SOCIETY OF ACTUARIES

A World of Mortality Issues and Insights Seminar
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Session 5 – Mortality of Disabled Lives

Presenter

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Mortality of disabled people

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Agenda

- Introduction
- Disability insurance and Income Protection
- Actuarial approaches to disability benefits
- Mortality of disabled people: some remarks
- Modeling extra-mortality
- Currently available material
- Concluding remarks

Introduction

Mortality of disabled people required, as item of the technical basis, by many insurance products, in particular:

- Income protection (IP) policies
- Long Term Care (LTC) policies
- Critical Illness (CI, or Dread Disease)
- Life insurance products with disability-related supplementary benefits

Large experience (insurance companies, pension funds, social security, etc)

but

Variety of disability situations implies

→ heterogeneity in data

→ difficulties in summarizing data

Aim of this presentation:

§ information about available data sets

§ possible use of parametric models

Disability insurance and Income Protection

Individual disability insurance

- Disability income benefits
- Lump-sum benefits
- Waiver-of-premium benefits

Group disability insurance

- Short term disability benefits (STD)
- Long term disability benefits (LTD)

Actuarial approaches to disability benefits

Rigorous actuarial models require a lot of statistical data

Data may be scanty, in particular when new insurance products are concerned

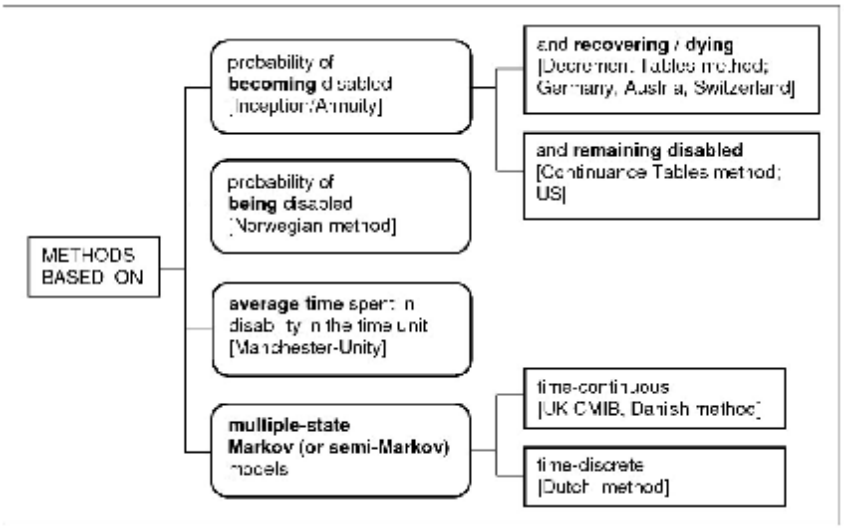
Simplified calculation procedures often used

Choice of the procedure according to type and format of data available

- Methods based on the *probability of becoming disabled*
  - Based on *inception rates* (and *recovery rates, mortality rates*)
- Methods based on the *probability of being disabled*
  - Based on *prevalence rates*
- Methods based on the *average time spent in disability*
  - Based on *disability rates* (or *central sickness rates*), i.e. *persistency rates*

- Methods implementing *multistate models*
  - A rigorous and sound framework (for all the insurances of the person)
  - Time-continuous or time-discrete context
  - Probabilistic structure: Markov (or semi-Markov) stochastic processes

See: Haberman and Pitacco (1999), and references therein



A classification

Mortality of disabled people: some remarks

- Inception-select data
  - Both frequencies of recovery and death of disabled people depend on past duration of disability
  - Assumptions about mortality of disabled people should rely on inception-select mortality data
- Mortality by cause
  - Mortality depends on the cause (e.g. accident vs sickness) and severity (partial vs total)
  - Eligibility to disability benefits varies according to legislation, policy conditions, market practice, etc
  - Difficulties in grouping data

- Safe-side technical bases

  Disability benefits (e.g. in IP and LTC insurance products) are “living benefits”, payable as long as the insured is alive and disabled

  Safe-side assessment (in pricing and reserving)

  ⟶ mortality of disabled people should not be overestimated

Modeling extra-mortality

Disabled people constitute substandard risks

Mortality of disabled people contains an “extra-mortality” term

Extramortality represented as

- specific mortality (table, parametric mortality law)
- adjustments to the standard mortality pattern

Mortality of disabled people expressed as

$$q_{x,t}^{(k)} = \Psi(x, t; k)$$

where:

- Ψ = mortality table or parametric law
- x = age at disability inception
- t = time elapsed since disability inception
- k = category of disability

Alternative approach: express the mortality of disabled people in relation to standard mortality

$$q_{x,t}^{(k)} = \Phi(q_{x+t}, t; k)$$

where:

- Φ = a transform
- q_{x+t} = standard mortality at age $x+t$
- t, k enter the function via appropriate parameters

Examples

A rather general model

$$\Phi(q_{x+t};\, t;\, k) = A_t^{(k)}\, q_{x\,|\,B^{(k)}\,|\,t} - C_t^{(k)} \qquad (*)$$

where:

- parameters A, B and C
  - – are category dependent
  - – can express the past duration effect
- $B^{(k)}$ = “years to age” addition (age-shift parameter)

See: Ainslie (2000)

Particular implementations of model (*)

- Linear model: $\Phi(q_{x-t};\, k) = A^{(k)}\, q_{x+t} + C^{(k)}$
- Age-shift model: $\Phi(q_{x\ \ t};\, k) = q_{x+B^{(k)};\,-t}$

Particular linear models

- Additive model: $\bar{\Phi}(q_{x-t};\, k) \quad q_{x-t}\ |\ C^{(k)}$
- Multiplicative model: $\bar{\Phi}(q_{x-t};\, k) = \bar{A}^{(k)}\, q_{x-t}$

Another simplified model:

$$\bar{\Phi}(q_{x-t};k) - q_{x+t} \mid \Delta(x \mid t;k)$$

with

$$\Delta(x-t;k) - \frac{\alpha}{1 \mid 1.1^{50}\ (x\ \ t)} \frac{\max\{k-5,0\}}{5}$$

See: Rickayzen (2007), Rickayzen and Walsh (2002)

Parameter k: category of disability according to the OPC scale

See: Martin and Elliot (1992)

Currently available material

- **Study on Canadian Group Long Term Disability Termination Experience (1988-1997)**
  - Disabled recovery (Québec / Non-Québec, unisex)
  - Disabled mortality (Québec / Non-Québec, gender specific)

http://www.actuaries.ca/members/publications/2010/210002e_revised.pdf

- **Actuarial Report on the Canada Pension Plan**
  - Information to evaluate Plan's financial sustainability over a long period
  - Sensitivity analysis performed

http://www.osfi-bsif.gc.ca/app/DocRepository/1/eng/oca/reports/CPP/cpp23_e.pdf

- **Social Security Disability Insurance Program. Worker Experience**
  - Select probability of death for male / female disabled workers
  - Select life tables for male / female disabled workers

http://www.ssa.gov/oact/NOTES/pdf_studies/study118.pdf

- **Society of Actuaries. The RP-2000 Mortality Tables**
  - Findings of the Retirement Plans Experience Committee
  - Tables: raw disabled retiree death rates (male / female)

http://www.soa.org/research/experience-study/pension/research-rp-2000-mortality-tables.aspx

- **Pension Benefit Guaranty Corporation (PBGC)**
  - ERISA Section 4044 Mortality tables, used to determine the present value of annuities in involuntary termination and distress termination of single-employer plan

http://www.pbgc.gov/prac/interest/erisa.html

- **Institute and Faculty of Actuaries, UK**

http://www.actuaries.org.uk/research-and-resources/pages/continuous-mortality-investigation-reports

– Working papers 5, 6, 7, 46, 47 and 48

Graduation of individual IP sickness inception and termination experience, using the multistate model described in CMIR12 (1991)

– Working papers 34 and 35; in particular:

- WP 34 – methodology and assumptions underlying the data set used for graduations
- WP 35 – graduation of the CMI Self-administered Pension Scheme experience 2000-2006; tables
  - S1IFA: Ill-health pensioners, Female, Amounts – in terms of both probability of dying q_x , and force of mortality μ_x
  - S1IMA: Ill-health pensioners, Male, Amounts – in terms of both probability of dying q_x , and force of mortality μ_x

Concluding remarks

Main aspects affecting the mortality of disabled people:

- definition of disability
- severity of the disability, to be quantified in terms of an appropriate scale
- cause of disability (ranging from various types of sickness to body injuries and dismemberments)

A significant heterogeneity in the data follows

Use of parametric models representing the extra-mortality of disabled people: alternative to the construction of specific tables

- reduction of the dimension of the statistical problem
- higher reliability of the results

For more information:

E. Pitacco (2012), Mortality of Disabled People, Working Paper.

Available at SSRN:

http://ssrn.com/abstract=1992319

or

http://dx.doi.org/10.2139/ssrn.1992319

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Rickayzen B.D. (2007), An Analysis of Disability-linked Annuities, Actuarial Research Paper No. 180, Faculty of Actuarial Science and Insurance, Cass Business School, City University, London. Available at: http://www.cass.city.ac.uk/__data/assets/pdf_file/0018/37170/180ARP.pdf

Rickayzen B.D. and Walsh D.E.P. (2002), A multi-state model of disability for the United Kingdom: Implications for future need for Long-Term Care for the elderly, *British Actuarial Journal*, **8**, Part II, 36: 341 - 393

Many thanks
for your kind attention