REAL INTEREST RATES AND TOTAL OFFSET IN COMPUTATIONS OF DAMAGES IN DEATH AND DISABILITY CASES

By Allan M. Feldman*

In a death or disability action, lifetime earnings of a decedent or disabled plaintiff are a major element of damages. Those earnings may be projected over a long future period — in the case of an injured infant, for example, the future projection may be 70 years long. Then projected earnings are reduced to a lump sum present value equivalent, which is awarded to a successful plaintiff. The method used to translate the future stream of earnings into a single lump sum equivalent as of the date of trial (or possibly the date of injury) is the subject of this article.

Laws in most states either allow or require consideration of several factors in a present value calculation:

(i) The length of the projection. This might be based on plaintiff's life expectancy, or worklife expectancy, or a presumed date of retirement.

(ii) The rate of increase in plaintiff's earnings attributable to his promotions, seniority, career advancement, or other factors specific to the individual.

(iii) The rate of increase in plaintiff's earnings attributable to general increases in output in the United States economy. This is "productivity growth": As the economy accumulates new technology, new capital, new or improved infrastructure, all earnings tend to rise. A rising tide lifts all boats. For example, barber's wages will rise because of new computer technology, new highways, and new airplanes, even though these things aren't visible in the barber shop, simply because society will have to pay barbers more to prevent their migrating into other, more lucrative, occupations.

(iv) The rate of increase in plaintiff's earnings attributable to general increases in the price level. Price inflation will tend to lift wages, in the absence of promotions or productivity growth.

(v) The discount rate. Money in future years is different from money this year, aside from the inflation issue, since a sum received today can be invested with interest. Thus, if the interest rate is 10 percent, \$100 next year is equivalent to \$90.91 dollars today, since \$90.91 x 1.10 = \$100. Courts

* Associate Professor of Economics, Brown University

have generally held that the interest rate used to discount future sums to present value should be one earned on "the best and safest investment," normally United States Treasury securities. Of course, what is best may not be safest, and vice versa. One author observes that "courts have always assumed that all plaintiffs are half-wits, who despite having retained skilled attorneys for their lawsuits, will thereafter be ignorant and helpless in the investment world and can only be trusted to invest in government bonds."[1]

Finally, if taxes are separately subtracted in the damage computation, the United States Supreme Court has held that the interest rate ought to be adjusted so as to represent an after-tax rate of return.

I. The Adjustment Factor and the Three Methods

In order to focus on particular issues of discounting methods, it is convenient to use a mathematical formula to represent the process outlined above. Suppose a totally disabled plaintiff's earnings in the current year would be $E, absent his injury. Assume for simplicity that plaintiff's taxes are not separately subtracted, and that he would have had no wage growth due to promotions, seniority, or other individual-specific factors. Let n represent the number of future years over which the earnings projection is made. Let P represent the productivity growth rate (P is a decimal fraction, so if the rate is 1.5 percent per year, we write P=.015). Let I represent the expected inflation rate, and let R represent the discount rate, both expressed as decimal fractions. Then the present value of future damages is given by the formula:

$$\text{Damages} = \frac{(1+P)\,(1+I)}{(1+R)}E + \frac{(1+P)^2(1+I)^2}{(1+R)^2}E + \cdots + \frac{(1+P)^n(1+I)^n}{(1+R)^n}E$$

$$= \sum_{t=1}^{n} \left[\frac{(1+P)(1+I)}{(1+R)}\right]^t E.$$

The crucial and potentially most confusing part of this formula is the adjustment factor

$$\frac{(1+P)(1+I)}{(1+R)}$$

and we focus on it here.

[1] Conklin, *Wrongful Death Damages*, in 28 Trial Lawyers Guide 249-96 (1984).

Unfortunately for courts, the expected inflation term I is quite unobservable and will depend on what happens to the United State economy in future years. However, productivity growth is not as variable as inflation, and expert economists may not disagree drastically on P. The interest rate R may or may not be observable: If the court assumes plaintiff will invest in short-term assets, such as three- or six-month Treasury bills, the investment will have to be rolled over many times in the future, and rates available when roll-over occurs are unknown today. However, if the court assumes, as is more plausible, that plaintiff will invest in assets with lives comparable to the actual projection period, R may be as available as today's newspaper, which generally shows yields on United States Treasury bonds (and other assets) with maturities as long as 30 years.

In order to cope with the adjustment factor, courts have developed three apparently different methods. The methods were well summarized by the United States Supreme Court in the case of *Jones and Laughlin Steel Corp. v. Pfeifer.*[2]

Method 1 is the "market interest rate" approach, also and more descriptively called the "inflate-discount" approach. Here evidence is allowed regarding productivity growth and inflation, and discounting is done using a market interest rate. In other words, all parts of the adjustment factor are explicitly considered. The advantages of inflate-discount are (i) that it can be based on an observable, provable interest rate, and (ii) that it makes clear what plaintiff or plaintiff's economist is assuming, particularly regarding inflation. If the fact-finder knows that plaintiff's economist is assuming future inflation at 20 percent per year for 40 years, that assumption can be judged and discounted appropriately. The disadvantage is that the court may feel the inflation factor I is too speculative.

Method 2 is the "real interest rate" approach, originated by Judge Blumenfeld in the case of *Feldman v. Allegheny Airlines, Inc.*[3] This method assumes, as the Court notes, "that market interest rates include two components — an estimate of anticipated inflation, and a desired 'real' rate of return on

[2] 462 United States 523 (1983). *See also* George, Simien and Culbertson, *The Courts and Inflation*, 20 Trial 22-26 (1984), for a summary and comparison of the decisions in *Pfeifer* and Culver v. Slater Boat Co., 722 F.2d 114 (5th Cir. 1983), and *Conklin, supra* note 1, for a critical discussion of the legal origins of the methods.

[3] 524 F.2d 384, 388 (2d Cir. 1975).

investment — and that the latter is essentially constant over time."[4] The notion that the market interest rate is comprised of a real part and an inflation part can be expressed mathematically by writing

$$1+R = (1+R^*)(1+I),$$

where R^* is the real interest rate, expressed as a decimal fraction.[5] Now the adjustment factor can be rewritten:

$$\frac{(1+P)(1+I)}{(1+R)} = \frac{(1+P)(1+I)}{(1+R^*)(1+I)} = \frac{1+P}{1+R^*}$$

and, to the relief of many courts, the problematic I term disappears! This is the advantage of method 2.

The real interest rate R^*, however, is published in no newspaper, and is directly observable nowhere. Moreover, when a court calculates damages over a future period of several decades, the R^* it would use would typically be based on market interest rates and inflation rates that obtained in past decades. As any banker knows, what interest rate held in the market 10 years ago, or even 10 weeks ago, has no bearing whatsoever on what interest rate he pays or offers today.[6] Another way of saying the same thing is to note that plaintiff, if successful, will invest his award in the market today, at today's market interest rate, and not in a hypothetical market at an historical "real" interest rate. Moreover, the typical plaintiff will be able to *lock in* today's market interest rate on all or much of his award, by investing in long-term securities. With respect to what real interest rate to use, the Supreme Court finds that although "the economic evidence [is] distinctly inconclusive regarding an essential premise of those approaches, we do not believe a trial court adopting such an approach . . . should be reversed if it adopts a rate between one and three percent and explains its choice."[7]

Method 3 is the "total offset" approach. This assumes that the denominator of the original adjustment factor, that is 1+R, cancels out all of, or part of, the numerator. One version of the

[4] Jones & Laughlin Steel Corp. v. Pfeifer, *supra* note 2, 462 United States at 542.

[5] Note that this equation produces almost the same R^* as would the equation $R = R^* + I$; the two equations are used here interchangeably. *See* Nowak, *The Total Offset Method: "Is It Valid?,"* in TRIAL LAWYERS GUIDE 121-35 (1985), for a technical objection to this shortcut.

[6] *See* Ledford and Zocco, *New Evidence on the Selection of an Appropriate Discount Rate in Economic Loss Determination*, 36 FED. INS. Q. 27-40 (1985), for a clear criticism of the use of historical interest rates.

[7] Jones & Laughlin Steel Corp. v. Pfeifer, *supra* note 2.

method presumes that 1+R equals (1+P)(1+I), so the whole adjustment factor equals 1! This is the Alaska version of total offset, based on *Beaulieu v. Elliot*.[8] In terms of real interest rates, "Alaska total offset" is equivalent to assuming $R^* = P$, or the real interest rate equals the productivity growth rate. The advantage of Alaska total offset is that it greatly simplifies the present value calculation, for now damages simply equal yearly earnings times the number of years. Thus, judges and juries are spared the drudgery of hearing an economist explain how to calculate present values.

The other version of total offset presumes that 1+R = 1+I; that is, the market interest rate equals the expected inflation rate (or, in terms of real interest rates, $R^* = 0$). Consequently, the adjustment factor equals 1+P. This is the Pennsylvania version of total offset, following *Kaczkowski v. Bolubusz*.[9] In *Kaczkowski*, the Pennsylvania Supreme Court corrected a fallacy of an earlier Pennsylvania case, *Havens v. Tonner*,[10] in which a superior court had held that inflation and productivity growth were too speculative to enter the present value calculation. The Pennsylvania Supreme Court found "as a matter of law that future inflation shall be presumed equal to future interest rates with these factors offsetting."[11] Moreover, productivity was to be treated separately.

The advantage of computational simplicity is lost in Pennsylvania total offset, but for plaintiff there is a great advantage: damages are maximized. The disadvantage of both total offset approaches is that they fly in the face of current economic evidence. It would be neat and simple, perhaps, if R = I. It would also be neat and simple if the number π were equal to 3.0 instead of 3.14159. . . , but courts have fortunately refrained from requiring that engineers assume $\pi = 3.0$.

II. A Numerical Example

To illustrate the three methods, we turn to an example. Suppose annual earnings E equals $10,000 per year in the current year. Assume further that a totally disabled plaintiff would have worked 30 years into the future, and abstract from promotions,

---

[8] 434 P.2d 665 (Alaska 1967).
[9] 491 Pa. 561, 421 A.2d 1027 (1980).
[10] 243 Pa. Super. 371, 365 A.2d 1271 (1976).
[11] *Kaczkowski, supra* note 9 at 1038-39.

seniority and particular characteristics by assuming his earnings would only have risen due to general economy-wide productivity growth and inflation. Let us suppose that the interest rate on 30-year United States Treasury bonds is 8.7 percent (the actual yield as this is being written), and that the court takes this as an appropriate market interest.[12] Assume further that the court assumes inflation in the future will average 4.7 percent per year (which equals its average rate over the last 30 years), and that productivity growth will average 1.6 percent per year (the average growth rate of real hourly compensation in the private sector of the United States economy over the last 30 years).

The inflate-discount method incorporates all this information into the adjustment factor to get

$$\frac{(1+P)(1+I)}{(1+R)} = \frac{(1.016)(1.047)}{(1.087)} = 0.979,$$

in which case Damages = \$218,000.

The real interest rate approach ignores I, and discards R. Instead, the court assumes some value for R°. Following Judge Blumenfeld in *Feldman*, suppose that the real interest rate is presumed to be 1.5 percent, or R° = 0.15. Then the adjustment factor is

$$\frac{1+P}{1+R^\circ} = \frac{1.016}{1.015} = 1.001,$$

in which case Damages = \$305,000.

Alternatively, suppose a court notes the Supreme Court's implicit suggestion that R° ought to lie between 1 and 3 percent, and splits the difference at R° = .020. Then the adjustment factor is

$$\frac{1+P}{1+R^\circ} = \frac{1.016}{1.020} = .996,$$

in which case Damages = \$282,000.

The Alaska version of the total offset approach presumes that everything cancels out, so the adjustment factor is 1, in which

[12] Rather than, say, the yield on short-term Treasury securities, which might be two percentage points lower, or on long-term 40-year AA Bell System bonds, which might be two percentage points higher.

case Damages = \$300,000. The Pennsylvania version presumes that the interest rate equals the inflation rate, in which case the adjustment factor is

$$1+P = 1.016,$$

and Damages = \$387,000.

Evidently, the esoteric adjustment factor can play an extremely large role in determining damages. Moreover, it is a role that is generally unappreciated by a jury, which clearly understands when a plaintiff claims the loss of a \$16,000 car, but which may not even know that plaintiff's use of an economically implausible zero real rate of interest boosts damages, as our example suggests might happen, by more than \$160,000.

III. Stability of the Real Interest Rate

As Justice Stevens observes in a footnote to the *Pfeifer* decision, in the real interest rate approach and the total offset approach to damage calculations, "[t]he key premise is that the real interest rate is stable over time," a premise that the court holds "distinctly inconclusive."[13] In *Culver*, however, the Fifth Circuit concludes that "[r]ecent studies discredit the received wisdom, voiced a decade ago, that there is a constant real rate of interest. . . ."[14] Yet some courts remain convinced that the real interest rate is stable and predictable. And they remain convinced that it is more speculative to use an objectively observable market interest rate R in conjunction with a judgmental expected inflation rate I, than to use an objectively unobservable real estate rate R.° For example, Judge Tauro, in *Brown v. United States*,[15] writes that the real interest rate method

> eliminates unnecessary speculation as to the level of future inflation. The fairly constant differential between interest and inflation rates, on which the real discount rate is premised, makes it more reasonable to predict the relationship between the two rates than to predict the level of either rate in isolation.[16]

In adopting the premise that the "real interest rate is stable over time," courts have taken a position on an economic issue that would be rejected by most economists. The latter would

[13] Jones and Laughlin Steel Corp. v. Pfeifer, *supra* note 2, 462 United States at 548 and n. 30.

[14] Culver v. Slater Boat Co., *supra* note 2, 722 F.2d at 121.

[15] 615 F. Supp. 391 (D. Mass. 1985).

[16] *Id.* at 396.

generally view R* as a variable rather than a constant, a variable whose value depends on other economic factors. For instance, economists might argue that R* should change with changes in the federal deficit; that R* should change in response to international capital flows; that R* should change in response to war, depression, oil shocks, and so on.

Certainly, the traditional economic view was that in a world with no inflation, the market interest rate and hence R* would vary according to aggregate savings and investment, or according to aggregate supply of and demand for loanable funds. But there is no good theoretical reason why it should be constant over time. However, in an unusual mid 1970's study, Professor E. F. Fama ran statistical tests on short-term real interest rates over the period 1953-1971, and concluded that those tests could not disprove the hypothesis that the real interest rate was constant.[17] Fama's conclusion was probably the strongest scientific basis for subsequent constant real interest rate assumptions by courts. It was an important part of the foundation upon which rested the stable real interest rate premise.

Unfortunately, the foundation was weak, based on a limited sample period, the 1950's and 1960's, and based on rudimentary statistical tests. In subsequent work, Fama himself has abandoned the hypothesis of a constant real interest rate.[18] He writes that he and other authors find "statistically reliable variation in expected real returns."[19] One current view regarding R* is that over time it takes what statisticians would describe as a "random walk."[20] This means that if R* is high at time t there is no particular tendency for it to drop back to its historical average at time t+1, or, conversely, if R* is low, there is no particular tendency for it to rise. If R* is a random walk, then past history is irrelevant: the average R* over the 1950's, 1960's and 1970's has no significance for predicting next year's R*; all that matters is this year's. In short, with respect to the hypothesis

[17] Fama, *Short-Term Interest Rates as Predictors of Inflation*, 65 AMER. ECON. REV. 269-82 (1975).

[18] Fama and Gibbons, *Inflation, Real Returns and Capital Investment*, 9 J. MONETARY ECONOMICS 269-82 (1982).

[19] *Id.*

[20] *See, e.g.*, Fama and Gibbons, *supra* note 17; Garbade and Nachtel, *Time Variation in the Relationship Between Inflation and Interest Rates*, 5 J. MONETARY ECONOMICS 755-65 (1978); and, for data up to 1979, Litterman and Weiss, *Money, Real Interest Rates and Output: A Reinterpretation of Postwar United States Data*, 53 ECONOMETRICA 129-56 (1985).

of constancy of the real interest rate, most of the econometric work since Fama rejects the hypothesis. An especially clear statement is made in Mishkin's article, which examines the real interest rate over the period 1931-1979.[21] Mishkin concludes, "The hypothesis that the real rate of constant is strongly rejected both for the 1953-1979 period and the 1931-1952 period. Fama's finding that the constancy of the real rate could not be rejected is the exception and not the rule."[22] As another example, Hamilton finds that real interest rates are twice as high during periods of recession as they are during normal periods.[23]

In an essay in this journal, aimed at a legal audience, Professor Ward S. Curran examines the differences between yields on United States Government securities, and inflation over the period 1953 to 1981.[24] His tables show real rates ranging between -3.07 percent and +3.49 percent for 10-year notes. After taking averages, Curran concluded that a real "rate of two percent is reasonable [based on] the empirical evidence to date."[25] The following section updates Curran's evidence and shows that a real interest rate of two percent would be most unreasonable in the 1980's.

In an article on the Alaska total offset method, Nowak[26] rejects total offset essentially because the real interest rate is not constant. On the other hand, Mead[27] makes a case for Alaska total offset. However, his graph of the adjustment factor over time (that is, $(1+P)(1+I) \div (1+R)$) reveals a factor that varies significantly, between a low of .92 and a high of 1.06. Although he provides no tabular results, Mead's real interest rate seems to vary between -7.5 percent in 1949 to + 5.0 percent in 1983.

IV. THE EVIDENCE ON REAL INTEREST RATES

A. *What Market Interest Rate?*

Let us turn to the factual evidence on the alleged stability of the real interest rate. First, we sort out some concepts: Our

---

[21] Mishkin, *The Real Interest Rate: An Empirical Investigation* in 15 CARNEGIE-ROCHESTER CONFERENCE SERIES ON PUBLIC POLICY 151-200 (1981).

[22] *Id.*

[23] Hamilton, *Uncovering Financial Market Expectations of Inflation*, 93 J. POL. ECON. 1224-42 (1985).

[24] Curran, *Inflation and the Discount Rate in Estimating Damages in Torts*, 56 CONN. B. J. 420-37 (1982).

[25] *Id.* at 432.

[26] *Supra* note 5.

[27] Mead, *Calculating Present Value*, 20 TRIAL 16-20 (1984).

R* is the difference between the market interest rate and the expected inflation rate. This raises two questions: Which market interest rate, and whose expected inflation rate? We follow the courts in narrowing down the interest rate to a yield on United States Treasury securities. Only these securities have no risk of default and very limited risk of being called before maturity. But that raises another question: What maturity is appropriate?

As this is written, yields on Treasury securities are as follows: 5.9 percent on 3-month bills; 6.2 percent for 6-month bills; 8.3 percent for 7-year notes; and 8.7 percent for 30-year bonds. In fact, it is normal for the longer term securities to pay more, since their prices are more volatile. In light of the price volatility of the longer-term securities, is it reasonable for the courts to use only 3-month bill rates? No, it is not. If held to maturity, the longer-term Treasury bond carries zero risk with respect to its nominal dollar returns. Because of unanticipated changes in the price level, it does carry a risk with respect to its real, constant-dollar returns. On the other hand, rolling over a long sequence of short-term Treasury bills carries large risk with respect to nominal dollar returns. In addition, it carries risk with respect to real, constant-dollar returns. Therefore, there is no clear reason to prefer the short-term securities over the long-term, on the basis of risk. And on the basis of return, there is a clear reason to prefer the long-term securities.

It has occasionally been suggested that plaintiff's economist ought to construct a mixed portfolio of bonds of varying maturities, selected so as to generate, via interest plus redemptions, exactly the hypothesized stream of earnings.[28] If this were done for a long projection, say 30 years, the average interest rate over the entire portfolio would be fairly close to the yield on the 30-year securities.

In short, arguments can be made for using short-term yields or long-term yields; on balance, the arguments for the long-term yields seem sounder in the case of a long future projection. For a long projection, "best and safest investment" should mean long-term bonds.

---

[28] *See, for example,* Jarrell and Pulsinelli, *Obtaining the Ideal Discount Rate in Wrongful Death and Injury Litigation*, 32 DEF. L. J. 191 (1983), who discuss how such a portfolio can be constructed.

In order to present the evidence for interest rates on securities of various maturities, Table 1 below includes interest rates on short-, medium- and long-term securities. R_1 is the average yield on 3-month Treasury bills; R_2 is the average yield on 3-year Treasury notes; and R_3 is the average yield on 10-year Treasury bonds. (Thirty-year bonds are omitted since their yields are usually quite similar to ten-year bond yields.)

B. *What Inflation Rate?*

And now, what inflation rate? Table 1 includes a one-year inflation rate, I_1, and a 3-year inflation rate, I_2. I_1 is the percentage change in the Consumer Price Index between the current year and the previous year, while I_2 is a geometric average percentage change in the CPI over the preceding three years.

The constant real interest rate hypothesis maintains that people making an investment today require a return roughly equal to the stable real interest rate plus their expected inflation rate. Investors are looking forward and estimating inflation *ex ante*, that is, before the fact. Economists and courts can observe inflation *ex post*, or after the fact. However, the proper real interest rate is the difference between the market return (which is guaranteed into the future) and *ex ante* inflation, and is therefore itself *ex ante*.

How can the (unobservable) *ex ante* inflation be estimated? Many economists would argue that investors' expectations of inflation depend on past history. Moreover, recent history counts more heavily than distant history since underlying economic structure changes permanently, and since memories fade. One way to model expected inflation would be to assume it is a weighted average of rates of inflation over a long past history, where the weights assigned events in the recent past are high, and the weights assigned events in the distant past are low. A naive, but reasonably accurate, version of this approach is to assume that the expected rate of inflation over a forthcoming period equals the actual rate of inflation over the past year. The past is prologue. This is the assumption underlying three of the real interest rate series illustrated in Table 2.

The real interest R^*_1 is the difference between the yield on 3-month Treasury bills and *ex ante* inflation assumed equal to last year's inflation. R^*_2 is the difference between the yield on

3-year Treasury notes and *ex ante* inflation, and R^*_3 is the difference between the yield on 10-year bonds and *ex ante* inflation.

Although the proper real interest rate for a damage calculation is an *ex ante* rate (since the court is looking into the future), it is tempting to sidestep the confusion generated by expected future inflation by considering *ex post* real interest rate: What did investors earn on their securities, in real terms after the fact? R^*_4 shows the yield on 3-year Treasury notes minus the actual inflation that occurred during the period of the notes.

V. Conclusions on Real Interest Rates

Now let us examine the numbers, although without elegant and complex statistical tests. The first conclusion is crystal clear: These real interest rates are not even approximately constant. The real yield on 3-month Treasury bills varies between a low of -3.30% and a high of +5.41%. The real yield on 3-year notes varies between a low of -3.15% and a high of +7.63%. The real yield on 10-year bonds varies between a low of -3.41% and a high of +8.18%. The *ex post* real interest rate varies between a low of -4.10% and a high of +9.91%. In fact, the difference between the highest and the lowest year's real interest rate exceeds 10 percentage points for three out of the four measures!

A second conclusion is striking: Real interest rates, no matter how measured, were unusually low in the late 1970's, and unusually high in the 1980's. If a court, therefore, were using an average real interest rate based on data from the 1950's, 1960's and early 1970's in order to compute damages in the late 1970's, it would unjustly undercompensate a plaintiff. If a court were using an average real interest rate from the 1950's, 1960's and early 1970's to compute damages in 1980's, it would unjustly overcompensate a plaintiff.

And a third conclusion is equally compelling: A court making an award in the 1980's should not feel bound by the Supreme Court's suggested 1 to 3 percent boundaries on the real interest rate. In fact, a real interest rate as high as 6 percent would not be unreasonable in the mid 1980's, just as a real interest rate as low as -1 percent would not have been unreasonable in the 1970's. The Supreme Court explicitly recognized the nonconstancy of the *Australian* real interest[29] but unfortunately it did not recognize that the American data are not unlike the Australian.

VI. The Adjustment Factor Revisited: The Evidence on Productivity Growth and the Real Interest Rate

At this point we put productivity growth P back into the picture. The interest rate that an economist ultimately enters into his calculator or computer is often neither the market rate R nor the real rate R°. It is a real interest rate *adjusted for productivity growth*, which we shall call Q°. This crucial variable, which depends on the market interest rate, the inflation rate, and productivity growth, can be calculated in several different ways.

The most accurate way to define Q° is through the equation

$$\frac{(1+P)(1+I)}{(1+R)} = \frac{1}{1+Q^\circ}.$$

This formula says Q° is the interest rate which, if used alone and by itself, would give the same present value as would consideration of the inflate-discount triumvirate of productivity, inflation, and market interest.

A simpler though slightly less accurate way to calculate Q° is with the formula

$$Q^\circ = R^\circ - P.$$

Here Q° is the difference between the real interest rate R° and the productivity growth rate P. Note that Alaska total offset is equivalent to the assertion that Q° = 0. For if Q° = O, then R° = P, the adjustment factor equals 1, and damages are found by multiplying the yearly loss by the number of years.

Since R° = R - I, the above formula can be rewritten

$$Q^\circ = R - (P+I),$$

and since P+I represents the growth rate in earnings attributable to society-wide factors, the last formula can be rewritten

$$Q^\circ = \text{Market Interest Rate} - \text{Earnings Growth Rate}$$

Now we consider some data on the difference between the market interest rate and the earnings growth rate. Table 3 below presents the evidence on Q°. The market interest rate shown is

[29] Jones and Laughlin Steel Corp. v. Pfeifer, *supra* note 2, 462 United States at 548 n.30.

R_2, the yield on 3-year United States Treasury notes. The weekly earnings column shows average gross weekly earnings of workers in the private sector of the United States economy. The earnings growth rate column shows, for each year, the percentage growth in average weekly earnings between that year and the previous year. Finally, Q^* is the difference between the interest rate and the earnings growth rate. Note that Q^* is formed in the same way as R^*_1, R^*_2, and R^*_3 in Table 2. That is, it is an *ex ante* concept, constructed under the naive assumption that earnings will grow in the future at the same rate as they have in the past year. The numbers would be slightly different but the qualitative conclusions the same had we used an *ex post* measure of Q^*.

What does the evidence on Q^* show? The first thing to note is that Q^* varies greatly. It has a low of -2.66 percent in 1953, and a high of +8.19 percent in 1982, with a consequent difference of over ten percentage points between the low and the high. But there is also a pattern, which can be seen by calculating averages for Q^* over the 50's, 60's and 70's and 80's:

Period	Mean Q^*
1953-1959	-0.81
1960-1969	+0.76
1970-1979	+0.50
1980-1986	+6.35

Thus Q^* tended to be slightly less than zero during the 1950's period, and it tended to be slightly greater than zero during 1960's and 1970's. In the 1980's Q^* has been high, much higher than its average value in previous decades.

Recall that Alaska total offset implies $Q^* = 0$, at least on average. When *Beaulieu*[30] was decided in 1967, this presumption was not unreasonable. In the 1980's, however, the presumption that $Q^* = 0$ is most unreasonable.

Recall that Pennsylvania total offset implies $R^* = 0$, at least on average, so $Q^* = -P$. Since P averaged around 1.6 percent over the 1953-1986 period, Pennsylvania total offset presumes $Q^* = -1.6$ percent, at least approximately. Thus when *Kaczkowski*[31] was decided, in 1980, Pennsylvania total offset was slightly unreasonable, and gave the plaintiff an advantage of roughly 1

[30] *Supra* note 8.
[31] *Supra* note 9.

percent in the discount rate. (This was a significant improvement over the *Havens* rule,[32] which by disallowing consideration of inflation and productivity and using a six percent interest rate in effect assumed $Q^* = +6.0$ percent.) It would appear that the Pennsylvania court recognized its slight pro-plaintiff bias in *Kaczkowski* when it wrote, "An additional feature of the total offset method is that where there is a variance, it will be in favor of the innocent victim and not the tortfeaser who caused the loss."[33] Now, however, in the 1980's, Pennsylvania total offset is strikingly unreasonable! It errs as far in the plaintiff's favor as *Havens* had erred in the defendant's favor.

VI. Summary

The evidence shows that neither real interest rates nor real interest rates adjusted for productivity growth are constant or stable. It shows that real interest rates were unusually low in the late 1970's, and unusually high in the 1980's. Moreover, real interest rates adjusted for productivity growth averaged less than zero in the 1950's, but positive in the 1960's, 1970's and 1980's. And real interest rates adjusted for productivity growth have been extremely high in the 1980's.

Are the 1980's anomalous? Will we return to the low real interest rates of previous decades? No economist knows for certain, but two observations can be made: First, according to a study of Professor Poole,[34] there have been long periods in United States history with high real interest rates. From 1890 to 1915, for example, the average real yield on short-term commercial paper was 4.6 percent; in the decade of the 1920's it was 6.81 percent. For the years 1980 through 1985 the average was 6.13 percent. Second, interest rates can be locked in. A plaintiff who receives a judgment in 1987 to compensate for expected losses over the next twenty-five years can invest in United States Treasury bonds today, and be guaranteed the dollar returns printed on those bonds. Because of the possibility of locking in returns, it is incorrect to assume it would penalize plaintiff to use a currently high interest rate because plaintiff's returns will drop in the future. Professors Ledford and Zocco

---

[32] *Supra* note 10.

[33] Kaczkowski v. Bolubusz, *supra* note 9, 421 A.2d at 1038.

[34] Poole, *Monetary Policy Lessons of Recent Inflation and Disinflation*, to be published in Economic Perspectives.

clearly make this point in reference to market interest rates.[35]

In summary, where do these observations leave the fact finder? First, in light of the experience of the 1980's, there is now no serious economic rationale for either of the total offset methods. Alaska total offset is appealing for its computational simplicity, but it is inconsistent with current economic conditions. Pennsylvania total offset is even more implausible. The Pennsylvania Supreme Court wrote in *Kaczkowski* that

> [a] court has a responsibility to the citizenry to keep abreast of changes in our society. In light of the recognized acceptance of the science of economics, the courts of this Commonwealth can no longer maintain their ostrich-like stance and deny the admissibility and relevancy of reliable economic data concerning the impact of productivity and inflation on lost future earnings.[36]

The current state of economic science refutes the *Kaczkowski* holding that "as a matter of law . . . future inflation shall be presumed equal to future interest rates. . . ."[37]

Second, there is no logical reason not to use a real interest rate approach, provided a court recognizes that the real interest rate is <u>not</u> constant over time, and that an <u>ex ante</u> real interest rate that looks decades into the future is exactly as uncertain and speculative as an inflation projection that looks decades into the future. No more speculative, but no less. Third, the market interest rate or inflate-discount method is as reliable as the real interest rate method, and it has two virtues, unshared by the other methods: One, it is based on the objectively observable current market interest rate, rather than on a hypothetical real rate. Two, its use forces the expert economist for plaintiff (or defendant) to lay his cards face up on the table.

---

[35] *Supra* note 6.
[36] *Supra* note 9, 421 A.2d at 1033.
[37] *Id.* at 1038-39.

TABLE 1

Year	Price Level	Inflation I_1	I_2	Market Interest Rates R_1	R_2	R_3
1953	80.1	0.75	3.57	1.93	2.47	2.85
1954	80.5	0.50	1.14	.95	1.63	2.40
1955	80.2	-0.37	0.29	1.75	2.47	2.82
1956	81.4	1.50	0.54	2.66	3.19	3.18
1957	84.3	3.56	1.55	3.27	3.98	3.65
1958	86.6	2.73	2.59	1.84	2.84	3.32
1959	87.3	0.81	2.36	3.41	4.46	4.33
1960	88.7	1.60	1.71	2.93	3.98	4.12
1961	89.6	1.01	1.14	2.38	3.54	3.88
1962	90.6	1.12	1.24	2.78	3.47	3.95
1963	91.7	1.21	1.11	3.16	3.67	4.00
1964	92.9	1.31	1.21	3.55	4.03	4.19
1965	94.5	1.72	1.41	3.95	4.22	4.28
1966	97.2	2.86	1.96	4.88	5.23	4.92
1967	100.0	2.88	2.49	4.32	5.03	5.07
1968	104.2	4.20	3.31	5.34	5.68	5.65
1969	109.8	5.37	4.15	6.68	7.02	6.67
1970	116.3	5.92	5.16	6.46	7.29	7.35
1971	121.3	4.30	5.20	4.35	5.65	6.16
1972	125.3	3.30	4.50	4.07	5.72	6.21
1973	133.1	6.23	4.60	7.04	6.95	6.84
1974	147.7	10.97	6.78	7.89	7.82	7.56
1975	161.2	9.14	8.76	5.84	7.49	7.99
1976	170.5	5.77	8.60	4.99	6.77	7.61
1977	181.5	6.45	7.11	5.27	6.69	7.42
1978	195.4	7.66	6.62	7.22	8.29	8.41
1979	217.4	11.26	8.44	10.04	9.71	9.44
1980	246.8	13.52	10.79	11.51	11.55	11.46
1981	272.4	10.37	11.71	14.03	14.44	13.91
1982	289.1	6.13	9.97	10.69	12.92	13.00
1983	298.4	3.22	6.53	8.63	10.45	11.10
1984	311.1	4.26	4.53	9.58	11.89	12.44
1985	322.2	3.57	3.68	7.48	9.64	10.62
1986	328.4	1.92	3.24	5.98	7.06	7.68

Footnotes for Table 1:

1. The price level is the Consumer Price Index as reported in the *Economic Report of the President, 1987*, Table B-55.

2. I_1 is the rate of inflation over the previous year. Let P(t) represent the price level in year t. Then I_1 at year t is given by:

$$I_1(t) = \left[\frac{P(t)}{P(t-1)} - 1\right] \times 100.$$

3. I_2 is the (geometric) average rate of inflation over the previous three years:

$$I_2(t) = \left[\left(\frac{P(t)}{P(t-3)}\right)^{1/3} - 1\right] \times 100.$$

4. R_1 is the average yield on 3-month United States Treasury bills, R_2 is the average yield on 3-year United States Treasury notes, and R_3 is the average yield on 10-year United States Treasury bonds, based on the *Economic Report of the President, 1987*, Table B-68.

TABLE 2
Real Interest Rates

Year	R^*_1	R^*_2	R^*_3	R^*_4
1953	1.18	1.72	2.10	1.93
1954	0.45	1.13	1.90	0.08
1955	2.12	2.84	3.19	-0.12
1956	1.16	1.69	1.68	0.83
1957	-0.29	0.42	0.09	2.27
1958	-0.89	0.11	0.59	1.70
1959	2.60	3.65	3.52	3.22
1960	1.33	2.38	2.52	2.87
1961	1.37	2.53	2.87	2.33
1962	1.66	2.35	2.83	2.06
1963	1.95	2.46	2.79	1.71
1964	2.24	2.72	2.88	1.54
1965	2.23	2.50	2.56	0.91
1966	2.02	2.37	2.06	1.08
1967	1.44	2.15	2.19	-0.13
1968	1.14	1.48	1.45	0.48
1969	1.31	1.65	1.30	2.52
1970	0.54	1.37	1.43	2.69
1971	0.05	1.35	1.86	-1.13
1972	0.77	2.42	2.91	-3.04
1973	0.81	0.72	0.61	-1.65
1974	-3.08	-3.15	-3.41	0.71
1975	-3.30	-1.65	-1.15	0.87
1976	-0.78	1.00	1.84	-1.67
1977	-1.18	0.24	0.97	-4.10
1978	-0.44	0.63	0.75	-3.42
1979	-1.22	-1.55	-1.82	-0.26
1980	-2.01	-1.97	-2.06	5.02
1981	3.66	4.07	3.54	9.91
1982	4.56	6.79	6.87	9.24
1983	5.41	7.23	7.88	7.21
1984	5.32	7.63	8.18	n.a.
1985	3.91	6.07	7.05	n.a.
1986	4.06	5.14	5.76	n.a.
Means	1.18	2.07	2.29	1.47

Footnotes for Table 2:

1. R^*_1 is based on Treasury bills and one-year inflation:
$$R^*_1(t) = R_1(t) - I_1(t).$$
2. R^*_2 is based on Treasury notes and one-year inflation:
$$R^*_2(t) = R_2(t) - I_1(t).$$
3. R^*_3 is based on Treasury bonds and one-year inflation:
$$R^*_3(t) = R_3(t) - I_1(t).$$
4. R^*_4 is based on Treasury notes and three-year inflation, ex post:
$$R^*_4(t) = R_2(t) - I_2(t+3).$$

TABLE 3
Real Interest Rate Adjusted for Productivity Growth

Year	Weekly Earnings	Earnings Growth Rate	R_2	Q^*
1953	$ 63.76	5.13	2.47	-2.66
1954	64.52	1.19	1.63	0.44
1955	67.72	4.96	2.47	-2.49
1956	70.74	4.46	3.19	-1.27
1957	73.33	3.66	3.98	0.32
1958	75.08	2.39	2.84	0.45
1959	78.78	4.93	4.46	-0.47
1960	80.67	2.40	3.98	1.58
1961	82.60	2.39	3.54	1.15
1962	85.91	4.01	3.47	-0.54
1963	88.46	2.97	3.67	0.70
1964	91.33	3.24	4.03	0.79
1965	95.45	4.51	4.22	-0.29
1966	98.82	3.53	5.23	1.70
1967	101.84	3.06	5.03	1.97
1968	107.73	5.78	5.68	-0.10
1969	114.61	6.39	7.02	0.63
1970	119.83	4.55	7.29	2.74
1971	127.31	6.24	5.65	-0.59
1972	136.90	7.53	5.72	-1.81
1973	145.39	6.20	6.95	0.75
1974	154.76	6.44	7.82	1.38
1975	163.53	5.67	7.49	1.82
1976	175.45	7.29	6.77	-0.52
1977	189.00	7.72	6.69	-1.03
1978	203.70	7.78	8.29	0.51
1979	219.91	7.96	9.71	1.75
1980	235.10	6.91	11.55	4.64
1981	255.20	8.55	14.44	5.89
1982	267.26	4.73	12.92	8.19
1983	280.70	5.03	10.45	5.42
1984	292.86	4.33	11.89	7.56
1985	299.09	2.13	9.65	7.51
1986	304.50	1.81	7.06	5.25

Footnotes for Table 3

1. Weekly earnings are gross average weekly earnings for private non-agricultural workers, as reported in the *Handbook of Labor Statistics, 1975 Reference Edition*, Table 104; *Monthly Labor Review*, April 1982, Table 20; and subsequent issues of the *Monthly Labor Review*.
2. The earning growth rate in year t is the percentage difference between weekly earnings in year t and year t-1.
3. $Q^*(t) = R_2(t)$ - Earning growth rate in year t.