THE EVALUATION OF EARNINGS LOSS IN ALASKA COURTS: THE IMPLICATIONS OF *BEAULIEU* AND *GUINN*

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I. INTRODUCTION

In cases involving personal injury or wrongful death, the courts, often assisted by an economic expert, attempt to determine the monetary amount needed to compensate the victim for the complete or partial loss of his earning stream. *Beaulieu v. Elliott*[1] and *State v. Guinn*[2] guide and limit the methods Alaska courts use to determine the award.

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1. 434 P.2d 665 (Alaska 1967). After suffering permanent injuries during an automobile accident which occurred in April 1963, James Elliott brought an action for damages against Richard Beaulieu. Beaulieu conceded liability and the court tried the damages issue without a jury. The trial court awarded Elliott compensatory damages of $169,937.25, of which $78,744.00 was compensation for pain and suffering and $91,193.25 for loss of earnings. *Id.* at 667.

The award for loss of earnings was $10,752.85 for pre-trial loss of wages, *id.* at 673, and an amount for future earnings loss based on a 50% impairment of Elliott's wage earning capacity and a remaining work life of twenty-nine years. *Id.* at 668. The court did not discount the award to reflect the present value of the future stream of income nor did it increase the award to reflect wage increases the injured plaintiff expected to receive in the future. Instead, the court held that the market interest rate discount was fully offset by inflationary and real wage increases. *Id.* at 671-72. Although the court conceded that any wage earner can expect to receive an occasional wage increase, it held that "This factor is generally not taken into account when loss of future wages is determined, because there is no definite way of determining at the time of trial what [individual] wage increases the plaintiff may expect to receive in the years to come." *Id.* at 672. On appeal, the Alaska Supreme Court affirmed the trial court's application of the total offset rule in determining lost future earnings.

2. 555 P.2d 530 (Alaska 1976). In December 1970, Robert Guinn suffered fatal injuries in a collision between his automobile and a truck registered to Mack McGee, who had left the truck parked on the shoulder of the road. Mary Guinn, wife of the decedent, brought an action against McGee, asserting his negligence in parking and leaving his vehicle at the site, and also against the State of Alaska, alleging its negligence in failing to remove the vehicle and improperly maintaining the highway. *Id.* at 553-34. In a nonjury trial, the superior court held that the negligence of each defend-

These important cases are difficult to understand because the language of the opinions is often confusing, and although the rules enunciated are fairly clear, the economic justification for them is at times badly muddled.

The recent article, *The Economics of Beaulieu,* by Dr. P.J. Hill,[3] in this journal's predecessor, has added to the confusion over *Beaulieu* and its interpretation. Hill claims that the *Beaulieu* rule is "unsupportable in economic theory or by principles of tort" and "has resulted in a major windfall to plaintiffs claiming loss of future wages." These claims are seriously in error.[4]

This article will show that the rules of *Beaulieu* and *Guinn* taken together provide a sensible basis for the evaluation of future earnings loss in cases involving the average or typical worker. This approach accords closely with sound economic principles and is strongly supported by available economic evidence. Systematic use of the approach over the last three decades would have resulted in a slight undercompensation of the average plaintiff in most years, but would have provided a much more accurate and consistent basis for setting compensation than any of the competing approaches.[5] This article also provides the basis for responding to the Supreme Court's requirement in *Jones & Laughlin Steel Corp. v. Pfeifer*[6] of economic proof of

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ant was the proximate cause of death and awarded damages jointly and severally against McGee and the state in the amount of $898,623.

The award for loss of earnings was $37,021 for past earnings from the date of the accident to the trial and $702,977 for lost future earnings. *Id.* at 544 n.35. The court followed *Beaulieu v. Elliott* when calculating the award, with the exception that it permitted allowances for step-wage increases set forth in the current union wage contract for Guinn's position. *Id.* at 545. In deviating from *Beaulieu,* the supreme court held that it was permissible to consider this type of "certain and predictable" individual wage increase and that this was "not the type of wage increase to which reference was made in *Beaulieu* as offsetting the failure to discount the award to its present value." *Id.* at 546 n.39.

The Supreme Court of Alaska affirmed the trial court's adoption of the offset rule and the inclusion of "certain and predictable" individual wage increases in determining the decedent's lost future earnings. *Id.* at 545-47.

3. Hill, *The Economics of Beaulieu,* 12 U.C.L.A.-ALASKA L. REV. 57 (1982-1983).

4. *Id.* at 58 (citations omitted). Hill's argument in support of his claims rests on an apparent confusion concerning two relationships: (1) the relationship between interest rates and the rate of *price* inflation and (2) the relationship between interest rates and the rate of growth in wages (roughly, *wage* inflation). The latter relationship is important in estimating earnings loss. The former relationship plays no direct role in such calculations, but is the primary focus of Hill's data analysis.

5. This article does not suggest that the *Beaulieu* rule should be applied exclusively in all cases. In some cases, data concerning the specific plaintiff may support a departure from the general rule. For further discussion of possible refinements, *see infra* notes 70-75 and accompanying text.

6. 462 U.S. 523 (1983). Howard Pfeifer brought an action for damages against

the efficacy of the rule that future wage growth offsets future interest rates.

Jones & Laughlin Steel Corp. after suffering permanent injury in the course of his employment with the company in January 1978. Pfeifer alleged that his injury had been caused by the negligent operation of the vessel on which he was working within the meaning of the Longshoremen's and Harbor Worker's Compensation Act. *Id.* at 526. The federal district court found in favor of Pfeifer and awarded damages of $275,881.31, of which $50,000 was compensation for pain and suffering and $225,881.31 for loss of earnings. *Id.*

The district court's award for lost earnings took into consideration that Pfeifer's injury made him permanently unable to "perform anything other than light work" during his remaining work expectancy of 12-1/2 years. *Id.* The court arrived at its loss of earnings award "by taking 12-1/2 years of earnings at respondent's wage at the time of injury ($325,312.50), subtracting his projected hypothetical earnings [from light work] at minimum wage ($66,352) and the compensation payments he had received under § 4 [of the Longshoremen's and Harbor Worker's Compensation Act] ($33,079.14)." *Id.* The court did not discount the award to reflect the present value of the future stream of earnings nor did it increase the award to account for inflation. Instead, following a decision of the Supreme Court of Pennsylvania, the district court applied an offset rule which presumes that future inflation shall equal, and hence offset, future interest rates. The Court of Appeals for the Third Circuit agreed with the district court's application of the offset rule and affirmed the decision. *Id.* at 527.

The United States Supreme Court held that although the total offset method "has the virtue of simplicity and may even be economically precise," the trial court's automatic use of an offset was not acceptable as a matter of law without evidence to support its validity. *Id.* at 550. The Court therefore remanded the case for findings in support of the offset. *Id.* at 551.

In *Jones & Laughlin,* the Supreme Court examined a Pennsylvania decision, Kaczkowski v. Bolubasz, 491 Pa. 561, 583, 421 A.2d 1027, 1038-39 (1980), which held "as a matter of law that future inflation shall be presumed equal to future interest rates with these factors offsetting." *Jones & Laughlin,* 462 U.S. at 527. The Pennsylvania rule was thus similar to the Alaska approach discussed in *Beaulieu.* This article argues that the *Beaulieu* and *Guinn* approach is in fact consistent with the approach required by the *Jones & Laughlin* court, at least for the average worker.

In discussing the appropriate method for calculating the present value of a lost income stream, the *Jones & Laughlin* Court stated, "If sufficient proof is offered, the trier of fact may increase [the worker's base income] to reflect the appropriate influence of individualized factors (such as foreseeable promotions) and societal factors (such as foreseeable productivity growth within the worker's industry)." *Id.* at 536. Having made a forecast of the "real" earnings stream (with no allowance made for increases associated with general price inflation), the Court stated that "it is necessary to choose an appropriate below-market discount rate" in which "all that should be set off against the market interest rate is an estimate of future price inflation." *Id.* at 548.

The evidence discussed in this article demonstrates that the rate of growth in nominal earnings approximately offsets the nominal interest rate used for discounting and is fully equivalent to the evidence that would be required by the *Jones & Laughlin* opinion to show that the rate of growth in real wages approximately offsets the real rate of interest. The rate of growth in nominal earnings can be viewed as the sum of the real rate of growth and the rate of inflation. Similarly the nominal interest rate can be viewed as the sum of a real interest rate and the rate of inflation. If it can be shown that the rate of growth of nominal earnings is approximately equal to the nominal rate of interest, then by deducting the common rate of inflation from both, it

Section II of this article outlines the key economic ideas involved in the evaluation of earnings loss. This expositional section introduces the major concepts, economic variables, and relationships. The next section analyzes the implications of the *Beaulieu* rule for simple cases that do not involve change of earnings with age ("age-earnings change"). This section presents empirical evidence to show that for the average worker, the *Beaulieu* rule produces results that closely parallel the past behavior of interest rates and wage inflation.[7] These findings are then used to place certain alternative approaches to the evaluation of earnings loss in perspective. Finally, the empirical evaluation of the complete offset advocated by *Beaulieu* is used to evaluate the claims made by Dr. Hill.

Section IV considers the combined effects of the *Beaulieu* and *Guinn* rules in more complicated cases where courts make an allowance for age-earnings change. Previous attempts to evaluate the *Beaulieu* rule have not considered this important feature.

II. Economic Evaluation of Earnings Loss

The general principle underlying the assessment of damages in tort cases is "that an injured person is entitled to be replaced as nearly as possible in the position he would have occupied had it not been for the defendant's tort."[8] Basic economic principles applied in light of this general principle of tort compensation provide a guide to the evaluation of a claim for future earnings loss through the following steps:[9]

1. Determine the person's pre-tort expected work life.
2. Estimate earnings for each year of the person's work life under the assumption that the tort has not occurred.[10] These estimates should consider the anticipated changes in wages and earnings associated with inflation, productivity growth, experience, promotions, and seniority.
3. Discount to present value the future portion of the earnings

becomes evident that the rate of growth in real earnings approximately equals the real rate of interest. *Cf. Jones & Laughlin,* 462 U.S. at 548-50.

7. For similar results and conclusions, *see* Comment, *Inflation, Productivity, and the Total Offset Method of Calculating Damages for Lost Future Earnings,* 49 U. CHI. L. REV., 1003-25 (Fall 1982); Jensen, *The Offset Method for Determining Economic Loss,* TRIAL, 84-99 December 1983; Meed, *Calculating Present Value — A Practical Forecasting Method,* TRIAL, 16-20 July 1984.

8. Beaulieu v. Elliott, 434 P.2d 665, 670 (Alaska 1967).

9. Jones & Laughlin Steel Corp. v. Pfeifer, 462 U.S. 523, 543 (1983), and references cited therein.

10. For purposes of the present discussion the article considers only a simple case in which the tort results in the total loss of all earnings. Complications associated with death cases, as well as problems associated with fringe benefits and non-market services are ignored in order to focus on the principal issues discussed in *Beaulieu* and *Guinn.*

stream calculated in (2), using interest rates that reflect the rate of return the plaintiff could be expected to earn on safe investments accessible to him.[11]

4. Add the amount in (3) to the pre-trial loss of wages.

An award calculated by this method would establish a fund which, if invested at the interest rates available for "safe" investments, would be just sufficient to provide the plaintiff with an annual payment of the dollar amounts of lost earnings. By the end of the expected work life, the award, together with all interest income gathered by the award, would be completely exhausted.[12]

Economists typically agree that this general approach is appropriate.[13] The courts face practical problems in its implementation, however, particularly in estimating future earnings and properly discounting them to present value. The article focuses first on these problems, which also confronted the court in *Beaulieu.*[14]

In most cases a court calculating a damage award has information about the person's age, occupation, education, and training at the time of the injury or death. It also typically has data on wages or earnings for a period prior to the tort as well as data on the wages or earnings that the victim would have received from the date of the tort

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11. Symmetric economic logic suggests that lost earnings for the period from the date of the tort to the date of trial should be accumulated with interest to the trial date. *See generally,* R. BREALEY & S. MYERS, PRINCIPLES OF CORPORATE FINANCE, 85-108 (2d ed. 1984) [hereinafter cited as BREALEY & MYERS]. In *Jones and Laughlin,* however, the Court stated that "It is both easier and more precise to discount the entire stream of earnings back to the date of injury. . . . The plaintiff may then be awarded interest on that discounted sum for the period between injury and judgment. . . ." 462 U.S. at 538 n.22. If the interest allowed is computed at market rates prevailing during that interval, the Court's procedure would provide for full symmetry in the treatment of timing.

12. This article does not consider tax consequences. The *Beaulieu* decision requires the deduction of taxes that would have been paid on the past portion of the loss. No deduction is required on the future portion of the loss. 434 P.2d at 673.

Increasingly, federal courts are considering the full consequences of taxation in calculating damage awards. *See Jones & Laughlin,* 462 U.S. at 534; Norfolk & Western Railway v. Liepelt, 444 U.S. 490, (1980); Culver v. Slater Boat Co., 722 F.2d 114 (5th Cir. 1983). The potential tax consequences include (a) the effect of the anticipated tax liability on the plaintiff's earnings and (b) the tax liability for interest generated by the fund created to compensate for the loss.

For a more complete discussion of the effects of taxes on lost earnings *see* Bassett, *The Impact of Income Taxes on Damage Awards in Personal Injury Trials,* 12 INT'L SOC'Y BARRISTERS Q. 301 (1977); Bell, Bodenhorn & Taub, *Taxes and Compensation for Lost Earnings,* 12 J. LEGAL STUD. 181 (1983); Brady, Brookshire & Cobb, *The Development and Solution of a Tax-Adjusted Model for Personal Injury Awards,* 51 J. RISK INSUR. 138 (1984); Bruce, *An Efficient Technique for Determining the Compensation of Lost Earnings,* 13 J. LEGAL STUD. 375 (1984).

13. The approach follows the standard method for evaluating the present value of an income stream. *Cf.* BREALEY & MYERS, *supra* note 11, at 26-31.

14. *See Beaulieu,* 434 P.2d at 670-72.

to the date of trial. With this information the court can make a reasonably straightforward calculation of past earnings and also a determination of the person's "base earnings" that would be used to forecast future earnings.[15] The person's "base earnings" can be defined as the annual earnings the person would have received as of the trial date had the tort not occurred.

This straightforward analysis is complicated by the fact that if the tort had not occurred, the person's earnings over his future work life would almost certainly differ from his earnings at the time of the injury. This change in earnings results from two sets of factors that significantly influence a worker's earnings over his lifetime — (a) age-earnings factors and (b) general wage inflation and productivity factors. It is not possible to understand the issues discussed in *Beaulieu* and *Guinn* without a clear understanding of the distinction between those two sets of factors and their relevance to the loss estimate.

Figure 1 illustrates the relationship between income and age for male high school graduates in the United States based on income data for 1981.[16] The figure shows a typical pattern of the variation in income by age. Young people who have just entered the labor force have relatively low income. Income is noticeably higher for older workers with more experience and seniority. In late middle age, a worker's income levels off, and declines slightly near retirement. Although the age-income pattern for male high school graduates shown in Figure 1 represents data for 1981 only, the general pattern is similar in other years as well.[17] Data for other educational levels or for specific occupations follow a similar pattern.[18]

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15. *See Jones & Laughlin,* 462 U.S. at 523.

16. The data underlying Figure 1 are from BUREAU OF THE CENSUS, U.S. DEP'T OF COMMERCE, PUB. NO. 137, SERIES P-60, CURRENT POPULATION REPORTS, Table 47 (1981) [hereinafter cited as CENSUS REPORT]. The average income for male high school graduates in each of four age groups was used to estimate the parameters of a quadratic earnings function, $y(x) = a + bx + cx^2$, where $y(x)$ denotes income at age x and where a, b, and c are the parameters to be estimated. The fitted function was then used to generate the values plotted in Figure 1.

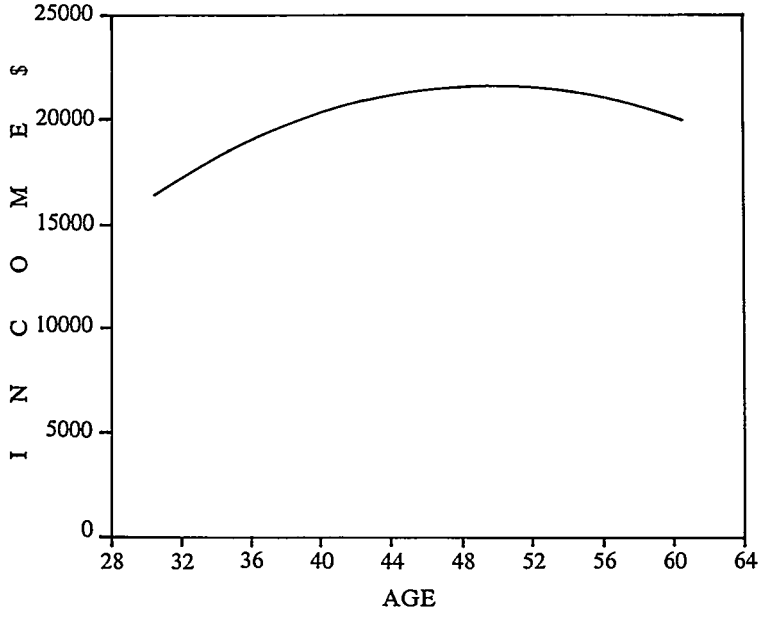
Recent Census Bureau publications provide separate series on both income and earnings. Earnings is a narrower concept than income and generally corresponds to the return on a person's labor effort. Income *includes* earnings but may also include receipts from pensions, welfare, interest, rent, dividends and other property sources. *See* CENSUS REPORT, *supra* at 206 (articulating complete census definitions). In tort cases involving disability or death, the court is usually concerned with estimating a person's *earnings* loss. Unfortunately, consistent series on earnings by age and education do not extend as far into the past as the income by age and education series used for this article.

17. *See infra* Figure 2.

18. Data on earnings by age, education and occupation are available from the decennial census publications. *See* BUREAU OF THE CENSUS, U.S. DEP'T OF COMMERCE, FINAL REPORT PC(2)-88, CENSUS OF POPULATION: 1970 SUBJECT REPORTS

FIGURE 1

INCOME BY AGE FOR MALE HIGH SCHOOL GRADUATES, 1981



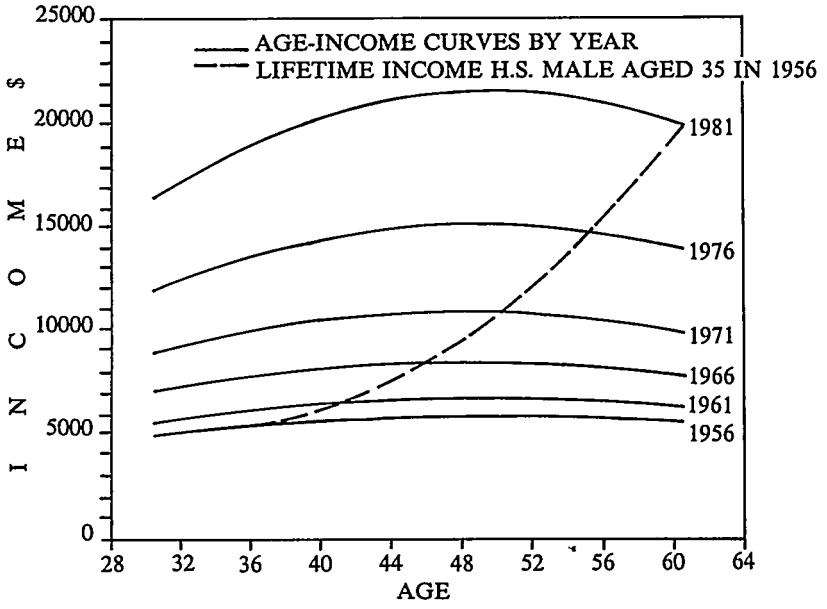
The age-income function shown in Figure 1 does *not* predict how a given person's income will change over his or her lifetime. Figure 1 represents only the relationship between age and income at a single point in time, 1981. Over time the entire age-income function has shifted upward. Figure 2 shows separate age-income functions based on data for 1956 to 1981 at five-year intervals.[19] This upward shift represents the combined effects of general wage and salary increases

(1973) (earnings by occupation and education). More detailed data is available for engineers and for a few other occupations from non- census sources. Income data for engineers is available in AMERICAN ASSOCIATION OF ENGINEERING SOCIETIES, ENGINEERING MANPOWER COMMISSION, PROFESSIONAL INCOME OF ENGINEERS 12 (1982).

19. The data underlying Figure 2 are similar to that used for Figure 1. For each of the years noted in Figure 2, an estimation was made of an income function by age for male high school graduates using data from the following sources: BUREAU OF THE CENSUS, U.S. DEP'T OF COMMERCE, PUB. NO. 74, SERIES P-60 Table 1 (1970) (years 1956, 1961, and 1966); BUREAU OF THE CENSUS, U.S. DEP'T OF COMMERCE, PUB. NO. 85, SERIES P-60 Table 49 (1971) (year 1971); BUREAU OF THE CENSUS, U.S. DEP'T OF COMMERCE, PUB. NO. 114, SERIES P-60 Table 47 (1978) (year 1976); CENSUS REPORT, *supra* note 16 (1983) (year 1981).

Figure 2 shows plots of the fitted functions for each year. In addition, Figure 2 shows an age-income function *over time* as the dashed curve. It represents the lifetime income of the average male high school graduate who was 35 in 1956, 40 in 1961 . . .,

FIGURE 2
INCOME BY AGE FOR MALE HIGH SCHOOL GRADUATES, 1956-1981



associated with increased labor productivity and general wage inflation.[20] Determining a person's lifetime income requires following the age-income function as it shifts over time.

As an example, consider a "typical" male high school graduate with average income who was thirty-five years old in 1956. That person would have earned approximately $5300 in 1956. Five years later in 1961 the same person, now forty, would have earned approximately $6400. This increase in income between 1956 and 1961 can be viewed as the combination of a movement to the right along the age-income function for 1956, which captures the effect of increased experience, together with an upward shift in this function associated with increased labor productivity and wage inflation from 1956 to 1961. The dashed line in Figure 2 shows the course of an average male high school graduate's income from 1956 to 1981 for ages thirty-five to sixty superimposed on the age-income functions for those years.

The above discussion is based on past data, but it shows that forecasting a person's *future* lifetime earnings requires consideration of

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and 60 in 1981. This curve was obtained by fitting a quadratic function to the relevant income for each age and year.

20. For a discussion of these general productivity increases, *see* J. MINCER, SCHOOLING EXPERIENCE AND EARNINGS 76-78 (1974).

both the age-earnings factor and the general productivity and wage inflation factors. This forecast involves the determination of a path like the dashed curve in Figure 2, but covering the future period of the person's work life instead of the past. This task is problematic, however, because although the past rates of growth for wages and income are observable, future rates are somewhat uncertain.

After developing estimates of expected future earnings, the court must discount the income to present value.[21] The discount rate used for the income received t years from now should reflect the opportunity cost of money invested today until t years from now. Although other values can be used as reasonable substitutes, the rates on pure discount bonds of varying maturities come closest to capturing the conceptually relevant set of discount rates.[22]

The tasks of forecasting future earnings and discounting to present value can be greatly simplified using the principles of *Beaulieu* and *Guinn*. The discussion below explains the potential accuracy of forecasts made using the *Beaulieu/Guinn* approach. The distinction drawn above between (1) age-earnings factors and (2) general wage inflation and productivity factors remains important and corresponds with the emphasis given by the two separate opinions. *Beaulieu* focuses on the changes in the overall level of wages and earnings that are associated with wage inflation and productivity changes and the problem of discounting to present value.[23] *Guinn* focuses on the allowance made for changes associated with age-earnings factors such as experience and seniority.[24]

III. THE *BEAULIEU* RULE: WAGE GROWTH VERSUS DISCOUNTING

A. The *Beaulieu* Approach

Consider a worker who can be expected to receive the average manufacturing wage rate for forty hours per week over his or her entire worklife. If age-earnings effects are ignored, any changes in earnings over his or her work life are primarily those associated with wage inflation and productivity increases.[25]

An economist who wants to carry out the general earnings loss approach outlined above in section II must estimate the rate of wage

21. For a detailed discussion of discounting to present value, see BREALEY & MYERS, *supra* note 11, at 26-113.

22. *See id.* at 26-42, 459-93.

23. 434 P.2d at 670-72.

24. State v. Guinn, 555 P.2d 530, 545-46 (Alaska 1976).

25. In keeping with *Beaulieu,* and as an expository device, this section ignores age-earnings effects. The next section discusses age-earnings effects. *See infra* notes 64-70 and accompanying text.

growth and select appropriate rates of interest for discounting to present value. It is at this point that *Beaulieu* becomes relevant. *Beaulieu* applies the simplifying assumption that the future rate of growth in wages will be equal to the rate of interest used to discount future earnings to present value.[26] *Beaulieu* states rather crudely that courts should ignore future wage increases and also ignore discounting to present value. Under this simplification, the present value of expected lifetime earnings is the product of the person's remaining work life and the current or base earnings. It is important to recognize that when the interest rate and wage growth rate are equal, this simple rule produces results that conform to the general economic principles outlined above.[27]

The validity of the *Beaulieu* simplification rests on the extent to which this key assumption — that the rate of wage increases equals the rate of interest used for discounting — is accurate over the relevant future period. Courts would have difficulty justifying use of the rule if the evidence suggested it created a systematic bias for plaintiffs or for defendants. Ultimately there is no way of determining with complete certainty the validity of this approximation for the future

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26. Beaulieu v. Elliott, 434 P.2d 665, 670-71 (Alaska 1967).

27. Let Y_t denote expected earnings t-periods in the future. Let r denote the interest rate used to discount to present value, and let T be the retirement date. The present value of future earnings is:

$$PV_o = \sum_{t=1}^{T} \frac{Y_t}{(1+r)^t}$$

If future income is related to current base income by a constant growth process, then $Y_t = Y_o(1+g)^t$ where g is the annual rate of earnings growth. Finally, if we assume, as *Beaulieu*, 434 P.2d at 670 implies, that the rate of interest equals the rate of earnings growth, or in our example, if $r = g$, then the present value of earnings is simplified as follows:

$$PV_o = \sum_{t=1}^{T} \frac{Y_o(1+g)^t}{(1+r)^t} = TY_o$$

It is not necessary to assume that the earnings growth rate and interest rate remain unchanged over time. Let r_t denote the rate of interest used for discounting period t's income to present value, and let g_t be the rate of earnings growth for the same period. If we assume $r_t = g_t$ for all future time periods, then we obtain the same result:

$$PV_o = \sum_{t=1}^{T} \frac{Y_t}{(1+r_t)^t} = \sum_{t=1}^{T} \frac{Y_o(1+g_t)^t}{(1+r_t)^t} = TY_o$$

This latter expression shows that even if interest rates and earnings growth rates fluctuate in the future (as they clearly have in the past), the *Beaulieu* offset rule will be accurate provided that r_t and g_t change together and are about equal in magnitude.

For a general discussion of present value computation, see BREALEY & MYERS, *supra* note 11, at 26-113.

except to wait and see what evolves, but past data can be very useful for examining the issue. The remainder of this section and the next demonstrate that an examination of past data provides strong support for the simplification as a conservative estimate of lost earnings.[28] In addition to the empirical support, several principles of economic theory add support for the *Beaulieu* simplification as a reasonable method of approximating future earnings.

B. The Empirical Basis for the *Beaulieu* Rule: The Relation Between Wage Growth and Interest Rates

Table 1 presents data for the United States on wages, wage growth rates, and interest rates — the key variables relevant to the discussion of *Beaulieu*. Figures 3, 4, and 5 present some of the same material graphically. Column 1 of Table 1 shows the average manufacturing wage for the years 1953 to 1982.[29] Column 4 shows the index of average total compensation for the non-agricultural workforce. The compensation index is broader than the wage rate because it includes fringe benefits as well as wage earnings. It also includes data on a greater part of the workforce than the wage rate data. Since the article's analysis focuses on the *rates of growth* for wages or for compensation, Table 1 also presents the annual and three-year average growth rates for these two wage series in columns 2, 3, 5, and 6. Table 1 further shows the interest yields on one year and three year United States Treasury Bonds in columns 7 and 8, and the rate of price inflation as measured by the movement in the Consumer Price Index in column 9.

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28. *See infra* Tables 2 & 3.

29. Wage and earnings series for the population of the United States as a whole are used for the comparisons presented in this paper. Comparable data for Alaska *only* is not always available. The ratio of average wages for Alaska and for the entire United States has been quite stable at about 1.47, and patterns of growth within the two entities are similar, so that the analysis of the United States data is largely applicable to the situation in Alaska.

For the United States and Alaska average wage series, see FEDERAL RESERVE BANK OF SAN FRANCISCO, WESTERN ECONOMIC INDICATORS, B-11 (July/August 1976); *Id.* at B-5 (July/August 1983). For the period 1966-1982 these data show an average growth rate of 7.4% for U.S. wages and 7.5% for Alaska wages.

TABLE 1
WAGES, TOTAL COMPENSATION, GROWTH RATES, INTEREST RATES: UNITED STATES, 1953-1982

Year	Mfrg Wage $/Hr. (1)	g_{m1} % (2)	g_{m3} % (3)	Comp. Index (4)	g_{c1} % (5)	g_{c3} % (6)	r_1 % (7)	r_3 % (8)	Infl. % (9)
1953	1.74	2.30	3.87	26.5	3.02	4.22	2.14	2.47	0.8
1954	1.78	3.93	4.65	27.3	3.66	5.11	1.05	1.63	0.5
1955	1.85	5.40	4.32	28.3	6.01	5.15	2.04	2.47	−0.4
1956	1.95	4.61	3.94	30.0	5.67	4.46	2.99	3.19	1.5
1957	2.04	2.94	3.47	31.7	3.78	4.04	3.62	3.69	3.6
1958	2.10	4.29	3.38	32.9	3.95	3.80	2.27	2.84	2.7
1959	2.19	3.20	2.96	34.2	4.39	3.85	4.23	4.46	0.8
1960	2.26	2.65	2.73	35.7	3.08	3.52	3.63	3.98	1.6
1961	2.32	3.02	2.93	36.8	4.08	4.00	2.98	3.53	1.0
1962	2.39	2.51	2.98	38.3	3.39	3.77	3.10	3.47	1.1
1963	2.45	3.26	3.42	39.6	4.54	4.66	3.36	3.67	1.2
1964	2.53	3.16	3.68	41.4	3.38	4.98	3.85	4.03	1.3
1965	2.61	3.83	4.87	42.8	6.07	6.36	4.14	4.22	1.7
1966	2.71	4.06	5.59	45.4	5.51	6.47	5.20	5.23	2.9
1967	2.82	6.74	5.91	47.9	7.52	7.01	4.88	5.03	2.9
1968	3.01	5.98	5.85	51.5	6.41	6.67	5.69	5.68	4.2
1969	3.19	5.02	6.19	54.8	7.12	6.77	7.12	7.02	5.4
1970	3.35	6.57	6.88	58.7	6.47	6.90	6.90	7.29	5.9
1971	3.57	7.00	7.38	62.5	6.72	7.89	4.88	5.65	4.3
1972	3.82	7.07	8.13	66.7	7.50	8.84	4.96	5.72	3.3
1973	4.09	8.07	8.47	71.7	9.48	9.06	7.31	6.95	6.2
1974	4.42	9.28	8.72	78.5	9.55	8.40	8.18	7.82	11.0
1975	4.83	8.07	8.50	86.0	8.14	8.09	6.76	7.49	9.1
1976	5.22	8.81	8.68	93.0	7.53	8.50	5.87	6.77	5.8
1977	5.68	8.63	8.57	100.0	8.60	9.39	6.09	6.69	6.5
1978	6.17	8.59	9.00	108.6	9.39	9.76	8.34	8.29	7.7
1979	6.70	8.51	8.25	118.8	10.18	9.04	10.66	9.71	11.3
1980	7.27	9.90	--	130.9	9.70	--	12.05	--	13.5
1981	7.99	6.38	--	143.6	7.24	--	14.78	--	10.4
1982	8.50	--	--	154.0	--	--	--	--	6.1

SOURCES: *Economic Report of the President*, February 1983.

Mfrg Wage: Average hourly earnings in manufacturing. Source, ERP Table B38.

Comp. Index: Compensation per hour in nonfarm business sector, wages and salaries plus employers contributions for social insurance and private benefit plans. Source, ERP Table B40.

g_{m1}, g_{c1}: Annual rate of growth in wages or compensation index.

g_{m3}, g_{c3}: Average annual rate of growth over a three year period in wages or compensation index.

r_1: Yield on one year Treasury bonds. Source: 1953-1961, Federal Reserve Board, 1962-present, Treasury Department.

r_3: Yield on three year Treasury bonds. Source, ERP, Table B67.

Infl.: Annual rate of change in the Consumer Price Index. Source: Department of Labor, Bureau of Labor Statistics.

FIGURE 3
COMPARISON OF WAGE GROWTH AND INTEREST RATES, ONE YEAR

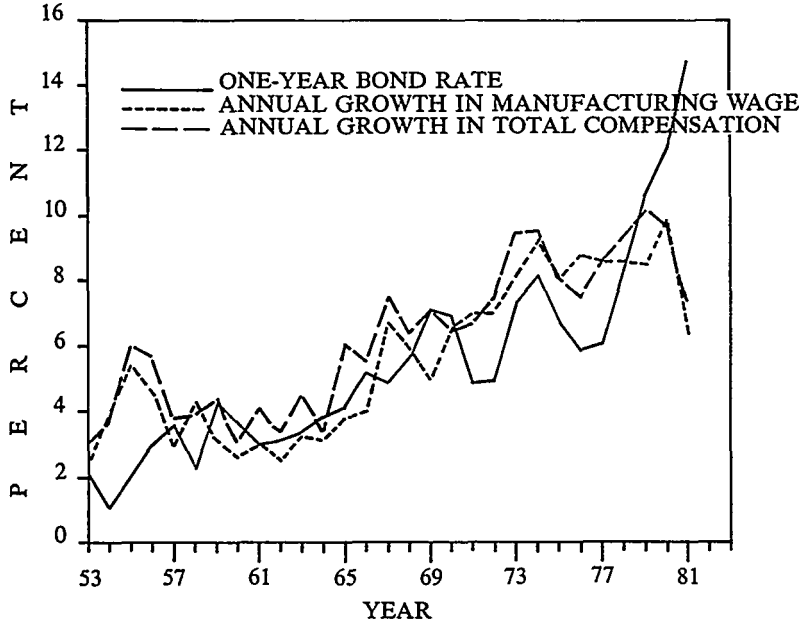


FIGURE 4
COMPARISON OF WAGE GROWTH AND INTEREST RATES, THREE YEAR

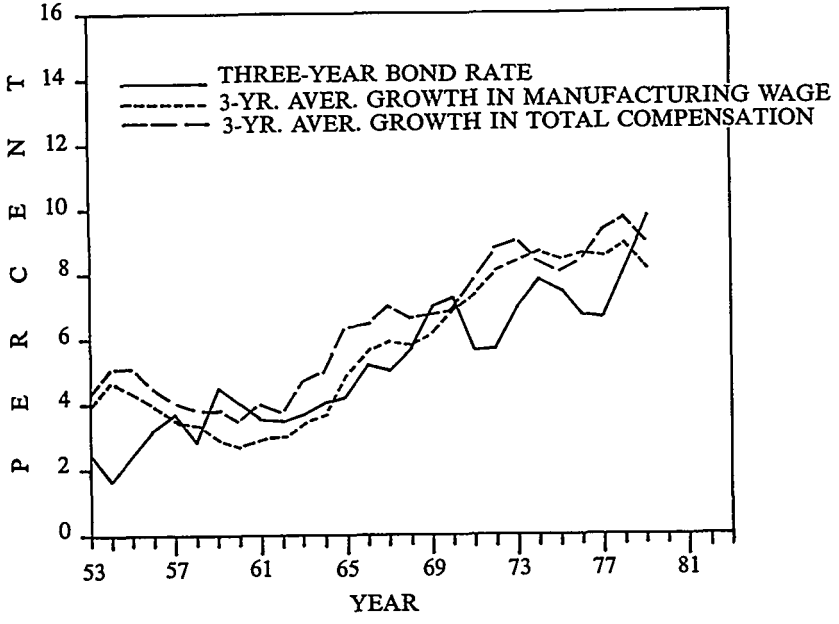
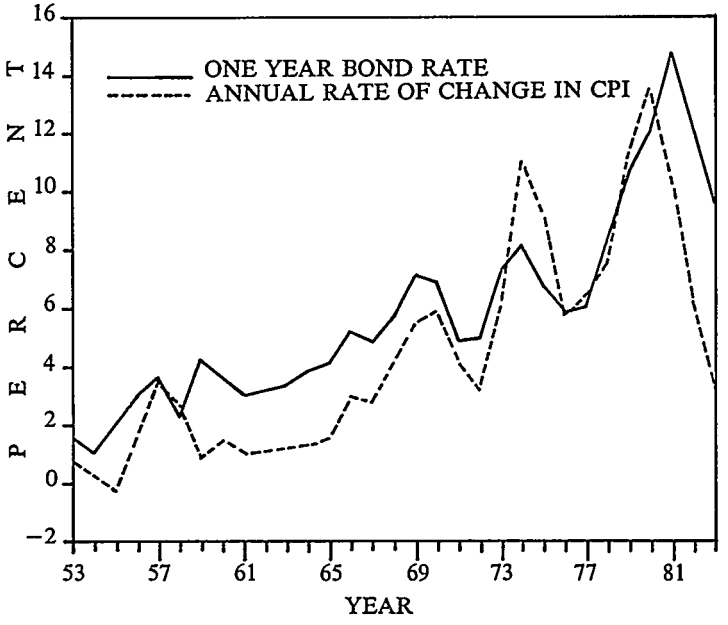


FIGURE 5
COMPARISON OF INFLATION AND INTEREST RATES



As Figures 3 and 4 show, the growth rate and interest rates have fluctuated considerably over this three decade period. These rates have also moved in an upward trend that reflects the progression from low levels of inflation in the 50's to higher rates in the 60's and 70's. As Figure 5 shows, the early 80's show an apparent peak and some reversal in the level of both interest rates and wage growth rates, accompanying the slow-down in the rate of inflation.

Figure 3 plots the one-year growth rate in the manufacturing wage and the compensation index and the one-year bond interest rate series. Although the three series are clearly not equal at all times, as would be required for strict justification of the *Beaulieu* rule, they have shown considerable co-movement. For the period 1953 to 1981 the average annual growth rate in the manufacturing wage was 5.65% and in the compensation index 6.28%, while the average yield on one-year bonds was only 5.49%. Thus, on average over this period, wages or compensation grew at a rate that exceeded the interest rate on one-year bonds. Although the wage growth series and the interest rate series show a similar rising pattern over the period, the two series do not move together closely on a year-by-year basis. Only about 47% of the movement in the growth rate for wages can be explained by move-

ment in the one-year interest rate.[30] Results using the one-year growth rate in the compensation index are similar.[31]

A comparison of the movements in the three-year average growth rate for manufacturing wages and for the compensation index with the movements in the three-year interest rate is shown in Figure 4. These three-year figures demonstrate a much closer correspondence between compensation growth rates and interest rates. For the period 1954 to 1979 the average growth rate for manufacturing wages and for the compensation index was 5.68% and 6.32% respectively, while the average for the three-year interest rate was only 5.15%.[32] The interest rate explains about 72% of the variation in the average growth in wages over the next three years, and movements in the interest rate produce almost equal movements in the average growth rate for wages.

For the *Beaulieu* rule to be useful, the correspondence between wage growth rates and interest rates does not have to be perfect. If the rate of wage growth is approximately equal to the rate of interest used for discounting, the two series have similar average levels, and because

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30. The relationship between the two series can be analyzed using the statistical techniques of regression analysis. Consider the problem of explaining or predicting the movement in the wage growth series on the basis of the movements in the interest rate series. If the relationship is assumed to be linear, then the growth rate, g, is related to the interest rate, r, by the equation $g = a + br + e$, where a and b are the intercept and slope coefficients, and where e is a statistical disturbance. The statistical technique of regression analysis finds the values of a and b that produce the best fit to the data. For a careful exposition of both the rationale and techniques of regression analysis, see J. JOHNSTON, ECONOMETRIC METHODS (3d ed. 1984).

A regression of the growth rate in the manufacturing wage on the one-year interest rate produces the following results:

$$g_{m1} = \underset{(0.67)}{2.77} + \underset{(0.11)}{0.53r_1} \qquad R^2 = 0.470 \quad \text{(standard errors in parentheses)}$$

The R^2 value provides an overall measure of fit to the data and indicates that the relationship explains about 47% of the variation in the growth rate series on the basis of movements in the interest rate series. The 0.53 coefficient for the interest rate shows that a change of 1% in the interest rate produces a change of only about half of one percent in the wage growth rate. The standard errors provide a measure of precision for the estimates.

31. The regression using g_{c1} gives:

$$g_{c1} = \underset{(0.58)}{3.33} + \underset{(0.09)}{0.54r_1} \qquad R^2 = 0.566 \quad \text{(standard errors in parentheses)}$$

32. The regression of the three-year growth rate for manufacturing wages on the three-year interest rate gives:

$$g_{m3} = \underset{(0.64)}{0.92} + \underset{(0.12)}{0.92r_3} \qquad R^2 = 0.719 \quad \text{(standard errors in parentheses)}$$

The growth rate in the compensation index produced similar results. The regression using g_{c3} gives:

$$g_{c3} = \underset{(0.60)}{1.96} + \underset{(0.11)}{0.85r_3} \qquad R^2 = 0.712 \quad \text{(standard errors in parentheses)}$$

they move together over time in a similar manner, the relationship between the two measures is sufficiently parallel to make the *Beaulieu* principle useful. The 1953-1982 data for the United States shown in Table 1 and in Figures 3 and 4 demonstrate that these requirements have been satisfied over the last three decades.

C. Retrospective Tests of the *Beaulieu* Rule

The final empirical demonstration in support of the *Beaulieu* rule involves a hypothetical experiment using the historical data shown above. Suppose that in some past year, 1953, for example, the economic loss for a typical worker[33] had been evaluated under the *Beaulieu* approach. The *Beaulieu* approach for this simple case involves computing the person's annual income at the time of the evaluation and mutiplying by the number of years of his expected future work life. The experiment tests whether the *Beaulieu* estimate would have overcompensated or undercompensated the worker for his loss.

Table 2 presents the results of conducting this experiment for past years starting with 1953. The first two columns show the date the evaluation is made and the years of remaining work life from that date to the end of 1982. The next column gives the loss estimate resulting from application of the *Beaulieu* principles on the evaluation dates.[34] The true present value figures shown in column 4 represent the amounts which, if awarded in full and permitted to accrue interest from the date of the award, would just permit payment of each year's lost income over the remaining work life, exhausting the entire fund of principal and interest.[35] The final column shows the amount by which the *Beaulieu* estimate differs from the true loss expressed as a percentage of the true loss.

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33. In this section the article continues to treat the worker as one expected to earn the average manufacturing wage in each year of his remaining worklife.

34. An individual's base earnings are calculated by multiplying the average hourly manufacturing wage by 2080 hours per year (52 weeks a year times 40 hours per week). The resulting income is then multiplied by the number of years remaining in the individual's work life to produce the estimate of economic loss. For example, in 1953, 2080 multiplied by $1.74 (the year's average wage as indicated in Table 1, col. 2), times an expected work life of 30 years equals $108,576.

35. With the perfect hindsight provided by the historical data on wages and interest rates the true present value of the loss can be computed for any past evaluation date. For each year from the evaluation date to 1982 that year's lost earnings can be computed by multiplying the wage rate by 2080 hours. These income figures are then discounted to the evaluation date using the actual interest rate for the year (r_3 in our example) as the discount factor. For example, 1970 earnings of $6968 equal 2080 hours times $3.35 per hour (from Table 1, col. 1). This figure is discounted back to 1953 by dividing by the factor $(1+r_{53})(1+r_{54})\ldots(1+r_{69})$ using the r_3 interest rates presented in Table 1, col. 8. *See supra* Table 1, Figures 3, 4, & 5 & note 27.

TABLE 2
COMPARISON OF *BEAULIEU* LOSS ESTIMATES
WITH TRUE LOSS

Evaluation Year	Remaining Worklife (years)	*Beaulieu* Estimate[a] $	True Loss[b] $	Percent Error[c]
1953	30	108,576.00	112,564.74	−3.5
1954	29	107,369.60	111,636.49	−3.8
1955	28	107,744.00	109,695.58	−1.8
1956	27	109,512.00	108,463.07	1.0
1957	26	110,323.20	107,734.53	2.4
1958	25	109,200.00	107,306.02	1.8
1959	24	109,324.80	105,858.37	3.3
1960	23	108,118.40	105,821.29	2.2
1961	22	106,163.20	105,146.10	1.0
1962	21	104,395.20	103,866.83	0.5
1963	20	101,920.00	102,329.28	−0.4
1964	19	99,985.60	100,800.77	−0.8
1965	18	97,718.40	99,389.52	−1.7
1966	17	95,825.60	97,923.05	−2.1
1967	16	93,849.60	97,109.12	−3.4
1968	15	93,912.00	95,836.72	−2.0
1969	14	92,892.80	94,668.32	−1.9
1970	13	90,584.00	94,210.40	−3.8
1971	12	89,107.20	93,599.75	−4.8
1972	11	87,401.60	91,045.58	−4.0
1973	10	85,072.00	87,854.13	−3.2
1974	9	82,742.40	84,864.71	−2.5
1975	8	80,371.20	81,590.11	−1.5
1976	7	76,003.20	76,902.33	−1.2
1977	6	70,886.40	70,517.28	0.5
1978	5	64,168.00	62,627.75	2.5
1979	4	55,744.00	53,921.59	3.4
1980	3	45,364.80	43,870.19	3.4
1981	2	33,238.40	32,068.48	3.6
1982	1	17,680.00	17,680.00	0.0

NOTES: [a] *Beaulieu* estimate equals manufacturing wage in the evaluation year multiplied by 2080 hours and multiplied by remaining worklife.

[b] True loss is the present discounted value of the wage times 2080 hours for the evaluation years through 1982 using the three year Treasury yield for each year as the discount rate.

[c] The error is the difference bsetween the *Beaulieu* estimate and the true loss, expressed as a percentage of the true loss.

Consider some concrete examples from the table. In 1953, for a person with a thirty-year future work life and with an earnings potential represented by the average manufacturing wage, the loss estimate based on the *Beaulieu* principles would have been $108,576. Given the actual subsequent history of wage growth and interest rates, $112,565 would have been required to fully compensate the worker for his loss. Thus, the *Beaulieu* loss estimate involves a negative error of

3.5%. Negative values indicate undercompensation; positive values indicate overcompensation.

If a similar analysis had been performed in 1959, the loss estimate using the *Beaulieu* approach for a worker with twenty-four years of remaining worklife would yield $109,325, compared with the actual present value amount of $105,858. In this case the *Beaulieu* approach would have yielded a slight overestimate of the actual loss. The magnitude of the errors resulting from the *Beaulieu* approach over the entire period is small, generally less than plus or minus five percent. The evidence suggests that the *Beaulieu* approach would have produced undercompensation a bit more often than overcompensation, but there is no evidence that the approach is systematically biased in either direction.[36]

The empirical evidence presented in this section provides strong support for the reasonableness of the *Beaulieu* approach. Over the past three decades the growth rate for wages has been nearly equal to the interest rate. In addition, a retrospective study shows that the *Beaulieu* approach would have provided an accurate measure of the true present value of future earnings loss for workers whose earnings potential could be represented by the average manufacturing wage. These claims cannot be made by any of the competing approaches to *Beaulieu.*[37]

Economic theory suggests that the empirical link between the growth rate for wages and the interest rate is not simply an historical accident. This theory also leads economists to expect that the relationship will continue in the future and thus provides support for the use of the *Beaulieu* offset rule. The theoretical foundation for the *Beaulieu* rule can be best understood by developing the distinction between *real* and *nominal* interest rates and wage growth.[38] Nominal

36. Since the Table 2 results are a retrospective analysis and the table is restricted by the endpoint of the historical data, the length of the projection becomes shorter as the evaluation date comes closer to the present. Thus, the weight accorded the more recent, shorter projections should be less than that given the longer projections.

If the retrospective analysis is performed using the total compensation index instead of the manufacturing wage, a similar picture emerges, but since fringe benefits have grown more rapidly than wages, the growth rate for total compensation has been higher than the rate for wages alone. This difference means that using the *Beaulieu* assumption of equality between the growth rate and the interest rate in computations with the compensation index introduces slightly more error than using it in computations with wage rates alone. This error produces slightly more underestimation of the true compensation loss than appears in Table 2. *See* Woodbury, *Substitution Between Wage and Non-Wage Benefits,* 73 AM. ECON. REV. 166-82 (1983).

37. These competing approaches are discussed *infra* notes 40-45 and accompanying text.

38. The distinction between real and nominal quantities is carefully developed in Jones and Laughlin Steel Corp. v. Pfeifer, 462 U.S. 523, 540-46 (1983).

rates are defined to be the sum of the corresponding real rates and the rate of inflation. Alternatively, the real interest rate and the real rate of wage growth represent the values that these variables would have in a hypothetical inflation-free economy.

Comparing the difference between the nominal rate of interest and the nominal rate of wage growth eliminates the effect of the rate of inflation, the common element that historically has been the more volatile component. The difference between the nominal rates represents the difference between the real interest rate and the real rate of wage growth. This difference, which is determined by fundamental or structural aspects of the economy, can be expected to be both small and stable.[39]

D. Competitors to the *Beaulieu* Rule

To appreciate the reasonableness of the *Beaulieu* approach, it is useful to compare the performance of the rule with that of other competing approaches. This section briefly describes the three major competitors and discusses their performance. The failings of these competing approaches clearly indicate that *Beaulieu* is the preferable approach.

1. *The traditional approach.* Courts using this approach project future earnings at the level currently observed with no allowance for future growth in wages. The resulting income stream is then discounted to present value using market interest rates observable at the time of trial.

The traditional approach was commonly used during a period of time when there was little or no inflation. The approach is flawed conceptually, however, because even when used in a noninflationary context it ignores real wage growth. When applied in a context where inflation is also present the inflation magnifies the error enormously. For example, using the data underlying Table 2, applying the traditional approach in 1953 would have resulted in an award of only $76,055, an underestimate of the true loss by over thirty-two percent.[40] If applied in 1968, when interest rates were higher, the error would have been over 35%, despite a shortening of the period of the

39. *See* Fama, *Short Term Interest Rates as Predictors of Inflation,* 65 AM. ECON. REV. 269 (1975). *See also Jones & Laughlin,* 462 U.S. at 541-42 and references cited therein.

40. Multiplying the 1953 manufacturing wage of $1.74 per hour by 2080 hours per year produces annual earnings of $3619.20 per year. This figure, multiplied by the remaining work life of 30 years, considering no inflation, and discounting to present value using an interest rate of 2.67% (that of long term bonds in 1953) equals $76,055. This number is 32% below the "true loss" figure in Table 2.

projection.[41]

2. *The myopic approach.* The name *myopic* can be applied to any of a variety of approaches that estimate future earnings by projecting current earnings into the future using a growth rate based on current or recent past experience and then discount the resulting income to present value using current interest rates. Given the variability of wage growth and of interest rates, the myopic approach will yield net discount rates that are sometimes positive, sometimes negative, and occasionally zero. Over the period considered in the retrospective analysis, the errors, although both positive and negative, are often quite substantial. Courts applying the myopic rule in 1953, for example, would have overcompensated tort victims by greater than twenty-five percent.[42] That error arises because the wage growth rate around 1953 was temporarily above market rates of interest, but the temporary experience did not accurately predict the longer run behavior of the two rates. Application of the myopic rule in years when the interest rate was temporarily above the growth rate for wages would result in underestimates of loss.

3. *The partial offset approach.* The term *partial offset* can be used to describe any of the approaches which focus on the difference between the rate of interest and the rate of wage growth, but which assume that this difference will not equal zero.[43] Based on the data underlying Table 2, any partial offset approach using a positive net discount rate, that is, with interest rates assumed to be above the wage growth rate, would produce greater undercompensation on average than the *Beaulieu* rule produces.[44] Given that wage growth exceeded interest rates on average over the period, a small negative net discount rate would have reduced the undercompensation.[45]

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41. For a more detailed comparison of the offset and traditional approaches see Comment, *supra* note 7, at 1003-25.

42. For recent years prior to 1953, wage growth exceeded interest rates by about 1.7%. Using the 1953 annual earnings of $3,619.20, *see supra* note 40, and projecting wage growth at a rate exceeding the discount rate by 1.7% gives a present value of $140,760. This number is over 25% greater than the "true loss" given in Table 2.

43. The *Beaulieu* approach estimates this value to be zero. *See supra* notes 26-27 and accompanying text.

44. This greater undercompensation would result because the use of any discount rate would necessarily reduce the earnings loss estimate given by a partial offset approach below the *Beaulieu* estimate shown in column 3 of Table 2.

45. In following the Supreme Court's requirement in *Jones & Laughlin* to present evidence in support of the approach used in a specific case, economists would often be required to use a partial offset approach. This issue is discussed further *infra* Section V.

E. A Critique of Dr. Hill's Analysis

As presented above, the theoretical analysis and empirical results reached through application of the *Beaulieu* principle directly contradict Dr. Hill's assertion that the *Beaulieu* rule is "unsupportable in economic theory or by principles of tort," and that it has "resulted in a major windfall to plaintiffs."[46] In particular, the results of the retrospective study above show that use of the *Beaulieu* rule over the past three decades would have resulted in slight undercompensation a bit more often than overcompensation and that in all cases the compensation errors would have been small.[47]

Hill criticizes *Beaulieu* on economic grounds for its failure to use discounting, but in making this criticism he apparently has failed to realize that the *Beaulieu* rule has two parts: (a) make no adjustment to account for expected future general wage growth[48] and (b) do not discount the resulting current dollar earnings to present value.[49] As shown in Section II, use of the *Beaulieu* rule gives a correct evaluation of the *present value* of expected future earnings provided that the implicit assumption that wage growth rates equal discount rates is valid. The degree to which this assumption is validated by the historical data was demonstrated in Section III.

In Section III of his paper, Dr. Hill attempts to disparage the results reached under *Beaulieu* by incorrectly focusing on the relationship between interest rates and the rate of *price* inflation.[50] The difference between these two variables is the *real* interest rate. Hill's error consists either in a failure to consider the corresponding *real* rate of wage growth or in confusion of the rate of price inflation with the rate of nominal wage growth.

The rate of growth that is relevant in an earnings loss case is the rate of growth in wages or earnings and not the rate of growth in consumer prices. Price inflation plays no direct role in an earnings loss calculation.[51] The source of the confusion for Dr. Hill and others may lie in the language of the *Beaulieu* court. The *Beaulieu* opinion makes several references to the "rate of inflation."[52] In most instances the only interpretation of "inflation" in the *Beaulieu* opinion that is consistent with the sensible economic approach to the calculation of earnings loss is one that involves the rate of *wage* inflation. In refer-

46. Hill, *supra* note 3, at 58.

47. For similar results and conclusions see Comment, *supra* note 7, at 1003-25; Jensen, *supra* note 7, at 84-99.

48. 434 P.2d at 672.

49. *Id.* at 671.

50. Hill, *supra* note 3, at 61-64 (1982).

51. *See supra* notes 25-27 and accompanying text.

52. 434 P.2d at 671.

ring to wage increases the court states that "this factor may be taken into account to some extent when considered to be an offsetting factor to the result reached when future earnings [with no allowance for future wage growth] are not reduced to present value."[53]

The empirical evidence presented above shows that the wage growth associated with general inflation and productivity factors can indeed be regarded as an offset to the discounting process. Hill presents no evidence on this issue. The problem of adjusting for age-earnings factors[54] is considered in Section IV.

The data presented by Dr. Hill indicate that over the past thirty years interest rates have tended to be slightly above the rate of *price* inflation.[55] Although this observation is accurate, it does not constitute evidence against the *Beaulieu* offset rule because the rate of *wage* growth has also been above the rate of price inflation and by a similar amount.[56] The offset argument of the *Beaulieu* court is thus supported either by a comparison of nominal wage growth and nominal interest rates or by a comparison of real wage growth and real interest rates.

Section VI of Hill's paper presents an example that clearly shows he has ignored the rate of real wage growth while introducing a real interest rate for discounting. As an example of his analysis, he considers a twenty-year income stream of $10,000 per year.[57] He makes no allowance for growth, either nominal or real, in the income stream, but he discounts the income by a real interest rate between two and three percent.[58] If Dr. Hill had introduced real wage growth, which historical data show should be about the same rate as the real interest rate, the *Beaulieu* result would have reemerged as the correct procedure.[59] Once it is recognized that the *Beaulieu* rule produces the correct present value amount for future wage loss, Hill's complaint that Alaska courts are inconsistent in their treatment of the time value of money is seen to be unwarranted.[60]

Hill's Section VII,[61] entitled "A Proposed Solution," fails to offer

53. *Id.* at 672.

54. *See* Hill, *supra* note 3, at 65-66.

55. *Id.* at 68. The comparison can be made using the data from Table 1 of this paper. The values in column 9 representing inflation are essentially the same as the values Hill presents apart from rounding of the numbers. *See id.* at 68. Columns 7 and 8 give interest rates on one year and three year treasury bonds. Hill's interest rate series is for Aaa rated corporate bonds. *Id.*

56. *See* columns (2) and (9) of Table 1.

57. Hill, *supra* note 3, at 66-67.

58. *Id.* at 66.

59. *Jones & Laughlin,* 462 U.S. at 532-53, makes it very clear that both real interest and real wage growth rates should be considered in evaluating earnings loss. To consider one without the other as Hill does is error.

60. Hill, *supra* note 3, at 67.

61. *Id.*

any concrete advice to guide the courts. Although he correctly states that we should "project earnings over the plaintiff's working life, allowing increases resulting from occupational and professional progress as well as increases reflecting future inflation,"[62] and then discount to present value, he makes no concrete suggestions regarding the techniques to be used in forecasting future earnings. Furthermore, his recommendation to use long run interest rates on private sector bonds is flawed in several regards. Recent case law makes it clear that the plaintiff is entitled to expect such a risk-free rate of return on his compensation fund as would be available from United States Treasury Bonds, not the higher rate which would be available from corporate bonds.[63] In addition, the use of long term bonds as the investment vehicle for providing the stream of payments contemplated by the award involves an additional element of risk which the plaintiff is not required to bear.

IV. *BEAULIEU* AND *GUINN* COMBINED: WAGE GROWTH, DISCOUNTING, AND AGE-EARNINGS EFFECTS

The Alaska Supreme Court's opinion in *State v. Guinn*[64] clearly distinguished between "a general increase along the entire wage scale," which is offset against the discount rate according to *Beaulieu,* and "[a]utomatic step increases keyed to length of service," which are wage increases associated with likely promotions.[65]

The wage changes permitted under the *Guinn* opinion are the changes associated with the age-earnings factors discussed in Section II.[66] Although the *Guinn* case involved a known union formula for varying wages according to seniority, Figures 1 and 2 show that the age-earnings effect is a persistent and prevalent phenomenon in the pattern of lifetime earnings.[67] In cases involving young workers who have only recently entered the labor force, their entry level earnings are well below the average of real earnings that they will receive over

62. *Id.*

63. "The discount rate should be based on the rate of interest that would be earned on 'the best and safest investments.' Once it is assumed that the injured worker would definitely have worked for a specific term of years, he 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." *Jones & Laughlin,* 462 U.S. at 537; *see also* Shaw v. United States, 741 F.2d 1202, 1205 n.1 (9th Cir. 1984).

64. 555 P.2d 530 (Alaska 1976).

65. *Id.* at 546.

66. *See supra* notes 8-24 and accompanying text.

67. *See* R. EHRENBERG & R. SMITH, MODERN LABOR ECONOMICS, THEORY AND PUBLIC POLICY 257-59 (1982); D. HAMMERMESH & A. REES, THE ECONOMICS OF WORK AND PAY 73 (1973).

their work life.[68] Similarly, for workers at or past the age of peak earnings, current earnings are above average real earnings for the remainder of their worklives.[69] In both cases an allowance for the age-earning effect is appropriate. Failure to include such an adjustment will result in a systematic undercompensation in the first case and overcompensation in the second.

Adjustments for the age-earnings effect can be made in a straightforward manner that is fully consistent with the *Beaulieu* principles regarding general wage growth as an offset against the discount factor. An estimate of the present discounted value of future lifetime income allowing for age-earnings factors is obtained by adding up the income derived from the age-earnings function for the year of trial for each year from the person's age at trial to his expected retirement age.

Table 3 presents the results of a retrospective experiment similar to the one discussed in Section III. Here, however, the combined use of the *Guinn* allowance for age-earnings effects and the *Beaulieu* offset for general wage level changes are analyzed in light of average income for male high school graduates.

TABLE 3
COMPARISON OF LOSS ESTIMATES BASED ON *BEAULIEU* AND *GUINN* WITH TRUE LOSS

Year of Evaluation	Years of Remaining Worklife to 1981 (years)	*Guinn/ Beaulieu* Estimate (a) $	True Present Value as of Evaluation Year (b) $	Percent Error
1956	25	148,473	142,994	+3.8
1961	20	138,333	139,567	−0.9
1966	15	132,116	129,101	+2.3
1971	10	115,466	117,584	−1.8

NOTES: [a] Computed as the integral under the quadratic age-earnings function estimated from the age-income data for males for each evaluation year.

[b] Income taken from the age-income curves for years 1956 through 1981 and for ages from 30 to 60. Income was discounted to the evaluation year using the sequence of interest rates shown as r_3 in Table 1.

The first two columns of Table 3 show the year in which the evaluation is made and the number of years of future work life to 1981 which is the end of the age-income data and the limit for this retrospective study. The third column shows the estimate of lifetime income that results from an application of the combined *Guinn* and

68. J. MINCER, *supra* note 20, at 67-71.
69. *Id.*

Beaulieu rules The estimate of the value of remaining lifetime income is computed using the age-income function *for the year of the evaluation.* For 1956, for example, the *Beaulieu/Guinn* estimate of $148,473 is the area or sum of the incomes shown by the 1956 age-income function in Figure 2.[70] This includes the *Guinn* allowance for changes in real earnings that can reasonably be expected over the person's life. No further adjustment is made for general increases in earnings over time nor is the sum of the incomes discounted to present value. The two rates are assumed to offset one another as suggested by *Beaulieu.* The fourth column of Table 3 presents the evaluation of the true present value of remaining lifetime income. Using the retrospective view, we now know the level of income for each year from the evaluation date up to 1981. This income stream follows the dashed curve in Figure 2 that shows the lifetime income of a male high school graduate who was thirty-five in 1956. The increases over time in this income series include both age-income effects and general wage increases. The actual income is then discounted back to the evaluation date using the sequence of interest rates that prevailed during the intervening years. The final column of Table 3 gives the size of the prediction error expressed as a percentage of the true present value on the date of the evaluation.

The results of Table 3, like those in Table 2, indicate only modest prediction errors for the *Beaulieu/Guinn* approach and involve no systematic underprediction or overprediction of lost income. Thus, over the past three decades the use of the *Beaulieu/Guinn* technique based on the age-income function would have provided a reasonable guide for the court's evaluation of economic loss for male high school graduates.

V. Conclusions and Some Refinements

This article has demonstrated that in evaluating the loss of a person's future earnings stream, a court must determine the present discounted value of the stream of income that the person would have received in the absence of the injury or death. This present value amount should provide a fund that is just sufficient to permit the year-by-year payment of the lost income out of the principal and interest. At the end of the person's work life, the fund would be exhausted.

70. For example, the age-income function for 1956 is $y(x) = -407.4125 + 248.055x - 2.4525x^2$, where x is age and $y(x)$ is the person's income at age x. The *Beaulieu/Guinn* estimate of the present value of lifetime income for a man aged 35 in 1956 and retiring at age 61 in 1982 is given by:

$$\int_{35}^{61} y(x)dx = \left[-407.4125x + \frac{248.055x^2}{2} - \frac{2.4525x^3}{3}\right]_{35}^{61}$$

$$= \$148,473.26.$$

The *Beaulieu* and *Guinn* opinions can be interpreted as providing guidance to the courts concerning the efficient determination of economic loss. *Beaulieu* requires the court to assume that the rates of growth in the general level of future earnings will equal the rates of interest used to discount the estimate of future earnings to present value. If this assumption is true, then the simple product of a worker's current income and his expected work life provides a reasonable estimate of his earnings loss. Empirical evidence supports this general approach by showing that over the past three decades the rates of growth in wages and earnings have exhibited a strong tendency toward equality with interest rates. In addition, the retrospective experiments show that if the *Beaulieu/Guinn* approach had been used to evaluate economic loss at various times over this past period, the results would have conformed closely with the present value amounts calculated from actual historical data. The use of these procedures to evaluate earnings loss extending into the future is supported not only by the past empirical regularities but by general economic theory that suggests these regularities are likely to continue.[71]

The empirical analyses are based on data for the average wage in manufacturing for the United States, the total compensation index for the non-agricultural business sector, and on data for income by age for male high school graduates. In performing the earnings loss calculations in a specific case a number of refinements can be introduced. In many cases a court has detailed information available regarding the person's age, sex, occupation, and earnings. In some cases, additional details are available to the court regarding the person's likely future career. When accessible, all of these details provide potentially useful sources of additional precision in the loss calculation.[72]

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71. The discussion and evidence presented here in support of the offset approach to the calculation of the present value of earnings loss does not extend automatically to the calculation of other components of loss. With regard to pension benefits, for example, the Alaska Supreme Court in Alaska Airlines, Inc. v. Sweat, 568 P.2d 916, 933-34 (Alaska 1977), correctly points out that the *Beaulieu* rule may not be applicable. Pension contracts vary greatly in the extent to which their benefits are indexed to changes in the cost of living and in most cases some net discounting is appropriate.

72. The Alaska Supreme Court departed from consistent and economically sensible application of the *Beaulieu* and *Guinn* rules in State v. Harris, 662 P.2d 946 (Alaska 1983). The court upheld the use of contractually set increases in the union wage for carpenters extending into the future. These increases had no specific, personal, or seniority-based provisions. They represented the increments associated with the combined effects of productivity changes and expected inflation. To handle these increments in a manner consistent with the approach outlined above one can treat the contractually fixed future wages as known and discount them to the trial date using known market interest rates for the same time period. For that portion of the future beyond the contract period, the *Beaulieu* offset rule could then be applied for the remainder of the future period.

Examination of data on wage growth in specific occupations and industries over the past three decades shows some industries or occupations have systematically lower and others systematically higher rates of growth than the average.[73] If these differences can be expected to persist, some departure from the strict *Beaulieu* procedures would be justified. In projecting the income loss for a person who had worked in an occupation where wages consistently grew more slowly than the average growth in wages, some net discounting would be warranted. The full offset assumed by *Beaulieu* would otherwise provide an overestimate of earnings loss.[74] Conversely, for a person working in an occupation where wages grew more rapidly than the average, the *Beaulieu* rule would provide undercompensation. In non-Alaska jurisdictions it is common for economists to analyze the behavior of interest rates and wage growth for the specific occupation involved in order to add precision to the earnings loss calculation.[75] Alaska should be encouraged to incorporate this practice into its use of the *Beaulieu/ Guinn* approach to evaluation of earnings loss.

73. *See* BUREAU OF THE CENSUS, U.S. DEP'T OF COMMERCE, CENSUS OF POPULATION, SUBJECT REPORT PC80-2-8B (1970) (EARNINGS BY OCCUPATION AND EDUCATION); *id.* (1980).

74. See the expressions in note 27. If the growth rate for wages, g, is in fact smaller than the interest rate used for discount, r, then use of the offset results in an overestimate of income. Conversely, if wage growth is larger than the discount rate, the offset results in an underestimate of lost earnings.

75. This more detailed approach is fully consistent with the Supreme Court's ruling in *Jones & Laughlin Steel Corp. v. Pfeifer,* which holds that courts must consider evidence regarding the relation between the rate of growth in wages and the interest rate for the particular individual involved and make a deliberate choice in determining the net discount factor. 462 U.S. 523, 532-53 (1983).