

THE CHOICE OF DISCOUNT RATE IN THE ASSESSMENT OF DAMAGES

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[At common law damages are assessed once and for all as a lump sum. Future loss therefore has to be converted to its value at the date of judgment. Since the plaintiff can invest the lump sum and earn interest on it, the courts for many years assumed that the future loss had to be discounted by the rate available to the plaintiff on a secure investment. The effects of high inflation in the 1970s and high taxation on the nominal returns from investment caused courts to reconsider the discount rates which they had traditionally adopted. The High Court of Australia faced up to the question for the first time in *Pennant Hills Restaurants Pty Ltd v. Barrell Insurances Pty Ltd*, but the Court was divided on the solution to be adopted.

At this stage, an economist at the Australian National University, Mr E. Sieper, prepared a paper on the matter. Although it has gained some circulation among economists, the paper has never been published. Despite subsequent developments in the law, some of which are outlined in the next paragraph, the editors have thought it worthwhile to publish the paper now in its original form, with changes only to match the stylistic requirements of the Review.

Shortly after the preparation of the original paper, the High Court decided *Todorovic v. Waller* (1981) 150 C.L.R. 402. Once again the members were divided. However, five of them were prepared to compromise. The Court adopted the unusual procedure of issuing a statement as to the effect of its decision. The statement read:

In an action for damages for personal injuries, evidence as to the likely course of inflation, or of possible future changes in rates of wages or of prices, is inadmissible. Where there has been a loss of earning capacity which is likely to lead to financial loss in the future, or where the plaintiff's injuries will make it necessary to expend in the future money to provide medical or other services, or goods necessary for the plaintiff's health or comfort, the present value of the future loss ought to be quantified by adopting a discount rate of 3 per cent in all cases, subject, of course, to any relevant statutory provisions. This rate is intended to make the appropriate allowance for inflation, for future changes in rates of wages generally or of prices, and for tax (either actual or notional) upon income from investment of the sum awarded. No further allowance should be made for these matters.

Meanwhile, the Queensland legislature has enacted a statute which provided for a discount rate to be prescribed and, in the absence of such prescription, for a discount rate of 5 per cent to be adopted. Other legislatures, after *Todorovic*, also passed legislation, dealing with damages in certain classes of case or more generally, and prescribing differing discount rates. Details of these statutes may be found in *H. Luntz, Assessment of Damages for Personal Injury and Death* (3rd ed. 1990) paras [7.4.10-11].

Although in *Todorovic* it contemplated that its ruling would prevail, in the absence of statutory modification, only so long as economic conditions remained unchanged, the High Court has so far refused to review the rate of 3 per cent there laid down, reaffirming in 1987 that it had prescribed a rule of practice and not merely made a decision of fact: *Commonwealth v. Blackwell* (1987) 163 C.L.R. 428. Should it undertake such a review in the future, the paper by Mr Sieper — possibly with some modifications to allow for changes such as the introduction of a general, inflation-adjusted capital gains tax — will provide it with a strong theoretical foundation. Legislatures not motivated by purely political considerations in order to keep premiums down would benefit by taking the matters here dealt with into account when prescribing the discount rates to be adopted.]

INTRODUCTION

In establishing damages awards for personal injury the courts apply the principle of *restitutio in integrum*, aiming to restore the position of the plaintiff in so far as it is possible to do so 'by means of money'. Since the courts are only

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able to provide restitution in the form of a lump sum award, made once and for all at the conclusion of the trial, they must necessarily convert the estimated future damage suffered by the plaintiff into an equivalent present value.

While the manner in which this conversion is to be effected is explicitly considered below only for the case of lost future earnings, the general approach is applicable to compensation for other heads of damage such as future medical expenditure, pecuniary loss suffered by dependants in actions brought under the Fatal Accidents Acts and, in principle if not in practice, also to the calculation of damages for non-pecuniary loss.

In the case of lost future earnings the normal procedure is for the court to establish the plaintiff's rate of earnings at the time of the injury and to estimate what this would have been had the plaintiff remained similarly employed at the date of the trial. This rate of potential earnings at the time of the trial net of the plaintiff's present earnings capacity then forms the basis for the estimation of the rate of future earnings loss over the remainder of his or her normal working life. In following this procedure the courts clearly depart from the principle of strict nominalism to the extent of calculating future loss in terms of nominal earnings at the date of judgment rather than at the date of the tort.

Future loss earnings so estimated are then subject to an adjustment for 'contingencies' which typically operates to reduce the rate of earnings loss and which establishes what we shall term the 'agreed stream' of future lost earnings. This 'agreed stream' is then capitalized at some rate of discount, chosen by the court, to arrive at the present value of future loss which forms the basis of the damages award.

The discussion below focuses on the conceptual basis of the steps involved in this procedure of arriving at lump sum awards of damages for future earnings loss, paying special attention to the principles involved in the choice of discount rate. Interest in this question has been heightened by the recent High Court decision in *Pennant Hills Restaurants Pty Ltd v. Barrell Insurances Pty Ltd*¹ in which the majority of the Court adopted rates of discount (of either 0 per cent or 2 per cent p.a.) which were significantly lower than the previous rate of 5 per cent p.a. conventionally assumed by the High Court and far lower than the rates of 8-9 per cent until recently employed in some State jurisdictions.

Such variations in the rate of discount, while exercising little influence on the present value of losses proximate, in time, to the trial have an enormous effect on the present value of remote future losses. Thus while the present value of an annual rate of loss of \$20,000 occurring over the next year is only raised from \$19,221 to \$19,801 by the switch from an 8 per cent p.a. to a 2 per cent p.a. discount rate, the present value of such an annual loss occurring in thirty years time is increased from \$1,744 to \$10,867 by such a change and is, of course, further raised to \$20,000 by the adoption of a zero discount rate. The discount rate chosen by the courts will therefore be a very significant determinant of the size of the damages awarded to plaintiffs permanently injured early in their working lives.

¹ (1981) 145 C.L.R. 625.

1. THE NEXUS BETWEEN THE CONTINGENCY ADJUSTMENT AND THE ADOPTION OF A RISK-FREE RATE OF DISCOUNT

There is considerable evidence that in capitalizing the agreed stream of future lost earnings to arrive at a lump sum award, the courts attempt to employ a risk-free discount rate. Such evidence is provided by the fact that the courts have typically been guided by the interest rates available on bonds, which represent contractual obligations for the payment of interest and the repayment of principal, rather than rates of return on, for example, shares, which make no such promises. Moreover Australian courts have typically had regard to interest rates available on Australian government bonds² which, unlike commercial paper, are virtually free of risk of default. This section of the paper examines the rationale for the use of a risk-free discount rate. In particular we consider the theoretically appropriate form of the 'adjustment for contingencies' employed by the courts in arriving at the agreed stream of foregone earnings and its relationship to the practice of discounting at a risk-free rate of interest.

The courts are faced with the problem that the stream of foregone future earnings is inherently a risky one due to the operation of a multitude of contingencies which include the chance that the plaintiff's future earnings may have been truncated by his death or injury, diminished by sickness, accident, unemployment, technological change *etc.* or augmented by the plaintiff's promotion or by future increases in real wages. In the same way the stream of potential consumption which the lump-sum award will support when invested, or otherwise disposed of, according to the plaintiff's preferences, will in practice also be uncertain or risky.

In attempting to restore the position of the plaintiff the courts must in principle endeavour to find a lump-sum award which preserves the equivalence of these two risky streams from the viewpoint of the plaintiff. On my interpretation they do this by subjecting the risky stream of earnings foregone to an adjustment for 'contingencies' or the 'vicissitudes of life' which conceptually converts the uncertain stream of lost earnings to an equivalent sure, or certain, stream which it is then appropriate to capitalize at a risk-free rate of discount.

The adjustment for contingencies employed by the courts can be conceptualized in the following way. Initially the risky stream of lost earnings is reduced to its 'certainty equivalent', defined as the stream of sure earnings which the plaintiff would regard as equivalent to the risky stream foregone. Estimation of the certainty equivalent stream can be thought of as taking place in two stages. At the first stage the uncertain stream of lost earnings is replaced by its mathematical expectation. In principle this mathematical expectation is derived for any date by summing the product of the plaintiff's earnings under every contingency affecting those earnings and the probability of that contingency conditional upon the plaintiff's survival to that date, and then multiplying the resultant sum by the actuarial probability of his or her survival to that date. At the second step the

² Luntz, H., *Assessment of Damages* (1974) 207.

mathematical expectation of foregone earnings is subject to a downward adjustment for risk to arrive at the 'certainty equivalent' of the uncertain earnings foregone. The justification for this downward risk adjustment resides in the prevalence of risk aversion; that is in the observation that most individuals require compensation for the assumption of risk. In consequence most individuals would be willing to exchange an uncertain future receipt for a sure receipt of lower expected value. Since the 'certainty equivalent' stream of earnings is defined as the sure stream that the individual would accept as equivalent to the risky stream foregone it will lie below the expected value of that risky stream by an amount that is larger the riskier is the stream of lost earnings and the greater is the plaintiff's distaste for risk.

Having reduced the risky stream of lost earnings to its risk-free 'certainty equivalent', the court can proceed to capitalize this latter stream at a risk-free rate of discount. Were the plaintiff to receive an award equal to the present value of the 'certainty equivalent' stream, capitalized at a *market determined* risk-free rate of discount he or she could hypothetically invest the award at this rate of interest and thereby be able to recreate, by recourse to both interest and principal, the 'certainty equivalent' stream over time. Since the plaintiff is, by definition, indifferent between the correctly estimated 'certainty equivalent' stream and the risky stream of earnings actually foregone, it might appear at first sight that a lump sum award equal to the present value of the 'certainty equivalent' stream at a risk-free market rate of discount would accurately compensate the plaintiff for his or her loss. However, the fact that the plaintiff (unless an infant or under some mental disability) is left free to invest the verdict in accordance with his or her own preferences implies that a lump-sum award equal to the present value, at a risk-free rate of discount, of the 'certainty equivalent' of the plaintiff's lost earnings, would in general *overcompensate* him or her. This arises because there exist systematic, or non-diversifiable, risks on the nation's capital stock which someone must, of necessity, bear. As a result the trade-off between risk and return available in the market place must necessarily be such that all but (perhaps) the most risk averse investors will prefer a portfolio which offers a higher expected return, together with the assumption of some risk, to one which promises a risk-free rate of return. It follows that plaintiffs in receipt of lump-sum awards can be expected, in general, to prefer to adopt an investment strategy which exploits the available market trade-off between risk and return rather than confine themselves to investments which offer the risk-free rate of interest assumed in arriving at the verdict. Since the plaintiff is, by definition, indifferent between the actual stream of uncertain earnings foregone and its 'certainty equivalent' and since he or she will typically prefer a somewhat risky investment strategy to one that is totally risk free, it follows that the plaintiff would be overcompensated were he or she to receive the present value at a risk-free rate of discount of the 'certainty equivalent' stream. In consequence the award ought in principle to be reduced somewhat on this account or, alternatively, the downward adjustment of the mathematical expectation of his or her lost earnings ought to contain a second, conceptually separate, adjustment for risk.

On this analysis the use of a risk-free rate of discount in arriving at the compensatory present value of risky future loss is justified where the future loss has been subject to an adjustment for contingencies which comprises, first, the estimation of the mathematical expectation of the future loss at any date and second, two adjustments of that mathematical expectation for risk. The first of these risk adjustments will have the function of reducing the mathematical expectation of loss to its 'certainty equivalent' and the second will have the purpose of effecting a reduction in the award which just offsets the advantage that accrues to the plaintiff from being able to dispose of the award in a manner preferred to its investment at the risk-free rate employed in its calculation. The estimation of the mathematical expectation of future loss is in principle a relatively objective matter in the sense that it depends solely upon the circumstances of the plaintiff into which the courts can, and do, inquire. By contrast the theoretically correct magnitude of the two risk adjustments depends in part on the plaintiff's preferences, specifically on the plaintiff's attitudes to risk, which the court will find difficult, or impossible, to fathom. One might therefore expect to find that some conventional rate of adjustment for risk is adopted on this account; always recognizing that the size of the reduction in the mathematical expectation of loss required to produce its 'certainty equivalent' will depend on the riskiness of the stream of foregone earnings and will necessarily be smaller the more certain were the plaintiff's prospects.

It should be noted that the above rationalization of the 'contingency adjustment' differs significantly from others contained in the academic literature. For example Posner argues that the courts,

pay the victim a lump sum equal in value to the expected future stream of earnings³

and describes the latter as the mathematical expectation of the victim's lost future earnings. He then argues that the appropriate discount rate to be employed in finding the present value of this stream of earnings is 'the real riskless cost of capital'.⁴ Given that Posner recognizes the rule that awards of damages are to be compensatory,⁵ his analysis suffers from a neglect of the two downward adjustments for risk stressed above. Posner's implication that plaintiffs will be accurately compensated for their risky future loss at any date by the receipt of its expected value discounted at a risk-free rate of interest involves the unwarranted assumption that victims are risk neutral. Moreover, by failing to recognize the second adjustment for risk, Posner's argument fails to notice that a risk neutral plaintiff would be particularly heavily overcompensated by the receipt of the present value of his or her expected earnings loss at a risk-free rate of discount because, given his or her assumed indifference to risk, the plaintiff would be particularly advantaged by the opportunity to assume risk in exchange for higher expected return in the investment of the award.

By contrast Luntz appears to acknowledge the logical nexus between a

³ Posner, R. A., *Economic Analysis of Law* (1977) 144.

⁴ *Ibid.* 147.

⁵ *Ibid.* 143.

downward contingency adjustment for risk and the adoption of a risk-free discount rate when he writes,

It is true that a plaintiff is free to gamble away his lump sum . . . , but if he wishes to provide for his family and himself in the future he should be free to invest the money securely. The risk that, if the accident had not deprived him of his earning capacity, he might have been prevented in some other way from so providing, is taken into account when the lump sum is reduced for contingencies: to expose him to the risk of loss of the capital which seeks to replace the earning capacity is to penalize him twice over.⁶

However it is notable that when describing the nature of the contingency adjustment in detail Luntz refers only to the steps involved in the calculation of the mathematical expectation of loss and that he argues, on the basis of statistics on the frequency of contingencies affecting future earnings such as sickness, accidents, unemployment and strikes, that,

if these contingencies are to be given any weight at all . . . such weight should be very modest and a good deal less than the weight apparently given to them by the courts.⁷

Moreover Luntz's contention that the plaintiff should not be 'penalized' twice over is clearly inconsistent with the line of argument developed above, which contends that the contingency adjustment should, in principle, incorporate an allowance for the fact that individuals in receipt of a lump sum award will typically be advantaged by having the option of access to investments other than the risk-free ones hypothesized by the process of capitalization at a risk-free rate of discount.

In a similar vein the practice of making a substantial downward adjustment for contingencies has on occasion been the subject of judicial questioning. Thus Aickin J. has argued that,

To make as a matter of course an adjustment for unfavourable contingencies which may operate to reduce the estimate for the future rather than to advert to both favourable and unfavourable contingencies, is a departure from logic . . . With due respect to those who have thought otherwise it appears to me that there is no sound basis for supposing that there is always a preponderance of bad luck over good luck. No statistical material has been put forward in support of that proposition. Not all contingencies are adverse nor all vicissitudes, *i.e.* changes, for the worse.⁸

Mr Justice Aickin goes on to quote with approval the view of Windeyer J. that,

No just complaint can be made of the base figure so arrived at by his Honour. But he reduced it by a third, having regard to what he described as 'the usual deduction of one-third to one-quarter for contingencies'.⁹ This, of course, would be quite correct if he thought that the 'contingencies' that he foresaw for the appellant in the future justified such a reduction. But I find it hard to understand why there should be a convention that in all cases one is to take off a third for bad luck, or rather for the balance of future bad luck over future good luck.¹⁰

This line of reasoning might be justified if it were assumed (as it apparently is by both Posner and Luntz) that the sole purpose of the contingency adjustment is to estimate the mathematical expectation of loss. The mathematical expectation of future loss might clearly exceed the individual's rate of earnings at the time of the tort if those earnings had been unexpectedly low or where the individual's

⁶ Luntz, H., *op. cit.* 208.

⁷ *Ibid.* 180.

⁸ *Cullen v. Trappell* (1980) 146 C.L.R. 1, 33.

⁹ [1962] S.A.S.R. 117, 123.

¹⁰ *Teubner v. Humble* (1963) 108 C.L.R. 491, 508-9.

circumstances were such that his or her possible future earnings under favourable contingencies, when multiplied by their respective probabilities, exceeded the expected value of earnings under the adverse contingencies. In this restricted sense Aickin and Windeyer JJ. were right to query any presumption that bad luck must necessarily dominate good. On the other hand if the contingency adjustment is more broadly interpreted to encompass also the risk adjustments adverted to above, the presumption that it will normally operate to reduce, rather than inflate, the award, clearly re-emerges. Good luck operates symmetrically with bad in imparting variability, and thus risk, to the stream of earnings foregone. Since the necessity to balance the favourable against the unfavourable contingencies in estimating the expected value of future loss attests to the uncertainty of the stream of earnings foregone and since the courts would appear to be justified in assuming that the representative plaintiff is risk averse, they would also appear to be correct in ensuring that the contingency adjustment normally operates to reduce the size of the award.

2. *THE NEXUS BETWEEN THE RULE OF O'BRIEN v. McKEAN AND THE USE OF A REAL RATE OF DISCOUNT*

In Australia *O'Brien v. McKean*¹¹ is authoritative that the courts shall not incorporate any allowance for future money wage increases due to general inflation when assessing damages for loss of earnings. While that decision paralleled that in the United Kingdom case *Fletcher v. Autocar & Transporters Ltd*¹² the Australian courts have been slow to adopt the corollary to this position enunciated by Lord Diplock in *Mallet v. McMonagle*:

In estimating the amount of the annual dependency in the future, had the deceased not been killed, money should be treated as retaining its value at the date of the judgment, and in calculating the present value of annual payments which would have been received in future years, interest rates appropriate to times of stable currency such as 4 per cent to 5 per cent should be adopted.¹³

O'Brien v. McKean explicitly confirmed the courts' conventional practice of disregarding possible future changes in the purchasing power of money and consequently in the general level of nominal earnings, when defining the agreed stream of foregone earnings. This convention means that the stream of lost earnings, being defined in terms of dollars having the purchasing power of the date of the hearing is a 'real' stream. It follows that if the individual is to be properly compensated for his or her loss such a stream must be capitalized at a real rate of interest (strictly defined as the rate of return on a security whose future promised payments are defined in terms of present purchasing power *i.e.* whose promised nominal payments are linked to a broadly based index of the price level such as the Consumer Price Index).

When expected inflation is significant the interest rates on nominal government bonds (*i.e.* ones whose promised payments are defined in money terms) will provide a very poor guide to the appropriate real interest rate. For the courts

¹¹ (1968) 118 C.L.R. 540.

¹² [1968] 2 Q.B. 322 (C.A.).

¹³ [1970] A.C. 166, 176.

to use observed nominal interest rates to capitalize a real stream in such circumstances would be a gross error of logic which can result in significant undercompensation of victims. A simple example will illustrate this. Suppose that the agreed stream of lost earnings is \$100 per week over a ten year period, that inflation is confidently expected to occur at an annual rate of 10 per cent p.a. over this period and that the interest rate on nominal government bonds of all maturities to ten years is 12 per cent p.a. If the nominal interest rate of 12 per cent were used to capitalize the real stream of \$100 per week an award of approximately \$30,435 will result. When invested at 12 per cent and drawn down over the ten year period such an award will be capable of providing the agreed stream of \$100 per week. However, if expectations as to inflation are realized, the purchasing power of this \$100 per week will have fallen to about 0.6 of its original level after five years and to 0.38 of its original level at the end of the ten year period. Clearly proper compensation requires that the plaintiff receive a lump sum sufficiently large to enable him or her to generate, via recourse to the capital sum and the interest payments generated by the investment of the award at the assumed nominal interest rate of 12 per cent p.a., a ten year stream of dollars per week having the same purchasing power as possessed by \$100 per week at the date of the hearing. This will, on the present assumptions which abstract from the influence of taxation, require the stream of \$100 per week to be capitalized at an interest rate of 2 per cent p.a. yielding an award of \$47,060.

The difficulty that Australian courts have in the past had in absorbing this message is documented by Luntz,¹⁴ who notes that whereas the Commonwealth bond rate of about 3½ per cent was commonly used in the pre-war years, the discount rate employed gradually rose in the post-war period to rates of 6 per cent and higher. Indeed in recent years rates of 8 and 9 per cent have been employed by courts in Victoria and Queensland. The obverse error, producing overcompensation of victims, would result if the courts were to ignore the rule of *O'Brien v. McKean* and to inflate the stream of future lost earnings using some estimate of the expected rate of inflation and were then to discount this *nominal* stream at a very low, presumably real, rate of interest. This error was arguably committed by the Court of Appeal in the *Barrell* case¹⁵ when Yeldham, J., under reference from the Court, assumed a 10 per cent annual inflation rate in assessing the plaintiff's liability to the Workers' Compensation Fund and then discounted this assumed nominal stream at the conventional discount rate of 5 per cent.

By contrast, the recent *Barrell* judgment by the High Court, though not in respect of a personal damages case, was one in which the Court by a majority of six to one correctly affirmed both the essential logic of Lord Diplock's position and its relevance to the assessment of damages for lost earnings. Thus Gibbs J. argued that,

¹⁴ Luntz, H., *op. cit.* 207-8.

¹⁵ *Pennant Hills Restaurants Pty Ltd v. Barrell Insurances Pty Ltd* [1977] 2 N.S.W.L.R. 827 (C.A.); 7 September 1978 (Yeldham J., Common Law Division).

It is unreasonable to suppose that any economist will be able to predict with accuracy the nature and extent of changes in the purchasing power of money during a period extending for several decades ahead. Whether inflation increases or is brought under control depends upon political and economic events and decisions at home and abroad as to whose occurrence it is not possible to do more than conjecture. Predictions as to the economic future in thirty years time may perhaps be made by a soothsayer but expert evidence cannot rationally be given on such a subject . . . The only practicable course is, I think, that suggested by Lord Diplock in *Mallet v. McMonagle*: 'to leave out of account the risk of further inflation, on the one hand, and the high interest rates which reflect the fear of it and capital appreciation of property and equities which are the consequence of it, on the other hand'.¹⁶ His Lordship was there speaking of cases under the Fatal Accidents Acts, but in my opinion his remarks are applicable to the case of assessment of damages for personal injuries. In such a case, as well as in cases under the Fatal Accidents Acts, money should (except in exceptional cases) be treated as retaining its value, but in calculating the present value of payments which would have been received in future years, interest rates appropriate to times of stable currency should be adopted.¹⁷

Similarly Mason J. (Wilson J. concurring) observed that,

In substance the United Kingdom approach to the assessment of damages for personal injury is to ignore the element of inflation and to assume two of the characteristics of a stable economy, (a) a continuation of existing nominal wage rates, and (b) low interest rates appropriate to such an economy. It has been thought that by taking an approach which is adapted to the fiction that we have a stable economy the plaintiffs damages will be fairly assessed, it being for the plaintiff to counter the effects of inflation as best he can by pursuing a suitable investment policy. The use of a low interest rate in the selection of the multiplier excludes one of the principal characteristics of inflation, the prevalence of high rates of interest. The consequence of this is that, if inflation continues, the plaintiff will be able to invest his verdict at a higher rate of interest than that on which the verdict was based. Conversely if inflation does not continue, the verdict will have been calculated on an interest rate which will approximate the prevailing rate.

Because the high rates of interest are themselves a product of inflation, it would not be right to take them into account and thereby diminish the amount of the plaintiff's verdict. To a substantial extent they compensate the lender for the erosion of the value of his capital. Certainly they significantly exceed the real rate of interest.¹⁸

Moreover after considering various ways in which an appropriate real rate of interest might be gauged his Honour endorsed the United Kingdom method of adopting a rate 'reflective of a stable economy' but argued for two per cent on the ground that the four to five per cent rate advocated by Lord Diplock 'reflects an element of inflation for even in times of a stable economy inflation has proceeded at two to three per cent'.¹⁹ Stephen J. (Aickin J. agreeing) rejected what he described as 'the real interest rate approach'²⁰ but advocated an 'undiscounted approach' on the ground that,

The only reason for discounting for present payment is to offset the unintended advantage which a plaintiff gets from present payment, namely, the chance to earn income from its investment. But against that should be weighed the disadvantage he suffers by only being compensated at present rates of wages (or at present rates of outgoings) when his lost future wages (or future outgoings) would have proved much greater in money terms. If the advantage and disadvantage can be seen approximately to offset each other, neither need figure in the process of assessment and the occasion for discounting disappears.²¹

and this,

continuing, as I do, to ignore for the moment the impact of income tax upon investment income.²²

Lastly Murphy J., who had already in *Cullen v. Trappell* foreshadowed the present approach of the High Court in arguing,

¹⁶ [1970] A.C. 166, 176.

¹⁷ (1981) 145 C.L.R. 625, 639.

¹⁸ *Ibid.* 678.

¹⁹ *Ibid.* 680.

²⁰ *Ibid.* 652. See pp. 627-8 for a critical discussion of the basis of this rejection.

²¹ *Ibid.* 658.

²² *Ibid.*

The injustice is compounded when the notional wage loss is discounted by 6 per cent. That discount rate is a reflection of inflation. To ignore the probable effects of inflation on future earnings or expenses while taking it into account by adopting inflated interest rates when assessing the present value of those earnings or expenses is clearly an injustice to injured plaintiffs.²³

also supported the application of a zero discount rate. Specifically he reasoned that,

When dealing with money, and ignoring the possibility of turning it into non-monetary hedges against inflation, a justifiable approach is to adopt a discount figure which represents the difference between the inflation rate and the return upon a supposedly safe monetary investment, that is, bonds (gilt edged) or loans on mortgage. These are safe in the sense that the capital is safe although unsafe in the sense that the real value is susceptible to erosion by inflation. If inflation is running at 10 per cent and safe interest rates at 12 per cent, then the appropriate discount rate is 2 per cent; in times of what has been called 'stable currency', that is, when inflation is running at about 3 per cent, and interest rates at 5 to 6 per cent, the discount rate also logically should be about 2 to 3 per cent . . . The proper way to assess the present value of the amounts to be paid under the indexing machinery of the Workers' Compensation Act, is to ignore the effects of monetary inflation on increasing the payments and if any discount is applied, to adopt a rate, if there is one, which prevails as the difference between the rate of inflation and the return upon safe investment, which may be described as a 'constant' or 'real' interest. Otherwise, one is making an assessment in which monetary inflation, instead of being cancelled out, affects both the payments and the offsetting discount rate. But as Stephen J. shows, there is no 'constant' or 'real' interest. The variations above and below zero justify the adoption of a rough zero rate, in other words, no discount. The merits of such a convergent approach are simplicity and absence of wild fluctuations in times of sudden inflation or deflation.²⁴

Subsequently to the *Barrell* case a zero discount rate has been adopted by the Supreme Court of New South Wales (*Brazel v. Annis-Brown*²⁵ and *Todorovic & Anor. v. Waller*²⁶) while the Supreme Court of Victoria in *Barker and O'Sullivan v. Neilsen*²⁷ reduced the seven per cent discount rate employed by the trial judge to four per cent which rate was also adopted by the Supreme Court of the A.C.T. in *Dabrowski v. Oldfield*.²⁸

There can be little doubt that the *Barrell* case marks the acceptance by the High Court of the logic that, since the stream of foregone earnings must be defined without reference to possible future changes in the purchasing power of money, such a stream should not be discounted at nominal rates of interest that are themselves a reflection of anticipated inflation. The implications of this for the choice of discount rate are considered in the next section.

3. ALTERNATIVE APPROACHES TO THE CHOICE OF A RISK-FREE REAL RATE OF DISCOUNT

We have argued that if the 'agreed stream' to be capitalized is a risk-free real stream of foregone earnings it should be discounted at a risk-free real rate of discount and that that rate (or term structure of such rates) should be a market rate so that the plaintiff could potentially avail him or herself of the market opportunity to devise an investment strategy which would re-create the 'agreed stream'.

²³ (1980) 146 C.L.R. 1, 27.

²⁴ (1981) 145 C.L.R. 625, 684-5.

²⁵ [1981] 1 N.S.W.L.R. 85.

²⁶ [1981] 1 N.S.W.L.R. 97.

²⁷ 31 March 1981, unreported.

²⁸ April 1981 unreported.

From this perspective the difficulty faced by the courts in selecting an appropriate discount rate arises from the fact that in Australia, as in most other countries, the securities which would allow a market determined, risk-free real rate of interest to be observed directly do not presently exist. What would be required would be the existence, in a suitable range of maturities, of Government bonds ('Government' so that the *desideratum* that the bonds be default-free were met) for which both the nominal value of the interest coupons and of the principal at maturity were linked to a broadly-based index of the general price level such as the Consumer Price Index. Existing Government bonds have their interest coupons and principal at maturity denominated in nominal terms so that the interest rates (holding period yields) that they reveal are risk-free *nominal* interest rates. They fail therefore to reveal the desired risk-free real rate of interest for two reasons. First, the nominal interest rate on such bonds will differ from a real interest rate in that it will incorporate some allowance for expected inflation over the term to maturity of the bond. Second, the nominal government bond, while riskless in terms of its promised nominal payments (because of its negligible default risk), is risky in terms of the real (purchasing power adjusted) payments that it will provide.

Unable to observe risk-free real rates of interest directly, the courts would appear to have two alternatives. The first would be to approach established financial institutions and solicit quotations as to the capital sum at which they would sell an annuity defined in real terms and equal to the 'agreed stream' of foregone earnings. More concretely, the courts could admit evidence as to the sum that such institutions would require to induce them to provide such an index-linked annuity and make such evidence the basis of the award. Such a possible procedure was alluded to by Murphy J. in the *Barrell* case:

The problem is to assess the damage suffered by the plaintiff. The obvious way to assess the damage would be to ascertain the amount it would cost the plaintiff to relieve it of this liability. There is a large insurance industry in Australia. The defendant was an insurance broker and, no doubt, it would be possible to obtain expert evidence on what those in the industry would regard as an appropriate sum for the assumption of such a liability. This would include an element for the administrative expenses and the profits of an insurer who would undertake to assume such a liability, but, as I see it, these would properly be included. The computation of such liabilities is an every day task for those who are concerned with the transfer of such liabilities on purchase or merger of insurance businesses. However, no attempt was made by the plaintiff or the defendant to adduce such evidence.²⁹

The approach suggested by Mr Justice Murphy has the obvious merit that, by establishing the purchase price of an appropriate real life-annuity and making this the basis of the award, the courts could simultaneously dispense with the need to perform their own actuarial calculations based on the victim's pre-accident survival probabilities and with the need to enquire into the appropriate real rate of discount.³⁰ The function of the court under these circumstances would be limited

²⁹ (1981) 145 C.L.R. 625, 683.

³⁰ The *Barrell* case was unusual in that the defendant's negligence lay in his failure, as an insurance broker, to secure the insurance of the subsequently injured employee. Since the plaintiff employer thereby became liable to reimburse the Workers' Compensation Fund for the periodical payments from the Fund to which the employee became entitled, the award, and thus the life-annuity suggested by Mr Justice Murphy, should in this case have been based on the *post-accident* survival probabilities of the injured employee. In personal damages cases it will be the *pre-accident* survival

to that of establishing the correct rate of the annuity in the light of those contingencies, other than death, affecting the plaintiff's lost future earnings and of the risk adjustments discussed above. It remains to be seen whether the parties to some future action take up Mr Justice Murphy's suggestion. Unfortunately the very absence of an established market in *real* bonds or annuities suggests that evidence of this type would, at best, be widely divergent and thus highly inconclusive, or that, at worst, no firm quotations would be forthcoming. Indeed it is difficult to see how, in the absence of an active market, the courts could satisfy themselves that any proffered quotations were in fact firm.

The second alternative is to attempt to infer the unobservable risk-free real rate of interest from the nominal interest rates that are, or have been, thrown up by the market. In his *Barrell* judgment Mason J. identified three methods by which such a process of inference might proceed:

- (a) the application of a discount rate which reflects the difference between the long-term investment rate and the predicted inflation rate, the difference throwing up the real rate of interest . . . and (b) the suggested application of such a discount rate as represents the steady difference between the nominal interests rate and the inflation rate as established by research based on past experience³¹

and subsequently added the United Kingdom option of selecting a discount rate based on rates of interest appropriate to a stable economy.³²

The ensuing discussion of these three options will be based on the simplifying assumption that the influence of taxation can be wholly neglected. In actual fact the operation of the tax system is relevant to the choice of discount rate in two distinct ways. The first arises simply out of the fact that the courts are required, in determining the size of the award, to have regard to the fact that the plaintiff will be liable for tax on the income that could notionally be produced by the award. A second, and more fundamental, consideration is that the operation of the tax system can be argued to so influence market outcomes as to complicate considerably the choice of discount rate, and this even in situations where the liability for tax of plaintiffs themselves could be neglected. In this section of the paper we provisionally set these difficulties to one side by examining how the choice of discount rate might logically proceed in a *tax-free world*. This discussion will provide a benchmark against which the complications introduced by taxation can then be assessed.

The first of the procedures alluded to by Justice Mason is based on the observation that the expected real rate of interest (on a short term nominal bond) is approximately given by $r = i - \pi$ where r is the expected real rate of return, i is the observed nominal rate of interest on the bond and π is the expected rate of inflation over the term of the bond.³³ From the term structure of nominal interest

probabilities that are relevant. This distinction represents a potentially significant difference between lump-sum awards of damages for lost earnings, ideally based on the victim's pre-accident survival probabilities (*Skelton v. Collins*, (1966) 115 C.L.R. 94), and compensation under statutory schemes that provide for periodical payments which are necessarily contingent on the (possibly much lower) post-accident survival prospects of the victim.

³¹ (1981) 145 C.L.R. 625, 674-5.

³² *Ibid.* 678.

³³ This relationship may be derived as detailed in Appendix A.

rates the courts could then infer the implicit term structure of expected real rates of interest if they had evidence on the term structure of the expected rate of inflation. While the courts have on occasion accepted 'expert' evidence on the likely course of future inflation (for example Yeldham J. under reference from the Supreme Court of New South Wales in the matter of *Pennant Hills Restaurants v. Barrell Insurances*) there has been considerable judicial reluctance to place much credence on such evidence particularly when tendered with respect to inflation rates in the distant future.³⁴ Moreover the fact that evidence on the term structure of inflationary expectations, rather than on some average rate over the period encompassed by the verdict, is what is required was noted both by Gibbs J. and Stephen J. in the *Barrell* case.³⁵ From an arithmetical standpoint the attempt to infer the term structure of real interest rates from observed nominal rates and 'expert' evidence on the term structure of inflationary expectations and then to use these resulting real rates to discount a real stream of future loss is fully equivalent to using such 'expert' evidence to inflate the stream of lost earnings and to discount this nominal stream of earnings at observed nominal interest rates. In consequence this approach would seem to violate the spirit, if not the letter, of the rule of *O'Brien v. McKean*.

The second approach suggested by Mason J. might proceed on the following basis. Since the expected real rate of interest is by definition equal to the observed nominal rate minus the expected rate of inflation one might attempt to infer the former by assuming, first, that the expected real rate of interest is constant and, second, that inflationary expectations, as reflected in nominal interest rates, are formed efficiently and are therefore correct on average (*i.e.* that the expected rate of inflation is equal to the actual realized rate plus an error term distributed with a zero mean). On these assumptions one could attempt to deduce the expected real rate of interest by averaging the realized real rate of interest over a run of observations or, more sophisticatedly, by regressing the realized rate of inflation on the nominal interest rate and interpreting the real rate of interest as the negative of the constant term of the resulting regression equation. This approach assumes that changes in the expected rate of inflation are fully reflected in observed nominal interest rates which adjust so as to hold constant an underlying expected real rate of interest; a line of reasoning associated with the economist Irving Fisher.³⁶

One difficulty with this approach arises out of the consideration that economic theory fails to suggest either that the expected real rate of interest should be anticipated to be strictly constant over time or even that it should be uncorrelated with the expected rate of inflation.³⁷ However, in the present context, the

³⁴ Cf. the comment of Gibbs J. in the *Barrell* case: 'Predictions as to the economic future in thirty years time may perhaps be made by a soothsayer but expert evidence cannot rationally be given on such a subject' ((1981) 145 C.L.R. 625, 639).

³⁵ (1981) 145 C.L.R. 625, 641 (Gibbs J.); *ibid.* 656-7 (Stephen J.).

³⁶ Fisher, I., *The Theory of Interest, As Determined by Impatience to Spend Income and Opportunity to Invest It* (1930).

³⁷ Economic theory draws attention to at least two reasons why, even in the absence of taxation, the expected real rate of interest might not be invariant with respect to the expected rate of inflation. The first arises because a rise in the expected rate of inflation will lower (make more negative) the

approach draws strength from the presumption that variations in the expected real rate of interest are likely to be small relative to variations in the expected rate of inflation and in nominal interest rates, and from the consideration that variations in the expected real rate of interest will be the outcome of a multitude of causes whose magnitude and influence is likely to be beyond the power of the courts to predict. Moreover the adoption by the courts of a 'conventional' estimate of the real rate of interest would at least serve to avoid the gross error of logic that arises when awards based on the rule of *O'Brien v. McKean* are capitalized at the high nominal interest rates that the above reasoning suggests are themselves the outcome of anticipated inflation. In short the adoption of a conventional estimate of the expected real rate of interest can be justified (tax considerations aside) as a pragmatic response by the courts to the problems created for the logic of the process of damages assessment by the fact that the required risk-free real rate of return is not directly observable.

In his judgment in the *Barrell* case Stephen J. described what he termed the 'real interest rate approach' as follows:

It rests upon the assumption that interest rates have two principal components: the market's own estimation of likely rates of inflation during the term of a particular fixed interest investment, and a 'real interest' component, being the rate of return which, in the absence of all inflation, a lender will demand and a borrower will be prepared to pay for the use of borrowed funds. It also relies upon the alleged economic fact that this 'real interest' rate, of about 2 per cent, will always be much the same and that fluctuations in nominal interest rates are due to the other main component of interest rates, the inflationary expectation.³⁸

and continued,

However founded as it is upon the assumed existence of a relatively constant rate of 'real interest', if that assumption be shown to be false, the method loses the rationale upon which it depends. Past Australian economic experience appears to provide little support for the concept of a relatively constant rate of 'real interest'. Year by year a figure for 'real interest' can of course be calculated, simply by subtracting from nominal interest rates the rate of inflation. But these figures are no more than a series of numbers bearing no resemblance to any relatively constant rate of interest which lenders are supposed to demand and borrowers to pay after allowing for estimated inflation.³⁹

expected real rate of return on money balances, whose nominal rate of return may be taken to be fixed at zero. In so doing a rise in the expected rate of inflation will lower the demand for real money balances and will thereby produce pressure for a discrete, once over, rise in the general level of prices and money wages sufficient to reduce the real value of money balances to a level which corresponds to the now lower demand. To the extent that this fall in that part of national wealth represented by the real value of money balances induces a higher rate of saving it might be expected to reduce the underlying real rate of interest. The second qualification to the 'Fisherian' presumption that nominal interest rates should be expected to immediately increase by the amount of any increase in the expected rate of inflation is also based on the observation that an increase in the anticipated inflation rate will lower the demand for real money balances. Where prices and wages are flexible they are able to rise in such a way as to equate the actual quantity of real money balances held with the lowered demand. If however this required rise in the price level is inhibited, in the short-run, by some element of nominal price or wage rigidity the expected real rate of interest will have to fall sufficiently to equate the reduced demand for money with the actual supply; that is to say, the nominal interest rate will have to rise by less than the increase in the expected rate of inflation. While the first of these qualifications may hold some implications for the long run course of the real rate of interest its empirical significance is questionable. The second, based as it is on an assumed element of nominal price or wage rigidity, is at best of short-run significance for the nature of the adjustment to nominal interest rates under conditions of anticipated inflation.

³⁸ (1981) 145 C.L.R. 625, 653.

³⁹ *Ibid.* 654.

Although Mr Justice Stephen's rejection of the 'real interest approach' on these grounds has apparently commanded widespread judicial assent,⁴⁰ it is in fact based on a simple confusion. The data assembled by him on the real rate of interest on two-year Australian government bonds are data on the *realized* real interest rate.⁴¹ The hypothesis of a constant real rate of interest on the other hand refers to the *expected* real rate of interest and there is no reason to expect these two to coincide unless it were to be supposed that market participants forecast inflation without error; an hypothesis that is patently absurd. The fluctuations in the *realized* real rate of interest recorded by Stephen J. are thus perfectly consistent with the hypothesis that he takes them to refute; being on that hypothesis the consequence simply of forecast errors in the expected rate of inflation. As we note below, when discussing the influence of taxation, there are, in fact, strong *a priori* reasons for rejecting the hypothesis of a constant expected pre-tax real rate of interest in the Australian context, but this hypothesis is incapable of being rejected on the grounds adduced by Mr Justice Stephen.

The approach, proposed by Lord Diplock, of basing awards on the nominal interest rates available on government bonds in 'times of stable currency'⁴² also relies on the logic of the 'real interest rate approach'; postulating the existence of a relatively constant underlying expected real rate of interest that will be preserved in the face of variations in the expected rate of inflation. It differs only in the suggested procedure for estimating that underlying real rate, avoiding the need to correct for expected inflation by basing the estimate on a potential subset of historical experience. This approach promises the advantage that if one can find a period of 'stable currency', during which it can plausibly be assumed that the expected inflation rate was approximately zero, the variance of inflationary expectations can also be presumed to have been low so that nominal bonds will have been subject to little purchasing power risk. Observed nominal interest rates during such a period would therefore be indicative of the required *risk-free* real rate of interest. The difficulty with this approach, at least from an Australian standpoint, is the absence of a really suitable historical period. Even during the 'relatively stable' years 1954-69 the realized rate of inflation averaged about 2.5 per cent p.a., suggesting that observed nominal interest rates in those years also require some correction for expected inflation.

Even when the difficulties introduced by the tax system are ignored, two

⁴⁰ Thus Murphy J. has accepted that 'as Stephen J. shows, there is no 'constant' or 'real' interest' (*Barrell* case, *ibid.* 685) while Mason J. argued that '[t]he adoption of the real interest rate would have an obvious advantage. Unfortunately it also has disadvantages. One such disadvantage is that the statistical and other information relating to past experience which is available to me does not establish that there is a steady real rate of interest in Australia' (*ibid.* 681). These views were accepted by the Supreme Court of New South Wales in its judgment in *Todorovic & Anor v. Waller* [1981] 1 N.S.W.L.R. 97, 101.

⁴¹ Strictly speaking they are not even that because his Honour appears to have subtracted the realized inflation rate over the ensuing financial year from the nominal yield per annum on two year Commonwealth bonds in June of that year. Since such bonds should be priced on the basis of expected inflation over the ensuing *two* years their realized annual real rate of return is more correctly approximated by the difference between their annualized nominal yield and the average realized rate of inflation over the succeeding two years.

⁴² [1970] A.C. 166, 176.

factors complicate the estimation of the required risk-free expected real rate of interest from the average realized real rate of return on nominal bonds. The first arises because realized rates of inflation, as estimated by the rate of change of price indices such as the Consumer Price Index, tend to overestimate the true decline in the purchasing power of money. They do this for two reasons. First, being fixed weight indices, conventional price indices give too much weight to commodities whose *relative* prices have increased and too little to those whose relative prices have declined over the period in question. This bias relative to an 'ideal' index occurs because consumers in practice engage in some degree of substitution against the consumption of goods whose relative prices have increased in favour of those whose relative prices have declined. Second, conventional price indices fail to allow for the effects of progressive improvements in product quality. While difficult to quantify, the bias introduced by these considerations may mean that measured rates of inflation overestimate the true decline in the purchasing power of money by about one per cent p.a.

The second complication results from the purchasing power risk to which nominal bonds are subject. While the money payments promised by such bonds are certain (if the bonds are default-free) uncertainty as to the future price level makes their real rate of return uncertain. It follows that any estimate of the average realized real rate of return on such bonds must be adjusted for risk if it is to yield an estimate of the required expected *risk-free* real rate of interest. While it might appear that the average realized real rate of return on nominal bonds should be adjusted downwards on this score this is not necessarily the case. The theory of asset pricing under uncertainty suggests that securities will be priced so that the risk premia that they exhibit are positively related to the marginal contribution that they make to the overall riskiness of a well-diversified portfolio rather than to their riskiness when considered in isolation. Consequently securities whose real returns are *negatively correlated* with the real returns on such a well-diversified portfolio, and which therefore *reduce* the riskiness of such a portfolio, are predicted to be priced so that their expected real rate of return lies *below* the risk-free real rate. There are some considerations which suggest that nominal bonds may have this characteristic. Such bonds yield real rates of return that are higher (lower) than expected whenever the realized rate of inflation turns out to be unexpectedly low (high). To the extent that unexpectedly high rates of inflation are associated with buoyant business conditions, and conversely, the real yield on nominal bonds will tend to be negatively correlated with that on equity investments. This presumption is reinforced by the consideration that, because nominal bonds represent monetary liabilities of their issuers, the unexpected movements in the price level which generate deviations in the real rate of return on bonds will, other things constant, necessarily generate oppositely signed deviations in the realized rate of return on equity. Unfortunately studies of the co-variance structure of security returns appear invariably to be cast in terms of nominal rather than real returns and thus exclude bonds from consideration. This theoretical deficiency is presumably explained by data considerations; stock market prices being recorded daily while the C.P.I. is only available quarterly. In consequence the evidence which would indicate

the required risk adjustment to the real rate of return on nominal bonds is not readily available.

We have identified the overstatement of the true decline in the purchasing power of money by conventional price indices, and the purchasing power risk to which nominal bonds are subject, as two considerations which may justify some *upward* adjustment to an average of past realized real rates of interest on nominal bonds in estimating a risk-free real rate of discount. On the other hand, were the courts willing to incorporate an allowance for an assumed steady secular increase in future real wage rates when assessing damages for lost earnings, this factor could logically be taken into account by defining the 'agreed stream' of lost earnings without reference to such real wage increases and employing a discount rate significantly (*i.e.* two to three per cent p.a.) *lower* than the risk-free real rate of interest. In terms of the arithmetic of capitalization this is clearly equivalent to inflating an agreed stream of earnings loss based on constant real wage rate by an assumed rate of increase of future real earnings and then discounting this inflated stream at an unadjusted discount rate.

In *O'Brien v. McKean* Barwick C.J. suggested that it would be appropriate to take account of

real advances in remuneration due to an increase in the real reward for an increased or a better regarded exercise of that [earnings] capacity if there is solid evidence upon which the probability of such an advance can be inferred.⁴³

However in making an allowance for increases in real earnings conditional on 'solid evidence' it would appear that Barwick C.J. was referring to increases in real earnings that were dependent on the particular circumstances of the plaintiff rather than endorsing a conventional allowance for the secular trend of real wage rates in general. In *Cullen v. Trappell* Murphy J. referred to

the prevailing approaches to assessment which operated unjustly against the plaintiff in a number of ways⁴⁴

among them being the neglect by the courts of the

probable increase in real wages reflected throughout the Australian community (these had averaged about 3 per cent per year over the 25 years before the trial, see 'Report of the Working Party on the Measurement of Labour Productivity' Department of Employment and Industrial Relations November 1975).⁴⁵

In the *Barrell* case Mr Justice Murphy reiterated that

In view of this long experience of increasing productivity being reflected in increased real wages, it is reasonable to expect that over a similar period of decades (with which this case is concerned) the same trend will occur⁴⁶

but was apparently (and in my judgment wrongly) influenced by '... the evidence . . . that, since 1975, average real wages have decreased'⁴⁷ to conclude that

In what must be a crude process of assessment under present circumstances this factor of increase or decrease should be left out.⁴⁸

⁴³ (1968) 118 C.L.R. 540, 546.

⁴⁴ (1980) 146 C.L.R. 1, 27.

⁴⁵ *Ibid.*

⁴⁶ (1981) 145 C.L.R. 625, 683.

⁴⁷ *Ibid.*

⁴⁸ *Ibid.* 683-4.

The position of Stephen J. on this issue is unclear. On the one hand, his Honour when arguing in the *Barrell* case for his 'undiscounted approach' stated categorically that this approach did not incorporate an allowance for secular future real wage increases:

It is appreciated that wage rates will not necessarily vary in step with changes in the purchasing power of money . . . Yet in the course of these reasons I have tended to draw no distinction between future growth in nominal wages and general price inflation . . . The complexity which any such a distinction would introduce outweighs, I think, any loss of accuracy which is entailed in ignoring it.⁴⁹

However in apparent contradiction of that position he later argued that

[i]t is the very capacity of the invested capital to produce income roughly equivalent to and offsetting the effects of inflation and increased productivity that is the justification for the undiscounted approach.⁵⁰

Although the courts have to date not been persuaded to adopt a conventional allowance for secular increases in average real earnings, Luntz⁵¹ and Posner⁵² would seem to be correct in arguing that the proper compensation of plaintiffs demands that this factor be explicitly incorporated into the assessment of damages. When the stream of lost earnings is a lengthy one the impact of a two to three per cent p.a. variation in the discount rate is so large that it is surely cold comfort to plaintiffs to be told that the resulting 'loss of accuracy' in the verdict is justified by a desire to avoid 'complexity'.

4. THE COMPLICATIONS INTRODUCED BY TAXATION

The majority of the High Court in *Cullen v. Trappell* reversed the earlier *Atlas Tiles Ltd v. Briers*⁵³ decision that awards of damages for future loss should be based upon the gross of tax earnings of the victim and that any taxation of the award, or of income arising out of the award, should be similarly disregarded. *Cullen v. Trappell* followed the decisions of the House of Lords in ruling that damages are to be based on lost future earnings net of tax (*British Transport Commission v. Gourley*⁵⁴) and are to have regard for the taxation liable on the assumed income from the verdict (*Taylor v. O'Connor*⁵⁵).

Basing the verdict on the net, rather than the gross of tax loss of future earnings normally creates no particular difficulties either of principle or practice. It affirms the compensatory nature of the damages award and, given that the award itself is in practice not taxed in the hands of the plaintiff, thereby allocates the windfall that arises out of the foregone taxation of lost future earnings, entirely to defendants who are thus assessed at less than the social cost of the damage done. While this aspect of the decision of the Court in *Cullen v. Trappell* appears now to be generally applied in personal damages cases, it is worth noting that in the matter of *Barrell v. Pennant Hills* the courts nowhere formally took

⁴⁹ *Ibid.* 661.

⁵⁰ *Ibid.* 663 (emphasis added).

⁵¹ Luntz, H., *op. cit.* 212.

⁵² Posner, R. A., *op. cit.* 147.

⁵³ (1978) 144 C.L.R. 202.

⁵⁴ [1956] A.C. 185.

⁵⁵ [1971] A.C. 115.

into account the fact that Pennant Hills would, in the normal course of events, be able to set its periodic reimbursements to the workers' compensation fund off against tax. Had this case been decided strictly on the logic of *Cullen v. Trappell* it would seem that the estimate of Pennant Hills' periodic liability to the fund should have been reduced by 46 per cent (the company tax rate) on this account and should thus have been \$46 rather than \$85 per week. The attempt by Stephen J. to distinguish the *Barrell* case:

As a consequence of *Cullen v. Trappell* . . . it is once more upon net after-tax loss of income that awards of damages for future economic loss are to be expressed. In addition regard is to be had to the income tax notionally payable on the income which would be produced were the sum awarded in respect of future economic loss to be invested. The first of these two consequences of *Cullen v. Trappell* is of no relevance in the present case because the plaintiff makes no claim to loss of future income⁵⁶

is to me wholly unconvincing. Significantly his Honour then went on to use the fact that Pennant Hills' future disbursements would be tax deductible to justify making no allowance for its tax liability on notional investment income. In essence the *Barrell* case, while paying lip-service to *Cullen v. Trappell*, was decided on the lines of *Atlas Tiles*.

While the courts now typically base damages awards on the net of tax loss of earnings, the manner in which the second aspect of the decision in *Cullen v. Trappell* is to be given practical application remains shrouded in uncertainty. As the High Court has to date successfully avoided providing clear guidance as to the manner in which taxation on future investment income is to be brought into account, the lower courts appear to have refrained from giving formal effect to this aspect of *Cullen v. Trappell*.

Since the manner in which the plaintiff may dispose of his or her award is not normally dictated by the court and since '[i]t is fundamental that the court has no concern with what the plaintiff actually does with his damages',⁵⁷ the tax in question is clearly notional tax on the expected income generated by some hypothetical form of investment of the award. Assessment of the likely amount of such notional tax is subject to three difficulties. First, because different avenues of investment differ in risk they will generate differing expected rates of return and thus differing expected tax liabilities. Second, different forms of investment income are treated very differently by Australian tax law. (At one extreme capital gains are exempt from taxation if realization occurs later than 12 months after acquisition of the asset and if the taxpayer can establish the absence of intent to profit from resale of the asset. At the other extreme the full nominal interest receipts from fixed interest investments are subject to tax). And thirdly, the marginal rate of personal tax is not constant under Australian tax law but varies in discrete steps with taxable income.

In the *Barrell* Case Gibbs J., in fixing upon a discount rate of two per cent, claimed to 'take into account the effect . . . of the notional tax on the notional income of the invested fund'⁵⁸ but did not explain the principles involved in his

⁵⁶ (1981) 145 C.L.R. 625, 661.

⁵⁷ *Ibid.* 642 per Gibbs J.

⁵⁸ *Ibid.* 643.

allowance for tax. While Stephen J., like Mason J., made no allowance for tax in this particular case, he did consider the issue from a broader perspective; quoting the United Kingdom Pearson Report recommendation that the courts should adopt a discount rate equal to

the real rate of return after tax, that is, approximately the net rate of return after tax less the rate of inflation⁵⁹

and suggesting that

the general approach of the Pearson Report appears to be suitable in Australian conditions.⁶⁰

Murphy J. in *Barrell* agreed that

[l]ogically, taxation on the earnings on the moneys awarded to the plaintiff should be taken into account by way of increasing the award. This is because the no discount approach is an offset of high interest on such moneys against inflation of the sums to be paid. But the high interest (or other earnings) must still be obtained in order to justify the offset. The interest or other earnings will be subject to income taxation, and to fail to take this into account is to fail to achieve complete restitution⁶¹

but failed to develop the point because,

the majority does not share my view, and because the task would be extremely difficult on the material in evidence.⁶²

As the *Barrell* judgments indicate, the form that the notional investment should be assumed to take is, to say the least, unsettled. However the internal logic of the process of determining the damages award would appear to require that the notional investment postulated in assessing the tax liability should be that postulated in capitalizing the agreed stream of lost earnings at a risk-free real rate of discount. That investment in turn would appear to be most nearly approximated by the default-free fixed interest securities to which the courts have traditionally directed attention when assessing the discount rate. While it is difficult to predict how this issue will ultimately be resolved, the *Barrell* judgments of Justices Stephen and Murphy are suggestive of the conclusion that they would adopt such fixed interest investments as the benchmark for the assessment of notional tax and we shall provisionally proceed on this basis.

The question of whether the tax rate, or rates, to be assumed in accounting for the notional tax liability on investment income should be allowed to depend on the likely circumstances of the plaintiff, should be based on the assumption that the plaintiff has no other income⁶³ or should be of some other conventional magnitude,⁶⁴ also remains unsettled. For example in *Cullen v. Trappell* Gibbs J. argued that

It cannot be too strongly emphasized that what has been said relates to notional tax on notional income derived from that part of the damages which is attributable to future economic loss, and that no similar justification exists for regarding as relevant the tax which a plaintiff may actually be called upon to pay on the investments into which he may put the damages he receives.⁶⁵

⁵⁹ Royal Commission on Civil Liability and Compensation for Personal Injury, *Report* (1978, Cmnd 7054), para. 677.

⁶⁰ (1981) 145 C.L.R. 625, 664.

⁶¹ *Ibid.* 685.

⁶² *Ibid.*

⁶³ Cf. the opinions of Lord Reid ([1971] A.C. 115, 129) and Viscount Dilhorne (*ibid.* 139) in *Taylor v. O'Connor*.

⁶⁴ Cf. the Pearson Report, which suggested using the tax rate applicable to the lost earnings at the time of the trial: *op. cit.* para. 684.

and added,

In some cases, where the amounts involved are small, the notional tax will be negligible, as Lord Reid pointed out in *Taylor v. O'Connor*.⁶⁶ In the same case Lord Reid⁶⁷ and Viscount Dilhorne⁶⁸ suggested that in dealing with the question of tax it could be assumed that the plaintiff had no other income, but with all respect I should have thought it proper to have regard to the actual situation of the plaintiff, in so far as it will affect the rate of the notional tax, provided that the necessary evidence has been adduced.⁶⁹

However in the *Barrell* case his Honour, in apparent contradiction of his earlier position, maintained that

in applying an arithmetical method to determine the present value of a future loss, is it right to have regard to the probable taxation position of the individual plaintiff? In my opinion it is not, for the method is a purely abstract one, which leads to the same result irrespective of the circumstances of the particular case. The estimated amount of the loss, and the length of time for which it will be suffered, depend entirely on the circumstances of the individual case, but the present value of such a loss is merely a matter of calculation, to which the facts of the case are not relevant.⁷⁰

The present value calculation makes due allowance for the assumption that the agreed stream of future loss must be capable of being reproduced by recourse to both the capital sum and the income generated by its investment. If notional tax on such income is to be deducted from the gross income in performing this calculation we have the situation that the appropriate award will depend on the amount of notional tax while that amount of tax will in turn depend on the size of the award. This simultaneity was recognized by Moffitt P.:

The other matter is that difficulty in the calculation of tax on the income from the verdict is no justification for making no allowance. Sufficient support is found in *Gourley's* case for a broad approach to be made to the calculation. The fact that, strictly, the solution lies in solving an equation, in which the verdict plays a part in its own determination, does not create a real difficulty once a broad approach is accepted.⁷¹

The solution of the equation referred to by Moffitt P. is straightforward if the rate of tax to which the notional interest income will be subject is independent of the level of that income, *i.e.* if such income is subject to a constant rate of tax. It is then appropriate to arrive at the lump sum award by discounting the agreed stream at the real after tax interest rate on the assumed notional investment, so that the appropriate allowance for notional taxation can be accommodated by an appropriate adjustment to the discount rate.⁷² This conclusion remains valid even if the assumed tax rate is a function of time (as it would be if the court were to recognize some pre-announced alteration to future tax rates). However, whenever the amount of notional interest income will change in such a way as to take the plaintiff across a tax threshold (*i.e.* to alter his or her marginal tax rate) the simultaneity alluded to by Moffitt P. cannot be accommodated in any simple

⁶⁵ (1980) 146 C.L.R. 1, 15.

⁶⁶ [1971] A.C. 115, 128.

⁶⁷ *Ibid.* 129.

⁶⁸ *Ibid.* 139.

⁶⁹ (1980) 146 C.L.R. 1, 16.

⁷⁰ (1981) 145 C.L.R. 625, 642.

⁷¹ *Beneke v. Franklin* [1975] 1 N.S.W.L.R. 571, 585.

⁷² This proposition is proved in Appendix B for the case, relevant under Australian tax law, where the plaintiff will be subject to tax on the *nominal* interest income provided by the notional fixed interest investment of the award (*cf.* p. 636 *infra*). The proof for the hypothetical case where *real* interest income is subject to tax (*cf.* pp. 635-6 *infra*) proceeds along similar lines.

fashion and its rigorous solution would require the employment of computer-based numerical methods. Although it will often be clearly inappropriate, the assumption that the tax rate on notional interest income is independent of the amount of that income is therefore convenient because it allows the likely effect of an allowance for notional tax to be gauged simply in terms of the adjustment to the discount rate that it implies. Accordingly we adopt the assumption in what follows.

With these preliminaries aside we now turn to a consideration of the choice of discount rate in the presence of taxation. It is important to appreciate that the complications potentially introduced by taxation are of two conceptually distinct kinds. Most obviously there is the problem of giving effect to the rule of *Cullen v. Trappell* by selecting an appropriate post-tax rate of discount. However even if the rule, that notional tax must be allowed for, were ignored (so that a gross of tax real interest rate would be relevant) recognition of the operation of the tax system creates potential difficulties for the process of estimating the appropriate pre-tax real interest rate. Since the issues involved are somewhat complex we postpone the consideration of the operation of the *actual* Australian tax laws and begin by analysing a hypothetical case in which the complications introduced by taxation are minimal.

We assume that this hypothetical tax system provides that, where interest income is subject to tax, taxable income is defined to include realized *real* interest income, being nominal interest receipts minus the product of the principal and the realized rate of inflation over the tax period. Conversely where a borrower is entitled to offset his or her interest payments against taxable income we assume that deductibility is accorded to the borrower's real interest payments, similarly defined. Under these tax rules the logic of the 'Fisher-effect', which argues that (pre-tax) nominal interest rates should be expected to adjust to anticipated inflation so as to keep the underlying (pre-tax) expected real interest rate unchanged, carries over without modification to a world of taxation even where different lenders and borrowers are subject to different rates of tax.

In the presence of taxation it may be assumed that lenders and borrowers will be concerned with expected post-tax real rates of interest which, on the present assumptions as to the tax law, will be

$$q_i = (i - \pi)(1 - T_i)$$

where T_i is the tax rate faced by the i^{th} borrower or lender. It is therefore clear that if the gross of tax nominal interest rate, i , adjusts by the exact amount of any variations in the expected rate of inflation π so as to maintain the underlying gross of tax expected real rate of interest \bar{r} , then the expected post-tax real rate of interest of every lender and borrower will also remain constant (at $q_i = \bar{r}(1 - T_i)$ for the i^{th} individual or corporation). Consequently, if we abstract from those qualifications to which the logic of the 'Fisher-effect' would in any case be subject in a tax-free world (see note 37 *supra*), it follows that this logic applies unaltered to the case where *real* interest is subject to tax.

Under this definition of the tax law, estimation of the underlying expected pre-tax real rate of interest could proceed as before by taking some average of realized gross of tax real interest rates over a period of years, provided only that the distribution of tax rates across the population of lenders and borrowers had not undergone any very significant systematic changes over time (such changes being potentially capable of altering the underlying gross of tax real interest rate thus destroying the relevance of the estimate). Moreover, having settled on an estimate of the expected pre-tax real rate of interest, the courts could give effect to the rule of *Cullen v. Trappell* by the simple expedient of using the discount rate $\bar{r}(1 - T_i)$ implied by the tax rate relevant to the circumstances of the plaintiff.

The actual Australian tax law differs significantly from that just considered in that, where interest receipts are taxed or interest payments are tax deductible, the taxpayer's tax liability is calculated with reference to his or her *nominal* rather than *real* interest receipts or payments. This means that the taxpayer faces an expected post-tax real rate of interest of

$$Q_i = i(1 - T_i) - \pi$$

which may be written as

$$Q_i = (i - \pi)(1 - T_i) - \pi T_i$$

implying that the expected post-tax real rate of interest is equal to the product of the expected gross of tax real rate of interest $(i - \pi)$ and one minus the tax rate *minus* an additional term equal to the product of the expected rate of inflation and the tax rate. This additional term arises because whenever taxation is based simply on nominal interest receipts (or payments) tax is levied (or exempted) not only on the real rate of return but also on that part of the nominal interest receipt (or payment) that represents compensation for the anticipated erosion of the purchasing power of the principal of the loan by inflation. In effect the tax law then operates to combine taxation of real interest income with a *capital levy* (or subsidy) per dollar lent (or borrowed) whose expected magnitude varies directly with the expected rate of inflation.

Recognition of the fact that nominal rather than real interest receipts are taxable under existing tax law has led to the suggestion that the courts should estimate the after-tax real discount rate from the formula,

$$Q_i = (i - \pi)(1 - T_i) - \pi T_i$$

by adopting a conventional gross of tax real discount rate $(i - \pi)$ in the range zero to three per cent p.a., explicitly or implicitly based on an average of past realized pre-tax real rates of return on government bonds. This suggestion corresponds to the procedure put forward by the Pearson Report⁷³ and has been proposed as applicable to Australian conditions by Stephen J.⁷⁴ It is also implicit in the observation of Murphy J. that the adoption of a conventional zero pre-tax

⁷³ *Op. cit.* paras 662-7.

⁷⁴ *Barrell case* (1981) 145 C.L.R. 625, 664.

real rate of discount does not justify the neglect of the tax liability of the plaintiff on his or her nominal interest receipts.⁷⁵ In a similar vein the Supreme Court of New South Wales in *Todorovic and Anor. v. Waller* remarked that

[t]he adoption of a zero discount rate will, of course, be inconsistent with the making of any allowance for tax upon the assumption that the notional income of the lump sum awarded is earned at notional discount rates. It would, however, not be incompatible with an allowance for the tax attracted by the actual return from a notional investment of the lump sum in some secure form such as Commonwealth bonds or building society deposits.⁷⁶

Justices Stephen and Murphy in the *Barrell* case and the Supreme Court of New South Wales in *Brazel v. Annis-Brown*⁷⁷ and *Todorovic v. Waller* argued for a zero pre-tax real rate of discount. Their observations on taxation recognize that while this would also imply a zero post-tax real rate of discount if taxation were based on *real* interest receipts it will, from the formula above, imply a discount rate of

$$Q_i = -\pi T_i$$

when the fact that nominal interest receipts are subject to tax is allowed for. Significantly neither of these two Justices of the High Court nor the Supreme Court of New South Wales have thus far adopted the very large negative discount rates to which this line of argument leads (*e.g.* with an expected inflation rate of 10 per cent p.a. and a tax rate of 50 per cent the implied post-tax real discount rate is *minus* 5 per cent p.a.).

At first sight it might appear that the approach alluded to by Justices Stephen and Murphy and by the Supreme Court of New South Wales will once again require the courts to entertain those speculations, 'expert' or otherwise, as to the future course of inflation; the need for which the adoption of a real discount rate promised to avoid. That this is *not* the case can be seen by noting that the *assumption* that $i - \pi = \bar{r}$ (where \bar{r} is now the conventional estimate of the pre-tax real rate of discount) allows the relationship

$$Q_i = (i - \pi)(1 - T_i) - \pi T_i$$

to be expressed in the form

$$Q_i = \bar{r} - iT_i$$

which makes the post-tax real discount rate depend simply on the conventional estimate of the pre-tax real discount rate, observed nominal interest rates and the relevant tax rate. In short the 'Fisherian' assumption that pre-tax nominal interest rates adjust to preserve unchanged an underlying expected pre-tax real interest rate itself allows the estimates of inflationary expectations, required to make an appropriate allowance for tax, to be inferred from observed nominal interest rates.

The difficulty with the approach outlined by Justices Stephen and Murphy is therefore not that of giving it practical application. Rather this approach is

⁷⁵ *Ibid.* 685.

⁷⁶ [1981] 1 N.S.W.L.R. 97, 102.

⁷⁷ [1981] 1 N.S.W.L.R. 85.

logically flawed by its tacit assumption that the 'Fisher-effect', under which nominal interest rates adjust by the amount of variations in the expected rate of inflation, can be transferred intact to a world in which nominal, rather than real, interest receipts and payments form the basis of taxation.⁷⁸

Recall that the 'Fisherian' logic argues that nominal interest rates will adjust to expected inflation in such a way as to hold constant the expected *post-tax* real interest rates faced by all borrowers and lenders. Ignoring differences in inflationary expectations across individuals, that outcome can be achieved in a tax-free world by a rise in nominal interest rates by the exact amount of any expected inflation. Moreover the same adjustment will serve to produce this result in a situation where real interest receipts are taxed and real interest payments are tax deductible, even if tax rates vary across individuals (*cf.* p. 635 *supra*). However the formula

$$Q_i = (i - \pi)(1 - T_i) - \pi T_i$$

clearly reveals that when taxation is based on nominal interest and tax rates differ across individuals, there exists *no* adjustment to the gross of tax nominal interest rate i which will preserve the expected post-tax real interest rate of all lenders and borrowers. This arises because the implicit capital levy on lenders and the implicit capital subsidy to borrowers (given by πT_i) varies according to the tax rate T_i to which an individual lender or borrower is subject. Under these circumstances there is *no a priori* reason to expect pre-tax nominal interest rates to adapt to changing inflationary expectations so as to maintain the underlying expected pre-tax real interest rate unchanged: the *simple* 'Fisherian' logic simply breaks down.

One can shed further light on the manner in which pre-tax nominal interest rates should be expected to respond to variations in anticipated inflation when taxation is based on nominal interest receipts and payments, by considering the special *polar case* in which *all* interest receipts are subject to tax, *all* interest payments are fully tax deductible and all taxable income is subject to a *uniform* tax rate T . In this special case *all* lenders and borrowers face the *same* expected post-tax real interest rate,

$$Q = (i - \pi)(1 - T) - \pi T$$

and one can indeed find a pre-tax nominal interest rate which will preserve this common expected post-tax real interest rate at the level, $\bar{r}(1 - T)$, which would apply in the absence of anticipated inflation. That nominal interest rate solves the equation

⁷⁸ It should be noted, in defence of those Justices of the High Court and of the Supreme Court of New South Wales who have endeavoured to provide a logically coherent analysis of the issues involved, that the economic literature on the subject is, with very few exceptions, shockingly negligent in its failure to observe that the logic of the 'Fisher-effect' applies only where *real* interest is the subject of taxation; a hypothetical situation far removed from the provisions of actual Income Tax Acts either in Australia or overseas.

$$(i - \pi)(1 - T) - \pi T = \bar{r}(1 - T)$$

and is therefore given by

$$i = \bar{r} + \frac{\pi}{1 - T}$$

This 'tax-adjusted Fisher-effect' predicts that nominal interest rates will rise in response to anticipated inflation not simply by the amount of the expected rate of inflation but by the product of the expected rate of inflation and the reciprocal of one minus the tax rate. To take an example, if the underlying expected gross of tax real interest rate were two per cent p.a., the expected rate of inflation were ten per cent p.a., and the uniform tax rate were 50 per cent the 'Fisherian' logic, applied to an economy in which nominal interest receipts and payments were universally taxable and tax deductible, predicts a pre-tax nominal interest of 22 per cent p.a.

Notice that by undergoing this dramatic adjustment to anticipated inflation the pre-tax nominal interest rate responds by an amount sufficient to preserve the expected post-tax real interest rate at precisely the level ($\bar{r}(1 - T)$) that would apply if *real* rather than *nominal* interest receipts and payments were recognized for tax purposes (*cf.* p. 635 *supra*). What is happening in this special case is that the capital levy implied by the taxation of nominal interest receipts in times of inflation is precisely offset in its effects on post-tax real interest rates (and the Treasury coffers) by the equal and offsetting subsidy to borrowers that results from the assumed universal tax deductibility of nominal interest payments.

When this 'tax-adjusted Fisher-effect' applies, the procedure, explicitly or implicitly adopted by the courts, of inferring the underlying expected gross of tax real interest rate by averaging data on realized pre-tax real interest rates observed in the past, is clearly inappropriate. If the nominal interest rate at time t is

$$i_t = \bar{r} + \frac{\pi_t}{1 - T}$$

and we denote the realized rate of inflation by p_t , the realized gross of tax real interest rate will be

$$i_t - p_t = \bar{r} + \frac{\pi_t}{1 - T} - p_t$$

Taking an average over a large number of observations we find that the average observed pre-tax real interest rate ($i - p$) is given by

$$(i - p) = \bar{r} + \frac{T}{1 - T} \bar{p}$$

if the predictions of inflation by market participants are correct on average (*i.e.* if $\bar{\pi} = \bar{p}$, where \bar{p} is the average realized inflation rate over the period). This average will clearly not be indicative of the underlying pre-tax real (and nominal) interest rate that would apply in the absence of inflation; being instead an

arbitrary number dependent on the extent of past inflationary experience (as captured by \bar{p}).

In reality the tax laws do not operate to make all nominal interest receipts taxable or all interest payments tax deductible. Many lenders have tax exempt status (religious and charitable organizations, some superannuation funds *etc.*) Moreover, given the ease with which investment income can be arranged to accrue to dependants, a significant proportion of personal interest receipts is presumably subject to a zero marginal tax rate. Doubtless many other personal lenders exempt themselves from taxation of interest by failing to declare such income. Where borrowers are concerned there is a similar diversity of tax treatment. While corporated and unincorporated business enterprises, and persons borrowing for investment purposes, receive tax deductibility of interest, borrowings to finance personal consumption, the purchase of consumer durables or owner-occupied housing, do not enjoy such deductibility. Furthermore even where nominal interest is subject to, or deductible against, tax, the relevant tax rate will differ across taxpayers because of the distinction between personal and corporate taxation, because of progression in personal marginal tax rates and because of the limitations on the carry-forward of tax losses by business enterprises.

Under the actual provisions of the tax laws one would therefore expect that while pre-tax nominal interest rates will respond to anticipated inflation by rising by *more* than the expected inflation rate (because of the large number of lenders and borrowers who are taxed on, and receive deductibility for, nominal interest) they will rise by *less* than predicted by the pure 'tax-adjusted Fisher-effect' (because of the significant number of tax exempt lenders and borrowers). This suggests that we may describe the nominal interest rate by the relationship

$$i = \bar{r} + \alpha\pi$$

and expect the inflation adjustment factor α to lie somewhere within the range $2 > \alpha > 1$ (the upper bound being based on the factor $\frac{1}{1-T}$ given a roughly rep-

resentative tax rate $T = 0.5$ applying where interest receipts are taxable and interest payments tax deductible). Under the actual Australian tax laws the parameter $\frac{1}{\alpha}$ will be a weighted average of the tax factors $(1 - T_i)$ to which

different classes of lenders and borrowers are subject, the weights depending on the proportion of total lending and borrowing subject to each type of tax treatment and the interest responsiveness, or elasticity, of each such category of the demand for and supply of loanable funds.

Given that the notional nominal interest receipts of the plaintiff are taken to be taxed at the rate T_i , the required post-tax real rate of discount is

$$q_i = i(1 - T_i) - \pi$$

Assuming that

$$i = \bar{r} + \alpha\pi$$

we have (substituting for the expected rate of inflation π),

$$\rho_i = \frac{\bar{r}}{\alpha} + i(1 - T_i - \frac{1}{\alpha})$$

as the appropriate formula for the post-tax real rate of discount.⁷⁹ In applying this formula the court would use the observed pre-tax nominal interest rate i together with whatever tax rate T_i it chooses as relevant and would require, in addition to an estimate of the underlying pre-tax real rate of interest \bar{r} , an estimate of the inflation adjustment factor α .

We have seen that when taxation is based on nominal interest, an average of past realized real interest rates provides no indication of the underlying inflation-free real rate of interest \bar{r} (pp. 639-40 *supra*). Moreover to implement the approach suggested above the courts would require an estimate not only of \bar{r} , but also of the inflation adjustment factor α . To obtain such estimates recourse must be had to regression techniques. To illustrate; if we assume that inflationary expectations are formed so as to be correct on average we have

$$p = \pi + e$$

where p is the realized rate of inflation and e is a forecast error having a zero mean. If we now assume that the nominal interest rate is determined by the relationship,

$$i = \bar{r} + \alpha\pi$$

we have (on substituting for π) the model

$$p = -\frac{\bar{r}}{\alpha} + \frac{1}{\alpha}i + e$$

Thus, given data on nominal interest rates i and realized rates of inflation p one can estimate the parameters of the regression

$$p = \beta + \gamma i + e$$

and identify \bar{r} and α from the knowledge that $\bar{r} = -\frac{\beta}{\gamma}$ and $\alpha = \frac{1}{\gamma}$.

One recent Australian study that performs this type of exercise is that by W. Poole.⁸⁰ Poole uses quarterly data on the nominal interest rate on 90-day bank-accepted commercial bills, and the Consumer Price Index, over the period

⁷⁹ Note that the expression

$$\rho_i = \frac{\bar{r}}{\alpha} + i(1 - T_i - \frac{1}{\alpha})$$

reduces to the formula,

$$\rho_i = \bar{r} - iT_i$$

of p. 637 if the invalid *a priori* assumption that $\alpha = 1$ is made.

⁸⁰ Poole, W., 'Nominal and Real Rates of Interest in Australia' working paper, Reserve Bank of Australia, June 1981. Note that Poole's paper fails to take due account of the fact that the pure 'Fisher-effect', whereby nominal interest rates adjust simply by the amount of the expected rate of inflation, cannot be expected to apply under Australian tax law. Nonetheless his estimated equations are of the form required by our analysis and allow the identification of the parameters \bar{r} and α .

1969(1) to 1980(2), to estimate the parameters of the above regression equation (Poole in fact uses the theoretically more appropriate rate of change of the purchasing power of money in place of the inflation rate). His basic regression equation⁸¹ yields $\beta = 0.025$ and $\gamma = 0.783$ which produces $\bar{r} = -0.032$ and $\alpha = 1.28$ as estimates of the two relevant parameters. Since Poole's data on 90-day interest rates and quarterly inflation are expressed in annualized rates, this implies that the inflation-free pre-tax real rate of interest is estimated by him to be *minus* 3.2 per cent p.a. and that nominal interest rates are estimated to adjust to anticipated inflation by an amount that is 28 per cent in excess of the expected inflation rate.

Poole's study is of interest because it provides the type of estimates that are required if the courts are to attempt the logically consistent estimation of post-tax real rates of discount in the face of the complications caused by Australia's actual tax laws. It is notable that while Poole's implicit estimate of α confirms our expectation that this parameter should, under Australian conditions, fall in the range $2 > \alpha > 1$, his implied estimate of \bar{r} is clearly very low relative to nominal interest rates observed in former years of low inflation. For example in the years 1954-1968 pre-tax nominal interest rates averaged about 4.5 per cent p.a. On the basis of the estimates $\bar{r} = -0.032$ and $\alpha = 1.28$ an expected inflation rate of about six per cent would have been required to produce this level of nominal interest rates. This level of expected inflation is clearly implausibly high in relation to the average realized rate of inflation of 2.5 per cent p.a. over the period. In part the implausibly low estimate of \bar{r} may be the consequence of the fact that Poole's sample is relatively small and is dominated by a period during which the rate of inflation rapidly, and perhaps to a large degree unexpectedly, accelerated to historically high levels. If one were to provisionally accept $\alpha = 1.28$ as a reasonable value for the inflation adjustment factor then the average observed nominal interest rates and rates of inflation over the years 1954-1969 suggest a value for the inflation-free pre-tax rate of interest of 1.3 per cent p.a. (*i.e.* $\bar{r} = \bar{i} - \alpha\bar{p} = 0.045 - 1.28(0.025) = 0.013$).

As suggested above the courts could, on the basis of estimates of the parameters, \bar{r} and α , arrive at a logically consistent estimate of the post-tax real discount rate from the formula

$$q_i = \frac{\bar{r}}{\alpha} + i(1 - T_i - \frac{1}{\alpha})$$

To illustrate we shall assume that the court sets $\bar{r} = 0.013$ and $\alpha = 1.28$, that the relevant tax rate is taken to be 33 per cent ($T_i = 0.33$) and that a pre-tax nominal interest rate of 14.1 per cent p.a. ($i = 0.141$) is observed. On this basis the post-tax real rate of discount will be

$$q_i = \frac{0.013}{1.28} + 0.141(1 - 0.33 - \frac{1}{1.28}) = -0.005$$

or *minus* 0.5 per cent p.a. In effect this procedure means that the court uses the estimated inflation-free pre-tax rate of interest \bar{r} and the inflation adjust-

⁸¹ *Ibid.* (equation 5).

ment parameter α to infer that if the observed nominal interest rate is 14.1 per cent p.a. the implied expected rate of inflation must be 10 per cent p.a. ($\pi = \frac{i - \bar{r}}{\alpha} = \frac{0.141 - 0.013}{1.28} = 0.1$). At a tax rate of 33 per cent a nominal

interest rate of 14.1 per cent p.a. implies a post-tax nominal interest rate of about 9.5 per cent p.a., and subtracting the 10 per cent p.a. estimate of the expected rate of inflation yields the -0.5 per cent p.a. post-tax real discount rate.

We have seen that under the Australian tax system the pre-tax nominal interest rate cannot be expected to adjust to expected inflation in the dramatic fashion predicted by the pure 'tax-adjusted Fisher-effect' which emerges from the polar case (analysed on pp. 638-9 *supra*), and the empirical evidence clearly indicates that it fails to do so. Accordingly the expected post-tax real interest rates faced by most lenders and borrowers will not in practice remain invariant to alterations in the expected rate of inflation. Indeed, given that the inflation adjustment factor α exceeds unity (as it should be expected to do in the light of the actual Australian tax system), the expected post-tax real rate of interest faced by individual lenders and borrowers subject to high rates of tax (or tax exemption) on nominal interest will be *lower*, while that faced by those subject to low rates of tax (or tax exemption) will be *higher*, the *higher* is the expected rate of inflation and therefore the level of nominal interest rates. In short under the actual Australian tax system higher rates of expected inflation, and therefore of nominal interest, should be expected to hurt those who lend subject to high rates of tax (rich widows) and those who borrow subject to low (or zero) rates of tax deductibility (home buyers) while benefiting those who lend subject to low rates of tax (charitable organizations and tax evaders) and those who borrow subject to high rates of tax exemption (business enterprises).

The expected post-tax real rate of interest faced by a lender (or borrower) subject to tax (or tax exemption) on nominal interest at the rate T_i is $q_i = i(1 - T_i) - \pi$. Since $i = \bar{r} + \alpha\pi$ it follows that

$$\begin{aligned} q_i &= (\bar{r} + \alpha\pi)(1 - T_i) - \pi \\ &= \bar{r}(1 - T_i) + \pi(\alpha(1 - T_i) - 1) \end{aligned}$$

This reveals that the *critical tax rate* at which the expected post-tax real rate of return is invariant to changes in the expected rate of inflation is given by

$$T^* = \frac{\alpha - 1}{\alpha}$$

which is positive if $\alpha > 1$. On the basis of Poole's estimate of $\alpha = 1.28$, used for illustrative purposes above, that critical tax rate will be 22 per cent.

Consider now the implications of this for the post-tax real rate of discount that would result were the courts to follow the procedure suggested above. Where the courts fix upon a tax rate above the critical value $T^* = \frac{\alpha - 1}{\alpha}$, the suggested formula

$$q_i = \frac{\bar{r}}{\alpha} + i(1 - T_i - \frac{1}{\alpha})$$

will operate to produce a lower post-tax real rate of discount and therefore, other things constant, a higher verdict, the higher is the level of the nominal interest rate observed by the court. Conversely where the courts choose to regard a tax rate lying below the critical value as relevant, higher nominal interest rates will act to increase the chosen post-tax real rate of discount and thus to depress the size of the damages award.

These consequences, reflecting as they do the market realities that result from variations in the expected rate of inflation (and therefore in nominal interest rates) would create no complications for those, relatively rare, cases in which the courts stipulate that the corpus of the award be placed in trustee investments which closely approximate the notional fixed interest investments which are hypothesized by the calculation of the post-tax real rate of discount.

Most plaintiffs are however left free to invest their damages in a manner of their own choosing and will typically prefer an investment strategy which takes some advantage of the much higher expected rates of return available on risky equity investments (*cf* p. 617 *supra*). It is important therefore to consider how the expected post-tax real rate of return on such investments should be expected to respond to variations in the expected rate of inflation.

The historical cost basis of company taxation leads one to expect that the *expected* post-tax real rate of return on risky equity investments may be somewhat depressed by secular increases in the expected rate of inflation; this being more likely for those companies which eschew a heavily levered capital structure and thus forego much of the benefit which accrues to borrowers whose nominal interest payments are deductible against tax at a rate which substantially exceeds the critical tax rate T^* .⁸² However there is nothing in the overall (company plus personal) tax treatment of equity income (dividends plus capital gains) which suggests that the *expected* post-tax rate of return on equity should experience those violent fluctuations in response to variations in the expected rate of inflation which *must of necessity* occur in the expected post tax real rate of return on debt at tax rates which deviate significantly from T^* .⁸³

The implications of this for the procedure of capitalizing the 'agreed stream' of real earnings loss at a risk-free post-tax real rate of discount are straightforward. Suppose that the expected rate of inflation was zero, that the tax rate chosen by the court was significantly greater than T^* , and that the 'contingency adjustment' has been nicely chosen so that the victim is exactly compensated by the receipt of

⁸² Two aspects of the difference between existing company tax law and an ideal system based on *real* economic income are relevant here. First by basing depreciation allowances on the historical cost of fixed assets, rather than on that historical cost written up by the ratio of the current value of the C.P.I. to its value at the date of acquisition of the asset, the existing tax law reduces the real value of depreciation allowances under inflationary conditions. Second the existing tax law brings some proportion of the purely inflationary capital gains realized on stocks held into the tax base. For both of these reasons the effective tax rate on *real* company income rises with the rate of inflation.

⁸³ For the tax system to treat company income symmetrically with interest income (where as we have seen *nominal* interest receipts are taxed) it would need not only to index depreciation allowances but would also have to bring any purely inflationary capital gains on fixed assets and all inflationary gains on stocks into the tax base. The fact that the existing tax system does not do this can be held to justify the presumption of the text.

the present value of the ‘agreed stream’ of future earnings loss capitalized at the discount rate defined by the formula,

$$Q_i = \frac{\bar{r}}{\alpha} + i(1 - T_i - \frac{1}{\alpha})$$

Now suppose that the expected rate of inflation, and therefore the level of observed nominal interest rates entering into the above formula, had been substantially higher. Given that the chosen tax rate T_i has been assumed to significantly exceed $T^* = (\alpha - 1)/\alpha$, the post-tax real rate of discount defined by the above formula will then fall considerably and, as a result, the size of the verdict will rise substantially whenever the ‘agreed stream’ is a lengthy one. Because the plaintiff can be expected to place a portion of his or her award in equity investments whose expected post-tax real rate of return undergoes no corresponding downward adjustment in the face of the higher expected rate of inflation, the consequence will be that the previously exactly compensated victim will now be overcompensated. Conversely, had the court opted for a tax rate significantly less than T^* the opposite implication would emerge. In this case the higher expected rate of inflation raises the discount rate chosen on the basis of the above formula and depresses the size of the award so that the plaintiff will now be undercompensated.

This line of reasoning leads to the uncomfortable conclusion that, if the courts are to avoid the systematic over- or undercompensation of victims as the expected rate of inflation alters, they must systematically vary that part of the ‘contingency adjustment’ which is ideally designed to offset the advantage which accrues to plaintiffs as a result of their freedom to invest the award in other than fixed interest securities (*cf.* p. 617 *supra*). Specifically, as the expected rate of inflation rises the courts must increase the downward ‘contingency adjustment’ for those plaintiffs for whom a tax rate greater than T^* is chosen as relevant and reduce it for those who are taken to be subject to a notional tax rate less than T^* .

Recall however that the courts have thus far appeared totally incapable of arriving at a settled procedure for selecting the tax rate which is to be assumed to be applied to notional interest income in arriving at the post-tax real rate of discount (pp. 633-4 *supra*). In these circumstances the choice of a ‘conventional’ tax rate equal to the tax rate $T^* = (\alpha - 1)/\alpha$ at which the expected post-tax real rate of interest is independent of the expected rate of inflation, immediately commends itself as that which neatly fills the vacuum; obliterating at a single stroke the vexing problem identified above. Substituting this tax rate into our formula

$$Q_i = \frac{\bar{r}}{\alpha} + i(1 - T_i - \frac{1}{\alpha})$$

for the post-tax real rate of discount, we arrive finally at the suggested ‘conventional’ post-tax real rate of discount

$$Q = \frac{\bar{r}}{\alpha}$$

which, by making the 'conventional post-tax real rate of discount equal simply to the ratio of the inflation-free pre-tax real rate of interest \bar{r} and the inflation adjustment factor α also frees the courts of the necessity to employ the observed nominal interest rate in calculating the discount rate.

On the basis of our illustrative magnitude for these two critical parameters ($\bar{r} = 0.013$ and $\alpha = 1.28$) we would then have a 'conventional' post-tax real rate of discount of

$$\rho = \frac{\bar{r}}{\alpha} = \frac{0.013}{1.28} = 0.01$$

which at one per cent p.a. happens, by coincidence, to be the arithmetic mean of the rates chosen by those six Justices of the High Court who, in the *Barrell* case, recommended that the conventional discount rate of five per cent p.a. be abandoned.

APPENDIX A

The expected real rate of return on a short term (one period) bond whose only promised payment occurs at the end of the period (as with a bill) is

$$r_t = \frac{E_t \left(\frac{1}{P_{t+1}} \right) (1+i_t) - 1}{\frac{1}{P_t}}$$

where i_t is the nominal interest rate on such a bond at time t , P_t is the current price level and $E_t(P_{t+1})$ is the expectation of the price level in period $t + 1$ formed at date t . Note that one dollar has purchasing power $\frac{1}{P_t}$ in period t . Invested in a nominal bond having the interest rate i_t the dollar will yield $(1+i_t)$ dollars one period hence, having expected purchasing power of $E_t \left(\frac{1}{P_{t+1}} \right) (1+i_t)$ so that r_t is the expected rate of growth of purchasing power (expected real rate of return) on such a nominal bond. Defining

$$z_t = \frac{E_t \left(\frac{1}{P_{t+1}} \right) - \frac{1}{P_t}}{\frac{1}{P_t}}$$

as the expected rate of change of the purchasing power of money over the period we see that,

$$r_t = i_t + z_t + i_t z_t$$

If the period is short both i_t and z_t will be small and their product negligible so that,

$$r_t = i_t + z_t$$

Noting that the expected rate of inflation,

$$\pi_t = \frac{E_t(P_{t+1}) - P_t}{P_t}$$

is approximately equal to $-z_t$ we have the relationship used above.

APPENDIX B

By way of notation let, t , τ and v be time indices, t_0 be the date of judgment, L be the plaintiff's normal, pre-accident, date of retirement, $E(\tau)$ be the 'agreed rate' of earnings loss at date τ measured according to the rule of *O'Brien v. McKean* in the dollars of the date of the trial, $V(\tau)$ be the nominal sum invested at date τ , $P(\tau)$ be the expected price level at date τ , $i(\tau)$ be the short term nominal interest rate at date τ and $T(\tau)$ be the tax rate to which the plaintiff's notional interest is assumed to be subject at date τ .

Now if the plaintiff is to be able to enjoy a nominal level of consumption of $E(\tau)P(\tau)/P(t_0)$ at every future date $\tau \leq L$ he must clearly invest at any future date t an amount of dollars given by,

$$V(t) = \int_{\tau=t}^L \left\{ \frac{E(\tau)P(\tau)}{P(t_0)} + i(\tau) T(\tau) V(\tau) \right\} e^{-\int_{v=t}^T i(v)dv} d\tau$$

That is to say, he must invest an amount equal to the present value of the stream of nominal dollars required to achieve a *real* stream of consumption $E(\tau)/P(t_0)$ in the light of the expected price level $P(\tau)$ and the expected rate of tax payments $i(\tau)T(\tau)V(\tau)$ to which he will be subject, at any date τ ; the capitalization being performed at the short term nominal rates of interest $i(v)$ implicit in the present term structure of interest rates.

For $t = t_0$ (the date of judgment) this is the equation referred to by Moffitt P. which makes the size of the verdict $V(t_0)$ depend on the stream of future tax liability which, being a function of the amount invested at any future date, depends in turn on the size of the verdict. Since this equation holds identically in t we have, on differentiating with respect to t ,

$$\dot{V}(t) = - \left\{ \frac{E(t)P(t)}{P(t_0)} + i(t)T(t)V(t) \right\} + i(t)V(t)$$

as the time rate of change of the amount invested. The *real* sum invested at any date t is $V(t)/P(t)$ so that,

$$\left[\frac{\dot{V}(t)}{P(t)} \right] = \frac{\dot{V}(t)}{P(t)} - \frac{V(t)}{P(t)} \pi(t)$$

where $\pi(t) = \dot{P}(t)/P(t)$ is the expected rate of inflation at date t .

Substituting for $\dot{V}(t)$ we have that,

$$\left[\frac{\dot{V}(t)}{P(t)} \right] = - \frac{E(t)}{P(t_0)} + \{ i(t)[1-T(t)] - \pi(t) \} \frac{V(t)}{P(t)}$$

Finally, integrating this equation over $[t, L]$ we see that,

$$\frac{V(t)}{P(t)} = \int_{\tau=t}^L \frac{E(\tau)}{P(t_0)} e^{-\int_{v=t}^{\tau} \{i(v)[1-T(v)] - \pi(v)\} dv} d\tau$$

which makes the *real* sum that must be invested at any date t equal to the present value of the agreed *real* stream capitalized at the *post-tax real* rate of interest $\{i(v)[1 - T(v)] - \pi(v)\}$. Therefore when $t = t_0$ we have as the verdict,

$$V(t_0) = \int_{\tau=t_0}^L E(\tau) e^{-\int_{v=t_0}^{\tau} \{i(v)[1-T(v)] - \pi(v)\} dv} d\tau$$

which is the present value of the 'agreed stream' defined according to the rule of *O'Brien v. McKean*, capitalized at the post-tax real rate of discount.