NDC Schemes and Heterogeneity in Longevity: Proposals for Re-design

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But feedback is more than welcome as we're extending this study!

Structure

Mortality heterogeneity

- Heterogeneity in longevity has long been experienced and identified but potential solutions are novel...
- There is increasing evidence that heterogeneity in longevity is high, increasing for many dimensions, in particular for income, with expected further rise
- This heterogeneity acts like a tax/subsidy mechanism, reducing the link between lifetime contributions and pensions typically found in defined contribution pension schemes
- Data points for OECD countries suggest that tax rates can reach 30 percent for low income, and subsidy rates of over 20 percent for high income earners (Ayuso et al. 2017).

Main insights

- We explore five mechanisms to compensate for mortality heterogeneity:
  - Individualized annuities
  - Individualized contribution rates
  - Two-tier contribution structured (social+individual contribution rate)
  - Two additional schemes to deal with the tails
- Individualized schemes and two-tier are feasible policy options
- However, de-pooling of gender may be required

Structure

Overview of pensions

Funding methodologies

- Pay as you go (PAYG): current contributors pay current pensioners (Unfunded schemes)
- Funding: contributions are accumulated in a fund which earns a market return (Funded schemes)

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Benefit formula

- Defined Benefit (DB): Pension is calculated according to a fixed formula which usually depends on the members salary and the number of contribution years.
- Defined Contributions (DC): Pension is dependent on the amount of money contributed each year and their return.

Global shift from DB to DC

- Global shift from DB to DC
- *In PAYG*: increasing fiscal burden of wage-based pension schemes
- *In Funding*: defined contribution shift return risk to the individuals

Public pension expenditure over 2010-2060 (in % of GDP)

Country	2010	2020	2040	2060	Change 2010-2060
BE	11,0	13,1	16,5	16,6	5,6
DE	10,8	10,9	12,7	13,4	2,6
IT	**15,3**	**14,5**	**15,6**	**14,4**	**-0,9**
SW	**9,6**	**9,6**	**10,2**	**10,2**	**0,6**
PL	**11,8**	**10,9**	**10,3**	**9,6**	**-2,2**
UK	7,7	7,0	8,2	9,2	1,5
UE27	11,3	11,3	12,6	12,9	1,5

Source: European Commission - The 2012 Ageing Report

Mixing possibilities

The financing choice is present for both DB and DC pension schemes.

	Pay-as-you-go	Funding
DB	Classical social security	Classical Employee DB Plan
DC	Notional Accounts (NDCs)	Pension savings accounts

Advantages of PAYG DC (NDC)

- It's *more or less* actuarially fair (takes into account life expectancy and contributions)
- Portability of pension rights between jobs, occupations and sectors is permitted.
- It promises to deal with the effects of population ageing more or less automatically.
- Arbitrariness in benefit indexation rules and adjustment factors is avoided.

# Structure

Challenge to the distribution of heterogeneity

- Linking life expectancy to a measure from life-time income requires the crossing of various sources of data (e.g. tax declaration and death certificate)
- Most available datasets provide data points for income terciles, quartiles and quintiles, or link mortality to educational attainment
- However, the tails of the income matter and full distributions are preferable.
- We use two datasets:
  - United States: Chetty et al. (2016) use federal income tax and social security records
  - England and Wales: income and mortality data for statistical geographies used by the Office of National Statistics (ONS)

USA Period Life Expectancy in 2014 at age 65 by nominal Household Income
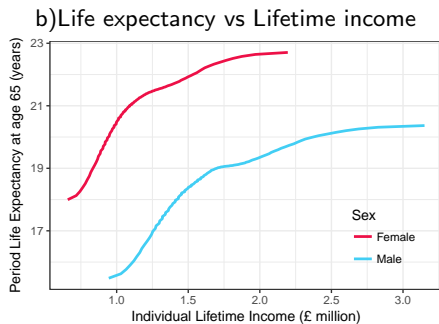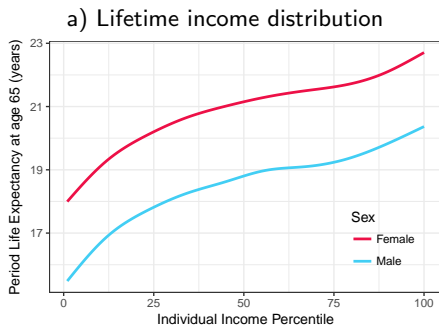

a) Lifetime income distribution

USA Period Life Expectancy in 2014 at age 65 by nominal Household Income

a) Lifetime income distribution
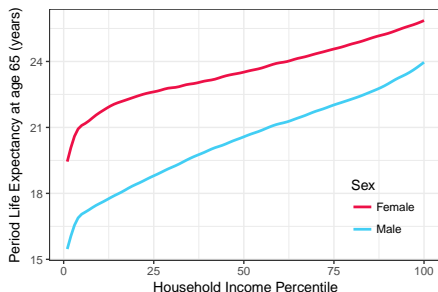
b) Life expectancy vs Lifetime income

UK Period Life Expectancy in 2014 at age 65 by nominal Household Income

a) Lifetime income distribution
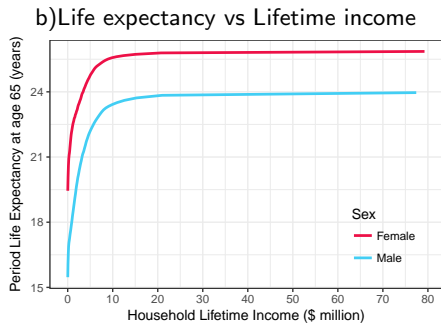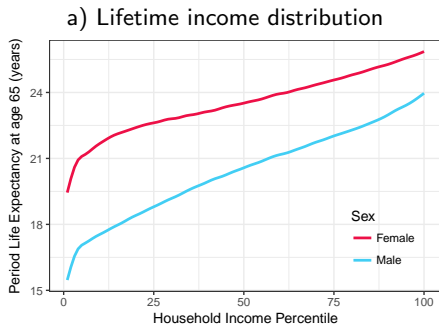
b)Life expectancy vs Lifetime income

# Heterogeneity in longevity as tax-subsidy mechanism

- The pension at retirement is commonly calculated as the lifetime accumulated (notional) wealth ($AK^k(tc)$) and the average life expectancy LE^a

- We measure the pension wealth and assess the effect of individual life expectancy:

$$PW_{x_r}^k = P_{x_r}LE^k = AK^k(tc)\frac{LE^k}{LE^a}$$

However, if the individual's life expectancy differs from the average mortality experience a tax or subsidy will arise:

$$
\begin{aligned}
t^k &= \frac{\text{Actual liability}}{\text{Accumulated notional capital}} - 1 = \frac{PW_{x_r}^k}{AK^k(tc)} - 1 \\
&= \frac{LE^k}{LE^a} - 1
\end{aligned}
$$

Tax and subsidy for US and England & Wales
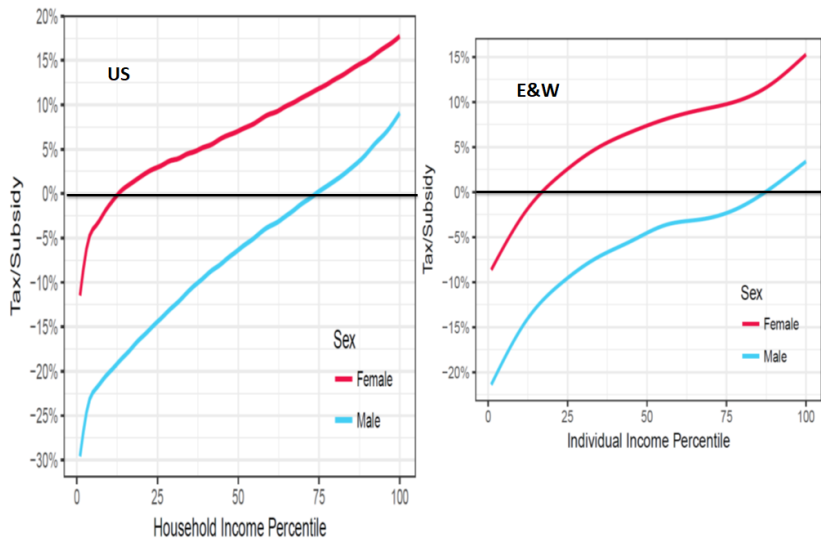
Implications for scheme design and pension reform

If left un-addressed, heterogeneity in longevity will diminish much of the rationale for approach

- It eliminates the *direct link* between contributions and benefits and thus claimed fairness
- It **eliminates** the linear intertemporal budget constrains for individuals earning further away from average income and thus the neutrality of retirement decisions
- It introduces again implicit **redistributive** features and hence eliminates the neutrality of NDC where redistribution needs to be introduced explicitly

Structure

Explored design alternatives

- **0: Benchmark**: status-quo (non-individualized rates or annuities)
- **1: Individualized annuities**
- 2: Individual contribution rates (2 versions)
- **3: Two-tier contribution schemes with flat and individualized contribution rates**
- 4: Two-tier contribution scheme with caps on the contributions
- 5: Two-tier contribution scheme with individualized contribution rates to deal with lower tail

Starting Position and Benchmark (Design 0)

- Taxes to deprived and subsidies to higher income households is (jointly) undesired.
- We assess the redistribution of the system by defining a measure of aggregate tax/subsidy effects:

    Total Absolut Tax Subsidy Indicator (TATSI)

    = average of absolute values of tax and subsidy rates

- We assess the effect of gender by studying a joint and gender-specific pools:

    $\rightarrow$ To explore how much of TATSI for a country can be reduced by simply separating the risk pools

Recall: Tax and subsidy for US and England & Wales
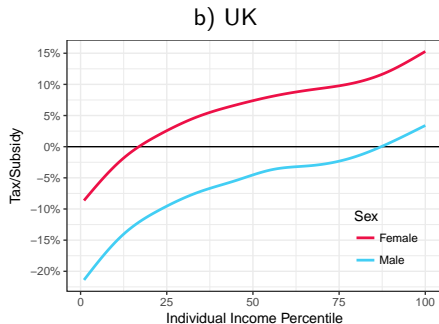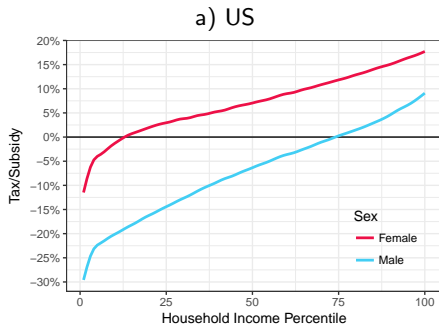
Aggregate Measures of Tax Subsidy Rates

	England & Wales			
	Joint		Gender separated	
	Female	Male	Female	Male
Nominal tax/subsidy rate	6.02%	-6.02%	0%	0%
Absolute tax/subsidy rate	7.34%	6.48%	4.28%	5.00%
	Total			
Nominal tax/subsidy rate	0%		0%	
TATSI	6.91%		4.64%	

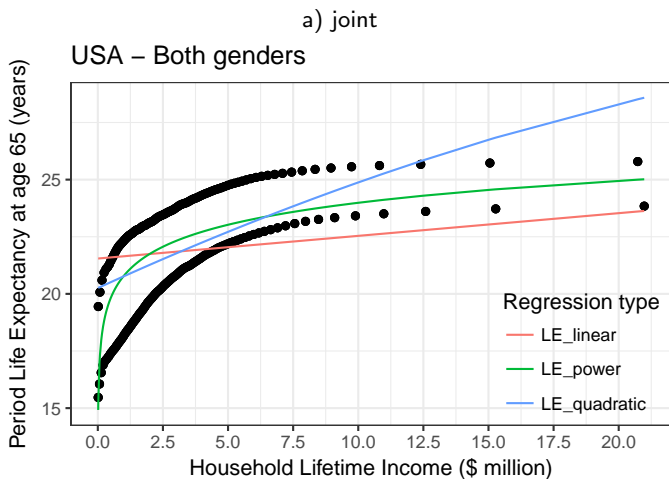|	United States			
	Joint		Gender separated	
	Female	Male	Female	Male
Nominal tax/subsidy rate	7.05%	-7.05%	0%	0%
Absolute tax/subsidy rate	8.02%	9.16%	4.73%	8.31%
	Total		Total	
Nominal tax/subsidy rate	0%		0%	
TATSI	8.59%		6.52%	

Life expectancy as a function of income

- To reduce the tax/subsidy distortion, we seek to model life expectancy using a simple function that policymakers can use
- Depending on the data availability, the function links individual life expectancy to lifetime income, education, geographical location, etc.
- Among the simple specifications we have:

$$\text{quadratic: } LE_i = a + b \cdot Y_i + c \cdot Y_i^2$$
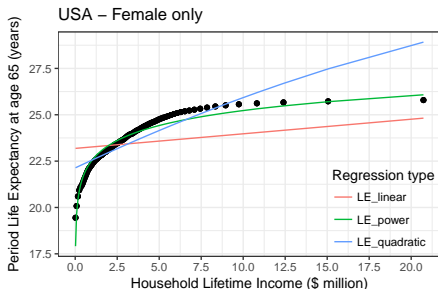$$\text{logistic: } LE_i = a + b \cdot \log(Y_i)$$

- The logistic seemed to work best.

US: Alternative Approximations for LE/LY Link

a) joint

US: Alternative Approximations for LE/LY Link

US: TATSI using approximations

	Joint pool		Separate pool	
	Female	Male	Female	Male
Nominal tax pp	7.28%	-7.26%	-0.01%	-0.05%
Absolute tax pp	7.36%	7.33%	2.06%	3.75%
	Total		Total	
Nominal rate	0%		0%	
TATSI	7.34%		2.90%	
	logistic		quadratic	

EW: Alternative Approximations for LE/LY Link

a) joint
England and Wales – Both genders

EW: Alternative Approximations for LE/LY Link

b) female

c) male
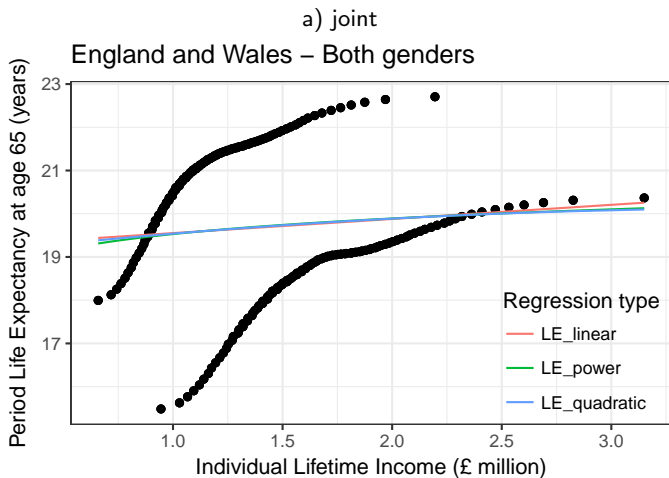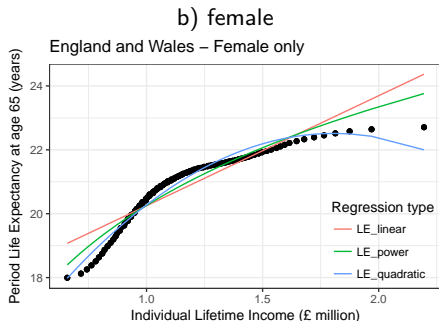
EW: TATSI using approximations

	Joint pool		Separate pool	
	Female	Male	Female	Male
Nominal tax pp	6.45%	-6.45%	0.00%	0.00%
Absolute tax pp	7.47%	6.52%	0.88%	1.02%
	Total		Total	
Nominal rate	0%		0%	
TATSI	6.99%		0.95%	
	linear		quadratic	

Calculation of the two-tier arrangement

Proposal: divide the total contribution *tc* into:

- *sc*: social contribution that yields average pension rights
- *nc*: contribution that yields individualized pension rights

We calculate the split by minimising the squared differences between the individualized annuities (zero-subsidy) and the two-tier approach:

$$sc^* = tc \cdot \frac{\sum_{k \in I} \frac{Y^k}{LE^k} \left(LE^k - LE^a\right) \left(Y^k - Y^a\right)}{\sum_{k \in I} \left(Y^k - Y^a\right)^2}$$

Optimal split for USA and EW ($tc = 20\%$)

	England & Wales		United States
Common Life Expectancy			
sc population	0.58%	sc population	2.45%
sc female	1.15%	sc female	3.16%
sc male	0.34%	sc male	1.70%
Separate Gender Life Expectancies			
sc population	3.21%	sc population	2.56%
sc female	2.58%	sc female	1.89%
sc male	3.42%	sc male	3.09%

Tax rates: status quo vs two-tier

b) England and Wales
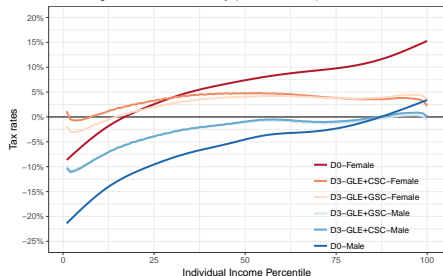
c) USA
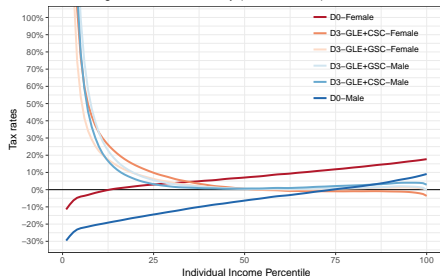
- Even a small social contribution in the US reduces the lifetime tax/subsidy arrangement for the wealthier cohorts.
- This goes at the expense of a massive subsidy to the lowest incomes
  → in nominal terms this implies a poverty alleviation payment

Structure

Comparison between re-designs

England and Wales

	Design Option 0: Status quo				Design Option 1: Individualized Annuities				Design Option 3: Two-tier contributions			
	Joint pool		Separate pool		Joint pool		Separate pool		Joint pool		Separate pool	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Nominal tax pp	0%	0%	0%	0%	6%	-6%	0%	0%	3%	-3%	3%	-3%
Absolute tax pp	5%	4%	4%	0%	7%	7%	1%	1%	3%	3%	3%	3%
	Total		Total		Total		Total		Total		Total	
Nominal rate	0%		0%		0%		0%		1%		0%	
TATSI	6.91%		4.64%		7.01%		0.95%		3.07%		2.98%	
					quadratic		quadratic		pooled sc		separate sc	

United States

	Design Option 0: Status quo				Design Option 1: Individualized Annuities				Design Option 3: Two-tier contributions			
	Joint pool		Separate pool		Joint pool		Separate pool		Joint pool		Separate pool	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Nominal tax pp	7%	-7%	0%	0%	7%	-7%	0%	0%	27%	30%	20%	37%
Absolute tax pp	8%	9%	5%	8%	7%	7%	2%	4%	28%	30%	20%	37%
	Total		Total		Total		Total		Total		Total	
Nominal rate	0%		0%		0%		0%		57%		57%	
TATSI	8.59%		6.52%		7.34%		2.90%		29.21%		28.32%	
					logistic		quadratic		pooled sc		separate sc	

Conclusion

- Heterogeneity in longevity is multi-dimensional, relevant in scope, and with regard to life-time income likely to continue increasing
- Without addressing heterogeneity DC type reforms may not move forward and cannot convincingly be argued (such as reducing the hard to measure tax wedge of NDB schemes)
- There are promising and operational policy options to reduce the tax/subsidy effects of heterogeneity
  - Risk pooling by gender would help but alone is not sufficient
  - Individualized annuities by individual LE estimations promise to be effective without being too complex
  - A two-tier contribution scheme (for NDC) may go a long way ? with some gender differentiation
  - Other elements can be added to the two-tier design, dealing in particular with the tails of the distribution

Thanks

Thank you for your attention

Questions?

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