

# Variability of mortality at different ages

*Sonny Loo and Allen Truslove examine the figures.*

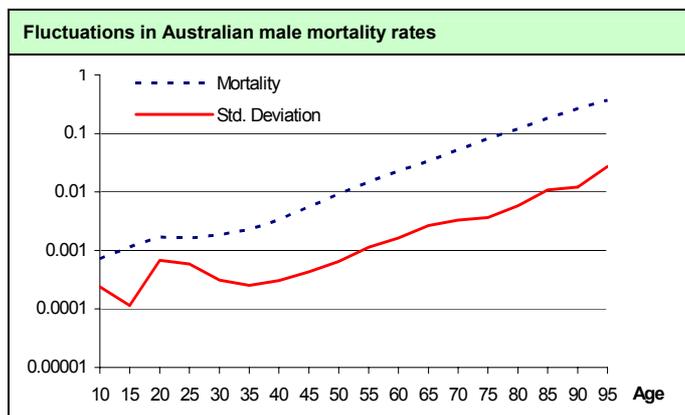
Customers buy insurance to avoid carrying the high variability inherent in the risk arising from high-value infrequently occurring events. Customers pay a margin over the average claim cost as the price of removal of the variability. How does mortality variability differ with age?

Diversifiable variance becomes less significant as portfolio size increases. Variance is then systemic, arising from fluctuations in mortality rates across the whole population due to harsh winters, disease epidemics, and so on.

To quantify systemic variation in mortality rates we have:

- used available Australian male mortality rates in quinquennial age groups for the period from 1886 to 1986;
- measured mortality variation relative to a trend line fitted to the mortality rates over time of each quinquennial age group to remove the effect of the downward trend in mortality rates;
- graphed mortality standard deviation (relative to the mortality trend) against age; and
- compared this with the mortality rate by age to consider whether a fixed percentage loading on the mortality rate is a suitable pricing method.

The results for male mortality rates and corresponding standard deviations (logarithmic scale) are shown in the graph.



The accident hump in mortality rates for the age range 15 to 35 is also present in the standard deviation, but in a much more pronounced form. Above age 30, the increase in the standard deviation with age is not as great as the increase in the mortality rate with age.

The conclusion is that the standard deviation is not a constant fraction of the mortality rate. Hence the common actuarial practice of providing for a mortality profit loading as a fixed fraction of the mortality rate does not price the fluctuation risk in accordance with modern finance theory. The results derived here allow us to properly price the mortality risk.

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