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Gary A. Anderson

David L. Roberts

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Stability in the Present Value Determination of Future Lost Earnings: An Historical Perspective with Implications for Predictability

GARY A. ANDERSON* AND DAVID L. ROBERTS**

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I. INTRODUCTION

In the past several years, courts have utilized a variety of alternative methods to assess the present value of future lost earnings in personal injury litigation.¹ In some cases, courts have recommended methods that are grossly biased in favor of either the plaintiff or the defendant.² In other cases, courts have used methodologies that violate well-known economic relationships and that incorporate incorrect definitions of the economic parameters³ needed to assess awards.⁴ Even when courts have employed methods that are not biased, they have used variations of the underlying economic parameters that are inconsistent with widely accepted economic theories and historical experience.⁵ The potential

* Assistant Professor of Finance, University of Miami.

** Associate Professor of Finance, University of Tampa.

1. For a discussion of these methods, see Anderson & Roberts, *Economic Theory and the Present Value of Future Lost Earnings: An Integration, Unification, and Simplification of Court Adopted Methodologies*, 39 U. MIAMI L. REV. 723 (1985); Landsea & Roberts, *Inflation and the Present Value of Future Economic Damages*, 37 U. MIAMI L. REV. 93 (1984).

2. See, e.g., Anderson & Roberts, *supra* note 1, at 724 n.10.

3. See *id.* at 725 nn.11-12. For a discussion of the percentage errors in present value awards that will result if a court incorrectly defines the economic parameters needed to calculate the award, see Landsea & Roberts, *supra* note 1.

4. For a discussion and explanation of the economic relationships that courts need to assess in calculating present value awards, see Anderson & Roberts, *supra* note 1, at 732-38.

5. To prove this proposition we have compared the differential discount rates used in

for inequity is enormous. In the past there have been large variations of awards among cases involving similar circumstances.⁶

The Supreme Court of the United States has been reluctant to adopt a single methodology, or to establish guidelines specifying the magnitude and relationship of the relevant economic variables that courts need to assess in calculating awards for lost earnings. In *Jones & Laughlin Steel Corp. v. Pfeifer*,⁷ the Court had the opportunity to select one exclusive method to assess awards in all federal trials. The Court reviewed many methods, but failed to adopt an exclusive one, and chose instead to identify several acceptable methods.⁸ The Court stated, "by its very nature the calculation of an award for lost earnings must be a rough approximation . . . [and] any lump sum represents only a 'rough and ready' effort to put the plaintiff in the position he would have been in had he not been injured."⁹

In an earlier article of this series, we disagreed with the Supreme Court's view that awards for lost earnings are highly speculative.¹⁰ We argued that courts can calculate an unbiased and accurate award for future lost earnings when using a forecasted differential discount rate for the period of loss.¹¹ The differential discount rate is based on the relative difference between the average annual after-tax rate of interest that the plaintiff is expected to earn by investing the award, and the average annual rate of growth in after-tax earnings expected in the plaintiff's preinjury occupation.¹² In the second article of this series we suggested that the differential discount rate is stable both over time and across different occupations.¹³ The stability of the differential discount rate implies that awards are more predictable than many critics believe.¹⁴

Table I illustrates the differential discount rates that courts have used in several different cases.¹⁵ The amount that courts al-

various cases to the differential discount rates that would have historically produced correct present value awards. See *infra* Table III p. 859, Table IV p. 861, Table V p. 867, Figure I p. 862, Figure III p. 866, Figure IV p. 868, & Figure V p. 870.

6. See Anderson & Roberts, *supra* note 1, at 725 n.13.

7. 462 U.S. 523 (1983).

8. See Anderson & Roberts, *supra* note 1, at 726.

9. *Jones & Laughlin Steel Corp. v. Pfeifer*, 462 U.S. 523, 546-47 (1983).

10. See Anderson & Roberts, *supra* note 1.

11. See *id.* at 739-47.

12. See *infra* Section II.

13. See Anderson & Roberts, *supra* note 1, at 748-49.

14. See *infra* notes 80-82 and accompanying text.

15. Given the earnings in the year prior to injury and the number of years of lost earn-

low the differential discount rate to vary is significant because the present value award is sensitive to changes in this rate. For example, a change of one percent (from 1% to 0%) would cause changes of approximately 11% and 22% in awards designed to represent twenty and forty years of lost earnings. A change of seven percent (from 7% to 0%) would cause changes of approximately 89% and 200% in awards estimated for twenty and forty years of lost earnings.

TABLE 1
COURT ALLOWED DIFFERENTIAL DISCOUNT RATES

<u>Case</u>	<u>Differential Discount Rates</u>
<i>Beaulieu v. Elliott</i> ¹⁶ (1967)	0.0%
<i>Jones & Laughlin Steel Corp. v. Pfeifer</i> ¹⁷ (1982)	0.0%
<i>Feldman v. Allegheny Airlines, Inc.</i> ¹⁸ (1975)	1.5%
<i>Doca v. Marina Mercante Nicaraguense, S.A.</i> ¹⁹ (1979)	2.0%
<i>Culver v. Slater Boat Co.</i> ²⁰ (1982)	2.0%
<i>Malat v. Bjornson</i> ²¹ (1979)	4.0%
<i>Arnold v. Teno</i> ²² (1978)	7.0%
<i>Andrews v. Grand & Toy Alberta Ltd.</i> ²³ (1978)	7.0%

The magnitude and stability of the differential discount rate is an important empirical issue that courts must resolve before establishing unbiased guidelines in the assessment of fair awards. Although a number of historical studies have investigated this issue,²⁴ these studies suffer from two major deficiencies. First, they

ings, we can calculate the differential discount rate for any award. Therefore, every award, regardless of the methodology that the court uses to determine the award, implicitly assumes a particular differential discount rate. See *infra* equation (1) p. 853; see also text accompanying note 41.

16. 434 P.2d 665 (Alaska 1967).

17. 678 F.2d 453 (3d Cir. 1982).

18. 524 F.2d 384 (2d Cir. 1975).

19. 634 F.2d 30 (2d Cir. 1980).

20. 688 F.2d 280 (5th Cir. 1982), *rev'd*, 722 F.2d 114 (5th Cir. 1983).

21. 114 D.L.R.3d 612 (B.C. Ct. App. 1980).

22. 83 D.L.R.3d 609 (Can. 1978).

23. 83 D.L.R.3d 452 (Can. 1978).

24. See, e.g., S. SPEISER, RECOVERY FOR WRONGFUL DEATH ECONOMIC HANDBOOK (1970); Carlson, *Economic Analysis v. Courtroom Controversy, The Present Value of Future Earnings*, 62 A.B.A. J. 628 (1976); Coyne, *Present Value of Future Earnings: A Sensible Alternative to Simplistic Methodologies*, 25 INS. COUNS. J. 26 (1982); Formuzis & O'Donnell, *Inflation and the Valuation of Future Economic Losses*, 38 MONT. L. REV. 197 (1977); Franz, *Simplifying Future Lost Earnings*, 13 TRIAL 34 (1977).

examine before-tax rather than after-tax rates of interest and growth in earnings, and provide historical observations of the differential discount rate that do not reflect the effects of income taxes on earnings and interest income. In *Pfeifer* the Supreme Court stated, "since . . . the lost stream of income should be estimated in after-tax terms, the discount [interest] rate should also represent the after-tax rate of return to the injured worker."²⁵ Second, these studies have examined only the average wage of the average worker in the economy; they do not provide any information concerning the stability of the differential discount rate across different occupations. In reference to these studies, the Supreme Court stated that "we have not been given sufficient data to judge how closely the national patterns of wage growth are likely to reflect the patterns within any given industry."²⁶ In addition, the Court stated that "the Legislative branch of the federal government is far better equipped than we are to perform a comprehensive economic analysis and to fashion the proper general rule."²⁷

This article reports the results of the first comprehensive and integrated economic analysis of the present value determination of future lost earnings,²⁸ and recommends that courts use the after-tax differential discount rate to assess these awards. The primary objective of this study was to determine the magnitude and stability of the after-tax differential discount rate.²⁹ Consistent with economic theory, the after-tax differential discount rate is remarkably stable over time and across different occupations. The historical stability of the after-tax differential discount rate contradicts the Supreme Court assertion that awards of future lost earnings are highly speculative. During the volatile period of this study, 1952-

25. *Jones & Laughlin Steel Corp. v. Pfeifer*, 462 U.S. 523, 537 (1983).

26. *Id.* at 551.

27. *Id.*

28. The authors of this article conducted this study. Section III offers a description of the data utilized and the methodology employed in this study. See *infra* p. 855.

29. The authors used data on annual earnings, interest rates, effective income tax rates, and tax laws for the 1952-1982 time-period in order to compute the after-tax differential discount rates for 454 different occupations under various years of lost earnings. We did not include the post World War II years prior to 1952 in the study because this period included unusual economic phenomenon. For example, the federal government "pegged" interest rates and instituted wage and price controls, and there was substantial price inflation, contrary to experts' forecast of price deflation. For a discussion of how unexpected price inflation effects the differential discount rate, see *infra* note 63 and accompanying text. For a general discussion of the economic conditions of this time-period, see DARBY, *MACRO-ECONOMICS* 356-69 (1979). We excluded the post-1982 period from the study because the effective income tax rates for different income classifications that we would need to determine the after-tax differential discount rate are not yet available from the federal government.

1982, economic conditions varied unexpectedly and dramatically. There were periods of rapid expansion in the economy, recessions, double-digit price inflation, wage and price controls, the energy crisis, and two major wars. Moreover, the interest and growth in earnings rates varied substantially during this time. The fact that the differential discount rate is stable across different occupations over this time-period suggests that it is possible to establish a benchmark for this rate that is appropriate for most cases of future lost earnings. This benchmark could have produced accurate awards in most cases during the stated time-period, regardless of the plaintiff's preinjury occupation or the economic conditions that prevailed over the period of loss.³⁰

The stability of the differential discount rate indicates that the differences among awards in various cases should result primarily from differences in preinjury earnings and/or differences in the number of years of lost earnings. This is based on the presumption that courts only use the after-tax differential discount rate, after-tax earnings in the year prior to injury, and the number of years of lost earnings to calculate the award.³¹ The differential discount rate's stability also implies that other factors, such as the rate of price inflation or the rate of growth in the total output of the economy, are not necessary to calculate the appropriate award.³² For example, suppose that prior to injury two plaintiffs were well-established in their occupations, were not expected to change occupations, were expected to work for another twenty years, and were expected to progress on average with their coworkers. As we shall demonstrate below,³³ if one plaintiff earned one and one-half times the after-tax income of the other plaintiff in the year prior to injury, then this plaintiff should receive an award which is approximately one and one-half times the award that the other received. This should be the result in most cases, regardless of the economic conditions that a court expects to exist over the period of losses.

Finally, the differential discount rate approach provides a simple, straightforward method to estimate awards of future lost earnings. All parties to the litigation should be able to use the benchmark differential discount rate to compute an award that is reasonably consistent with economic theory and historical evi-

30. See *infra* notes 80-82 and accompanying text.

31. See *infra* Section II.

32. See Anderson & Roberts, *supra* note 1, at 728, 749.

33. See *infra* note 46 and accompanying text.

dence.³⁴ Although courts should allow some deviations from this estimate, these deviations should be relatively small.³⁵ Therefore, the results of this study should provide a simple methodology with guidelines that are stringent enough to reduce the inequity in awards of future lost earnings.

Section II explains the differential discount rate approach in assessing the present value of future lost earnings. Section III describes the methodology employed in this study. Section IV presents the results of the study and an evaluation of these results. Section V recommends a benchmark for the differential discount rate, and Section VI contains concluding remarks.

II. THE DIFFERENTIAL DISCOUNT RATE APPROACH

The goal of personal injury litigation is to award plaintiffs a present sum of money that, over time and through investment in relatively safe government securities, will allow them to replicate their lost earnings.³⁶ The court calculates the present value of future lost earnings by forecasting future lost earnings and then discounting to present value. When the court discounts the award, it reduces the forecasted future lost earnings to present value by removing the amount of interest income that the plaintiff is expected to earn through investment.³⁷ The amount of the award, therefore, depends on the rate at which the plaintiff's earnings would have grown (the growth rate) and the rate of interest earned on the invested award (the discount rate) over the period of loss.

Growth in earnings and interest rates have varied widely from year-to-year. Most present value assessment methods, therefore, are based on the forecasting of average, annual, after-tax growth and interest rates.³⁸ In *Pfeifer*, the Supreme Court of the United States favored three approaches: (1) the "market" (or nominal) growth in earnings and interest rates; (2) the "below-market" (or real) growth in earnings and interest rates; or (3) the "offset" (or differential) discount rate.³⁹ In the second article of this series we

34. The benchmark differential discount rate must be based on the historical evidence presented in this article. For a discussion of the economic theory underlying the stability of the differential discount rate, see Anderson & Roberts, *supra* note 1, at 732-38.

35. See *infra* Section IV(B).

36. See *Jones & Laughlin Steel Corp. v. Pfeifer*, 462 U.S. 523, 533-38 (1983).

37. *Id.*

38. For example, the below-market (or real) interest rate approach, the market (or nominal) interest rate approach, the *Feldman* approach, and modifications of the *Feldman* approach are all based on averages. See *supra* note 1, at 732 n.47.

39. Nominal growth in earnings and interest rates refer to the rates of change in earn-

explained, evaluated, and contrasted these three basic methodologies and showed them to be mathematically equivalent.⁴⁰ All three approaches yield the same present value award provided that courts correctly define and consistently estimate the economic parameters involved.⁴¹

The differential discount rate approach is based on the fact that the amount of the award ultimately depends on the difference between the interest rate the court uses to discount future lost earnings to present value and the growth rate used to forecast future lost earnings. This results because increases or decreases in both the interest and growth in earnings rates are offset by each other. For example, an increase in the interest rate (other things being constant) will decrease the award, because it increases the interest income earned per dollar of award. An increase in the growth rate (other things remaining constant) will increase the award, because it increases the forecasts of future lost earnings. If the interest and growth rates increase, there will be no effect on the after-tax differential discount rate because the two increases will offset each other.⁴²

The algebraic expression of the differential discount rate is:⁴³

$$(1) d = \frac{k - g}{1 + g} = \frac{k_r - g_r}{1 + g_r}$$

In the equation d is the after-tax differential discount rate, k is the nominal, and k_r is the real average, annual, after-tax interest rate forecasted for the period of loss; and g is the nominal and g_r is the real average, annual growth rate in after-tax lost earnings forecasted for the period of loss. Equation (1) indicates that courts can define the differential discount rate in terms of the difference between the nominal (or market) interest and growth in earnings rates $((k - g)/(1 + g))$ or the real (or below-market) interest and growth in earnings rates $((k_r - g_r)/(1 + g_r))$. Both definitions produce the same differential discount rate provided that the courts

ings and interest received using actual dollars received (without adjustment for what these dollars will purchase). The real growth in earnings and interest rates refer to the rates of change in earnings and interest received after reducing these rates for inflation (after adjusting for the actual purchasing power of these dollars). For a more complete discussion of this issue and its relationship to the present value determination of lost earnings, see Anderson & Roberts, *supra* note 1, at 729-31.

40. See *id.* at 732-38.

41. See *id.* at 732-34.

42. See *supra* note 1, at 736-39.

43. See *id.* at 736 n.55.

correctly define the nominal and real interest and growth rates in relation to each other.⁴⁴

The amount of the award depends on the absolute values of the interest and growth rates that the court uses to calculate the award, but only to the extent that these absolute values determine the magnitude of the differential discount rate. For example, interest and growth rates (whether nominal or real) of 1% and 1.51%, 3% and 3.52%, 5% and 5.53%, or 7% and 7.54%, respectively, all yield the same present value award because they are all related to the same after-tax differential discount rate of $-.5\%$ (using equation (1): $d = (k - g)/(1 + g) = (.01 - .0151)/(1 + .0151) = -.005$ or $-.5\%$).⁴⁵ Moreover, because the nominal (or market) and real (or below-market) interest and growth rate approaches to assessing awards require the courts to forecast interest and growth rates, awards determined by both approaches are based on an implicit assumption concerning the magnitude of the after-tax differential discount rate. Thus, guidelines for an economic theory based on both the after-tax differential discount rate and historical experience would be useful in evaluating the reasonableness of awards. This is true regardless of the methodology courts have employed in arriving at these awards.

Awards of lost earnings are easy to calculate once the court has forecasted the after-tax differential discount rate for the period of loss. Table II presents "multipliers" for various combinations of differential discount rates over numbers of years of lost earnings. The product of the appropriate multiplier from this table and the after-tax earnings of the plaintiff in the year prior to injury determines the present value award. For example, assume that prior to injury a plaintiff was earning the average income for his/her occupation, was expected to continue in this occupation, and to progress at the same rate as his/her coworkers. If the plaintiff had a remaining work-life expectancy of twenty years at the time of injury, and the after-tax differential discount rate is expected to be $-.5\%$ over this time-period, then the multiplier listed in Table II is 21.09. Thus, if the plaintiff's after-tax income during the year prior to injury was \$10,000, the correct award under these assumptions would be \$210,900 (that is, $\$10,000 \times 21.09 = \$210,900$).⁴⁶

44. *See id.*

45. Note that we could substitute each pair of interest and growth rates into equation (1) to calculate the differential discount rate, and that each pair produces the same differential discount rate of $-.5\%$.

46. If the plaintiff's after-tax income during the year prior to injury was \$15,000, then

TABLE II

MULTIPLES FOR VARIOUS DIFFERENTIAL DISCOUNT RATES
AND NUMBERS OF YEARS OF LOST EARNINGS (MULTIPLIER
X AFTER-TAX EARNINGS = PRESENT VALUE AWARD)

Differential Discount Rate	Number of Years of Lost Earnings					
	<u>5</u>	<u>10</u>	<u>15</u>	<u>20</u>	<u>25</u>	<u>30</u>
2.0%	4.71	8.98	12.85	16.35	19.52	22.40
1.5%	4.78	9.22	13.34	17.17	20.72	24.02
1.0%	4.85	9.47	13.87	18.05	22.02	25.81
0.5%	4.93	9.73	14.42	18.99	23.45	27.79
0.0%	5.00	10.00	15.00	20.00	25.00	30.00
-0.5%	5.08	10.28	15.62	21.09	26.70	32.45
-1.0%	5.15	10.57	16.27	22.26	28.56	35.19
-1.5%	5.23	10.88	16.96	23.53	30.61	38.24
-2.0%	5.31	11.19	17.70	24.89	32.85	41.66
-2.5%	5.40	11.52	18.48	26.37	35.33	45.49
-3.0%	5.48	11.87	19.31	27.96	38.05	49.79

III. METHODOLOGY OF STUDY

The primary objective of this study was to accurately determine the magnitude and stability of the after-tax differential discount rate over time and across different occupations. We used data from the period between 1952 and 1982 to calculate historical differential discount rates for various occupations and periods of loss. The data included annual wage information for 454 occupations,⁴⁷ annual yields on one-year Treasury notes,⁴⁸ and annual ef-

the correct award would be \$315,350 ($\$15,000 \times 21.09$). Alternatively, if base year earnings are \$10,000 and the number of years of lost earnings are expected to be ten, then the correct award would be \$105,450 ($\$10,000 \times 10.28$).

47. We took the annual wage information used in this study from the National Bureau of Economic Research computer data tape which the City Bank of New York maintains and distributes, and from the Lab-Stat data tape which The Bureau of Labor Statistics maintains and distributes. These tapes contain millions of observations of different economic variables which the National Bureau of Economic Research and The Bureau of Labor Statistics have collected. The University of Miami purchased copies of these data tapes from the City Bank of New York and The Bureau of Labor Statistics. These tapes are stored at the University's computer center and are available to faculty members for research purposes. The National Bureau of Economic Research tape contains annual observations of before-tax wages for the average worker in manufacturing, mining, and construction, and for the average worker in each of nineteen manufacturing industries. The Lab-Stat data tape contains annual observations of before-tax earnings for 454 occupations, including 11 occupations in mining, 15 occupations in construction, 324 occupations in manufacturing, 19 occupations in transportation and public utilities, 52 occupations in wholesale and retail

fective income tax rates of thirty-two income classifications.⁴⁹

An accurate present value award allows the plaintiff, through investment in "relatively safe" government securities, to replicate future after-tax lost earnings over the period of loss.⁵⁰ Different government securities of varying maturities offer different yields and risks, therefore, the correct award depends on the plaintiff's investment strategy. In this study, the plaintiff adopts a short-term "roll-over" strategy in which he invests and reinvests the award exclusively in one-year Treasury notes.⁵¹ The plaintiff immediately invests the entire award in one-year notes, and at the end of each successive year the investment fund increases by the amount of that year's after-tax interest income and decreases by the amount of that year's after-tax lost earnings. The plaintiff then reinvests the balance of the investment fund in one-year Treasury notes. After these adjustments for the last year of lost earnings,

trade, 10 occupations in finance, insurance, and real estate, and 23 occupations in services. All of the wage data contained on the National Bureau of Economic Research tape encompasses the time-period of this study. Of the 454 wage series contained on the Lab-Stat tape, 140 span the 1952-1982 time-period, 124 span the 1965-1982 period, and 190 span the 1973-1982 period. We used all of the wage information contained on these two tapes to compute the correct present value awards and after-tax differential discount rates for the different occupations for various periods of lost earnings during the 1952-1982 time-period.

48. We took this information from the National Bureau of Economic Research (NBER) computer data tape which consists of the interest rates on one-year United States Treasury notes for January 1 of each year from 1952 through 1982. We used these interest rates to compute the before-tax interest income that the plaintiff would have earned each year from the invested award.

49. We collected the effective income tax rates used in this study from the Statistics of Income Bulletin which is published annually by the Internal Revenue Service, Department of the Treasury, United States Government. The collected information consists of the effective (or average) income tax rates actually paid by taxpayers in each of 32 income classifications for each year from 1952 through 1982. The income classifications are: \$0 to \$500, \$500 to \$3,000 by increments of \$250, \$3,000 to \$5,000 by increments of \$500, \$5,000 to \$15,000 by increments of \$1,000, \$15,000 to \$30,000 by increments of \$5,000, \$30,000 to \$100,000 by increments of \$10,000, \$100,000 to \$300,000 by increments of \$50,000, \$300,000 to \$500,000 by increments of \$100,000, \$500,000 to \$1,000,000 by increments of \$250,000, \$1,000,000 to \$2,000,000 by increments of \$500,000, \$2,000,000 to \$5,000,000 by increments of \$1,000,000, and over \$5,000,000.

50. See *supra* note 36 and accompanying text.

51. Some authors have advocated a "buy and hold" investment strategy in which the entire award is assumed to be invested in long-term government securities. Other authors have recommended a strategy in which the award is assumed to be invested in a combination of short-term, intermediate-term, and long-term government securities. See, e.g., Fulmer & Geraghty, *The Appropriate Discount Rate to Use in Estimating Financial Loss*, 32 FED. INS. COUNS. Q. 263 (1982); Jarrell & Pulsinelli, *Obtaining the Ideal Discount Rate in Wrongful Death and Injury Litigation*, 32 DEFENSE L. J. 191 (1983). The Supreme Court does not prefer one investment strategy over another. See *Jones & Laughlin Steel Corp. v. Pfeifer*, 462 U.S. 523 (1983). We prefer the short-term investment strategy. This issue will be addressed in a future article.

the balance of the investment fund is zero.

We developed a computer program to calculate the correct present value awards for various numbers of consecutive years of lost earnings during the 1952-1982 period, in any occupation for which annual wage information was available. In all cases, we assumed that the only purpose of the award was to replicate after-tax lost earnings, that the plaintiff was unable to work in any capacity, and that the plaintiff's lost earnings were equal to the earnings of the average worker in the plaintiff's preinjury occupation. The awards that the computer program calculated were based on the actual earnings, interest rates, and effective income tax rates that existed during each year of the period of loss. We applied these awards to the plaintiff's earnings in the year prior to injury in order to calculate the correct after-tax differential discount rates. Therefore, the program is able to compute an after-tax differential discount rate that courts can use to determine the correct present value award for any number of consecutive years of lost earnings for which occupational data is available.⁵²

IV. PRESENTATION AND EVALUATION OF RESULTS

The significant result of this study is that the after-tax differential discount rate is stable over time and across different occupations. In addition: (1) the variability of the after-tax differential discount rate over time decreases as the number of years of lost earnings increases, (2) we can trace a substantial portion of the

52. The computer program arrives at the correct present value award by working backwards in time from the last year of lost earnings to the date of injury. For example, suppose that the average worker in an occupation was injured in 1955 and lost earnings for the 10 year period from 1956 through 1965. First, the program computes the after-tax earnings of the average worker in this occupation for 1965, using before-tax earnings and the 1965 effective income tax rate for the worker's income classification. The program then uses the interest rate on one-year Treasury notes for 1965 and the correct effective tax rate for 1965 to compute the amount of money the plaintiff has to invest at the beginning of 1965 to pay income taxes on interest income that he earned during 1965, and to replicate 1965 after-tax earnings. This amount of money is then added to computed after-tax earnings for 1964 to determine the total sum required in 1964 to replicate both 1964 and 1965 lost earnings. The program then uses the interest rate on one-year Treasury notes for 1964 and the correct effective tax rate for 1964 to compute the amount of money the plaintiff would have to invest at the beginning of 1964 to pay income taxes on interest income earned during 1964, and to replicate the total sum required in 1964 to replicate both 1964 and 1965 lost earnings. This amount of money is then added to computed after-tax earnings in 1963 to determine the total sum required in 1963 to replicate 1963, 1964, and 1965 lost earnings. The program continues to work backwards in time until the computer determines the total amount of money required at the date of injury (1955) to replicate lost earnings for each of the following ten years. This amount of money is the correct present value award.

small variance that did exist in the after-tax differential discount rate over time to time-periods in which the actual rate of price inflation differed from the expected rate of inflation for that period, and (3) we can explain a significant portion of the small variance that existed in the after-tax differential discount rate across different occupations according to whether the plaintiff's occupation was in an expanding or contracting industry. These results are documented and evaluated in this section.

A. *Stability Over Time*

Economic conditions varied unexpectedly and dramatically during the years between 1952 and 1982, but the after-tax differential discount rates remained stable. This is particularly true of the differential discount rates for longer periods of lost earnings. Table III lists the after-tax differential discount rates for the average worker in the manufacturing, mining, and construction industries for ten and twenty years of lost earnings, and for the average worker (based on an index of these three industries) for five, ten, fifteen, and twenty years of lost earnings. The table lists rates according to the first year of lost earnings. For example, if the average wage earner was injured on the last day of 1951, and his first year of lost earnings was 1952, then the appropriate differential discount rate to be used with 1951 after-tax earnings to compute the correct present value award for five years of lost earnings would be -2.22% . If the average wage earner is manufacturing twenty years of lost earnings beginning in 1962, the appropriate differential discount rate would be $-.55\%$.

TABLE III
AFTER-TAX DIFFERENTIAL DISCOUNT RATES FOR THE
OVERALL AVERAGE WORKER AND THE AVERAGE WORKER IN
MANUFACTURING, MINING, AND CONSTRUCTION

Year	Average*					Manufacturing		Mining		Construction	
	N**=5	N=10	N=15	N=20	N=10	N=20	N=10	N=20	N=10	N=20	
1952	-2.22%	-1.67%	-1.38%	-1.14%	-1.60%	-1.04%	-1.80%	-1.12%	-2.00%	-1.61%	
1953	-2.11%	-1.44%	-1.19%	-1.00%	-1.44%	-0.92%	-1.74%	-1.09%	-1.43%	-1.35%	
1954	-1.65%	-1.11%	-0.94%	-0.83%	-1.01%	-0.68%	-0.95%	-0.70%	-1.31%	-1.29%	
1955	-2.05%	-1.21%	-0.96%	-0.87%	-1.20%	-0.76%	-1.20%	-0.85%	-1.08%	-1.17%	
1956	-0.17%	-0.53%	-0.44%	-0.51%	-0.37%	-0.33%	-0.07%	-0.32%	-1.18%	-1.21%	
1957	0.12%	-0.17%	-0.17%	-0.34%	-0.10%	-0.20%	0.58%	-0.09%	-0.75%	-1.00%	
1958	0.09%	-0.16%	-0.20%	-0.40%	-0.11%	-0.28%	0.61%	-0.21%	-0.77%	-1.01%	
1959	-0.38%	-0.42%	-0.42%	-0.59%	-0.38%	-0.49%	-0.28%	-0.78%	-0.77%	-1.01%	
1960	0.66%	0.17%	0.08%	-0.35%	0.32%	-0.21%	0.45%	-0.55%	-0.74%	-0.98%	
1961	-0.47%	-0.30%	-0.47%	-0.65%	-0.16%	-0.52%	-0.10%	-0.93%	-1.05%	-1.09%	
1962	-0.70%	-0.36%	-0.58%	-0.69%	-0.16%	-0.55%	-0.36%	-1.15%	-1.06%	-0.98%	
1963	-0.43%	-0.29%	-0.60%		-0.06%		-0.48%		-1.33%		
1964	-0.30%	-0.35%	-0.69%		-0.07%		-0.62%		-1.39%		
1965	0.23%	-0.22%	-0.60%		0.09%		-0.73%		-1.23%		
1966	0.93%	0.06%	-0.50%		0.25%		-0.69%		-1.23%		
1967	0.67%	-0.34%	-0.62%		0.05%		-0.94%		-1.23%		
1968	-0.30%	-0.93%			-0.69%		-1.44%		-1.28%		
1969	-0.53%	-1.06%			-0.85%		-2.10%		-1.40%		
1970	-0.92%	-1.31%			-1.19%		-2.26%		-0.90%		
1971	-2.16%	-1.83%			-1.93%		-2.72%		-0.71%		
1972	-1.69%	-1.34%			-1.60%		-2.81%		-0.28%		
1973	-0.83%										
1974	-1.15%										
1975	-1.86%										
1976	-1.58%										
1977	-0.06%										

*Average worker based on an index of the manufacturing, mining, and construction industries.
 **N: number of years of lost earnings.

Table IV lists the mean and standard deviations of the after-tax differential discount rates over time for ten and twenty years of lost earnings for the average wage earners in various industries.⁵³ The mean and standard deviations for the average construction, mining, and manufacturing wage earners are based on the information provided in Table III. For example, Table III lists the after-tax differential discount rates for ten years of lost earnings beginning each year from 1952 through 1972 for the average worker in the manufacturing, mining, and construction industries. The mean and standard deviation of these rates are $-.71\%$ and $.57\%$, respectively. Likewise, Table III lists the differential discount rates for twenty years of lost earnings beginning each year from 1952 through 1962 for the average worker in each of these industries. The mean and standard deviation of these rates for the average worker in mining are $-.71\%$ and $.35\%$, respectively. The mean and standard deviations for the nineteen individual manufacturing industries listed in Table IV are based on the same time-period, and are comparable to the other statistics presented in this table.

53. The standard deviation for a set of data is a measure of the dispersion of that data around the mean (or average). For normal distributions (a frequency distribution of the data forms a symmetrical, bell-shaped curve centered on the mean), a relatively large sample should contain approximately 68%, 95%, and 99% of the observations within one, two, and three standard deviations of the mean, respectively.

TABLE IV

MEANS AND STANDARD DEVIATIONS OF AFTER-TAX
DIFFERENTIAL DISCOUNT RATES OVER TIME FOR THE
AVERAGE WAGE EARNERS IN VARIOUS INDUSTRIES

	N** = 10		N = 20	
	\bar{d}^{***}	σ^{****}	\bar{d}	σ
Average*	-0.71%	0.57%	-0.67%	0.25%
Construction	-1.08%	0.43%	-1.15%	0.19%
Mining	-0.94%	0.99%	-0.71%	0.35%
Manufacturing	-0.58%	0.67%	-0.54%	0.27%
Food & Kindred Products	-0.74%	0.83%	-0.69%	0.39%
Textile Mill Products	-0.35%	0.50%	-0.39%	0.25%
Apparel & Other Textiles	0.17%	0.39%	0.12%	0.21%
Lumber & Wood Products	-0.69%	0.66%	-0.58%	0.20%
Furniture & Fixtures	0.09%	0.48%	0.07%	0.26%
Paper & Allied Products	-0.87%	0.78%	-0.80%	0.31%
Printing & Publishing	-0.06%	0.53%	-0.05%	0.31%
Chemicals & Allied Products	-0.93%	0.95%	-0.86%	0.44%
Petroleum & Coal	-0.95%	0.99%	-0.76%	0.33%
Rubber & Misc. Plastic	-0.04%	0.96%	-0.06%	0.53%
Leather & Leather Products	0.07%	0.40%	-0.06%	0.24%
Stone, Clay & Glass	-0.79%	0.74%	-0.71%	0.34%
Primary Metal Industries	-0.99%	1.26%	-0.80%	0.41%
Fabricated Metal Products	-0.50%	0.71%	-0.48%	0.33%
Machinery (excl. electric)	-0.52%	0.66%	-0.53%	0.25%
Electric & Electronic Equip.	-0.32%	0.77%	-0.27%	0.33%
Transportation Equipment	-0.92%	0.87%	-0.86%	0.25%
Instruments & Related Prod.	-0.14%	0.71%	-0.20%	0.33%
Misc. Manufacturing	0.00%	0.52%	0.02%	0.28%

*Average worker based on an index of the manufacturing, mining & construction industries.

**N: number of years of lost earnings

***d: mean of differential discount rates

**** σ : standard deviation of differential discount rates.

The information provided in Tables III and IV indicates that the after-tax differential discount rates for major industries have been exceptionally stable over time. This stability is illustrated in Figure I, which plots the after-tax differential discount rates for the average worker with twenty years of lost earnings. The mean of these differential discount rates is $-.67\%$, with a standard deviation of only $.25\%$. In this case, 55% of the after-tax differential discount rates fall within one standard deviation of the mean (that is, between $d + \sigma = -.42\%$ and $d - \sigma = -.92\%$) and 100% of

the differential discount rates fall within two standard deviations of the mean (between $d + 2 = -.17\%$ and $d - 2 = -1.17\%$). This is remarkable given that an error in the differential discount rate equal to $.25\%$, or one standard deviation, would produce an error in the present value award of approximately 2.5% , while an error in the differential discount rate of $.50\%$, or two standard deviations, would yield an error in the award of approximately 5.5% .⁵⁴

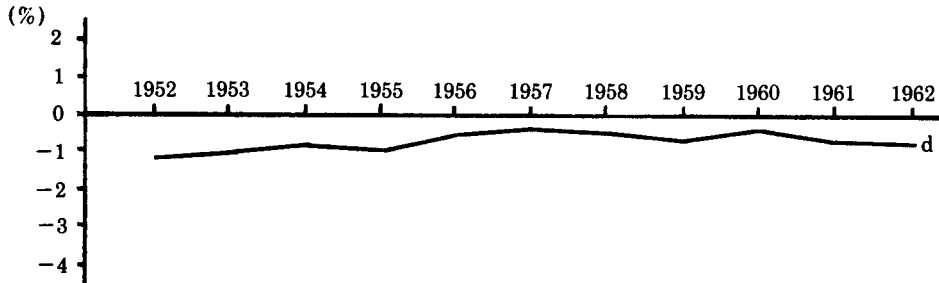


FIGURE I

Differential Discount Rates for the Average Wage Earner in Manufacturing, Mining, and Construction With Twenty Years of Lost Earnings

The stability of the after-tax differential discount rates of the industries listed in Table IV is indicative of the stability we found in the differential discount rates of all the other occupations for which earnings information was available. We calculated after-tax differential discount rates for each successive five, ten, fifteen, and twenty year time-period from 1952 through 1982 for 140 occupations, for each successive five, ten, and fifteen year time-period from 1965 through 1982 for an additional 124 occupations, and for each successive five and ten year time-period from 1973 through 1982 for an additional 190 occupations. We also computed the mean and standard deviations of the differential discount rates over time for each occupation.

Figure II is a frequency distribution graph for 140 occupa-

54. We can determine the percentage difference in present value awards that results from using two different differential discount rates by computing the percentage difference in the related multipliers presented in Table II. See *supra* p. 855. Alternatively, we can use the multipliers to calculate the awards associated with two discount rates, and then we can compute the percentage difference in the two awards. For example, a $.5\%$ change in the discount rate from 0% to $-.5\%$ for twenty years of lost earnings would change the multiplier from 20.00 to 21.09 , which would cause a 5.5% change in the award ($1.09/20.00 = .055$ or 5.5%).

tions. This graph shows the standard deviations of the after-tax differential discount rates for twenty years of lost earnings and for each successive twenty year period from 1952 through 1982. The graph indicates that 38% of the standard deviations of the 140 occupations were between .2% and .3%. In addition, 76% of the standard deviations were less than .4%, and only one standard deviation was greater than .7%. An error of .4% in the differential discount rate for twenty years of lost earnings results in an error in the present value award of approximately 4.2%.⁵⁵ Note that the distribution of these standard deviations is comparable to the distribution of the standard deviations for the industries listed in Table IV (for twenty years of lost earnings).⁵⁶

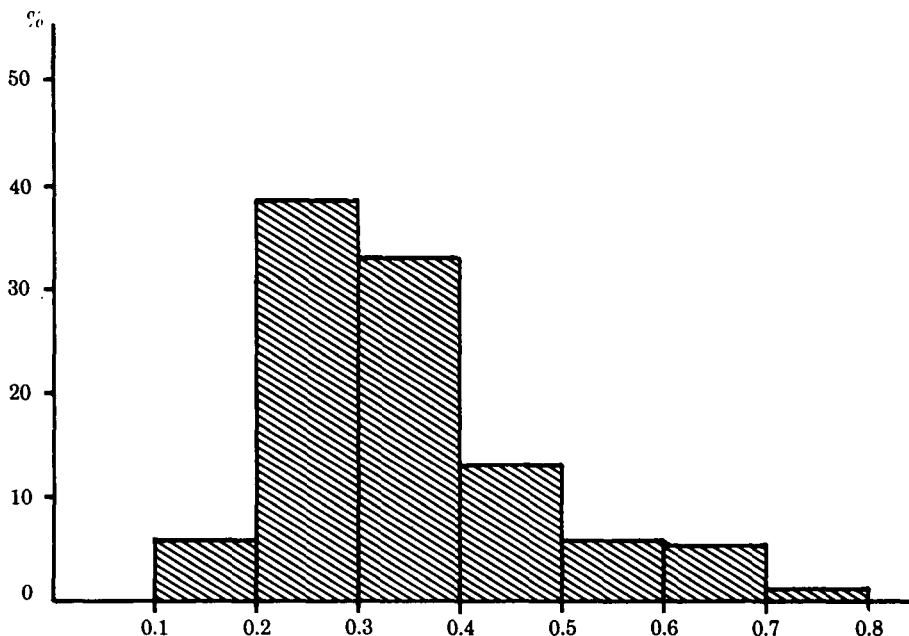


FIGURE II: Frequency Distribution of the Standard Deviations of the Differential Discount Rates Over Time For 133 Occupations (For Each Successive Twenty Year Period From 1952 - 1982).

The stability of the differential discount rate over time is consistent with accepted economic and financial theories. As equation

55. See *supra* note 54.

56. For example, of the nineteen manufacturing industries listed in Table IV, 42% have standard deviations between .2% and .3%, and 84% have standard deviations less than 4%. See *supra* p. 861.

(1) indicates,⁵⁷ the differential discount rate may be based on the difference between either the real interest and growth in earnings rates or the nominal interest and growth in earnings rates. The real interest and growth rates increase and decrease together over time because they are positively related to the real rate of growth in gross national product (GNP).⁵⁸ Increases and decreases in real GNP cause increases and decreases, respectively, in both the real interest and growth rates. Furthermore, the nominal interest and growth rates also increase and decrease together over time, because they depend on the real interest and growth rates, which are positively related, and because they are both positively related to the rate of price inflation.⁵⁹

Changing economic conditions cause the real interest and growth in earnings rates and the nominal interest and growth in earnings rates to change in the same direction. Because the differential discount rate is based on the difference between the real interest and growth rates or the nominal interest and growth rates,⁶⁰ the differential discount rate should be stable, even though changing economic conditions cause changes in the real growth rate of GNP and the rate of price inflation.⁶¹

In addition, we can trace a substantial portion of the small variance that does exist in the differential discount rates over time to the time-periods in which the actual rate of price inflation differed from the expected rate of inflation. Unexpected price inflation characterized the years between 1952 and 1982,⁶² with the periods of greatest unexpected inflation occurring during the 1954, 1956-1958, 1968-1970, 1973-1974, and 1978-1980 time-periods. As Tables III and IV indicate, the differential discount rates based on replicating earnings for these periods tend to be relatively smaller.⁶³ This is an important observation because it suggests that

57. See *supra* text accompanying note 43.

58. See Anderson & Roberts, *supra* note 1, at 739 n.63. For evidence that the real interest and growth rates vary positively with the real rate of growth in GNP, and for an explanation of why increases and decreases in real GNP cause increases and decreases respectively in the real interest and growth rates, see *id.* at 743-46.

59. For an explanation of why the nominal interest and growth rates depend on the real interest and growth rates, evidence that the nominal interest and growth rates vary positively with the rate of price inflation, and an explanation of why changes in the rate of price inflation cause changes in the nominal interest and growth rates, see *id.* at 729-31, 741.

60. See *supra* equation (1) p. 853 and text accompanying notes 42-43.

61. See *supra* notes 58-59.

62. Holland, *Does Higher Inflation Lead to More Uncertain Inflation?*, FED. RESERVE BANK ST. LOUIS REV., Feb. 1984, at 15.

63. This is true because wage contracts, and thus growth in earnings rates, often reflect

courts should give these rates less weight if they establish benchmarks for future personal injury litigation. Because these rates are based on periods of unexpected inflation, if courts use them to establish a benchmark for future differential discount rates, the rates would imply that future periods of unexpected price inflation are expected; unexpected price inflation, however, is by definition unexpected.

Finally, the variability of the differential discount rate over time decreases substantially as the number of years of lost earnings increases.⁶⁴ This phenomenon is illustrated for the average wage earner in Figure III, which plots the differential discount rates for five, ten, fifteen, and twenty years of lost earnings. This is an important observation because it suggests that differential discount rates for longer periods of lost earnings are potentially more predictable than differential discount rates for shorter periods of lost earnings.⁶⁵

past discrepancies between expected and realized price inflation, while investment contracts, and thus interest rates on one-year Treasury notes, do not. For example, after a year in which inflation is greater than expected, labor may be able to negotiate a higher wage increase to compensate for the decreased purchasing power of their earnings. Labor can negotiate such increases because of their continuing relationship with employers. In fact, many wage contracts have escalator clauses that give workers automatic wage increases during periods of price inflation. Such *ex post facto* adjustments are not possible for investors (lenders) because they have no continuing relationship with the U.S. Treasury (borrower). The maturity value of one-year notes is fixed, regardless of the prevailing rate of price inflation. Therefore, when inflation is greater than expected, the growth in earnings rate increases to compensate workers, but the interest rate earned on one-year notes does not increase to compensate investors. As equation (1) indicates, this causes the differential discount to be smaller. *See supra* p. 853.

64. The differential discount rates for longer periods of lost earnings are stable over time because they are not effected by temporary variations in the differences between annual growth in earnings and interest rates. The nominal growth in earnings and interest rates tend to increase and decrease together over time because they both depend on the rate of price inflation and the real rate of growth in GNP. The positive relationship, however, between the annual growth in earnings and interest rates is not perfect, because each rate depends on other factors, such as wage contracts, the relative bargaining strength of employers and employees, the demand and supply of loanable funds, the federal government's monetary and fiscal policies, and whether expected price inflation rates are realized. *See generally* SAMUELSON & NORDHAUS, *ECONOMICS* (12th ed. 1985). These factors may cause temporary deviations in the differences between annual growth in earnings and interest rates, and therefore cause deviations in the differential discount rate for shorter periods of loss. *See supra* equation (1) p. 853 and accompanying text. Over longer periods of lost earnings, these temporary deviations tend to offset each other (because some are positive and some are negative), and they have a relatively small impact on the differential discount rate. *See* Anderson & Roberts, *supra* note 1, at 741.

65. The fact that the differential discount rate is more predictable for longer periods of lost earnings helps to offset the fact that awards for longer periods of loss are more sensitive to changes in the differential discount rate than awards for shorter periods of loss.

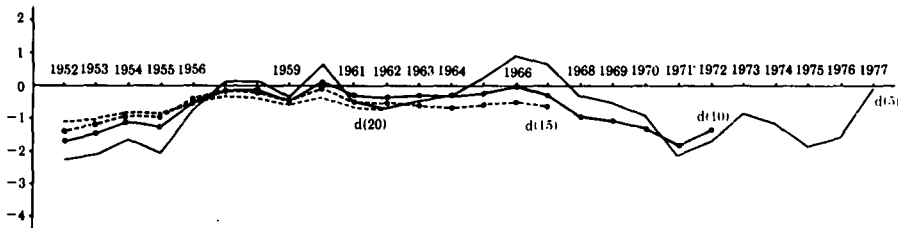


FIGURE III

Differential Discount Rates for the Average Wage Earner With Five (d(5)), Ten (d(10)), Fifteen (d(15)), and Twenty (d(20)) Years of Lost Earnings

B. Stability Across Occupations

The after-tax differential discount rate is stable across occupations. Table V lists the means and standard deviations of the after-tax differential discount rates across occupations for five, ten, fifteen, twenty, twenty-five, and thirty years of lost earnings. These statistics are based on 140 occupations in the 1952-1954 period,⁶⁶ 264 occupations in the 1965-1972 period,⁶⁷ and 454 occupations in the 1973-1982 period.⁶⁸ The table lists the means and standard deviations according to the first year of lost earnings. For example, if the average workers in each of the 140 occupations were injured on the last day of 1958, the average of the 140 occupational after-tax differential discount rates necessary to replicate twenty years of lost earnings would be -0.43% , with a standard deviation of $.54\%$. Likewise, if the average workers in each of the 264 occupations were injured on the last day of 1967, the average of the 264 occupational differential discount rates necessary to replicate ten years of lost earnings is -0.58% , with a standard deviation of $.82\%$.

66. See *supra* note 47.

67. See *supra* note 47.

68. See *supra* note 47.

TABLE V
MEANS AND STANDARD DEVIATIONS OF AFTER-TAX
DIFFERENTIAL DISCOUNT RATES ACROSS OCCUPATIONS*

Year	N = 5		N = 10		N = 15		N = 20		N = 25		N = 30	
	\bar{d}	σ	\bar{d}	σ	\bar{d}	σ	\bar{d}	σ	\bar{d}	σ	\bar{d}	σ
1952	-2.03%	1.08%	-1.51%	0.88%	-1.23%	0.73%	-0.98%	0.60%	-0.92%	0.56%	-0.91%	0.55%
1953	-2.03%	1.28%	-1.37%	0.97%	-1.09%	0.78%	-0.88%	0.63%	-0.86%	0.60%	-0.81%	0.59%
1954	-1.53%	1.10%	-1.02%	0.83%	-0.82%	0.65%	-0.69%	0.56%	-0.73%	0.55%		
1955	-1.94%	1.11%	-1.11%	0.77%	-0.83%	0.60%	-0.71%	0.53%	-0.76%	0.53%		
1956	-0.47%	1.04%	-0.38%	0.70%	-0.26%	0.54%	-0.32%	0.50%	-0.45%	0.51%		
1957	0.20%	1.04%	-0.07%	0.69%	-0.03%	0.53%	-0.19%	0.51%	-0.32%	0.52%		
1958	-0.02%	0.97%	-0.15%	0.66%	-0.11%	0.52%	-0.29%	0.52%	-0.35%	0.53%		
1959	-0.34%	0.99%	-0.29%	0.70%	-0.25%	0.56%	-0.43%	0.54%				
1960	0.74%	0.88%	0.34%	0.56%	0.13%	0.50%	-0.18%	0.50%				
1961	-0.46%	0.73%	-0.16%	0.52%	-0.30%	0.49%	-0.51%	0.51%				
1962	-0.44%	0.90%	-0.07%	0.57%	-0.32%	0.53%	-0.49%	0.53%				
1963	-0.06%	0.73%	0.04%	0.54%	-0.31%	0.52%	-0.38%	0.54%				
1964	-0.07%	0.79%	-0.07%	0.59%	-0.44%	0.55%						
1965	0.44%	0.74%	0.08%	0.60%	-0.35%	0.60%						
1966	1.17%	0.91%	0.22%	0.68%	-0.27%	0.66%						
1967	1.07%	1.10%	-0.02%	0.77%	-0.35%	0.72%						
1968	0.15%	0.89%	-0.58%	0.82%	-0.55%	0.79%						
1969	-0.14%	1.09%	-0.79%	0.93%								
1970	-0.58%	1.20%	-1.06%	1.01%								
1971	-1.89%	1.30%	-1.65%	1.08%								
1972	-1.53%	1.46%	-1.20%	1.17%								
1973	-0.49%	1.18%	-0.17%	1.00%								
1974	-0.91%	1.28%										
1975	-1.65%	1.34%										
1976	-1.39%	1.34%										
1977	0.12%	1.11%										
1978	2.28%	1.26%										

*N = number of years of lost earnings, \bar{d} = mean (average) of differential discount rates across occupations, and σ = standard deviation of differential discount rates across occupations. Observations for the periods 1952-1964, 1965-1972, and 1973-1978 are based on 140 occupations, 264 occupations, and 454 occupations, respectively.

Figure IV illustrates the stability of the after-tax differential discount rate across occupations. The figure plots the averages of the occupational differential discount rates plus and minus one and two standard deviations for fifteen years of lost earnings. For example, in 1961 the average of the 140 occupational differential discount rates necessary to replicate fifteen years of lost earnings for the 1961-1975 period is $-.30\%$, with a standard deviation of $.49\%$. This small standard deviation is remarkable, because we would expect approximately 68% of the occupation to fall within one standard deviation of the mean and approximately 95% within two standard deviations of the mean. A change in the differential discount rate for fifteen years of lost earnings of $.49\%$ (from $-.30\%$ to $.19\%$ or from $-.30\%$ to $-.79\%$) would cause a change in the present value award of only about 4%.⁶⁹

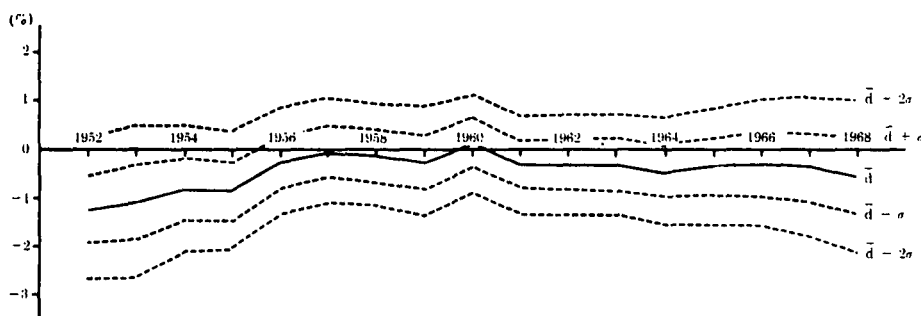


FIGURE IV

Average of Differential Discount Rates
Across Occupations (d) for Fifteen Years
of Lost Earnings with Boundaries of One ($d \pm \sigma$)
and Two ($d \pm 2\sigma$) Standard Deviations

The stability of the after-tax differential discount rate across occupations is consistent with economic theory because differences in the growth in earnings rates across occupations should be relatively small. Large differences in the growth in earnings rates would cause dramatic changes over time in the wage differentials for alternative occupations.⁷⁰ Such changes would induce workers to relocate from the low to the high growth in earnings occupa-

69. See *supra* note 54.

70. For example, suppose that the average annual growth in earnings rates for two different occupations are 10% and 6%, respectively. If the earnings in both occupations are \$10,000 this year, then in 15 years the annual earnings will be \$41,772 and \$23,966, respectively.

tions, which over time would tend to equalize the growth in earnings rates. The increased supply of labor to the high growth in earnings occupation would tend to cause a reduction in its growth in earnings rate, while the decreased supply of labor to the low growth in earnings industry would tend to cause an increase in its growth in earnings rate.⁷¹ Thus, any differences in growth in earnings rates for various occupations should be relatively small for longer periods of lost earnings.⁷²

Variance in the after-tax differential discount rate across occupations stems from differences in the growth in earnings rates of these occupations. This is true because the differential discount rates for each occupation are based on the same interest and effective tax rates.⁷³ Growth in earnings rates are usually higher in expanding industries and lower in contracting industries,⁷⁴ therefore, we associate relatively small differential discount rates with "growth" industries and relatively large differential discount rates with "declining" industries.⁷⁵ This phenomenon is illustrated in Figure V, which plots the differential discount rates over time for the average workers in the manufacturing, mining, and construction industries for ten years of lost earnings. The recent declines in the differential discount rates for mining may be related to increased investment in this industry as a result of the energy crisis,⁷⁶ and the recent increases in the differential discount rates for construction may be related in part to decreased investment in this industry as a result of large increases in mortgage rates.⁷⁷

71. For an explanation of how demand and supply factors effect the levels of wages in different occupations, see SAMUELSON & NORDHAUS, *supra* note 64.

72. For evidence that the differences in growth in earnings rates are small for different occupations and a more complete explanation of why this is true, see Anderson & Roberts, *supra* note 1, at 748.

73. The interest rates on one-year Treasury notes and the effective income tax rates used to compute after-tax earnings and interest income are the same regardless of the plaintiff's occupation. Thus, as equation (1) indicates, differences in differential discount rates for different occupations result primarily from differences in the growth in earnings rates. See *supra* p. 853. If the growth in earnings rates for two occupations are equal, then their after-tax differential discount rates will be equal.

74. Expanding industries often pay higher wages to attract additional workers, whereas contracting industries usually have a surplus of workers and pay lower wages. See *supra* note 71.

75. Relatively large growth in earnings rates imply relatively large differential discount rates. See *supra* equation (1) p. 853.

76. The term "energy crisis" refers to the rapid increase in energy prices that occurred in the late 1970's as a result of the restricted supply of foreign oil. These price increases induced expanded investment in alternative sources of energy in the United States.

77. Mortgage rates increased from 7.81% to 14.47% from 1969 to 1982.

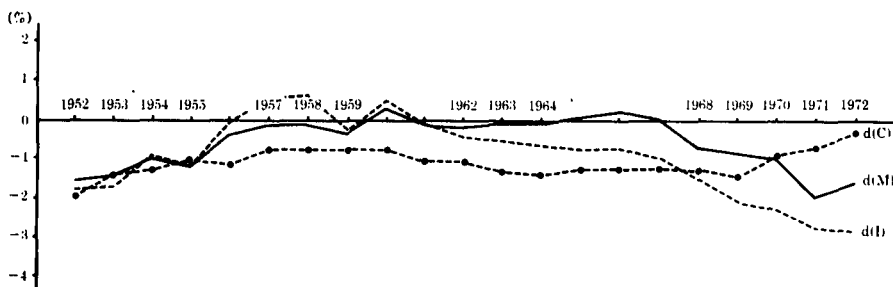


FIGURE V

Differential Discount Rates for the Average Wage Earners in Manufacturing (d(M)), Mining (d(I)), and Construction (d(C)) for Ten Years of Lost Earnings

V. THE RECOMMENDED BENCHMARK

The after-tax differential discount rates that would have produced the correct present value awards for lost earnings during the 1952-1982 study period were exceptionally stable both over time and across different occupations. If the Supreme Court had adopted a benchmark for this rate between .0% and -1%, lower courts would have been able to calculate accurate awards of lost earnings.⁷⁸ For example, the average after-tax differential discount rate for the average worker with twenty years of lost earnings is -.67%.⁷⁹ This rate would have produced accurate awards for almost all possible intervals and occupations of loss. If courts used the average differential discount rate of -.67% to estimate awards for the average worker for each twenty year period between 1952 and 1982, then the largest understatement would have been 5% and the largest overstatement would have been 3.6%.⁸⁰ Similarly, if courts had used the average rate of -.67% to estimate awards for the average worker for each ten year period between 1952 and 1982, the largest understatement would have been 6.4% and the

78. See *infra* notes 80-82 and accompanying text.

79. See *supra* Table IV p. 861.

80. The smallest and largest correct differential discount rates for twenty years of lost earnings over this period are -1.14% in 1952 and -.34% in 1957. See *supra* Table III p. 859. For the 1952-1971 period, the -1.14% rate yields the correct award of \$74,435, while the average rate of -.67% produces an estimate of \$70,717 (an error of -5%). Similarly, for the 1957-1976 period, the -.34% rate yields the correct award of \$82,897, while the average rate of -.67% produces an estimate of \$85,883 (an error of 3.6%).

largest overstatement would have been 4.8%.⁸¹ Finally, the largest and smallest average after-tax differential discount rates over the study period for the 140 individual occupations were .65% and -1.77%. If the courts had used a -.67% rate instead of a .65% or -1.77% rate in order to calculate awards for twenty years of lost earnings, then the present value award would change less than 13%.⁸²

The errors in present value awards for lost earnings that would have resulted from using a benchmark differential discount rate are slight in comparison to the degree of judicial economy and efficiency that courts would have achieved by using this relatively simple approach. If the courts use a benchmark rate, then they will eliminate inequity among awards of future lost earnings.⁸³ These results, combined with the fact that the after-tax differential discount rate has been remarkably stable over a time-period that encompasses unexpected and dramatic changes in economic conditions, indicate that a benchmark for this rate of between 0% and -1% is appropriate for future personal injury litigation.

We therefore recommend that the Supreme Court adopt a benchmark after-tax differential discount rate of -.5% for assessing present value awards of lost earnings.⁸⁴ Deviations from this benchmark would be appropriate for cases involving: (1) growth or declining industries for which the growth in earnings rates are expected to differ from the average growth in earnings rate over the period of losses,⁸⁵ (2) lost earnings for shorter time periods for which factors such as wage contracts or government's monetary and fiscal policies are expected to influence the relationship between growth in earnings and interest rates,⁸⁶ and (3) plaintiffs

81. The largest understatement occurs in 1971, when the differential discount rate is -1.83%, and the largest overstatement occurs in 1960, when the differential discount rate is .17%. See *supra* Table III p. 859. For the 1971-1980 time-period, the correct award (based on -1.83%) is \$79,490, while the estimate (based on -.67%) is \$74,426. This is an understatement of only 6.4%. For the 1960-1969 time-period, the correct award (based on .17%) is \$43,587, while the estimate (based on -.67%) is \$45,661, an overstatement of only 4.8%.

82. Of the 140 occupations for which earnings data is available for the 1952-1982 time-period, the largest average differential discount rate for twenty years of lost earnings of 0.65% was for workers manufacturing women's and misses' outerwear, and the smallest average differential discount rate for twenty years of lost earnings of -1.77% was for workers producing cement and hydraulic equipment. See *supra* note 47.

83. See *supra* note 5 and accompanying text.

84. Because during the period of this study there was unexpected price inflation, we recommend a benchmark rate -.5% rather than the average rate of -.67%. See *supra* note 63 and accompanying text.

85. See *supra* note 74 and accompanying text.

86. See *supra* note 65 and accompanying text.

whose earnings in the year prior to injury are considered atypical or plaintiffs who, prior to injury, were not expected to continue in their occupations and to progress on average with their coworkers.⁸⁷ The magnitude of such deviations from the benchmark, however, should be relatively small and should decrease as the period of lost earnings increases.⁸⁸ For example, after-tax differential discount rates outside the range of 0% to -1% should be rare for periods of loss in excess of twenty years.⁸⁹

VI. CONCLUSIONS

The results of this study indicate that it is possible for the Supreme Court to establish a benchmark for the after-tax differential discount rate which would enable courts to calculate accurate present value awards. We therefore recommend that the Supreme Court adopt a benchmark after-tax differential discount rate of -.5% for assessing present value awards of lost earnings. This benchmark, combined with the information contained in this article, will provide litigants with a simple and unbiased method to compute accurate awards. Specific case assessments may require a court to deviate from the benchmark differential discount rate, but these deviations should be small and litigants must justify them according to the criteria developed in this article.⁹⁰

In contrast to the evidence presented in this article, the courts have demonstrated a tendency to implicitly accept positive after-tax differential discount rates.⁹¹ There is, however, no reasonable historical evidence or any acceptable economic theory to support after-tax differential discount rates ranging from 2% to 7%.⁹² This would be evident if the courts would compare these rates to the historical averages plotted in Figure IV. If the Court establishes a benchmark after-tax differential discount rate of -.5%, inequity among present value awards will begin to disappear.

87. See *supra* p. 857.

88. This is true, because the standard deviations of the after-tax differential discount rates over time and across occupations decrease as the number of years of lost earnings increase. See, e.g., *supra* Table IV p. 861, note 65 and accompanying text.

89. Of the 140 occupations for which earnings data was available for the 1952-1982 time-period, 22 occupations had an average differential discount rate for 20 years of lost earnings greater than 0%, and 19 had an average rate less than -1%. In addition, only four occupations had average rates greater than .25%, and only eight occupations had average rates less than -1.25%.

90. See *supra* notes 85-87 and accompanying text.

91. See *supra* Table I p. 849.

92. See *supra* Table I p. 849.