Does money buy you longevity?

Mortality & Longevity Symposium 2016

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30 second summary…..

Yes!

But....
What do we know about longevity of higher income annuitants?
Get Rich, Live Longer: The Ultimate Consequence of Income Inequality

The income gap meets the longevity gap.

Source: The Atlantic / Wall Street Journal
Exploring the CMI SAPS study

- For each pension band in CMI S2 dataset:
  - Life expectancies based upon fitting a Gompertz model to amounts based mortality rates within each pension band
  - Average pension amount calculated as total amounts exposure amongst divided by total lives exposure (amongst those aged 65 and over)
- Ultimate age of life table assumed to be 125
An illustrative model

Method

1. Mortality assumed to be Gompertz with parameters a function of pension amount

\[ \ln(\mu_x: \text{Pension} = P) = f_1(P) + f_2(P).x \]

2. Fit a function for the Gompertz intercept and slope parameters for log force of mortality

\[ f_i(P) = g_i(lnP) \]
\[ g_i(y) = ay^2 + by + c \]

3. Extrapolate outside of range fitted to as a means of informing assumption across affluence scale / higher pension amounts

![Gompertz intercept as a function of pension](image)

![Gompertz slope as a function of pension](image)
An illustrative model

Results

Weaknesses of illustrative model
- Extrapolation beyond realm of data
- Simple Gompertz (no curvature with age)
- Poor fit to life expectancies (£10k to £40k)?
- Crossovers of mortality / absence of co-fitting

Needs improving if going to rely on...

Weaknesses of data
- Small number of data points
- Largest pension band very influential
- Pension a ‘noisy’ affluence metric
- Socio-economic drift (potential overstatement of life expectancy)

Fundamental! Let’s explore...
A noisy covariate

Meet Joe

- Worked for 10 years
- Routine manual job
- 1.25% accrual
- Retired in 2011 on a salary of £20,000
- Pension of £2,500 p.a. (= 10 × 1.25% × £20k)

Meet John

- Worked for 2 years
- Senior manager
- 1.67% accrual
- Retired in 2011 on a salary of £75,000
- Pension of £2,500 p.a. (= 2 × 1.67% × £75k)

Relying on pension amount will be misleading

4 times less likely to die between 60 and 65
Socio-economic drift

- **Survivorship bias**: Expect increased prominence of high income at older ages
- **Socio-economic drift**: A £10k pension at age 95 represents higher affluence than a £10k pension at age 65
  - Impact of pension increases (often less than inflation) vs earnings (often inflation plus) and history of pension schemes.
  - If do not control for this risk overstating life expectancies for younger cohorts (drift up socio-economics as age)

Source: Own calculations based upon SAPS S2 data for normal health pensioner men.
Using salary to add insights into high earner baseline longevity.
A practical alternative
Salary widely held

2 in every 3 BPA transactions

When available have for 88% of members

Richness at top ages
A more powerful covariate
Salary improves model fit

Improvement in modelling mortality rates over and above reflecting age (normal health pensioner men)

Age * Pension
Age * Salary
Age * Geo-dem
Age * (Pension + Geo-dem)
Age * (Salary + Geo-dem)

Change from Age-only model

BIC
AIC

Better model
A diminishing marginal impact

Life expectancy from age 65 by revalued salary

Solid foundation for applying interpolative models

Analysis of Club Vita data spanning 2004-2013. Data subject to usual Club vita quality controls and only good quality salary data included. Each point represents a salary quantile and a fitted life expectancy has been plotted at the average salary for that quantile. Life expectancies fitted by fitting a Gompertz formula to underlying data and assuming a terminal age of 125. Salaries revalued to April 2016 from last known date with RPI.
Affluence and women?

For current pensioners

- Affluence (pension or salary) less predictive than for men
- Better to include occupation (manual/non-manual) with postcode-based socio-demographics
  - Role of household vs individual?
- Conclusion dominated by those 75+

For younger annuitants / future pensioners

- Changes in employment histories mean care needed with younger annuitants / deferred annuitants
Adding insights into high earner longevity trends.
Socio-economic convergence?

Period life expectancy at 65 for men

Life expectancy from age 65, males

Managerial & professional
Routine & manual

Table 3. Male Average Annualised Mortality Improvement Rates (Ages 65–84)

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IMD Quintile 1</td>
<td>2.55</td>
<td>3.36</td>
<td>3.70</td>
</tr>
<tr>
<td>IMD Quintile 2</td>
<td>2.57</td>
<td>3.18</td>
<td>3.53</td>
</tr>
<tr>
<td>IMD Quintile 3</td>
<td>2.49</td>
<td>3.15</td>
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<tr>
<td>IMD Quintile 4</td>
<td>2.22</td>
<td>2.79</td>
<td>2.98</td>
</tr>
<tr>
<td>IMD Quintile 5</td>
<td>1.98</td>
<td>2.43</td>
<td>2.41</td>
</tr>
<tr>
<td>Total</td>
<td>2.45</td>
<td>3.10</td>
<td>3.36</td>
</tr>
</tbody>
</table>

Sources:
1. Own calculations based upon ONS data
2. Kings Fund report:
Socio-economic trend groups

Method...

- Clustering based on pension and deprivation
- Split into 4 groups and 5 deprivation quintiles
- Clustered according to six core principles
- 3 groups for men and 2 groups for women
- Used combination of methods:
  - Partitioning about medoids
  - Fuzzy analysis

Principles...

1. Credible size
2. Clear differences in improvements
3. Group where similar improvements
4. Separate where levels very different
5. Interpretable
6. Manageable number
## Socio-economic trend groups

### Pension

<table>
<thead>
<tr>
<th>Deprivation of the area</th>
<th>High deprivation</th>
<th>Low deprivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; £5k p.a.</td>
<td>Blue</td>
<td>Red</td>
</tr>
<tr>
<td>£5k - £7.5k p.a.</td>
<td>Blue</td>
<td>Green</td>
</tr>
<tr>
<td>&gt; £7.5k p.a.</td>
<td>Blue</td>
<td>Green</td>
</tr>
</tbody>
</table>

### Source: Club Vita & PLSA longevity trends model
A narrowing longevity gap (men)

Period life expectancy for men

2000: +3.7 years
2010: +3.2 years
2013: +2.9 years

Notes:
- Due to rounding the gaps shown above differ from the differences between the labels shown on the chart.
- Data post 2010 (dashed lines) provisional and based upon 3 year (centred) moving average mortality rates with a Gompertz mortality curve fitted and a terminal age of 125.
- Data up to 2010 uses smoothing and as per the NAPF Longevity Trend Model (p-spline smoothing)
A narrowing longevity gap (women)

Period life expectancy for women

Making do / Comfortable

Hard pressed

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Socio-economic health cascade?
An “information cascade” / “social diffusion” in action

- Earlier adopters tend to be of higher socio-economic status
- Influence of social networks:
  - decision of whether to adopt made in context of observing friends, neighbours and colleagues
  - “Social diffusion” a long discussed concept e.g. tetracycline adoption (Coleman et al, 1967) and hybrid corn (Ryan & Gross, 1950)*

“A paradox inherent in the scientific method is that, attached though we are to the hypotheses we formulate, we must subject them to assault and search for circumstances that really test their resilience.” Paneth & Susser

* Source references identified via Mascolo
Why socio-economic trends matter

Most BPA books have 20-40% lives in the ‘comfortable’ group, but 50-80% of annual pensions.

Source: Own calculations based upon Club Vita data. Analysis based upon pensioner men from 149 schemes contributing exposure in 2012 within the NAPF Longevity Trend Model research carried out by Club Vita.
What else do we know about high earners?
Top-slicing

1. Identify individuals representing (say) top 20% of liabilities in a pension scheme
2. Seek quotations for medically underwritten annuities
3. Purchase annuities for these named lives (*may release capital, removes a concentration of risk*)
4. Leaves a residual population to be secured at a later date

“The problem with top-slicing is that no insurer will be interested in the rest of the annuity book....”
Is top-slicing a Pandora’s box?

- Looked at 23 pensioner portfolios in Club Vita dataset with between 500 and 5,000 lives
- Assumed a top-slicing approach to market happened in 2005
- **Objective criteria for top-slicing**: Based on pensions in payment above a (scheme-specific) threshold so that covered 20% of liabilities
- Where those lives went on to have ‘heavier than expected’ mortality we have assumed this was due to a health condition which would have been identified by underwriting and so those schemes would have ‘top-sliced’
- Looked at experience of residual population post 2005 for schemes which top-sliced for evidence of selection – no (obvious) evidence of adverse selection
Is there any truth in stereotypes?

- Healthier: ✔️
- More likely to be married: ✔️
- Young spouse: ✗
The material and charts included herewith are provided as background information for illustration purposes only. It is not a definitive analysis of the subjects covered, nor is it specific to circumstances of any person, scheme or organisation. It is not advice and should not be relied upon. It should not be released or otherwise disclosed to any third party without our prior consent. Hymans Robertson LLP accepts no liability for errors or omissions or reliance upon any statement or opinion.
References

- NAPF Longevity Trend Model
- SAPS S2 data
- Ryan B. & Gross N.(1950) *Acceptance and Diffusion of Hybrid Corn Seed in Two Iowa Communities* Agricultural Research Bulletin 372
Thank you