Centraal Planbureau

The optimal mix of the first and second pension pillar

Marcel Lever
Thomas Michielsen
Sander Muns

19th January 2017

Introduction

- Public debate in many Western countries about 'best' structure of old-age pensions

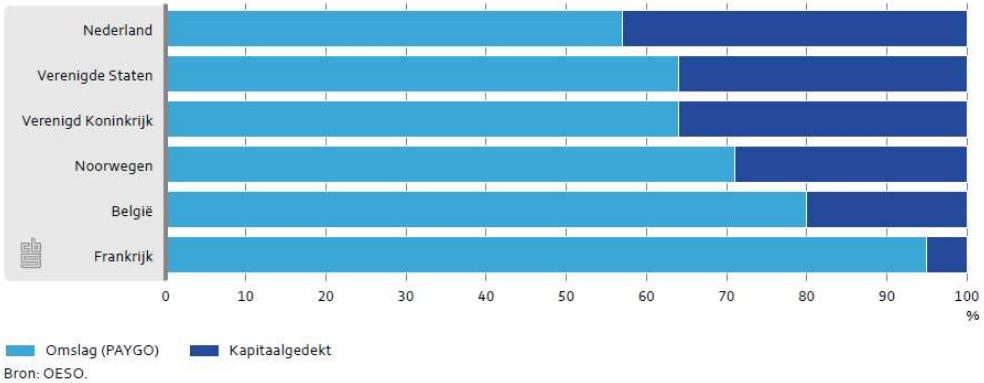
- Population ageing makes 1st pillar pensions more expensive
  - Strikes in Belgium, France and Greece against retirement age increases
  - Bundesbank: raise retirement age to age 69 in 2060
  - OECD Pensions Outlook: more pre-funding old-age provisions

- Low interest rate makes 2nd pillar pensions more expensive
  - lower expected returns in 2nd pillar
  - decreases funding ratios of 2nd pillar pensions immediately

- Larger 1st pillar may compensate current retirees for low interest rate

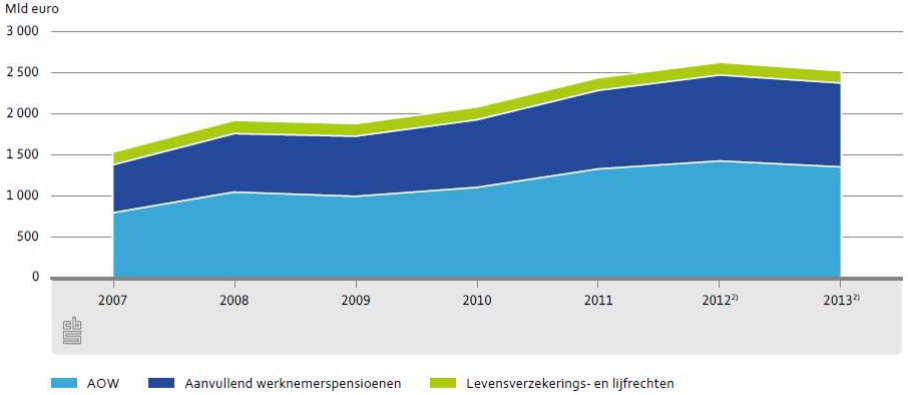
Introduction

NL pillars in an international context (left) and over time (right)



Bron: OESO.

5.1 Totale pensioenrechten[1)]



Bron: CBS.
[1)] Eindbalansstanden.
[2)] Berekeningen zijn gemaakt op basis van veronderstellingen voor 2011.

Introduction

<u>Returns (Aaron-Samuelson rule)</u>

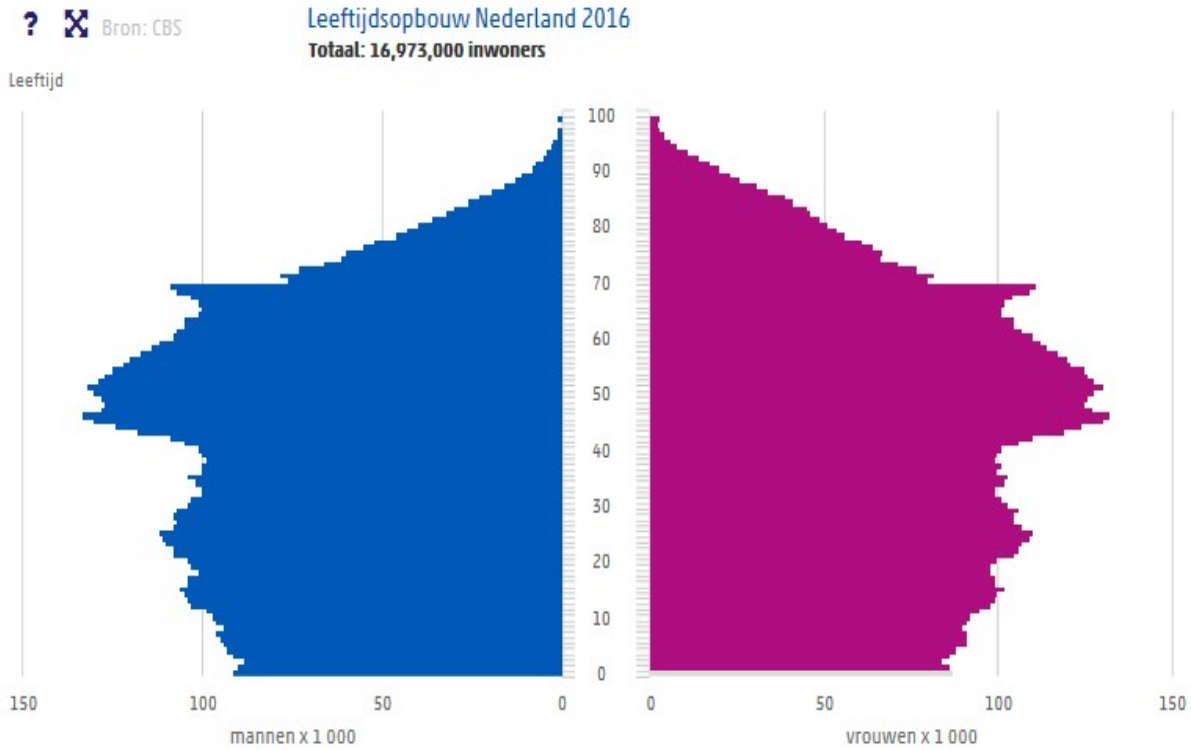
1st pillar: growth wage *sum*

2nd pillar: return on assets

con 1: age decomposition

con 2: low interest rate

After the financial crisis, asset returns have been (temporarily?) higher by increasing bond prices and increasing stock prices due to lower interest rates and lower discount rates



Introduction

<u>Returns (Aaron-Samuelson rule)</u>

1st pillar: growth wage *sum*

2nd pillar: return on assets

- In general: growth in wage sum < return on assets
  - potential Pareto improvement from larger 2nd pillar (Miles and Černý, 2006)
  - zero-sum in present value of public tax income (Sinn, 2000)

- General equilibrium effect with larger 1st pillar (closed economy): less savings → lower capital stock → lower wages (Kitao, 2014)

- This is about expected returns, our paper takes uncertainty into account

This paper

- Simulation study of pension outcomes with different mixes of 1st and 2nd pillar
- 2000 simulations using an Asset Liability Management model
- Scenarios vary in demographic as well as financial variables
- Evaluation based on CRRA utility and distribution of replacement rates
- Impulse response analysis evaluates impact of shocks in mortality and equity premium

Main results

- Compared to 1st pillar, 2nd pillar has a higher but less certain return
- Young and future generations prefer a mix of both pillars
- Preferences of cohorts born before 1970s depend on initialization:
  - first pillar-only if initial rights are always based on 50-50 mix
  - second pillar-only if initial rights are adjusted to each mix
- Different shocks have a different speed of impact:

Type of shock	1st pillar	2nd pillar
Mortality	Slow	Immediate
Equity premium	No	Slow

Literature: Risk sharing in the two pillars

- 1st pillar and DB 2nd pillar (Beetsma and Bovenberg, 2009; Beetsma, Romp and Vos, 2013)
  - old share in wage risk of the young
  - insulates the old from volatile financial markets

- Diversification benefits between 1st (demographic) and 2nd pillar (financial) risks (Matsen and Thøgersen, 2004)

Literature: Welfare gains from intergenerational risk sharing in second pillar

- In 2nd pillar, individuals can be exposed to financial market risk before they are 'born'/enter the labor market (Teulings and de Vries, 2006; Bovenberg et al, 2007; Gollier, 2008; Cui, de Jong and Ponds, 2011; Mehlkopf, 2011)

- The longer investment horizon enables a better risk/return tradeoff

- Welfare benefits range from zero to 25%, depends on labour market response, equity premium, risk aversion, etc.

Assumptions

- Regardless of mix, same total contribution rate (17¼% of wage)

- Representative individual per birth cohort:
  starts to work full-time at age 25, maximum age 120

- Retirement age fixed at 70, independent of life expectancy

- No cross-sectional difference in wages:
  - in each year, all workers earn same wage, regardless of age
  - real wages do grow over time

- CRRA utility function (β = 0.98, r_t = replacement rate periode t)

$$U(r;\beta,\gamma) = \sum_{t=0}^{\infty} \mathrm{P}[\text{alive and pensioned in year } t]\beta^t \frac{r_t^{1-\gamma} - 1}{1-\gamma}$$

Assumptions 1st pillar

- No contribution from public finances

- Fixed contribution rate for working individuals
  → benefit per retiree inversely proportional to old-age dependency ratio

Assumptions 2nd pillar

- Collective defined contribution (CDC)
- Yearly rights adjustment 1/10th of [nominal funding ratio – 100%]
- Asset mix: 50% equities and 50% matching bonds
- Risk sharing with future generations
- Actuarially fair rights accrual (cohort life expectancy)
- Asset management costs 0.5%/yr

Limitations

- **No analysis of intragenerational redistributions**
  Larger 1st pillar makes a flexible pension age more attractive for low incomes (*flexibilisering AOW-leeftijd*).

- **Limited analysis transition effects**
  In practice, more straightforward from 2nd to 1st pillar than vice versa

- **No long-term correlation demography and financial markets**
  May weaken diversification benefits if aging → low interest rate

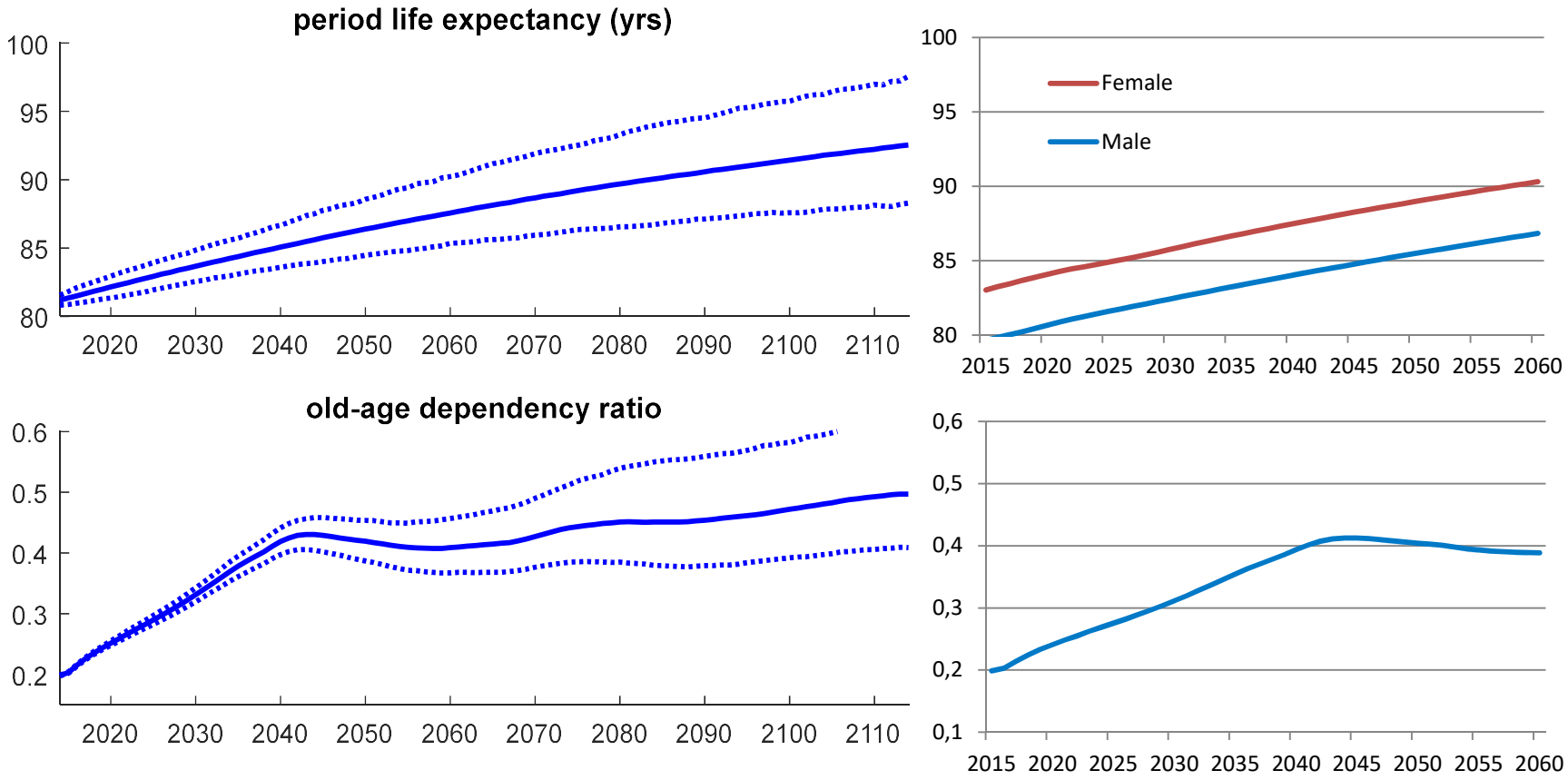
- **No migration**

- **No general equilibrium effects**

- **To do**
  - coupling pension age on life expectancy
  - impact of a fertility shock

Scenario set demography

Scenario set (left) and forecast Statistics Netherlands (right)



Scenario set financial descriptives – base set

Correlation table arithmetic returns	1 year riskfree rate	5 year riskfree rate	5 year bond return	Stock return	Inflation	Wage inflation
1 year riskfree rate	1	0.98	0.26	0.21	0.89	0.76
5 year riskfree rate	0.98	1	0.32	0.21	0.87	0.75
5 year bond return	0.26	0.32	1	0.08	0.35	0.37
Stock return	0.21	0.21	0.08	1	0.19	0.15
Inflation	0.89	0.87	0.35	0.19	1	0.84
Wage inflation	0.76	0.75	0.37	0.15	0.84	1
Mean return (%)	2.74	3.21	3.85	7.17	2.03	3.31
Standard deviation (%)	3.15	2.92	5.82	17.94	1.65	2.16
min (%)	-7.81	-6.18	-15.48	-35.98	-3.09	-3.78
max (%)	13.29	12.60	27.21	74.50	7.39	11.42

Scenario set financial descriptives – base set

Correlation table geometric returns	1 year riskfree rate	5 year riskfree rate	5 year bond return	Stock return	Inflation	Wage inflation
1 year riskfree rate	1	0.97	0.22	0.15	0.89	0.76
5 year riskfree rate	0.97	1	0.29	0.15	0.87	0.75
5 year bond return	0.22	0.29	1	0.02	0.35	0.39
Stock return	0.15	0.15	0.02	1	0.11	0.08
Inflation	0.89	0.87	0.35	0.11	1	0.85
Wage inflation	0.76	0.75	0.39	0.08	0.85	1
Mean return (%)	2.5	3.0	3.6	5.5	2.0	3.3
Standard deviation (%)	3.1	2.8	5.6	16.4	1.6	2.1
min (%)	-7.3	-6.0	-14.8	-47.1	-2.7	-5.2
max (%)	11.5	11.4	22.0	58.1	6.7	9.0

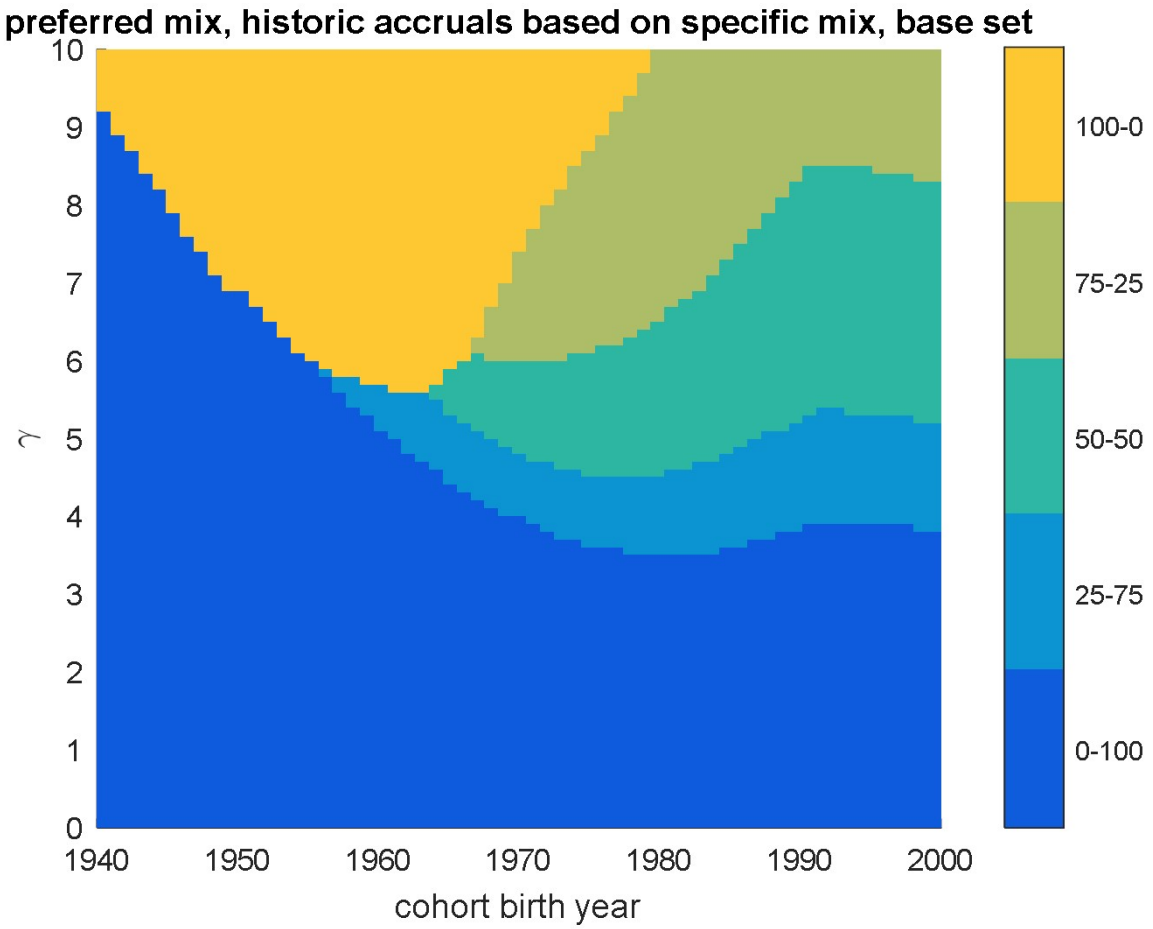
Aaron-Samuelson rule on replacement rates

- Wage growth **3.3%/yr**
  Dependency ratio 0.4 in 2040 and 0.55 in 2115
  Long-run increase: $\left(\frac{0.55-0.4}{0.4}\right)^{1/75}$ =**0.4%/yr**
  → 1st pillar 'real' return: 3.3% - 0.4% - 3.3% = -0.4%/yr

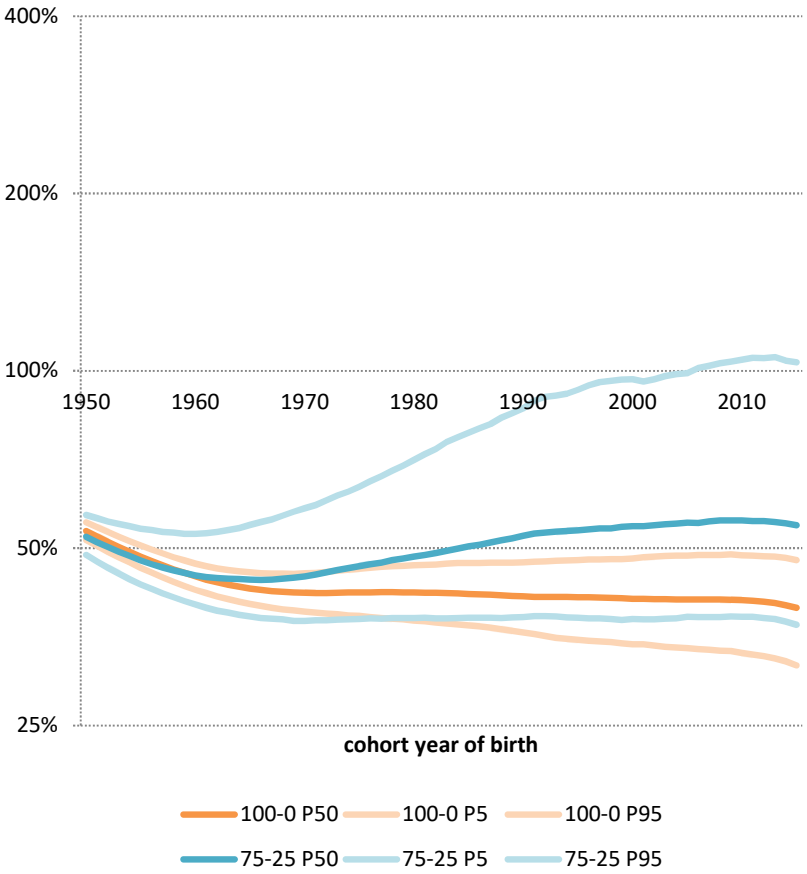
- Stock return **5.5%/yr**, bond return **3.6%/yr**
  Asset management cost **0.5%/yr**
  Median pension period from 11 yrs in 2015 to 23 yrs in 2115
  Long-run increase payout period: $(23/11)^{0.01} - 1$ = **0.74%/yr**
  Long-run increase investment period: (23-11)/100 = 0.12 yrs/yr
  gives increase on investments:
  $(1 + ½(5.5\% + 3.6\%) - 0.5\%)^{0.12} - 1$ = **0.5%/yr**

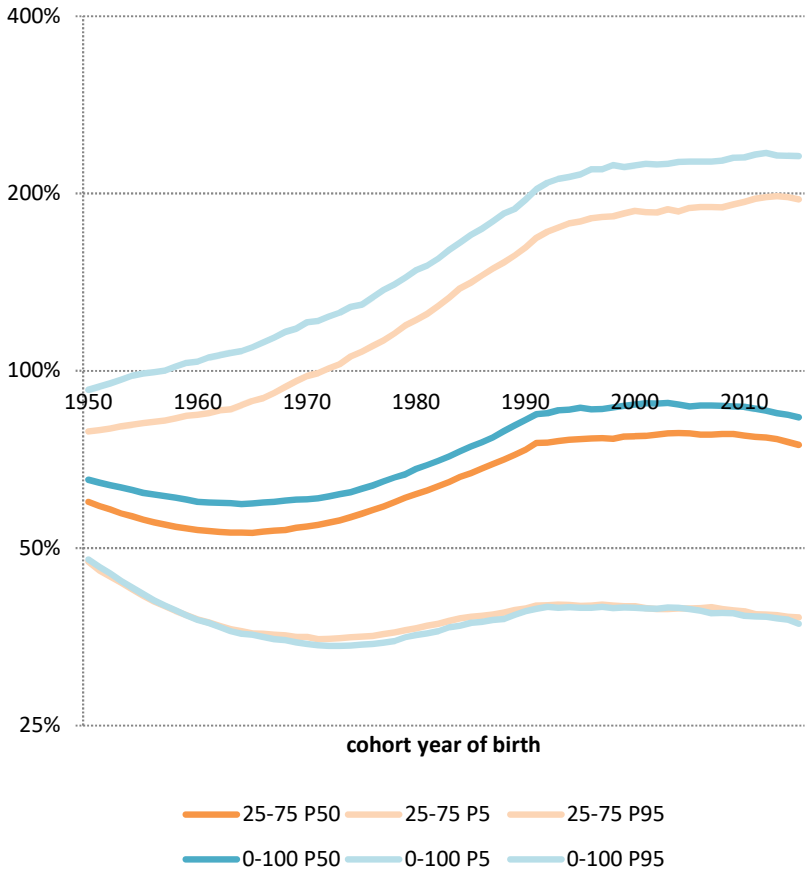
  → 2nd pillar 'real' return:
  ½(5.5% + 3.6%) – 0.5% – 0.74% + 0.5% – 3.3% = +0.5%/yr

Preferred mix



Bandwidth replacement rate



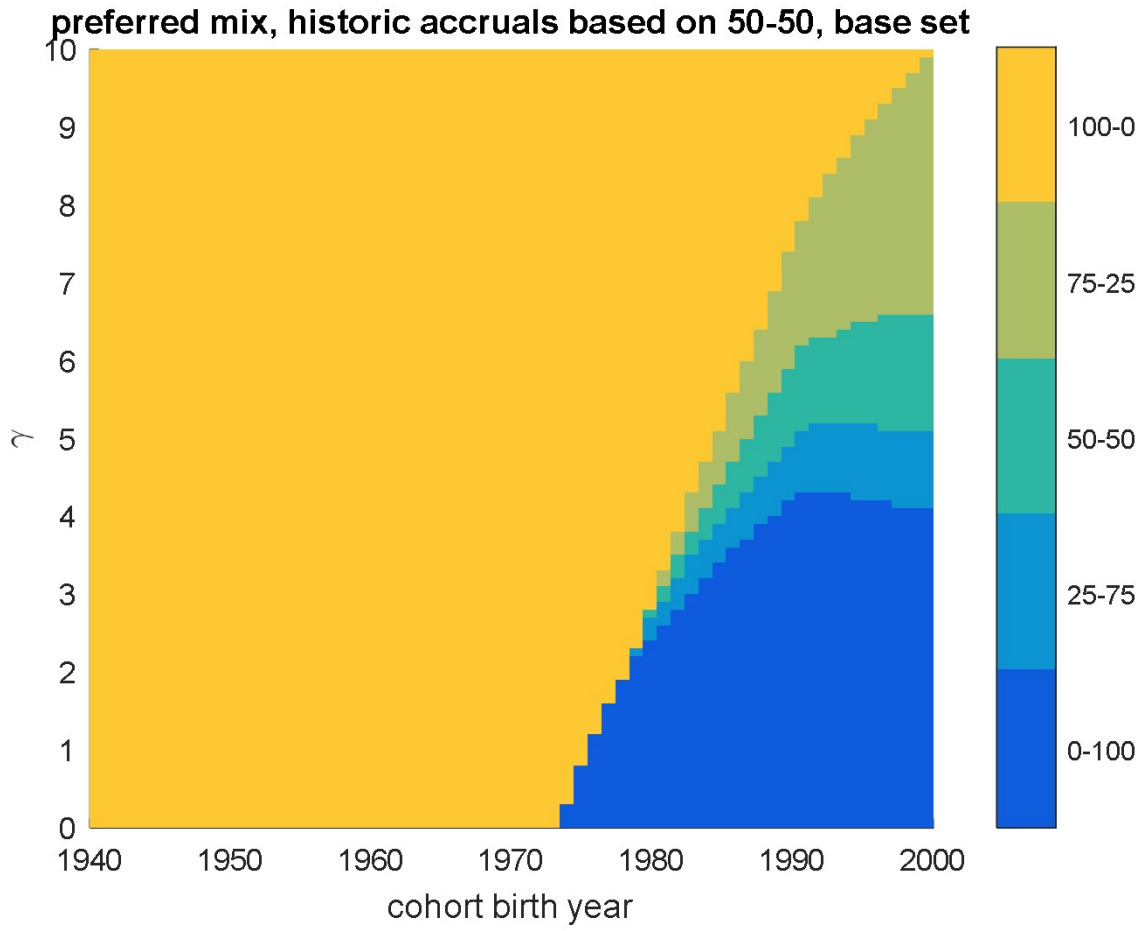


Replacement rate

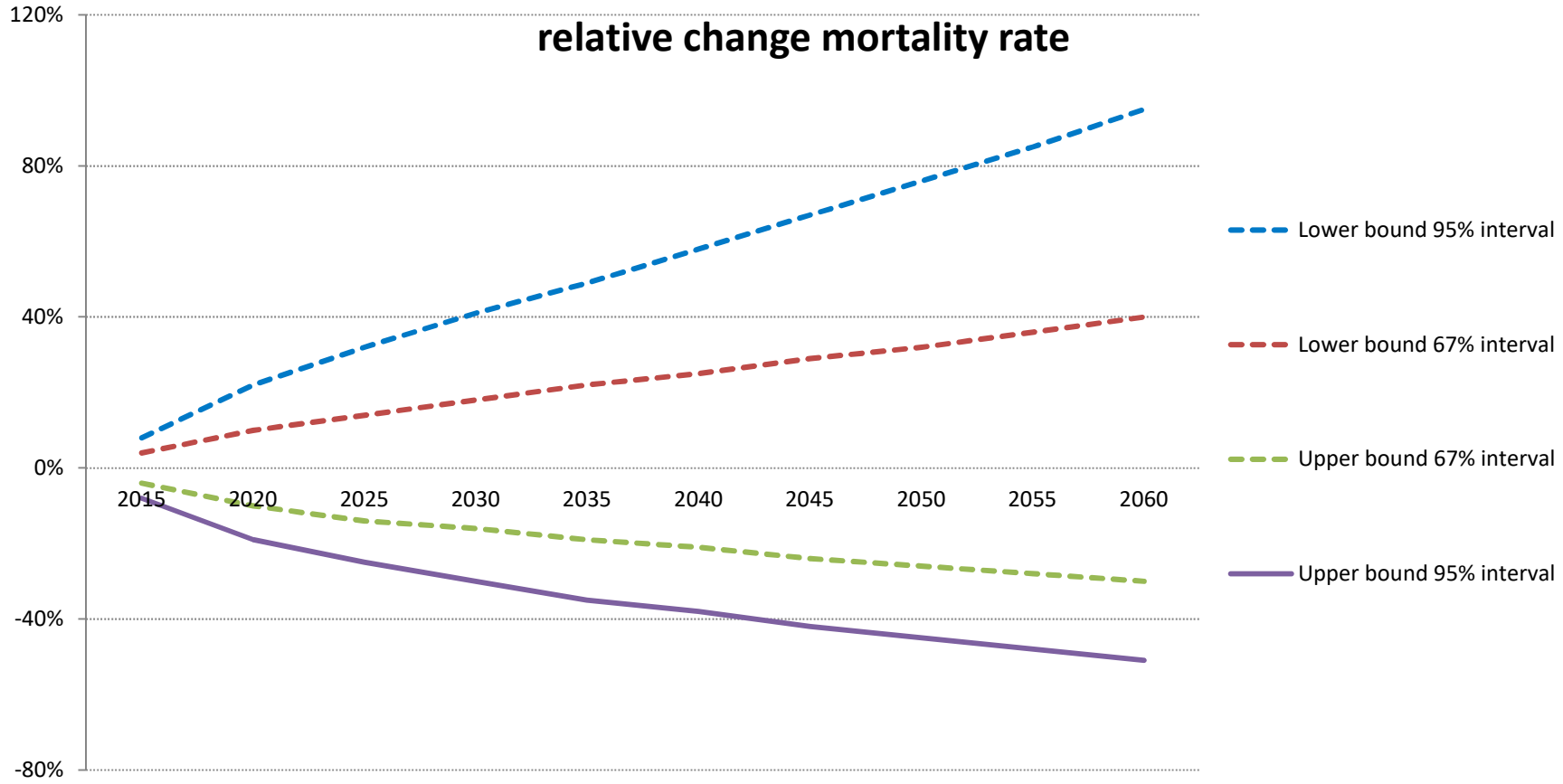
Birth cohort 1942	100-0	75-25	50-50	25-75	0-100
Median	61.4%	60.2%	62.4%	65.6%	69.3%
P5	59.9%	57.5%	56.8%	56.7%	56.9%
P1	59.4%	56.6%	54.9%	54.1%	53.5%

Birth cohort 1992	100-0	75-25	50-50	25-75	0-100
Median	41.3%	53.1%	65.3%	75.5%	84.7%
P5	35.4%	38.3%	39.5%	40.0%	39.7%
P1	33.1%	35.0%	34.5%	32.8%	30.9%

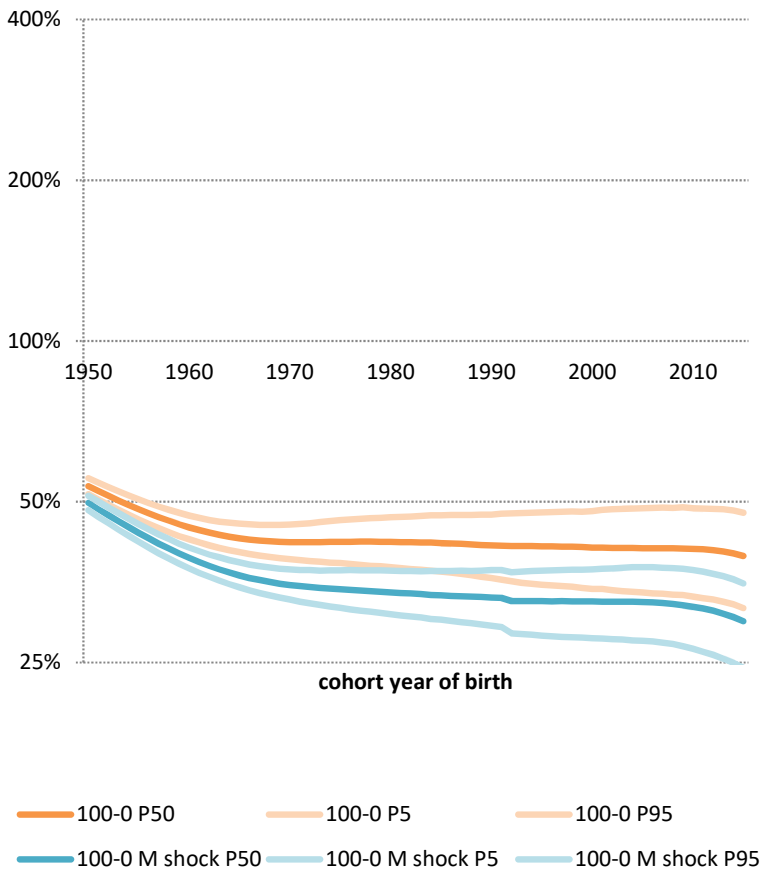
Preferred mix

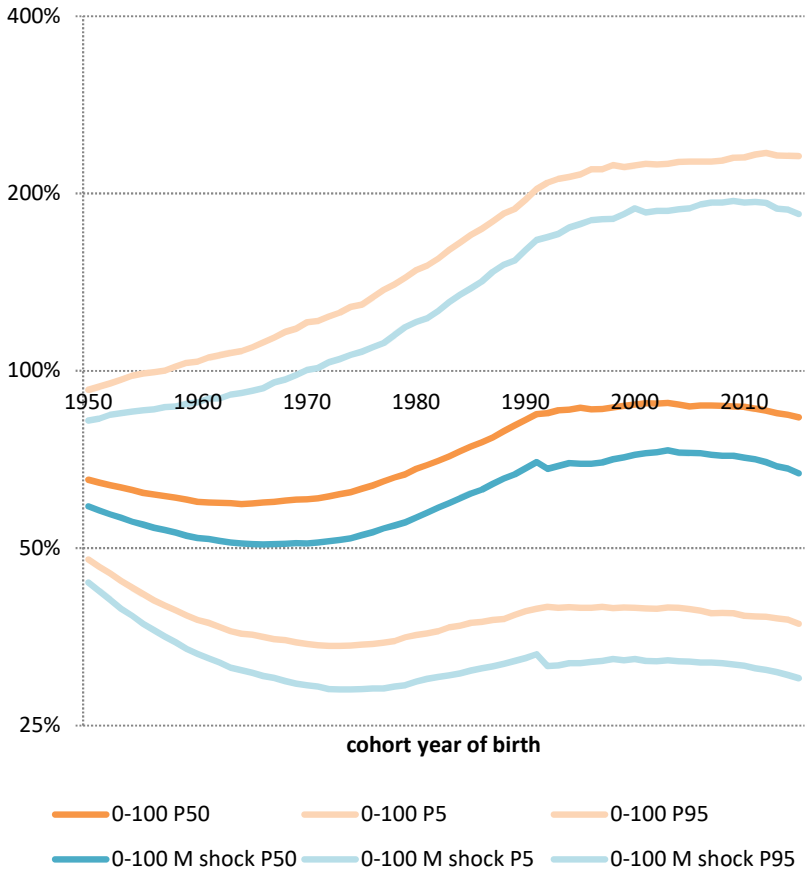


Impulse response mortality rates



Bandwidth replacement rate mortality shock



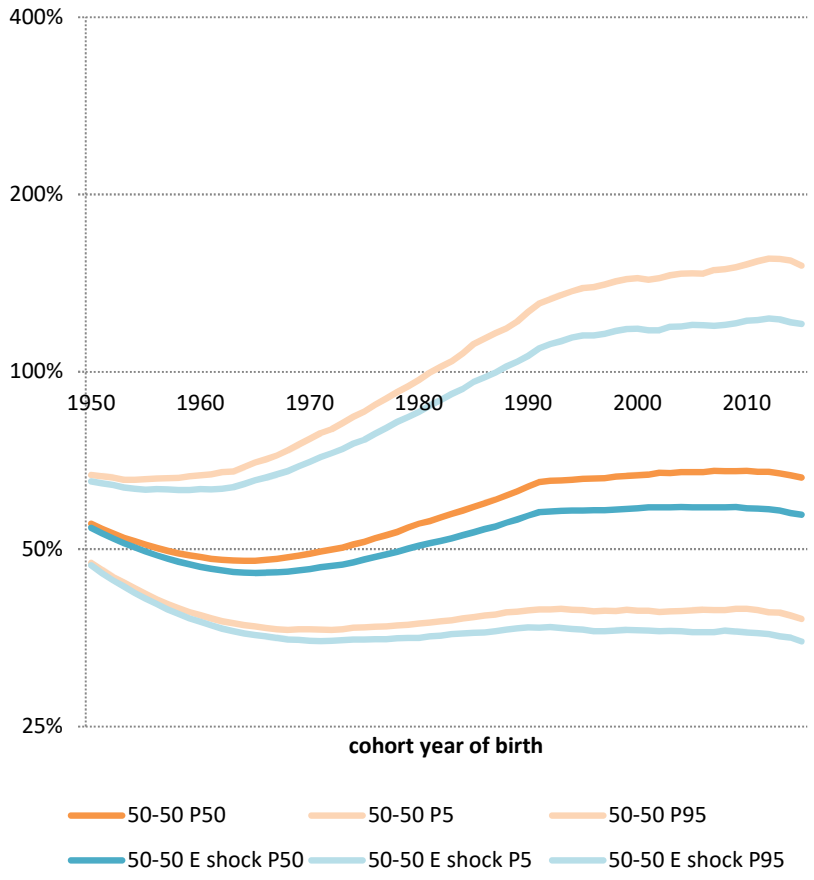


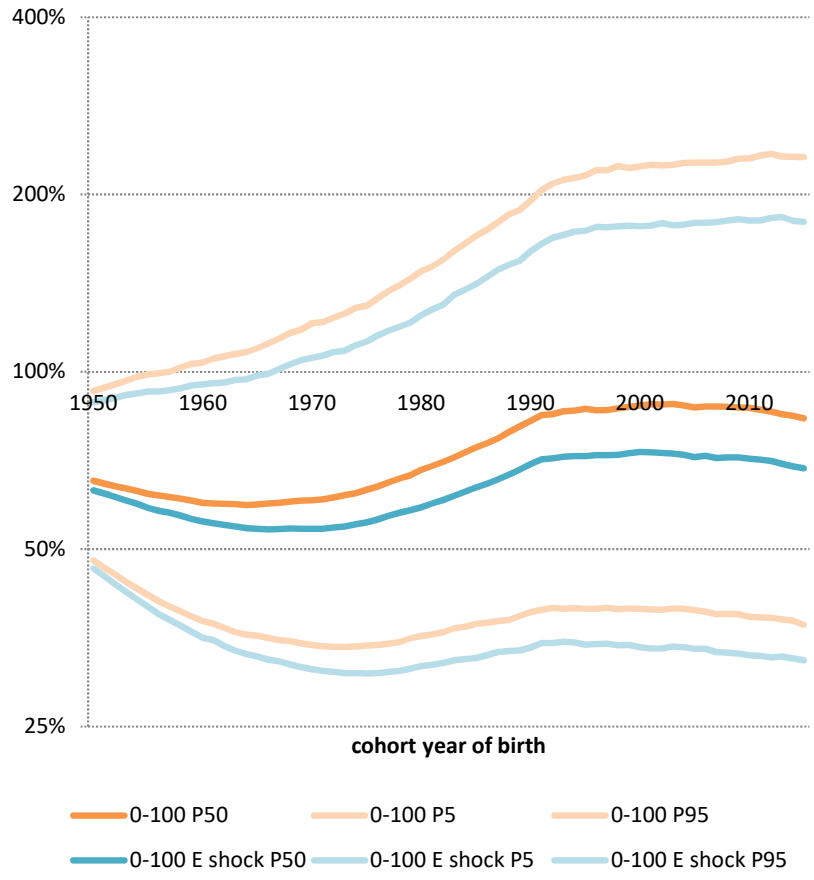
Replacement rates – mortality shock

Birth cohort 1942	100-0			50-50			0-100		
	base	M shock	rel. diff	base	M shock	rel. diff	base	M shock	rel. diff
Median	61.4%	59.0%	**-3.9%**	62.4%	59.3%	**-5.0%**	69.3%	64.5%	**-6.9%**
P5	59.9%	57.7%	**-3.7%**	56.8%	54.3%	**-4.4%**	56.9%	53.7%	**-5.6%**
P1	59.4%	57.2%	**-3.7%**	54.9%	52.6%	**-4.2%**	53.5%	50.3%	**-6.0%**

Birth cohort 1992	100-0			50-50			0-100		
	base	M shock	rel. diff	base	M shock	rel. diff	base	M shock	rel. diff
Median	41.3%	32.5%	**-21%**	65.3%	52.0%	**-20%**	84.7%	68.1%	**-20%**
P5	35.4%	28.3%	**-20%**	39.5%	31.5%	**-20%**	39.7%	31.5%	**-21%**
P1	33.1%	26.6%	**-20%**	34.5%	27.5%	**-20%**	30.9%	24.0%	**-22%**

Bandwidth replacement rate equity premium shock





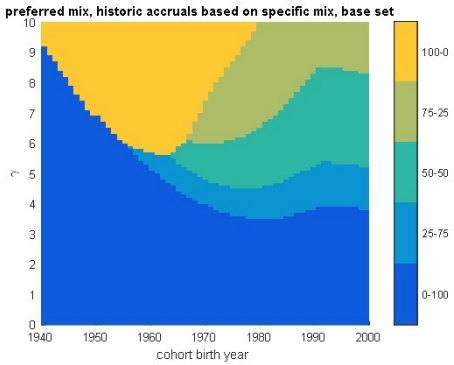
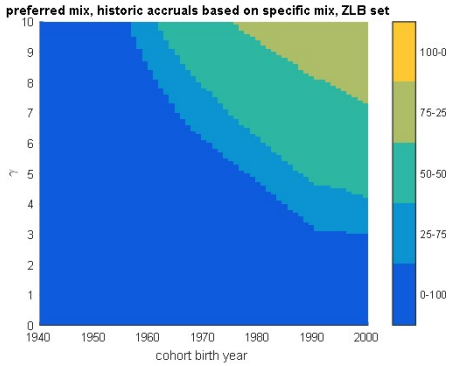
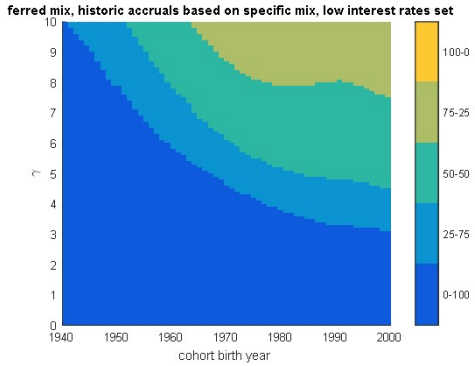
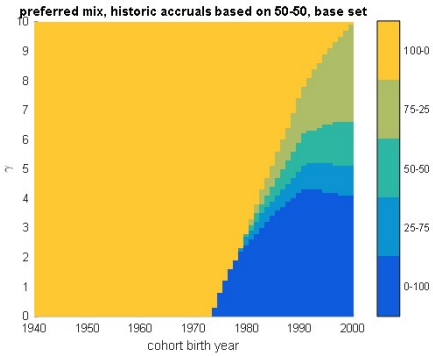
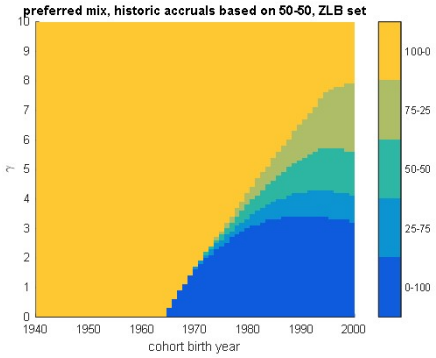
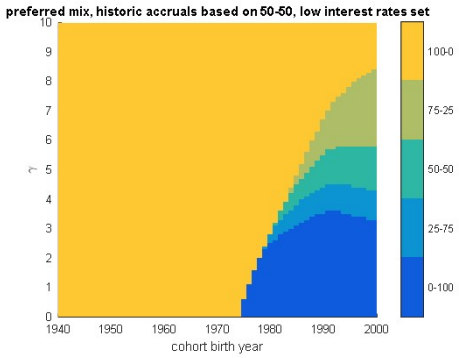
Replacement rates – equity premium shock

Birth cohort 1942	100-0			50-50			0-100		
	base	E shock	rel. diff	base	E shock	rel. diff	base	E shock	rel. diff
Median	61.4%	61.4%	0.0%	62.4%	61.9%	-0.8%	69.3%	68.1%	-1.7%
P5	59.9%	59.9%	0.0%	56.8%	56.5%	-0.5%	56.9%	56.2%	-1.2%
P1	59.4%	59.4%	0.0%	54.9%	54.6%	-0.5%	53.5%	52.8%	-1.3%

Birth cohort 1992	100-0			50-50			0-100		
	base	E shock	rel. diff	base	E shock	rel. diff	base	E shock	rel. diff
Median	41.3%	41.3%	0.0%	65.3%	57.9%	**-11.3%**	84.7%	71.3%	**-15.8%**
P5	35.4%	35.4%	0.0%	39.5%	36.8%	-6.8%	39.7%	34.6%	-12.8%
P1	33.1%	33.1%	0.0%	34.5%	32.6%	-5.5%	30.9%	27.3%	-11.7%

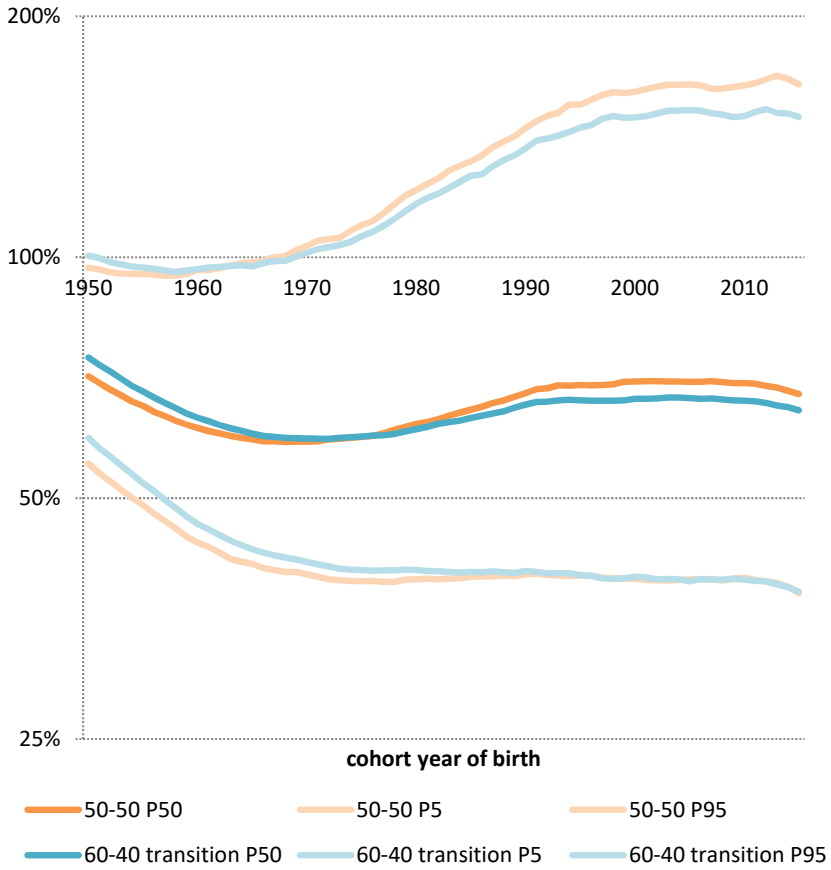
Robustness

scenario set

historic accruals	base	ZLB	low interest rate
specific mix			
50-50 mix			

Transition towards first pillar

- Assume historic contribution rate to both pillars is 50%
- From the first simulation year onwards, the contribution rate to the 1st pillar is 60% and to the 2nd pillar 40%
- Current pensioners benefit directly
- Future loss of 2nd pillar pension dominates for generations born in 1975 and later



Conclusions

- Generational gap
  - Young generations prefer a mix of both pillars
  - Preferences of older generations depend on initialization

- Permanent mortality shock
  - immediate impact on 2nd pillar benefits through the funding ratio
  - slower impact on 1st pillar benefits

- Permanent equity premium shock
  - small impact on 2nd pillar benefits in the short run
  - stronger impact in the longer run

- Results are qualitatively the same with scenario sets with a zero lower bound or with permanently low interest rates

Policy implications

- Current Dutch policy mix is about 50-50

- A larger 1st pillar at the expense of the 2nd pillar would result in
  - lower median replacement rate: coming increase in the dependency ratio dominates the effect of lower interest rates
  - a redistribution between generations where only older cohorts are still better off in case asset returns are low

- A redistribution *within* cohorts is not evaluated, 1st pillar guarantees minimum of existence

- Current Dutch policy for 1st pillar pension as a minimum of existence seems very reasonable