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Inflation and the Present Value of Future Economic Damages

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Inflation and the Present Value of Future Economic Damages

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The extent to which damage awards realistically reflect the plaintiff's future loss or expense depends largely on the discounting method employed and on the economic variables different methods incorporate and emphasize. The authors present a method for accurately assessing the present value of future economic damages and explore the dynamics of accounting for economic factors. In explaining and comparing other damages formulae popularly used by the courts, the authors conclude that their recommended approach produces the fairest possible result.

I. INTRODUCTION

The practice of awarding plaintiffs in personal injury cases a current sum of money as compensation for future loss of earnings or medical care makes the assessment of economic damages a difficult task. The assessment necessarily involves (1) forecasting the future damages and (2) discounting these damages to determine their present value. Discounting the expected future damages is re-

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quired because the plaintiff may invest the current award and earn additional income until actual expense is incurred. The anticipated rate of future price inflation affects both the rate at which future damages are expected to grow and the rate at which future damages should be discounted. Incomes, medical expenses, and returns on investments all tend to increase during inflationary periods.

Judges, attorneys and jurors ordinarily do not have the training, skills and knowledge required to forecast and calculate the present value of future economic damages. As a result, the legal system is often forced to rely on the testimony of "expert" witnesses. Unfortunately, these experts are sometimes less expert than their credentials imply. In addition, the competition for lucrative expert witness employment often puts pressure upon experts to become advocates for the party that employs them. It is not surprising, therefore, that federal and state courts have accepted a variety of different approaches to determining the present value of future damages, based on alternative methods of incorporating anticipated price inflation. Similarly, it is not surprising that, for a given set of conditions and assumptions, these alternative methods of calculating present value often result in dramatic differences in calculated values of damages. The inability of the legal system to evaluate objectively the methodology of economic experts has led to substantial inequities in the settlement of personal injury cases.

The apparent difficulty for some within the legal community to appreciate the economic complexities involved in accurate damages assessment is evident in certain opinions of the United States Court of Appeals for the Fifth Circuit. In *Johnson v. Penrod Drilling Co.*,[1] the Fifth Circuit prohibited the consideration of expected future price inflation in determining the present value of future economic damages. The court's position was that the "influence on future damages of possible inflation or deflation is too speculative a matter for judicial determination"[2] and, therefore, triers of fact "should not be instructed to take into account future inflationary or deflationary trends in computing future lost earnings, nor should the jury be advised to consider such alternative descriptions of inflationary and deflationary trends as the purchasing power of the dollar or the consumer price index."[3] In practice, this position

1. 510 F.2d 234 (5th Cir. 1975) (en banc) (expressly overruled in Culver v. Slater Boat Co., 688 F.2d 280 (5th Cir. 1982) (en banc)).
2. 510 F.2d at 241.
3. *Id.*

became an inflexible standard that forbade any evidence of price inflation in assessing economic damages and often led to substantial understatements in present value awards.[4]

In *Culver v. Slater Boat Co.*,[5] the Fifth Circuit overruled the precedent established in *Penrod* and evaluated a number of alternative methods of assessing the present value of future damages. The different methods discussed are widely used in other federal circuits and in the state courts. In *Culver*, the court concluded: "[W]e have discussed several acceptable methods that are useful in the consideration of the likely effect of inflation,"[6] but warned that those methodologies were "only suggested approaches, and not strait-jackets, for courts to use in determining future earnings."[7] For the same set of conditions and assumptions, these several "acceptable" methods often produce substantially different present values.

The purpose of this article is to provide a convenient reference on present value calculations in personal injury cases that will be useful in evaluating and comparing the alternative methods often employed by expert witnesses and accepted by the courts. In Part II a "preferred" method of calculating present value is presented and explained. Part III explores the effects on present value of changing such factors as the expected growth rate of damages or the discount rate. In Part IV the relationships between the expected rate of price inflation and the expected growth and discount rates for damages are explained, and Part V presents evaluations of the more widely used methods of calculating present values and illustrates the errors to which these approaches often lead.

II. The Preferred Methodology

The purpose of forecasting and then discounting future economic damage is to determine the present money award that, along with income earned by investing this award, would exactly compensate the recipient for future losses at the time these losses would be incurred. The best methodology for calculating this present money value depends on several essential assumptions. Eco-

4. *See, e.g.*, Davis v. Hill Engineering, Inc., 549 F.2d 314, 332 (5th Cir. 1977); Higginbotham v. Mobil Oil Corp., 545 F.2d 422, 433-35 (5th Cir. 1977); *In re* S.S. Helena, 529 F.2d 744, 753 (5th Cir. 1976); Lacaze v. Olendorff, 526 F.2d 1213, 1222 (5th Cir. 1976); Standefer v. United States, 511 F.2d 101, 107 (5th Cir. 1975).

5. 688 F.2d 280 (5th Cir. 1982) (en banc).

6. *Id.* at 308.

7. *Id.* at 310.

nomic experts usually assume that damages will grow at a constant annual rate over the years in which damages are expected to be incurred, that investment income in excess of current damages will be reinvested at the same rate of return as the initial award (so that all future damages may be discounted with the same discount rate), and that future damages will be incurred annually, at the end of each year. These assumptions are incorporated in each of the alternative methods discussed in *Culver* and evaluated in Part V of this article. Since the preferred method presented in this part will serve as a basis of comparison, it also incorporates these assumptions.

Given these assumptions, forecasting future economic damages involves an assessment of the current level of damages (based on the most recent past period's income or medical costs), an estimate of the annual growth rate of damages (based on historical observations of income or medical costs, anticipated future price inflation, and changes in such factors as productivity and competitive conditions), and a forecast of the number of future years damages would be incurred (based on the work-life or life expectancy of the victim). Discounting future expected damages to the present requires an annual discount rate, which is commonly based on the current rates of return on relatively "safe" long-term investments.[8]

Courts have relied on a number of different approaches for forecasting and discounting future economic damages, hopeful of arriving at award amounts that most accurately reflect the expenses the plaintiff will actually incur.[9] The one approach that best accommodates fluctuations in variables likely to affect the accuracy of damage awards is represented by the following equation.

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8. There are other considerations that may have a significant impact on the accuracy of future damage estimates, which are commonly omitted from the kinds of analyses presented here. These include: (1) the taxability of lost earnings and other future damages as compared to the tax-free nature of judgment awards; (2) the cost of investing judgment awards as a factor tending to reduce discount rates; (3) life contingencies such as prospective future illness and unemployment as factors tending to reduce potential future losses. Any one of these factors can have a drastic impact on the fairness of the award in certain cases, but they are not deemed to have the generally pervasive significance of those variables treated in this article. Even though beyond the scope of this article, such considerations should at least be acknowledged.

For a recent treatment of the taxation issues, see Elligett, *Income Tax Considerations in Florida Personal Injury Actions*, 36 U. MIAMI L. REV. 643 (1982).

9. For a critical view of the most common methods, see *infra* Part V.

$$(1) \qquad PV = \sum_{t=1}^{N} \frac{X_0 (1 + g)^t}{(1 + d)^t}$$

In this equation,[10] PV is the present money value of expected future damages, X_0 is the current level of damages, g is the expected annual growth rate of damages, N is the number of years damages are expected to be incurred, d is the annual discount rate, and t is a variable that takes on the values of 1 through N.

The numerator of the fraction in equation (1) is the economic damage forecast for year t and the denominator discounts this forecasted value to the present. For example, suppose that a victim's current level of damages is $20,000 per year, that these damages are expected to grow at an annual rate of 8%, and that the annual discount rate is 10%. The numerator indicates that damages incurred at the end of year one are expected to be $20,000(1 + .08) = $21,600. Dividing this amount by (1 + .10) yields a present value of $19,636. Thus, an immediate award of $19,636, invested at 10% per annum, would grow to $21,600 by the end of the first year, the exact amount of the damages expected at that time. For the second year, the numerator indicates that damages are expected to be $20,000$(1 + .08)^2$ = $23,328. Dividing this amount by $(1 + .10)^2$ yields a present value of $19,279. An immediate award of this amount invested at 10% for two years would grow to $23,328, the exact amount of the damages expected at that time.

Equation (1) indicates that the present value of expected year-end damages should be calculated for each of the N years damages are expected to be incurred and then summed. The result would be the present money value required to exactly compensate the victim for each year's loss during the year the loss would be incurred, assuming that the loss grows at the annual rate of g, that the present money value is invested at the annual rate of d, and that damages are incurred at the end of each year. If these assumptions are not valid, then equation (1) obviously yields an incorrect present value. Incorporating varying growth and/or discount rates into the analysis complicates the calculations somewhat, but the basic strategy remains the same. One should forecast the dollar value of each future damage and then determine the present amount of money that would grow to that future value through investment. The sum

10. Equation (1) represents an approach to damages that will be referred to as the "preferred" method.

of these present values yields the most accurate award.

III. Sensitivity Analysis

Equation (1) indicates that an increase in the initial level of damages (X_0), the annual growth rate of damages (g), or the number of years damages are incurred (N) would increase present value, while an increase in the discount rate (d) would decrease present value. Also, for given levels of annual damages, an increase in the frequency at which damages are incurred (e.g., monthly rather than annually) would increase present value. The economic expert has little control over the initial level of damages and the number of years damages are expected because these variables are largely determined by given information such as actual income or medical expenses, age of victim, work-life and life expectancy tables, and expert medical testimony. Nevertheless, the economic expert has considerable discretion concerning the annual growth rate of damages, the discount rate, and the frequency of damages.

The purpose of this part is to illustrate just how sensitive present value is to changes in these three variables whose values are determined by the "professional opinion" of the economist. The effect on present value of a change in one variable will depend on the given values of the other variables. For example, the effect of a 1% reduction in the discount rate will vary according to the values of the growth rate of damages, number of years damages are expected, and so forth. Thus, all relevant combinations of the variables cannot be examined. Enough combinations are illustrated, however, to give a clear indication of the significance each variable has in determining present value.

A. *Changes in Growth and/or Discount Rates*

Other variables held constant, an increase in the growth rate of damages causes an increase in the present money award required to compensate the victim because a larger growth rate implies larger future damages. An increase in the rate at which future damages are discounted causes a decrease in the present money award required because an increase in the discount rate implies that the immediate award is expected to be invested at a higher rate of return and thus to generate greater investment income. These phenomena are illustrated in Table I where the present value factors related to various growth and discount rates are presented for the case in which the initial damage is one dollar per year. The present value factors in Part A of the table are for the situation in which annual damages are incurred for twenty years, while Part B relates to the situation in which annual damages are incurred for forty years.

The present value factors indicate the present award that would be required to compensate a victim whose initial damage is one dollar, assuming that damages are incurred annually for the specified number of years, that damages grow at the specified growth rate, and that the award is invested at the specified discount rate. When the initial damage differs from one dollar it may be multiplied by the present value factors in Table I to determine the correct award. For example, assume that a victim's current level of damages is $20,000 per year, that damages are expected to be incurred annually for twenty years, that damages are expected to grow at an annual rate of 8%, and that the annual discount rate is 10%. Table I indicates that the appropriate present value factor for these conditions is 16.59. Thus, the award required to compensate the victim would be $20,000(16.59) = $331,800. For the same situation when damages are expected for forty years, the appropriate award would be $20,000(28.08) = $561,600.

Present value's sensitivity to various changes in the growth and/or discount rates may be determined by comparing the present value factors listed in Table I. For example, assume that damages are expected for twenty years and that the growth and discount rates are 8% and 10%, respectively. If the growth rate is increased from 8% to 9%, other factors held constant, the present value factor changes from 16.59 to 18.20. This implies an increase in present value of 10% (i.e., (18.20 - 16.59)/16.59 = .10). Alternatively, if the growth rate is held constant at 8% and the discount rate is increased from 10% to 11%, present value will decrease by 8% (i.e., (16.59 - 15.19)/16.59 = .08). For the same situation when damages are expected for forty years, an increase in the growth rate from 8% to 9% would cause a 19% increase in present value; an increase in the discount rate from 10% to 11% would cause a 15% decrease in present value.

TABLE I

PRESENT VALUE FACTORS FOR VARIOUS GROWTH AND DISCOUNT RATES*

A. Annual Damages for Twenty Years:

Discount	Growth Rate									
Rate	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1%	20.00	22.22	24.73	27.59	30.83	34.52	38.72	43.51	48.96	55.16
2%	18.06	20.00	22.19	24.68	27.50	30.70	34.33	38.46	43.16	48.50
3%	16.38	18.08	20.00	22.17	24.63	27.41	30.56	34.14	38.20	42.82
4%	14.92	16.41	18.10	20.00	22.15	24.58	27.32	30.43	33.96	37.96
5%	13.64	14.96	16.44	18.12	20.00	22.13	24.53	27.24	30.31	33.78
6%	12.51	13.69	15.00	16.47	18.13	20.00	22.10	24.48	27.16	30.19
7%	11.53	12.57	13.73	15.04	16.50	18.15	20.00	22.08	24.43	27.08
8%	10.65	11.58	12.62	13.78	15.08	16.53	18.16	20.00	22.06	24.39
9%	9.88	10.71	11.63	12.67	13.82	15.11	16.54	18.18	20.00	22.04
10%	9.19	9.93	10.76	11.69	12.72	13.87	15.15	16.59	18.20	20.00
11%	8.57	9.24	9.99	10.82	11.74	12.77	13.91	15.19	16.62	18.21
12%	8.02	8.63	9.30	10.05	10.87	11.79	12.82	13.95	15.22	16.64

B. Annual Damages for Forty Years:

Discount	Growth Rate									
Rate	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1%	40.00	49.27	61.33	77.12	97.87	125.26	161.53	209.70	273.81	359.32
2%	32.90	40.00	49.17	61.07	76.59	96.95	123.73	159.10	205.93	268.09
3%	27.45	32.96	40.00	49.07	60.80	76.08	96.05	122.25	156.76	202.31
4%	23.23	27.54	33.02	40.00	48.97	60.55	75.58	95.17	120.82	154.50
5%	19.91	23.34	27.64	33.08	40.00	48.87	60.30	75.09	94.33	119.44
6%	17.28	20.03	23.44	27.73	33.13	40.00	48.78	60.05	74.62	93.51
7%	15.16	17.39	20.14	23.55	27.82	33.19	40.00	48.68	59.82	74.16
8%	13.44	15.27	17.51	20.25	23.66	27.91	33.25	40.00	48.59	59.58
9%	12.03	13.55	15.38	17.62	20.37	23.76	27.99	33.30	40.00	48.50
10%	10.85	12.13	13.65	15.49	17.73	20.48	23.87	28.08	33.36	40.00
11%	9.87	10.95	12.23	13.76	15.60	17.85	20.59	23.97	28.16	33.41
12%	9.03	9.96	11.04	12.33	13.87	15.71	17.96	20.70	24.07	28.25

* Relative to initial loss of one dollar per year

Present value is obviously very sensitive to changes in the growth and discount rates. This sensitivity is often underestimated. In *Culver v. Slater Boat Co.*,[11] for example, one judge advocated using the *Feldman* approach in which future damages are discounted with the "real" rate of interest.[12] In discussing this interest rate, he stated that "it may be 1.5% to some and 3% to others, but the total dollar impact upon the expected verdict in a given case is so relatively small that litigants will likely find it hardly worth the cost of the expert testimony necessary to disputatiousness."[13] As the present value factors in Table I indicate, however, for a growth rate of 2% and damages for forty years, a reduction from 3% to 2% in the discount rate would cause an increase in present value of 21%. A reduction in the discount rate from 3% to 1% would cause an increase in present value of 49%.

The sensitivity of present value to changes in the growth and discount rates is often the reason why, for the same case, two economic experts may arrive at widely different estimates of the present award deemed appropriate. For example, assume that a victim's initial damage is $20,000 and that damages are expected for forty years. The expert witness for the plaintiff might forecast that damages will grow at 8% and that the present award may be invested at 9%, while the expert for the defendant might forecast that damages will grow at 7% and that the award may be invested at 10%. Using the present value factors in Table I, the plaintiff's expert would estimate the present value of future damages to be $20,000(33.30) = $666,000 and the defendant's expert would estimate the present value to be $20,000(23.87) = $477,400, a difference of 40%.

B. *Frequency of Damages: Assumption v. Reality*

A common practice is to forecast annual economic damages and then discount these damages to the present using a method that implicitly assumes that damages are incurred at the end of the year. The methods discussed throughout this article are based on this assumption. The problem, of course, is that damages are usually incurred over the course of the year. Damages from lost income and medical expenses are normally incurred monthly or

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11. 688 F.2d 280, 311-13 (Hill, C.J., concurring in part and dissenting in part).

12. For a discussion of the approach used in Feldman v. Allegheny Airlines, Inc., 382 F. Supp. 1271 (D. Conn. 1974), *aff'd*, 524 F.2d 384 (2d Cir. 1975), see *infra* Part V, C.

13. 688 F.2d 280, 313 (Hill, C.J., concurring in part and dissenting in part).

weekly rather than annually. The assumption that damages will be incurred at the end of each year when they will actually be incurred more frequently leads to an understatement in present value. Increasing the frequency at which the victim incurs expenses reduces the victim's investment fund more quickly and thus reduces investment income.

The percentage understatements in present values associated with different combinations of discount rates and frequencies of damages are presented in Table II.[14] As the table indicates, the understatement in present value associated with assuming annual damages when damages are actually expected more frequently may be substantial. For example, assume that a victim's current level of damages is $20,000 per year, that damages are expected to be incurred for forty years, that the expected annual growth rate in damages is 8%, and that the annual discount rate deemed appropriate is 10%. If damages are assumed to be incurred at the end of each year, equation (1) would yield a present value of $561,600. If damages are assumed to be incurred monthly, the present value would be $586,872, a difference of $25,272 or 4.5%.[15]

14. The understatement percentages in Table II are constants that are not affected by the dollar amount of the damages, the period over which damages are incurred, or the expected growth rate of future damages in any given case.

15. There are two possible equations when damages are incurred more frequently than at the end of each year. Damages may grow at the annual rate g, and the growth (e.g., anticipated salary increase) assumed to be initiated in the first payment period, m, (e.g., 1st month, if $m = 12$). Each successive m would incorporate an equal percentage of that year's increase. This situation is represented by the equation

$$PV = \sum_{t=1}^{N} \left(\frac{X_0 (1 + g)^t}{m}\right)\left(\sum_{i=1}^{m} \frac{1}{(1 + d)^{i/m}}\right)\left(\frac{1}{(1 + d)^{t-1}}\right)$$

where m is the number of times damages are incurred per year. This is the equation used to develop Table II. If damages are assumed to grow monthly or weekly at a rate consistent with the annual growth rate g (e.g., some types of medical expenses or incomes of some professionals), the appropriate equation would be

$$PV = \sum_{t=1}^{m \cdot N} \left(\frac{X_0 (1 + g)}{\sum_{i=1}^{m} (1 + g)^{i/m}}\right)\left(\frac{(1 + g)^{t/m}}{(1 + d)^{t/m}}\right)$$

where the first term in brackets is equal to the current periodic damage based on the initial annual damage of X_0. Note that when $m = 1$ (i.e., damages are incurred at the end of each year), both equations may be reduced to equation (1).

IV. Growth and Discount Rates and Anticipated Price Inflation

The expected growth and discount rates for damages both depend on the anticipated rate of future price inflation. An increase in the rate of expected price inflation would cause an increase in the rate at which damages are expected to grow and an increase in the rate at which future damages should be discounted.

TABLE II

PERCENTAGE UNDERSTATEMENTS IN PRESENT VALUES DUE TO ASSUMING DAMAGES ARE INCURRED AT THE END OF EACH YEAR

Annual Discount Rate (d)	Actual Frequency of Damages	
	Monthly	Weekly
1%	0.46%	0.49%
2%	0.91%	0.98%
3%	1.37%	1.46%
4%	1.82%	1.95%
5%	2.27%	2.43%
6%	2.72%	2.91%
7%	3.17%	3.39%
8%	3.62%	3.87%
9%	4.06%	4.35%
10%	4.50%	4.82%
11%	4.95%	5.30%
12%	5.39%	5.77%
13%	5.83%	6.24%
14%	6.26%	6.71%
15%	6.70%	7.18%

Understanding these relationships is important because the present value of future damages is so sensitive to changes in the growth and discount rates and because the alternative methods of calculating present values, which will be discussed, are based on different approaches to incorporating anticipated inflation.

A. *The Discount Rate and Anticipated Price Inflation*

The discount rate is the rate of return the victim is expected to earn by investing the award. Price inflation erodes the purchasing power of both the principal sum invested and the interest income earned by investors. Thus, when future price inflation is expected, lenders demand higher returns to protect the purchasing power of their investments and borrowers are willing to pay these higher returns because they expect to make their principal and interest payments with dollars that have reduced purchasing power.

At any point in time, therefore, the observed rate of return on investments is a "nominal" rate in the sense that it reflects both the anticipated rate of price inflation and the expected "real" rate of return on the principal sum invested. This relationship between the nominal and real interest rates may be expressed as

$$(2) \qquad d = d_r + i + d_r(i)$$

or

$$(3) \qquad d_r = \frac{d - i}{1 + i}$$

where d is the nominal rate of interest (used as the discount rate in equation (1)), d_r is the real rate of interest, and i is the expected rate of inflation.[16]

The difference between the nominal and real interest rates is equal to the expected rate of price inflation plus the real rate of interest multiplied by the expected rate of price inflation (i.e., $d - d_r = i + d_r(i)$). The first term (i) protects the purchasing power of the principal sum invested and the second term ($d_r(i)$) protects the interest income from erosion by price inflation. For example, if the real rate of interest is 3% and the expected rate of price inflation is 0%, equation (2) indicates that the nominal, observed interest rate would also be 3%. Alternatively, if the real rate is 3% and the expected rate of inflation is 7%, equation (2) indicates that the nominal rate would be 10.21%. Of this 10.21%, 3% would represent the real interest rate, 7% would protect the principal invested from inflation, and 0.21% would protect the interest income from inflation.

B. *The Growth Rate and Anticipated Price Inflation*

Price inflation erodes the purchasing power of fixed income. When future price inflation is expected, therefore, employees demand higher incomes. Employers normally grant higher incomes to their employees because they expect to pay them with dollars that have reduced purchasing power and because they expect to in-

16. This relationship was originally described by Irving Fisher; *see* I. FISHER, THE THEORY OF INTEREST 399-451 (1930). Most modern basic finance textbooks offer a treatment of the relationship between nominal and real interest rates; *see e.g.*, J. VAN HORNE, FINANCIAL MANAGEMENT AND POLICY 132 (5th ed. 1980).

crease sales prices. Medical care expenses and other elements of damages also increase when future price inflation is expected. Thus, the nominal growth rate in damages reflects both anticipated price inflation and the expected real rate of growth in damages that originates in productivity increases.

The relationship between nominal and real growth rates in damages may be expressed as

$$g = g_r + i + g_r(i) \tag{4}$$

or

$$g_r = \frac{g - i}{1 + i} \tag{5}$$

where g is the expected nominal rate of growth (used in equation (1)), g_r is the expected real growth rate (productivity changes), and i is the expected rate of price inflation. The difference between the nominal and real growth rates is equal to $i + g_r(i)$, where i prevents the erosion of the initial damage through inflation and $g_r(i)$ prevents the erosion of the real growth rate.

C. *The Relationship Between Growth and Discount Rates*

The nominal growth and discount rates are clearly interrelated because they both depend on the anticipated rate of price inflation. As equations (2) and (4) indicate, an increase in expected future inflation would cause an increase in both the nominal growth rate and the nominal discount rate. It is important, therefore, that the growth and discount rates used to calculate the present value of future damages both reflect the same rate of expected inflation.

In practice, this consistency is often neglected. In *Culver v. Slater Boat Co.*, for example, the Fifth Circuit recommended that "[u]sing the average annual rate of increase in the plaintiff's own salary in the years prior to the incapacitating event . . . over, for example, the ten years prior to his injury, the parties can project the annual earnings for the remainder of the plaintiff's estimated income-generating years."[17] The court added, "[T]he present value of the plaintiff's average annual income is then computed . . . . This calculation can take the form of applying a traditional discount rate, and it will be based upon relatively safe investments such as Treasury Bills or bonds . . . ."[18] The problem with this

17. 688 F.2d 280, 309 (5th Cir. 1982).
18. *Id.*

recommendation is, of course, that the historical growth rate in salary reflects past rates of price inflation, while the current rate of return on relatively safe investments reflects the anticipated future rate of price inflation.

V. ALTERNATIVE APPROACHES TO PRESENT VALUE CALCULATIONS

A wide variety of alternative methods of calculating the present value of future economic damages has been employed by economic experts and accepted by the courts. The Fifth Circuit Court of Appeals, in *Culver v. Slater Boat Co.*,[19] discussed many of the more common methods and considered several of them acceptable. In this part, each of these alternative methods will be explained and evaluated in comparison with the preferred method presented in Part II. In addition, the errors in present values to which these alternative methods may lead are illustrated for various situations.

A. *The* Penrod *Method*

The *Penrod* approach, employed exclusively by the Fifth Circuit, was overruled in *Culver v. Slater Boat Co.*[20] It will be instructive, however, to examine this approach and the inequities that resulted from its use before analyzing the other methods that continue to be utilized. The *Penrod* court ruled that expected future price inflation is too speculative a matter for judicial determination and, therefore, should not be considered in forecasting future economic damages. As the court noted in *Culver*, the *Penrod* rule became an inflexible standard in assessing future damages: "no evidence of inflation may be presented to the trier of fact, regardless of how expert the testimony, how understandable the presentation, or how fair to the parties. Argument of counsel is also forbidden, as is jury instruction by the Court."[21]

In practice, the *Penrod* rule resulted in enormous inequities in awards. As explained earlier, both the expected nominal growth rate of damages and the nominal discount rate for damages depend on the anticipated rate of future price inflation. Higher levels of anticipated price inflation are normally associated with higher expected growth and discount rates (see equations (2) and (4)). Under the *Penrod* rule, however, no evidence was permitted to show any likely increase in future damages due to inflation, but

19. 688 F.2d 280 (5th Cir. 1982).
20. *Id.*
21. *Id.* at 292.

future damages were discounted to the present using the nominal discount rate, which reflects anticipated price inflation. This inconsistency in the growth and discount rates, allowed under *Penrod*, clearly penalized the plaintiff unfairly during periods when future price inflation was expected. Increases in the rate of expected inflation were not allowed to have any effect on estimated damages, but were allowed to increase the discount rate because the rate of return on long-term investments increased.

In some cases under *Penrod* the growth rate in damages was reduced to zero. The *Culver* court stated that the *Penrod* standard

> has at times been so overwhelming that it has prohibited evidence that should have been allowed, such as evidence of likely wage increases based upon merit or productivity, either on a misreading of *Penrod* or a perceived (and sometimes actual) impossibility of separating out inflationary elements from admissible merit-productivity increases.[22]

In these cases annual damages were held constant and discounted using the nominal discount rate. The equation for this approach would be

$$(6) \qquad PV = \sum_{t=1}^{N} \frac{X_0 (1 + g - g)^t}{(1 + d)^t} = \sum_{t=1}^{N} \frac{X_0}{(1 + d)^t}$$

where each of the variables has been previously defined.[23] Equation (6) is equivalent to equation (1), the preferred approach, except that the growth rate of damages has been set to zero (i.e., $X_0(1 + 0)^t = X_0$).

The percentage understatements in present values due to the *Penrod* approach are presented in Table III. These percentages are based on a comparison of the present values calculated with equations (1) and (6). Thus, they indicate the effect on present value of reducing the specified growth rate to zero, while holding the discount rate constant. Table III is also useful in approximating the percentage understatements in present values related to those cases in which the growth rate was not reduced to zero because of productivity increases. In these cases the approximate understatement is in the column that corresponds to the reduction in the growth rate.

For example, suppose that a victim's initial damage is $20,000

22. *Id.*
23. *See supra* text accompanying note 10.

per year, that damages are expected to be incurred annually for twenty years, that the expected nominal growth rate of damages is 8%, and that the discount rate is 10%. Under these assumptions the preferred method (equation (1)) yields a present value of $331,800. Application of the *Penrod* rule can lead to one of two errors. First, if no productivity and/or inflationary increases in damages are allowed so that the nominal growth rate is set to zero, the *Penrod* approach (equation (6)) yields a present value of $170,271. This represents a 48.68% understatement in present value (as indicated in the 8% column, 10% row of Table III). Second, if we allow for productivity increases of 2% per annum but no inflationary increases, present value would be $198,600, an understatement of about 40%.[24] In this case the approximate understatement may be found by consulting the column on Table III headed by a growth rate equal to the rate of inflation removed from the nominal growth rate. The 6% growth rate column in the twenty year portion of Table III shows a 38.62% error for a 10% discount rate.

In either case, a significant reduction in the growth rate without a corresponding reduction in the discount rate will result in substantial understatements in present value. Table III indicates that errors of 40% to 60% and higher are common for many likely situations.

TABLE III

PERCENTAGE UNDERSTATEMENTS IN PRESENT VALUES DUE TO THE *Penrod* RULE

A. Annual Damages for Twenty Years:

Nominal Discount Rate	Nominal Growth Rate 2%	4%	6%	8%	10%
2%	18.24%	33.75%	46.74%	57.48%	66.29%
4%	17.18%	32.05%	44.71%	55.34%	64.20%
6%	16.22%	30.36%	42.65%	53.15%	62.01%
8%	15.21%	28.75%	40.60%	50.91%	59.75%
10%	14.26%	27.17%	38.62%	48.68%	57.43%
12%	13.45%	25.68%	36.65%	46.46%	55.11%

24. This present value was calculated with equation (1), but with a 2% (rather than 8%) growth rate.

B. Annual Damages for Forty Years:

Nominal Discount Rate	Nominal Growth Rate 2%	4%	6%	8%	10%
2%	31.61%	55.21%	71.78%	82.81%	89.80%
4%	28.13%	50.52%	67.31%	79.20%	87.19%
6%	24.88%	45.74%	62.38%	74.94%	83.91%
8%	21.91%	41.11%	57.27%	70.19%	79.99%
10%	19.38%	36.87%	52.25%	65.17%	75.55%
12%	17.23%	33.14%	60.55%	60.17%	70.82%

B. *The Alaska Method*

The Alaska method of determining present awards was established by the Supreme Court of Alaska in *Beaulieu v. Elliott*[25] and was recently adopted by the Third Circuit in *Pfeifer v. Jones & Laughlin Steel Corp.*[26] This approach, which is sometimes referred to as the "total offset" method, is based on the observation that both the nominal growth rate and the nominal discount rate for damages vary directly with the expected rate of price inflation. Moreover, an increase in the growth rate increases present value, while an increase in the discount rate decreases present value. It follows that any changes in the growth and discount rates caused by a change in the expected rate of inflation will tend to offset each other. The Alaska method is based on the assumption that the nominal growth and discount rates are equal and, therefore, their effects on present value offset each other exactly.

If the nominal growth rate equals the nominal discount rate, the present value of any future damage will equal the initial damage. For example, if an initial damage of \$20,000 grows for ten years at an 8% growth rate and this future value is then discounted back ten years to the present with an 8% discount rate, the present value is \$20,000 (i.e., $\$20{,}000(1 + .08)^{10}/(1 + .08)^{10} =$ \$20,000). The equation for the Alaska method, therefore, is simply

$$(7) \qquad PV = \sum_{t=1}^{N} \frac{(1 + g - g)^t}{(1 + d - d)^t} = N(X_0)$$

which is the number of years damages are expected to be incurred multiplied by the value of the initial damage. Note that equation

25. 434 P.2d 665 (Alaska 1967).
26. 678 F.2d 453 (3d Cir. 1982).

(7) is equivalent to equation (1), the preferred equation, only if the nominal growth rate equals the nominal discount rate.

The difficulty with the Alaska method is that the nominal growth and discount rates may not be equal. As shown in equations (2) and (4), both nominal rates depend in part on the expected rate of price inflation. The nominal growth rate, however, also depends on the expected real rate of growth (basically the expected productivity changes), while the nominal discount rate also depends on the expected real return on long-term investments. The nominal rates will be equal, therefore, only if the expected real growth and real discount rates of incomes vary according to productivity changes in different occupations. Incomes in some occupations grow faster than the rate of price inflation, while others grow more slowly. Similarly, the real growth rates of various medical expenses differ. Because the real growth rates of damages vary, they cannot all be expected to equal the real discount rate.

The Alaska method often leads to substantial errors in present values because nominal growth and discount rates are seldom actually equal. When the expected growth rate is greater than the discount rate, the Alaska approach understates present value; when the expected growth rate is less than the discount rate, present value is overstated. The percentage misstatements in present values under the Alaska rule are presented in Table IV for various combinations of the nominal growth and discount rates.

Table IV indicates that if damages are expected for twenty years and the growth rate is expected to be 1% more than the discount rate, the Alaska method leads to an understatement of about 9% in present value. When the growth rate is expected to be 1% less than the discount rate, the present value overstatement is about 10%. For example, if the discount rate is 8% and the growth rate is 9%, present value is understated by 9.34%; if the discount rate is 8% and the growth rate is 7%, present value is overstated by 10.13%. For the same example with damages extending over forty years, the understatements and overstatements would be 17.68% and 20.30% respectively. Clearly, the Alaska rule may lead to dramatic inequities in present money awards.

TABLE IV

PERCENTAGE MISSTATEMENTS IN PRESENT VALUES DUE TO THE ALASKA RULE

A. Annual Damages for Twenty Years:

Nominal Discount Rate	Nominal Growth Rate 1%	3%	5%	7%	9%
2%	10.74%	-9.87%	-27.27%	-41.74%	-53.66%
4%	34.05%	10.50%	-9.71%	-26.79%	-41.11%
6%	59.87%	33.33%	10.31%	-9.50%	-26.36%
8%	87.79%	58.48%	32.63%	10.13%	-9.34%
10%	117.63%	85.87%	57.23%	32.01%	9.89%
12%	133.37%	115.05%	83.99%	56.01%	31.41%

B. Annual Damages for Forty Years:

Nominal Discount Rate	Nominal Growth Rate 1%	3%	5%	7%	9%
2%	21.58%	-18.65%	-76.59%	-67.67%	-80.58%
4%	72.19%	21.14%	-18.32%	-47.08%	-66.89%
6%	131.48%	70.65%	20.74%	-18.00%	-46.40%
8%	197.62%	128.44%	69.06%	20.30%	-17.68%
10%	268.66%	193.04%	125.61%	67.57%	19.90%
12%	342.97%	262.32%	188.39%	122.72%	66.18%

C. *The* Feldman *Approach*

The method introduced in *Feldman v. Allegheny Airlines, Inc.*,[27] like the Alaska method, attempts to account for the effects of expected price inflation on both the nominal growth and discount rates by offsetting them. This approach effectively holds future damages constant at their initial level, and discounts them to present value using a discount rate obtained by subtracting the expected rate of price inflation from the nominal discount rate. The equation for the *Feldman* method is

27. 524 F.2d 384 (2d Cir. 1975).

$$(8) \qquad PV = \sum_{t=1}^{N} \frac{X_0 (1 + g - g)^t}{(1 + d - i)^t} = \sum_{t=1}^{N} \frac{X_0}{(1 + d - i)^t}$$

where i is the expected rate of price inflation. Equation (8) attempts to remove the impact of expected inflation on damages by reducing the nominal growth rate to zero and attempts to remove the impact on the nominal discount rate by subtracting the expected rate of price inflation.[28]

An obvious weakness in this approach is that it assumes that the expected nominal growth rate of damages is equal to the expected rate of price inflation. Thus, the nominal growth rate is reduced to zero, although incomes in specific occupations or certain types of medical expenses may grow faster or slower than the general price level. In the absence of inflation, future incomes and expenses may still increase or decrease with changes in productivity and competition. The *Feldman* approach ignores these possibilities. Furthermore, even in cases where g (nominal growth) does happen to equal i (expected inflation), the *Feldman* equation still leads to miscalculations of present value because of inherent mathematical errors.

Table V presents the percentage misstatements in present values that result when the *Feldman* approach is applied to various combinations of nominal discount rates, nominal growth rates, and anticipated inflation rates. Negative values represent understatements and relate to those situations in which the expected growth rate is greater than the expected inflation rates. Positive values represent overstatements and are associated with those cases in which the expected growth rate is less than the expected inflation rate. When the expected growth and inflation rates are equal, the error may be positive or negative. For example, assume that the initial damage is $10,000, that the nominal discount rate is 10%, that the expected nominal growth rate is 8%, and that damages are expected for twenty years. The preferred method (equation (1)) yields a present value of $331,800. If the expected inflation rate is 7%, the *Feldman* approach, equation (8), yields a present value of $297,549 which is in error by 10.32%. If annual inflation is expected to be 9%, the present value is $360,911. This is 8.77% more than the present value obtained under the preferred method.

28. The *Feldman* approach is sometimes referred to as the "offset" method (the Alaska rule is the "total offset" method) and also as the "real interest rate" approach. Note, however, that the real interest rate is not equal to $d - i$, but, as equation (3) indicates, $d_r = (d - i)/(1 + i)$.

TABLE V

PERCENTAGE MISSTATEMENTS IN PRESENT VALUES DUE TO THE *Feldman* APPROACH

A. Annual Damages for Twenty Years:

Nominal Discount Rate	Nominal Growth Rate-Inflation Rate 4%-2%	4%-3%	4%-4%	4%-5%	4%-6%	8%-6%	8%-7%	8%-8%	8%-9%	8%-10%
2%	-18.96%	-9.79%	0.87%	13.31%	27.88%	-17.94%	-6.94%	6.04%	21.43%	39.74%
4%	-18.24%	-9.77%	0.00%	11.36%	24.47%	-18.19%	-8.10%	3.72%	17.61%	34.02%
6%	-17.48%	-9.67%	-0.72%	9.57%	21.43%	-18.30%	-9.06%	1.69%	14.23%	28.92%
8%	-16.76%	-9.56%	-1.38%	7.96%	18.66%	-18.24%	-9.77%	0.00%	11.32%	24.47%
10%	-16.01%	-9.38%	-1.88%	6.61%	16.26%	-18.08%	-10.32%	-1.44%	8.77%	20.55%
12%	-15.29%	-9.17%	-2.31%	5.41%	14.13%	-17.78%	-10.67%	-2.58%	6.65%	17.21%

B. Annual Damages for Forty Years:

Nominal Discount Rate	Nominal Growth Rate-Inflation Rate 4%-2%	4%-3%	4%-4%	4%-5%	4%-6%	8%-6%	8%-7%	8%-8%	8%-9%	8%-10%
2%	-34.50%	-18.97%	1.82%	30.00%	68.60%	-35.28%	-14.75%	13.99%	54.67%	112.80%
4%	-31.61%	-17.91%	0.00%	23.71%	55.46%	-34.66%	-16.58%	8.19%	42.51%	90.57%
6%	-28.62%	-16.64%	-1.35%	18.41%	44.25%	-33.39%	-17.60%	3.55%	32.20%	71.47%
8%	-25.70%	-15.26%	-2.26%	14.15%	35.09%	-31.61%	-17.91%	0.00%	23.71%	55.46%
10%	-23.02%	-13.93%	-2.86%	10.78%	27.78%	-29.51%	-17.68%	-2.58%	16.93%	42.45%
12%	-20.69%	-12.75%	-3.29%	8.12%	22.03%	-27.31%	-17.11%	-4.38%	11.67%	32.15%

As Table V demonstrates, the *Feldman* approach may lead to very large errors in present values, particularly when the expected nominal growth and inflation rates differ by more than 1 or 2 percentage points. Percentage misstatements from 10% to 30% and higher are common in many situations.

D. *The Modified* Feldman *Approach*

The primary problem with the *Feldman* approach is that it implicitly assumes that the nominal growth and inflation rates are equal. Thus, the *Feldman* approach ignores potential growth in damages related to such factors as changes in productivity. Recognition of this deficiency has led to the development of an alternative: the modified *Feldman* approach. The *Culver* court strongly recommended this approach as one acceptable method.[29] The other method most favored in *Culver*—the average annual damage approach—is discussed in the next section.

In the modified *Feldman* approach, the nominal growth rate is set to zero while the nominal discount rate is set equal to the nominal discount rate less the expected nominal growth rate. The equation for this method is

$$(9) \qquad PV = \sum_{t=1}^{N} \frac{X_0 (1 + g - g)^t}{(1 + d - g)^t} = \sum_{t=1}^{N} \frac{X_0}{(1 + d - g)^t}$$

where each of the variables has been previously defined.[30]

The shortcomings of equation (9) may be seen by comparing it to equation (1), the preferred method. Equation (9) differs from equation (1) in that the nominal growth and discount rates have both been reduced by the value of the nominal growth rate (note that X_0 in the numerator is derived from X_0 $(1 + g - g)$). Equation (9) will yield the same present value as equation (1), therefore, only if the growth rate equals the discount rate; in that case, subtracting the growth rate from both variables will reduce the numerator and denominator of equation (1) in the same proportion. If the growth rate is less than the discount rate, subtracting the growth rate from both variables in equation (1) will cause a larger

29. Culver v. Slater Boat Co., 688 F.2d 280 (5th Cir. 1982). The modified *Feldman* approach has been widely used in Canada; *see, e.g.*, Jeselon v. Waters, [1981] 3 W.W.R. 715 (B.C. 1981); Malat v. Bjornson, 114 D.L.R.3d 612 (B.C. Ct. App. 1980).

30. *See supra* text accompanying note 10. This approach is clearly preferable to the *Feldman* approach in which the growth rate is reduced to zero and the discount rate is reduced by the expected inflation rate. Note, however, that both approaches produce the same present value when the growth and inflation rates are equal.

percentage reduction in the numerator than in the denominator, so that the present value yielded by equation (9) will be smaller. If the growth rate is greater than the discount rate, subtracting the growth rate from both variables will cause a smaller percentage reduction in the numerator than in the denominator of equation (1), and equation (9) will yield larger present values.

These phenomena are illustrated in Table VI, which presents for various relevant situations the percentage misstatements in present values due to error induced by the modified *Feldman* approach. When damages are incurred monthly, the percentage errors are considerably higher than when damages are incurred annually.[31] For example, assume that the initial damage is $20,000 per year, the annual damages are expected for forty years, the expected nominal growth rate is 8%, and that the discount rate is 10%. The correct present value, produced by equation (1), is $561,600 while the present value produced by the modified *Feldman* approach is $547,110—an understatement of $14,490 or 2.58%. For the same situation, except that monthly rather than annual damages are incurred, the correct present value (calculated with the first equation in note 15) is $586,800, while the present value yielded by the modified *Feldman* approach (calculated with the equation in note 31) is $552,200—an understatement of $34,600 or 5.90%.

31. The portion of Table VI that relates to annual damages was developed by comparing the present values calculated with equations (1) and (9). When damages are incurred more frequently than annually, the equation for the modified *Feldman* approach would be

$$PV = \sum_{t=1}^{m \cdot N} \frac{X_0/m}{(1 + d - g)^{t/m}}$$

where m is the number of times per year damages are incurred. This equation discounts m x N payments of X_0/m to the present using the periodic discount rate which is consistent with the annual net discount rate of d - g. Note that when $m = 1$, this equation is equal to equation (9). The portion of Table VI related to monthly damages was developed by comparing present values calculated with this equation and the first equation in note 15.

TABLE VI

PERCENTAGE MISSTATEMENTS IN PRESENT VALUES DUE TO THE MODIFIED *Feldman* APPROACH

A. Damages for Twenty Years:

Nominal Discount Rate	Nominal Growth Rate: Annual Damages				Nominal Growth Rate: Monthly Damages			
	2%	4%	6%	8%	2%	4%	6%	8%
2%	0.00%	0.87%	2.80%	6.04%	-0.89%	-0.94%	-0.01%	2.16%
4%	-0.40%	0.00%	1.28%	3.72%	-1.25%	-1.77%	-1.42%	-0.04%
6%	-0.73%	-0.72%	0.00%	1.69%	-1.58%	-2.48%	-2.63%	-1.89%
8%	-0.95%	-1.38%	-1.08%	0.00%	-1.82%	-3.10%	-3.67%	-3.47%
10%	-1.13%	-1.88%	-2.02%	-1.44%	-1.99%	-3.51%	-4.50%	-4.79%
12%	-1.35%	-2.31%	-2.71%	-2.58%	-3.09%	-3.94%	-5.21%	-5.93%

B. Damages for Forty Years:

Nominal Discount Rate	Nominal Growth Rate: Annual Damages				Nominal Growth Rate: Monthly Damages			
	2%	4%	6%	8%	2%	4%	6%	8%
2%	0.00%	1.82%	6.20%	13.99%	-0.92%	-0.01%	3.30%	9.82%
4%	-0.67%	0.00%	2.70%	8.19%	-1.59%	-1.79%	-0.06%	4.29%
6%	-1.18%	-1.35%	0.00%	3.55%	-2.03%	-3.07%	-2.65%	-0.13%
8%	-1.46%	-2.26%	-1.99%	0.00%	-2.30%	-3.99%	-4.55%	-3.50%
10%	-1.69%	-2.86%	-3.36%	-2.58%	-2.48%	-4.51%	-5.83%	-5.90%
12%	-1.82%	-3.29%	-4.22%	-4.38%	-2.58%	-4.88%	-6.67%	-7.60%

The percentage understatements caused by using the modified *Feldman* method are obviously much smaller than those caused by using the alternative approaches discussed thus far. The errors resulting from the modified *Feldman* method, however, can be very significant. In the above example (in which the modified *Feldman* approach resulted in a 5.90% understatement), if the victim was awarded $552,200, if this award were invested at 10% per annum, and if the victim withdrew from the investment fund to cover monthly damages which grew at the annual rate of 8%, the investment fund would be depleted after only thirty-seven years and six months. Thus, what appears to be a small error in present value can imply (for understatements) substantial future time periods during which damages are incurred without compensation or (for overstatements) compensation for substantial future time periods after damages are no longer incurred.[32]

E. *The Average Annual Damage Approach*

The other approach most favored by the court in *Culver* was described as follows:

> [T]he parties can project the annual earnings for the remainder of the plaintiff's estimated income-generating years. A lump sum of likely lifetime earnings is the result of these calculations. . . .
> The above lifetime earnings are converted to an average an-

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32. The *Culver* court also suggested another variation of the *Feldman* approach in which equation (1) is modified by subtracting the expected inflation rate from both the growth and discount rates. The equation for this approach would be

$$PV = \sum_{t=1}^{N} \frac{(1 + g - i)^t}{(1 + d - i)^t}$$

Note that this equation involves the same type of problem as the modified *Feldman* approach represented by equation (9). Subtracting the expected inflation rate from both the growth rate and the discount rate will change the numerator and the denominator of equation (1) in the same proportion only if the growth and discount rates are equal. Furthermore, this approach is based on the incorrect assumption that nominal rates may be adjusted for expected inflation simply by subtracting the expected inflation rate. As demonstrated in Part IV, however, the real growth (g_r) and discount (d_r) rates are equal to $(g - i)/(1 + i)$ and $(d - i)/(1 + i)$ respectively. If these real rates are substituted for the nominal rates in equation (1), the result is

$$PV = \sum_{t=1}^{N} \frac{(1 + g_r)^t}{(1 + d_r)^t}$$

which would yield the same present values as equation (1). This substitution of real for nominal rates, however, does not always produce the correct equation. For example, substituting real for nominal rates in the first equation in note 15 would produce an equation that would yield significant errors in present values.

> nual income by dividing the lump sum by the number of income-generating years.
>
> The present value of the plaintiff's average annual income is then computed. . . . This calculation can take the form of applying a traditional discount rate . . . .[33]

The equation for this approach is

$$(10) \qquad PV = \left(\sum_{t=1}^{N} \frac{X_0 (1 + g)^t}{N} \right) \left(\sum_{t=1}^{N} \frac{1}{(1 + d)^t} \right)$$

where $X_0 (1 + g)^t$ is the damage for year t. These values are computed for each year, then summed, divided by N, and multiplied by an annuity present value factor. The result is the present value of N annual damages set equal to the average annual damage the victim is expected to incur. This approach will be referred to as the average annual damage approach.

The problem with assuming that the same level of damages, equal to the average annual damage, is incurred each year is that the damages actually expected in the early years are grossly overstated and the damages expected in the later years are grossly understated. The present values of the overstatements will outweigh the present values of the understatements because they are discounted a fewer number of years.

For example, assume that the initial damage is $20,000 per year, that the expected nominal growth rate is 8%, that the discount rate is 10%, and that annual damages are expected for twenty years. The present value of the damages actually expected at the end of year one is $20,000 $(1 + .08)/(1 + .10)$ = $19,636 and the present value of the damages actually expected at the end of year twenty is $20,000$(1 + .08)^{20}/(1 + .10)^{20}$ = $13,856. Average annual damages would be $49,423 (i.e., the sum of $20,000$(1 + .08)^t$ for t values of one through twenty divided by the number of years). The present value of the average annual damage when it is discounted one year is $49,423$/(1 + .10)$ = $44,930 and the present value when it is discounted twenty years is $49,423$/(1 + .10)^{20}$ = $7,346. Comparing these present values to those of the damages actually expected indicates that the average annual damage approach overstates the present value of the damages for year one by $25,294 (or 129%) and understates the present value of the damages for year twenty by $6,510 (or 47%).

The percentage overstatements in present values that result

33. 688 F.2d at 309.

from the average annual damage approach are presented in Table VII. For the example discussed above, the 8% growth rate column at the 10% discount rate row indicates that the average annual damage approach would lead to an overstatement of 26.81%. In many cases the overstatements exceed 100%. For the same example, but when damages are expected for forty years, the overstatement would be 143.59%.

Ironically, the average annual damage approach recommended by the court in *Culver* produces larger errors in present values than the *Penrod* approach, which was overruled in *Culver*. Under the *Culver* recommendation, however, the inequities favor the plaintiff rather than the defendant.

TABLE VII

PERCENTAGE OVERSTATEMENTS IN PRESENT VALUES DUE TO THE AVERAGE ANNUAL DAMAGE APPROACH

A. Annual Damages for Twenty Years:

Nominal Discount Rate	Nominal Growth Rate				
	2%	4%	6%	8%	10%
2%	1.31%	2.59%	3.84%	5.06%	6.20%
4%	2.62%	5.22%	7.80%	10.36%	12.78%
6%	3.82%	7.84%	11.81%	15.78%	19.68%
8%	5.06%	10.33%	15.80%	21.31%	26.81%
10%	6.24%	12.77%	19.67%	26.81%	34.09%
12%	7.25%	15.09%	23.52%	32.32%	41.40%

B. Annual Damages for Forty Years:

Nominal Discount Rate	Nominal Growth Rate				
	2%	4%	6%	8%	10%
2%	5.34%	10.67%	15.72%	20.26%	24.19%
4%	10.70%	22.25%	34.06%	45.47%	55.92%
6%	15.70%	34.06%	54.27%	75.26%	95.84%
8%	20.28%	45.49%	75.22%	108.52%	143.60%
10%	24.17%	55.98%	95.83%	143.59%	197.56%
12%	27.48%	65.19%	115.21%	178.56%	255.18%

F. *Summary*

At this point it will be helpful to apply each of the alternative methods discussed to a given situation and compare the results. Assume that a lost-income victim, who received monthly paychecks and annual raises, has an initial income of $12,000 and a remaining work-life expectancy of thirty years. Further assume that the victim's income was expected to have grown at 8% annually, that the victim is expected to invest the present award at 10% annually, and that the expected annual rate of price inflation is 7%. Given these assumptions, the most accurate present value was determined using the first equation in note fifteen. The present values for the other approaches were calculated with the equations stated in the foregoing text, which are based on the typical (but usually incorrect) assumption that damages are incurred at the end of each year.

The results of this analysis are presented in Table VIII, which lists the present values and the percentage errors in present values for each approach. The number of years required to deplete the investment fund established under each method assumes that the initial award is invested at 10% and that an amount equal to expected damages is withdrawn from the investment fund each month. The inequities resulting from the inability of the legal system to adequately evaluate alternative methods of determining the present value of future damages are obvious and substantial.

TABLE VIII

COMPARISON OF ALTERNATIVE METHODS FOR A GIVEN SET OF ASSUMPTIONS*

Method	Present Value	Percentage Error in Present Value	Investment Fund Depleted After
Preferred	$286,670	0%	30 years
Penrod	$113,123	-60.54%	11 years
Alaska	$360,000	+25.58%	43 years
Feldman	$235,205	-17.95%	23 years
Modified *Feldman*	$268,757	-6.25%	27 years
Average Annual Damage	$461,338	+60.93%	62 years

* The initial damage is $12,000, monthly damages are expected for thirty years, damages are expected to grow at 8% annually, the award will be invested at 10% annually, and the expected annual inflation rate is 7%.

VI. CONCLUSIONS

Present value calculations in the estimation of economic damages should meet one simple test of fairness: Do they produce a present value which, if invested, will exactly replace the plaintiff's future economic losses? An award too large penalizes the defendant unfairly and unjustly enriches the plaintiff. An award too small allows the defendant to escape part of the consequences of his acts, and leaves the victim with inadequate funds to fully recover future damages as they occur.

The sensitivity of the final result to variations in method makes the selection of a correct method a very significant issue to all parties. Table VIII graphically demonstrates the great disparity of results that can follow from an arbitrary selection of methodology.

Present value calculations are not a matter of mere arithmetic as many non-economists might suppose. Given numerous conflicting methods presented by "experts" and accepted—even endorsed—by the courts, it is apparent that there is no ready solution to the search for a method that is fair to all parties in a suit for economic damages. Unfortunately, no widely recognized authority from the economics profession has come forth to identify and endorse the fairest method.

Logic, however, does strongly suggest use of the "preferred" methodology. This approach is the only one that will consistently approximate the damages' purpose of awarding precisely enough to meet lost future values. It is true that debate continues, and should continue, over the nature of such fundamental variables as expected growth rates, expected working-lives, and so on. As experience and theory combine to advance the certainty of these yet unsettled factors, however, the fairness of damage awards will be greatly enhanced through the mechanics of discounting by the "preferred" method.