Socio-economic differences in mortality: recent trends and implications for pension programmes

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Agenda

Socio-economic differences in mortality

- Mortality by deprivation in England
 - Trends in all-cause and cause-specific mortality
 - Implications for annuity pricing
 - Implication of tackling inequalities
- Mortality by income in England and Wales
 - Differences in all-cause mortality
 - implication for redistribution and fairness of pension systems

Conclusion

Heterogeneity in mortality

Well-documented relationship between mortality and socioeconomic variables

Difference in life expectancy at age 65, by education relative to the population average



Source: OECD (2016). Note: Australia is at age 60.

Heterogeneity in mortality

Well-documented relationship between mortality and socioeconomic variables

Male life expectancy at age 65 by social class - England and Wales



Source: ONS Longitudinal Study

Implications of heterogeneity in mortality

These socio-economic difference have important implications on social and financial planning

- Public policy for tackling inequalities
- Social security design
- Annuity reserving and pricing
- Longevity risk management

Mortality by deprivation in England

The Index of Multiple Deprivation IMD 2007/2015

- Socio-economic classification using the Index of Multiple Deprivation 2007/2015 (IMD 2007/2015)
- 7 deprivation domains combined for each geographically defined Lower Layer Super Output Area (LSOA)
 - Income, employment, health, education, housing and services, crime, and living environment
- 32,482 LSOA in England with approximately 1,500 people each
- LSOAs ranked from 1 to 32.482 by IMD 2007 score and grouped into quintiles
 - Q1: Least deprived quintile
 - Q5: Most deprived quintile



Source: Noble et al (2007)

Life Expectancy by Deprivation

Implications for life annuities (Villegas and Haberman, 2014)

Male life expectancy at age 65 by deprivation quintile – England



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Annuity rates at 4% interest for males age 65 as a percentage of the rate for England and Wales



Life Expectancy by Deprivation

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Significant variation of annuity rates with the level of deprivation
Baseline mortality differentials have a very significant impact
The impact of improvement differences is of second order

Causes of mortality in England by Deprivation

Age-Standardised Death rates for males age 25-84)





Causes of mortality in England by Deprivation

Level differences by deprivation quintile - Males (Villegas et al 2018)

Mortality rate in 2010 as a percentage of the rate in England



Understanding life expectancy differences in England

Decomposition of differences in Life Expectancy at age 50, Q5 vs Q1



Impact of differences for policies to tackle inqualities

Life Expectancy for Males age 45 (Alai et al 2018)

Which scenario of cause elimination would help to close the life expectancy gap while achieving the highest overall increase in life expectancy across the society?

- WHO NCD Global Monitoring Framework 2025 target: Overall reduction in premature mortality by 25%, from cardiovascular disease, chronic respiratory disease, diabetes and neoplasms.
- Is it the optimal strategy?

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Mortality by Income in England and Wales

Weekly household income by Middle Layer Super Output Area (MSOA)

ONS Household Income Report

England and Wales GLA income estimates House price to income and London ONS with ONS comparison ratio income data England and Wales Household Income 2011/12 Indicators (Mean gross weekly income (K) Mean Net income (exclusioned) before housing costs (E) O Mean Nat income (equivalent) ofter bousing costs (F)

Household Income distribution by MSOA



Mortality by Income in England and Wales: Males 2015



Mortality rate by income percentile

Cohort Life Expectancy by Income in England and Wales: Males age 65 in 2016



Allowance for mortality improvements:

- ► Lee-Carter model with cohort effects: $\log \mu_{xt} = \alpha_x + \beta_x \kappa_t + \gamma_{t-x}$
- Fitted to England and Wales Males age 50-89, years 1961-2015
- Assume same improvement for all percentiles

Survival function by Income in England and Wales: Males age 65 in 2016



Age at death statistics

Income percentile	10	30	50	70	90	EW
Q1	77.3	79.4	80.5	81.0	82.1	80.0
median	86.7	88.9	90.0	90.5	91.5	89.5
Q3	95.5	97.1	97.8	98.2	98.8	97.6
Interquartile Range (Q3-Q1)	18.2	17.7	17.3	17.2	17.6	97.6

Why do worry about heterogeneity in longevity for benefit design and pension reforms?

- Heterogeneity induces a tax/subsidy effect which reduces any design-indented progressivity and under an "actuarially" fair schemes turns it highly regressive
- What does the tax/subsidy effect imply for the design of longevity pooling products such as income tontines or group-self annuitisation schemes?
- What does the tax/subsidy effect imply for the policy proposal to move from DB to DC schemes (unfunded and funded)?
- What does the tax/subsidy effect imply for the policy proposal to index standard and minimum retirement ages to cohort life expectancy?

Tontine/GSA: 1000 homogeneous members

Source: Labit-Hardy et al (2019))

Pool: 1000 EW males; Initial Investment: 100

Pricing mortality: EW males; Pricing interest rate: 4%



Tontine/GSA: 1000 heterogeneous members

Source: Labit-Hardy et al (2019))

Pool: 200 in each percentile; Initial Investment: 100

Pricing mortality: EW males; Pricing interest rate: 4%



Tax/Subsity rate in a hypotethical Notional Defined Contribution scheme

Source: Holzmann et al (2019))

Pension = Acc. notional capital at retirement Average Life Expectancy at 65

Accumulated notional capital at retirement: sum of the gender-specific annual incomes between age 20 and age 64 times the contribution rate

 Tax/Subsidy = Pension Liability
 Notional capital at retirement - 1

► Tax/Subsidy =
$$\frac{\text{Individual Life Expectancy}}{\text{Average Life Expectancy}} - 1$$



Conclusions

- There are significant differences in life expectancy and mortality across socio-economic groups measured by different markers (income, deprivation, education, etc)
 - Significant differences in levels as well as in trends
 - Differences are likely to continue to increase
- Mortality differentials have important social and financial implications
 - Setting appropriate mortality assumptions for annuities/pensions
 - Design of policies for tackling social inequalities
 - Implications for the redistribution of pensions programs
- Policy makers should facilitate the timely availability of mortality data by socio-economic group

Thank you!

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