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ASSESSMENT OF DAMAGES: ECONOMIC AND ACTUARIAL EVIDENCE

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I. INTRODUCTION

In 1978 the Supreme Court of Canada attempted to provide definitive guidance on the principles to be used in the assessment of damages in personal injury[1] and fatal accident cases.[2] A number of articles and commentaries have discussed these principles and their implications.[3] Since these decisions were handed down, the lower courts have struggled to interpret in the context of particular cases the principles laid down by the Supreme Court. These developments have highlighted the importance of economic and actuarial evidence in the estimation of pecuniary loss. The purpose of the present paper

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[1] *Andrews* v. *Grand and Toy Alberta Ltd.*, [1978] 2 S.C.R. 229, 83 D.L.R. 452, 3 C.C.L.T. 225; *Arnold* v. *Teno*, [1978] 2 S.C.R. 287, 83 D.L.R. (3d) 609, 3 C.C.L.T. 272; *Thornton* v. *Bd. of School Trustees*, [1978] 2 S.C.R. 267, 83 D.L.R. (3d) 480, 3 C.C.L.T. 257.

[2] *Keizer* v. *Hanna*, [1978] 2 S.C.R. 342, 82 D.L.R. (3d) 449, 3 C.C.L.T. 316.

[3] See, *e.g.*, Charles, *A New Handbook on the Assessment of Damages in Personal Injury Cases in the Supreme Court of Canada* (1978), 3 C.C.L.T. 345; Bissett-Johnson, *Damages for Personal Injuries — The Supreme Court Speaks* (1978), 24 McGill L.J. 316.

is to discuss the current situation from the perspective of an economist and an actuary and provide a critical analysis of some of the issues involved.

The net discount rate used in the calculation of pecuniary loss critically affects the size of the award. Part II of this paper presents an economic analysis which should prove helpful in the selection of an appropriate net discount rate. This approach involves an analysis of the relationships between interest rates, inflation rates and earnings growth and has been accepted by the trial courts in some recent cases.[4] Part III discusses the problem of valuing the housework performed by a spouse and presents several possible approaches.

Part IV is devoted to a discussion of the nature and impact of actuarial assumptions and, in particular, the mortality assumptions. To illustrate the impact of the underlying variables in the size of the award various tables have been prepared.

Part V examines the treatment of the tax factor in the assessment of pecuniary loss. It is suggested that some of the principles enunciated by the Supreme Court in this connection are economically unsound and logically inconsistent. Furthermore, it has been suggested that by ignoring the tax factor in personal injury awards the plaintiff will be over-compensated. It is argued that in many cases, particularly where longer time periods are involved, the situation is the exact opposite. A more theoretically correct procedure that is designed to produce an after-tax income stream identical to the after-tax income stream which has been lost is referred to in this part.

The last few sections of the paper discuss specific illustrations of the application of economic and actuarial methods to the valuation of pecuniary loss. A case study is presented to illustrate a number of the concepts discussed earlier in the paper and to highlight certain practical points.

Some of the weaknesses of the lump sum award procedure for compensating plaintiffs in personal injury and fatal accident cases can be overcome by a system of periodic payments. The paper concludes with a very brief discussion of structured settlements and highlights the importance of including a suitable provision for inflation protection in these agreements.

II. ECONOMIC ASSUMPTIONS

In order to calculate the sum of money necessary to compensate the plaintiff for all pecuniary losses resulting from a serious accident or fatality long range economic assumptions are required. This calculation typically involves 1) forecasting a stream of foregone earnings and additional living expenses, and 2) forecasting the rate of return the plaintiff can reasonably expect to earn by investing the lump sum awarded by the court. The rate of return on investment is used to discount the projected stream of lost income and thereby obtain a present value (or lump sum) equivalent for these future losses. The discounting procedure is necessary in order to avoid over-compensating the plaintiff. Since any monies received today can be invested to

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[4] *Lan* v. *Wu*, [1979] 2 W.W.R. 122, [1979] 7 C.C.L.T. 314 (B.C.S.C.), *rev'd with respect to quantum of damages*, (1980), 21 B.C.L.R. 216 (B.C.C.A.).

generate a stream of future income, the plaintiff is able to draw on both the capital and the returns provided by the award so as to offset foregone earnings and additional living expenses.

It is contended that many awards have been calculated at unreasonably high discount rates.[5] While estimates of the base period loss and the life of the award are important ingredients in the lump sum calculation, the final value is also very sensitive to changes in the discount rate. Due to their failure to appreciate the significance of variations in the discount rate, the courts have adopted, until recently, a rather off-handed approach to their determinations.[6] Direct economic evidence was seldom considered on this important issue. Instead, the courts relied on secondary sources and casual observation, generally misinterpreting any data and theories that were provided.[7]

The seven percent net discount rate applied in the four Supreme Court decisions appears to be based on overly optimistic estimates of real investment returns and it made no allowance for growth in real earnings and productivity adjustments. Allowance must also be made with regard to wages for growth in foregone income, recognizing the impact on earnings of productivity gains and career advancement. The net discount rate used to determine the lump sum award should equal the forecast rate of return on investments less the forecast growth in earnings.

Unfortunately, experience has shown that it is all but impossible to forecast these income growth and investment return factors over an extended period of time due to the great uncertainty surrounding future economic events—most notably, inflation. Changes in the growth of earnings and the rate of return on investments are largely dependent upon the rate of inflation. [See Appendix I.] Wages and salaries typically rise by an amount sufficient to compensate workers for general price increases plus an allowance for increased productivity. Although changes in labour income usually follow changes in inflation quite closely, income adjusts by more than the rate of inflation, thereby providing a gradual improvement in the standard of living enjoyed by the workers. This difference between the growth in "nominal" income and the rate of inflation is often referred to as the growth in "real" income. The size of the differential will vary from individual to individual depending upon his age, job experience and advancement opportunities, given the general state of the economy.

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[5] *Supra* notes 1 and 2.

[6] For an additional analysis of the pitfalls see, *e.g.*, Dexter, Murray, and Pollay, *Inflation, Interest Rates and Indemnity: The Economic Realities of Compensation Awards* (1979), 13 U.B.C. L. Rev. 298.

[7] The famous "Deutsch forecast" was conveyed to the Supreme Court indirectly through the testimony of a home economist (Doris Dadir). It is based on a preliminary and dated analysis by the Economic Council of Canada and was quoted out of context. *Julian* v. *Northern and Central Gas Corp.* (1978), 5 C.C.L.T. 148 at 159 *per* Southey J. (H.C. Ont.) cites the source of this forecast as a report given by the ECC to the Minister of Labour regarding inflation to be taken into account when management and unions of the railway companies were negotiating pension benefits. This forecast was based, however, on data gathered over 1962 to 1972 and, as pointed out in the *Julian* case, thus did not encompass the higher inflation rates since that time.

Investment returns are also affected by inflation since the yield offered on securities adjusts to reflect investors' expectations about inflation over the life of the asset. Investors expect their investment returns to compensate them for inflation and to provide for some growth in purchasing power. The difference between the "nominal" rate of return realized on any security and the rate of inflation is called the "real" rate of return. The size of this differential will vary according to the securities held by the investor and will reflect the overall risk of his investment portfolio.

A. *Inflation*

Given the major role inflation plays in the income and investment return components of lump sum calculations, a reliable forecast of future price movements would seem to be essential if one is to arrive at a fair settlement. Appendices II and III provide some information on past price trends and forecasts of future inflation. Although inflation has averaged two to three percent annually over the past fifty years, most researchers are now projecting higher inflation rates of seven to eleven percent over the immediate to medium-term. Beyond the mid 1980's there is no consensus as few economists are willing to risk an estimate for the long-term. Inflation is affected by a number of variables which cannot be accurately predicted. These variables include: future monetary policy, government deficits, exchange rate movements, and supply-side shocks (*e.g.*, oil price increases). Indeed, unforeseen changes in the above variables have played havoc with the forecasts made for the 1970 to 1980 period. [See Appendix IV.] It seems that even medium-term projections have very limited usefulness.

To the extent that both components of the discount rate respond to changes in the inflation rate the inability to accurately forecast inflation would seem to present a serious obstacle to the lump sum calculation. Fortunately this is not the case. The dependence shared by income growth and investment return on inflation actually makes the task much easier. One need not forecast inflation if it affects both streams symmetrically. The discount rate is determined solely by the difference between the growth rate used to augment earnings over time and the rate of return expected on invested capital. This difference merely reflects differences in their respective real rates if they adjust to inflation by equivalent amounts.[8] Therefore, the appropriate discount rate can be estimated by obtaining forecasts of the productivity gains in wages and real returns on investments. This approach produces more reliable estimates than the alternative nominal approach since productivity gains and real investment on diversified portfolios are relatively stable over time.

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[8] For example, assume wages grow at 3 percent and investments yield 4 percent in an economy with no inflation. Our discount rate would then be 1 percent (4% return on investment less a 3% growth in wages). If inflation was forecast to grow at 10 percent the following year, one would expect workers to demand a wage increase of 13 percent (or a real growth in income of 3 percent after adjustment for inflation). Similarly, investors would demand a 14 percent yield on securities in order to realize the same "real" return of 4 percent. The discount rate appropriate in this inflationary economy is still 1 percent, but can now be obtained one of two ways: 1) deducting the growth in nominal wages from the nominal rate of return on investment, or 2) deducting the growth in real wages from the real rate of return.

In summary, it is unnecessary to forecast inflation in order to arrive at an equitable lump sum settlement. The discount rate required for these calculations can be reasonably approximated by observing the past behaviour of labour income and investment returns, where both have been adjusted for inflation.

B. *Earnings Performance*

Evidence is presented in this section which suggests that the past rate of growth in earnings has equalled (and at times exceeded) the rate of return that investors have realized on relatively riskless investment portfolios. Therefore, a relatively low net discount rate is recommended in cases involving lost earnings. In other cases where only extra living costs are at issue the appropriate rate may reflect only real investment returns as no offset is required for real earnings growth.

While it is difficult to forecast the rate of growth applicable to the foregone earnings stream of a specific individual, data on past wage growth for a number of industrial sectors and the individual's own salary history should provide some guidance. National averages for the construction, manufacturing, and service sectors are shown in Appendix V. Wage growth in these sectors has moved within a fairly narrow range of two to five percent since 1920. Earnings performance in the professions has been very similar [See Appendix VI.] Resource constraints and other disruptive structural changes make smaller productivity gains probable over the immediate to medium-term; however, a conservative range of one or two percent for real wage growth, especially over the long-term, is not unrealistic.[9]

Three significant factors which usually favour even higher growth rates should be noted. First, there is reason to believe that many workers experience higher rates of growth in their earnings than the data above would suggest, since earnings improvement via promotion and other forms of career advancement is ignored.[10] Age-earnings profiles indicate that experience and promotion increments accelerate earnings growth by an extra two or three percent in the first few years of work and then gradually diminish.[11]

The second factor is related to pensions and fringe benefits. The data also excludes those items which are an increasingly important component of most workers' total compensation package. Fringe benefits have grown more rapidly than the wage portion of earnings.

Finally, the relevant growth rate for our calculations is the rate at which

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[9] See Institute for Policy Analysis and Data Resources of Canada, 4 *Canada Review*, No. 2, (Toronto: University of Toronto, 1976). Informetrica Ltd., *The Canadian Economy of 1986*, Post-Workshop 11, 1976. (Ottawa, Informetrica, 1976). Eyford and Cain, *Simulation with CANDIDE to the Year 2000* Discussion Paper No. 89, (Ottawa: Economic Council of Canada, 1977).

[10] Dick, *Determining the Present Value of Future Income: Selecting Income Growth Rates* (1974), 41 J. Risk and Ins. 729. Harris, *Selecting Income Growth and Discount Rates in Wrongful Death and Injury Cases: Comment* (1977), 44 J. Risk and Ins. 117.

[11] Millar and Hornseth, *Present Value Estimated Lifetime Earnings*, Technical Paper 16 (Washington: Bureau of Census, Dept. Commerce, 1967).

the lost earnings increase. This is not necessarily consistent with the growth rate observed in the plaintiff's pre-accident occupation. If the victim is able to continue working in some alternative employment, one must focus on the difference between his pre- and post-accident earnings streams. An example will clarify this final point.

Let the plaintiff's pre-accident earnings be $10,000 initially and further assume that these earnings would have grown at four percent a year. If his earnings in an alternative job begin at $5,000 and grow at two percent a year, then the appropriate earnings adjustment factor is a variable rate and is not the four percent associated with his previous job or the two percent associated with his present job. In the first year the loss will grow by a rate of six percent, but it will grow at a declining rate in future years.

C. *Investment Performance*

The real rates of return needed to discount the growth adjusted income stream can be obtained in one of two ways. The "historical approach" focuses on the averages of past real rates of return and modifies these figures, where required, to accommodate any peculiarities which the forecaster believes will distinguish the future period from earlier years. The "inflation forecast approach" uses the nominal yields currently observed on long-run bonds and then adjusts these returns by the forecast rate of inflation. Both methods will produce the same rates if consistent assumptions are made concerning inflation.

Despite this apparent equivalence, we believe that the "historical approach" produces much more reliable projections. The "inflation approach" is more susceptible to serious forecasting errors because of its reliance on an accurate forecast of inflation to obtain the required real rates.[12] It is interesting to note, nevertheless, that even this approach yields real rates of only 4.0 to 4.5 percent for the forty year investment horizon under consideration here, when the "optimistic" inflation forecasts contained in Appendix IV are applied to the high nominal yields now offered on long-term government bonds.[13] While these figures are much too high for fixed income returns they provide a benchmark for comparisons with the "historical" results described below.

Researchers have recently completed a comprehensive investigation of the investment returns realized on several alternative investments in the United States.[14] Total returns on common stocks, corporate bonds, long-term government bonds, and Federal Treasury bills were analyzed over the period 1926 to 1976 and all possible sub-periods. The results showed that returns were sensitive to the riskiness of the particular investment.[15] [See Appendix

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[12] See Section A, *supra.*

[13] These figures assume that inflation will average a conservative 4 percent in the thirteen years following 1985, and that bond yields over the remaining twenty or twenty-five years average a generous 2 percent, net of inflation.

[14] Ibbotson and Sinquefield, *Stocks, Bonds, Bills and Inflation: The Past (1926-1976) and the Future (1977-2000)* (Chicago: Financial Analysts Research Foundation, 1976).

[15] *Supra* note 14.

VII.] Treasury bills, which have a fixed interest return, a short maturity and no default risk had a 2.4 percent average nominal return. Since average inflation was 2.3 percent per annum from 1926 to 1976, the real return from holding this security was approximately zero. Long-term government bonds, which subject the investor to more risk,[16] had a very small positive real yield while long-term corporate bonds which are more likely to default carried a slightly larger return. Only when most of the investor's portfolio was composed of common stock did returns become significantly positive in real terms.

When the analysis was replicated with Canadian data, the results were almost identical.[17] [See Appendix VIII.] Returns adjusted for inflation were all negative for Treasury bills, government bonds, and corporate bonds over the 1937-1976 period.[18] Moreover, these results are not particularly sensitive to the investment period over which they are calculated. When the same calculations are made for the buoyant post-war period, real returns on common stocks are marginally higher, but real returns on the other fixed income securities are virtually unchanged.[19] [See Appendices IX and X.]

Since a portfolio composed entirely of common stocks subjects the investor to tremendous risk, it is an inappropriate substitute for a secure income stream. A balanced portfolio composed of bonds and stocks, displaying a modest level of risk, cannot be expected to earn more than a three to four percent real return. If the portfolio is dominated by fixed income securities such as bonds, the rates should be slightly lower. Transaction costs and management fees involved in investing funds will also reduce the rates.

III. ESTIMATION OF VALUE OF UNPAID EMPLOYMENT

Many of the products and services produced in our economy originate from non-market activities through "unpaid" employment. Examples of this are the housework performed by a spouse and the supervision of children by a parent. The economic losses sustained by victims of disabling accidents and their dependents often include lost domestic services and the foregone benefits of other non-market work. These losses should be incorporated in the award.

Three methodologies are commonly used to measure the value of unpaid employment: the "opportunity cost" approach, the "individual-function-cost" approach and the "third-party substitute" approach.[20] Functions are categorized and average times are assigned to each according to the socio-economic characteristics of the household. The methodologies differ with respect to the wages which are used to convert the hours worked into annual dollar equivalents.

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[16] *Id.*

[17] Williamson, *Rates of Return on Stocks and Bonds: Historical Comparisons* (unpublished manuscript, U.B.C. Fac. of Comm. & Bus. Admin., 1977).

[18] *Supra* notes 14 and 17.

[19] *Id.*

[20] Adler and Hawrylyshyn, *Estimates of the Value of Household Work Canada, 1961 and 1971* (1978), 24 Rev. of Income and Wealth 333.

The first approach assumes that a utility maximizing individual adjusts his or her allocation of time so as to equalize the "return" to time invested at the margin in each activity.[21] This process implies that "unpaid" work in the home should be valued at the same wage rate the individual receives, or would receive, for a marginal hour of paid work outside the home. Obviously there are certain theoretical and practical problems associated with this procedure. Individuals probably do not place equal subjective values on all their activities. Furthermore, few people are able to freely adjust their hours of work and the hours devoted to certain other activities. Institutional constraints and other forms of "fixedness" make it difficult to trade-off paid and unpaid employment.

The second approach multiplies the hours of unpaid work of the individual by the average wage paid to persons outside the home who perform similar functions. For example, the time estimated for house cleaning is multiplied by the hourly wage received by professional cleaners and the time estimated for dishwashing is multiplied by the hourly wage received by dishwashers at a restaurant. In this way each function has a unique wage assigned to it, and total value becomes a weighted average of the components.[22]

The third approach is somewhat simpler. It merely asks what one would have to pay a housekeeper or repairman to perform all the services previously provided by the injured party or the deceased.[23] The value generated with this last approach is usually more conservative than others.

Whichever measure is selected, it is important to remember that all the services provided by the unpaid employment were essentially tax-free before the accident. After the accident they must be paid out of investment returns which are taxable.

IV. ACTUARIAL EVIDENCE: THE MORTALITY ASSUMPTION

In the *Andrews* case Dickson J. conceded that "[s]o long as we are tied to lump-sum awards, however, we are tied also to actuarial calculations as the best available means of determining amount."[24] Although there are a number of articles which describe the basis of actuarial calculations,[25] it is clear that the courts often have serious problems in accepting and understanding this type of evidence. Sometimes there is reluctance in accepting actuarial evidence with regard to the survival prospects of the plaintiff on

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[21] Hawrylyshyn, *Estimating the Value of Household Work in Canada, 1971* (Ottawa: Stats. Can., 1978).

[22] Hunt and Kiker, *Valuation of Household Services: Methodology and Estimation* (1979), 46 J. Risk and Ins. 697.

[23] The courts seem to be using this latter approach, see *e.g.*, *Franco* v. *Woolfe* (1976), 12 O.R. (2d) 549 at 552, 69 D.L.R. (3d) 501 at 504 (C.A.).

[24] *Supra* note 1, at 236-37 (S.C.R.), 458 (D.L.R.), 230 (C.C.L.T.).

[25] See, *e.g.*, Prevett, *Actuarial Assessment of Damages* (1968), 94 J. of Inst. of Actuaries 293; Howroyd and Howroyd, *The Assessment of Compensation for Loss of Support* (1958), 75 South African L.J. 65; Callisbird, *Damages in Personal Injuries Cases*, Woodsworth ed., (Vancouver: UBC Centre for Continuing Education, 1978); Traversi, *Actuaries and the Courts* (1956), 29 Aust. L.J. 557.

the grounds that the actuary uses statistics and averages developed on the basis of a large population. That is, the plaintiff is a particular individual and there is often a desire to have the projections based or related to his particular characteristics. During the discussion of Mr. Prevett's paper to the Institute of Actuaries this point was clearly expressed by Mr. Gilley, a consulting actuary.

It was at this point, he suspected, that some judges said,

> "Ah, but we are not dealing with the average man, we are dealing with the plaintiff, and there is in consequence, no way in which an actuary can help us." ... If the actuarial calculation were rejected it would only be rejected on the grounds that the plaintiff did not have the same characteristics as the group of individuals whose experience in relationship to the relevant contingencies was the foundation for the assumptions on which the calculation was made. If, however, the relevant points of difference between the characteristics of the plaintiff and those of the group could be identified, it should be possible to modify the experience of the group in such a way as to make the actuarial calculation appropriate once more. That was a process familiar to every underwriter.[26]

At this stage it may be useful to analyse the impact of the mortality factor using a set of illustrative calculations. Table 1 contains figures for the lump sum equivalent of an amount of $1,000 per annum payable in the case of a male life starting at different ages and using various interest rates. It is assumed for convenience that the $1,000 is payable at the end of each year if the life is alive and that consequently the payments are made for life. The interest rates used correspond to the net discount rates which were analysed in Part II.

Table 1 — Present Value of $1000 per annum at different interest rates assuming 1975-77 Canadian Life Table (Males) mortality and payments made for life.

	Interest rate percentage per annum							
Age	0	1	2	3	4	5	6	7
20	$51593	$39503	$31177	$25282	$20996	$17800	$15361	$13458
30	42396	33837	27617	23002	19507	16810	14690	12995
40	33093	27512	23238	19913	17289	15187	13482	12081
50	24358	21055	18393	16226	14442	12960	11715	10661
60	16735	14995	13526	12275	11202	10278	9474	8773
70	10549	9758	9060	8441	7890	7398	6956	6558
80	5942	5644	5370	5118	4887	4673	4476	4292

Table 1 indicates that for a given interest rate assumption the present value of the stream of future payments decreases with age. The older a person is, the shorter the expected period during which the payments will be made. This Table also illustrates, however, the dramatic impact of changing the interest rate assumption from the figure of two percent, which is in line with the economic analysis in this paper, to the seven percent per annum employed in the four landmark Supreme Court decisions. For example, in the case of a male aged twenty, assuming an initial payment of $20,000 per

[26] Prevett, *id.* at 325-26.

annum; the present value of such a lifetime payment stream at a two percent discount rate is

$$20 \times 31177 = \$623{,}540.$$

If, however, the interest rate is raised to seven percent per annum, then the revised value of this payment stream becomes

$$20 \times 13458 = \$269{,}160.$$

This represents a reduction of fifty-seven percent and highlights the critical role played by the economic assumptions employed in the valuation procedure. By the same token it confirms the importance of economic evidence in cases involving the assessment of damages.

In order to give a compact representation of the mortality experience reflected in a particular life table, the concept of "the expectation of life" is used. This is a very useful concept and it is extremely helpful to the courts. It is, however, a summary statistic and does not embody all the characteristics and features of a given mortality table. Put another way, the expectation of life for a male aged twenty could be the same under two different mortality tables. The fact that the "expectation of life" for a male aged twenty under the 1975-77 Canadian Life Table is 51.593 can be visualized as follows.[27]

Imagine a large group of males all aged twenty. For each life the additional years of life are counted. The average of this series is the expectation of life: 51.593. If half of the large group of twenty year old lives died at age fifty while the other half died at age ninety the expectation of life would be the average of thirty and seventy, *i.e.*, fifty. In practice of course there is a probability of death at each age. Using the same mortality assumptions and ages as Table 1 the expectations of life are given in Table 2.

Table 2 — Expectation of life on the basis of 1975-77 Canadian Life Table (Males)

Age	Expectation of life (in years)
20	51.593
30	42.396
40	33.093
50	24.358
60	16.735
70	10.549
80	5.942

Sometimes the Courts value an income stream by taking first the life expectancy in question and then computing an "annuity certain"[28] for a period equal to the life expectancy in question. This procedure is not strictly accurate from a purely theoretical point of view. This is because the life expectancy, being an average figure, does not uniquely capture the year by

[27] This is the "curtate" expectation of life and is 6 months below the actual expectation of life normally used.

[28] "Annuity certain." This is a well-defined actuarial concept referring to a stream of periodic payments that are payable for a fixed period. Unlike a life annuity these payments are not contingent upon the survival of a given individual. Hence, it can be valued using just pure compound interest functions.

year variations in the survival probabilities. If this approach is used the resulting figures will be higher than the correct ones, except in the case of a zero discount rate where they coincide. Table 3 gives the valuation factors or multipliers when this approach is employed. If one compares Table 3 with Table 1 it will be noted that the differences between corresponding entries are not too large. The average error in using the life expectancy approach (Table 3) results in an overstatement of the true value by about forty-six percent.

If the payment streams had ceased at age sixty-five instead of continuing for life, the difference between these two approaches becomes even less. The courts sometimes include a specific deduction to allow for the plaintiff's early death. If the valuation procedure has been properly carried out as in Table 1 it would appear that this is completely incorrect. The survival probabilities embodied in the calculation already include a specific allowance to cover the possibility of early death; thus, this procedure involves double counting.

Table 3 Value of $1000 per annum when an annuity certain corresponding to the plaintiffs life expectancy is used. (Same parameter values as Table 2)

	Interest rate percentage per annum							
Age	0	1	2	3	4	5	6	7
20	$51593	$40152	$32000	$26080	$21695	$18386	$15842	$13850
30	42396	34417	28405	23813	20260	17473	15257	13475
40	33093	28057	24037	20800	18173	16021	14243	12763
50	24358	21523	19133	17108	15383	13906	12635	11537
60	16735	15339	14104	13007	12031	11160	10381	9681
70	10549	9965	9426	8929	8471	8046	7653	7288
80	5942	5741	5551	5369	5197	5034	4878	4729

Sometimes additional medical evidence indicates that the plaintiff's life expectancy has been reduced and the court attempts to obtain the value of an award by adjusting figures already calculated on the basis of normal mortality. Care is needed here because the "obvious" approach is not always correct. Suppose that the life expectancy has been reduced from thirty years to twenty years. It would be natural to assume that the revised award would be two thirds of the original award. This is only the case if a zero net discount rate has been used. The life expectancy of a male aged thirty from Table 2 is 42.396 years whereas the corresponding figure for a male aged forty is 33.093. Thus, there is a reduction in life expectancy of 9.303 years if, as a result of an accident, a thirty year old male can be expected to have the mortality experience corresponding to a forty year old male. Since the ratio of 9.303 to 42.396 is .2194 there has been a 21.94 percent reduction in the plaintiff's life expectancy. Using the figures in Table 1 one can compute the revised values of the lump sum equivalents of $1000 per annum under both sets of mortality assumptions.

Table 4 shows the value of $1,000 per annum under both sets of mortality assumptions and various net discount rates: the percentage reduction in the award by using the heavier (older) mortality assumption is given in the final column. Note that as the net discount rate used increases the amount of this percentage reduction decreases. Thus, if a three percent discount rate is used the actual reduction is 13.4 percent and it would be incorrect to use a

21.9 percent reduction. The rationale for this difference lies in the fact that under the operation of compound interest payments made at points in the distant future count for less than payments made in the near future (as long as a positive net discount rate is used).

Table 4 Changes in lump sum awards corresponding to lifetime payments of $1000 per annum resulting from increased mortality in the case of a male aged 30 (Values from Table 2)

Interest Rate	Value of $1000 per annum		
% p.a.	Old Basis (Normal mortality) (age 30)	New Basis (Increased mortality) (age 40)	Correct Percentage Reduction
0	$42396	$33093	21.9
1	33837	27512	18.7
2	27617	23238	15.9
3	23002	19913	13.4
4	19507	17289	11.4
5	16810	15187	9.7
6	14690	13482	8.2
7	12995	12081	7.0

It is worth pointing out that the relative error involved in reducing the lump sum value calculated on the basis of the normal mortality assumption by a factor corresponding to the reduction in life expectancy increases with the interest rate used. If a seven percent interest rate assumption is employed and the "correct" assumption is two percent then this approach aggravates the error already present.

A similar type of error can result when attempting to modify an award for loss of prospective earnings by amending a figure which is based on one assumed retirement age to adjust for a lower retirement age. Figures may be available on the basis of retirement at age sixty-five when figures based on age sixty are required. [See Tables 5 and 6.] The entries on Table 6 are smaller reflecting the shorter time period until retirement.

Table 5 Lump sum equivalent of $1000 per annum payable until age 65 or earlier death based on Canadian Life Table Mortality 1975-77 (Males)

Male Age	Interest Rate percentage per annum							
	0	1	2	3	4	5	6	7
20	$41703	$33745	$27793	$23275	$19796	$17077	$14921	$13189
25	37069	30673	25745	21902	18869	16448	14493	12896
30	32338	27369	23423	20260	17701	15611	13889	12457
35	27576	23873	20842	18344	16270	14536	13075	11837
40	22848	20235	18030	16159	14565	13198	12021	11001
45	18196	16486	14998	13699	12561	11560	10676	9894
50	13647	12650	11756	10952	10227	9572	8979	8441
55	9195	8703	8266	7862	7486	7138	6813	6511
60	4697	4562	4432	4308	4190	4077	3968	3864
65	—	—	—	—	—	—	—	—

Table 6 Lump sum equivalent of $1000 per annum payable until age 60 or earlier death based on Canadian Life Table Mortality (1975-77 Males)

Male Age	Interest Rate percentage per annum 0	1	2	3	4	5	6	7
20	$37844	$31228	$26144	$22190	$19079	$16601	$14604	$12977
25	33174	28003	23907	20632	17989	15836	14065	12596
30	28414	24541	21378	18777	16622	14823	13311	12032
35	23620	20877	18567	16611	14946	13522	12297	11238
40	18850	17053	15491	14129	12937	11891	10968	10151
45	14131	13085	12148	11306	10547	9863	9243	8682
50	9467	8975	8521	8099	7708	7345	7008	6693
55	4803	4663	4530	4403	4281	4165	4053	3946
60	—	—	—	—	—	—	—	—

Consider a male aged forty with an expected retirement age of sixty-five. On the basis of Table 5 the lump sum equivalent or present value of a $1,000 per annum income stream, assuming a two percent per annum net discount rate, is $18,030. If there is additional evidence that suggests that sixty is the appropriate retirement age, then it might be tempting to reason as follows: with a retirement age of sixty-five there were twenty-five years left and with a retirement age of sixty there are only twenty years remaining. By taking 20/25 or eighty percent of the amount of $18,030 one obtains the revised figure of $14,424, whereas the accurate figure from Table 6 is $15,491. This discrepancy arises because the short cut approach takes into account neither mortality nor compound interest. It can be contended that the short cut approach gives an answer that is approximately correct and since there are many imponderables strict precision is not required.

There seems to be strong grounds, however, for performing accurately those calculations which can be carried out exactly even though there may be considerable uncertainty regarding some of the underlying assumptions. More importantly, several of the short cut approaches involve a bias and their cumulative impact can be substantial.

Both Tables 5 and 6 serve to reinforce the point made earlier concerning the impact of the net discount rate assumption on the value of the future earnings stream. In the case of a male aged twenty, with an initial wage level of $20,000 the present value of the future earnings stream, assuming a two percent per annum net discount rate and retirement at age sixty-five, is

$$20 \times 27793 = \$555{,}860.$$

If, instead, the retirement age is assumed to be sixty, then the revised amount is

$$20 \times 26114 = \$522{,}280.$$

If, however, the net discount rate employed is changed from two percent per annum to seven percent while retaining the retirement age of sixty-five, then the consequences are much more dramatic. With the seven percent per annum assumption the present value is

$$20 \times 13189 = \$263{,}780.$$

For an older life the changing of the retirement age assumption becomes more significant. For example, for a male aged fifty-five earning $45,000 per

annum the present value of future earnings on the basis of a retirement age of sixty-five and a net discount rate of two percent per annum is

$$45 \times 8266 = \$371,970.$$

If, instead, a retirement age of sixty is assumed, the revised figure is

$$45 \times 4530 = \$203,850.$$

Notice that in this case raising the net discount rate has a smaller but still substantial impact. If the net discount rate is seven percent per annum instead of two percent per annum and the same retirement age of sixty-five is used for both calculations, the amount of the award declines from $371,970 to $292,995.

V. TAX COMPLICATIONS

It seems as if many plaintiffs have been undercompensated because the courts have either failed to adjust their awards for tax considerations or have done so in a "lopsided" inequitable fashion. Victims in personal injury cases typically have their awards based on gross of tax pecuniary damages, while awards in fatal accident situations are based on after-tax losses.[29] In the former, the courts have justified the "gross approach" with two seemingly reasonable but quite spurious arguments. The net impact of taxes is probably minimal, they suggest, as both the lost earnings and compensating investment income streams are taxable. Also, future tax legislation is an uncertain thing —difficult, if not impossible, to forecast.

This attitude is at variance with the facts and inconsistent with the stance adopted by the courts in other even more speculative matters. Major tax revisions are legislated very occasionally, so the present tax provisions would seem to offer a reasonably accurate (though perhaps conservative) guide to future tax obligations. The courts are willing to entertain and act upon highly speculative admissions regarding inflation and other uncertain economic conditions yet they dismiss tax projections as extremely unreliable. The impact of taxation on the net economic benefits realized by the plaintiff in personal injury cases has been ignored in the past. If our objective is to fairly compensate the victims of serious accidents and fatalities it befits us to take a less cavalier and defeatist attitude towards the necessary tax adjustments.

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[29] This is the approach suggested by Dickson J. in *Andrews, supra* note 1, at 259-60 (S.C.R.), 475 (D.L.R.), 250-51 (C.C.L.T.). The Supreme Court followed the decision in *R.* v. *Jennings*, [1966] S.C.R. 532, 57 D.L.R. (2d) 644, in that no deduction was to be made for taxes which would have been paid from the income. They, however, did not allow any sum for future taxes on the capital sum. This was based on the argument that the court in a personal injury case is compensating the plaintiff for a loss or diminution of earning capacity, not for loss of earnings. On the other hand, the court held that tax would be taken into consideration in fatal injury cases because, in that circumstance, the court is compensating the plaintiff for loss of support payments; these support payments come from the deceased's earnings but only after tax and the deceased's personal expenditure were deducted. Secondary reasons for this method lay in the problem with determining the tax burden because "rate and coverage of taxes swing with the political winds." (*Andrews, op. cit.*, at 260 (S.C.R.), 475 (D.L.R.), 251 (C.C.L.T.) *per* Dickson J.)

This approach was also followed in the two personal injury cases: *Arnold, supra* note 1; *Thornton, supra* note 1; and the fatal injury case *Keiser, supra* note 2.

Only coincidentally will the tax effects impinging on the foregone earnings stream and the substitute investment income stream cancel one another. The plaintiff may actually be over-compensated by the gross approach when the award spans a very short time period.[30] In this case most of the compensation is received as tax free capital from the award rather than as taxable investment income. Such occurrences, however, are the exception and not the rule. Most awards involving significant sums of money span a longer period of time in which the plaintiff faces onerous tax liabilities on the investment income forming the bulk of his or her compensation.

The lump sum settlement is made according to an exhausting fund principle. Much of the interest earned in the early years must be reinvested in order to accumulate enough capital to provide for income in later years. The progressive nature of our tax system means, however, that a significant portion of these large initial returns will be lost to taxes. The interest subsequently earned on the reinvested income will also be subject to tax. In short, the plaintiff loses a considerable part of the settlement due to the effects of a progressive tax system and the double taxation of his investment income.

This inequity is further aggravated because the tax system fails to distinguish between real and nominal interest rates. Although the present tax system gives favourable treatment to realized capital gains and dividends received from Canadian corporations, these advantages can be offset by the discriminatory treatment accorded to interest income. By taxing nominal interest rather than real interest, the system is actually taxing both the income and the capital of the investor. Part of the nominal interest rate is an adjustment for inflation, compensating the lender for the eroded purchasing power of the dollars used to repay his principal. In order to receive the same after-tax income in an inflationary economy as one could in an economy with complete price stability, the investor must demand a nominal interest rate that is increased by $\frac{1}{1-t}$ percent for every one percent in inflation (where t is the investor's marginal tax rate). Evidence to date indicates that such an adjustment is seldom observed in the market, thus implying a lower net of tax real income for holders of debt in inflationary periods.[31]

The award must be adjusted to reflect these important tax considerations. Net of tax losses should be equated with net of tax compensation. The experience in past cases suggests that the adjustment can often be substantial. The adjustment depends on the "life" of the award, the net discount rate selected, and the base period loss.[32] When a portion of the pecuniary loss is explicitly or effectively after-tax in nature, the required

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[30] Krishna, *Tax Factors in Personal Injury and Fatal Accident Cases: A Plea for Reform* (1978), 16 Osgoode Hall L.J. 723 at 727.

[31] Pesando, *The Impact of Inflation on Financial Markets in Canada* (Montreal: C. D. Howe Research Inst., 1976) at 31.

[32] Patterson, *Effective Presentation of Actuarial Evidence in Permanent Disability Cases* (1979), 37 Advocate 13 at 21-35 provides a detailed discussion of the procedures needed to obtain "tax adjusted" awards. Rea, *Inflation, Taxation and Damage Assessment* (1980), 58 Can. B. Rev. 280 at 286-97 provides an analysis of the impact of taxation on damage awards.

adjustment is even higher. For example, individuals receiving compensation for the costs of future care and additional living expenses are now paying for services which were essentially tax free before their accidents as they were "self-produced." While most medical bills are tax deductible, some part of the expenses related to future care and additional living expenses are not (*e.g.*, extra costs related to recreation and travel). The tax penalty is even more severe in the case of fatalities. All cases are calculated on an after-tax basis, but they are matched with a gross of tax present value sum. Inadequate recognition is given to the taxes payable on the investment income generated by the award.[33] It is surprising that this glaring asymmetry has not received more attention.

VI. CASE STUDY

In this Part an illustrative case is presented and discussed. This exercise serves to highlight many of the points made earlier and also helps to illustrate some additional practical points.

A. *Background*

Pierre, a twenty year old male, was injured in an automobile accident and sustained spinal cord injuries which rendered him a paraplegic. Prior to the accident he was employed full-time as an electrician earning $30,000 per annum. It is estimated that Pierre may be able to carry on some form of "bench-work" (for example, television repairs) for which the current wages are approximately $10,000 per annum. The assessment of pecuniary loss involves estimating his lost earnings and additional living expenses.

For convenience, there is discussion of the various elements that enter into the computation of pecuniary loss under different subheadings.

B. *Earnings Performance*

Pierre's earnings performance over the period comprising his expected work life would have been influenced by his past experience, his occupation, his chances for promotion, and general economic conditions.

As was mentioned above, Pierre was a fully apprenticed electrician at the time of the accident. His gross wage rate was $12.30 per hour exclusive of benefits and overtime. After the addition of fringe benefits his wage was $15.38 per hour (roughly twenty-five percent higher). On an annual basis this works out to approximately $30,000. His best alternative job following the accident is a salaried position repairing televisions at $10,000 per year (inclusive of benefits). Pierre's base period loss is therefore $20,000.

The annual rate of growth in the real wages of electricians was 2.5 percent from 1963-79. Adverse medium-term trends[34] recommend scaling this figure, but one must also allow for the additional wage growth common-

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[33] *Julian, supra* note 7. In this case, the plaintiff was awarded an increase of 25% of the award to offset the amount of tax due on the amount of income earned from the award.

[34] See Part II B, *supra*.

ly observed among younger workers. A real adjustment factor of two percent seems reasonable, if not a bit conservative. Since there is no clear indication as to the earnings growth Pierre could expect in his alternative job a similar value was assumed. The implied growth rate for lost real wages is therefore two percent.

C. *Investment Returns*

A portfolio diversified to include fixed income securities and common stock is recommended in order to provide a secure investment income stream and to act as a buffer against unanticipated inflation.[35] Based on the historical data, a three percent real rate of return on investment seems appropriate. The transactions costs related to brokerage, fiduciary services and counselling, are ignored here for ease of exposition. In actual cases the importance of these changes should not be minimized. Their combined effect could be significant.

D. *Net Discount Rate*

A three percent real rate of return on investment less a two percent growth rate for real wages produces a net discount rate of one percent to be applied to Pierre's lost earnings.

E. *Additional Living Expenses and Health Care Costs*

Pierre's permanent disability will not only reduce his expected earnings; it will also force him to bear additional living expenses and health care costs.

Some of the costs incurred by Pierre are once-and-for-all expenditures that will not have to be repeated in the future;[36] others are continuing expenditures. The latter will increase over time as inflation and rising wages affect the prices of medical supplies, equipment and labour services. In order to adequately compensate Pierre for these escalating costs one must include some adjustment for inflation and wage growth in the health care and living expense projections. Like foregone earnings, the adjusted costs must be discounted at a realistic rate of return to determine the lump sum equivalent in current dollars.

The initial outlays classified as "once-and-for-all" totalled $5,500. The yearly or "continuing" expenditures totalled $13,500. The continuing expenditures can be further classified, however, according to their wage versus price sensitivity.

Some expenditures such as those for medical supplies, equipment, household items, and transportation are closely tied to the general price increases (*i.e.*, movements in the consumer price index). Other expenditures, such as support services and the cost of a travelling companion represent labour services, the costs of which increase with wages and salaries. Since

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[35] The slight negative correlation between the real returns generated by the two investment categories stabilize total returns and reduce overall risk.

[36] This includes such things as modifications to Pierre's house to accommodate moving about in a wheelchair.

wages and salaries are expected to increase by more than the rate of inflation, these expenditures will grow at a faster rate than the "goods" expenditures.

The two percent differential is accounted for by the productivity component in labour services. "Goods" prices can be proxied by increases in the consumer price index. The net discount rate in this case is simply the real rate of return on investment.

F. *Tax Complications*

These important adjustments will be passed here in order to simplify the analysis. Their impact should not be underestimated, however.

G. *Mortality Assumptions*

It seems appropriate, and in line with current practice, to evaluate Pierre's lost earnings as an electrician on the basis of his pre-accident mortality. The 1975-77 Canadian Life Table (Males) has been used for this computation. The 1978 Supreme Court decisions confirm that the lost earnings should be based on the plaintiff's pre-accident mortality.[37]

In the present case, however, the plaintiff is expected to have some residual earnings. It would seem much more realistic to use the plaintiff's estimated post-accident mortality in computing the lump sum equivalent of these residual earnings. The lump sum equivalent of these residual earnings will be deducted from the lump sum equivalent of the pre-accident earnings since it is this difference which represents the value of lost earnings.

Similarly, the value of future health care and additional living expenses should be computed using the best possible estimate of the plaintiff's future mortality. In the *Andrews* case both the Court of Appeal and the Supreme Court pointed out that it would have been more useful and accurate to use statistics relating to the expectation of life of quadraplegics.[38]

A recent article in the *Archives of Neurological Science* dealing with the survival rates of spinal cord injury patients is of considerable interest.[39] Paraplegic patients experience higher mortality rates than the population in general. This paper shows that the highest mortality occurs in the first year after the accident and, in particular, the first few months after the accident. The likelihood of survival is influenced by both the age at the time of injury and the level of the lesion. In many personal injury cases the trial often takes place over a year after the accident by which time the plaintiff has survived the most critical period even though his future life expectancy will normally have been reduced. In the case of Pierre, it has been assumed that his post-

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[37] English courts have at last come around to this viewpoint as well: *e.g.*, *Pickett* v. *British Rail Engineering Ltd.*, [1980] A.C. 136, [1978] 3 W.L.R. 955, [1979] 1 All E.R. 774 (H.L.).

[38] *Andrews, supra* note 1, at 249 (S.C.R.), 467 (D.L.R.), 241 (C.C.L.T.); [1976] 2 W.W.R. 385 at 419-20, 64 D.L.R. (3d) 663 at 695-96 *per* McGillivray C.J.A. (Alta C.A.).

[39] Mesard *et al.*, *Survival After Spinal Cord Trauma* (1978), 35 Arch. Neurological Sci. 78.

accident mortality will correspond to that of a male aged thirty years. Referring back to Table 2, as a result of the accident his life expectancy has been shortened from 51.59 years to 42.40 years, a reduction of 9.19 years.

H. *Other Contingencies*

Under this heading are grouped all those events which might have affected Pierre's future earnings or which might affect the cost of future care or the extent to which he will be able to earn income in his post-accident state. Clearly, there are a large number of factors that will have a bearing on this. Currently the courts tend to make an arbitrary deduction of twenty percent to allow for future contingencies. Three points can be made in this connection. First, not all the contingencies are adverse. Second, the estimation of the amount of the deduction seems to be much more of an art than a science. Third, there do not appear to be any compelling reasons for applying the contingency factor to the cost of future care if an accurate estimate of the plaintiff's future mortality has been made.

Essentially, the contingency adjustment is applied to cover the impact of deviations from the assumptions and to allow for other factors that have not been explicitly included. In both cases a more scientific approach is available although it does not appear to be used often. In the case of Pierre, suppose it is felt that there is a possibility that the retirement age may be sixty and not sixty-five. If an estimate of this probability can be made, then it would seem appropriate to incorporate such an estimate in the actual calculations. For example, suppose that there is an equal probability of 0.5 that retirement will take place at age sixty or at age sixty-five. Under the mortality and interest assumptions set out in Sections B, C, and H the capitalized value of $1,000 per annum payable from age twenty to age sixty is $31,228. [See Table 6.] Hence the capitalized value of $30,000 per annum is

$$30 \times 31228 = \$936{,}810.$$

With a retirement age of 65 the value of $30,000 per annum is

$$30 \times 33{,}745 = \$1{,}012{,}350.$$

Hence:

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Capitalized value of $30,000 per annum assuming retirement age sixty-five.	1,012,350
Capitalized value of $30,000 per annum assuming retirement age of sixty.	936,840
Expected capitalized value when there is a .5 probability of either retirement age.	974,595

This last figure of 974,595 is obtained by computing .5(936,840) + .5(1,012,350).

Another example of a contingency is future unemployment. It is suggested that a study of historical trends should prove rewarding in the quest for suitable estimates for the impact of this parameter. In Pierre's case, there seems every likelihood that the demand for skilled electricians will continue for at least the next decade. Even if the plaintiff were to become unemployed in the future, however, the existence of unemployment insurance benefits

serves to cushion the adverse financial impact of unemployment. In Pierre's case the unemployment benefits do not, of course, replace his full earnings.

Moreover, this leads to a more general point relating to the appraisal of the effect of contingencies. Many of the insurance and benefit programmes operated by firms, trade unions and governments have as their principal aim the protection of their members against the adverse financial consequences of death, disability, unemployment and other perils. If the value of these benefits is not included in the estimates of pecuniary loss then this should be taken into consideration in arriving at the appropriate contingency deduction. It seems that the size of the reduction should be reduced considerably in these circumstances. Of course it has to be recognized that many of these benefit programmes are partly paid for by employees and this also has to be taken into account.

The rationale for applying a contingency reduction to the award for the cost of future care seems less clear. If there is a reduction made in this case it must be on the grounds that the expected cost of this item has been overestimated. The argument that this reduction is to take account of the possibility of the plaintiff's early death will not hold if an accurate estimate of the plaintiff's expected mortality is embodied in the calculations.

The present case follows precedent and takes a contingency reduction of twenty percent in the value of lost prospective earnings. In this case it turns out that the use of a twenty percent reduction for contingencies precisely offsets the amount included in Pierre's base earnings to allow for fringe benefits. In other words, the same results would be obtained on the basis of an initial earnings loss of $24,000 per annum and no reduction for contingencies being used. Note that the inclusion of fringe benefits brings his initial earnings up to $30,000 but that the twenty percent reduction brings them back to $24,000. It is not suggested that those factors will always cancel out exactly but this case study incorporates a substantial degree of realism. It strengthens the conviction that in cases where fringe benefits are not included in the computation the Courts should examine the situation carefully rather than blindly apply a twenty percent contingency reduction.

I. *Summary of assumptions and results of computations*

Age of Plaintiff - 20 years		
Current earnings as electrician	$30,000	p.a.
Current earnings after accident	10,000	p.a.
Additional living expenses		
Initial outlays	$ 5,500	
Annual outlays (goods)	4,500	p.a.
Annual outlays (labour services)	9,000	p.a.
Mortality assumptions		
Pre-accident mortality - male age 20	1975-77 Table	
Post-accident mortality - male age 30	1975-77 Table	
Assumed retirement age	65	
Allowance for future unemployment and disability and other contingencies	20% deduction	

I. *Summary of assumptions and results of computations* (continued)

Allowance for fringe benefits lost	Full
Net discount rates used	
Earnings	1% p.a.
Labour services	1% p.a.
Goods Expenditures	3% p.a.
Allowance for Taxation	None
Estimates of Pecuniary Loss	
1. Cost of future care	
(a) Initial Outlays	$ 5,500
(b) Capitalized value of annual outlays on goods (annual amount $4,500)	103,509
(c) Capitalized value of annual outlays on Labour services (annual amount $9,000)	304,533
2. Loss of future earnings	
(a) Capitalized value of pre-accident earnings less 20% contingency factor	$809,880
(b) Less value of residual earnings (less 20% contingency factor)	(251,874)
Total	$971,548

J. *Computation of pecuniary losses using seven percent per annum net discount rate*

This computation shows the tremendous reduction in the size of the award if the net discount rate used to value all future amounts is seven percent per annum.

Revised Estimate of Pecuniary Losses	
1. Cost of future care	
(a) Initial Outlays	$ 5,500
(b) Capitalized value of annual amount of $4,500 at 7 percent per annum	58,478
(c) Capitalized value of annual amount of $9,000 at 7 percent per annum	116,955
2. Loss of future earnings	
(a) Capitalized value of pre-accident earnings (30,000 p.a.) less 20% reduction	$316,536
(b) Capitalized value of residual earnings (10,000 p.a.)	(102,958)
Total	$394,511

Again, this example highlights the profound impact of the net discount rate assumed for the calculations. In Pierre's case the award has been slashed from $971,548 to $394,511, a reduction of $577,037. Note that in this case the impact of the taxation factor has not been taken into account. If the analysis presented in this paper is accepted as being substantially correct then it would appear that the Supreme Court should rethink its position.

VII. PERIODIC PAYMENTS

There are a number of problems with the system of making lump sum awards for loss of earnings and continuing care. In recent years a number of observers[40] have suggested that a system of periodic payments would eliminate some of these difficulties. It should be clear from the preceding parts that there are considerable problems of estimation involved in the determination of the amount of the award. Furthermore, even with the best possible estimates it is highly unlikely that the amount of the award will coincide exactly with the plaintiff's actual needs.

Mr. Justice Dickson has mentioned some of these problems:

> The lump-sum award presents problems of great importance. It is subject to fluctuation on investment; income from it is subject to tax. After judgment, new needs arise and present needs are extinguished; yet our law of damages knows nothing of periodic payments. The difficulties are greatest where there is a continuing need for intensive and expensive care and a long-term loss of earning capacity.[41]

Professor O'Connell is very critical of various aspects of the lump-sum system:

> This is in contrast, of course, to other forms of insurance, such as medical and disability insurance, in which payment is made periodically. This requirement of one lump-sum payment means that when payment is made—if it is made—it covers not only all the losses which have already accrued but also a final estimate of all the losses ever to occur in the future. Once the damages are fixed by a settlement or verdict, the amount ordinarily cannot be reviewed even if it turns out to be woefully inadequate or wildly excessive. This means oftentimes that the settlement process and the trial see the plaintiff's doctor grossly exaggerating the after-effects of an injury while the insurance doctor is equally grossly disparaging them —with the hapless and ignorant jury left eventually to decide between the warring experts.[42]

Recently there has been increasing interest in structured settlements,[43] which involve periodic payments in lieu of or in conjunction with lump sum awards. Such a system would seem to offer considerable advantages. If the payments are designed to continue throughout the plaintiff's future lifetime, the risk of the plaintiff "outliving" the award can be eliminated. One of the other major risks facing an injured plaintiff is the risk of unanticipated future inflation. Again, structured settlements could be set up so as to protect the plaintiff against this risk. To do this properly, the size of the payment should be reviewed periodically and increased in line with some appropriate index (such as the consumer price index or an earnings based index). In our view, it is imperative that this provision be included if such settlements are to accomplish their objectives.

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[40] *E.g.*, Guile, *Actuarial Evidence in the Quantum of Damages in Tort Law* (1975), 10 U.B.C. L. Rev. 251.

[41] *Supra* note 1, at 236 (S.C.R.), 458 (D.L.R.), 230 (C.C.L.T.).

[42] O'Connell, *Ending Insult to Injury* (Urbana: Univ. of Illinois Press, 1975) at 49.

[43] Cave, *Structured Settlements, An Alternative Resolution of Claims Involving Death or Substantial Injury* (1979), 30 Advocate 331; Monopoli, "Sued or Suing: Both May Win with Annuity," *Financial Post* July 19, 1980 at 1-2; Kakosclike, "Damage Awards to use Structured Settlements?", *National* July-August, 1980.

APPENDIX I
INFLATION, WAGE GROWTH AND LONG-TERM BOND YIELDS
1962 - 1980

Year	Inflation[a]	Growth in Hourly Wages[b]	Long-Term Yields[c]
1962	1.2%	2.7%	5.4%
1963	1.8	3.7	5.5
1964	1.7	3.6	5.5
1965	2.5	5.0	6.0
1966	3.7	6.1	6.8
1967	3.6	7.0	7.5
1968	4.1	7.4	8.1
1969	4.5	8.1	9.3
1970	3.4	8.0	8.0
1971	2.8	8.9	8.4
1972	4.8	7.8	8.3
1973	7.6	8.9	8.5
1974	10.9	13.5	10.1
1975	10.8	15.7	10.8
1976	7.5	13.8	10.5
1977	8.0	10.8	9.7
1978	8.0	7.1	10.0
1979	9.1	8.8	10.9
1980	10.1	10.6	13.2
Average	5.4	8.3	8.6

Note that all tables do not simply reprint figures from the tables cited. Rather these figures have been arrived at via an intermediate calculation.

(a) Inflation is measured by the percentage change in the Consumer Price Index (CPI)—derived from Table 1.

(b) Hourly wages in the manufacturing sector—derived from Table 1.

(c) The McLeod, Young and Wier index of long-term industrial bonds—derived from Table 20.

Source: Bank of Canada, *Bank of Canada Review*, Tables 1 and 20, various issues (monthly) (Ottawa).

APPENDIX II
AVERAGE INFLATION RATES IN CANADA: 1915 - 1978

Interval	Inflation	Interval	Inflation
1915 - 1925	4.0%	1925 - 1950	1.3%
1925 - 1935	-2.3%	1950 - 1975	3.5%
1935 - 1945	2.2%		
1945 - 1955	4.5%	1925 - 1975	2.4%
1955 - 1965	1.9%	1915 - 1978	2.9%
1965 - 1975	5.6%		
1975 - 1978	8.4%		

Sources: Bank of Canada, *Bank of Canada Review*, various issues (monthly) (Ottawa). Urquhart and Buckley, *Historical Statistics of Canada* (Toronto: MacMillan, 1965).

APPENDIX III
INFLATION AND PRODUCTIVITY FORECASTS: 1978 - 1985
(all figures in percentages)

	Inflation	Productivity
Department of Finance	8.4 - 9.5	.6
Economic Council of Canada	8.8	1.2
Informetrica	7.3 - 8.3	1.5
Data Resources Inc.	7.9	1.1

Source: Department of Finance. *The Economic Assumptions Underlying the Fiscal Projections of the Budget*, December 11, 1979, at 16, 20. Table 7, p. 16; Projected Percentage Rates of Growth of CPI 1979 to 1985 acts as the basis for Department of Finance's estimates which appear in Table 8, at 20: Main Elements of the Most Recent DRI (Data Resources Incorporated) Informetrica and Economic Council of Canada Projections compared to the Department of Finance Projections 1979 to 1985.

APPENDIX IV
ACTUAL AND FORECAST INFLATION: 1967 - 1981
(all figures in percentages)

Year	Actual	Forecast 1[a]	Forecast 2[b]	Forecast 3[c]	Forecast 4[d]
1967	3.6				
1968	4.1				
1969	4.5				
1970	3.4				
1971	2.8			forecast average inflation of 2.5-3.0% per year	forecast average inflation of 4.5% per year
1972	4.8				
1973	7.6				
1974	10.9	9.9			
1975	10.8	7.7			
1976	7.5	6.5			(versus an actual inflation rate of 6.1% over this period)
1977	8.0	6.5	8.0		
1978	8.9	6.3	6.0		
1979	9.8		5.0		
1980	11.1*		4.3		
1981	n.a.		3.5	(versus an actual inflation rate of 6.9% over this period)	

*Based on 10 months of 1980 and converted to an annual rate.

(a) Medium-term Forecast, Economic Council of Canada, "Economic Targets and Social Indicators," *Annual Review 1971*, Table 7-3 Provisional Forecast of Changes in Consumer Price Indexes, Canada's Principal Trading Patterns, 1974-78, weighted average, at 168.

(b) Medium-term Forecast, Department of Finance, *Canada's Economy—Medium Term Projections and Targets*, February 1978, Table 18. Price, Wage and Unit Labour Cost Scenario 1977-81. Price Percentage Change from Previous Year, at 61.

(c) Long-term Forecast, Economic Council of Canada, *The Years to 1980: The Ninth Annual Review* (Ottawa: ECC, 1972) at 36, Table 4-2, Average Annual Percentage Change in Labour Force and Employment and Average Unemployment Rates.

(d) Financial Post Publications: Habibugahi and Weintraub, "How Much Inflation in the 1970s?" *Financial Post*, January 3, 1970, at 5.

APPENDIX V
ANNUAL GROWTH RATES FOR REAL HOURLY WAGES, BY INDUSTRY

Interval	Construction	Manufacturing	Services
1965 - 1978	5.5%	3.1%	2.1%
1945 - 1978	5.8%	2.8%	2.4%
1920 - 1978	3.1%	2.8%	n.a.

Source: Bank of Canada, *Bank of Canada Review*, monthly (Ottawa). Statistics Canada, *Employment Earnings and Hours*, monthly, (Ottawa). Urquhart and Buckley, *Historical Statistics of Canada*, (Toronto: MacMillan, 1965).

APPENDIX VI
ANNUAL GROWTH RATES FOR REAL INCOMES IN SELECTED PROFESSIONS: CANADA

Interval	Doctors	Lawyers	Accountants	Engineers
1965 - 1975	1.6%	2.8%	4.1%	2.9%
1955 - 1965	4.7%	2.7%	2.5%	1.4%
1950 - 1975	3.0%	2.8%	n.a.	2.3%

Source: Bank of Canada, *Bank of Canada Review*, monthly (Ottawa). Revenue Canada. "Taxable Income by Occupation," *Taxation Statistics*, annual (Ottawa).

APPENDIX VII*
AVERAGE NOMINAL RATES OF RETURN: 1927 to 1976
United States

	Average	Standard Deviation
Common stocks	9.2%	22.4%
L-T Corporate bonds	4.1	5.6
L-T Government bonds	3.4	5.8
Treasury bills	2.4	2.1
Inflation	2.3	4.8

AVERAGE REAL RATES OF RETURN: 1926 to 1976
United States

	Average	Standard Deviation
Common stocks	6.7%	22.6%
L-T Corporate bonds	1.6	11.2
L-T Government bonds	1.0	8.0
Treasury bills	0.0	4.6

* Risk is represented by the standard deviation statistic reported opposite each of the average returns. The higher the standard deviation the more variable (or risky) is the investment return.

Sources: Williamson, *Rates of Return on Stocks and Bonds: Historical Comparisons* (unpublished manuscript, U.B.C. Fac. of Comm. and Bus. Admin., 1977). (Canadian figures) Ibbotson and Sinquefield, *Stocks, Bonds, Bills and Inflation: The Past (1926-1976) and the Future (1977-2000)* (Chicago: Financial Analysts, Research Foundation, 1976). (American figures)

APPENDIX VIII

CANADA

AVERAGE NOMINAL RATES OF RETURN: 1937 to 1976

	Average rate	Standard Deviation
Inflation	3.7%	3.7%
Stocks	8.1	16.8
Government bonds	3.1	5.9
Treasury bills	2.8	2.5

AVERAGE REAL RATES OF RETURN: 1937 to 1976

	Average rate	Standard Deviation
Stocks	4.3%	17.2%
Government bonds	–.6	7.2
Treasury bills	–.8	3.7

UNITED STATES

AVERAGE NOMINAL RATES OF RETURN: 1937 to 1976

	Average rate	Standard Deviation
Inflation	3.6%	4.0%
Stocks	9.5	19.1
Government bonds	2.9	5.6
Treasury bills	2.5	2.2

AVERAGE REAL RATES OF RETURN: 1937 to 1976

	Average rate	Standard Deviation
Stocks	5.7%	20.06%
Government bonds	–.7	7.0
Treasury bills	–1.1	3.6

Sources: Williamson, *Rates of Return on Stocks and Bonds: Historical Comparisons* (unpublished manuscript, U.B.C. Fac. of Comm. and Bus. Admin., 1977). (Canadian figures) Ibbotson and Sinquefield, *Stocks, Bonds, Bills and Inflation: The Past (1926-1976) and the Future (1977-2000)* (Chicago: Financial Analysts' Research Foundation, 1976). (American figures)

APPENDIX IX
AVERAGE NOMINAL RATES OF RETURN IN %

For the decade ending 12/31	CANADA			UNITED STATES		
	Stocks	Govt. Bonds	Corp. Bonds	Stocks	Govt. Bonds	Corp. Bonds
1976	6.28	4.87	6.10	6.63	4.26	5.38
1975	4.41	3.16	3.80	3.27	3.02	3.59
1974	3.32	3.00	2.91	1.24	2.19	2.03
1973	8.93	3.81	4.03	6.00	2.11	2.93
1972	10.51	4.10	4.34	9.93	2.35	3.04
1971	7.06	4.27	3.90	7.06	2.47	3.10
1970	9.27	4.09	3.39	8.18	1.30	2.51
1969	9.86	2.64	3.22	7.81	1.44	1.68
1968	10.44	2.42	2.88	10.00	1.74	2.44
1967	11.24	1.86	2.95	12.85	1.13	1.95
1966	6.91	2.79	3.77	9.20	2.85	3.30
1965	9.19	2.23	3.10	11.06	1.89	2.58
1964	11.07	2.08	3.40	12.82	1.69	2.68
1963	11.99	2.39	3.97	15.91	2.04	2.74
1962	10.37	2.32	3.83	13.44	2.29	2.86
Average	8.72	3.07	3.71	9.03	2.19	2.86

APPENDIX X
AVERAGE REAL RATES OF RETURN IN %

For the decade ending 12/31	CANADA			UNITED STATES		
	Stocks	Govt. Bonds	Corp. Bonds	Stocks	Govt. Bonds	Corp. Bonds
1976	.20	–1.13	.03	.72	–1.52	–.46
1975	–1.36	–2.55	–1.94	–2.31	–2.54	–2.01
1974	–1.76	–2.09	–2.18	–3.77	–2.86	–2.92
1973	4.56	–.35	–.14	1.81	–1.93	–1.14
1972	6.83	.63	.86	6.30	–1.03	–.36
1971	3.86	1.15	.78	3.75	–.70	–.09
1970	6.49	1.44	.76	5.11	–1.58	–.40
1969	7.09	.04	.61	5.16	–1.05	–.82
1968	7.99	.15	.60	7.78	–.32	.37
1967	8.94	–.25	.82	10.88	–.63	.18
1966	4.87	.83	1.80	7.29	1.06	1.50
1965	7.19	.35	1.21	9.18	.16	.84
1964	9.29	.45	1.75	11.08	.12	1.09
1963	10.35	.89	2.45	14.31	.63	1.32
1962	8.93	.98	2.48	11.99	.98	1.54
Average	5.56	.04	.66	5.95	–.75	–.09