Does the Prudent Investor Rule for Fund Trustees Matter in the Determination of Present Value Damages?

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I. Introduction: The Uniform Law Commission and its Work

The Uniform Law Commission [ULC] (formerly the National Conference of Commissioners on Uniform State Laws [NCCUSL]) was founded in 1892 to work for uniformity in state laws. It is an organization composed chiefly of retired lawyers, law professors and judges who serve specific terms and receive no compensation for their time. The only requirement is membership in the bar. The National Conference meets for one specific purpose – to achieve uniformity in state laws by drafting proposals for uniform and model laws, and then working for the laws' enactment in their respective state legislatures.

While the organization has drafted more than 200 uniform laws in areas such as probate, child custody, partnership and family support, its signature accomplishment is the Uniform Commercial Code. The development of the UCC was instigated in 1940 and conducted for ten years until adoption by the Commission. The Act's subsequent adoption across the states was ushered in over a fourteen-year period. Currently UCL has working groups studying consumer leasing law, estate tax and tort liability apportionment, health care law, mediation, and other areas.

Of potential interest to forensic economists are the three recently approved recommendations: 1) for the management of employee retirement systems [Uniform Management of Public Employee Retirement Systems Act (1997), UMPERS], 2) for custodial trustees [Uniform Custodial Trust Act (1987), UCTA], and 3) for investment practices of fiduciaries [Uniform Prudent Investor Act (1994), UPIA]. All three of these pieces of model legislation contain language relating to the investment decisions of a trustee. An example is

from the UCTA: "…the custodial trustee shall observe the standard of care that would be observed by a prudent person dealing with property of another."

The language of UMPERS is more to the point:

> …modern portfolio theory strongly supports a diversification requirement…. the premise of the subsection is that [retirement plan] participants are better protected by the Act's emphasis on close attention to risk/return objectives, than in attempts to identify categories of investment that are prudent or imprudent **per se** [emphasis added].

The Uniform Prudent Investor Act (UPIA hereafter) is most revealing of the general current of these model laws. UPIA undertakes to update the law of trust investment to reflect changes in investment practice that have accompanied new empirical and theoretical knowledge about the behavior of capital markets. The Act seeks to bring trust investment law under the influence of what is know as "modern portfolio theory". The Prudent Investor Act has been enacted in 43 states[1] as of this date (see the NCL website).

There are a number of passages of the model Act that reveal its orientation but its essential goal is to allow modern trust fiduciaries to:

1. delegate detailed investment and management decisions to specialists;
2. consider for purposes of assessing prudence, the entire portfolio rather than individual investments;
3. consider the risk-return tradeoff in forms of investment;
4. consider all different types of investment and not be subject to "categorical" prohibitions;
5. seek diversification as part of the very definition of "prudent" investing.

The Act requires that the trustee exercise due standards of care but under Section 2 ("Standards of Care") states that a trustee should "invest and manage trust assets as a prudent

investor would, by considering the purposes, terms, distribution requirements, and other circumstances of the trust." (UPIA, section 2 (a) p. 5). The Act goes on to confront the "risk-return" tradeoff.

> Returns correlate strongly with risk, but tolerance of risk varies greatly with the financial and other circumstances of the investor, or in the case of a trust, with the purposes of the trust and the relevant circumstances of the beneficiaries. A trust whose main purpose is to support an elderly widow of modest means will have a lower risk tolerance than a trust to accumulate for a young scion of great wealth. (Section 2, comment, p. 7)

Regarding diversification, the Act goes beyond permitting it to actually *requiring* it, quoting a rational from a recent finance text:

> Diversification reduces risk…[because] stock price movements are not uniform. They are imperfectly correlated. This means that if one holds a well diversified portfolio, the gains in one investment will cancel out the losses in another. (Jonathon R. Macey, *An Introduction to Modern Financial Theory* , 1991, p. 20, cited in UPIA Section 3, comment, p. 10).

The exceptions to the need to diversify are also given: when tax considerations discourage it and when a family business is involved that the family wishes to maintain. Mutual funds are also mentioned as an opportunity whose advantage is in making diversification available to small-scale funds.

In summary, the three model acts[2] attempt to bring the law of investment fiduciaries in line with modern portfolio theory that 1) matches risk-return to investor (beneficiary) preferences, 2) employs diversification as a fundamental element of prudent investing, and 3) considers all forms of investment including equities when prudent and when part of an

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[1] All states except Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, New York.
[2] For information relating to the Uniform Law Commission and its acts, drafts, and

overall investment strategy. The model acts reveal an increasing sophistication of state legislatures in matters of financial analysis. The increased financial sophistication can be presumed to exist not only in state legislatures, but also to extend to the bench, to the bar and to juries.

II. Legal Background On The Forensic Economist's Choice Of A Discount Rate

Our concern in this paper is whether these recent "*prudent investor"* acts of the Uniform Law Commissioners may have relevance for the choice of a proper discount rate by forensic economists. While some argue that plaintiffs' actual investment practices with respect to the awarded lump sum are irrelevant to forensic economists' determination of damage awards, the language of judicial opinion clearly contemplates the investment dimension, both as the final step in the process of serving justice on victims, and as a logical and rational component of the very process of calculating the award. Judicial language from two leading cases is illustrative:

> We begin by recognizing that awards based on income streams spread over time are usually discounted to present value to account for the fact that a plaintiff, by receiving the money in a lump sum, "up front", will invest the sum and earn additional income from the investment. [*Trevino*, p. 1517]

> …where it is reasonable to suppose that interest may safely be earned upon the amount that is awarded, the ascertained future benefits ought to be discounted in the making up of the award. [*Kelly*, p .490, n20]

The work of forensic economists is peculiarly situated at the margins of both legal theory and economic science. Perhaps it would be better to say that opinions of forensic economists are simultaneously shaped by law and economics. In any event, it is true that most practicing forensic economists, while offering scientific opinion, are nonetheless cognizant of

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legislation, see the organization website***: http://www.nccusl.org/***

the legal parameters. As far as can be determined, the accepted legal framework is derived chiefly from two legal cases: *Chesapeake & Ohio Railway Co. v. Kelly* [hereafter: ***Kelly***] and *Jones & Laughlin Steel Co. v. Pfeifer* [hereafter: ***Pfeifer***].

A. Chesapeake & Ohio Railway Co. V. Kelly 241 US 485 (1916)

This case set forth guidelines for calculation of loss to survivors: "…if the jury should find for the plaintiff they should fix the damages at such sum as would reasonably compensate the dependent members of Kelly's family for the pecuniary loss." (pp. 487-8) With regard to the necessity of making one-time lump sum awards to replace lost earning streams, the Supreme Court advanced the law of tort damages into the modern era. They rejected a lower court argument that discounting to present value was beyond the capability of juries. They advanced the argument "that what the beneficiary is entitled to is not a lump sum equal to what he would receive during the estimated term of dependency, but the present cash value of such aggregate amount," and found that instructions to discount the future wages should have been given at trial. The lower court had held that lost earnings are not so difficult to estimate, "and the average juryman is competent to compute it, but to figure interest on deferred payments, with annual rests, and reach a present cash value of such loss…is more than ought to be asked of anyone less qualified than an actuary." (p. 489)

The Court went on to make explicit the potential for overcompensation when discounting is not employed, and simultaneously made the connection between the calculation of present value lump sum awards and the earnings potential for the invested lump sum.

> So far as a verdict is based upon the deprivation of future benefits, it will afford more than compensation if it be made up by aggregating the benefits without taking account of **the earning power of the money that is presently**

> **to be awarded** [emphasis added]. It is self evident that a given sum of money in hand is worth more than the like sum of money payable in the future. (p. 489)

The opinion also applied the established concept of mitigation to the investment of the awarded lump sum and held that: "Ordinarily a person seeking to recover damages for the wrongful act of another must do that which a reasonable man would do under the circumstances to limit the amount of the damages." (p. 489)

The Court relied on self-interest and the reasonable man standard to predict a return to the invested award.

> ...the putting out of money at interest is at this day so common a matter that ordinarily it cannot be excluded from consideration in determining the present equivalent of future payments, since a reasonable man, even from selfish motives, would probably gain some money by way of interest upon the money recovered. (p. 490)

The opinion even mentioned financial institutions and both bank deposits and municipal bonds as potential investments.

> Savings banks and other established financial institutions are in many cases accessible for the deposit of moderate sums at interest, without substantial danger of loss; the sale of annuities is not unknown; and, for larger sums, state and municipal bonds and other securities of almost equal standing are commonly available. (p. 490)

After a clear rejection of setting the discount rate at the "legal rate of interest", the Supreme Court goes on to state that:

> …it is evident that the compensation should be awarded upon a basis that does not call upon the beneficiaries to exercise such skill [of an experienced financial investor] , for where this is necessarily employed, the interest return is in part earned by the investor rather than by the investment. This, however,

> is a matter that ordinarily may be adjusted by scaling the rate of interest to be adopted in computing the present value of the future benefits; it being a matter of common knowledge that, as a rule, **the best and safest investments** [emphasis added], and those which require the least care, yield only a moderate return. (pp. 490-1)

In this passage, the Supreme Court made clear that the injured parties should not be expected to achieve high returns, and that safer investments will yield lower returns, but the Court left unresolved the tension between the two extremes of high-risk and high-return securities and safer but lower-yielding securities.

Finally, regarding the scope of its own decisions, the Court denied that its purpose in the case was to provide a precise formula, "but merely to indicate some of the considerations that support the view…that limiting the recovery to compensation requires that adequate allowance be made, according to circumstances, for the earning power of money." (p. 491)

The *Kelly* decision thus presents us with several of the same issues addressed in the model statutes relating to the investment decisions of trustees: a desire for reasonable compensation, the accessibility of "established financial institutions", a variety of investment vehicles of reasonable security, and an over-riding goal of basing the discount rate on investments that can be described as "best and safest".

B. *Jones & Laughlin Steel Co. v. Pfeifer 462 US 523 (1983)*

The more recent decision in *Pfeifer* also touched on several key elements of the forensic economist's calculation of the present value of future income streams, including inflation, the earnings growth rate assumption, the discount rate assumption and the type of investment to be used as the basis for discounting.

With respect to inflation, the court made clear its understanding of the need for

consistency in the handling of inflation in the earnings growth forecast and the discount rate forecast. “As long as inflation continues, the amount of the ‘offset’ against the market rate should be chosen on the basis of the same factors that are used to estimate the lost stream of future earnings.” [paragraph (d), pp. 524-5] The court demonstrated an understanding of the difference between real and nominal interest rates. “The relevant real interest rate is the difference between the short term market interest rate in a given year and the average rate of price inflation during that same year.” [p. 543, fn 26].

With respect to the growth rate in earnings being forecast, the Court referred to productivity increases as “a permanent feature of the national economy” and made clear that such increases will increase workers’ wages and should be considered in calculating the proper award. [p. 536]

On page 537, the Court gave its fullest discussion of discount rates. Referring to and quoting liberally from the other, earlier standard citation, *Chesapeake & Ohio Railway Company v. Kelly*, the Court wrote: “…the ascertained future benefits ought to be discounted in the making up of the award.” (*Kelly,* p. 490). It went on to state “The discount rate should be based on the rate of interest that would be earned on ‘the best and safest investments’”. (*Kelly*, p. 490). The *Pfeifer* Court concluded that (its own words, not *Kelly*) the injured worker “is entitled to a risk-free stream of future income to replace his lost wages; therefore the discount rate should not reflect the market’s premium for investors who are willing to accept some risk of default.” (*Pfeifer*, p. 537).

At face value, the Court is holding to a presumed risk-free investment strategy that would preclude non risk-free investment. Yet, the Court went on to explain that the discount rate should reflect a rate of interest “that would be earned on ‘the best and safest investment” (referring again to *Kelly*, p. 491, at p. 537). The Court also noted that Canada uses a 7% return

to long-term investments minus an inflation forecast. It is also mentioned that Australia uses a (presumably risk-free) "2% real market rate". [p. 541]

After rejecting price inflation forecasts and reciting the famous quote about "not converting trial courts into graduate economics seminars", the Court went on to declare that it is necessary to choose an appropriate below-market rate of interest, and indicated that trial courts using a discount rate between 1% and 3% would rarely be reversed. [p. 548] After this, three paragraphs later, the Court stated that, after accounting for inflation and societal factors affecting wage increases, "then these wage growth factors should be set off against the market interest rate in an estimation of future price inflation." [p. 548]

From the snapshot view of *Pfeifer*, it becomes apparent that the Supreme Court used the case to address several specifics relating to the forensic economists' present value calculation. It is also apparent that while displaying much understanding, the Court also displayed some confusion and leaves a number of important issues subject to varied interpretation. While at times giving instructions regarding risk-free discount rates, the Court also created confusion by referring to both "market" and "below-market" interest rates. At least one observer believes that the Court's phrase "below-market discount rate" was simply an imprecise way of referring to the "net discount rate". (Ireland, 2000, p. 55) The decision also created confusion by displaying both the "return on investment" and the "reduced future earning stream" interpretations, and by considering the cessation of income streams but not their possible variance. Thus *Pfeifer* supports the risk-free discount rate interpretation and at the same time provides ample leeway for alternative interpretations as well. Insofar as it gives instruction regarding the predicted investment behavior of award trustees, the decision favors risk-free securities but leaves open the door for any securities mix that meets the ambiguous criteria of "best and safest". The "prudent investor" of the model statutes might thus be

reconciled with the Supreme Court's concern with safety, so long as the level of risk assumed by a prudent investor is "reasonable". Presumably, the phrase "reasonable" in this context should be understood in light of modern financial and portfolio investment theory.

III. Legal and Economic Perceptions of Risk

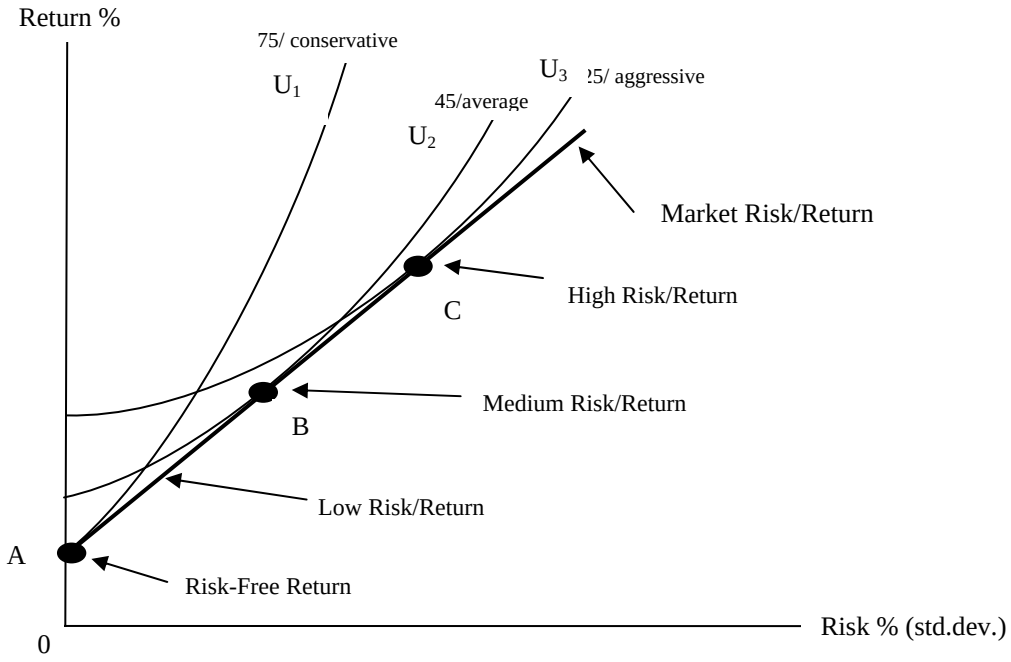
In one sense, the question of an appropriate discount rate for present value calculations in legal proceedings dissolves into a question about the proper treatment of risk. Some economists have simply relied on *Pfeifer* and similar court opinions as a *legal* justification for the use of a risk-free discount rate. Other economists have justified the use of a risk-free discount rate on the basis of the *economic* argument that using any risk-adjusted discount rate in computing present value damages is equivalent to forcing a plaintiff to accept risk. As plaintiffs undertake any investment in non risk-free securities, their higher expected return is merely a compensation for the "felt" uneasiness of being forced to shoulder greater-than-zero levels of risk. Under this argument, a plaintiff is no better off by bearing risk. In fact, they are worse off and the reduction in a calculated present value lump sum due to the use of risk-adjusted returns is a precise measure of their misfortune. The implication of this line of reasoning, however, is that no one is ever better off when bearing risk, a proposition that is clearly counterfactual.

To understand the risk-return tradeoff, consider Figure 1 below that illustrates the tradeoff between risk and return using indifference curve analysis. Since risk is a "bad" and return is a "good", an indifference curve located more to the northwest would represent a higher level of utility for the risk-averse investor than one located more to the southeast. The darker straight line represents the market's risk/return tradeoff opportunities, exogenous to any investor. The three indifference curves shown depict unique risk preference profiles of

three risk-averse individuals with different attitudes toward risk, which we label "conservative," "average," and "aggressive." Alternatively, the three different risk preference profiles could be interpreted as portraying a given individual at different ages (say 25, 45 and 75) with attitudes toward risk derived from the time horizon of the investment activity. With either interpretation, an individual whose indifference curves include U_1 would maximize utility at Point A and earn the risk-free return. An individual whose indifference curves include U_2, on the other hand, would maximize utility at Point B, bearing some risk to obtain a higher return, and an higher level of utility than the individual would gain at Point A. Finally, another individual whose indifference curves include U_3 would maximize utility at Point C, bearing still more risk for a still greater return, also gaining more utility than this individual would gain at Point A. Only the first of these three individuals would be worse off from bearing investment risk. The other two are clearly better off.

While there may certainly be some individuals who are risk averse to an extreme and who would undertake risk-free investments exclusively, there can also be little doubt that the median person's attitude toward risk recognizes a tradeoff. What we observe in the marketplace is a variety of ideal points from lower-risk to higher-risk, with higher-risk solutions generally associated with longer investment horizons.

Figure 1



If the median investor chooses to bear some risk when faced with investment options, it becomes difficult to state categorically that taking on risk lowers utility. Of course exposure to greater risk results in lower utility, ceteris paribus, but when coupled with greater return, greater risk to some level is desired. The optimal balance of "best" returns with "safest" investments will undoubtedly differ person to person. It will also differ for one person when considered at different points in a lifetime. The conclusion, however, that a prudent plaintiff upon the award of a lump sum award for injury will undertake a mixed portfolio and not rely exclusively on risk-free investments seems inescapable, save for the rare case of extreme risk aversion.

The several acts presented at the start of this paper repeatedly refer to a "prudent

investor[3] strategy" which may entail equities as well as US Treasury securities in a diversified investment portfolio. Since the standard of care and of protectiveness toward the investment for this class of fiduciaries and trustees is very high, and since the class of retirement and trust funds overseen by the intended audience of these acts bears a striking resemblance to the lump sum award in a tort action, it is not apparent that attitudes toward risk in the several instances of care should be radically different.

Historically, trustees were restricted by law to the very safest forms of investments (in many states trustees were limited to certain categories of securities), couldn't delegate to investment specialists the oversight and direction of funds, and were prohibited from diversifying funds in any trust account. Modern law surrounding trustees acknowledges modern portfolio theory, investment practices of diversification, and the abundance of financial information and expertise commonly available. If actual practice of trustees today follows the clear direction of these model laws, then lump sum awards for personal injury and wrongful death losses will be overseen in a manner that employs the tools of modern investment and portfolio theory. If this is the case, then the common practice of many forensic economists of exclusive reliance on US Treasury bonds or bills for interest rates to be employed in the discounting process may be based on counterfactual assumptions. The practice of forensic economists may be inconsistent with both legal understanding of financial markets and actual investment practice. Accordingly, an assessment of the sensitivity of the contemplated lump sum to alternative investment scenarios is called for.

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[3] From a legal dictionary: the *prudent man rule*: n. the requirement that a trustee, investment manager of pension funds, treasurer of a city or county, or any fiduciary (a trusted agent) must only invest funds entrusted to him/her as would a person of prudence, i.e. with discretion, care and intelligence. Thus solid "blue chip" securities, secured loans, federally guaranteed mortgages, treasury certificates and other conservative investments providing a reasonable return are within the prudent man rule. ***http://www.dictionary.law.com/***

The foregoing presents an economic argument for using risk-adjusted discount rates in forensic economics. It should be noted that there is an entirely different economic approach to this question that leads to the same conclusion. Rather than focusing on the investment choices that would likely be made by a prudent investor, this alternative (but not conflicting) approach focuses on the fact that the future earnings stream that is to be discounted to present value is by no means certain to occur. It is a well-established principle of finance that a risk-free discount rate should be used only if the money stream to be discounted consists of *certainty equivalents.* Since there are many reasons why an *actual* earnings stream might deviate from the expected levels (see Breeden, 2002), there is a case for incorporating these risks into the discount rate. (For a thorough review of the issues, see Brush (2003.) The main point to be made in the present paper is that there is economic justification for using a risk-adjusted discount rate, *even for the projection of a certain income stream.*

IV. Prudent Portfolios and Life-Cycle Investment Returns

Useful information about how a "prudent investor" might invest a lump sum damage award can be found in the asset allocations chosen by so-called life-cycle retirement funds, also known as retirement target-date funds. These mutual funds are designed to take the worry out of investing for retirement by automatically adjusting the asset allocation among stocks, bonds and money market equivalents over time. The more distant is the retirement date, the more heavily the funds are invested in stocks, but as the investor moves towards the retirement date, there is a gradual adjustment towards a less-and-less risky portfolio.

Table 1 gives an illustration of how life-cycle funds adjust asset allocation both before and after retirement.[4] With retirement 36 years away, almost 90 percent of the funds would

[4] The figures given are approximate averages for three life-cycle funds offered by Fidelity

be invested in equities, but this percentage steadily declines over time, declining to 28 percent approximately 9 years after retirement.[5]

Table 1										
Illustration of Representative Asset Allocation - Life Cycle Retirement Plans										
Investment Category	Years to Retirement									
	36	31	26	21	16	11	6	1	-4	-9
Stocks	89%	85%	80%	75%	67%	60%	50%	44%	32%	28%
Bonds	11%	15%	20%	25%	30%	37%	45%	49%	51%	52%
Money*	0%	0%	0%	0%	3%	3%	5%	7%	17%	20%
* money market funds, short term bond funds, etc.										

There is an important difference between the situation of a prospective retiree and the situation of a person who has received a lump sum damage award to replace future lost wages. At the point of retirement, an individual's life expectancy may still exceed 15 years[6], and asset allocation at that point must reflect the concern that the retirement funds will last through the period of retirement. With respect to the recipient of a lump sum damage award, the funds are not intended to last beyond the date of retirement. Rather, the award is intended to replace the individual's lost earning capacity up to, but not beyond, the expected retirement date.

The difference in the two situations just described suggests that an individual who must concern himself that a lump sum damage award will last until the expected retirement date might reasonably choose asset allocations over time that represent an approximately 15-

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Funds, Vanguard Funds, and T.Rowe Price, respectively. There were significant differences among the three funds examined, with the Vanguard fund being the most conservative and the T. Rowe Price fund being the least conservative. See each company's Retirement Funds prospectus.

[5] For all three funds, the percentage of stocks bottoms out at 20 percent during the retirement years.

[6] In 2002, the life expectancy of 65-year-old males was 16.6 in the U.S. See "United States

year forward shift in the asset allocations that would be recommended for retirement planning. In other words, the asset allocation appropriate for a prospective retiree who is 21 years from retirement would be appropriate for a lump sum award recipient who is 36 years from the target date at which the lump sum is to be exhausted, and the asset allocation for the retiree at the point of retirement would be appropriate for the lump sum recipient 15 years prior to retirement. Table 2 makes this adaptation to the information in Table 1 to illustrate appropriate asset allocations for a lump sum award recipient for any period of lost wages up to 40 years in length.[7]

Table 2
Adaptation of Life Cycle Retirement Plan Asset Allocation
To Economic Damage Awards

Investment Category	Years to Target Date -Exhaustion of Funds						
	36-40	31-35	26-30	21-25	16-20	11-15	1-10
Stocks	75%	67%	60%	50%	44%	32%	28%
Bonds	25%	30%	37%	45%	49%	51%	52%
Money	0%	3%	3%	5%	7%	17%	20%

To simulate the asset allocations found in the life-cycle retirement plans, we shall make use of simple portfolios consisting of a mix of large company stocks, intermediate-term government bonds, and U.S. Treasury bills to represent the stocks, bonds and money equivalents, respectively, found in these plans. This approach is conservative in that the retirement plans include small company stocks in their portfolios (which are riskier than large company stocks), and also include both investment grade and high-yield corporate bonds

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Life Tables, 2002," *National Vital Statistics Report*, Vol. 53, No. 6, p. 9, Table 2.

[7] The asset allocations shown are conservative in that the figures for 21 years until retirement in Table 1 are used for years 36 through 40 rather than just year 36 in Table 2, the figures for 16 years until retirement in Table 1 are used for years 31 through 35 in Table 2, etc. In reality, the asset allocations in life-cycle funds are typically adjusted annually rather than at 5-year intervals.

(which are riskier than the government bonds). Table 3 shows the average compound annual returns on large company stocks, intermediate-term government bonds and U.S. Treasury bills over the 40-year period, 1964-2003.[8] Also shown is the average compound growth rate in hourly wages in the U.S. private non-agricultural economy over the same period.[9] Large company stocks yielded 10.6% over this period, compared to 7.72% for the government bonds and 6.03% for the T-Bills. The average wage growth rate was 4.71%.

Table 3
Average Annual Compound Returns*
and Average Compound Wage Growth Rate**
40 Years, 1964-2003

Large Company Stocks	Intermediate Term Gov't Bonds	U.S. Treasury Bills	Wage Growth Rate
10.61%	7.72%	6.03%	4.71%

*Source: Ibbottson Associates 2004, Table 2-5.
**Source: *Economic Report of the President,* 2005, Table B-47

Forensic economists often use historical averages of interest rates and wage growth rates to calculate a net discount rate for purposes of discounting future wage losses to present value.[10] If R represents the average interest rate and W represents the average wage growth rate, then the net discount rate is defined as

$$NDR = ((1 + R)/(1 + W)) - 1.$$

If this is to be a risk-free net discount rate, then the appropriate interest rate to use is

[8] Calculated from data in Ibbotson Associates [2004], Table 2-5.
[9] Calculated from data in Council of Economic Advisors, *Economic Report of the President* [2005], Table B-47.
[10] As recently as 1999, a survey of the members of the National Association of Forensic Economics indicated that this historical averages method was used by nearly half of practitioners, but by 2003 this percentage had slipped to 38%. See Brookshire and Slesnick [1999, p. 74] and Brookshire, Luthy and Slesnick [2004, p. 33].

the Treasury bill rate, since T-bills are essentially free of both default risk and inflation risk. Given the data in Table 3, the risk-free net discount rate would be 1.26%. The present value of a base annual loss of $1,000 for 40 years using the risk-free discount rate of 1.26% is $31,269.

Suppose we now assume that the recipient of such a lump sum award would, in fact, behave as a prudent investor, following the asset allocations in Table 2 and reaping the returns shown for each category of investment as displayed in Table 3. The weighted average portfolio returns for each five year period of a 40-year future wage loss are then shown in Table 4.

Table 4
Weighted Portfolio Rates of Return
Based on Asset Allocation from Table 2 and Rates of Return from Table 3

	Years to Target Date						
	36-40	31-35	26-30	21-25	16-20	11-15	1-10
Rate of Return	9.89%	9.61%	9.40%	9.08%	8.87%	8.36%	8.19%

Table 5 illustrates the extent to which overcompensation results when the lump sum award is derived using a risk-free discount rate but the lump sum is "prudently" invested. The life cycle investment returns are shown in column (2) and the constant earnings growth rate is shown in column (3). At the start of the first year, the individual receives the lump sum of $31,269, which is the beginning balance shown in the first row in column (4). To this beginning balance, we add the first-year investment returns in column (5) and subtract the first-year wages in column (6), leaving the ending balance in column (7). This becomes the beginning balance in the second year, to which second-year investment returns are added and from which second-year wages are subtracted, leaving an ending balance that becomes the

beginning balance for the third year, etc. If prudently invested, the award of $31,269 would result in a **remainder interest** at the end of the 40th year of $394,547. This remainder should be zero.

Table 6 illustrates the correct lump sum award that would exactly replace the lost future wages, assuming prudent investing of the lump sum over the entire loss period. A lump sum award of $18,461 would be just large enough to cover the lost future wages and result in an ending balance of zero at the end of the 40th year.[11] Thus, the lump sum award of $31,269 represents overcompensation of 69% or $12,808.

Tables 7 and 8 show results for a 30-year future wage loss. The present value of a $1,000 annual loss for 30 years at the risk-free net discount rate of 1.26% is $24,853. Table 7 illustrates that an individual who receives this award and then behaves like a prudent investor will have a remainder of $94,055 at the end of the 30th year instead of the anticipated zero balance. Table 8 shows that the correct award under these circumstances would be $17,112. This is the amount that would result in a zero ending balance at the end of the 30th year. The award based on the risk-free net discount rate produces overcompensation of 45% or $7,741.

Finally, Tables 9 and 10 show results for a 20-year future loss. The present value of a $1,000 annual loss for 20 years at the risk-free net discount rate of 1.26% is $17,582. Table 9 indicates that an individual receiving this award who subsequently behaved as a prudent investor would have a remainder interest of $18,028 at the end of the 20th year. Table 10 indicates the correct award would be $13,991. In this case, the award based on a risk-free net discount rate overcompensates the plaintiff who diversifies his investment by 26% or $4,037.

As shown in the previous section, for all but the most risk-averse investor, bearing risk

[11] The "Goal Seek" function in Excel can be used to solve for the beginning balance in the first year that would result in a zero ending balance at the end of the 40th year. This is the

will result in not just higher returns, but also higher utility. Using a risk-free discount rate ignores this fact. This section has demonstrated the extent to which plaintiffs might be over-compensated through use of a risk-free discount rate when the recipient of a lump sum award would invest the proceeds as a "prudent investor" would. For longer term losses, the overcompensation may be quite substantial.

V. Conclusion

This paper has presented the general outlines of a development in legal theory and practice that has been referred to as the "prudent investor approach" along with a sketch of its rationale. The goal of the prudent investor statutes is to allow the active management of trust funds in a manner that is consistent with modern financial (that is to say, portfolio) theory.

The question suggested by this development in legal thought for the forensic economist revolves around the discount rate. If prudent investing entails recognition of (1) the risk/return tradeoff, (2) the value of diversification and (3) the consideration of all forms of investment, including equities, then why should a risk-free rate be used to discount future lost earnings to present value? As the "life cycle investment plan" scenarios demonstrate, significant errors in compensation can occur if tort damage awards are calculated based on risk-free discount rates when recipients of such awards in fact behave as prudent investors, gaining utility by diversifying across a range of alternative investments. In cases of long term injury and the consequent extended investment time horizon, remarkably large remainder interests exist. For example, in the case of a 40 year future loss period, a lump sum award to replace a $1,000 annual earning loss that is based on an assumption of risk-free investment but that is invested prudently will not fully liquidate as planned. Rather, it will leave a balance

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correct lump sum award. Other spreadsheet programs have similar functions.

at the end of the loss period of $394,547, a remarkable sum in view of the total annual loss of $1,000. The legal system appears to be adjusting its dictates in light of actual financial practice. If the goal of forensic economists is as *Trevino* instructs, to compute damage awards that "restore the plaintiff to the position that he would have been in but for the injury", then perhaps it is time as well for forensic economists to adjust their approaches to the calculation of present value in litigation matters in a manner that reflects modern portfolio theory.

Table 5
Illustration of Remainder Interest - 40 Year Target Date
Assuming Life Cycle Investment Returns
(PV of $1,000/year for 40 Years with 1.26% Net Discount Rate = $31,269)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Years to Target Date	Investment Returns (%)	Earnings Growth (%)	Beginning Balance	Plus Returns	Minus Wages	Ending Balance
40	9.89	4.71	**$31,269**	$3,093	$1,047	$33,314
39	9.89	4.71	$33,314	$3,295	$1,096	$35,513
38	9.89	4.71	$35,513	$3,512	$1,148	$37,877
37	9.89	4.71	$37,877	$3,746	$1,202	$40,421
36	9.89	4.71	$40,421	$3,998	$1,259	$43,160
35	9.61	4.71	$43,160	$4,148	$1,318	$45,989
34	9.61	4.71	$45,989	$4,420	$1,380	$49,029
33	9.61	4.71	$49,029	$4,712	$1,445	$52,295
32	9.61	4.71	$52,295	$5,026	$1,513	$55,808
31	9.61	4.71	$55,808	$5,363	$1,584	$59,586
30	9.40	4.71	$59,586	$5,601	$1,659	$63,528
29	9.40	4.71	$63,528	$5,972	$1,737	$67,763
28	9.40	4.71	$67,763	$6,370	$1,819	$72,313
27	9.40	4.71	$72,313	$6,797	$1,905	$77,206
26	9.40	4.71	$77,206	$7,257	$1,994	$82,469
25	9.08	4.71	$82,469	$7,488	$2,088	$87,869
24	9.08	4.71	$87,869	$7,978	$2,187	$93,661
23	9.08	4.71	$93,661	$8,504	$2,290	$99,875
22	9.08	4.71	$99,875	$9,069	$2,398	$106,546
21	9.08	4.71	$106,546	$9,674	$2,511	$113,710
20	8.87	4.71	$113,710	$10,086	$2,629	$121,168
19	8.87	4.71	$121,168	$10,748	$2,753	$129,163
18	8.87	4.71	$129,163	$11,457	$2,882	$137,737
17	8.87	4.71	$137,737	$12,217	$3,018	$146,936
16	8.87	4.71	$146,936	$13,033	$3,160	$156,810
15	8.36	4.71	$156,810	$13,109	$3,309	$166,610
14	8.36	4.71	$166,610	$13,929	$3,465	$177,074
13	8.36	4.71	$177,074	$14,803	$3,628	$188,249
12	8.36	4.71	$188,249	$15,738	$3,799	$200,188
11	8.36	4.71	$200,188	$16,736	$3,978	$212,946
10	8.19	4.71	$212,946	$17,440	$4,165	$226,221
9	8.19	4.71	$226,221	$18,527	$4,361	$240,387
8	8.19	4.71	$240,387	$19,688	$4,567	$255,508
7	8.19	4.71	$255,508	$20,926	$4,782	$271,652
6	8.19	4.71	$271,652	$22,248	$5,007	$288,893
5	8.19	4.71	$288,893	$23,660	$5,243	$307,311
4	8.19	4.71	$307,311	$25,169	$5,490	$326,989
3	8.19	4.71	$326,989	$26,780	$5,748	$348,021
2	8.19	4.71	$348,021	$28,503	$6,019	$370,505
1	8.19	4.71	$370,505	$30,344	$6,303	**$394,547**

Table 6 Correct Present Value Calculation - 40 Year Target Date Assuming Life Cycle Investment Returns						
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Years to Target Date	Investment Returns (%)	Earnings Growth (%)	Beginning Balance	Plus Returns	Minus Wages	Ending Balance
40	9.89	4.71	**$18,461**	$1,826	$1,047	$19,239
39	9.89	4.71	$19,239	$1,903	$1,096	$20,046
38	9.89	4.71	$20,046	$1,983	$1,148	$20,880
37	9.89	4.71	$20,880	$2,065	$1,202	$21,743
36	9.89	4.71	$21,743	$2,150	$1,259	$22,635
35	9.61	4.71	$22,635	$2,175	$1,318	$23,492
34	9.61	4.71	$23,492	$2,258	$1,380	$24,370
33	9.61	4.71	$24,370	$2,342	$1,445	$25,266
32	9.61	4.71	$25,266	$2,428	$1,513	$26,181
31	9.61	4.71	$26,181	$2,516	$1,584	$27,113
30	9.40	4.71	$27,113	$2,549	$1,659	$28,002
29	9.40	4.71	$28,002	$2,632	$1,737	$28,897
28	9.40	4.71	$28,897	$2,716	$1,819	$29,795
27	9.40	4.71	$29,795	$2,801	$1,905	$30,691
26	9.40	4.71	$30,691	$2,885	$1,994	$31,581
25	9.08	4.71	$31,581	$2,868	$2,088	$32,360
24	9.08	4.71	$32,360	$2,938	$2,187	$33,112
23	9.08	4.71	$33,112	$3,007	$2,290	$33,829
22	9.08	4.71	$33,829	$3,072	$2,398	$34,503
21	9.08	4.71	$34,503	$3,133	$2,511	$35,125
20	8.87	4.71	$35,125	$3,116	$2,629	$35,612
19	8.87	4.71	$35,612	$3,159	$2,753	$36,018
18	8.87	4.71	$36,018	$3,195	$2,882	$36,331
17	8.87	4.71	$36,331	$3,223	$3,018	$36,535
16	8.87	4.71	$36,535	$3,241	$3,160	$36,616
15	8.36	4.71	$36,616	$3,061	$3,309	$36,368
14	8.36	4.71	$36,368	$3,040	$3,465	$35,943
13	8.36	4.71	$35,943	$3,005	$3,628	$35,320
12	8.36	4.71	$35,320	$2,953	$3,799	$34,474
11	8.36	4.71	$34,474	$2,882	$3,978	$33,378
10	8.19	4.71	$33,378	$2,734	$4,165	$31,947
9	8.19	4.71	$31,947	$2,616	$4,361	$30,202
8	8.19	4.71	$30,202	$2,474	$4,567	$28,109
7	8.19	4.71	$28,109	$2,302	$4,782	$25,629
6	8.19	4.71	$25,629	$2,099	$5,007	$22,721
5	8.19	4.71	$22,721	$1,861	$5,243	$19,339
4	8.19	4.71	$19,339	$1,584	$5,490	$15,433
3	8.19	4.71	$15,433	$1,264	$5,748	$10,948
2	8.19	4.71	$10,948	$897	$6,019	$5,826
1	8.19	4.71	$5,826	$477	$6,303	**$0**

Table 7
Illustration of Remainder Interest - 30 Year Target Date
Assuming Life Cycle Investment Returns
(PV of $1,000/year for 30 Years with 1.26% Net Discount Rate = $24,853)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Years to Target Date	Investment Returns (%)	Earnings Growth (%)	Beginning Balance	Plus Returns	Minus Wages	Ending Balance
30	9.40	4.71	**$24,853**	$2,336	$1,047	$26,142
29	9.40	4.71	$26,142	$2,457	$1,096	$27,503
28	9.40	4.71	$27,503	$2,585	$1,148	$28,940
27	9.40	4.71	$28,940	$2,720	$1,202	$30,458
26	9.40	4.71	$30,458	$2,863	$1,259	$32,063
25	9.08	4.71	$32,063	$2,911	$1,318	$33,656
24	9.08	4.71	$33,656	$3,056	$1,380	$35,332
23	9.08	4.71	$35,332	$3,208	$1,445	$37,095
22	9.08	4.71	$37,095	$3,368	$1,513	$38,950
21	9.08	4.71	$38,950	$3,537	$1,584	$40,902
20	8.87	4.71	$40,902	$3,628	$1,659	$42,871
19	8.87	4.71	$42,871	$3,803	$1,737	$44,937
18	8.87	4.71	$44,937	$3,986	$1,819	$47,103
17	8.87	4.71	$47,103	$4,178	$1,905	$49,377
16	8.87	4.71	$49,377	$4,380	$1,994	$51,762
15	8.36	4.71	$51,762	$4,327	$2,088	$54,001
14	8.36	4.71	$54,001	$4,514	$2,187	$56,329
13	8.36	4.71	$56,329	$4,709	$2,290	$58,748
12	8.36	4.71	$58,748	$4,911	$2,398	$61,262
11	8.36	4.71	$61,262	$5,121	$2,511	$63,873
10	8.19	4.71	$63,873	$5,231	$2,629	$66,475
9	8.19	4.71	$66,475	$5,444	$2,753	$69,167
8	8.19	4.71	$69,167	$5,665	$2,882	$71,949
7	8.19	4.71	$71,949	$5,893	$3,018	$74,824
6	8.19	4.71	$74,824	$6,128	$3,160	$77,792
5	8.19	4.71	$77,792	$6,371	$3,309	$80,854
4	8.19	4.71	$80,854	$6,622	$3,465	$84,011
3	8.19	4.71	$84,011	$6,881	$3,628	$87,264
2	8.19	4.71	$87,264	$7,147	$3,799	$90,612
1	8.19	4.71	$90,612	$7,421	$3,978	**$94,055**

Table 8 Correct Present Value Calculation - 30 Year Target Date Assuming Life Cycle Investment Returns						
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Years to Target Date	Investment Returns (%)	Earnings Growth (%)	Beginning Balance	Plus Returns	Minus Wages	Ending Balance
30	9.40	4.71	**$17,112**	$1,609	$1,047	$17,673
29	9.40	4.71	$17,673	$1,661	$1,096	$18,238
28	9.40	4.71	$18,238	$1,714	$1,148	$18,804
27	9.40	4.71	$18,804	$1,768	$1,202	$19,370
26	9.40	4.71	$19,370	$1,821	$1,259	$19,932
25	9.08	4.71	$19,932	$1,810	$1,318	$20,424
24	9.08	4.71	$20,424	$1,854	$1,380	$20,898
23	9.08	4.71	$20,898	$1,898	$1,445	$21,350
22	9.08	4.71	$21,350	$1,939	$1,513	$21,776
21	9.08	4.71	$21,776	$1,977	$1,584	$22,168
20	8.87	4.71	$22,168	$1,966	$1,659	$22,476
19	8.87	4.71	$22,476	$1,994	$1,737	$22,732
18	8.87	4.71	$22,732	$2,016	$1,819	$22,929
17	8.87	4.71	$22,929	$2,034	$1,905	$23,058
16	8.87	4.71	$23,058	$2,045	$1,994	$23,109
15	8.36	4.71	$23,109	$1,932	$2,088	$22,953
14	8.36	4.71	$22,953	$1,919	$2,187	$22,685
13	8.36	4.71	$22,685	$1,896	$2,290	$22,292
12	8.36	4.71	$22,292	$1,864	$2,398	$21,758
11	8.36	4.71	$21,758	$1,819	$2,511	$21,066
10	8.19	4.71	$21,066	$1,725	$2,629	$20,163
9	8.19	4.71	$20,163	$1,651	$2,753	$19,061
8	8.19	4.71	$19,061	$1,561	$2,882	$17,740
7	8.19	4.71	$17,740	$1,453	$3,018	$16,175
6	8.19	4.71	$16,175	$1,325	$3,160	$14,340
5	8.19	4.71	$14,340	$1,174	$3,309	$12,205
4	8.19	4.71	$12,205	$1,000	$3,465	$9,740
3	8.19	4.71	$9,740	$798	$3,628	$6,910
2	8.19	4.71	$6,910	$566	$3,799	$3,677
1	8.19	4.71	$3,677	$301	$3,978	**$0**

Table 9
Illustration of Remainder Interest - 20 Year Target Date
Assuming Life Cycle Investment Returns
(PV of $1,000/year for 20 years with 1.26% Net Discount Rate = $17,582)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Years to Target Date	Investment Returns (%)	Earnings Growth (%)	Beginning Balance	Plus Returns	Minus Wages	Ending Balance
20	8.87	4.71	**$17,582**	$1,560	$1,047	$18,094
19	8.87	4.71	$18,094	$1,605	$1,096	$18,603
18	8.87	4.71	$18,603	$1,650	$1,148	$19,105
17	8.87	4.71	$19,105	$1,695	$1,202	$19,597
16	8.87	4.71	$19,597	$1,738	$1,259	$20,077
15	8.36	4.71	$20,077	$1,678	$1,318	$20,437
14	8.36	4.71	$20,437	$1,709	$1,380	$20,766
13	8.36	4.71	$20,766	$1,736	$1,445	$21,057
12	8.36	4.71	$21,057	$1,760	$1,513	$21,304
11	8.36	4.71	$21,304	$1,781	$1,584	$21,500
10	8.19	4.71	$21,500	$1,761	$1,659	$21,602
9	8.19	4.71	$21,602	$1,769	$1,737	$21,634
8	8.19	4.71	$21,634	$1,772	$1,819	$21,587
7	8.19	4.71	$21,587	$1,768	$1,905	$21,450
6	8.19	4.71	$21,450	$1,757	$1,994	$21,213
5	8.19	4.71	$21,213	$1,737	$2,088	$20,862
4	8.19	4.71	$20,862	$1,709	$2,187	$20,383
3	8.19	4.71	$20,383	$1,669	$2,290	$19,763
2	8.19	4.71	$19,763	$1,619	$2,398	$18,984
1	8.19	4.71	$18,984	$1,555	$2,511	**$18,028**

Table 10
Correct Present Value Calculation - 20 Year Target Date
Assuming Life Cycle Investment Returns

Years to Target Date	Investment Returns (%)	Earnings Growth (%)	Beginning Balance	Plus Returns	Minus Wages	Ending Balance
20	8.87	4.71	**$13,991**	$1,241	$1,047	$14,185
19	8.87	4.71	$14,185	$1,258	$1,096	$14,347
18	8.87	4.71	$14,347	$1,273	$1,148	$14,471
17	8.87	4.71	$14,471	$1,284	$1,202	$14,553
16	8.87	4.71	$14,553	$1,291	$1,259	$14,585
15	8.36	4.71	$14,585	$1,219	$1,318	$14,486
14	8.36	4.71	$14,486	$1,211	$1,380	$14,317
13	8.36	4.71	$14,317	$1,197	$1,445	$14,069
12	8.36	4.71	$14,069	$1,176	$1,513	$13,732
11	8.36	4.71	$13,732	$1,148	$1,584	$13,295
10	8.19	4.71	$13,295	$1,089	$1,659	$12,725
9	8.19	4.71	$12,725	$1,042	$1,737	$12,030
8	8.19	4.71	$12,030	$985	$1,819	$11,196
7	8.19	4.71	$11,196	$917	$1,905	$10,209
6	8.19	4.71	$10,209	$836	$1,994	$9,050
5	8.19	4.71	$9,050	$741	$2,088	$7,703
4	8.19	4.71	$7,703	$631	$2,187	$6,147
3	8.19	4.71	$6,147	$503	$2,290	$4,361
2	8.19	4.71	$4,361	$357	$2,398	$2,320
1	8.19	4.71	$2,320	$190	$2,511	**$0**

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