What can the history of actuarial thought teach us?
Some historical periods share similar key features to today.

A study of the historical reaction to those circumstances and their consequences can be illuminating.
Background on actuarial thought and practice in investment / ALM in mid-19\textsuperscript{th} century

- Long-term interest rates fell for several decades after end of Napoleonic Wars
  - Challenging to earn with-profit premium rate of 3%

- Mid-19\textsuperscript{th} century life office asset allocation ~ 50% gilts / 50% mortgages
British Life Office Asset Allocation in 1890s

An Appetite for Illiquid Assets

• British life offices invested substantially in non-exchange traded, illiquid asset classes in the late 19th century

• This tendency peaked in the 1890s, when the average British life office allocated 80% of assets to non-exchange traded asset classes:
  ▪ 52% mortgages;
  ▪ 6% property;
  ▪ 22% loans.

• The remainder was mainly held in cash and government bonds (colonial as well as gilts)
Bailey and Illiquid Asset Investing (1862)

• British actuarial thought in mid-19th century life assurance was predominantly focused on mortality modelling and with-profit reserving methods

• A few papers were published on investment strategy; most notable was A.H. Bailey’s 1862 paper (Bailey was Institute President 1878-1882)

• Bailey on life assurers’ uniquely illiquid form of long-term liabilities:

  “The probable amount of demands on their [life assurers’] resources can be calculated from time to time within not very wide limits.

  Unlike banks…they are not exposed to sudden or unusual demands on their resources in times of panic.”

• Bailey on the presence of an asset illiquidity premium:

  “The much larger proportion [of life office assets] may safely be invested in securities that are not readily convertible; and it is desirable…that it should be so invested, because such securities, being unsuited for private individuals and trustees, command a higher rate of interest in consequence”
The Major Rotation from Illiquid to Liquid Assets in early 20th century

• By 1920, the average British life office allocation to illiquid assets had fallen to less than 40%
  ▪ Mortgage investments reduced from 52% to 15% between 1890 and 1920

• Why this great rotation from illiquid to liquid assets?
  ▪ Falls in agricultural land values (mortgages mainly written on farms)
  ▪ Increase in lapse rates and recognition that liabilities were not as illiquid as previously assumed
  ▪ Patriotic buying of government bonds during First World War

• This trend continued through the 20th century; post-second World War II life office asset allocation changes dominated by increasing allocations to equities
Many of the big questions and ideas have been around for a long time.

Early thinking can be as insightful as the more recent.
Some examples worth examining

- Asset illiquidity premium – Bailey (1862) (see above)

- Dynamic portfolio insurance / guarantee replication strategy – Anderson & Binns (1957)

  “Suppose $k$ is the maximum depreciation on present market values which is envisaged. Estimate the value of a function we shall call the remainder, $R$, i.e. the excess of the total assets at market value over the liabilities on a gross premium basis…It can then be argued that $R / k$ can safely be invested in equities provided the balance of the fund is reasonably matched.’

- Rationale for advance funding of pension liabilities – Discussion, Manly (1911);
- …and the related topic of market-consistent valuation of pension liabilities, Discussion, Epps (1921)
The most important new ideas can initially be controversial and can take time to gain professional acceptance.
Risk theory and British actuaries prior to 1980

• ‘Risk theory’ was first developed and applied to general insurance reserving
  • Stochastic modelling of the incidence of general insurance claims in order to assess evolution of reserves and probabilities of ruin
  • Mainly developed by Scandinavian actuaries, most notably in 1950s

• Generally found distasteful by British actuaries of the time, e.g. Ryder (1976):

  “Risk theory is a rather esoteric branch of actuarial theory which has been extensively developed by the more theoretical continental actuarial tradition.

  The practical actuary, however, finds that he hardly ever uses this theory.”

• British life business continued to run on net premium valuations with asset yield discount rates and assets valued at lower of market value and book value
  ▪ Non-diversifiable nature of financial market risk was not explicitly addressed anywhere in British actuarial reserving framework of 1950s - 1970s
Benjamin (1971 / 1976): Approach

• Sidney Benjamin was the first to develop quantitative results for a risk theory approach to long-term financial guarantees in life business

• His approach:
  • Capital requirement defined as a tail percentile of the discounted present value of maturity guarantee shortfall (net of invested premiums charged for guarantee)
  • Probability distribution generated by independently sampling from the annual equity returns generated over the 51 years from 1919 to 1970
  • Assumed a 2% probability of ruin, generated 50 simulation paths and used the one that produced the greatest reserve

• Methodologically, rather quick and dirty
Benjamin (1971 / 1976): Results and Reaction

- Results implied that a ten-year money-back guarantee on a unit-linked equity fund required a starting capital requirement of c. 30% of the guarantee

> “Reserves…are unexpectedly high.
The contract is probably not a commercial proposition.”

- Results presented at Institute sessional meeting in 1971

- Meeting had to be converted by President into a ‘private discussion’ so as to avoid the debate being minuted
  - “By far the stormiest (sessional meeting) I have ever attended.”
    - P. Smith in Corby (1977)

- Results eventually published five years later after presentation at International Congress of Actuaries in Tokyo
Research and Policy Reaction

• The publication of Benjamin’s work at the ICA prompted a flurry of research on the topic:
  • Scott (1977)
  • Wilkie (1977)
  • Corby (1977)

• And, in 1980, the Maturity Guarantee Working Party published its report, materially agreeing with Benjamin’s 1971 results and using a probabilistic risk-of-ruin modelling approach

• Results implied writing non-hedged long-term equity guarantees required large and uneconomical amounts of capital
References
References


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