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Discount rates and life tables: *a review*

The use of discount rates and life tables is important in many cases where future economic loss is to be determined. This article looks at what they mean, the reasons they are used, and the impact of recent changes to statutory discount rates.[1]

DISCOUNT RATES

The discount rate relates to the rate of return that may be expected on money awarded in a lump sum settlement, and is expressed as a percentage per annum. A discount rate of 3% implies an expectation that the money, when invested, will achieve a return of 3% per annum.

Discount rates are used when assessing future economic loss. They are important in determining how much needs to be paid now in order to compensate for amounts that would have been received in the future.

For example, in the case of a 55-year-old injured worker who would have been eligible to receive a lump sum at age 65, quantifying this loss involves two steps: estimating the final payment which would have been received at age 65, and calculating how much should be awarded *now* to provide for this.

If the amount that would have been payable at age 65 is assumed to be $100,000, it is not correct to say that the current value of that loss is $100,000, because that sum can be invested, and would accumulate to be more than $100,000 over 10 years. The current value of the economic loss is the amount such that if it were invested, it would total $100,000 after accumulating with interest over 10 years. The discount rate is the rate of return that we assume on the current amount, in order to provide the $100,000.

Discount rates may allow for certain adjustments. For example, they may be quoted after allowance for tax, risk, and inflation.

Interest and Discounting

If we consider a bank account that earns 3% interest, then $74,411 invested now will accumulate in the following way:

Year	Balance at start of year (a)	Interest rate (b)	Interest (c)=(a)*(b)	Balance at end of year (d)=(a)+(c)
1	74,411	3%	2,232	76,643
2	76,643	3%	2,299	78,942
3	78,942	3%	2,368	81,310
4	81,310	3%	2,439	83,749
5	83,749	3%	2,512	86,261
6	86,261	3%	2,588	88,849
7	88,849	3%	2,665	91,514
8	91,514	3%	2,745	94,259
9	94,259	3%	2,828	97,087
10	97,087	3%	2,913	100,000

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Hence, $74,411 invested now accumulates with interest to $100,000 in 10 years time, where the interest rate is 3% per annum; and so this would be the value now of the $100,000 payment considered above. We could also say that $100,000 discounted at 3% for 10 years is worth $74,411. This example ignores any potential reduction in value arising from mortality or other vicissitudes.

Common Law and Statutory Rates

In 1981, the High Court in *Todorovic v Waller*[2] prescribed a discount rate of 3%. This has been largely over-ridden by state legislation. The following table shows our understanding of the discount rates that apply for new cases:

State	Work	Road	Medical Negligence	Public Liability
NSW	5%	5%	5%	5%
VIC	6%	6%	5%	5%
QLD	5%	5%	5%	5%
SA	NA	5%	5%	5%
WA	6%	6%	6%	6%
TAS	7%	7%	7%	7%
NT	NA	NA[a]	3%[b]	3%[b]
ACT	3%	3%	3%	3%

Notes: 'NA' indicates that common law economic loss claims are not allowed.

a. Our understanding is that common law rights are available to non-residents, and in that case a discount rate of 6% applies, as specified in the *Motor Accidents (Compensation) Act*.
b. Personal Injuries (Liabilities and Damages) Bill 2002 currently before the Legislative Assembly specifies a discount rate of 5%.

"Like discount rates, mortality rates are used in estimating the current value of a future payment."

LIFE TABLES

Life tables are published tables of data relating to the mortality of a population. They are published in Australia by the Australian Bureau of Statistics (ABS) each year, in 'Deaths' Cat. No. 3302.0, and by the Australian Government Actuary after each census.

The central data in life tables are mortality rates for the population. Mortality rates give some measure of the likelihood of death at each age, for males and females. For example, a life table might contain mortality rates as:

Age	Females	Males
10	0.01%	0.01%
20	0.04%	0.11%
30	0.05%	0.13%
40	0.09%	0.16%
50	0.20%	0.32%
60	0.51%	0.88%
70	1.37%	2.47%

This indicates that there is a 0.09% probability that a 40-year-old female would die during the year. In other words, at the time the table was published, about 9 per 10,000 40-year-old females would have died in a one-year period.

Like discount rates, mortality rates are used in estimating the current value of a future payment. The current value can also allow for the possibility that the claimant could die before the expected date of the future payment. Mortality rates are used to assess the probability of this.

Applying this principle to the earlier example of the 55-year-old, and using the mortality rates at each age between 55 and 65, it is possible to estimate the probability of survival to age 65. If, for example, it is assumed that a 55-year-old has a 10% chance of dying before age 65, we can reduce the estimate of current value to 90% of the amount otherwise calculated. So the current value to a 55-year-old of a $100,000 lump sum which would have been received at age 65, allowing for discounting and mortality, would be $66,970: 74,411 * 90% = 66,970.

Life Expectancies

Life tables will often contain various other data items in addition to mortality rates. Most commonly, the tables will also provide life expectancies. Life expectancies provide some measure of expectation for future years of life at each age, for males and females.

For example, the ABS publication 'Deaths', gives the following life expectancies:

Age	Females	Males
10	72.93	67.63
20	63.06	57.90
30	53.30	48.54
40	43.60	39.14
50	34.11	29.88
60	25.02	21.17
70	16.62	13.59

On this basis, a 40-year-old male may be expected to live for another 39.14 years.

These life expectancies are calculated on the basis of current mortality rates at each age. However, over the past 100 years mortality rates have significantly improved. Assuming that this trend continues, it is reasonable to expect that future mortality rates will be better than current mortality rates. The standard approach disregards possible future improvements in mortality, and in so doing seems to underestimate life expectancy.

An alternative method of assessing life expectancies is discussed in Cumpston and Sarjeant's 'Life expectancies and annuity values in 1998' published in the *Torts Law Journal*[3]. Under this approach, the mortality rates that are used to estimate life expectancy are projected mortality rates, which incorporate improvements in mortality.

The following table compares the current female life expectancy at various ages, on the standard approach, and allowing for future mortality improvements:

Age Now	ABS Life Tables 1999-01	Allowing for Future Improvements in Mortality
10	72.93	76.55
20	63.06	66.54
30	53.30	56.55
40	43.60	46.48
50	34.11	36.31
60	25.02	26.41
70	16.62	17.28

$1 PER WEEK MULTIPLIERS

Perhaps the most common use of discount rates and mortality rates by lawyers is in the $1 per week multipliers, and the published tables of such multipliers. Different states have adopted different positions in relation to these tables, with some such as New South Wales ignoring mortality, and others such as Victoria making allowance for mortality.

Multipliers are used in estimating the current value of a regular future expense or income. Multipliers can be prepared for any frequency of future payment, such as weekly, annually, or 10-yearly. The published tables are mostly available for weekly frequencies, and the discussion here is limited to weekly multipliers.

A 55-year-old male who has been injured may require weekly medical treatment for the next 10 years. This treatment is to cost $100 per week. If the discount rate and mortality were ignored, calculating the cost of this treatment would be a simple matter of multiplying the weekly expense by the number of weeks in the period. In 10 years there are 521.8 weeks (assuming 52.18 weeks per year), and so the cost would be estimated as: $100 * 521.8 = $52,180.

In order to allow for interest that may be earned on a lump sum, the multiplier 521.8 must be adjusted for the discount ▶

rate. The published tables provide these adjusted multipliers. The following multipliers are from Luntz (2002)[4].

The $1 per week multiplier for 10 years, at 3% discount rate, making no allowance for mortality, is 452.[5] Multiplying this by the weekly amount, the current value of this regular future medical treatment is estimated as: $100 * 452 = $45,200.

Further tables are available which also make allowance for mortality. Because mortality rates are different for males and females, the tables are available by sex. The $1 per week multiplier for a 55-year-old male to age 65 at a 3% discount rate is 435.5.[6] So, allowing for discounting and mortality, the current value of future medical treatment is estimated as: $100 * 435.5 = $43,550.

Deferral

If payments are to be made weekly, but with some period of deferral before the first payment, the same principles apply.

For example, it could be assumed that a 30-year-old female who has been injured will be able to continue working for some time without loss, and then retire prematurely because of injuries she has sustained. A $1 per week multiplier can be used for the 'deferred' period from the age of early retirement to age 65.

The following table illustrates $1 per week multipliers for deferred periods, at a 3% discount rate. These multipliers allow for the discount rate, but not mortality, in the deferred period. The deferred $1 per week multipliers for a 30-year-old, from the assumed retirement ages to age 65, are:

n Years	$1 per Week for Period	Assumed Retirement Age	Deferred $1pw Factor to Age 65
5	243	35	895
10	452	40	686
15	632	45	506
20	788	50	350
25	922	55	216
30	1038	60	100
35	1138	65	0

The left hand side of the above table contains the $1 per week multipliers for a regular payment for n years.[7] The right hand side is calculated on the basis of these factors; assuming a current age of 30, deferred to the assumed age of retirement, and payments thereafter to age 65. The deferred multiplier for a female currently aged 30, from age 55 to 65 is:

$1pw factor for 35 years, from age 30 to 65	(a)	1138
$1pw factor for 25 years, from age 30 to 55	(b)	922
$1pw factor for the deferred period from age 55 to 65	**(c)=(a)-(b)**	**216**

Loss in the period from age 55 to 65 can then be calculated using the deferred multiplier. Assuming earnings of $500 net per week: 500 * 216 = $108,000.

Tables of deferred multipliers for a population could be made, but would be voluminous, as they would have to consider the various possible deferral periods, as well as current age, the age at which payments would cease, the discount rate and sex where allowing for mortality. It is more common to prepare deferral multipliers on a case by case basis.

IMPAIRED LIVES

Most calculations of loss are based on the standard life tables published by the ABS, if mortality is to be considered at all.

In some cases, following injury, the plaintiff will be known to have substandard expectation of life, and adjustments may be required.

Two cases are common. If the additional mortality is expressed as an additional loading to the mortality rates, for example, if mortality will be 50% higher at each age than normal, it is straightforward to adjust the mortality table. In the more usual case, where opinions are expressed as to what the life expectancy now is, it is common to just use that period for future payment, and then to ignore mortality.

This latter case consistently overstates the valuation. A better approach is to adjust the mortality table until the required life expectancy is achieved; that modified table is then used in the calculations.

VICISSITUDES

Contingencies other than death, for example, disability and unemployment, are not usually allowed for in the standard life tables. A commonly used deduction for such vicissitudes is 15%, however we have seen no justification for this figure. We have suggested a more valid approach in our article 'Deductions for vicissitudes when estimating the value of future earnings'.[8] On this approach, the appropriate deduction for vicissitudes for any individual depends on factors such as age, sex, and occupation. This article is available at www.cumsar.com.au.

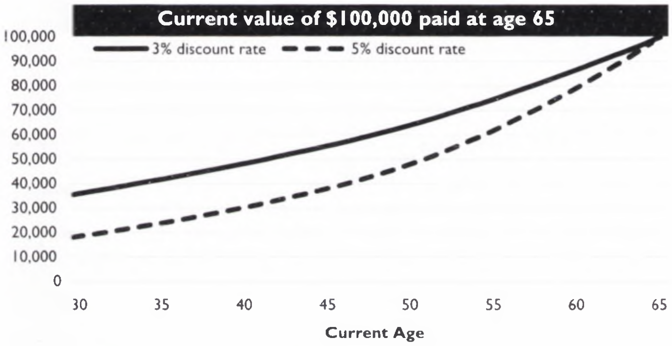
IMPACT OF A CHANGE IN DISCOUNT RATE

Recent changes in several states, as detailed in the December 2002 issue of *Plaintiff*[9], have seen an increase in the statutory discount rate. For example, in Victoria, the *Wrongs and Other Acts (Public Liability Insurance Reform) Act* 2002 increases the discount rate from 3% to 5% for medical negligence cases. In New South Wales, a statutory discount rate of 5% applies to all medical negligence cases commenced after 1 July 2001. Similarly, in New South Wales the *Civil Liability Act* 2002 increases the discount rate from 3% to 5% for public liability cases commenced on and after 20 March 2002. Common law claims arising from work accidents in Victoria are not possible for accidents arising between 12 November 1997 and

19 October 1999. A discount rate of 3% applies for accidents before 12 November 1997, and 6% for accidents on and after 20 October 1999.

All other things being equal, the higher the discount rate, the lower the current value of future loss. An increase in the discount rate thus reduces the current value of future loss. This is because with a higher discount rate, a greater rate of return is expected. The more that is expected in interest, the less that is required as an initial payment in order to compensate for a future loss.

The following graph shows the current value of a $100,000 lump sum paid at age 65, by current age, using 3% and 5% discount rates.



The current value of future loss is significantly lower when using a 5% discount rate than it is when using a 3% discount rate. Further, the effect of a higher discount rate is more significant where the period of discounting is longer; in the above example, at the lower ages. This is because there is a longer period over which to accumulate interest. PL

ENDNOTES:

1. No consideration is given to any logic there might be in having damages evaluated at different discount rates in different states of Australia.
2. [1981] 150 CLR 402.
3. JR Cumpston & HB Sarjeant 'Life expectancies and annuity values in 1998', *Torts Law Journal*, vol 6, May 1998, pp. 85-97.
4. H Luntz, (2002), 'Assessment of Damages For Personal Injury and Death', 4th ed., Butterworths, Sydney.
5. Ibid, Table 2, p. 683.
6. Ibid, Table 3A, p. 686.
7. Ibid, Table 2, p. 683.
8. JR Cumpston & HB Sarjeant, 'Deductions for vicissitudes when estimating the value of future earnings', *Plaintiff*, Issue 43, February 2001.
9. *Plaintiff*, Issue 54, December 2002.