom: this is due to the time horizon
  - This is wrong (Samuelson, 1963, *Risk and Uncertainty: the Fallacy of the Law of Large Numbers*)
- Recent papers have incorporated labor income
  - Labor income substitutes a riskless asset (Cocco et al RFS 2005)
  - Age $\uparrow \Rightarrow$ labor income stock $\downarrow \Rightarrow$ total bond in portfolio $\downarrow$

    $\Rightarrow$ Rebalance by $\uparrow$ bond in portfolio $\Rightarrow$ Equity share decreases with age
  - More generally, equity share is a function of labor income and assets

▸ Back to results ▸ Illustration

Welfare analysis - robustness

	Main	Fixed allocation outside	Random allocation outside	Left-skewed equity returns	Low equity premium	Low share of default investors
Main results						
Welfare gain of Optimal	1.6%	2.2%	2.4%	1.6%	1.7%	1.8%
Optimal age	0.4%	0.4%	0.4%	0.4%	0.6%	0.5%
Rule of thumb (incremental)	0.6%	0.7%	0.7%	0.6%	0.5%	0.7%
Share of default investors under Rule of thumb	0.75	0.73	0.74	0.77	0.76	0.62
Preferences & stock market participation cost						
Discount factor* β	0.933	0.940	0.943	0.933	0.951	0.939
Relative risk aversion* γ	14	14	14	14	8	14
Ceiling for opt-out cost* $\overline{\kappa}^{DC}$	3,600	5,800	5,700	3,700	3,300	13,700
Ceiling for stock market entry cost* $\overline{\kappa}$	15,600	5,400	4,200	14,700	5,200	1,800
Number of layers in the cost distribution*	3	4	4	3	4	3
Moments						
Financial wealth to labor income ratio	0.921	0.890	0.913	0.911	0.932	0.904
Equity share (conditional)	0.519	0.432	0.530	0.485	0.461	0.568
Active (opting out) / non-participation	0.158	0.150	0.124	0.140	0.147	0.289
Active (opting out) / participation	0.255	0.254	0.271	0.251	0.262	0.382
Passive (default) / non-participation	0.316	0.309	0.321	0.343	0.333	0.193
Passive (default) / participation	0.271	0.287	0.284	0.266	0.259	0.135

Back

Endogenous parameters details I

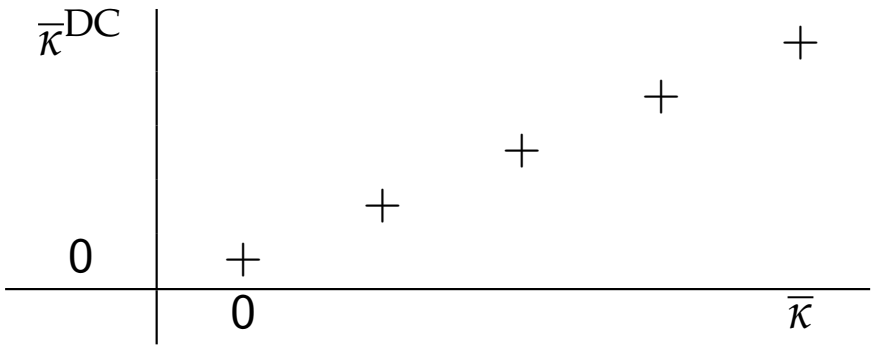
- Matching the opt-out and participation choices
  - Cap on opt-out cost (κ^{DC}) affects the opt-out decision
  - Cap on participation (κ) affects the participation decision
- To capture the joint distribution use the following cost structure:

$\overline{\kappa}^{\mathrm{DC}}$					
	4	3	2	1	0
	3	2	1	0	1
	2	1	0	1	2
	1	0	1	2	3
0	0	1	2	3	4
	0				$\overline{\kappa}$

- Key degree of freedom: distance from the diagonal

Endogenous parameters details II

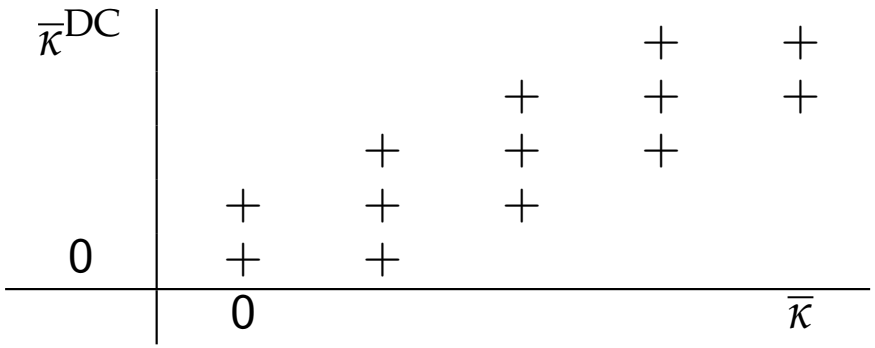
- Matching the opt-out and participation choices
  - Cap on opt-out cost (κ^{DC}) affects the opt-out decision
  - Cap on participation (κ) affects the participation decision
- To capture the joint distribution use the following cost structure:



- Diagonal **only** $\Rightarrow$ **strong** correlation in choices

Endogenous parameters details III

- Matching the opt-out and participation choices
  - Cap on opt-out cost (κ^{DC}) affects the opt-out decision
  - Cap on participation (κ) affects the participation decision
- To capture the joint distribution use the following cost structure:



- Diagonal **plus one level** $\Rightarrow$ **milder** correlation in choices

Endogenous parameters details IV

- Parameters used:
  - Diagonal distance $= 3$
  - Cap on opt-out cost ($\kappa^{DC} = 3,600$)
  - Cap on participation ($\kappa = 15,600$)

Moment	Data	Model
Active (opt out) / non-participation	0.15	0.16
Active (opt out) / participation	0.24	0.26
Passive (default) / non-participation	0.33	0.31
Passive (default) / participation	0.28	0.21

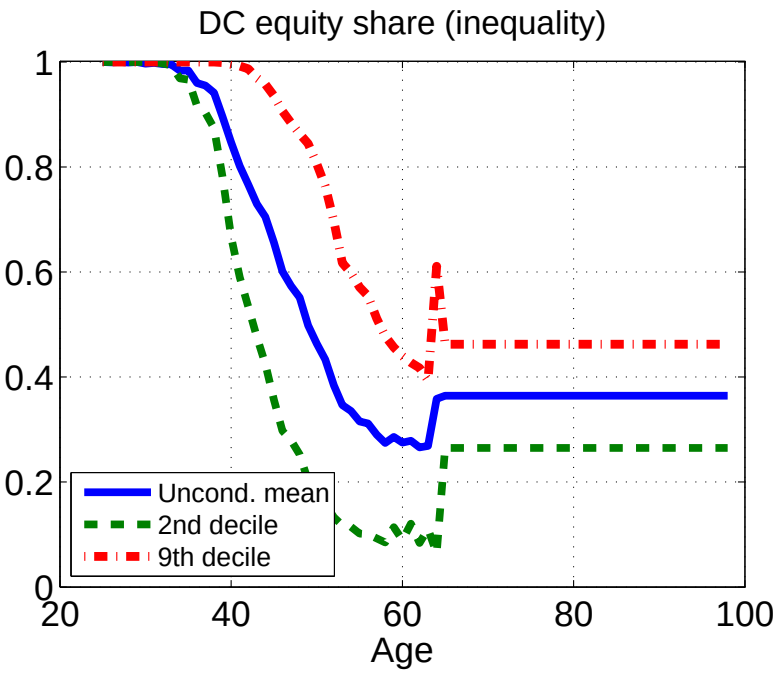
Back to endogenous parameters

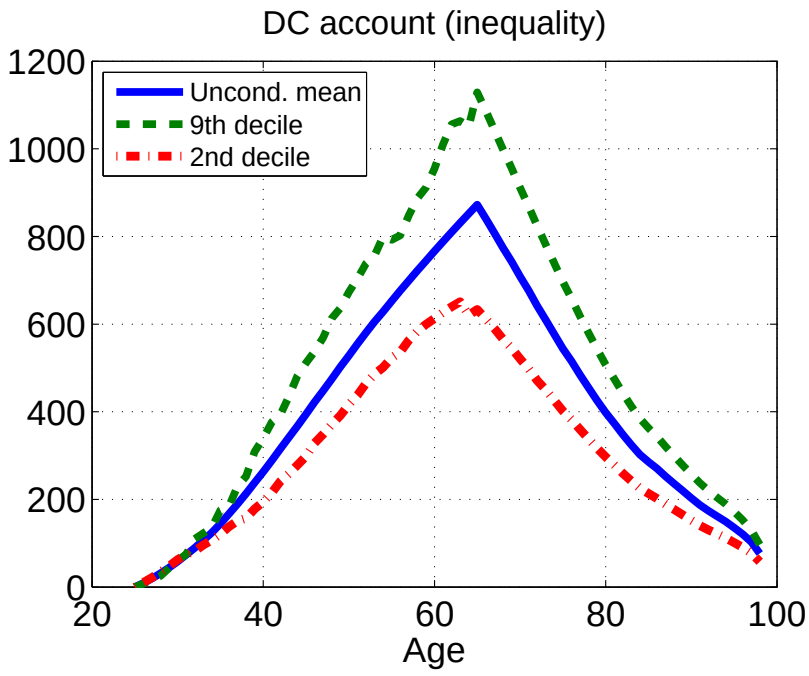
Heterogeneity within passive investors

Percentiles:	10%	25%	50%	75%	90%	Mean
All passive investors						
Age	30	38	46	56	64	46.6
Labor income	0	99,911	225,373	303,797	401,252	224,526
Financial wealth	7,135	17,116	68,580	218,505	560,981	217,846
Equity share	0.000	0.000	0.000	0.401	0.634	0.196
Age profile:						
Age profile	30	38	46	56	64	Mean
Labor income	201,696	244,114	276,989	261,305	163,009	224,526
Financial wealth	88,165	115,597	183,358	301,847	464,663	217,846
Equity share	0.086	0.144	0.176	0.202	0.249	0.196

▸ Back to heterogeneity within passive investors

DC equity share versus DC account





- DC account levels that correspond to the equity share deciles
- DC account responds to labor income shock
- No reverse causality story here
- Compression of pension income

▸ Labor income

Results: Who opts out?

Opt out is a response to a mix of factors; It

- decreases with the opt-out cost (κ^{DC})
- increases with the participation cost (κ)
  - indicating substitution between the two accounts
- increases with the potential gain (in absence of the opt-out cost)
  - As in Carroll et al., (2009) for 401(k)

▸ Share of default investors ▸ DC equity share average

Simulation method

- Two sources of risk:
  1. Idiosyncratic – uninsurable labor income shocks (inequality)
  2. Aggregate – shocks to stock market (equity risk)
- An economy: life-cycle path for one cohort with common equity returns
- Simulate many economies with different returns, each with many investors
- We study the life-cycle profile of the optimal DC equity share:
  1. Inequality: taking the average DC equity share of each individual over economies and sort *individuals*
  2. Equity risk: taking the average DC equity share of each economy over individuals and sort *economies*

Back to results

Default portfolio

TABLE: Comparison of the Default Fund and the Mean Actively Chosen Portfolio

Portfolio characteristic	Default	Mean actively chosen portfolio
Asset allocation		
Equities	82	96.2
Sweden	17	48.2
Americas	35	23.1
Europe	20	18.2
Asia	10	6.7
Fixed-income securities	10	3.8
Hedge funds	4	0
Private equity	4	0
Indexed	60	4.1
Fee	0.17	0.77
Beta	0.98	1.01
Ex post performance	29.9	39.6

Source: Cronqvist and Thaler (2004)

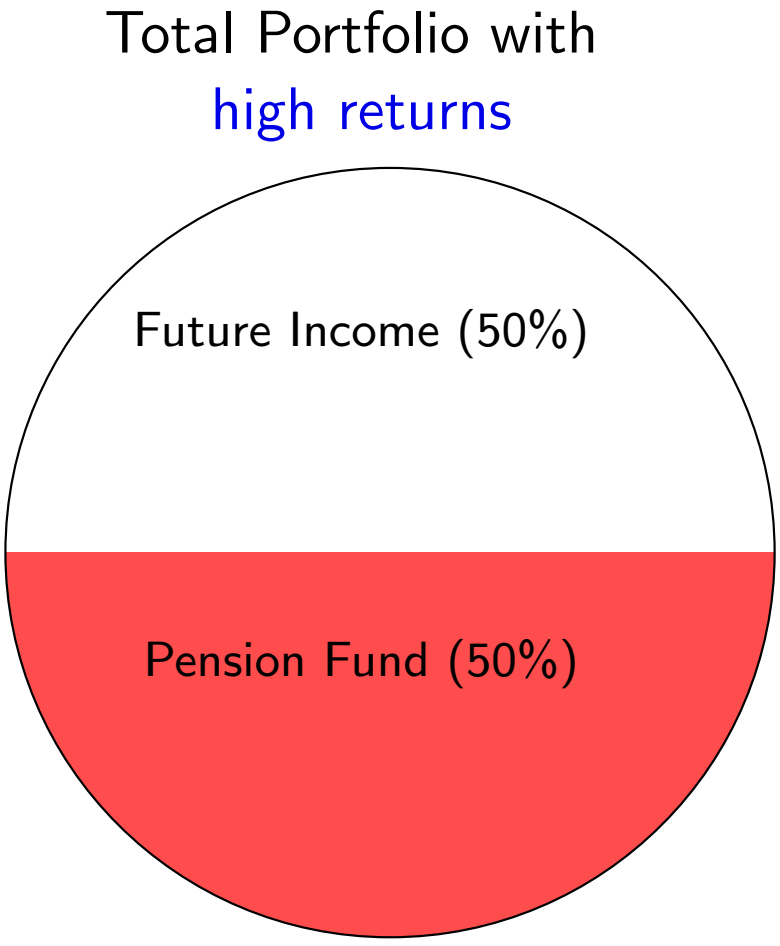
Back to Sweden pension plan

Portfolio decisions - the role of equity risk

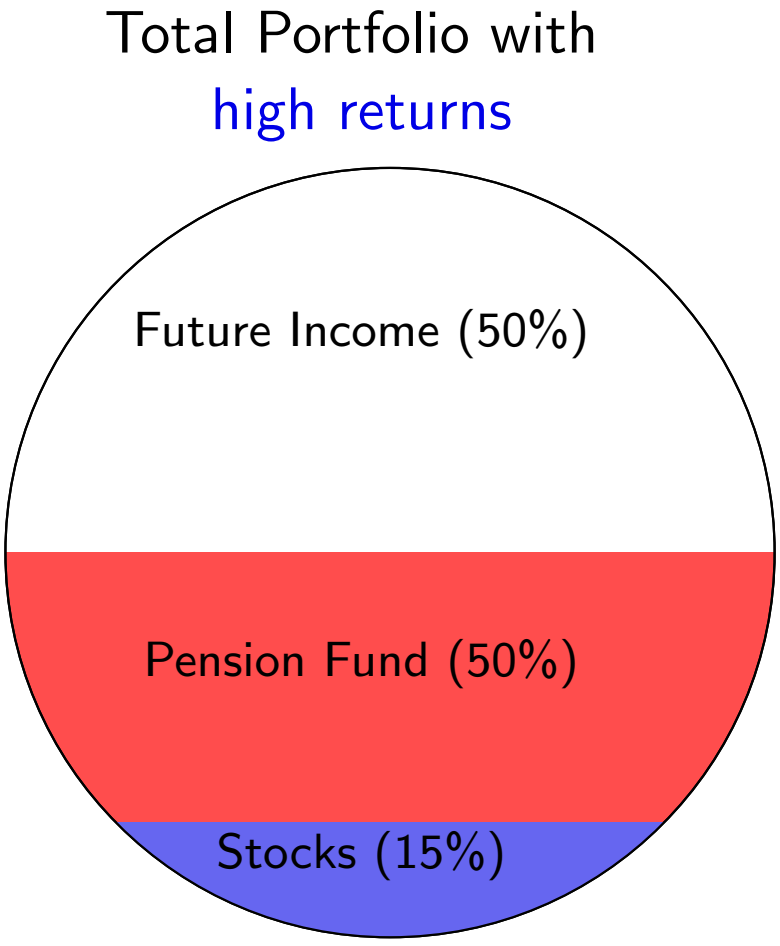
Total Portfolio with

high returns

Portfolio decisions - the role of equity risk

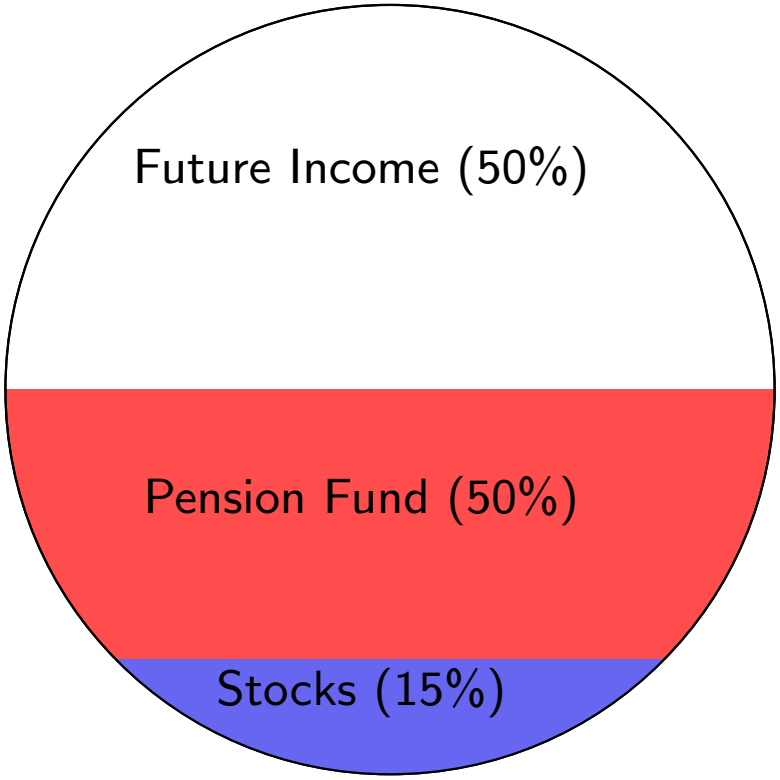


Portfolio decisions - the role of equity risk



Portfolio decisions - the role of equity risk

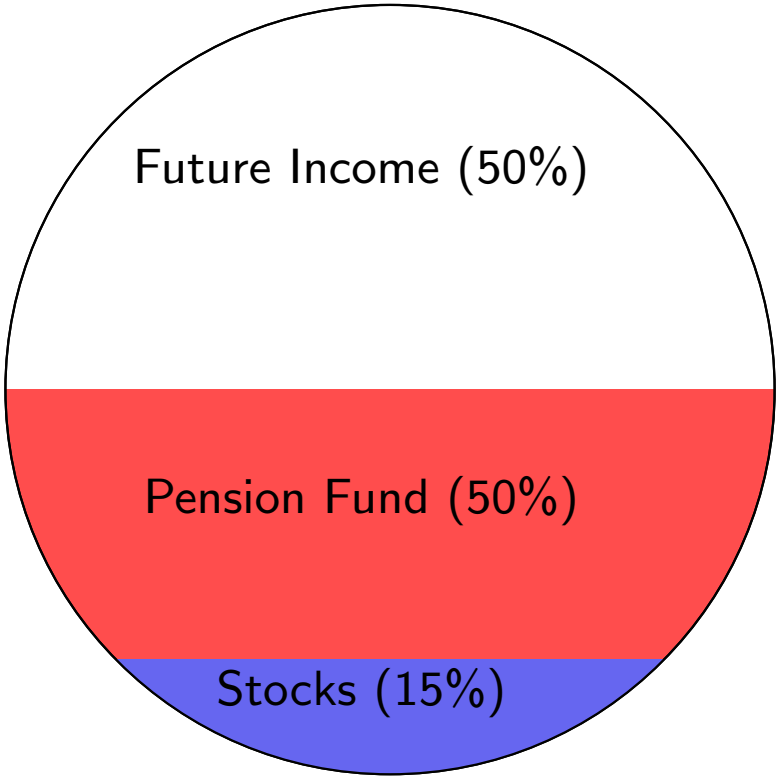
Total Portfolio with
high returns



Equity share $= \frac{15\%}{50\%} = 0.3$

Portfolio decisions - the role of equity risk

Total Portfolio with
high returns

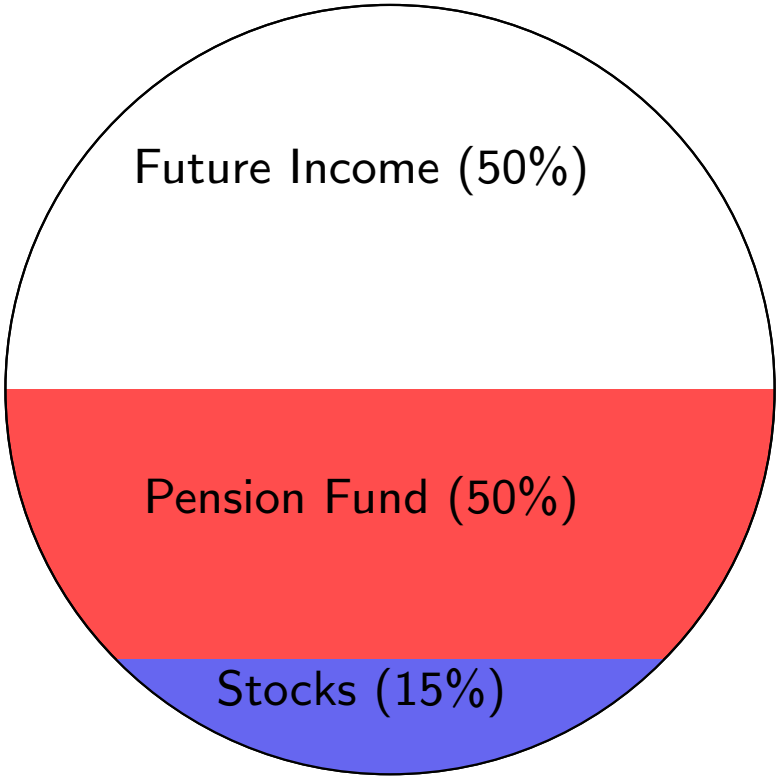


Equity share $= \frac{15\%}{50\%} = 0.3$

Total Portfolio with
low returns

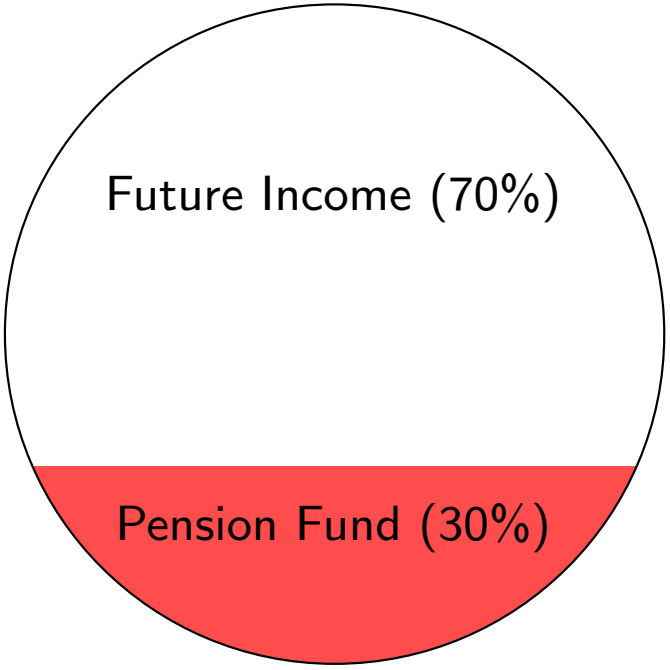
Portfolio decisions - the role of equity risk

Total Portfolio with
high returns



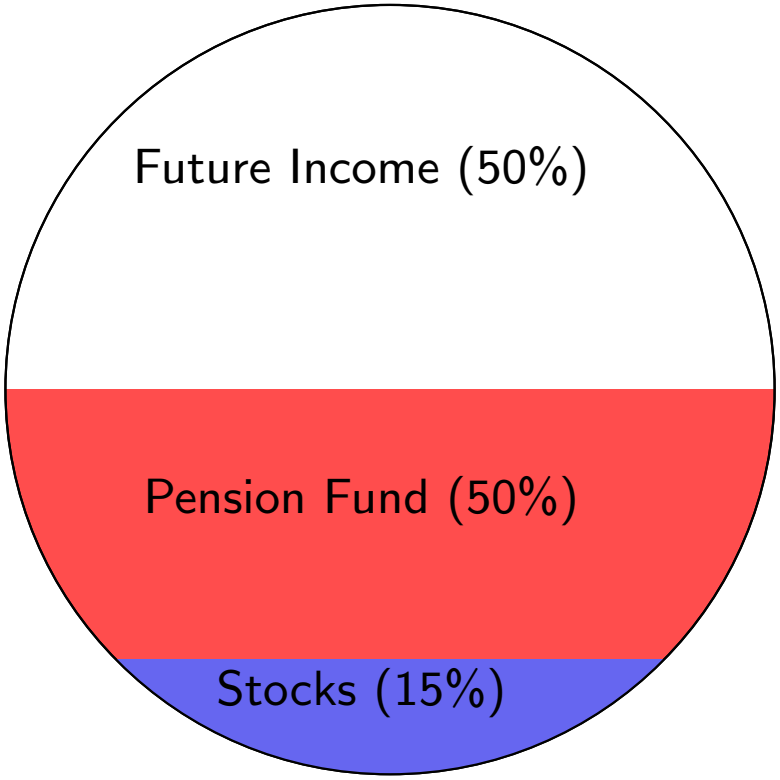
Equity share $= \frac{15\%}{50\%} = 0.3$

Total Portfolio with
low returns



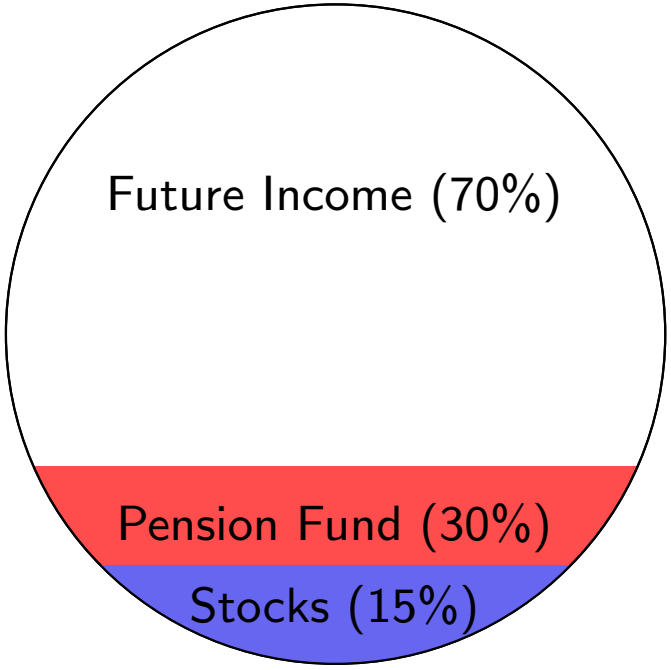
Portfolio decisions - the role of equity risk

Total Portfolio with
high returns



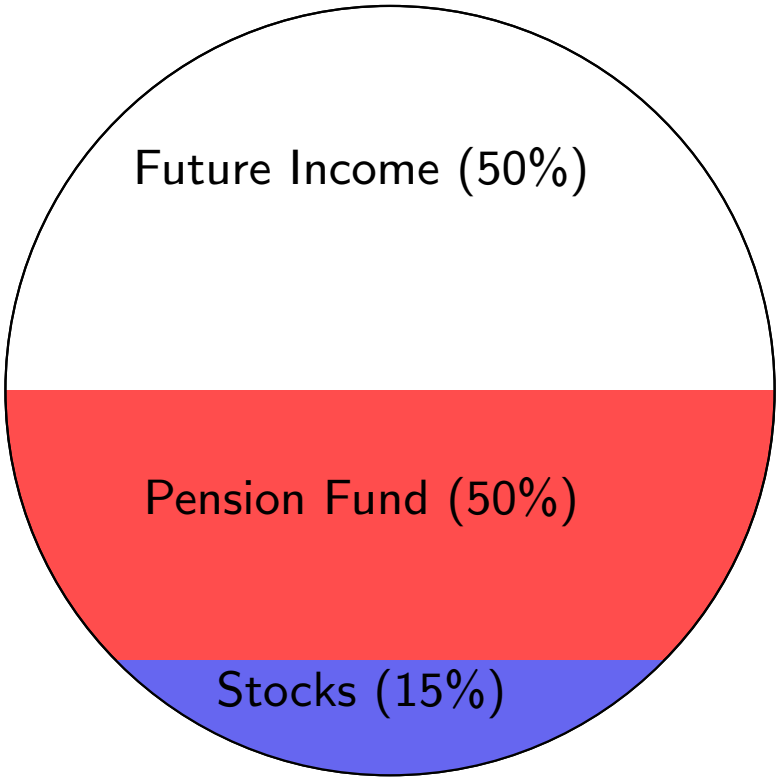
Equity share $= \frac{15\%}{50\%} = 0.3$

Total Portfolio with
low returns



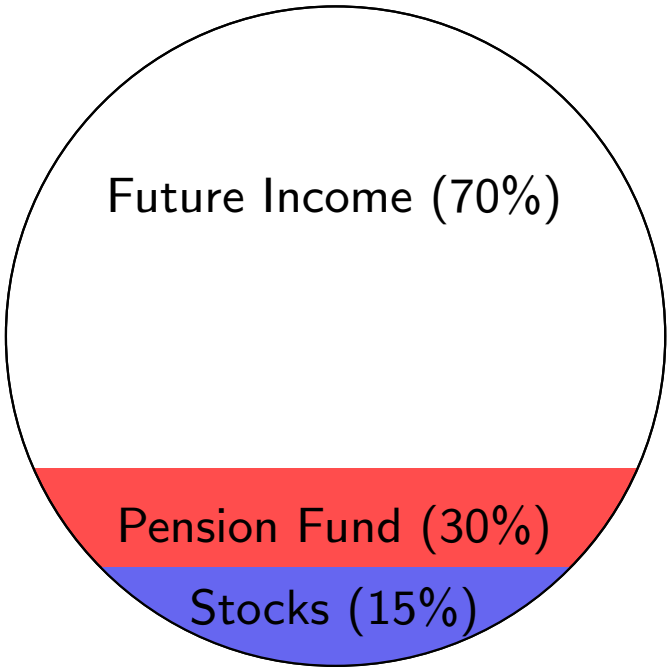
Portfolio decisions - the role of equity risk

Total Portfolio with
high returns



Equity share $= \frac{15\%}{50\%} = 0.3$

Total Portfolio with
low returns



Equity share $= \frac{15\%}{30\%} = 0.5$

▸ back to DC equity share versus balance equity risk

Model overview

- A life-cycle model with incomplete markets
  - Epstein-Zin preferences

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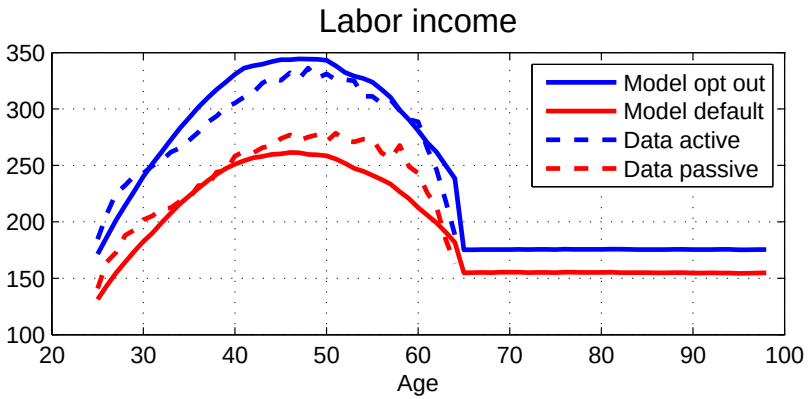
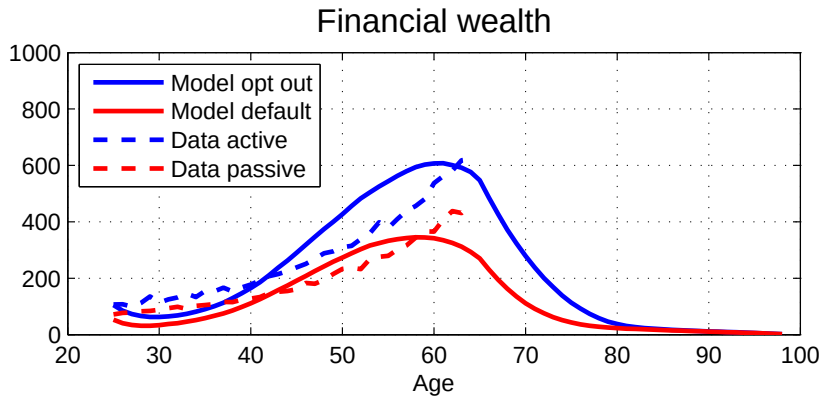
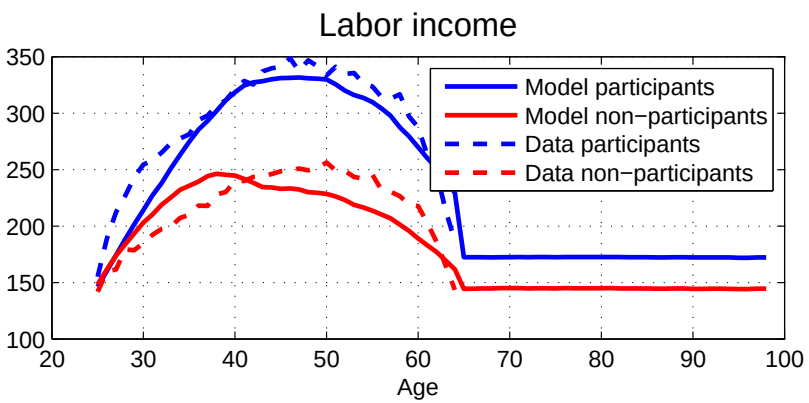
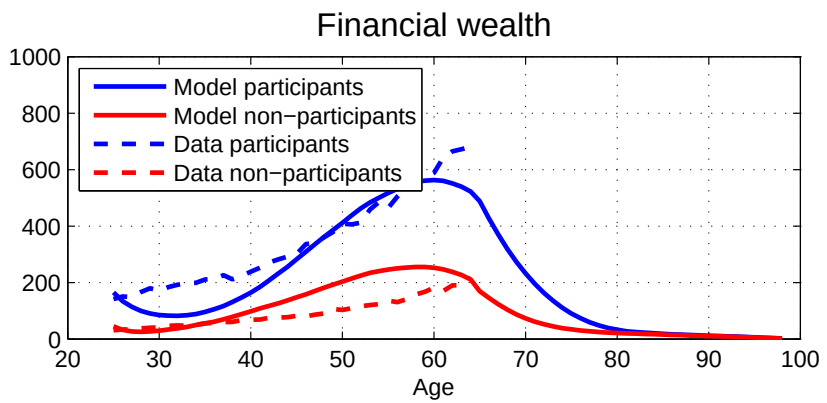
- Assets can be allocated into either:
  - Risk-free bond with gross return R_f
  - Stock market equity with $\log(R_{t+1}) = \log(R_f) + \underbrace{\mu}_{\text{Equity premium}} + \underbrace{\varepsilon_{t+1}}_{\text{Equity risk}}$

Model fit - by types









▸ Alternative model specification ▸ Back to model fit I

מגדל מקפת | קרנות פנסיה וקופות גמל בע"מ

מגדל

1129022040

לכבוד:
סטי עופר
חיים ואלישע 3
תל אביב 6428803

תאריך: 06/06/2016

א.ג.נ.,

הנדון: מעבר למסלול השקעה התואם לגילך במסגרת מודל השקעה תלוי גיל

את/ה חוסך/כת במסלול ההשקעה הכללי. במסלול זה מנוהלים כספי חוסכים בגילאים שונים באותו האופן.

באפשרותך להעביר את החיסכון ל"מודל השקעה מנוהל תלוי גיל" בעל מדיניות השקעה וסיכון התואמים לגילך.

על מנת לעבור למסלול ההשקעה המתאים לגילך במסגרת המודל, עליך לחתום על טופס זה ולהעבירו אלינו. אנו נעביר את כספי החיסכון שלך בהתאם לבקשתך בתוך 10 ימי עסקים מהיום בו יועבר אלינו טופס זה חתום, בצירוף המסמכים הנדרשים.

את הטופס החתום ניתן להעביר גם באמצעות כתובת דוא"ל Migdal_lakohot@migdal.co.il.
או באמצעות פקס שמספרו 076-8869840

לתשומת ליבך:

- הבחירה במודל מנוהל תלוי גיל, על גבי טופס זה, תחול הן ביחס להפקדות השוטפות לקרן הפנסיה והן ביחס לסכומי היתרה הצבורה.
- הבחירה במודל מנוהל תלוי גיל לא תחול על הפקדות שוטפות של כספי צבורה המנוהלים במסלולים אחרים שאינם במסלול הכללי

Back to welfare gain

Welfare gain

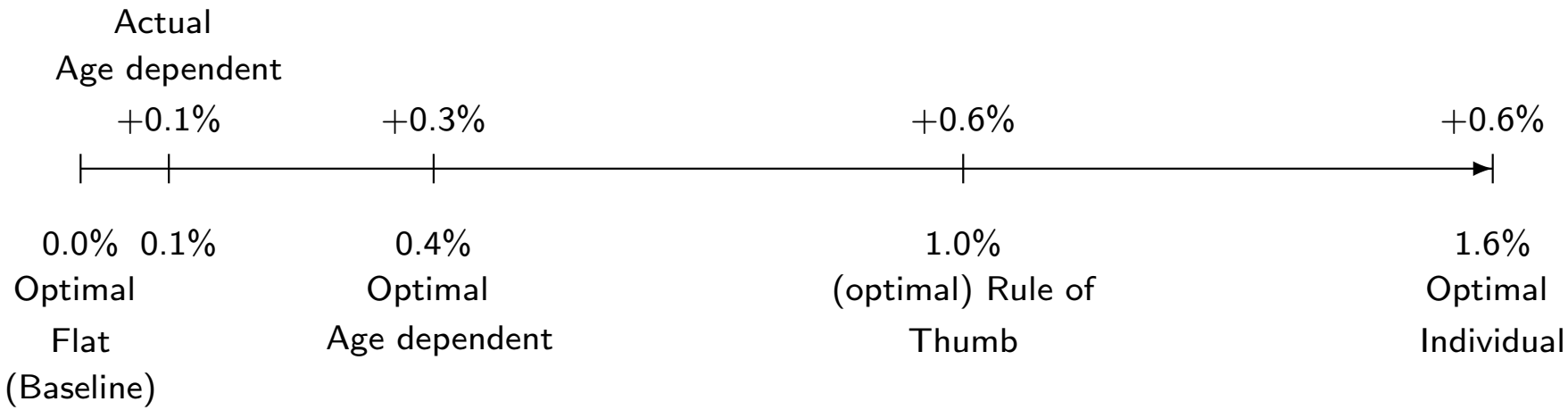
Welfare gain

Welfare gain

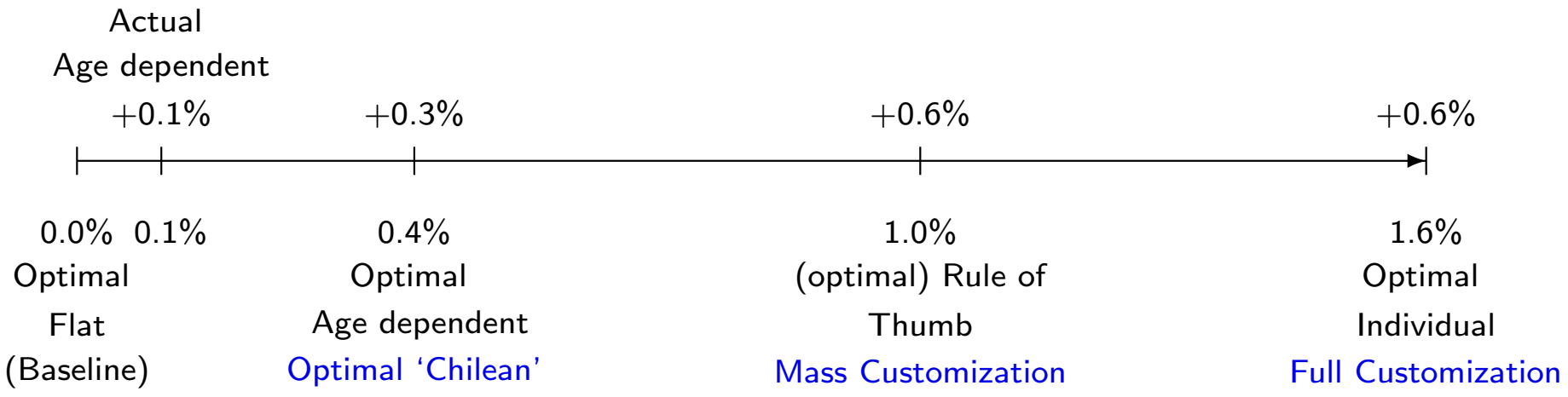
Welfare gain

Welfare gain

Welfare gain



Welfare gain



▸ Letter

INVESTOR PROBLEMS

Investor's value:

$$V_t\left(X_t, A_t^{\mathrm{DC}}, z_t, \kappa, \kappa^{\mathrm{DC}}, I_{t-1}, I^{\mathrm{DC}}\right); \Psi_t \equiv (X_t, A_t^{\mathrm{DC}}, z_t)$$

$$s.t.$$

$$A_{t+1}^{\mathrm{DC}} = A_t^{\mathrm{DC}}(R_f + \alpha_t^{\mathrm{DC}}(R_{t+1} - R_f)) + \lambda^{\mathrm{DC}} Y_t \quad (DC)$$

$$A_{t+1} = A_t\left(R_f + \alpha_t(R_{t+1} - R_f)\right) + Y_{t+1} - C_t \quad (FW)$$

$$X_{t+1} \equiv A_t\left(R_f + \alpha_t(R_{t+1} - R_f)\right) + Y_{t+1} \quad \text{(cash in hand definition)}$$

D1: Remain in the default fund ($I^{\mathrm{DC}} = 0$) or opt out ($I^{\mathrm{DC}} = 1$):

$$\max_{I^{\mathrm{DC}} \in \{0,1\}} \left\{ V_{25}\left(X_t, 0, z_{25}, \kappa, \kappa^{\mathrm{DC}}, 0, 0\right), V_{25}\left(X_t - \kappa^{\mathrm{DC}}, 0, z_{25}, \kappa, \kappa^{\mathrm{DC}}, 0, 1\right) \right\}$$

D2: Participant's problem

$$V_t\left(\Psi_t, \kappa, \kappa^{\mathrm{DC}}, 1, 1\right) = \max_{A_t, C_t, \alpha_t, \alpha_t^{\mathrm{DC}}} \left\{ \left((X_t - A_t)^{1-\rho} + \beta \phi_t \mathcal{R}_t \left(V_{t+1}\left(\Psi_{t+1}, \kappa, \kappa^{\mathrm{DC}}, 1, 1\right)\right)^{1-\rho} \right)^{\frac{1}{1-\rho}} \right\}$$

▸ Three saving accounts

INVESTOR PROBLEMS - CONTINUED

D3: Stock market entrant's problem

$V_t^+\left(\Psi_t, \kappa, \kappa^{DC}, 0, 1\right)$ is the value for an active investor who starts participating at t:

$$V_t^+\left(\Psi_t, \kappa, \kappa^{DC}, 0, 1\right) = \max_{A_t, C_t, \alpha_t, \alpha_t^{DC}} \left\{ \left((X_t - A_t - \kappa)^{1-\rho} + \beta \phi_t \mathcal{R}_t \left(V_{t+1}\left(\Psi_{t+1}, \kappa, \kappa^{DC}, 1, 1\right)\right)^{1-\rho}\right)^{\frac{1}{1-\rho}} \right\}$$

D4: Non-participant's problem

$V_t^-\left(\Psi_t, \kappa, \kappa^{DC}, 0, 1\right)$ is the value for an active investor who continues to not participate at t

$$V_t^-\left(\Psi_t, \kappa, \kappa^{DC}, 0, 1\right) = \max_{A_t, C_t, \alpha_t^{DC}} \left\{ \left((X_t - A_t)^{1-\rho} + \beta \phi_t \mathcal{R}_t \left(V_{t+1}\left(\Psi_{t+1}, \kappa, \kappa^{DC}, 0, 1\right)\right)^{1-\rho}\right)^{\frac{1}{1-\rho}} \right\}$$

D5: Optimal stock market entry

$$V_t\left(X_t, A_t^{DC}, z_t, \kappa, \kappa^{DC}, 0, 1\right) = \max_{I_t \in \{0,1\}} \left\{ V_t^-\left(X_t, A_t^{DC}, z_t, \kappa, \kappa^{DC}, 0, 1\right), V_t^+\left(X_t - \kappa, A_t^{DC}, z_t, \kappa, \kappa^{DC}, 0, 1\right)\right\}.$$

Demography and Preferences

- Individuals live from age 25 up to at most age 100 (retirement at 65)
  - Face age-specific survival rates ϕ_t
- Epstein-Zin preferences over a single consumption good.

$$\begin{aligned} U_t &= \left(c_t^{1-\rho} + \beta \phi_t E_t \left[U_{t+1}^{1-\gamma} \right]^{\frac{1-\rho}{1-\gamma}} \right)^{\frac{1}{1-\rho}}, \\ U_T &= c_T. \end{aligned}$$

  - β is the discount factor
  - $\psi = 1/\rho$ is the elasticity of intertemporal substitution
  - γ is the coefficient of relative risk aversion
  - Define $\mathcal{R}_t(U_{t+1}) \equiv E_t \left[U_{t+1}^{1-\gamma} \right]^{\frac{1}{1-\gamma}}$