“Multipliers”

Factors to convert a series of future payments into a lump sum

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Value depends on

- Discount rate
- Payment frequency
- Mortality
- Deferral period
- End of payment period
- … (complications …)

A trivial example

- A one-off payment, made now
- Multiplier = 1 (!)

- Discount rate (ignore)
- Payment frequency = 1
- Mortality (ignore)
- Deferral period = 0
- End of payment period = 0
- … (complications …) none

- With no delay in payment, and no uncertainty, the whole value is retained

A first approximation

- Discount rate - ignore
- Payment frequency e.g. weekly
- Mortality - ignore
- Deferral period - none
- End of payment period e.g. a year
- Value of $1 per week for 52 weeks = 52
- With no discounting and no uncertainty, the multiplier is just the number of payments

Discounting

- Set by legislation e.g. 5% pa for Wrongs Act
- Assumed to allow for all effects : tax, inflation …
- (So we do not allow for inflation in calculations)

- Effectively, a net rate of return pa on money paid to the beneficiary
- Saves arguments about different financial elements
- E.g. roughly 8% return and 3% inflation

Accumulating at 5%

- \$100 grows to \$105 in one year's time
- Which grows to 105 * 1.05 = \$110.25 after another year
- Over n years : 100 * 1.05 * 1.05 … n times
- Or \$100 * 1.05^n after n years

e.g . n = 2 (2 years)

After 2 years, 1.05 * 1.05 = 1.05^2 = 1.1025

Discounting at 5%

- Discounting is the inverse of accumulating
- 90.7 * 1.05 * 1.05 = 90.7 * 1.1025 = 100

The value now of 100 in 2 years time =
100/1.05/1.05 = 100/1.05^2 = 100/1.1025 = 90.70

- [\$100/1.05^n] grows to [100/1.05^n] * 1.05^n
  = [100/~~1.05^n]~~ ~~* 1.05^n~~ = \$100 in n years
- So : \$100/1.05^n is the discounted value of \$100, for n years, at 5%

A series of payments: an example

- Discount rate 5% pa
- \$1 payable every 5 years, for 10 years
- = \$1 now + \$1 in 5 years + \$1 in 10 years
- Value = Value of 1 now

  + value of 1 discounted for 5 years

  + value of 1 discounted for 10 years
- = 1 + 1/1.05^5 + 1/1.05^10
- = 1 + 0.7835 + 0.6139 = 2.3974

Weekly multipliers

- Discount rate 5% pa, $1 payable for 3 years
- = $1 now + $1 in 1 week + $1 in 2 weeks …
- Value = Value of 1 now; + value of 1 discounted for 1 week + … = 145.6

See tables

Other frequencies

- Annual, 5 yearly etc are OK. Add deferred values; or Formula is (1 – v^(n*k)) / (1-v^n)

  Where i = 5%

  v = 1/(1+i)

  n is years between payments

  k is number of payments

- E.g. $30 each 5 years, for 30 years

  Number of payments = 30/5+1 = 7

  v = 1/1.05 = .9538

  v^n = v^5 = 0.9538^5 = 0.7835

  v ^ (n*k) = v^(5*7) = 0.9538^35 = 0.1813

  Value = (1 – 0.1813)/(1 – 0.7835) = 3.7820

Allow for delay (s)

- Discount rate - ignore
- Payment frequency e.g. weekly
- Mortality - ignore
- Deferral period - none
- End of payment period e.g. two years

- Value of $1 per week for 104 weeks = 104
- Which is the sum of $1 per week for a year, and $1 per week deferred 1 year

A general point on deferral

- Deferral will usually reduce the values

    (would you rather have $1 now; or $1 in 10 years time?)

- But a series of payments can in general be broken into subsets e.g. 1st year, 2nd year …
- The multiplier for the whole period may be thought of as the sum of its parts

    1 year (immediate)

  \+ 1 year (deferred 1 year)

  \+ 1 year (deferred 2 years) …

Weekly multipliers

- Discount rate 5% pa, $1 payable for 3 years
- Or: = value of $1 pw for a year;
  - \+ .. $1 pw for a year, deferred one year
  - \+ .. $1 pw for a year, deferred two years
- = 50.92 + 50.92/[1.05] + 50.92/[1.05^2]
- = 50.92*1 + 50.92*0.9524 + 50.92*0.9070 = 145.6

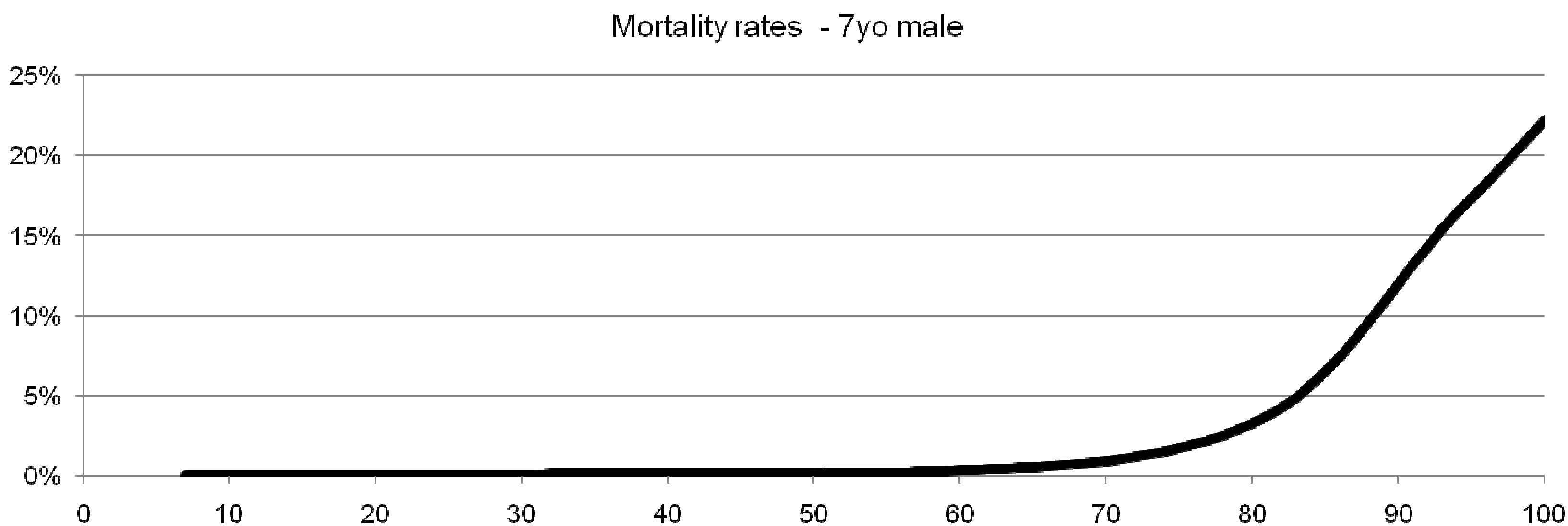
Life expectancies

- An average future lifetime
- E.g. a 10 year old, with a life expectancy of 70 has an expectation to live to age 80 (on average)

- Very small chance of early death, reasonable chance of living to at least age 60, small chance of reaching 100

Mortality rates

- Rates of death at a given age
- Used to calculated life expectancy
- No easy formula



Likelihood of death

- Low chance early
- Low chance very late, as most will have already died

Mortality

- Shorter life expectancies usually mean smaller values
- Which table?
  - ABS annual tables: easier to use, but do not allow for improvements
  - ABS projected .. (Zhang case): vary by future year, not just age

- We have been using only the ‘with improvement’ tables

Mortality

- Which approach?

Mortality rates

- precise, and more flexible
- Harder to use and understand
- Harder to calculate, and make adjustments to

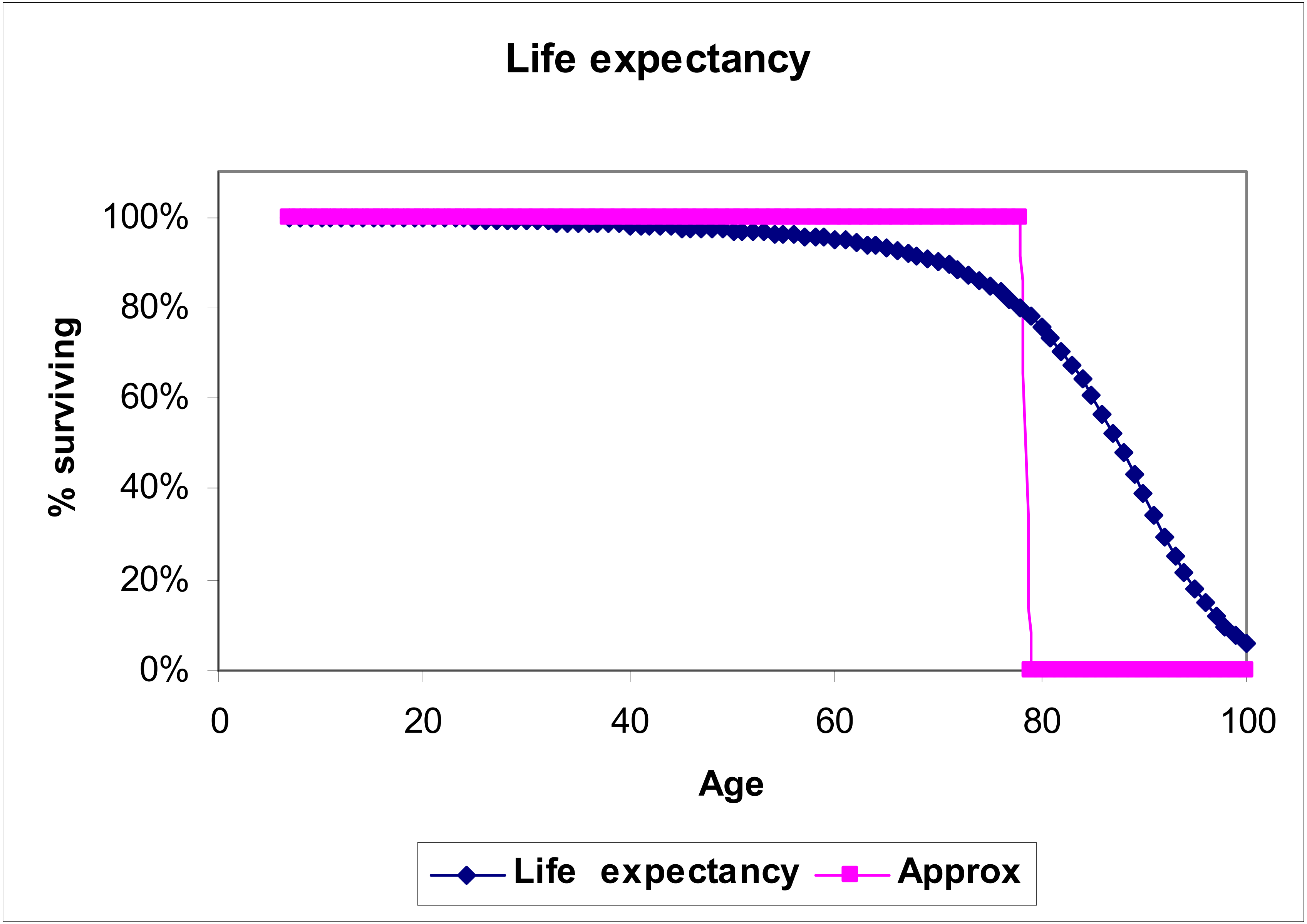
Life expectancies

- Some loss in precision, usually small
- Much easier to calculate and understand
- Enables deferral tables
- Easy to allow for different life expectancies

Mortality

- We have been using only the 'life expectancy' approach for about 18 months, and the factors in the law diary are on that basis.

- Assumes survival to assumed date of death, and no payments thereafter


Life expectancy
100%
80%
60%
40%
20%
0%
% surviving
0
20
40
60
80
100
Age
Life expectancy
Approx

Differences

7 year old male, 2007: Values of $1 pw

	Precise	Approx	Error
For life	**1035.9**	**1045.7**	**0.9%**
To age 70	**1011.0**	**1020.0**	**0.9%**
60	**982.0**	**988.9**	**0.7%**
50	**933.2**	**938.2**	**0.5%**
40	**852.6**	**855.7**	**0.4%**
30	**719.8**	**721.3**	**0.2%**
20	**502.0**	**502.3**	**0.1%**
10	**145.6**	**145.6**	**0.0%**

Complications

- Extreme cases e.g. payments that start beyond life expectancy
- Joint lives
- Payments with offsets e.g. annual repairs to a item purchased every 10 years

Practical issues

- Errors in calculation e.g. weekly payment * weeks <> payment pa
- Non-contiguous payments – does it matter?
  - Annually from now to 31/10/2010
  - Annually thereafter
- Lack of precision in dates e.g. paid every 5 years from 2020
- Range estimates e.g. $2000 to $3000
- Equating e.g. $50 each 10 years to $5 pa

Examples

Vicissitudes

- For any future payment?
- 15% often used for earnings loss
- No basis?
- What vicissitudes are to be considered?
- If mortality is the only one, and is already allowed for, there may be no need for more

Checking accuracy

- 5% = 1/20
- With $21, invested at 5%:
  - Pay a dollar
  - Leaves $20
  - Which one year later grows to 20*1.05 = 21
- So $21 pays $1 forever
- So the maximum multiplier pa must be less than 21
- Or 52.18*21 = 1096 for weekly cases

Checking accuracy (2)

An alternative method for some cases may be possible, and would provide a check.

e.g. A 5 year weekly payment, deferred 10 years might be calculated either

15 years of weekly payments, of value 555,

minus 10 years of weekly payments (412.9), equals 142.1

This is the same as a 5 year payment, value 231.5

times deferral factor for 10 years (0.6139) = 142.1

At the end

- The attendant care cost is usually by far the biggest cost. Is it reasonable?
  - Is the weekly value ($) OK?
  - Is the multiplier pa < 21? (5% case)

    Cost < 21 * cost pa
- For short durations of payment, multiplier pa is a bit less than the period of payment
- Are all the items included?
- No duplication? Alternatives allowed for correctly?

Addedum

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For an expense levied as 0.25% per annum, the cost of investment management might be estimated as

Term	Cost % of Award
30	2.9%
50	4.1%
70	4.7%