Life Insurance and Wealth Management

Actuarial Practice - Life Insurance and Wealth Management[1]

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[1] → latest slides

THE UNIVERSITY OF MELBOURNE

1. Life Insurance
2. Wealth Management

Introduction

A typical way of selling traditional policies: `video`

Life Insurance Products - Traditional Policies

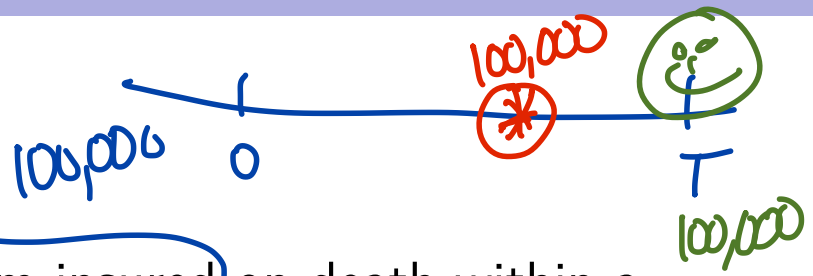
In case of death:

- Whole of life
  - Sum insured on death of the life insured regardless of when the life dies, can be limited term premium
  - **Non-participating** - fixed sum insured
  - **Participating** - bonus (profit share) is usually added as a percentage of the sum insured (*simple bonus*) or as a percentage of the sum insured plus previous bonuses (*compound bonus*)
- Term insurance
  - Sum insured paid on death within a specified term.
  - Pays nothing on survival to the end of the policy term.
  - **Reducing term insurance** - to cover a housing loan with reducing balance
  - **Renewable term insurance policy** - increasing premium rates, guaranteed renewable

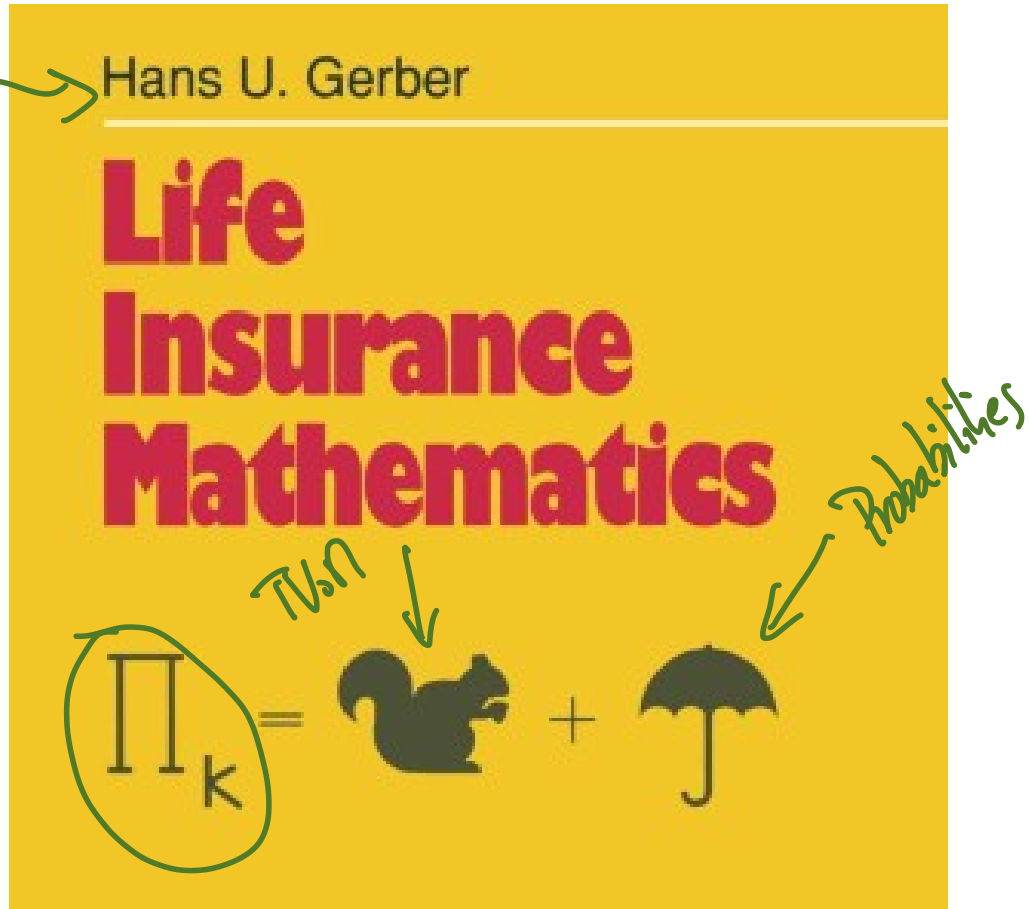
In case of life:

- Life annuities
  - Lump sum (*consideration* or the *single premium)* paid to purchase the annuity
  - Income stream in return (may be indexed)
  - Variants: Immediate; Deferred; Indexed; Joint
- Pure endowment
  - Sum insured benefit paid on survival to the end of the term of the policy
  - Earlier death - usually a return of premiums with interest

As a combination:



- Endowment assurance
  - An endowment assurance pays the sum insured on death within a specified term or survival to maturity.
  - Combines life insurance cover payable on death (*death cover*) with *savings* payable on maturity of the contract



Related products

- Disability
  - Additional benefits - **disability benefits rider** or **Total and Permanent Disability (TPD) benefits**
  - Separate **income protection policies** provide a percentage of the insured's income in the event of disability (here defined as inability to earn a salary - so loss of earnings) for a fixed period or to a fixed age
- Critical Illness (also called Trauma)
  - Critical illness policies pay a benefit if the insured suffers specified illnesses or surgical procedures (heart attack, cancer)
- Reverse mortgages
  - equity release product for the "asset rich, income poor" people
  - big unknown is whether there will be equity left at time of death of the borrower(s) – a guarantee may be involved (which is very complicated to calculate)

Definitions

Lapse:

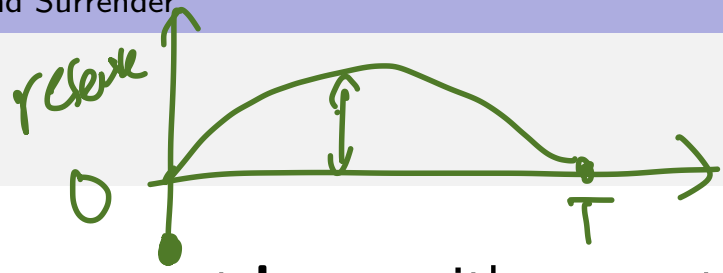
- Policyholder does not respect their obligations (e.g. does not pay premium and there is no owed benefit to offset).

Surrender:

- Policyholder decides to terminate the policy before maturity, and receives the *surrender value* of the policy
- Minimum surrender value required by life insurance law in many countries

These present distinct risks that need to be valued and monitored.

Risk of Lapse and Surrender



- Ideally one should make sure that policies cannot **lapse** with a negative value (by commission structure, minimum policy size, product design, ...)
  Insurance legislation does not usually allow life insurance companies to treat negative liability values as an asset, because there is no guarantee that the policyholder will pay the later premiums so that the asset is not guaranteed
- **Surrender values** are typically less than 100% of the reserve (because the insurance company is forfeiting some future profits it was entitled to)—this is of course regulated

Underwriting

- Insurance policies are mostly sold at what are called **normal rates** or **standard rates**.
- Insurers subdivide lives into groups, and charge premiums according to the grouping. Lives are often divided by
  - age (when a policy is issued)
  - policyholder's sex
- Further subdivision may take place by, e.g.
  - smoking or non-smoking
  - driving or not
  - marital status
  - health status
- The purpose of underwriting is to assess whether an individual should be
  - sold a policy at standard rates,
  - sold a policy at higher than standard rates,
  - or not sold a policy at all.

Selection is an issue we touched on earlier. This is very important for underwriting.

There are two types:

- self-selection (e.g. an individual buying a life annuity)
- adverse selection (risks higher than expected (and this being unbeknownst of the insurer) take up the cover)

The so-called **"Duty of disclosure"** (see, e.g., the `ICA's explanation`) is a powerful protection for the insurer, but is often misunderstood by the insured

Pricing

This involves calculating the premium for a policy.

- The standard approach is through the 'principle of equivalence': The EPV, at the time of issuing the policy, of all premium incomes must be equal to the EPV of future benefits and expenses.
- In calculating premiums, actuaries must set assumptions on interest, mortality and expenses.
- Why are there expenses?
  1. Initial and renewal expenses: policy linked expenses include things like the cost of a medical examination, commission to agents for selling a policy, and the cost of regular correspondence with policyholders (e.g. annual statements about their policies).
  2. General expenses (overhead): Business expenses have to be paid for – these include things like salaries, rent, investment expenses. Generally, it is a difficult task to allocate such expenses in a precise manner to policies.

Reserving

This is a statutory requirement in most countries. In Australia, a life insurance company has an **Appointed Actuary**.

- An insurance company must hold **reserves**.
- See this `Video` for an explanation of the concept of actuarial reserve.
- The reserve for a life insurance policy at time t (if the policy is still in force), denoted as ${}_tV$, is calculated as follows:

$$
\begin{aligned}
&{}_tV + \text{EPV at time } t \text{ of future premium income from the policy} \\
&= \text{EPV at time } t \text{ of future costs under this policy.}
\end{aligned}
$$

Maintaining the solvency of an insurance company is a very important task for an actuary.

Investment

- Actuaries are typically involved in the investment function of insurance companies, so much so that it is a whole area of practice in itself.
- This is developed in the `next section`.

Analysis of surplus

- Profit typically arises from three main reasons.
- When an insurer sets the premium for a policy, it is making assumptions about future levels of interest, mortality and expenses. It is unlikely that these assumptions will become reality exactly, and so the insurer makes a profit or a loss:
  1. If the assumed interest rate is lower than the real interest rate, then the insurer will make a profit;
  2. If the expected number of deaths in a year is more than the actual number of deaths, then the insurer makes a profit (in a death benefit context);
  3. If the assumed expenses in a year is more than the actual expenses occurred, the insurer makes a profit.

Example

As a simple example, suppose an insurer sells one hundred one-year term insurance policies to individuals aged 30 with sum insured \$100,000 for a pure premium of

$$\$952.38 = 100,000vq_{30}.$$

The following assumptions were made:

- Investment income: 5% per annum effective.
- Mortality: it is expected that one the policyholder will die, i.e., $100q_{30} = 1$.

If the **experience** is as expected, at the end of the year the insurer's fund will be

$$100 \times 952.38 \times 1.05 - 100{,}000 = 0.$$

Consider the following deviations from the assumptions:

- suppose that the insurer actually earns interest at **6% per annum effective**. Then the insurer's surplus is

$$100 \times 952.38 \times 1.06 - 100{,}000 = 952.38.$$

  and we would say that the profit has arisen through a favourable investment experience.

- Similarly, if no policyholder died and interest was earned at 5% per annum effective, the insurer would make a profit of 100,000.

- If two policyholders died and interest was earned at 5% per annum effective, the insurer would have a loss of amount:

$$100 \times 952.38 \times 1.05 - 2 \times 100{,}000 = -100{,}000.$$

Interview

`Video`

Edward Tam FIAA

Director at KPMG Australia

Take-aways

- [0:00] (actuaries and life insurance)
  - 15 years of career in a range of roles and companies
- [2:20] (actuaries and life insurance)
  - direct insurer: traditional actuarial work such as pricing and reporting
  - with consultant, changes a lot: actuarial **skill set** valued, for **any** job (also data analytics, mergers and acquisitions, risk management, claims assessment, industry surveys, climate change, government work, . . .)
  - also wealth management (and superannuation) space
  - secondment roles, any work to support the client (and where actuarial skill set is useful)
- [4:09] (typical employers)
  - consulting and direct life insurers hire bulk of life insurance graduates (but also super funds, risk management, but hire more experienced - not a lot of graduates)

- [4:33] (issues and challenges)
  - bad publicity for life insurance
  - no focus on the benefits...
  - technology: changes the landscape for clients
- [5:45] advice:
  - what you learn at uni gives useful context (understand concepts in simplified world before you can apply them in business context)
  - the edge: good results necessary but not sufficient, relevant work experience, communication skills, computing skills

What factors impact mortality?

`Actuary Magazine: Game on: Utilizing games to better understand policyholders in the life insurance realm (p. 32-38)`, see also `web version`

- Future expected mortality is very heterogeneous—see example with HK data.
- Other factors than just age, gender and smoking status have predictive power.
- Again, discussion of how more data will lead to more granular pricing due to adverse selection. This leads to "vulnerability" due to price segmentation.

How is the data obtained?

- purchase from vendors?
- ask policyholders (e.g. genetic tests)?
- lure them into providing information with games? (think `Facebook stupid quizzes`, `Tiktok scrolling data`, etc. . .)

Sounds unpalatable, but insurers argue this may lead to better health outcomes as insured learn about good behaviours.

Ethical issues

`AD: "Thinking about life insurance through a genetic lens`

"Our ability to predict disease risk based on genetics is rapidly advancing. What does this mean for life insurance?"

- "nature" (genetics) vs "nurture" (environment and lifestyle) effects: likelihood of some diseases can be dramatically impacted by genetic profile (heritability)
- 'polygenic risk score'
- Definitely more information
  - Becomes 'practical' (ratio of informative vs cost sky rockets)
  - Persistent
- Is it OK to require genetic tests?
  - If testing is conducted (and not necessarily disclosed): adverse selection, increased lapse
  - tension between inclusivity and sustainability

For more on nature vs nurture (non mandatory): read and watch `Three Identical Strangers`

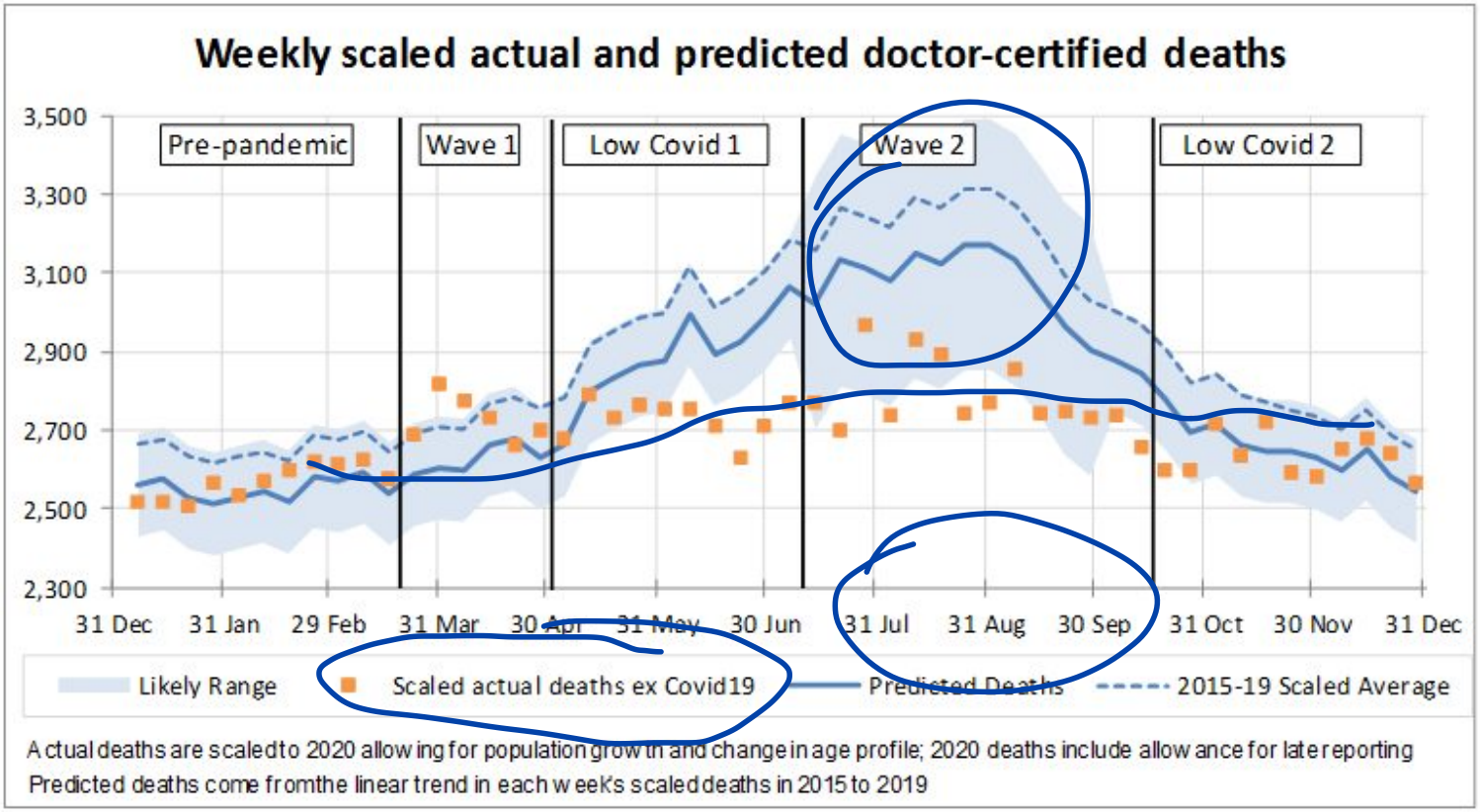
Impact of COVID-19

`AD: Impact of COVID-19 on Mortality and Morbidity in 2020`

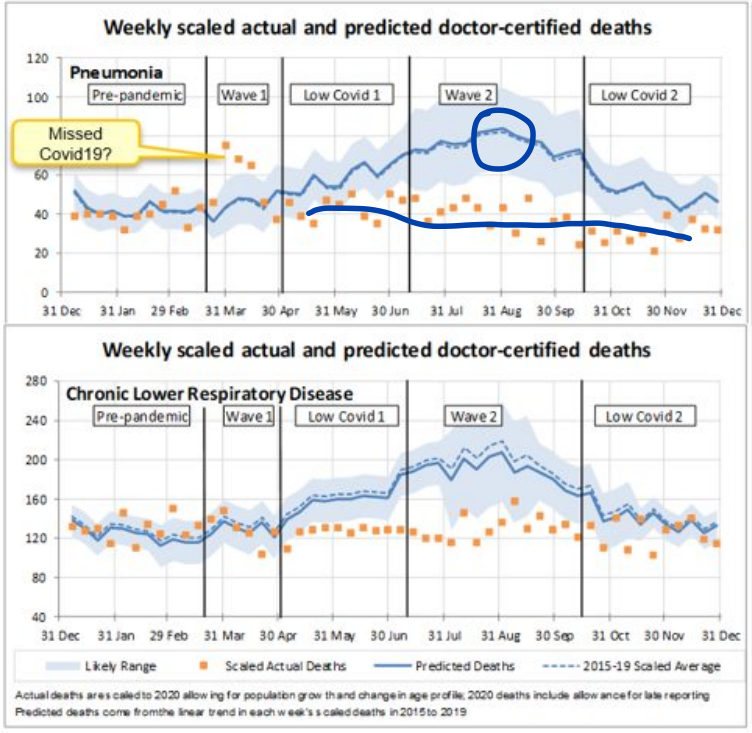
Overall, there were around 3,900 (2.7%) fewer deaths in 2020 than predicted:

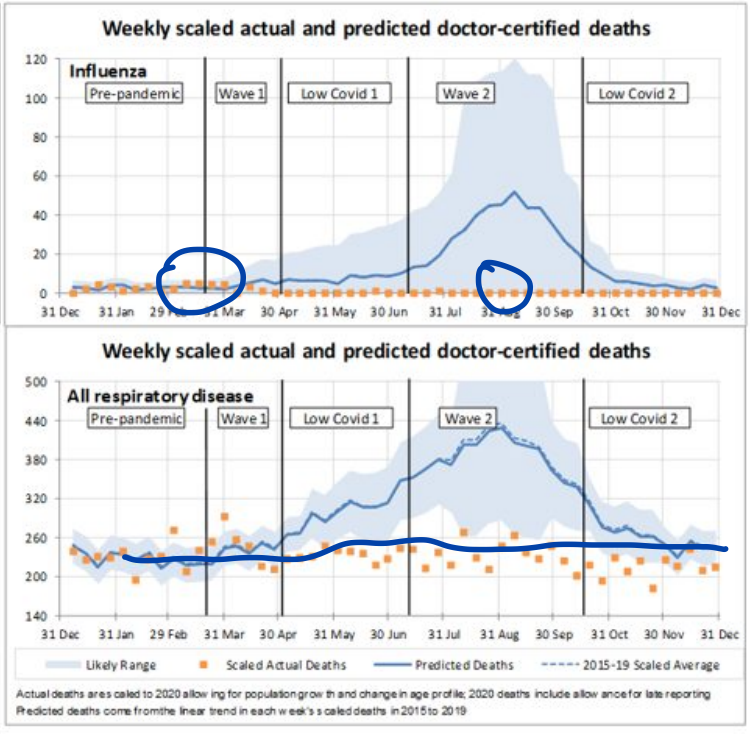
Year to 29 December – Actual vs Predicted					
Cause of Death	Actual	Predicted	Difference	% Diff	Contribution
Respiratory disease					
Lower respiratory	6,656	7,898	(1,241)	-16%	-0.9%
Influenza	42	648	(606)	-94%	-0.4%
Pneumonia	2,085	2,967	(882)	-30%	-0.6%
Other respiratory	3,197	3,689	(492)	-13%	-0.3%
Total	11,980	15,201	(3,221)	-21%	-2.2%
Cancer	47,786	48,154	(368)	-1%	-0.3%
Heart disease	13,442	13,423	19	0%	0.0%
Cerebrovascular disease	8,954	8,911	43	0%	0.0%
Dementia	14,439	15,197	(758)	-5%	-0.5%
Diabetes	4,844	4,516	328	7%	0.2%
Other	38,473	39,215	(742)	-2%	-0.5%
Total	127,938	129,416	(1,478)	-1%	-1.0%
COVID	832	-	832		0.6%
Total	140,750	144,617	(3,867)	-2.7%	-2.7%

Also, Covid measures almost totally cancelled the seasonal (winter) effects:



Drilling down:





2 Wealth Management

- Importance for insurers
- Asset-liability management
- Investment Policy

Importance for insurers

Asset management is a major issue for insurers:

- There is a long **time gap** between receipt of premiums and payment of benefits (especially in life insurance, and in **long tail** general insurance lines, and in superannuation)
  - premium money is invested in the meantime
  - investment income is accounted for in the premium amount
- In some cases it is even a critical competitive factor (in life insurance in particular), almost becoming one of the core businesses of insurance
- That explains to some extent why banks sometimes do insurance as well (along with ready to use sales channels).
- It also explains why financial mathematics and economics is an important part of the training of actuaries.

2 Wealth Management

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Asset-liability management

- One critical issue is to have assets that match well the type of liabilities that the company has (and which are best understood by actuaries).
- One has to balance risk and return, with matching liabilities well, all within the company's risk appetite.
- Things to think about are duration, volatility, liquidity, correlation/diversification (with other assets, and between assets and liabilities).

Asset classes

Here are typical asset classes:

- Cash
- Fixed interest (bonds) and inflation indexed
- Equities
- Property
- Derivatives

Asset allocation

Strategic:

- defined by the board, at a high level
- thought as an average to achieve in the long term
- an intention
- communicates a risk appetite

Tactical:

- implemented by the fund manager
- an actual allocation
- can change any minute
- can differ from the strategic allocation, as long as it reverts back to it in the long run, and is true to its spirit

2 Wealth Management

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Cash flow timing matters

- Investment policy determines the proportion of the total funds invested in the different asset classes such as shares, property, fixed interest and cash
- Investment policy also specifies the maturity term of any fixed interest investments and the currency of any investments
- Actuaries are concerned with the **matching** of asset cash flows and the liability expected cash flows
- Mismatching can cause insolvency or adverse profit results
- This has been a major problem with guarantees in life insurance products.

Possible solutions

- **Matching investment strategy** - when the cash flows on the assets from maturing investments and investment income is determined so that they occur at the same time and for the same amount as the expected future claims and expenses less premiums.
- **Immunization** - matching averages (e.g. duration) rather than actual cashflows, and in theory investments are selected so that the change in the value of the assets for a small change of interest rates will equal the change in the value of the policy liabilities for the same small change in interest rates.