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Parameter Uncertainty in the Estimation of the Markov Model of Labor Force Activity: Known Error Rates Satisfying Daubert

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Abstract

The Bureau of Labor Statistics (BLS) introduced the increment-decrement (Markov) model of labor force activity in *Bulletin* 2135 in 1982. A subsequent BLS publication, *Bulletin* 2254, in 1986 also used the increment-decrement methodology. That work has been continued in the 1990's by James Ciecka, *et al*., and most recently in 2000. Gary Skoog and Ciecka (2001a, 2001b, 2002) have extended this approach by framing the model in terms of random variables rather than demographic constructs. The result has been that not just the mean of the years of additional labor force activity (worklife expectancy), but all statistical characteristics of this distribution have been computed and published. The relatively large probability intervals reported in this work reflect variation which is intrinsic to the model and life itself – one may become active or inactive in the labor force or die tomorrow, or in 50 years – and do not reflect sampling error. However, the primitive statistical objects in the increment-decrement model are transition and mortality probabilities, and each is subject to a small amount of sampling error. This paper provides estimates of the way this sampling error affects estimates of worklife expectancy and more generally its distribution (or equivalently its previously tabulated probability mass function).

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This paper provides estimates of the statistical sampling theory standard errors of the parameters of the probability distributions reported in Skoog and Ciecka, and shows them to be remarkably small. The tables in this paper, the first "known error rates" associated with Markov models estimated along the lines of the BLS's nonparametric approach, would satisfy one of the Daubert criteria[1] (number (3), below, arguably one of the most difficult to establish) to be considered in allowing scientific (as well as technical or other specialized knowledge-based) testimony.

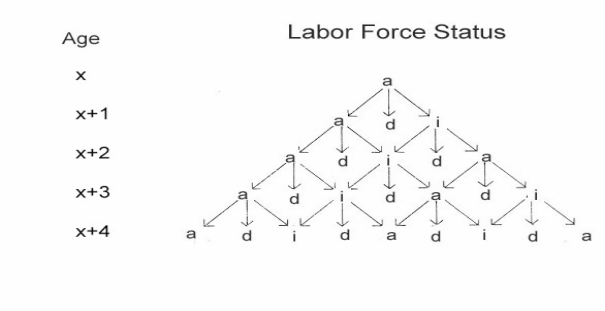
The Statistical Nature of the Problem and the Bootstrap

We refer the reader to Skoog and Ciecka (2001a) and (2002) for elaboration of labor force activity,

[1] In the important case *Daubert v. Merrell Dow Pharmaceuticals, Inc*., 509 U.S. 579 (1993) the U.S. Supreme Court listed four factors that a court should consider in determining whether scientific reasoning or methodology would pass muster under Federal Rule 702: whether it (1) can be (and has been) tested; (2) has been subjected to peer review and publication; (3) whether and what the "known or potential rate of error" is; and, (4) its general acceptance in a relevant scientific community. A fifth factor was added on remand: (5) whether the method grows "naturally and directly out of research" conducted independently of the litigation. Whether economic testimony was included, as opposed to excepted and based on "technical or specialized knowledge" was answered in the affirmative in *Kumho Tire v. Carmichael*, 526 U.S. 137 (1999) which re-iterated the usefulness of the Daubert criteria but acknowledged that some of them may be inapplicable to certain fields of expert testimony.

modeled as a random variable. To provide a brief background, we repeat an illustration (see Figure 1), similar to one in *Bulletin* 2135, used in Skoog and Ciecka (2001a) that depicts alternative paths of mortality and labor force attachment for those who are initially active in the labor force. It begins with individuals who are active at exact age *x*, and proceeds to trace all possible paths to age (*x*+4). Figure 1 illustrates the Markov model and offers a road map for calculating the probability of an initially active person spending various numbers of years in active and inactive states. The primitive statistical objects are the transition probabilities and mortality probabilities, each subject to a small amount of sampling error. Transition probabilities move us along the arrows in Figure 1 as people pass from one age to the next in the figure. Skoog (2002) and Skoog and Ciecka (2001a and 2002) have found the probability mass functions that completely capture all of the information contained in the literally thousands of trillions of paths that could occur if Figure 1 were to commence at age $x = 16$. Figure 2 shows some examples of probability mass functions for initially active men at various ages. Complete tables describing probability mass functions have been published recently by Skoog and Ciecka (2001b); these tables contain the mean (worklife expectancy) of years of activity, median, mode, standard deviation, skewness, kurtosis, and various percentile points, including 50% probability intervals which correspond to the idea of an event being more probably true than not true.

Figure 1. Triangle of Paths



a denotes active in the labor force
i denotes inactive in the labor force
d denotes the death state

Mortality probabilities (which lead to the *d* (death) state in Figure 1) do contain a miniscule amount of sampling error, so little that this source could be (but was not) ignored, as the following reasoning shows. The Decennial Census of 1990 Tables (1997), for example, records all deaths for individuals over the 3-year interval of 1989-1991 for the U.S. population. Consider males age 40, who have a probability of dying of 0.0027 with a reported standard error of 0.000024. The effective sample size per standard Bernoulli distribution calculations is 4.6 million.[2] We have experimented with acting as if the number in these sample sizes were only 10,000 in our statistical work in this paper, and the differences between this upper bound to estimation uncertainty and assuming that the probability is known with certainty (having infinitely many observations) represents a range which surely includes the actual samples entering into the decennial and annual U.S. Life Tables (2002). The results are indistinguishable: mortality sampling error is negligible.

The only potentially interesting sampling variability therefore comes from the Current Population Survey (CPS) based transition probabilities. Researchers match individuals who have a particular age, sex and educational background across two samples when subjects report being age *x* and the next year when they report being age *x*+1. Of those individuals who are active (*a*) at age *x*, the fraction who remain active and the fraction who become inactive (*i*) are recorded, thus yielding transition probabilities between *a* and *a* and between *a* and *i*. In a similar manner we compute the *i* to *a* and *i* to *i* transition probabilities by starting with a sample of inactive individuals at age *x* and observing the fraction switching to active and the fraction remaining inactive. However, the sampling distribution of complex functions of these parameters, like worklife expectancy, is analytically intractable because of statistical dependence among the estimated transition probabilities involved in the construction of worklife expectancy. Furthermore, the number of terms involved in a direct (as opposed to a recursive) calculation of worklife expectancy, while finite, exceeds computing capacity for young ages *x*. In situations such as these, bootstrap methods of sample re-use, originally proposed by Effron (1979, 1982, and 1993), are successful in revealing the statistical properties of estimators. The basic idea is to choose a number of bootstrap samples; and, from each bootstrap sample, one generates a value or replication for any desired estimator reflecting the size of real world (*e.g.*, CPS) samples. The mean and standard error of a large number of replications are then computed. We certainly expect the mean of the bootstrap replications generally to be very close to the published point estimate of any parameter, and we would increase the number of replications - or check our programming - if this were not found to be the case.[3] We

[2] Let Y denote a Bernoulli random variable; its probability mass function is $f(Y) = \pi^Y (1-\pi)^{Y-1}$ where Y takes on the values 1 and 0 with probability π and $1-\pi$, respectively. The expected value and variance of Y are $E(Y) = 1(\pi) + 0(1-\pi) = \pi$ and $V(Y) = (1-\pi)^2\pi + (0-\pi)^2(1-\pi) = \pi(1-\pi)$. The standard deviation of the sample mean (from a sample of size n) calculated from a Bernoulli distribution is $SD(\bar{Y}) = \sqrt{\pi(1-\pi)/n}$. Letting $\pi = 0.0027$ and noting the reported standard error of 0.000024, we have $0.000024 = \sqrt{0.0027(1-0.0027)/n}$, which implies n = 4.6 million.

[3] In most cases the bootstrap means of parameters are exactly as previously published (or within a few hundredths of a year) although previously published values were calculated from the point estimate of the probability mass function at each age. There are exceptions at ages and years of activity when parameters are equal, or close, to their limiting values and when probability masses are approximately equal at very different years of activity. For example, we have previously reported a mode of 16 at age 43 and a mode of zero at age 44 for inactive men, regardless of education (Skoog and Ciecka, 2001b, Table 7). Probability mass at age 43 is only slightly bigger at 16 years of activity than the mass at zero years; and, conversely, the mass is a bit larger at zero than at 15 years of activity at age 44. Bootstrap perturbed transition probabilities may easily alter probability mass values enough to flip the mode to zero at age 43 and the mode to 15 at age 44. We, therefore, would expect the bootstrap mode to be less than 16 at age 43 and be greater than zero at age 44. This is exactly what we observe: the bootstrap estimate of the average mode is 10.90 for age 43 and 4.53 for age 44. This same circumstance also causes the bootstrap standard deviation to be large.

thus can estimate the variance, its square root (the standard error), and other measures of the sampling distribution of any characteristic of probability mass functions we have published.[4] We report here bootstrap standard errors, both an end in itself (per Daubert) and perhaps as an invitation to use the normal distribution. These same replications, however, may be employed to compute bootstrap confidence intervals, by a variety of methods, freeing one of the normality approximation. By whatever confidence interval method is selected, the sizes of these intervals are quite small.

The tables in this paper represent the first results for the BLS's Markov model, which is nonparametric in age. By this, we mean that transition probabilities for various ages x do not depend on a small number of econometric parameters, and do not follow a parsimonious functional form, as would be the case if these probabilities followed a logistic distribution function fixed by a set of coefficients. This latter approach has been employed in Millimet, *et al.* (2002); but they did not report their regressors, their point estimates, or their standard errors, nor did they specify how they did their bootstrap estimation. They did, however, report estimated standard errors for their worklife expectancy estimates for both initial actives and inactives for their parametric model.

Had replications been calculated from (non-bootstrap) samples generated by the *true* transition probabilities, this paper would be a standard Monte Carlo study of an estimator. Since we do not have these true parameters, we need to "pull ourselves up by the bootstraps" and use the estimated transition probabilities instead. As long as our estimation is nonparametric, the variation introduced into the bootstrap replications because the estimated transition probabilities deviate from the true probabilities may be ignored. Conditions under which this dependence is appropriately weak may be found in the voluminous bootstrap literature produced over the past 24 years, much of which is cited in the Effron books listed here.

Standard statistical treatments of the bootstrap, or statistical theory generally, treats the data recorded by its gatherers and publishers at face value. With survey data, incomplete observations may be imputed or allocated – assigned reasonable values. The bootstrap can handle this procedure, if it is important, by generating data in the bootstrap sample by the implementation procedure actually used (Shao and Sitter, 1996). With large datasets like the CPS, this would be extremely time consuming. The "hot deck" method of allocating missing income values is important, since on the order of 17,000 out of 130,000 observations did not report income (David *et al*, 1986). However, in the 2003 March supplement (now the Annual Social and Economics Supplement) only about 0.25% of the observations are allocated regarding labor force status; so imputation for transition probabilities is not a problem.[5]

Here is an example of how the bootstrap works. Suppose we take a random sample of size $n = 10$ of the ages of current NAFE members. Assume that this hypothetical sample consists of the ages (32, 45, 52, 28, 65, 53, 59, 41, 56, 49), which has a mean $\bar{x} = 48.0$ and a standard deviation of $s = 11.69$. From statistical sampling theory, we know that the estimated standard deviation[6] of the sample mean is $s/\sqrt{n} = 11.69/\sqrt{10} = 3.70$. Although it is unnecessary to apply the bootstrap to this problem because sampling theory tells us how to compute the standard deviation of the sample mean, it is instructive to see how the bootstrap would approximate this answer. Bootstrap random samples, with replacement, of size 10 are drawn from our sample of ten ages. Since replacement is required when drawing a bootstrap sample, any particular age might appear more than once[7], or not at all, in a bootstrap sample. Compute the mean, called a replicate, of the bootstrap sample. Repeat the process, always drawing samples of size 10, with replacement, from the original sample delineated above. Finally, compute the standard deviation of the bootstrap replicates in the usual manner. The entire process can quickly be done with a small computer for a large number of bootstrap replications. For example, we generated 2,500 replicates, which compute instantly from a user's point of view, with the following results: the bootstrap estimate of the mean is 47.94, and the bootstrap estimate of the standard deviation of the sample mean is 3.64 – both of which are very close to the true values of 48.0 and 3.70, respectively. Figure 3 is the histogram of the bootstrap sample means.

The bootstrapping process used in this paper is more complicated in its details but is essentially the same as in the NAFE age example. We start with our estimates of transition and mortality probabilities and the sample sizes from which they were generated (using a sample size of 10,000 for mortality).[8] We generate a bootstrap sample of transition probabilities for each age of the same size as our CPS samples and a bootstrap sample of mortality probabilities (for each age). We compute replicates of transition and mortality probabilities for each age and use these replicates to compute the probability mass functions for actives and inactives. We then compute ten measures: the mean, median, mode, standard deviation, coefficient of skewness, coefficient of kurtosis, and the 10^{th}, 25^{th}, 75^{th}, and 90^{th} percentile points. This constitutes one complete bootstrap replication. We repeat the foregoing procedure numerous times; 2,500 replications were used in this paper although sizes of only 100 or 200 are commonly reported in the statistical literature. Finally, we compute the sample or estimated mean and

[4] Here we refer to all univarate statistics: mean, median, mode, standard deviation, skewness, kurtosis, and the 10^{th}, 25^{th}, 75^{th}, and 90^{th} percentile points. Users of our tables may make a 50 percent probability interval out of two of these, the 25^{th} and 75^{th} percentiles, respectively. We looked at the correlation between two distinct univariate parameters, such as the lower and upper endpoints for the inter-quartile range. The shortest 50 percent probability interval, since it involves two characteristics of the probability mass function simultaneously, suggests that such bivariate distributions be studied; but we have not undertaken that study here.

[5] We thank NAFE researchers Boyd Fjeldsted and Frank Hachman (personal communication) for determining the 0.25% figure for allocated labor force status.

[6] This is sometimes called the estimated standard error, and sometimes just the standard error, implying that it is estimated.

[7] In fact, the chance of no repeated value in this example in one replication is $10!/(10^{10})$ or 0.0363%.

[8] A more realistic sample size for mortality would be much larger than 10,000. Had we selected a larger sample size, the reported standard errors would be practically the same as we report in this paper but would be imperceptibly smaller.

sample standard deviation of each of the ten aforementioned statistical measures. These are the means and standard deviations reported in Tables 1, 4, 7, and 10 for initially active and inactive men and for initially active and inactive women, respectively. As an example, Figure 4 shows two histograms generated from the 2,500 replications of worklife expectancy for initially active men ages 20 and 65, respectively. These histograms represent the underlying data that enter into the calculations of the mean and standard deviation in Table 1 for ages 20 and 65. One might also notice the symmetric looking appearance of these histograms even though the corresponding probability mass functions in Figure 2 are not as symmetric, especially at age 65. In fact, Table 3 suggests that the distribution of worklife expectancy is not only symmetric but also approximately normal (*i.e*., approximately zero skewness and kurtosis of approximately 3.0). Additional tables (2, 5, 8, and 11) contain correlation coefficients between various parameters; and Tables 3, 6, 9, and 12 show the mean, standard deviation, skewness, and kurtosis of the sampling distribution of worklife expectancy. As mentioned, these tables suggest that the sampling distributions of worklife expectancy are approximately normal for active and inactive men and women and have quite small standard deviations.

Conclusions and Results: Bootstrap Standard Errors for the Markov Model

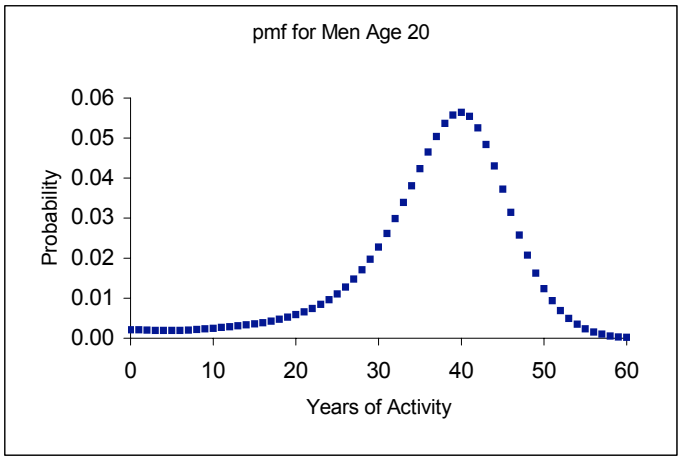
This paper offers the first discussion of sampling properties for probability mass functions which contain, as one parameter among many, worklife expectancy. The tables below provide estimates of the standard errors corresponding to ten of the twelve statistics characterizing the probability mass function for additional years of labor force activity reported in Tables 1, 7, 13, and 19 (tables for initially active and inactive men and women regardless of education) of Skoog and Ciecka (2001b). Standard errors for all of the parameters (previously published (Skoog and Ciecka, 2001b)) of our probability mass functions, with the exception of the shortest 50% confidence interval, have been provided here, using bootstrap estimation techniques. The standard errors caused by the finite sample size of the Current Population Survey are very minor: as an example, Table 1 for initially active men shows standard errors of approximately 0.2 years for the mean, median, and the 25th and 75th percentile points; about 0.1 year or less for the standard deviation, skewness, and kurtosis; and about 0.3 years for the 10th and 90th percentile points. The more significant variation in years of additional labor force activity is due to intrinsic variability in the nature of the outcomes themselves. For example, the standard deviation intrinsic to labor force activity itself, assuming that transition and mortality probabilities are known with certainty, for a 30-year-old active male is 8.19 years (Skoog and Ciecka, 2001b), whereas the sampling standard error for the mean is only 0.20 years (see Table 1). Thus, variation intrinsic to labor face activity itself is a more important issue, by at least an order of magnitude, than sample variation.

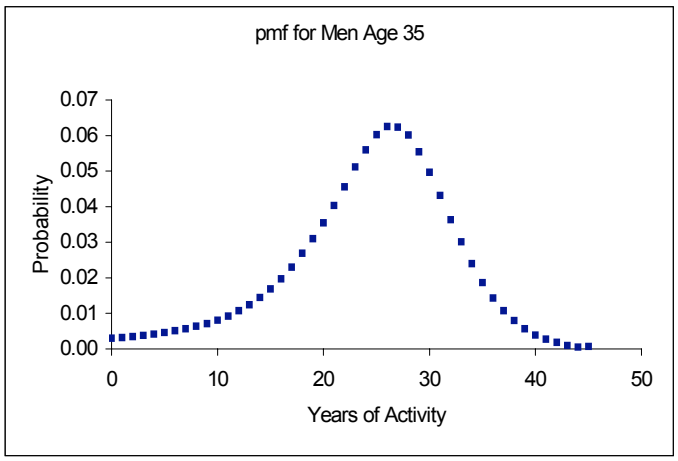
Table 2 contains bootstrap correlation coefficients between some of the properties of the probability mass function for initially active men. The correlation between the mean and the median is approximately 0.9 or larger, the correlation coefficient usually is between 0.5 and 0.7 for the 25th and 75th percentile points, and there is small (in absolute value) negative correlation between the mean and standard deviation at young ages and progressively larger positive correlation at later ages especially for initial inactives. In Table 3 we repeat the bootstrap means and standard deviations of worklife expectancy contained in Table 1 and additionally show the bootstrap skewness and kurtosis of the mean. How might one use these results? In particular, what is the confidence interval that might be constructed for worklife expectancy? The last two columns in Table 3, the bootstrap estimates of skewness and kurtosis of worklife expectancy, help us answer these questions. Skewness usually is positive but close to zero; and kurtosis is approximately 3.0, indicating approximate normality of the bootstrap replications of worklife expectancy. As an example, consider a 30-year-old active male. Tables 1 and 3 show a bootstrap worklife expectancy of 29.35 years and a standard deviation of 0.20 years.[9] Since the bootstrap replications of worklife expectancy are approximately normal, we can say that the probability is 95% that the true worklife expectancy falls within the interval $29.35 \pm 2(.20)$, or 28.95 years on the low side and 29.75 years on the high side.

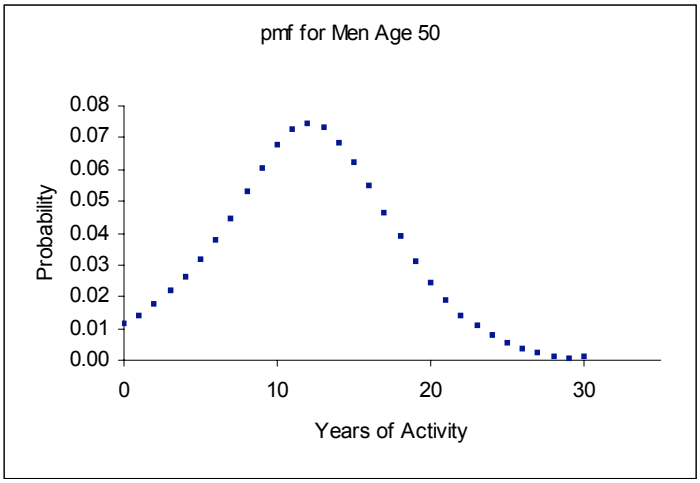
The foregoing description and interpretation of the tables referred to active men – Tables 1, 2, and 3 in this paper. Similar comments could be made about initially inactive men (Tables 3-6), active women (Tables 7-9), and initially inactive women (Tables 10-12). Most importantly, standard deviations are small for most parameters and the sampling distribution is approximately normal for worklife expectancy for all groups.

[9] Skoog and Ciecka (2001b) report exactly the same worklife expectancy for 30-year-old active males when sampling error is ignored, but there may be small differences between bootstrap generated means and parameter values previously reported as noted in footnote 3.

Figure 2. Probability Mass Functions for Initially Active Men at Various Ages







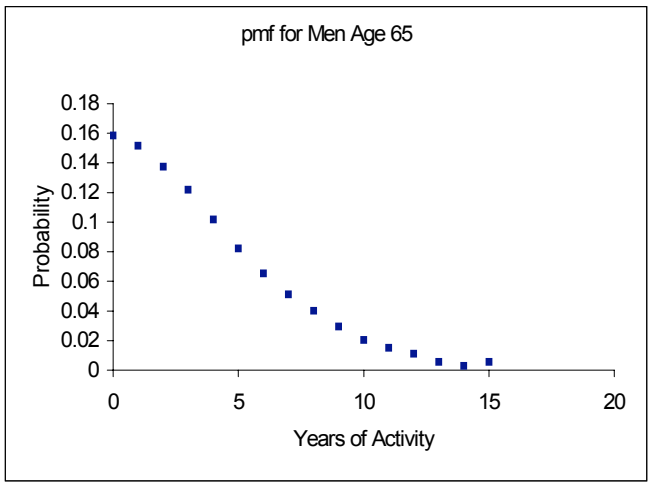


Figure 3. Bootstrap Histogram of Hypothetical NAFE Age Example

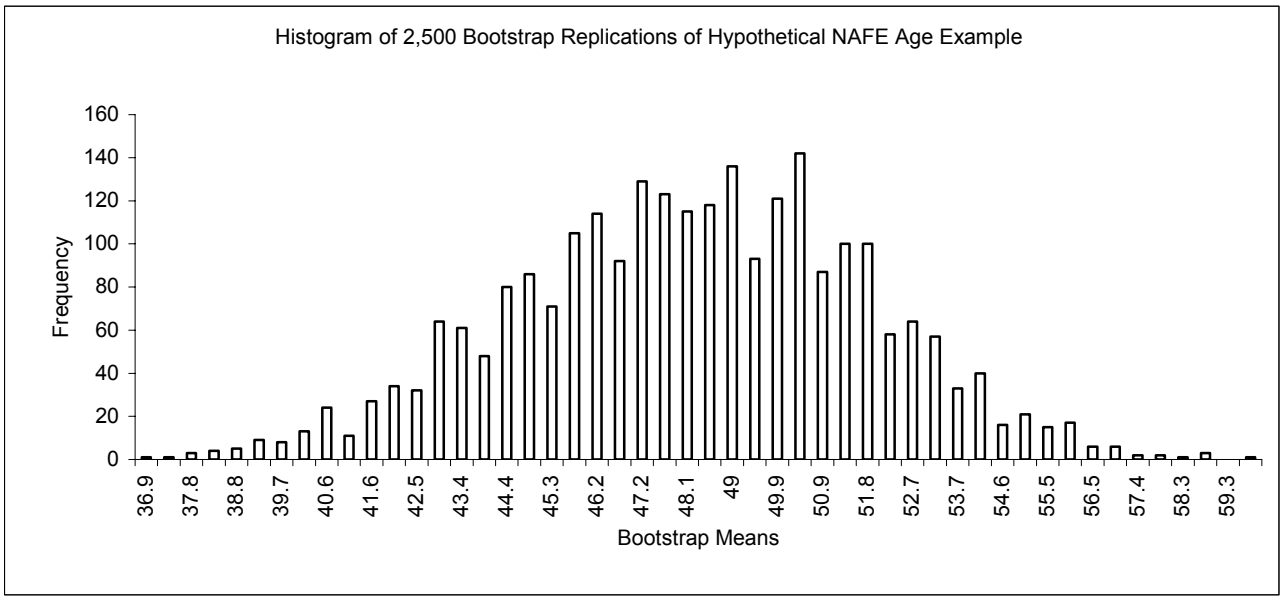
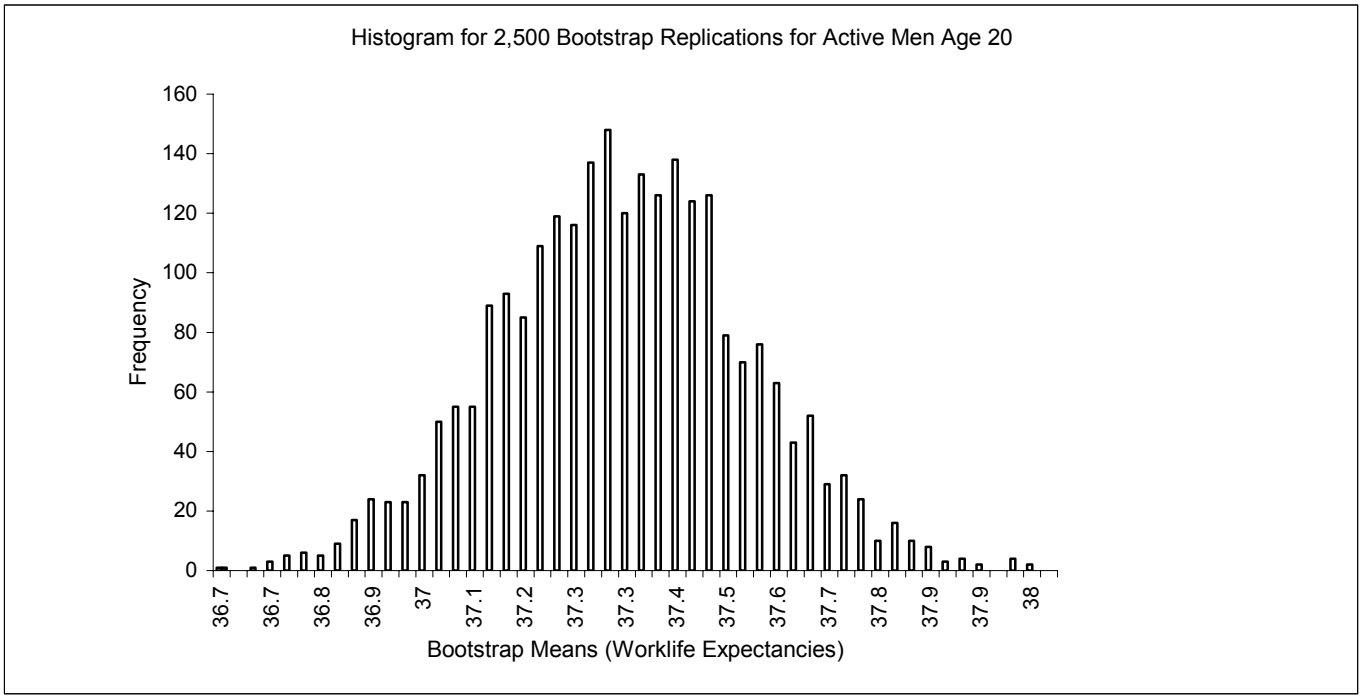


Figure 4. Bootstrap Histograms for Initially Active Men Ages 20 and 65



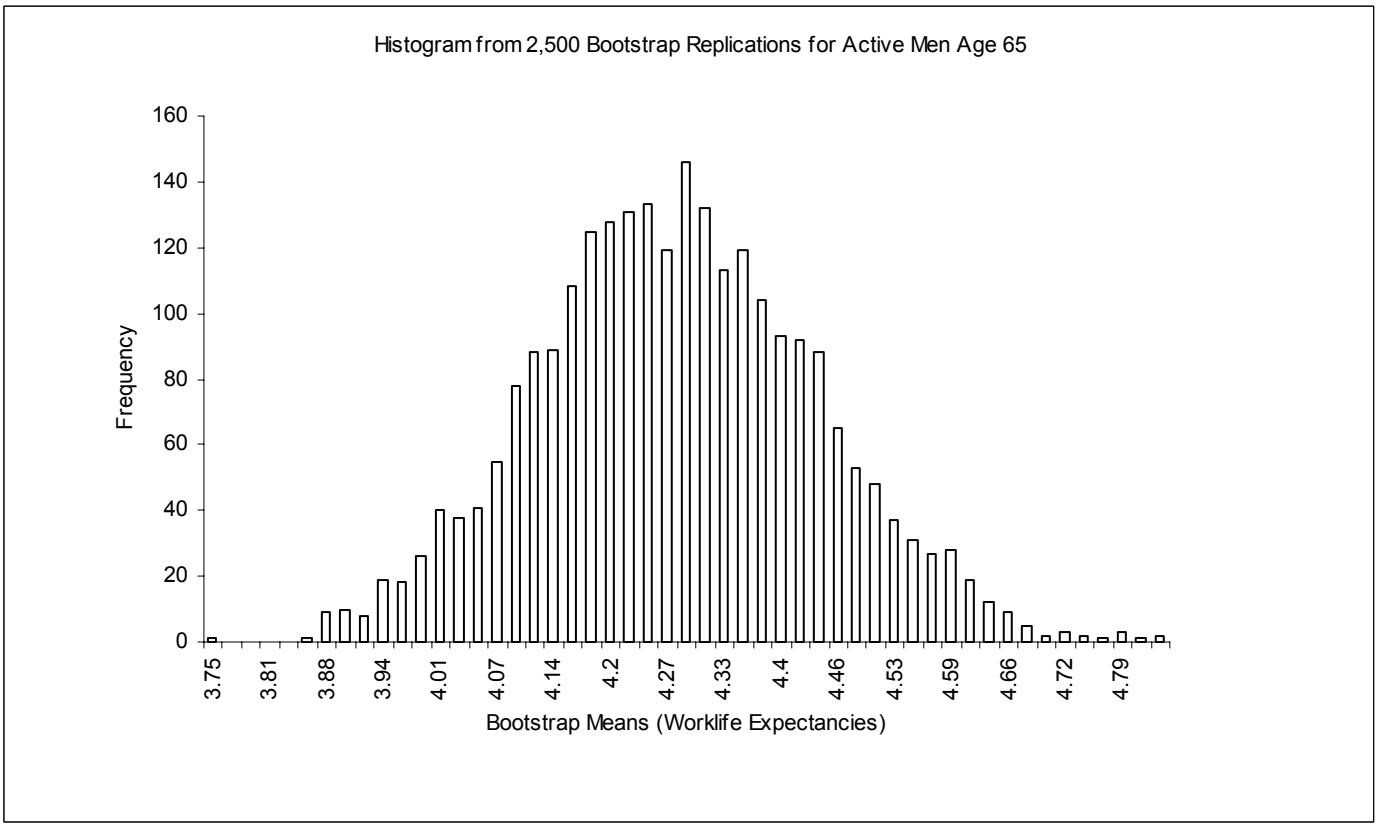


Table 1. Bootstrap Estimates of the Mean and Standard Deviation of Years of Activity Measures for Initially Active Men, Regardless of Education

Age	Bootstrap Mean of WLE	Bootstrap SD of WLE	Bootstrap Mean of Median	Bootstrap SD of Median	Bootstrap Mean of Mode	Bootstrap SD of Mode
16	39.47	0.22	40.58	0.23	42.70	0.42
17	39.01	0.22	40.10	0.23	42.30	0.45
18	38.50	0.22	39.57	0.22	41.77	0.52
19	37.95	0.22	38.99	0.22	41.18	0.55
20	37.28	0.21	38.29	0.22	40.45	0.58
21	36.63	0.21	37.60	0.22	39.74	0.61
22	35.94	0.21	36.87	0.21	38.97	0.66
23	35.20	0.21	36.10	0.21	38.15	0.70
24	34.42	0.21	35.28	0.21	37.29	0.73
25	33.62	0.21	34.44	0.21	36.42	0.76
26	32.79	0.20	33.57	0.21	35.52	0.78
27	31.95	0.20	32.69	0.21	34.59	0.80
28	31.09	0.20	31.79	0.20	33.67	0.82
29	30.22	0.20	30.88	0.20	32.72	0.84
30	29.35	0.20	29.97	0.20	31.77	0.84
31	28.48	0.20	29.05	0.20	30.82	0.85
32	27.61	0.19	28.14	0.20	29.88	0.86
33	26.75	0.19	27.23	0.20	28.92	0.87
34	25.89	0.19	26.32	0.20	27.97	0.87
35	25.03	0.19	25.41	0.20	27.03	0.88
36	24.17	0.19	24.50	0.20	26.07	0.88
37	23.32	0.19	23.59	0.19	25.11	0.88
38	22.47	0.19	22.68	0.19	24.15	0.89
39	21.62	0.19	21.78	0.19	23.18	0.89
40	20.77	0.19	20.87	0.19	22.22	0.90
41	19.94	0.18	19.98	0.19	21.26	0.90
42	19.11	0.18	19.09	0.19	20.30	0.90
43	18.29	0.18	18.20	0.19	19.34	0.90
44	17.46	0.18	17.31	0.19	18.37	0.90
45	16.64	0.18	16.43	0.19	17.41	0.90
46	15.82	0.18	15.54	0.19	16.45	0.90
47	15.01	0.18	14.67	0.19	15.50	0.90
48	14.21	0.17	13.80	0.19	14.54	0.91
49	13.41	0.17	12.94	0.18	13.59	0.91
50	12.63	0.17	12.09	0.18	12.64	0.92
51	11.86	0.17	11.25	0.18	11.70	0.92
52	11.10	0.17	10.43	0.18	10.75	0.92
53	10.37	0.16	9.63	0.18	9.81	0.92
54	9.66	0.16	8.85	0.18	8.88	0.93
55	8.97	0.16	8.09	0.18	7.97	0.93
56	8.30	0.16	7.36	0.17	7.06	0.94
57	7.65	0.15	6.65	0.17	6.17	0.94
58	7.04	0.15	5.99	0.17	5.31	0.94
59	6.48	0.15	5.38	0.17	4.48	0.94
60	5.97	0.15	4.82	0.18	3.68	0.95
61	5.51	0.15	4.34	0.17	2.95	0.96
62	5.12	0.15	3.92	0.18	2.29	0.97
63	4.77	0.15	3.55	0.18	1.73	0.95
64	4.47	0.16	3.26	0.18	1.38	0.84
65	4.20	0.16	2.99	0.18	1.14	0.74
66	3.96	0.16	2.74	0.20	1.01	0.68
67	3.74	0.16	2.53	0.19	0.90	0.57
68	3.53	0.17	2.35	0.20	0.74	0.46
69	3.36	0.17	2.23	0.20	0.72	0.46
70	3.19	0.17	2.10	0.21	0.76	0.49
71	3.01	0.17	1.94	0.21	0.75	0.50
72	2.81	0.18	1.76	0.23	0.78	0.50
73	2.62	0.19	1.60	0.24	0.70	0.43
74	2.44	0.18	1.52	0.23	0.65	0.40
75	2.26	0.17	1.39	0.21	0.81	0.54

Table 1. Bootstrap Estimates of the Mean and Standard Deviation of Years of Activity Measures for Initially Active Men, Regardless of Education (Continued)

Age	Bootstrap Mean of SD	Bootstrap SD of SD	Bootstrap Mean of Skewness	Bootstrap SD of Skewness	Bootstrap Mean of Kurtosis	Bootstrap SD of Kurtosis
16	9.87	0.12	-1.21	0.04	5.22	0.14
17	9.77	0.12	-1.20	0.04	5.18	0.14
18	9.64	0.12	-1.18	0.04	5.13	0.14
19	9.51	0.12	-1.16	0.04	5.07	0.14
20	9.39	0.12	-1.14	0.04	4.99	0.14
21	9.25	0.12	-1.11	0.04	4.91	0.14
22	9.12	0.11	-1.08	0.04	4.82	0.13
23	8.99	0.11	-1.05	0.04	4.72	0.13
24	8.86	0.11	-1.02	0.04	4.61	0.13
25	8.74	0.11	-0.98	0.04	4.51	0.12
26	8.63	0.11	-0.95	0.04	4.40	0.12
27	8.52	0.11	-0.92	0.04	4.30	0.12
28	8.41	0.11	-0.88	0.04	4.21	0.11
29	8.30	0.11	-0.85	0.04	4.11	0.11
30	8.19	0.10	-0.81	0.04	4.02	0.10
31	8.08	0.10	-0.78	0.04	3.92	0.10
32	7.96	0.10	-0.74	0.04	3.83	0.10
33	7.84	0.10	-0.70	0.04	3.74	0.09
34	7.72	0.10	-0.66	0.04	3.65	0.09
35	7.59	0.10	-0.62	0.04	3.57	0.08
36	7.46	0.10	-0.58	0.04	3.49	0.08
37	7.33	0.10	-0.54	0.04	3.41	0.08
38	7.20	0.10	-0.49	0.04	3.34	0.07
39	7.07	0.10	-0.45	0.04	3.27	0.07
40	6.94	0.10	-0.40	0.04	3.20	0.07
41	6.80	0.09	-0.36	0.04	3.14	0.06
42	6.66	0.09	-0.31	0.04	3.08	0.06
43	6.52	0.09	-0.26	0.04	3.03	0.06
44	6.38	0.09	-0.20	0.04	2.98	0.06
45	6.24	0.09	-0.15	0.04	2.94	0.06
46	6.10	0.09	-0.10	0.04	2.90	0.05
47	5.96	0.09	-0.04	0.04	2.87	0.05
48	5.81	0.09	0.01	0.04	2.85	0.06
49	5.67	0.09	0.07	0.04	2.83	0.06
50	5.52	0.09	0.13	0.04	2.83	0.06
51	5.38	0.09	0.19	0.04	2.83	0.06
52	5.23	0.09	0.26	0.04	2.84	0.07
53	5.07	0.09	0.32	0.04	2.87	0.07
54	4.91	0.09	0.39	0.04	2.91	0.08
55	4.75	0.09	0.46	0.04	2.96	0.09
56	4.59	0.09	0.53	0.04	3.02	0.09
57	4.44	0.09	0.60	0.04	3.09	0.10
58	4.28	0.09	0.67	0.05	3.17	0.11
59	4.12	0.09	0.74	0.05	3.26	0.13
60	3.97	0.09	0.80	0.05	3.35	0.14
61	3.81	0.10	0.86	0.05	3.45	0.16
62	3.66	0.10	0.91	0.06	3.54	0.18
63	3.51	0.10	0.96	0.06	3.62	0.19
64	3.36	0.10	0.99	0.07	3.69	0.22
65	3.22	0.10	1.02	0.07	3.75	0.24
66	3.08	0.10	1.04	0.08	3.78	0.27
67	2.94	0.11	1.06	0.09	3.80	0.30
68	2.81	0.11	1.06	0.09	3.79	0.33
69	2.67	0.11	1.06	0.10	3.78	0.36
70	2.52	0.11	1.05	0.11	3.79	0.41
71	2.37	0.11	1.06	0.13	3.81	0.46
72	2.21	0.12	1.07	0.15	3.84	0.51
73	2.06	0.12	1.07	0.16	3.90	0.57
74	1.90	0.12	1.08	0.18	4.01	0.62
75	1.73	0.14	1.14	0.20	4.26	0.68

Table 1. Bootstrap Estimates of the Mean and Standard Deviation of Years of Activity Measures for Initially Active Men, Regardless of Education (Continued)

Age	Bootstrap Mean of 25th%	Bootstrap SD of 25th Percentile	Bootstrap Mean of 75th%	Bootstrap SD of 75th Percentile	Bootstrap Mean of 10th%	Bootstrap SD of 10th% Percentile	Bootstrap Mean of 90th%	Bootstrap SD of 90th Percentile
16	34.67	0.27	45.37	0.22	26.80	0.36	49.41	0.25
17	34.22	0.28	44.84	0.22	26.43	0.37	48.85	0.25
18	33.74	0.27	44.26	0.21	26.03	0.37	48.23	0.24
19	33.22	0.28	43.63	0.22	25.60	0.36	47.57	0.25
20	32.56	0.27	42.89	0.21	25.03	0.36	46.80	0.25
21	31.93	0.27	42.16	0.21	24.50	0.36	46.05	0.25
22	31.25	0.27	41.38	0.21	23.91	0.35	45.25	0.24
23	30.52	0.27	40.57	0.21	23.28	0.35	44.42	0.24
24	29.75	0.26	39.72	0.21	22.61	0.34	43.55	0.25
25	28.95	0.26	38.85	0.21	21.90	0.34	42.67	0.25
26	28.13	0.26	37.96	0.21	21.17	0.34	41.77	0.25
27	27.29	0.26	37.06	0.21	20.42	0.34	40.85	0.25
28	26.43	0.26	36.13	0.21	19.65	0.33	39.92	0.25
29	25.56	0.25	35.20	0.21	18.88	0.33	38.98	0.25
30	24.69	0.25	34.27	0.21	18.11	0.32	38.04	0.25
31	23.82	0.25	33.33	0.21	17.35	0.32	37.09	0.24
32	22.95	0.25	32.40	0.21	16.60	0.31	36.15	0.24
33	22.10	0.25	31.46	0.21	15.85	0.31	35.20	0.24
34	21.25	0.25	30.52	0.21	15.13	0.30	34.25	0.24
35	20.40	0.24	29.59	0.21	14.41	0.30	33.31	0.24
36	19.55	0.24	28.65	0.21	13.69	0.29	32.36	0.24
37	18.71	0.24	27.72	0.21	12.99	0.29	31.41	0.25
38	17.87	0.23	26.79	0.21	12.29	0.29	30.46	0.25
39	17.03	0.24	25.85	0.21	11.60	0.28	29.52	0.25
40	16.21	0.24	24.92	0.21	10.93	0.27	28.57	0.25
41	15.40	0.23	24.00	0.21	10.27	0.27	27.63	0.26
42	14.59	0.22	23.07	0.21	9.63	0.26	26.70	0.26
43	13.80	0.22	22.15	0.21	9.00	0.25	25.76	0.26
44	13.00	0.22	21.23	0.21	8.37	0.25	24.83	0.26
45	12.20	0.22	20.31	0.21	7.74	0.23	23.89	0.26
46	11.41	0.21	19.39	0.21	7.11	0.23	22.96	0.26
47	10.63	0.20	18.48	0.21	6.51	0.22	22.03	0.26
48	9.86	0.20	17.57	0.21	5.91	0.21	21.11	0.25
49	9.10	0.20	16.68	0.22	5.35	0.21	20.19	0.25
50	8.36	0.19	15.79	0.22	4.79	0.19	19.28	0.25
51	7.63	0.18	14.91	0.22	4.26	0.19	18.37	0.26
52	6.93	0.18	14.04	0.21	3.76	0.17	17.48	0.26
53	6.25	0.18	13.18	0.21	3.29	0.18	16.59	0.27
54	5.60	0.17	12.34	0.21	2.85	0.15	15.73	0.27
55	4.96	0.16	11.52	0.22	2.45	0.15	14.88	0.27
56	4.37	0.16	10.73	0.22	2.04	0.14	14.05	0.27
57	3.79	0.15	9.96	0.22	1.67	0.12	13.24	0.26
58	3.26	0.15	9.22	0.21	1.34	0.12	12.46	0.27
59	2.78	0.14	8.52	0.22	1.04	0.11	11.73	0.28
60	2.37	0.13	7.89	0.22	0.79	0.09	11.03	0.28
61	2.01	0.13	7.30	0.21	0.60	0.08	10.39	0.28
62	1.72	0.13	6.78	0.23	0.51	0.03	9.81	0.29
63	1.49	0.13	6.31	0.23	0.50	0.01	9.28	0.29
64	1.30	0.13	5.91	0.25	0.50	0.00	8.79	0.30
65	1.15	0.13	5.55	0.25	0.50	0.00	8.33	0.30
66	1.02	0.13	5.22	0.25	0.50	0.00	7.90	0.32
67	0.90	0.13	4.93	0.26	0.50	0.00	7.49	0.33
68	0.78	0.13	4.64	0.27	0.50	0.00	7.12	0.35
69	0.72	0.14	4.39	0.27	0.50	0.00	6.77	0.35
70	0.67	0.13	4.13	0.28	0.50	0.00	6.39	0.33
71	0.62	0.11	3.87	0.31	0.50	0.00	5.97	0.32
72	0.58	0.10	3.63	0.30	0.50	0.00	5.50	0.31
73	0.54	0.08	3.36	0.29	0.50	0.00	5.06	0.33
74	0.52	0.06	3.06	0.26	0.50	0.00	4.63	0.34
75	0.52	0.05	2.71	0.27	0.50	0.00	4.23	0.35

Table 2. Bootstrap Estimates of Correlation Coefficients of Years of Activity Measures for Initially Active Men, Regardless of Education

Age	Correlation Coefficient Mean and Median	Correlation Coefficient Mean and Mode	Correlation Coefficient Median and Mode	Correlation Coefficient Mean and SD	Correlation Coefficient 25th and 75th Percentiles	Correlation Coefficient 10th and 90th Percentiles
16	0.96	0.42	0.51	-0.10	0.72	0.32
17	0.96	0.37	0.46	-0.10	0.72	0.33
18	0.95	0.31	0.39	-0.10	0.71	0.32
19	0.95	0.29	0.35	-0.09	0.70	0.31
20	0.95	0.25	0.32	-0.09	0.69	0.30
21	0.95	0.21	0.28	-0.09	0.69	0.30
22	0.95	0.17	0.24	-0.08	0.68	0.30
23	0.95	0.17	0.22	-0.07	0.67	0.29
24	0.95	0.17	0.23	-0.07	0.66	0.29
25	0.94	0.18	0.24	-0.06	0.66	0.29
26	0.94	0.16	0.23	-0.05	0.65	0.29
27	0.94	0.17	0.23	-0.05	0.65	0.28
28	0.94	0.17	0.23	-0.03	0.65	0.28
29	0.94	0.17	0.24	-0.02	0.64	0.28
30	0.94	0.18	0.25	-0.01	0.64	0.28
31	0.94	0.17	0.24	0.00	0.63	0.28
32	0.94	0.16	0.24	0.01	0.63	0.27
33	0.94	0.16	0.24	0.03	0.63	0.27
34	0.93	0.17	0.25	0.04	0.62	0.27
35	0.93	0.16	0.25	0.05	0.62	0.27
36	0.93	0.16	0.25	0.06	0.63	0.28
37	0.93	0.16	0.25	0.07	0.63	0.28
38	0.93	0.15	0.25	0.08	0.63	0.28
39	0.93	0.15	0.26	0.09	0.63	0.29
40	0.93	0.15	0.26	0.11	0.63	0.29
41	0.93	0.14	0.25	0.13	0.63	0.29
42	0.93	0.15	0.27	0.15	0.63	0.29
43	0.93	0.14	0.27	0.17	0.63	0.30
44	0.93	0.14	0.27	0.19	0.63	0.31
45	0.93	0.15	0.29	0.21	0.63	0.31
46	0.93	0.14	0.28	0.24	0.63	0.31
47	0.93	0.13	0.28	0.26	0.62	0.31
48	0.93	0.14	0.29	0.29	0.62	0.30
49	0.93	0.15	0.31	0.33	0.62	0.31
50	0.93	0.16	0.32	0.36	0.62	0.32
51	0.93	0.16	0.33	0.39	0.62	0.32
52	0.92	0.15	0.32	0.42	0.62	0.33
53	0.92	0.15	0.31	0.43	0.62	0.32
54	0.93	0.15	0.30	0.46	0.61	0.32
55	0.93	0.17	0.31	0.48	0.61	0.32
56	0.92	0.15	0.28	0.51	0.59	0.32
57	0.91	0.14	0.25	0.54	0.59	0.30
58	0.92	0.16	0.25	0.57	0.57	0.29
59	0.91	0.15	0.21	0.58	0.56	0.28
60	0.91	0.16	0.19	0.61	0.54	0.24
61	0.90	0.19	0.19	0.64	0.54	0.24
62	0.91	0.21	0.18	0.64	0.53	0.15
63	0.90	0.23	0.18	0.64	0.53	0.07
64	0.90	0.25	0.20	0.65	0.54	0.01
65	0.91	0.22	0.17	0.65	0.54	0.01
66	0.90	0.24	0.18	0.66	0.55	0.07
67	0.89	0.15	0.10	0.67	0.53	
68	0.90	0.17	0.12	0.67	0.53	
69	0.90	0.15	0.11	0.66	0.50	
70	0.89	0.22	0.17	0.65	0.50	
71	0.89	0.19	0.14	0.67	0.46	
72	0.90	0.22	0.16	0.63	0.43	
73	0.91	0.25	0.21	0.62	0.40	
74	0.90	0.25	0.23	0.61	0.36	
75	0.88	0.31	0.33	0.63	0.37	

Table 3. Bootstrap Estimates of the Mean, Standard Deviation, Skewness, and Kurtosis of the Mean of Years of Activity for Initially Active Men, Regardless of Education

Age	Bootstrap Mean of WLE	Bootstrap SD of WLE	Bootstrap Skewness of WLE	Bootstrap Kurtosis of WLE
16	39.47	0.22	-0.04	2.99
17	39.01	0.22	-0.03	2.97
18	38.50	0.22	0.00	2.96
19	37.95	0.22	0.00	2.94
20	37.28	0.21	0.01	2.93
21	36.63	0.21	0.01	2.92
22	35.94	0.21	0.02	2.93
23	35.20	0.21	0.00	2.94
24	34.42	0.21	0.00	2.94
25	33.62	0.21	0.00	2.95
26	32.79	0.20	0.01	2.97
27	31.95	0.20	0.01	2.98
28	31.09	0.20	0.03	3.00
29	30.22	0.20	0.03	2.97
30	29.35	0.20	0.03	2.98
31	28.48	0.20	0.02	2.93
32	27.61	0.19	0.00	2.93
33	26.75	0.19	0.00	2.94
34	25.89	0.19	0.00	2.96
35	25.03	0.19	0.00	2.94
36	24.17	0.19	-0.01	2.95
37	23.32	0.19	-0.02	2.98
38	22.47	0.19	-0.02	2.98
39	21.62	0.19	-0.01	2.98
40	20.77	0.19	0.00	2.96
41	19.94	0.18	0.00	2.95
42	19.11	0.18	0.00	2.96
43	18.29	0.18	0.01	2.93
44	17.46	0.18	0.02	2.94
45	16.64	0.18	0.03	2.98
46	15.82	0.18	0.04	3.02
47	15.01	0.18	0.03	3.03
48	14.21	0.17	0.05	3.00
49	13.41	0.17	0.05	3.00
50	12.63	0.17	0.07	2.99
51	11.86	0.17	0.08	2.98
52	11.10	0.17	0.07	2.96
53	10.37	0.16	0.07	2.99
54	9.66	0.16	0.04	2.98
55	8.97	0.16	0.05	3.02
56	8.30	0.16	0.06	3.03
57	7.65	0.15	0.06	3.03
58	7.04	0.15	0.06	2.99
59	6.48	0.15	0.05	3.00
60	5.97	0.15	0.02	3.01
61	5.51	0.15	0.03	2.97
62	5.12	0.15	0.01	2.91
63	4.77	0.15	0.01	2.93
64	4.47	0.16	0.12	3.03
65	4.20	0.16	0.11	3.17
66	3.96	0.16	0.14	3.30
67	3.74	0.16	0.14	3.03
68	3.53	0.17	0.09	3.01
69	3.36	0.17	0.13	3.16
70	3.19	0.17	0.12	3.02
71	3.01	0.17	0.18	3.14
72	2.81	0.18	0.19	3.11
73	2.62	0.19	0.19	3.16
74	2.44	0.18	0.18	3.07
75	2.26	0.17	0.28	3.25

Table 4. Bootstrap Estimates of the Mean and Standard Deviation of Years of Activity Measures for Initially Inactive Men, Regardless of Education

Age	Bootstrap Mean of WLE	Bootstrap SD of WLE	Bootstrap Mean of Median	Bootstrap SD of Median	Bootstrap Mean of Mode	Bootstrap SD of Mode
16	38.27	0.22	39.87	0.22	41.55	0.50
17	37.86	0.22	39.45	0.22	41.06	0.29
18	37.32	0.22	38.87	0.22	40.53	0.50
19	36.63	0.22	38.15	0.23	39.83	0.41
20	36.01	0.22	37.51	0.23	39.12	0.41
21	35.34	0.23	36.80	0.23	38.42	0.52
22	34.62	0.23	36.04	0.24	37.65	0.52
23	33.86	0.24	35.24	0.24	36.84	0.52
24	33.09	0.24	34.43	0.24	35.99	0.53
25	32.27	0.25	33.57	0.26	35.11	0.57
26	31.38	0.26	32.64	0.26	34.15	0.59
27	30.46	0.27	31.69	0.27	33.19	0.60
28	29.51	0.28	30.71	0.28	32.20	0.62
29	28.54	0.30	29.70	0.30	31.19	0.62
30	27.54	0.32	28.66	0.32	30.16	0.62
31	26.52	0.31	27.61	0.32	29.11	0.61
32	25.48	0.32	26.52	0.32	28.05	0.62
33	24.41	0.33	25.43	0.33	26.95	0.60
34	23.36	0.34	24.34	0.34	25.89	0.60
35	22.33	0.35	23.26	0.35	24.84	0.60
36	21.27	0.35	22.16	0.35	23.75	0.63
37	20.19	0.36	21.04	0.36	22.65	0.61
38	19.14	0.37	19.95	0.37	21.56	0.61
39	18.11	0.39	18.86	0.39	20.49	0.64
40	17.09	0.39	17.78	0.40	19.39	0.74
41	16.09	0.40	16.71	0.41	18.21	1.64
42	15.09	0.41	15.65	0.43	16.16	4.29
43	14.11	0.41	14.59	0.44	10.90	7.68
44	13.18	0.41	13.57	0.45	4.53	7.02
45	12.28	0.41	12.58	0.46	1.04	3.76
46	11.41	0.40	11.61	0.45	0.07	0.97
47	10.54	0.39	10.64	0.45	0.00	0.00
48	9.71	0.38	9.68	0.45	0.00	0.00
49	8.90	0.37	8.74	0.45	0.00	0.00
50	8.13	0.35	7.83	0.44	0.00	0.00
51	7.38	0.34	6.94	0.44	0.00	0.00
52	6.67	0.32	6.07	0.42	0.00	0.00
53	5.97	0.30	5.21	0.40	0.00	0.00
54	5.30	0.28	4.38	0.38	0.00	0.00
55	4.69	0.26	3.62	0.36	0.00	0.00
56	4.15	0.23	2.94	0.33	0.00	0.00
57	3.66	0.21	2.34	0.30	0.00	0.00
58	3.22	0.19	1.80	0.27	0.00	0.00
59	2.83	0.17	1.31	0.24	0.00	0.00
60	2.49	0.15	0.88	0.27	0.00	0.00
61	2.19	0.13	0.36	0.35	0.00	0.00
62	1.94	0.12	0.04	0.14	0.00	0.00
63	1.71	0.11	0.00	0.01	0.00	0.00
64	1.51	0.10	0.00	0.00	0.00	0.00
65	1.31	0.09	0.00	0.00	0.00	0.00
66	1.14	0.09	0.00	0.00	0.00	0.00
67	0.99	0.08	0.00	0.00	0.00	0.00
68	0.84	0.07	0.00	0.00	0.00	0.00
69	0.71	0.07	0.00	0.00	0.00	0.00
70	0.60	0.06	0.00	0.00	0.00	0.00
71	0.49	0.06	0.00	0.00	0.00	0.00
72	0.41	0.06	0.00	0.00	0.00	0.00
73	0.34	0.05	0.00	0.00	0.00	0.00
74	0.28	0.05	0.00	0.00	0.00	0.00
75	0.23	0.05	0.00	0.00	0.00	0.00

Table 4. Bootstrap Estimates of the Mean and Standard Deviation of Years of Activity Measures for Initially Inactive Men, Regardless of Education (Continued)

Age	Bootstrap Mean of SD	Bootstrap SD of SD	Bootstrap Mean of Skewness	Bootstrap SD of Skewness	Bootstrap Mean of Kurtosis	Bootstrap SD of Kurtosis
16	9.87	0.12	-1.20	0.04	5.20	0.14
17	9.78	0.12	-1.19	0.04	5.15	0.14
18	9.66	0.12	-1.17	0.04	5.08	0.14
19	9.54	0.12	-1.14	0.04	5.01	0.13
20	9.41	0.11	-1.12	0.04	4.93	0.13
21	9.29	0.11	-1.09	0.04	4.84	0.13
22	9.16	0.11	-1.06	0.04	4.74	0.13
23	9.04	0.11	-1.03	0.04	4.63	0.13
24	8.92	0.11	-0.99	0.04	4.52	0.12
25	8.81	0.11	-0.95	0.04	4.41	0.12
26	8.72	0.11	-0.92	0.04	4.29	0.12
27	8.62	0.11	-0.88	0.04	4.18	0.11
28	8.54	0.11	-0.84	0.04	4.06	0.11
29	8.46	0.11	-0.80	0.04	3.95	0.10
30	8.38	0.11	-0.76	0.04	3.82	0.10
31	8.31	0.11	-0.72	0.04	3.70	0.09
32	8.25	0.12	-0.67	0.03	3.57	0.09
33	8.18	0.12	-0.62	0.03	3.45	0.09
34	8.11	0.12	-0.58	0.03	3.33	0.08
35	8.05	0.12	-0.53	0.03	3.22	0.08
36	7.99	0.12	-0.48	0.03	3.10	0.08
37	7.92	0.13	-0.43	0.03	3.00	0.08
38	7.84	0.13	-0.38	0.03	2.90	0.07
39	7.76	0.13	-0.33	0.03	2.80	0.07
40	7.66	0.13	-0.27	0.04	2.72	0.07
41	7.55	0.12	-0.22	0.04	2.64	0.07
42	7.43	0.12	-0.16	0.04	2.57	0.07
43	7.30	0.12	-0.09	0.04	2.51	0.06
44	7.15	0.11	-0.03	0.04	2.47	0.06
45	6.99	0.11	0.03	0.05	2.44	0.05
46	6.82	0.10	0.10	0.05	2.42	0.05
47	6.64	0.10	0.18	0.05	2.42	0.04
48	6.44	0.10	0.25	0.05	2.43	0.04
49	6.23	0.10	0.33	0.05	2.47	0.05
50	6.01	0.09	0.42	0.05	2.53	0.05
51	5.78	0.10	0.51	0.06	2.61	0.07
52	5.53	0.10	0.61	0.06	2.73	0.08
53	5.27	0.10	0.72	0.06	2.90	0.10
54	4.99	0.11	0.83	0.06	3.11	0.13
55	4.70	0.11	0.96	0.07	3.37	0.16
56	4.42	0.11	1.07	0.07	3.66	0.18
57	4.14	0.11	1.20	0.07	4.00	0.21
58	3.87	0.11	1.32	0.07	4.39	0.24
59	3.61	0.12	1.45	0.07	4.82	0.27
60	3.37	0.11	1.58	0.08	5.28	0.31
61	3.14	0.11	1.70	0.08	5.78	0.34
62	2.93	0.10	1.83	0.08	6.31	0.38
63	2.73	0.10	1.95	0.09	6.88	0.44
64	2.54	0.10	2.08	0.09	7.52	0.50
65	2.35	0.10	2.23	0.10	8.28	0.59
66	2.16	0.10	2.39	0.11	9.15	0.70
67	1.98	0.09	2.55	0.12	10.15	0.83
68	1.80	0.09	2.74	0.14	11.38	1.02
69	1.62	0.09	2.95	0.16	12.86	1.24
70	1.45	0.09	3.18	0.19	14.64	1.57
71	1.28	0.09	3.43	0.23	16.75	2.03
72	1.13	0.09	3.69	0.29	19.15	2.65
73	0.99	0.09	3.94	0.35	21.72	3.44
74	0.87	0.09	4.19	0.43	24.56	4.58
75	0.75	0.09	4.48	0.57	28.01	6.59

Table 4. Bootstrap Estimates of the Mean and Standard Deviation of Years of Activity Measures for Initially Inactive Men, Regardless of Education (Continued)

Age	Bootstrap Mean of 25th%	Bootstrap SD of 25th Percentile	Bootstrap Mean of 75th%	Bootstrap SD of 75th Percentile	Bootstrap Mean of 10th%	Bootstrap SD of 10th% Percentile	Bootstrap Mean of 90th%	Bootstrap SD of 90th Percentile
16	33.95	0.27	44.66	0.22	26.09	0.36	48.71	0.25
17	33.57	0.27	44.21	0.21	25.77	0.36	48.23	0.24
18	33.03	0.28	43.60	0.22	25.32	0.36	47.59	0.25
19	32.36	0.28	42.83	0.22	24.73	0.36	46.80	0.26
20	31.75	0.28	42.15	0.22	24.21	0.36	46.10	0.25
21	31.09	0.28	41.41	0.22	23.64	0.36	45.34	0.25
22	30.37	0.29	40.62	0.23	23.02	0.36	44.53	0.26
23	29.62	0.29	39.79	0.24	22.36	0.37	43.69	0.27
24	28.84	0.29	38.96	0.23	21.67	0.36	42.84	0.27
25	28.01	0.31	38.08	0.24	20.93	0.37	41.95	0.28
26	27.10	0.31	37.14	0.25	20.10	0.38	41.01	0.28
27	26.17	0.33	36.18	0.25	19.24	0.39	40.04	0.28
28	25.20	0.34	35.19	0.26	18.35	0.41	39.05	0.28
29	24.20	0.37	34.18	0.28	17.41	0.43	38.05	0.30
30	23.16	0.38	33.15	0.29	16.44	0.45	37.02	0.31
31	22.11	0.38	32.11	0.29	15.45	0.46	35.99	0.31
32	21.01	0.40	31.05	0.29	14.41	0.47	34.93	0.31
33	19.90	0.41	29.97	0.30	13.36	0.48	33.86	0.31
34	18.80	0.42	28.89	0.30	12.32	0.50	32.79	0.32
35	17.72	0.43	27.84	0.31	11.29	0.52	31.75	0.32
36	16.60	0.44	26.76	0.31	10.24	0.53	30.68	0.33
37	15.47	0.45	25.66	0.32	9.17	0.54	29.60	0.33
38	14.36	0.47	24.59	0.32	8.14	0.56	28.53	0.33
39	13.28	0.50	23.52	0.34	7.15	0.58	27.47	0.34
40	12.20	0.51	22.45	0.34	6.18	0.59	26.41	0.34
41	11.15	0.52	21.40	0.35	5.25	0.59	25.37	0.34
42	10.11	0.54	20.34	0.36	4.35	0.60	24.31	0.35
43	9.09	0.55	19.28	0.37	3.49	0.59	23.26	0.36
44	8.12	0.55	18.25	0.38	2.70	0.57	22.23	0.36
45	7.19	0.56	17.24	0.39	1.98	0.55	21.22	0.38
46	6.29	0.54	16.26	0.38	1.30	0.53	20.23	0.37
47	5.41	0.54	15.26	0.39	0.64	0.52	19.23	0.38
48	4.56	0.52	14.28	0.39	0.16	0.31	18.23	0.38
49	3.75	0.50	13.31	0.39	0.01	0.08	17.25	0.38
50	2.99	0.47	12.35	0.38	0.00	0.00	16.28	0.37
51	2.28	0.44	11.40	0.39	0.00	0.00	15.32	0.38
52	1.63	0.40	10.47	0.38	0.00	0.00	14.37	0.38
53	1.00	0.41	9.52	0.37	0.00	0.00	13.39	0.37
54	0.35	0.40	8.58	0.37	0.00	0.00	12.41	0.37
55	0.03	0.14	7.68	0.36	0.00	0.00	11.46	0.37
56	0.00	0.01	6.86	0.34	0.00	0.00	10.57	0.36
57	0.00	0.00	6.09	0.32	0.00	0.00	9.73	0.35
58	0.00	0.00	5.37	0.30	0.00	0.00	8.93	0.34
59	0.00	0.00	4.71	0.29	0.00	0.00	8.17	0.33
60	0.00	0.00	4.11	0.27	0.00	0.00	7.47	0.31
61	0.00	0.00	3.56	0.25	0.00	0.00	6.83	0.30
62	0.00	0.00	3.09	0.23	0.00	0.00	6.25	0.28
63	0.00	0.00	2.64	0.22	0.00	0.00	5.71	0.28
64	0.00	0.00	2.24	0.20	0.00	0.00	5.20	0.26
65	0.00	0.00	1.84	0.21	0.00	0.00	4.68	0.27
66	0.00	0.00	1.46	0.20	0.00	0.00	4.20	0.25
67	0.00	0.00	1.13	0.20	0.00	0.00	3.72	0.26
68	0.00	0.00	0.75	0.32	0.00	0.00	3.24	0.24
69	0.00	0.00	0.31	0.35	0.00	0.00	2.77	0.26
70	0.00	0.00	0.06	0.18	0.00	0.00	2.33	0.24
71	0.00	0.00	0.01	0.06	0.00	0.00	1.92	0.26
72	0.00	0.00	0.00	0.01	0.00	0.00	1.54	0.26
73	0.00	0.00	0.00	0.00	0.00	0.00	1.25	0.28
74	0.00	0.00	0.00	0.00	0.00	0.00	0.99	0.36
75	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.43

Table 5. Bootstrap Estimates of Correlation Coefficients of Years of Activity Measures for Initially Inactive Men, Regardless of Education

Age	Correlation Coefficient Mean and Median	Correlation Coefficient Mean and Mode	Correlation Coefficient Median and Mode	Correlation Coefficient Mean and SD	Correlation Coefficient 25th and 75th Percentiles	Correlation Coefficient 10th and 90th Percentiles
16	0.96	0.51	0.62	-0.09	0.72	0.34
17	0.96	0.37	0.44	-0.09	0.72	0.34
18	0.96	0.44	0.54	-0.09	0.72	0.34
19	0.96	0.40	0.48	-0.09	0.72	0.35
20	0.96	0.36	0.44	-0.09	0.72	0.36
21	0.96	0.35	0.43	-0.08	0.72	0.37
22	0.96	0.32	0.41	-0.09	0.73	0.38
23	0.96	0.31	0.39	-0.10	0.74	0.40
24	0.96	0.28	0.35	-0.11	0.74	0.40
25	0.97	0.31	0.37	-0.12	0.76	0.45
26	0.97	0.31	0.37	-0.13	0.77	0.46
27	0.97	0.32	0.38	-0.16	0.78	0.48
28	0.97	0.35	0.40	-0.21	0.80	0.51
29	0.98	0.35	0.40	-0.23	0.82	0.56
30	0.98	0.36	0.41	-0.26	0.83	0.59
31	0.98	0.33	0.38	-0.30	0.83	0.57
32	0.98	0.39	0.44	-0.33	0.84	0.59
33	0.98	0.39	0.44	-0.35	0.84	0.60
34	0.98	0.40	0.45	-0.36	0.84	0.60
35	0.98	0.39	0.44	-0.39	0.85	0.61
36	0.98	0.41	0.46	-0.39	0.84	0.61
37	0.99	0.42	0.46	-0.40	0.84	0.61
38	0.99	0.41	0.46	-0.41	0.84	0.61
39	0.99	0.47	0.51	-0.41	0.85	0.63
40	0.99	0.44	0.48	-0.40	0.85	0.63
41	0.99	0.40	0.42	-0.38	0.85	0.64
42	0.99	0.53	0.54	-0.34	0.86	0.66
43	0.99	0.70	0.68	-0.29	0.86	0.66
44	0.99	0.67	0.66	-0.23	0.86	0.67
45	0.99	0.46	0.45	-0.13	0.87	0.69
46	0.99	0.16	0.15	-0.07	0.87	0.68
47	0.99			0.06	0.87	0.64
48	0.99			0.18	0.87	0.50
49	0.99			0.30	0.88	0.21
50	0.99			0.41	0.88	
51	0.99			0.55	0.89	
52	0.99			0.63	0.88	
53	0.99			0.71	0.86	
54	0.99			0.77	0.77	
55	0.99			0.82	0.42	
56	0.98			0.85	0.05	
57	0.97			0.87		
58	0.96			0.88		
59	0.95			0.90		
60	0.89			0.90		
61	0.82			0.90		
62	0.47			0.90		
63	0.04			0.90		
64				0.90		
65				0.90		
66				0.90		
67				0.90		
68				0.90		
69				0.90		
70				0.90		
71				0.90		
72				0.90		
73				0.89		
74				0.89		
75				0.90		

Table 6. Bootstrap Estimates of the Mean, Standard Deviation, Skewness, and Kurtosis of the Mean of Years of Activity for Initially Inactive Men, Regardless of Education

Age	Bootstrap Mean of WLE	Bootstrap SD of WLE	Bootstrap Skewness of WLE	Bootstrap Kurtosis of WLE
16	38.27	0.22	-0.08	3.08
17	37.86	0.22	-0.06	3.11
18	37.32	0.22	-0.07	3.11
19	36.63	0.22	-0.05	3.08
20	36.01	0.22	-0.04	3.10
21	35.34	0.23	-0.02	2.97
22	34.62	0.23	-0.04	2.96
23	33.86	0.24	-0.09	2.94
24	33.09	0.24	-0.09	2.97
25	32.27	0.25	-0.05	3.01
26	31.38	0.26	-0.03	2.96
27	30.46	0.27	-0.09	2.98
28	29.51	0.28	-0.14	3.11
29	28.54	0.30	-0.14	2.97
30	27.54	0.32	-0.16	2.97
31	26.52	0.31	-0.11	3.04
32	25.48	0.32	-0.15	3.11
33	24.41	0.33	-0.12	2.96
34	23.36	0.34	-0.16	3.01
35	22.33	0.35	-0.22	2.96
36	21.27	0.35	-0.12	2.98
37	20.19	0.36	-0.14	2.98
38	19.14	0.37	-0.13	2.82
39	18.11	0.39	-0.10	2.93
40	17.09	0.39	-0.13	3.25
41	16.09	0.40	-0.13	3.22
42	15.09	0.41	-0.13	3.21
43	14.11	0.41	-0.16	3.09
44	13.18	0.41	-0.13	2.97
45	12.28	0.41	-0.08	2.94
46	11.41	0.40	-0.06	2.91
47	10.54	0.39	-0.11	3.11
48	9.71	0.38	-0.10	3.13
49	8.90	0.37	-0.08	2.83
50	8.13	0.35	-0.03	2.88
51	7.38	0.34	-0.05	3.05
52	6.67	0.32	-0.04	3.02
53	5.97	0.30	-0.04	3.16
54	5.30	0.28	0.04	3.11
55	4.69	0.26	0.07	3.05
56	4.15	0.23	0.07	3.07
57	3.66	0.21	0.06	2.89
58	3.22	0.19	0.05	2.95
59	2.83	0.17	0.04	3.04
60	2.49	0.15	0.16	2.96
61	2.19	0.13	0.09	2.88
62	1.94	0.12	0.15	2.93
63	1.71	0.11	0.07	2.94
64	1.51	0.10	0.08	3.05
65	1.31	0.09	0.15	3.05
66	1.14	0.09	0.13	3.02
67	0.99	0.08	0.20	3.00
68	0.84	0.07	0.21	3.13
69	0.71	0.07	0.21	3.22
70	0.60	0.06	0.26	3.27
71	0.49	0.06	0.18	3.09
72	0.41	0.06	0.16	3.02
73	0.34	0.05	0.20	3.07
74	0.28	0.05	0.24	2.94
75	0.23	0.05	0.31	2.99

Table 7. Bootstrap Estimates of the Mean and Standard Deviation of Years of Activity Measures for Initially Active Women, Regardless of Education

Age	Bootstrap Mean of WLE	Bootstrap SD of WLE	Bootstrap Mean of Median	Bootstrap SD of Median	Bootstrap Mean of Mode	Bootstrap SD of Mode
16	34.40	0.25	34.52	0.26	36.24	0.45
17	33.85	0.24	33.96	0.25	35.60	0.36
18	33.27	0.24	33.38	0.25	35.07	0.50
19	32.66	0.24	32.76	0.25	34.45	0.38
20	32.03	0.24	32.12	0.25	33.78	0.48
21	31.40	0.24	31.48	0.25	33.18	0.51
22	30.75	0.24	30.83	0.25	32.49	0.51
23	30.08	0.24	30.15	0.25	31.77	0.56
24	29.41	0.23	29.47	0.24	31.08	0.61
25	28.73	0.23	28.78	0.24	30.37	0.68
26	28.03	0.23	28.07	0.24	29.65	0.72
27	27.33	0.23	27.35	0.24	28.95	0.76
28	26.61	0.22	26.63	0.23	28.21	0.81
29	25.90	0.22	25.90	0.23	27.48	0.86
30	25.17	0.22	25.16	0.23	26.78	0.91
31	24.45	0.22	24.42	0.23	26.07	0.96
32	23.71	0.21	23.67	0.23	25.34	0.97
33	22.98	0.21	22.91	0.23	24.59	1.00
34	22.24	0.21	22.15	0.23	23.83	1.02
35	21.50	0.21	21.39	0.22	23.07	1.03
36	20.76	0.21	20.63	0.22	22.30	1.04
37	20.01	0.20	19.86	0.22	21.53	1.06
38	19.27	0.20	19.09	0.22	20.76	1.08
39	18.53	0.20	18.32	0.22	19.95	1.11
40	17.78	0.20	17.55	0.22	19.13	1.12
41	17.04	0.19	16.77	0.22	18.30	1.14
42	16.30	0.19	16.00	0.21	17.50	1.15
43	15.56	0.19	15.22	0.21	16.68	1.16
44	14.83	0.19	14.45	0.21	15.86	1.15
45	14.10	0.19	13.68	0.21	15.00	1.16
46	13.37	0.18	12.91	0.21	14.13	1.15
47	12.65	0.18	12.14	0.21	13.26	1.15
48	11.96	0.18	11.40	0.20	12.39	1.14
49	11.27	0.17	10.66	0.20	11.53	1.12
50	10.60	0.17	9.94	0.20	10.67	1.09
51	9.94	0.17	9.22	0.19	9.80	1.08
52	9.30	0.17	8.52	0.19	8.93	1.06
53	8.68	0.16	7.84	0.19	8.08	1.05
54	8.08	0.16	7.19	0.18	7.21	1.03
55	7.53	0.16	6.58	0.18	6.38	1.02
56	6.99	0.16	5.99	0.18	5.54	1.02
57	6.47	0.16	5.41	0.18	4.72	1.01
58	5.97	0.16	4.86	0.18	3.93	1.02
59	5.50	0.16	4.36	0.18	3.16	1.03
60	5.07	0.16	3.90	0.19	2.45	1.03
61	4.69	0.16	3.49	0.19	1.82	0.99
62	4.37	0.16	3.16	0.19	1.43	0.84
63	4.08	0.17	2.87	0.20	1.12	0.73
64	3.82	0.17	2.60	0.20	0.96	0.67
65	3.60	0.17	2.38	0.20	0.92	0.62
66	3.39	0.17	2.17	0.20	0.81	0.53
67	3.21	0.18	2.01	0.22	0.72	0.45
68	3.07	0.18	1.91	0.23	0.68	0.41
69	2.94	0.19	1.84	0.24	0.67	0.41
70	2.79	0.19	1.75	0.24	0.71	0.46
71	2.61	0.18	1.61	0.23	0.74	0.47
72	2.41	0.18	1.44	0.22	0.73	0.47
73	2.21	0.19	1.28	0.23	0.69	0.42
74	2.02	0.19	1.16	0.26	0.66	0.42
75	1.83	0.19	1.01	0.24	0.78	0.48

Table 7. Bootstrap Estimates of the Mean and Standard Deviation of Years of Activity Measures for Initially Active Women, Regardless of Education (Continued)

Age	Bootstrap Mean of SD	Bootstrap SD of SD	Bootstrap Mean of Skewness	Bootstrap SD of Skewness	Bootstrap Mean of Kurtosis	Bootstrap SD of Kurtosis
16	8.78	0.09	-0.47	0.03	3.51	0.08
17	8.72	0.09	-0.46	0.03	3.46	0.08
18	8.66	0.09	-0.44	0.03	3.42	0.07
19	8.60	0.09	-0.43	0.03	3.37	0.07
20	8.54	0.09	-0.42	0.03	3.33	0.07
21	8.47	0.09	-0.41	0.03	3.30	0.06
22	8.40	0.09	-0.40	0.03	3.26	0.06
23	8.33	0.09	-0.39	0.03	3.22	0.06
24	8.26	0.09	-0.37	0.03	3.19	0.06
25	8.19	0.09	-0.36	0.03	3.16	0.05
26	8.11	0.09	-0.35	0.03	3.13	0.05
27	8.03	0.09	-0.34	0.03	3.10	0.05
28	7.94	0.09	-0.33	0.03	3.07	0.05
29	7.85	0.09	-0.31	0.03	3.05	0.05
30	7.76	0.09	-0.30	0.03	3.02	0.05
31	7.67	0.09	-0.29	0.03	2.99	0.05
32	7.57	0.09	-0.27	0.03	2.96	0.04
33	7.48	0.09	-0.25	0.03	2.93	0.04
34	7.38	0.09	-0.23	0.03	2.91	0.04
35	7.28	0.09	-0.21	0.03	2.88	0.04
36	7.17	0.09	-0.19	0.03	2.85	0.04
37	7.07	0.09	-0.17	0.03	2.83	0.04
38	6.96	0.09	-0.15	0.03	2.80	0.04
39	6.84	0.09	-0.12	0.03	2.78	0.04
40	6.73	0.09	-0.10	0.03	2.76	0.04
41	6.61	0.09	-0.07	0.03	2.74	0.04
42	6.48	0.09	-0.04	0.03	2.72	0.05
43	6.35	0.09	0.00	0.03	2.71	0.05
44	6.22	0.09	0.03	0.03	2.70	0.05
45	6.09	0.09	0.07	0.03	2.69	0.05
46	5.95	0.09	0.11	0.04	2.69	0.05
47	5.80	0.09	0.15	0.04	2.70	0.06
48	5.65	0.09	0.20	0.04	2.71	0.06
49	5.49	0.09	0.24	0.04	2.73	0.06
50	5.33	0.09	0.30	0.04	2.76	0.07
51	5.16	0.09	0.35	0.04	2.79	0.07
52	4.99	0.09	0.40	0.04	2.84	0.08
53	4.82	0.09	0.46	0.04	2.90	0.09
54	4.65	0.10	0.52	0.04	2.98	0.10
55	4.47	0.10	0.59	0.05	3.07	0.11
56	4.29	0.10	0.66	0.05	3.17	0.12
57	4.11	0.10	0.73	0.05	3.28	0.14
58	3.94	0.10	0.80	0.05	3.41	0.15
59	3.77	0.10	0.87	0.06	3.53	0.17
60	3.61	0.11	0.93	0.06	3.66	0.20
61	3.46	0.11	0.99	0.07	3.78	0.22
62	3.31	0.11	1.04	0.07	3.88	0.25
63	3.16	0.11	1.09	0.08	3.97	0.27
64	3.02	0.11	1.12	0.09	4.03	0.30
65	2.89	0.11	1.14	0.10	4.06	0.33
66	2.76	0.12	1.15	0.10	4.05	0.36
67	2.64	0.12	1.14	0.11	4.00	0.38
68	2.51	0.12	1.12	0.12	3.92	0.41
69	2.37	0.12	1.09	0.13	3.88	0.45
70	2.22	0.12	1.08	0.14	3.89	0.51
71	2.06	0.12	1.09	0.16	3.96	0.59
72	1.90	0.12	1.12	0.18	4.09	0.69
73	1.74	0.13	1.15	0.21	4.27	0.81
74	1.58	0.13	1.20	0.24	4.57	0.96
75	1.42	0.14	1.32	0.27	5.12	1.19

Table 7. Bootstrap Estimates of the Mean and Standard Deviation of Years of Activity Measures for Initially Active Women, Regardless of Education (Continued)

Age	Bootstrap Mean of 25th%	Bootstrap SD of 25th Percentile	Bootstrap Mean of 75th%	Bootstrap SD of 75th Percentile	Bootstrap Mean of 10th%	Bootstrap SD of 10th% Percentile	Bootstrap Mean of 90th%	Bootstrap SD of 90th Percentile
16	28.51	0.28	39.99	0.24	22.56	0.30	44.52	0.26
17	27.98	0.28	39.40	0.24	22.06	0.30	43.91	0.26
18	27.42	0.28	38.79	0.24	21.53	0.30	43.27	0.25
19	26.84	0.27	38.15	0.24	20.97	0.30	42.60	0.26
20	26.22	0.28	37.48	0.24	20.40	0.30	41.90	0.26
21	25.62	0.27	36.81	0.24	19.83	0.29	41.20	0.25
22	24.99	0.27	36.12	0.24	19.24	0.29	40.48	0.25
23	24.36	0.27	35.41	0.24	18.65	0.29	39.74	0.26
24	23.72	0.26	34.69	0.24	18.05	0.29	38.99	0.25
25	23.06	0.26	33.96	0.23	17.45	0.28	38.23	0.25
26	22.41	0.26	33.22	0.23	16.83	0.28	37.44	0.25
27	21.73	0.26	32.45	0.23	16.22	0.28	36.64	0.26
28	21.06	0.26	31.68	0.23	15.60	0.27	35.84	0.26
29	20.38	0.26	30.90	0.23	14.98	0.27	35.03	0.25
30	19.69	0.25	30.12	0.22	14.36	0.27	34.20	0.25
31	19.01	0.25	29.32	0.22	13.74	0.26	33.38	0.25
32	18.32	0.25	28.52	0.22	13.12	0.27	32.54	0.25
33	17.63	0.24	27.72	0.22	12.50	0.26	31.70	0.26
34	16.93	0.24	26.91	0.22	11.88	0.26	30.86	0.26
35	16.23	0.24	26.10	0.22	11.27	0.26	30.02	0.25
36	15.53	0.24	25.27	0.22	10.65	0.25	29.17	0.25
37	14.83	0.23	24.45	0.22	10.03	0.25	28.32	0.25
38	14.13	0.23	23.63	0.22	9.43	0.24	27.46	0.25
39	13.44	0.23	22.80	0.22	8.83	0.23	26.60	0.26
40	12.74	0.23	21.97	0.22	8.23	0.24	25.74	0.26
41	12.04	0.23	21.14	0.21	7.65	0.23	24.88	0.26
42	11.35	0.22	20.30	0.21	7.07	0.23	24.02	0.26
43	10.66	0.22	19.46	0.22	6.52	0.22	23.15	0.26
44	9.98	0.22	18.62	0.22	5.96	0.22	22.28	0.26
45	9.30	0.22	17.79	0.22	5.44	0.21	21.41	0.26
46	8.63	0.21	16.95	0.22	4.91	0.20	20.54	0.26
47	7.97	0.21	16.12	0.21	4.42	0.19	19.68	0.27
48	7.34	0.20	15.30	0.21	3.96	0.18	18.82	0.27
49	6.74	0.20	14.48	0.22	3.54	0.17	17.98	0.27
50	6.15	0.20	13.67	0.22	3.11	0.17	17.13	0.26
51	5.58	0.19	12.88	0.22	2.71	0.16	16.29	0.26
52	5.03	0.19	12.10	0.22	2.33	0.16	15.46	0.27
53	4.52	0.18	11.33	0.22	1.98	0.14	14.65	0.28
54	4.04	0.17	10.58	0.23	1.68	0.13	13.86	0.28
55	3.61	0.17	9.88	0.23	1.45	0.13	13.10	0.28
56	3.19	0.16	9.19	0.22	1.22	0.13	12.35	0.28
57	2.79	0.15	8.51	0.23	1.00	0.11	11.62	0.29
58	2.41	0.15	7.87	0.23	0.79	0.10	10.92	0.30
59	2.05	0.14	7.26	0.23	0.62	0.09	10.26	0.30
60	1.73	0.13	6.69	0.24	0.52	0.04	9.63	0.32
61	1.46	0.13	6.18	0.24	0.50	0.01	9.07	0.33
62	1.26	0.14	5.72	0.26	0.50	0.00	8.56	0.34
63	1.08	0.14	5.32	0.25	0.50	0.00	8.10	0.34
64	0.94	0.14	4.96	0.27	0.50	0.00	7.68	0.35
65	0.83	0.14	4.66	0.29	0.50	0.00	7.30	0.34
66	0.71	0.14	4.39	0.29	0.50	0.00	6.92	0.35
67	0.63	0.12	4.18	0.30	0.50	0.00	6.56	0.35
68	0.58	0.11	4.00	0.31	0.50	0.00	6.23	0.36
69	0.57	0.10	3.80	0.31	0.50	0.00	5.90	0.39
70	0.56	0.10	3.56	0.30	0.50	0.00	5.55	0.37
71	0.54	0.08	3.29	0.30	0.50	0.00	5.13	0.35
72	0.52	0.06	3.02	0.33	0.50	0.00	4.66	0.35
73	0.51	0.04	2.74	0.32	0.50	0.00	4.20	0.34
74	0.51	0.03	2.42	0.29	0.50	0.00	3.74	0.36
75	0.51	0.04	2.10	0.29	0.50	0.00	3.32	0.37

Table 8. Bootstrap Estimates of Correlation Coefficients of Years of Activity Measures for Initially Active Women, Regardless of Education

Age	Correlation Coefficient Median and Median	Correlation Coefficient Mean and Mode	Correlation Coefficient Median and Mode	Correlation Coefficient Mean and SD	Correlation Coefficient 25th and 75th Percentiles	Correlation Coefficient 10th and 90th Percentiles
16	0.99	0.63	0.68	-0.11	0.85	0.58
17	0.99	0.58	0.62	-0.10	0.85	0.58
18	0.99	0.63	0.68	-0.10	0.84	0.57
19	0.99	0.52	0.57	-0.10	0.84	0.57
20	0.99	0.54	0.58	-0.09	0.84	0.56
21	0.99	0.49	0.54	-0.08	0.83	0.55
22	0.99	0.46	0.50	-0.08	0.83	0.55
23	0.98	0.43	0.47	-0.07	0.83	0.54
24	0.98	0.39	0.43	-0.07	0.82	0.53
25	0.98	0.38	0.42	-0.06	0.81	0.52
26	0.98	0.33	0.39	-0.05	0.81	0.51
27	0.98	0.31	0.37	-0.04	0.80	0.50
28	0.98	0.30	0.35	-0.02	0.79	0.49
29	0.98	0.31	0.37	-0.02	0.79	0.48
30	0.98	0.29	0.35	-0.02	0.78	0.47
31	0.98	0.28	0.35	-0.01	0.77	0.46
32	0.97	0.28	0.33	0.01	0.76	0.44
33	0.97	0.29	0.35	0.02	0.75	0.43
34	0.97	0.26	0.33	0.04	0.74	0.43
35	0.97	0.25	0.33	0.05	0.73	0.42
36	0.97	0.24	0.32	0.07	0.73	0.41
37	0.96	0.22	0.30	0.08	0.71	0.40
38	0.96	0.20	0.28	0.10	0.70	0.39
39	0.96	0.22	0.30	0.12	0.69	0.38
40	0.96	0.21	0.30	0.14	0.69	0.37
41	0.95	0.22	0.31	0.15	0.68	0.36
42	0.95	0.22	0.31	0.18	0.66	0.35
43	0.95	0.23	0.33	0.19	0.66	0.35
44	0.95	0.21	0.32	0.21	0.65	0.34
45	0.94	0.22	0.33	0.24	0.64	0.33
46	0.94	0.21	0.33	0.27	0.63	0.31
47	0.94	0.18	0.31	0.30	0.62	0.30
48	0.93	0.18	0.33	0.33	0.61	0.30
49	0.93	0.19	0.35	0.37	0.60	0.30
50	0.93	0.19	0.36	0.39	0.59	0.29
51	0.92	0.17	0.35	0.42	0.58	0.28
52	0.91	0.16	0.34	0.44	0.58	0.27
53	0.91	0.15	0.33	0.47	0.55	0.26
54	0.91	0.15	0.32	0.50	0.55	0.25
55	0.90	0.16	0.33	0.52	0.54	0.23
56	0.90	0.14	0.27	0.55	0.52	0.23
57	0.90	0.12	0.22	0.58	0.51	0.23
58	0.90	0.13	0.19	0.60	0.49	0.23
59	0.89	0.14	0.16	0.62	0.49	0.20
60	0.89	0.19	0.16	0.65	0.48	0.15
61	0.88	0.17	0.10	0.67	0.50	0.07
62	0.90	0.20	0.13	0.66	0.52	0.02
63	0.89	0.18	0.11	0.66	0.51	0.04
64	0.88	0.20	0.13	0.66	0.52	
65	0.88	0.23	0.14	0.66	0.52	
66	0.89	0.21	0.15	0.64	0.48	
67	0.89	0.22	0.18	0.66	0.46	
68	0.90	0.22	0.16	0.67	0.43	
69	0.90	0.24	0.18	0.65	0.45	
70	0.89	0.26	0.21	0.63	0.43	
71	0.87	0.21	0.16	0.62	0.38	
72	0.87	0.25	0.25	0.61	0.30	
73	0.89	0.21	0.21	0.62	0.24	
74	0.91	0.27	0.29	0.62	0.21	
75	0.91	0.42	0.50	0.60	0.26	

Table 9. Bootstrap Estimates of the Mean, Standard Deviation, Skewness, and Kurtosis of the Mean of Years of Activity for Initially Active Women, Regardless of Education

Age	Bootstrap Mean of WLE	Bootstrap SD of WLE	Bootstrap Skewness of WLE	Bootstrap Kurtosis of WLE
16	34.40	0.25	0.03	3.03
17	33.85	0.24	0.03	3.00
18	33.27	0.24	0.03	3.02
19	32.66	0.24	0.04	3.01
20	32.03	0.24	0.04	3.00
21	31.40	0.24	0.05	2.96
22	30.75	0.24	0.06	3.04
23	30.08	0.24	0.05	3.04
24	29.41	0.23	0.06	3.09
25	28.73	0.23	0.04	3.11
26	28.03	0.23	0.01	3.09
27	27.33	0.23	0.02	3.13
28	26.61	0.22	0.04	3.16
29	25.90	0.22	0.02	3.16
30	25.17	0.22	0.03	3.16
31	24.45	0.22	0.02	3.17
32	23.71	0.21	0.03	3.17
33	22.98	0.21	0.00	3.10
34	22.24	0.21	0.00	3.14
35	21.50	0.21	0.03	3.18
36	20.76	0.21	0.03	3.17
37	20.01	0.20	0.00	3.18
38	19.27	0.20	0.01	3.15
39	18.53	0.20	0.00	3.18
40	17.78	0.20	0.01	3.19
41	17.04	0.19	0.01	3.25
42	16.30	0.19	0.01	3.20
43	15.56	0.19	0.00	3.22
44	14.83	0.19	0.01	3.25
45	14.10	0.19	0.00	3.26
46	13.37	0.18	0.01	3.21
47	12.65	0.18	0.00	3.21
48	11.96	0.18	-0.01	3.16
49	11.27	0.17	-0.03	3.05
50	10.60	0.17	-0.01	3.11
51	9.94	0.17	0.02	3.08
52	9.30	0.17	0.01	3.13
53	8.68	0.16	0.00	3.09
54	8.08	0.16	0.04	3.11
55	7.53	0.16	0.02	3.01
56	6.99	0.16	0.02	2.95
57	6.47	0.16	0.04	2.95
58	5.97	0.16	0.04	2.91
59	5.50	0.16	0.05	2.90
60	5.07	0.16	0.11	2.98
61	4.69	0.16	0.16	3.07
62	4.37	0.16	0.14	3.11
63	4.08	0.17	0.13	2.99
64	3.82	0.17	0.12	2.97
65	3.60	0.17	0.08	3.05
66	3.39	0.17	0.14	3.04
67	3.21	0.18	0.13	3.02
68	3.07	0.18	0.14	3.00
69	2.94	0.19	0.21	3.08
70	2.79	0.19	0.23	2.99
71	2.61	0.18	0.20	2.96
72	2.41	0.18	0.16	2.91
73	2.21	0.19	0.17	3.12
74	2.02	0.19	0.23	3.14
75	1.83	0.19	0.18	3.20

Table 10. Bootstrap Estimates of the Mean and Standard Deviation of Years of Activity Measures for Initially Inactive Women, Regardless of Education

Age	Bootstrap Mean of WLE	Bootstrap SD of WLE	Bootstrap Mean of Median	Bootstrap SD of Median	Bootstrap Mean of Mode	Bootstrap SD of Mode
16	33.22	0.25	33.83	0.26	34.99	0.34
17	32.76	0.25	33.37	0.26	34.53	0.50
18	32.23	0.25	32.83	0.26	34.00	0.34
19	31.54	0.25	32.14	0.26	33.26	0.45
20	30.80	0.25	31.38	0.26	32.55	0.50
21	30.10	0.25	30.68	0.26	31.86	0.41
22	29.36	0.25	29.93	0.26	31.07	0.40
23	28.60	0.25	29.15	0.27	30.28	0.47
24	27.81	0.26	28.35	0.27	29.48	0.51
25	26.99	0.26	27.52	0.27	28.66	0.50
26	26.14	0.26	26.66	0.27	27.78	0.49
27	25.28	0.26	25.78	0.27	26.88	0.46
28	24.43	0.26	24.92	0.27	25.97	0.45
29	23.60	0.25	24.07	0.26	25.10	0.46
30	22.77	0.25	23.23	0.26	24.23	0.49
31	21.94	0.25	22.38	0.26	23.37	0.52
32	21.11	0.25	21.53	0.26	22.50	0.54
33	20.28	0.24	20.68	0.25	21.65	0.55
34	19.49	0.24	19.88	0.26	20.84	0.55
35	18.72	0.24	19.08	0.26	20.04	0.58
36	17.94	0.25	18.28	0.26	19.23	0.59
37	17.13	0.25	17.46	0.26	18.39	0.61
38	16.31	0.24	16.61	0.26	17.54	0.63
39	15.46	0.24	15.74	0.26	16.67	0.64
40	14.63	0.25	14.87	0.27	15.81	0.66
41	13.79	0.25	14.00	0.27	14.87	1.17
42	12.94	0.25	13.10	0.27	11.86	5.16
43	12.05	0.25	12.15	0.28	2.06	4.83
44	11.14	0.26	11.16	0.29	0.01	0.34
45	10.23	0.26	10.16	0.30	0.00	0.00
46	9.36	0.26	9.17	0.31	0.00	0.00
47	8.53	0.25	8.21	0.31	0.00	0.00
48	7.71	0.25	7.23	0.32	0.00	0.00
49	6.90	0.25	6.24	0.33	0.00	0.00
50	6.13	0.24	5.28	0.33	0.00	0.00
51	5.42	0.23	4.38	0.33	0.00	0.00
52	4.78	0.22	3.55	0.32	0.00	0.00
53	4.20	0.21	2.80	0.31	0.00	0.00
54	3.67	0.19	2.11	0.29	0.00	0.00
55	3.20	0.17	1.49	0.27	0.00	0.00
56	2.77	0.16	0.93	0.29	0.00	0.00
57	2.40	0.15	0.29	0.35	0.00	0.00
58	2.07	0.13	0.01	0.07	0.00	0.00
59	1.78	0.12	0.00	0.00	0.00	0.00
60	1.53	0.10	0.00	0.00	0.00	0.00
61	1.30	0.09	0.00	0.00	0.00	0.00
62	1.11	0.08	0.00	0.00	0.00	0.00
63	0.95	0.08	0.00	0.00	0.00	0.00
64	0.81	0.07	0.00	0.00	0.00	0.00
65	0.69	0.06	0.00	0.00	0.00	0.00
66	0.59	0.05	0.00	0.00	0.00	0.00
67	0.50	0.05	0.00	0.00	0.00	0.00
68	0.43	0.05	0.00	0.00	0.00	0.00
69	0.36	0.04	0.00	0.00	0.00	0.00
70	0.30	0.04	0.00	0.00	0.00	0.00
71	0.24	0.03	0.00	0.00	0.00	0.00
72	0.19	0.03	0.00	0.00	0.00	0.00
73	0.15	0.03	0.00	0.00	0.00	0.00
74	0.11	0.03	0.00	0.00	0.00	0.00
75	0.09	0.02	0.00	0.00	0.00	0.00

Table 10. Bootstrap Estimates of the Mean and Standard Deviation of Years of Activity Measures for Initially Inactive Women, Regardless of Education (Continued)

Age	Bootstrap Mean of SD	Bootstrap SD of SD	Bootstrap Mean of Skewness	Bootstrap SD of Skewness	Bootstrap Mean of Kurtosis	Bootstrap SD of Kurtosis
16	8.78	0.09	-0.46	0.03	3.49	0.08
17	8.73	0.09	-0.45	0.03	3.45	0.07
18	8.68	0.09	-0.44	0.03	3.41	0.07
19	8.62	0.09	-0.42	0.03	3.36	0.07
20	8.56	0.09	-0.41	0.03	3.31	0.06
21	8.51	0.09	-0.40	0.03	3.27	0.06
22	8.46	0.09	-0.38	0.03	3.23	0.06
23	8.40	0.09	-0.37	0.03	3.19	0.05
24	8.35	0.09	-0.36	0.03	3.15	0.05
25	8.29	0.09	-0.34	0.03	3.12	0.05
26	8.24	0.09	-0.33	0.03	3.08	0.05
27	8.18	0.09	-0.31	0.03	3.04	0.04
28	8.11	0.09	-0.29	0.03	3.00	0.04
29	8.04	0.09	-0.28	0.03	2.97	0.04
30	7.97	0.09	-0.26	0.03	2.93	0.04
31	7.90	0.09	-0.24	0.03	2.90	0.04
32	7.82	0.09	-0.22	0.03	2.87	0.04
33	7.74	0.09	-0.20	0.03	2.83	0.04
34	7.66	0.09	-0.19	0.03	2.80	0.04
35	7.58	0.09	-0.17	0.03	2.77	0.04
36	7.50	0.09	-0.15	0.03	2.73	0.04
37	7.42	0.09	-0.12	0.03	2.70	0.04
38	7.33	0.10	-0.09	0.03	2.66	0.04
39	7.25	0.09	-0.06	0.03	2.62	0.04
40	7.16	0.09	-0.03	0.03	2.58	0.04
41	7.07	0.09	0.01	0.03	2.54	0.04
42	6.97	0.09	0.05	0.03	2.50	0.04
43	6.87	0.09	0.11	0.03	2.47	0.04
44	6.74	0.09	0.17	0.03	2.44	0.04
45	6.59	0.09	0.24	0.03	2.43	0.04
46	6.42	0.09	0.32	0.04	2.45	0.04
47	6.23	0.09	0.40	0.04	2.49	0.05
48	6.02	0.09	0.49	0.04	2.56	0.06
49	5.77	0.09	0.60	0.05	2.67	0.07
50	5.50	0.09	0.71	0.05	2.83	0.09
51	5.21	0.10	0.83	0.05	3.05	0.11
52	4.92	0.10	0.96	0.06	3.31	0.14
53	4.62	0.11	1.09	0.06	3.63	0.17
54	4.32	0.11	1.22	0.07	4.02	0.20
55	4.02	0.11	1.37	0.07	4.48	0.24
56	3.73	0.11	1.52	0.08	5.02	0.29
57	3.45	0.11	1.68	0.08	5.64	0.35
58	3.17	0.11	1.84	0.09	6.36	0.41
59	2.92	0.11	2.01	0.09	7.18	0.48
60	2.68	0.11	2.19	0.10	8.10	0.56
61	2.45	0.10	2.38	0.11	9.17	0.66
62	2.23	0.10	2.57	0.12	10.33	0.78
63	2.04	0.10	2.77	0.13	11.61	0.92
64	1.85	0.09	2.97	0.14	13.05	1.07
65	1.68	0.09	3.19	0.16	14.64	1.27
66	1.53	0.09	3.39	0.17	16.31	1.48
67	1.39	0.08	3.61	0.19	18.13	1.76
68	1.25	0.08	3.84	0.22	20.30	2.15
69	1.12	0.08	4.11	0.26	22.97	2.68
70	0.99	0.08	4.42	0.30	26.34	3.37
71	0.86	0.07	4.81	0.36	30.90	4.42
72	0.74	0.07	5.26	0.45	36.79	6.05
73	0.63	0.07	5.78	0.59	44.40	8.68
74	0.53	0.07	6.39	0.82	54.58	13.65
75	0.44	0.07	7.11	1.18	68.20	22.62

Table 10. Bootstrap Estimates of the Mean and Standard Deviation of Years of Activity Measures for Initially Inactive Women, Regardless of Education (Continued)

Age	Bootstrap Mean of 25th%	Bootstrap SD of 25th Percentile	Bootstrap Mean of 75th%	Bootstrap SD of 75th Percentile	Bootstrap Mean of 10th%	Bootstrap SD of 10th% Percentile	Bootstrap Mean of 90th%	Bootstrap SD of 90th% Percentile
16	27.83	0.28	39.31	0.25	21.87	0.30	43.85	0.26
17	27.39	0.28	38.82	0.25	21.46	0.30	43.34	0.26
18	26.87	0.28	38.26	0.25	20.97	0.30	42.76	0.26
19	26.20	0.28	37.54	0.25	20.33	0.30	42.03	0.26
20	25.47	0.28	36.77	0.25	19.63	0.30	41.22	0.26
21	24.79	0.28	36.04	0.25	18.98	0.30	40.47	0.26
22	24.06	0.28	35.27	0.25	18.29	0.30	39.68	0.27
23	23.31	0.29	34.47	0.26	17.58	0.30	38.87	0.27
24	22.54	0.29	33.65	0.26	16.83	0.30	38.03	0.27
25	21.73	0.29	32.79	0.26	16.06	0.30	37.16	0.27
26	20.90	0.29	31.91	0.26	15.27	0.31	36.26	0.27
27	20.05	0.29	31.01	0.26	14.47	0.31	35.34	0.27
28	19.22	0.29	30.12	0.26	13.68	0.30	34.43	0.27
29	18.41	0.28	29.24	0.25	12.91	0.30	33.53	0.27
30	17.61	0.28	28.37	0.25	12.16	0.30	32.64	0.27
31	16.80	0.28	27.49	0.26	11.41	0.30	31.74	0.27
32	15.99	0.28	26.60	0.26	10.66	0.30	30.83	0.27
33	15.19	0.28	25.72	0.25	9.91	0.29	29.92	0.27
34	14.43	0.28	24.88	0.25	9.21	0.30	29.05	0.27
35	13.68	0.28	24.05	0.25	8.52	0.30	28.19	0.27
36	12.92	0.28	23.21	0.25	7.81	0.30	27.33	0.27
37	12.13	0.29	22.36	0.25	7.07	0.31	26.46	0.27
38	11.32	0.29	21.48	0.25	6.31	0.31	25.56	0.27
39	10.48	0.29	20.58	0.25	5.53	0.31	24.64	0.27
40	9.64	0.30	19.69	0.26	4.74	0.32	23.74	0.28
41	8.79	0.30	18.80	0.25	3.96	0.33	22.84	0.27
42	7.92	0.31	17.90	0.26	3.15	0.33	21.92	0.28
43	6.98	0.32	16.94	0.26	2.31	0.33	20.96	0.28
44	6.02	0.33	15.95	0.27	1.48	0.33	19.97	0.29
45	5.07	0.34	14.94	0.28	0.63	0.41	18.96	0.29
46	4.14	0.35	13.94	0.29	0.03	0.14	17.96	0.30
47	3.26	0.34	12.97	0.29	0.00	0.00	16.98	0.29
48	2.40	0.33	11.97	0.29	0.00	0.00	15.99	0.30
49	1.58	0.32	10.94	0.30	0.00	0.00	14.95	0.30
50	0.80	0.38	9.92	0.31	0.00	0.00	13.92	0.31
51	0.10	0.24	8.93	0.31	0.00	0.00	12.90	0.32
52	0.00	0.02	7.99	0.32	0.00	0.00	11.93	0.32
53	0.00	0.00	7.10	0.31	0.00	0.00	10.99	0.32
54	0.00	0.00	6.24	0.30	0.00	0.00	10.07	0.32
55	0.00	0.00	5.42	0.30	0.00	0.00	9.18	0.32
56	0.00	0.00	4.66	0.29	0.00	0.00	8.33	0.32
57	0.00	0.00	3.96	0.28	0.00	0.00	7.52	0.32
58	0.00	0.00	3.31	0.26	0.00	0.00	6.76	0.31
59	0.00	0.00	2.72	0.25	0.00	0.00	6.06	0.30
60	0.00	0.00	2.19	0.23	0.00	0.00	5.39	0.28
61	0.00	0.00	1.69	0.23	0.00	0.00	4.76	0.28
62	0.00	0.00	1.25	0.21	0.00	0.00	4.19	0.26
63	0.00	0.00	0.85	0.27	0.00	0.00	3.66	0.27
64	0.00	0.00	0.33	0.35	0.00	0.00	3.17	0.24
65	0.00	0.00	0.04	0.15	0.00	0.00	2.70	0.25
66	0.00	0.00	0.00	0.02	0.00	0.00	2.30	0.22
67	0.00	0.00	0.00	0.00	0.00	0.00	1.93	0.23
68	0.00	0.00	0.00	0.00	0.00	0.00	1.57	0.23
69	0.00	0.00	0.00	0.00	0.00	0.00	1.24	0.23
70	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.32
71	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.40
72	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.29
73	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.14
74	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.06
75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02

Table 11. Bootstrap Estimates of Correlation Coefficients of Years of Activity Measures for Initially Inactive Women, Regardless of Education

Age	Correlation Coefficient Mean and Median	Correlation Coefficient Mean and Mode	Correlation Coefficient Median and Mode	Correlation Coefficient Mean and SD	Correlation Coefficient 25th and 75th Percentiles	Correlation Coefficient 10th and 90th Percentiles
16	0.99	0.58	0.61	-0.07	0.85	0.57
17	0.99	0.69	0.73	-0.07	0.84	0.57
18	0.99	0.58	0.62	-0.07	0.84	0.57
19	0.99	0.64	0.68	-0.06	0.84	0.57
20	0.99	0.65	0.70	-0.07	0.84	0.56
21	0.99	0.58	0.63	-0.07	0.84	0.57
22	0.99	0.54	0.59	-0.06	0.84	0.57
23	0.99	0.59	0.64	-0.06	0.84	0.58
24	0.99	0.61	0.65	-0.06	0.85	0.58
25	0.99	0.59	0.64	-0.06	0.84	0.58
26	0.99	0.56	0.60	-0.06	0.85	0.58
27	0.99	0.56	0.59	-0.05	0.84	0.58
28	0.99	0.53	0.57	-0.04	0.84	0.57
29	0.99	0.51	0.55	-0.03	0.83	0.56
30	0.99	0.49	0.53	-0.03	0.83	0.55
31	0.99	0.50	0.54	-0.03	0.83	0.55
32	0.99	0.49	0.54	-0.03	0.82	0.55
33	0.99	0.48	0.54	-0.02	0.81	0.52
34	0.99	0.49	0.55	-0.02	0.81	0.52
35	0.98	0.48	0.54	-0.02	0.80	0.51
36	0.98	0.48	0.54	-0.03	0.81	0.51
37	0.98	0.47	0.53	-0.03	0.80	0.51
38	0.98	0.43	0.50	-0.03	0.79	0.49
39	0.98	0.44	0.51	-0.03	0.79	0.49
40	0.98	0.42	0.49	-0.02	0.79	0.50
41	0.98	0.35	0.39	-0.02	0.79	0.50
42	0.98	0.54	0.54	0.02	0.79	0.50
43	0.99	0.49	0.48	0.06	0.79	0.51
44	0.99	0.06	0.05	0.11	0.80	0.52
45	0.99			0.19	0.81	0.50
46	0.99			0.29	0.81	0.25
47	0.99			0.36	0.81	
48	0.99			0.45	0.81	
49	0.99			0.56	0.82	
50	0.98			0.65	0.80	
51	0.98			0.72	0.56	
52	0.98			0.78	0.11	
53	0.97			0.82		
54	0.96			0.85		
55	0.95			0.87		
56	0.90			0.89		
57	0.78			0.90		
58	0.29			0.91		
59				0.91		
60				0.91		
61				0.92		
62				0.92		
63				0.92		
64				0.92		
65				0.92		
66				0.92		
67				0.91		
68				0.91		
69				0.91		
70				0.91		
71				0.91		
72				0.90		
73				0.90		
74				0.90		
75				0.91		

Table 12. Bootstrap Estimates of the Mean, Standard Deviation, Skewness, and Kurtosis of the Mean of Years of Activity for Initially Inactive Women, Regardless of Education

Age	Bootstrap Mean of WLE	Bootstrap SD of WLE	Bootstrap Skewness of WLE	Bootstrap Kurtosis of WLE
16	33.22	0.25	-0.05	2.91
17	32.76	0.25	-0.05	2.92
18	32.23	0.25	-0.05	2.91
19	31.54	0.25	-0.06	2.95
20	30.80	0.25	-0.05	2.93
21	30.10	0.25	-0.05	2.92
22	29.36	0.25	-0.06	2.91
23	28.60	0.25	-0.05	2.88
24	27.81	0.26	-0.04	2.84
25	26.99	0.26	-0.06	2.99
26	26.14	0.26	-0.11	3.06
27	25.28	0.26	-0.13	3.13
28	24.43	0.26	-0.15	3.23
29	23.60	0.25	-0.13	3.23
30	22.77	0.25	-0.11	3.21
31	21.94	0.25	-0.10	3.11
32	21.11	0.25	-0.09	3.02
33	20.28	0.24	-0.09	3.07
34	19.49	0.24	-0.09	3.15
35	18.72	0.24	-0.09	3.08
36	17.94	0.25	-0.07	3.06
37	17.13	0.25	-0.05	3.07
38	16.31	0.24	-0.02	3.00
39	15.46	0.24	-0.03	2.99
40	14.63	0.25	-0.06	2.96
41	13.79	0.25	-0.09	2.92
42	12.94	0.25	-0.03	2.89
43	12.05	0.25	-0.08	2.95
44	11.14	0.26	-0.07	3.02
45	10.23	0.26	-0.11	2.97
46	9.36	0.26	-0.06	3.00
47	8.53	0.25	-0.07	3.07
48	7.71	0.25	0.02	2.99
49	6.90	0.25	-0.02	2.87
50	6.13	0.24	-0.02	2.90
51	5.42	0.23	0.05	2.98
52	4.78	0.22	0.06	2.95
53	4.20	0.21	0.03	2.97
54	3.67	0.19	0.06	3.00
55	3.20	0.17	0.09	2.94
56	2.77	0.16	0.08	3.06
57	2.40	0.15	0.03	3.00
58	2.07	0.13	0.04	3.13
59	1.78	0.12	0.09	3.04
60	1.53	0.10	0.08	2.98
61	1.30	0.09	0.10	3.00
62	1.11	0.08	0.18	3.07
63	0.95	0.08	0.21	3.04
64	0.81	0.07	0.21	3.07
65	0.69	0.06	0.18	3.02
66	0.59	0.05	0.23	2.91
67	0.50	0.05	0.22	2.93
68	0.43	0.05	0.25	3.04
69	0.36	0.04	0.23	2.98
70	0.30	0.04	0.26	3.05
71	0.24	0.03	0.30	3.12
72	0.19	0.03	0.36	3.13
73	0.15	0.03	0.39	3.10
74	0.11	0.03	0.40	3.21
75	0.09	0.02	0.45	3.25

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Forensic Economists, Their Methods and Estimates of Forecast Variables: A 2003 Survey Study

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Abstract

In March 2003, 746 surveys were mailed to the population of NAFE (National Association of Forensic Economics) members, with libraries and attorneys excluded. The survey instrument covered numerous topics, including economic methodology, proposed research topics for forensic economists, current consulting practices, and open-ended questions concerning ethics and reaction to the survey instrument. The results of the survey were examined with a direct comparison to earlier surveys, although there were a few new questions involving punitive damages and cases related to the September 11, 2001 disaster. Results of the survey related to economic variables such as medical costs and discount rates showed few significant changes from earlier surveys. Two of the more interesting results were that forensic economists continue to leave academic teaching in favor of full-time consulting, and survey respondents felt that the work life of both disabled and non-disabled individuals should be an important focus of future research.

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As part of an ongoing longitudinal research effort, in March 2003, 746 surveys were mailed to the population of NAFE (National Association of Forensic Economics) members, with libraries and attorneys excluded. The survey instrument covered numerous topics, including economic methodology, proposed research topics for forensic economists, current consulting practices, and open-ended questions concerning ethics and reaction to the survey instrument. There were 177 usable surveys returned for a response rate of 23.73 percent. After the survey was mailed, several e-mail reminders were sent. The response rate was marginally lower than the three previous surveys, although the total mailed was higher. The absolute number of surveys returned was basically unchanged (the 1993, 1997 and 1999 surveys had 162, 179 and 184 returns respectively.) It is the intention of the authors to conduct the next survey in 2006 entirely through the Internet. By so doing, costs should be reduced, accuracy increased, and the response rate increased.

The results of the survey will be examined with a direct comparison to earlier surveys. Where possible the wording of the questions was taken from earlier surveys. For some of the questions however, it was necessary to add certain options and delete others. Further, there were a few new questions involving punitive damages and cases related to the September 11, 2001 disaster that were created.

Although comparisons are made with earlier surveys, there was no determination of whether the same individuals responded to the different surveys or whether those who responded were representative of the current NAFE population. Even if the survey is not entirely representative of the NAFE population, it is reasonable to assume that individuals with the greatest interest and experience in the field completed the survey. In fact, as indicated in Question 14, the average length of experience of the respondents was almost twenty years.

For most of the survey questions, the results will be explained and directly compared to earlier surveys. To simplify the presentation, codes will be used when referring to the surveys.

S1 – Brookshire, Slesnick and Lessne, *JFE*, Vol III, No 2, Spring/Summer 1990
S2 – Brookshire and Slesnick, *JFE*, Vol IV, No 2, Spring/Summer 1991
S3 – Brookshire and Slesnick, *JFE*, Vol VII, No 1, Winter 1993
S4 – Brookshire and Slesnick, *JFE*, Vol X, No 1, Winter 1997
S5 – Brookshire and Slesnick, *LED*, Vol IV, No 2, Fall 1999
S6 – Current Survey

Complete citations of the surveys are listed in the References at the end of the article. Since there will be frequent mention of earlier surveys, corresponding questions will be coded in the following manner: (Survey, Survey Question, Page Number). For example, a reference to (S5, 2, 68) will mean the second question in survey S5 on page 68.

In the opinion of the authors, there were some answers beyond the normal bounds of acceptability. Calculations were made with and without the imposed boundaries, but for consistency with earlier surveys comparisons focus on all responses. Further, some individuals did not adequately follow the directions provided. There were three situations where this occurred. First, some respondents changed the question asked. As an example, the first four questions required that the respondent consider a 30-year time horizon, but the answer might have indicated that the assumed time horizon was other than 30 years. Second, some questions asked for only one possible response but more than one response was checked. Finally, certain questions asked for answers as percentages that should add to 100%. However, some respondents provided percentages that did not add to 100%. In all three of these situations, the responses were not counted. (The only exception was if responses added to within 10 percentage points of 100%. That is why for certain questions the total percentages do not add up to exactly 100%). Responses not counted and questions left blank account for the reasons why the number of responses does not equal the total of 177 for some questions.

Most questions allowed for individual comments, and the last three questions are basically open-ended questions. It has been the experience of the authors that the comments are often more valuable than the statistical results. A selected number of comments are included in this article.

During the development of the previous survey, several members of NAFE expressed concern that some forensic experts were improperly using earlier survey results. Because of these discussions, the authors have agreed to the following statement:

> "This article stems from a survey of the NAFE (National Association of Forensic Economics) membership. The views of the respondents do not necessarily represent the view of the National Association of Forensic Economics, or of its Board of Directors, or of all the members of NAFE. The authors have not attempted to determine what biases, if any, exist in the results due to (a) the general composition of all experts who testify about economic damages, (b) the effect of non-responses, (c) the effects of various state and federal case and statutory laws, and (d) the accuracy and truthfulness of the responses received. To have determined the actual practice of all forensic economists and correcting for these potential biases was beyond the scope of the research effort."

COMPARISON OF SURVEY RESULTS

***Question 1**: Assume that the judge instructs that you MUST incorporate price inflation into a 30-year forecast of economic loss. Complete the sentence… "I would use _____% as the average annual rate of price inflation (increase in the CPI) over this 30-year period."*

The number of respondents was 171. The results of the current survey, S6, are as follows in comparison to earlier surveys:

	(S1,15, 22)	(S3,3,27)	(S4,1,2)	(S5,1,67)	(S6)
Mean	5.0%	4.3%	4.0%	3.6%	3.2%
Median	n/a	4.0	4.0	3.4	3.0

The middle 50% of the responses was between 2.52% and 3.70%. The answers varied between 2% and 7%. If one assumes that a reasonable upper limit is 5%, then the average drops slightly from 3.24% to 3.18%. The mean forecast value of estimated inflation over the next thirty years has fallen about one-and-three quarter points since the 1990 survey. The distribution is relatively "tight" given that half of the responses are between 2.52% and 3.70%.

Selected Written Comments from Survey Respondents on Question 1:

- This is the ultimate intermediate long-run forecast for the CPI-W in the 2003 report from the Office of the Chief Actuary of the Social Security Administration.
- Based on spread between 30-year TIIS and nominal US Treasury Bonds.
- I rely on The Survey of Professional Forecasters published yearly by The Fed in Philadelphia. Whatever their long-term inflation projection, I would use. Currently it is 2.5%.
- 2.5% based on 10-year CPI-U history. Most forecasts available show a range from 2.2% to 3.0% so my % falls within. If it didn't, I'd possibly use the Economic Outlook from the *Economic Report of the President*.

- 3% is an estimate. I would analyze the yield curve to estimate directly the market's estimate of inflation embedded in the 30 year Treasury bond YTM.
- I would use the 40-year average of 4.37% if given my choice.
- In Canada I use a real rate of discount mandated at 2.5% in the province of Ontario.
- 4.75 rate on 30 year treasuries minus 2.75% forecast real interest rate.
- 30-year average is 5.0%, 20-year average is 3.2%. We are currently in a low period so I would reduce 5% to 4% based on judgment.

***Question 2**: Assume that the judge instructs that you MUST incorporate medical cost inflation (increases in the MCPI) into a 30-year forecast of economic loss. Complete the sentence… "I would use _____% as the average annual rate of medical cost inflation over the 30-year period."*

The number of respondents was 154. The results of this survey, S6, are as follows in comparison to earlier surveys:

	(S1,22,25)	(S3,4,29)	(S4,2,3)	(S5,2,68)	(S6)
Mean	7.6%	6.5%	5.7%	5.2%	5.1%
Median	n/a	7.0	6.0	5.0	5.0
Differential over CPI	2.6	2.1	1.7	1.6	1.9

The middle 50% of the distribution ranged from 4% to 6% with the low and high values in the range of -.50% and 17%. The estimate of the increase in medical cost had fallen over time through the 1999 survey, but this trend has apparently been reversed. Whether this change is permanent or temporary is unknown at this time. The row labeled "Differential over CPI" shows the difference between responses to questions 1 and 2. As indicated, the differential significantly increased from the previous survey as a result of the CPI estimate continuing to decrease. If one assumes that a reasonable range is from 0% to 7%, however, the average drops significantly to 4.66%. (There were four responses that were greater than 10% whereas the 1999 survey had no responses greater than 10%). Thus, the above results have been influenced by what some may consider "outliers."

Selected Written Comments from Survey Respondents on Question 2:

- I would explain that MCPI captures changes in technology and is a poor proxy for changes in the cost of an established plan of care.
- I utilize a categorical approach to MCPI. The 5.34% above is a simple average of available MCPI for nine specific categories of medical costs. Also, this average is a nominal rate of increase.
- This is the long-range intermediate forecast in the 2003 Medicare Trustees report for the increase in expenditures per Medicare beneficiary.
- All medical services – 4.2%; Medical commodities – 3.1%; As based on *The Economic Report of the President, 2003*, looking at the last decade.
- I put medical costs into the mainstream because a higher rate greatly increases the relative share of this sector. Given past high rates of increase is all the more reason to expect a toned down future. The trees do not grow clear to the sky.
- The current 2.2% spread between the yield on long term inflation indexed treasury securities and the yield on long-term coupon treasury securities provides market evidence regarding expected inflation as measured by the CPI. I would increase the 2.2% expected CPI inflation to 3.0% to recognize the more rapid growth of medical care inflation.
- Source: *National Health Expenditures Projections 2001-2011*.
- Over the past 10 years, medical costs have exceeded the overall CPI by just over 1.6%. Since 1953 the difference is 2.2%.
- 20 year APRs: Medical Care Services: 5.927%; Medical Care Commodities: 5.241%; Medical Care Total: 5.799%.

***Question 3**: Assume that the judge instructs that you MUST forecast the rate of increase in attendant care costs over the next 30 years as part of estimating the cost of a life care plan. The attendant will be relatively unskilled requiring, at most, a certificate as a nurse's aide. Complete the sentence… "I would use _____% as the average annual rate of increase in attendant care costs over the 30-year period."*

157 individuals answered this question, which had first been used in the previous survey. The rationale was that for many life care plans used in lawsuits involving injury, attendant care is a significant proportion of total costs. In the authors' experience, attendant care can often be over 80 percent of total costs.

	(S5,3,69)	(S6)
Mean	4.08%	3.98%
Median	4.00	4.00

The middle 50% of the responses ranged from 3% to 4.5%. The extreme values were 0% and 10%. Imposing a range of 2% to 7% did not change the average. There was virtually no change between the two surveys except the distribution tightened up in the most recent survey. An increase of 4% is certainly in the generally accepted range of wage growth for the entire economy. Thus, respondents to the questionnaire generally believe that attendant care will increase at approximately the same rate as wages in general. (There was some evidence that a few respondents assumed that the question requested the real rather than nominal increase in attendant care costs. Subsequent surveys will clarify that if the question is asked again. However, there were only eight responses below 2% and 18 responses below 3%. Thus, any misinterpretation of the question likely had only a small downward bias on the results.)

Selected Written Comments from Survey Respondents on Question 3:

- Would increase the compensations by the rate of increase of workers in general, e.g., the *Economic Report of the President*.
- 10-year CPI-U services by other medical professionals.

- I would use the historical cost (PPI) for home health care.
- Based on long run trends for the median income of women who work full-time and year-round.
- Annual average growth in min. wage, 1937-2003 - 4.69%.
- Geometric average of 20 years: 1982-2002 of compensation in the business sector. I do not consider attendant care as a medical service in my projections.
- While the positions are relatively unskilled, given an aging population, the demand for attendants will be increasing over the 30-year period. Thus, one would expect attendant's wages to increase slightly higher than the 3.5% rate of inflation used.
- I had been using 2.9% based on the services by other medical provider but it is unclear where in the medical CPI these individuals (attendants) fall under. Recent inquiries to the Bureau of Labor Statistics say that in the past 5 years the average annual growth rate has been 4% and they fall under domestic services. I am considering changing to 3.9% based on professional medical services, but more research into this would be helpful.
- OES data for Home Health Aides. Expected job growth is much faster than average. However, lack of barriers to entry will keep it at a relatively low wage. Assume maximum rate of increase to be approximately .25% above CPI rate.

***Question 4**: Assume that the judge instructs that you MUST estimate a net discount rate in your forecast of economic loss for a 30-year period. The net discount rate may be based upon either nominal or real values. (Please note that for this question the net discount rate is equal to the interest rate minus the general rate of wage increase for all U.S. workers.) Complete the sentence… "I would use _____% per year as the average net discount rate over 30 future years."*

The number responding was 163. Based upon extended discussion with other forensic economists, in the previous survey it was decided that the question would determine the net discount rate directly. In three previous surveys, S1, S3, and S4, the net discount rate was determined by the difference between the real rate of interest and real wage growth, and was equal to approximately 1 percent. The results of the two most recent surveys are given below.

	(S5,4,70)	(S6)
Mean	2.13%	1.89%
Median	2.00	2.00

In this survey the net discount rate as defined in the question was 1.89%, a significant increase compared to the estimates from the first three surveys, although down slightly from the previous survey which asked an identical question. Given the relatively low interest rates in the last few years, this result is not surprising. The middle 50% range was 1.25% to 2.30%. The extreme values were -1% and 6%. Approximately 11% indicated that the net discount rate is .50% or below and 7% that the rate is 0% or below. One of the rules used by a few states is that the net discount rate should be zero, commonly known as the total offset rule. Clearly such a choice is not popular among forensic economists who responded to this survey.

Selected Written Comments from Survey Respondents on Question 4:

- There is solid statistical, economic and legal support for the 2% net discount rate.
- 5.16% is the 30-year rate using the daily treasury yield curve for 3/18/03 (the date I am completing this.) So 5.16 – 4.10 = 1.06 = net discount rate, where 4.10 is from Q3.
- The simple arithmetic difference for the previous 30-year period between current wage growth and average Treasury note yields.
- I've used a moving 20-year average for my 28 years of practice, and I believe this is the lowest NDR I've used.
- SSA OASDI's interest 6%, wage 4.1%.
- TIP bond rate 3%, minus Productivity growth of 2%, = 1%.
- Social Security's long term projections: 6.2% interest - 4.1% wage growth a little less than 2.1% NDR - the definition of NDR in this question is wrong. Currently real yields are lower than this social security estimate, and I have shaded this 2.1% down, depending on the worker's occupation recently. This is a difficult issue.
- Geometric averages for 3 mo. Treasury 1982-2002 = 5.89%, for compensation 1982-2002 = 4.07, 1.82% *(mathematically the net is actually 1.717%).
- I use the 10 year treasury and according to the 2/24/03 Philadelphia FRB. The corresponding real rate is 1.76%. The real rate of increase in the business sector wage rates over the past 10 years is 1.0%. Thus, the corresponding net discount rate is 0.76%.
- For earnings/fringe I use a real net effective discount rate of 1.76%. For household services or health care costs, I use a real net effective rate of 2.31%. The net discount rate would depend on the growth rate for the type of occupation or health care category used.
- 2.60% is the same rate as the real interest rate. From 1963 to 2002 the general rate of real wage increases (private average weekly earnings excluding fringe benefits) for all US workers for the labor force as a whole across all ages has been less than 0.0%.
- This is the average difference between the 3-month Treasury bill rate and the wages and salaries component of the ECI for the period, 1985-2002. I have been using the latter period of time since I began relying increasingly on the ECI to measure wage growth.

***Question 5**: Assume that an injured worker has 30 additional years of worklife expectancy. Regardless of your mix of government securities versus other securities that you might consider, what is the maturity of securities that you would emphasize in selecting an interest rate(s)? (Please check only one of the options below.)*

- ✓ *Short-term securities (maturing in less than one year).*
- ✓ *Intermediate-term securities (maturing in one to ten years).*
- ✓ *Long-term securities (maturing in more than 10 years).*
- ✓ *A "mixed" portfolio incorporating a variety of maturity lengths.*
- ✓ *Other (if you select this option, please explain below).*

The number responding was 172. Comparison with previous surveys indicates the following:

	(S2,11,134)	(S3,10,35)	(S4,8,9)	(S5,5,71)	(S6)
Short	17.8%	20.1%	20.3%	22.2%	16.3%
Interm.	18.9	20.1	22.6	17.1	15.1
Long	24.4	26.2	24.9	26.1	23.3
Mixed	32.2	23.5	27.1	29.0	37.2
Other	6.7	10.1	5.1	5.9	8.1

The previous survey stated that "There are two strong conclusions that can be based upon the above data. First, there is consistency in the percentage using the various portfolios of securities over the years of the survey. Second, there is little agreement concerning the appropriate maturity of the portfolio itself." The results of this survey indicate the same conclusion are valid. Although short-term securities are the choice of a smaller percentage of respondents compared to the previous survey, the results are virtually the same as the survey (S2) conducted in 1990. The percentage of those who utilize long-term securities has been unchanged for over a decade. Although the percentage that chose a "mixed" portfolio seems to have increased, only future surveys can help determine whether this is a temporary or permanent change.

Selected Written Comments from Survey Respondents on Question #5:

- I've just switched to a "mixed" portfolio this year because short-term yields are so low.
- A mix of TIPS bonds.
- Only 91-day treasury bills remove the risks of default and of unanticipated inflation. But I wouldn't object to 1-year treasuries.
- I use 5 year rates for projections up to 5 years; 10 year rates for projections up to 10 years; 20 year rates for projections over 10 years.
- I tend to use the PBGC select and ultimate rates for valuing annuity benefits for the current period.
- "Run off" rate incorporating rate of 15-year security and 70/0 (weighted average) - similar to formula used by actuaries.
- A structured settlement could pay those rates.
- U.S. Treasury strips weighted average over period of future loss.
- A mixed portfolio of securities with emphasis on longer term (maybe 5% short, 35% intermediate, 60% long).
- I generally use this short maturity range due to its minimal risk exposure. It probably makes more sense to use a mixed portfolio (and sometimes I have) but the latter can be confusing to a jury.

***Question 6**: Do you use Treasury Inflation Indexed Securities (TIIS) in developing an estimate of the interest rate or net discount rate? (check one)*

_____ ***YES*** _____ ***NO***

If you checked "Yes", please explain how you use TIIS in developing an estimate of the interest rate or net discount rate.

If you checked "No", please elaborate why you choose not to use TIIS.

The number responding was 172. This question was included for the first time in the previous survey.

	(S5,6,72)	(S6)
Percentage "Yes"	14.12%	20.96%
Percentage "No"	85.88	79.04

There has been a small increase in the percentage of individuals who use TIIS when calculating discount rates. Whether future surveys reveal that this trend will continue is uncertain. Previous surveys have shown apparent short-term trends with regard to other related questions that did not hold up in later surveys.

Selected Written Comments from Survey Respondents on Question 6:

- Not enough history yet.
- Too complicated to explain to a jury; not necessary; not liquid enough.
- Because I use a laddered portfolio to determine the market interest rate (for discounting). There are not enough in maturities to create the portfolio.
- Use the range of yields reported in Wall Street Journal, less a small tax penalty.
- I use it as a check against other methods, not by itself.
- I reference TIIS securities as one piece of information regarding a real interest rate for a particular security. I use this together with historical data, forecasts from the SS Office of the Actuary, the yield curve, and past NAFE forecasts as the basis for the NDR.
- Prefer to use tax-free AAA rated, insured, municipal bond yields.
- Discounting not done in New York.
- Haven't read the literature or looked at information about TIIS.
- In Canada we use the real return bonds, which are similar to TIIS; and I look at a variety of instruments.
- Actually, I have nothing against the use of TIIS but they still seem to be overly responsive to liquidity related risk or perhaps capital exposure issues.
- Tax ramifications, the uncertainty of future government sales and the smaller secondary markets preclude my use of TIIS bonds.

***Question 7**: When determining the interest rate for present value purposes over 30 future years, I generally use … (check one):*

- ✓ *Current interest rates.*
- ✓ *Some historical average of interest rates:*
- ✓ *I use a historical period of _____years.*
- ✓ *Some other method (please explain in Comments*
- ✓ *section).*
- ✓ *Not applicable (please explain in Comments section).*

The number of respondents was 170. In the previous survey this question was slightly different than the comparable question in other surveys. In earlier surveys, there was a category "Other or not applicable." In this and the previous survey, this option was broken into two separate possibilities. The results are as follows:

	(S1,19,24)	(S4,9,34)	(S5,7,8)	(S5,7,74)	(S6)
Historical Average	57.6%	48.0%	49.4%	49.7%	37.7%
Current Rates	24.6	34.2	31.4	31.6	47.1
Other	17.8	17.1	19.2	14.6	14.1
N/A	n/a	n/a	n/a	4.1	1.2

Even though the wording of the survey changed, all applicable surveys were included since two categories were derived from an original category. Comparing the last two surveys, use of historical averages dropped approximately 10% while use of current rates rose 15%. Again, caution should be used when interpreting the significance of these changes. These changes may be temporary (with reversion back to previous values) or perhaps signal even further changes in the future. For those who use historical rates, the average is 26.31 years. The range is from 5 to 62 years.

Selected Written Comments from Survey Respondents on Question 7:

- I use a net discount rate in almost all calculations. In the few instances where I do not use "net," I use current rates.
- Do you mean what interest to generate a net discount rate? If so, I look at data over last 40 years. If you mean what interest rate I used to discount a known future sum I would use current rates.
- I don't understand why somebody would use average historical rates since the interest a plaintiff could incur would be based on current yields, not historical.
- Actually, I use the 31-year average yield on 180 day T-bills, but I also specifically mention current rates as a reasonable alternative.
- I'm forced by state law to use 5%.
- I use CBO forecasts/projections for the first 10 years, then revert to historic average yields.
- I use the FRB Philadelphia Survey of Professional Forecasters estimate of 10-year yields for the current year.
- Look at historical rates (10, 20, 30, 50-year averages). Obtain forecasts from reputable agencies (purchase them). Research predictions. Based on above, I use a rate that synthesizes the information.
- I project future values in nominal terms with increases for inflation or other factors. Then I discount using US Treasury strips for the appropriate future year.
- When used in conjunction with the ECI, I go with 17 years. Otherwise I go with 42 years (1960 to 2002).

***Question 8**: In determining worklife expectancy, my generally preferred technique involves using (check one):*

- ✓ *Worklife expectancy tables as published by the U.S. Dept. of Labor.*
- ✓ *Worklife expectancy tables as published in economic journals*
  (e.g., Journal of Forensic Economics, Journal of Legal Economics, Journal of Econometrics, Economics Letters).
- ✓ *Median or Mean age to final labor force separation.*
- ✓ *LPE (joint probability of life, participation, and employment) approach.*
- ✓ *Ending loss calculation at age 65 or some other fixed retirement date.*
- ✓ *Combination of above techniques (please explain in Comments section).*
- ✓ *Other (please explain in Comments section).*

There were 170 responses. The results in comparison to earlier surveys were as follows:

	(S2,12,135)	(S3,15,40)	(S4,13,15)	(S5,8,75)	(S6)
BLS	71.6%	52.1%	50.9%	23.6%	12.9%
LPE Method	11.4	17.6	17.3	9.6	7.6
Fixed Period	n/a	17.6	19.1	8.4	10.6
Forensic Journals	n/a	n/a	n/a	21.4	40.0
Yrs. To Separation	n/a	n/a	n/a	6.7	1.7
Combo	n/a	n/a	n/a	25.3	20.6
Other	17.0	12.7	12.7	5.1	6.5

It is difficult to compare the current and previous survey with earlier surveys given the additional categories added to this and the previous survey. Clearly, use of the BLS tables has continued to decline significantly, primarily due to out-of-date information. The worklife estimates developed in the *Journal of Forensic Economics*, *Journal of Legal Economics,* and similar sources have to some extent provided a viable alternative for those forensic economists who wish to continue using worklife tables, and apparently are the single largest source of information. Over one-fourth of the respondents use a combination or other techniques.

Selected Written Comments from Survey Respondents on Question 8:

- Very case dependent. We use LPE in careers if not established and average retirement age for industry/profession if career is established.
- Worklife expectancy = LPE. Worklife capacity = L x (1 – Disabled) x E to a fixed age (usually SS retirement.)
- For most calculations, I will use 62.1 for men and 62.6 for women. (The average US retirement age). For blue-collar workers with no retirement plan, I will also

show an option for them working to the age at which they achieve full social security benefits.
- Get plaintiffs own estimate.
- We switch from LPE to tables contingent upon participation at injury for persons over 50.
- I use a variation of LPE. Instead of Labor Force Participation, I use the probability that the individual is physically and mentally capable of being employed based on data from the National Health Interview Survey.
- I usually use the Ciecka tables for WLE and I also use the maximum for social security age as an alternate benchmark for the jury to consider.
- We use a modified LPE, taking out participation and replacing with probability of disability. It takes out involuntary reasons for labor force withdrawal.
- How can you not use the new Skoog-Ciecka tables in JLE11(1), with means, medians, percentiles and probability intervals?
- WLE spread to age of qualification for full social security benefits to eliminate "front loading."
- I use, usually, data reported in Richards and Abele, Life and Worklife Expectancies. For some cases, especially older (past 40) workers I will use a combination of approaches. LPE is very useful for younger plaintiffs (families), but less useful for cases in which there are defined benefit retirement plans.
- The BLS tables are quite dated. I like tables that use the BLS methods but contemporary labor market data, e.g. the "non-disabled" Gamboa tables. I may also use WLE tables for specific occupations. Finally, the individual's major health history is of concern, as other factors, e.g., self-employed persons.
- I have obtained working life expectancy estimates from Statistics Canada and have published them in C.L. Brown, Damages: Estimating Pecuniary Loss, Chapter 4. These are by gender and education level and the first ones available in Canada. We are working on an internet calculator to show working life expectancy.
- Typically use WLE tables as published by the US Dept of Labor. For women, also frequently calculate through age 61 based on "Trends in Retirement Age by Sex, 1950-2005," Monthly Labor Review, July 1992. Occasionally others based on circumstances.
- In KY the focus is on loss of earning capacity, not loss of earnings. Hence I often project a range using WLE table for lower bound and full social security retirement age as upper bound.

***Question 9**: In determining the dollar value of lost household services per hour (or other relevant time period) for a homemaker not otherwise employed, I generally use (check one):*

- ✓ *The hourly wage this homemaker could have earned in the labor market as a full time worker.*
- ✓ *The cost of hiring one or more individuals to replace the particular services that were lost.*
- ✓ *The federal or state minimum wage.*
- ✓ *The cost of hiring a "housekeeper" whose role is to provide general household services.*
- ✓ *Combination of above techniques (please explain in Comments section).*
- ✓ *Other (please explain in Comments section).*

The number of respondents for this question was 174. Like the previous question, Question 9 added an option for this and the previous survey given that the respondent might use a combination of measuring techniques. Thus, comparison with the first three surveys is not completely straightforward.

	(S2,13,136)	(S3,17,43)	(S4,15,18)	(S5,9,77)	(S6)
Wage Earned	6.1%	3.0%	7.8%	4.0%	4.0%
Replacement Service	48.8	50.4	50.3	51.2	54.0
Minimum Wage	6.1	15.8	8.4	6.3	6.2
Housekeeper	18.3	17.3	18.0	14.9	10.4
Combination	n/a	n/a	n/a	12.1	12.1
Other	20.7	13.5	15.6	11.5	13.2

There has been relatively little change from previous surveys, especially S5, which had an identical question. Slightly more than half of the respondents use a technique that values household services as equivalent to the cost of replacing a particular service. A distant second is the cost of a general housekeeper. Both the wages earned by the individual (opportunity cost method) and a minimum wage are not used extensively. About one-fourth of the respondents use a combination of techniques.

Selected Written Comments from Survey Respondents on Question 9:

- Average hourly non-supervisory wage in all services industries in the US.
- Although I prefer replacement cost as a standard, I see a lot of merit in the opportunity cost method and, in some cases, the minimum wage. The "housekeeper" service "combination" is hard to find in the real labor market.
- Use the Douglass, Kenney, Miller study.
- Use average hourly rates for various types of services provided around the home per *Dollar Value of a Day* and Bureau of Labor Statistics.
- The current hourly wage of "residential care" worker found in Employment & Earnings (BLS).
- I use the hourly wage of production or non-supervisory workers on non-farm payrolls.
- I use hours from Gauger and Walker and value those hours at minimum wage.
- Courts in Canada award roughly $10 to $15 per hour. I use a combination of statistical earnings of housekeepers (so it excludes overhead, sales tax, and profit) and look at court decisions. It would be useful to know what rate all of the states use for hourly replacement costs.
- I have generally found that the opportunity cost method is better founded than the replacement cost method. The reason for this is that when viewed realistically, it is not possible to hire someone to perform the household task being replaced at strictly the time it needs to

be performed. Replacement costs would need to be purchased in larger blocks of time than necessary, thus resulting in inflated replacement costs.

- For some individuals (e.g., a long haul truck driver who is home only a few days per month) I use the federal minimum wage and usually provide a range of hours per week (say 7 to 14). Hopefully, this provides the trier of fact with some useful information. In other cases (e.g., a mother with small children), I use the "replacement cost" approach. To estimate the dollar values of replacement services, I use *The Dollar Value of a Day*.
- The cost of hiring a housekeeper is a reasonable and conservative estimate but if the homemaker was a professional who was giving up a large income to be a full-time homemaker that should definitely be considered in doing the valuation.
- A minimal wage (as opposed to minimum wage). That is a rate slightly above minimum wage ($6 per hour or so). This rate allows for some learning curve and seniority. If the person has exceptional skills in an area of household service I would consider a higher rate (e.g., a skilled handyman who earned $20 an hour for services similar to those rendered to a household).
- I survey local (bonded) maid services to determine their hourly rates. Apply those to most services.

***Question 10**: A plaintiff's attorney asks you to calculate lost enjoyment of life (hedonic damages) in an injury case. Would you be willing to calculate such damages?*

_____ ***Yes*** _____ ***No*** *(if you checked "No", please explain <u>why</u> you wouldn't do so in the Comments section below).*

There were 174 answers to this question. Although earlier surveys asked questions concerning hedonic damages, the authors felt that these questions were not adequately worded to obtain useful information. However, the two questions related to hedonic damages in the 1999 survey did obtain useful information concerning experience with this controversial measurement technique.

	(S5,10,79)	(S6)
Percentage "Yes"	23.59%	17.82%
Percentage "No"	76.41	82.18

It is clear that a large majority of the respondents would not be willing to calculate hedonic damages if asked to do so by a plaintiff's attorney. Some of the reasons are detailed below in the "Comments" section.

Selected Written Comments from Survey Respondents on Question 10:

- Generally not admissible in my state. Not familiar enough with the methodology on the literature.
- I do not think economists' estimates of hedonic value are "reliable" or "valid" and have published and testified to this effect!
- Have done so many times.
- Not allowed in my state, therefore, not worth keeping up with literature.
- I think that is best suited for the jury to determine. I consider it speculative.
- Opportunity cost of leisure time.
- Over 50% of my cases involved calculating H/D until CA Superior Court disallowed it in 1998.
- In my most humble opinion, this is an area that Ph.D. economists should not be getting involved with. We are economists and by designation hedonic damages are non-economic damages. This is outside our area of specialization. Any economist who testifies for a plaintiff in such an instance is shedding a poor light on our profession and bringing it a bad name.
- We use a valuation of advice, counsel and protection but believe hedonic measurements are too flawed to use.
- I would calculate as an alternative and add a statement that the attorney requests it.
- Hedonic damages are not recognized in Canada.
- I would explain the literature on the statistical value of an anonymous life and that there are conceptual problems with extending the interpretation of those values as measuring hedonic damages. Tom Ireland expressed those conceptual problems most clearly and forcefully.
- No reliable methods exist. If such methods ever did exist I will make such calculations.
- I will do so only with the input of a vocational/health professional who can give me an estimate of the amount of percentage of reduced enjoyment of life experienced by the injured person.
- I do not believe that an economist can calculate the dollar value of hedonic damages for a specific plaintiff. That is the responsibility of the jury. An economist may testify about how economists go about putting a dollar value on an intangible life and the results of those studies for an average statistical life, as a guideline, benchmark or assistance to the jury. The economist may also describe for the jury what it is that is being compensated for with hedonic damages, e.g., loss of leisure, loss of enjoyment or recreational activities, loss of enjoyment of pursuing hobbies, loss of interaction with friends, community and family.
- Sometimes use recreational activities.
- This is a weak yes. I would take a shot at it but I would advise the attorney that I have reservations with the main one being that there is a lack of sufficient scientific foundation to strongly support such a damage calculation. I feel more comfortable arguing against them. Also almost all of my work is in Kentucky and it is my understanding that testimony in KY courts on hedonic damages is inadmissible.

***Question 11**: A defense attorney asks you to critique an economist's report that has calculated the lost enjoyment of life (hedonic damages) allegedly suffered by an injured plaintiff. Would you be willing to critique such a report?*

_____ ***Yes*** _____ ***No*** *(if you checked "No", please explain why you wouldn't do so in the Comments section below).*

The number of respondents answering this question was 174.

	(S5,11,80)	(S6)
Percentage "Yes"	81.67%	71.84%
Percentage "No"	18.33%	28.16%

Viewing questions 10 and 11 together, respondents are far more willing to critique a report related to hedonic damages than write such a report for a plaintiff's attorney. Further, compared to the 1999 survey, there are fewer individuals who would either write a report or critique such a report.

Selected Written Comments from Survey Respondents on Question 11:

- I would be willing to review and testify as to why the results of such reports are neither "valid or reliable." I would not offer alternative values.
- I'm not sure I would accept such a commission since while I'm aware of the literature I'm not sure I'm familiar with it enough to be an "expert" on the matter.
- Hedonic damages based on willingness to pay studies are a misuse of those studies. The studies are inconsistent, theoretically, nonsensical and controversial. There is no such thing as a ubiquitous "value of statistical life".
- There is no professional conflict in answering "yes" to both Q10 and Q11. Obviously, one may disagree with the report but endorse the need to address this issue.
- To the extent that I can, mostly to provide material/references/explanation to the attorney who can then use it in cross-examination in depositions or trial or to prepare motions, pretrial, to exclude it altogether or get declarations from appropriate people. Here in CA it is no longer an issue that comes up.
- To review for logic, consistency and appearance of reasonableness with caveat I have no experience in this area.
- I have done this a number of times.
- With much more confidence than computing such damages.

***Question 12**: In the last two years, the number of cases involving punitive damages I have worked on (by either calculating punitive damages or analyzing punitive damage calculations by an opposing expert) is _____.*

This is a new question. There were 176 responses, of which 112 (63.64%) had not calculated punitive damages or critiqued a report which calculated punitive damages. 21.6% were involved in three or more cases and only 8.5% in ten or more cases over the two-year period.

Selected Written Comments from Survey Respondents on Question 12:

- Punitives are the next-door neighbor to hedonic damages. I do not see where any of the forensic economists' tools apply.
- In my local jurisdiction, punitives are determined by the jury.
- Ever increasing number of cases have punitives built into request by attorney when initially receiving case.
- On both plaintiff and defense sides. This is quickly becoming more important.
- No punitive damages in this state. Of course, punitive damages are available in federal court and I have had clients receive them but I have not calculated them.
- The public has a distorted view of this element. Punitive damages are rarely in play.
- I don't calculate punitive damages. This, in my opinion, should fall solely to the trier of fact. However, I have prepared information and given testimony for the jury/trier of fact to consider in their assessment. This includes net income (per year, per day, etc.), gross assets, net worth, gross revenue, etc. on a given company or individual defendant.
- Punitive damages are not generally awarded in Canada.
- The economic theory underlying this topic makes development economics look respectable.
- Usually I analyze financials and testify as to what a company can pay without going broke.
- I am usually asked to testify only to the net worth of the defendant. However, I am now exploring the objectives of punitive damages and what other guidelines are appropriate to change the defendant's behavior.

***Question 13**: Please assess the need for forensic economics research in each of these areas (circle one number for each area).*

There were 22 possible categories of research. In addition, the respondent could add their own categories they felt were worthy of further research investigation. Although two previous surveys asked a similar question, the categories listed are sufficiently different that a direct comparison will not be made. However, some general comments about how these results compare to the two earlier surveys will be provided.

Some respondents indicated an answer to certain categories and not others, but the number responding was in the range of 145 to 155. Respondents were asked to evaluate each category separately using a five-point scale (1-5) ranging from "Low" to "High." An average was then calculated and placed in rank order. The results are as follows:

Category	Average	Percentage "High" and "Somewhat High"	Percentage "High"
Worklife – Disabled	4.01	71.06%	45.91%
Worklife – Self-employed	3.77	65.35	30.72
Personal Consumption	3.71	63.12	20.00
Household Services	3.60	56.77	18.71

Category	Average	Percentage "High" and "Somewhat High"	Percentage "High"
Worklife – General	3.50	50.32	22.87
Medical Costs	3.45	51.27	15.38
Fringe Benefits	3.37	44.87	13.46
Life Care Plans	3.36	46.70	15.13
Daubert Issues	3.36	47.32	24.66
Small Business Eval.	3.28	44.58	18.91
Job Loss (Not injury)	3.25	40.40	12.32
Employment Discr.	3.25	40.13	14.28
Earnings Growth	3.09	38.15	10.52
Income Tax Effects	3.03	38.40	13.24
Ethical Issues	2.94	35.36	16.32
Earnings Base	2.93	30.91	8.55
Discounting	2.92	33.10	10.81
Antitrust and Comm.	2.79	25.73	11.76
Punitive Damages	2.70	30.39	14.18
Testimony Techniques	2.68	27.20	11.56
Divorce	2.67	23.44	6.20
Lost Enjoyment of Life	2.39	24.50	14.57

It is clear that issues related to worklife are at the top of the list. Worklife for the disabled is, in fact, significantly above the category ranked second. Also scoring high were personal consumption, household services, medical costs and fringe benefits. Interestingly, all of these issues have been discussed and debated for years, but respondents believe that additional research is required. In addition to an average score, the percentage of respondents indicating "somewhat high and high" and "high" are also indicated for each category. These percentages generally follow the average rankings, but there are some exceptions. "Daubert issues" has an average somewhere in the middle but almost 25% of the respondents ranked it as "high" in terms of need for future research. Lost enjoyment of life issues (hedonic damages) has the lowest average but almost 15% rated it as "high." (It should be noted that the category "Job Loss" and "Employment Discrimination" are overlapping and were both included in error. Not surprisingly, their rankings were virtually identical.)

Comparing rankings in this survey with those of the previous survey (S5), there are few changes. The top five in that survey were personal consumption, household services, worklife expectancy, medical costs, and fringe benefits. (Worklife expectancy was not broken down into three separate categories in the previous survey.) The bottom four categories were discounting, testimony techniques, earnings base and hedonic damages. Given the similarity of the rankings from the two surveys, the results provide a reasonably clear indication of what research is needed. However, the results are obviously biased towards the types of cases where NAFE members are employed. That explains the relatively low value for cases related to antitrust, commercial and punitive damages. Also, the survey results may not adequately reflect all NAFE members.

The following additional research topics were provided by some of the respondents: lost earning capacity of infants, cost of raising a child, certification of forensic experts, earning capacity of the self-employed, business aspects of forensic economics, employment after retirement, single parent families, age-earnings profiles from 2000 census, personal consumption of fringe benefits, international cases, current summary of case law, survey techniques, breach of contract, value of university degrees and occupational licenses in divorce cases, personal consumption of household services, and child support. (Not all suggestions were listed.)

***Question 14**: I have been practicing and earning income in the field of forensic economics for _____ years.*

177 individuals responded to this question. The mean number of years was 19.62, about one year greater than the mean in the 1999 survey. The middle 50% was between 13 and 26 years. Very few "novices" responded to the survey, with only 8.5% practicing five years or less. As expressed earlier, it is unknown whether the respondents to this survey are representative of NAFE. However, the results of this question imply that the respondents are "veterans" in terms of forensic practice.

***Question 15**: Looking back on the <u>total number</u> of cases for which I was hired as a consultant in the field of forensic economics in 2002, I would break down the percentage of cases as follows:*

% Cases where I did work for the plaintiff's side.
% Cases where I did work for the defendant's side.
% Other (please elaborate in the Comments section).
Total = 100%

175 individuals answered this question. This was a new question in the last survey. A comparison of the 1999 survey and this survey indicates the following:

	(S5,16,87)	(S6)
Plaintiff's Cases	66.99%	65.20%
Defense Cases	32.72	34.02
Other	0.29	0.68

There has been virtually no change in the last three years. Despite the preponderance of plaintiff cases, less than 10% of the respondents indicated that 90% or more cases were for the plaintiff. Thus, most forensic economists do have some balance in terms of the hiring attorney in their practice. (Virtually no respondents indicated that 90% or more of their cases were for the defense.)

Selected Written Comments from Survey Respondents on Question 15:

- The "other" are "pure consultation" cases. I was asked to do things such as updating social security case fees (fees to the attorney) by the CPI (or other). In these cases there are no plaintiffs or defendants as normally defined.
- Other: valuation of losses, businesses, etc. for non-litigation negotiation.
- Divorce or bankruptcy.
- This is the first year in which defense side income exceeded plaintiff side.
- Civil rights and divorce.
- I am retained by plaintiffs 2/3 of the time. I am retained by defendants 1/3 of the time. I never work for

either side. My job is to be objective and my retention agreement says so.
- We do five to seven "friends of court" reports for judges/year.
- The amount of defense work is growing roughly doubling each year.
- Review reports from both sides as a Special Master.
- Long run practice has been closer to 50/50 plaintiff/defendant. Also do corporate merger analyses and testimony.

***Question 16**: Looking back on the number of cases as a consultant in the field of forensic economics during 2002, I would break down the percentage geographically as follows:*

% Cases from consulting where the attorney(s) that hired me were located in my home state (or province).
% Cases from consulting where the attorney(s) that hired me were located in states (or provinces) contiguous to my home state.
% Cases from consulting where the attorney(s) that hired me were neither in my home state nor in contiguous states (or provinces).
Total = 100%

The number of answers to this question was 175. In surveys S1 and S5, a similar question was asked except that the respondent was to consider income earned rather than number of cases. As indicated below, the percentages for the three categories are virtually the same as earlier surveys, indicating that it likely makes little difference whether the question refers to net income or number of cases.

	(S1,5,17)	(S5,18,88)	(S6)
Home State	82.04%	78.76%	82.08%
Contiguous States	10.17	14.44	11.58
Other	7.79	6.80	6.16

It is evident that the vast majority of cases occur within the expert's home state, and this has not changed. 86.3% receive over half of their consulting cases within the home state and 24% receive all of their cases within the home state. On the other hand, only 6.2% receive over half their cases from contiguous states, while 2.90% receive over half their cases in non-contiguous states or in other countries.

Selected Written Comments from Survey Respondents on Question 16:

- I prefer cases within 100-150 miles of my home, although I have worked on cases beyond that mileage but I prefer not to. Why? In part, attorneys should be able to hire experts in their local market.
- Live in NJ. Large practice in New York City.

***Question 17**: My total annual, earned income in 2002 (in percentage terms) came from the following sources:*

% Faculty salary.
% Administrative salary.
% Net income (consulting) in the field of forensic economics.
% Net income in other consulting fields.
% Other (please elaborate in Comments section).
Total = 100%

171 individuals responded to this question. In the previous survey, the answers to this question showed significant change from the first survey. The results of this survey demonstrate that this change likely is a permanent shift in the sources of income for forensic economists.

	(S1,1,15)	(S5,19,89)	(S6)
Faculty Salaries	45.16%	26.45%	22.94%
Administrative Salaries	6.36	3.15	3.77
Consulting, Forensic Econ.	34.28	50.95	52.87
Consulting, Other	10.12	14.82	13.89
Other	4.08	4.63	5.95

The two most recent surveys clearly show that there is a large increase in the percentage of income derived from forensic consulting and a corresponding drop in income from faculty salaries. Nearly 58% received no faculty salaries whatsoever. On the other hand, 17% received all of their income from forensic economic consulting.

This increase in percentage of income derived from consulting, especially from 1990 to 1999, can be seen more clearly in the following table:

	(S1,1,15)	(S5,19,89)	(S6)
P <= 0.10	21.4%	11.04%	12.86%
0.10 < P <= 0.20	21.4	15.11	14.62
0.20 < P <= 0.30	17.6	9.30	11.70
0.30 < P <= 0.40	8.4	8.72	8.77
0.40 < P <= 0.50	9.9	12.79	7.60
P > 0.50	21.3	43.02	44.45

Over 44 percent of the respondents received at least half of their income from forensic economic consulting.

It should be noted that the data as presented cannot determine which of the following two hypotheses are correct: 1) Forensic economists presently in practice are reducing their academic commitment and placing more emphasis on consulting. 2) Forensic economists who are academics are retiring and being replaced by younger consultants who have little or no experience teaching. The reason is that the survey has not attempted to determine the specific individuals responding to each survey.

Selected Written Comments from Survey Respondents on Question 17:

- FE percentage is this high primarily because academic salaries at my institution are so low.
- 50% life care plans and vocational rehabilitation expertise.
- Financial and budget consulting for TV production.
- Other income includes required Keogh pension payment, real estate income, dividends and interest and social security. Half my earnings from forensic economics go to marginal income taxes and social security, but I like the challenge so I'm still active although I have dropped my corporate work.
- Other represents publishing.
- Retired professor elected to serve on city council.
- I am on salary with my firm. However, for ease of response, I have indicated that my earned income is derived through work in forensic economics. This may not be the accurate response, however, given the

choices. Some of the income I receive from my company comes from other sources.
- CEO of nonprofit research and educational foundation.

***Question 18**: Looking back over 2002, I would estimate that the number of cases I had as a consultant in the field of forensic economics came from the following types of cases:*

% Personal injury/wrongful death.
% Antitrust /commercial cases.
% Labor cases (termination, harassment, discrimination, etc.).
% Divorce cases.
% Other types of cases (please elaborate in Comments section).
Total = 100%

The number responding to this question was 171. Like Question 16, the corresponding question for surveys S1 and S5 referred to net income as opposed to number of cases. Therefore, comparison with these surveys is not exact. But Question 16 indicated that this change made little difference. This conclusion is evident in this question as well as indicated in the table below.

	(S1,8,18)	(S5,20,91)	(S6)
PI/WD	69.24%	66.07%	69.40%
Antitrust	11.62	12.25	7.85
Labor Cases	10.21	11.72	12.17
Divorce	5.16	3.42	5.14
Other	3.77	6.54	5.64

Although Question 17 indicated that more forensic economists are no longer teaching, the type of cases for which they consult has changed very little. 75.86% of the respondents designated that at least half their caseload was personal injury and death cases, while nearly 20% indicated that at least 90% of their cases were of this type. The other four categories had only a small percentage of respondents earning over 50% of their income from that type of case (less than 4% for any category). As indicated in the "Comments" section below, some individuals categorized cases as "Other" when they could have been identified otherwise. For example, lost business profits and wrongful termination cases probably belong in the second and third categories.

Selected Written Comments from Survey Respondents on Question 18:

- Medical monitoring and punitive damages cases.
- Statistical analysis in legal challenge of a law passed in Florida.
- Wrongful termination, sexual harassment.
- Commercial costs such a breach of contract.
- 9/11 cases.
- Products liability including "defective services" short of malpractice. Majority in agriculture.
- Federal cases involving pensions.
- I don't consider antitrust cases as forensic economics. Also, percentages don't tell the full story because antitrust cases are much larger and more complex.
- Present valuation of services received for estate tax purposes. Present value of services rendered for estate settlement purposes. Business loss.
- Lumping antitrust with commercial is misleading. I do very little anti-trust and I'll bet that is true of the average NAFE member.
- Assessment of business disruption.
- Child custody cases where the employability and earning capacity of a spouse is an issue.
- Expert witness in labor arbitration (compulsory binding interest arbitration - e.g., for police, firefighters).

***Question 19**: Since September 11 (the date of the attacks on the World Trade Center Towers), have you taken any cases stemming from the attack involving forensic economics*

...on a pro bono basis for consulting?
...at a discounted rate from what you normally charge for consulting?
...at your normal rate for services?

The question asked the respondent to indicate "Yes" or "No" to each option. This is obviously a new question. It is difficult to evaluate because the number who answered was not the same for each option – specifically, the respective numbers are 167, 157, and 152. Further, it is certainly possible for an individual to answer "Yes" to more than one option if they were hired in more than one case related to the World Trade Towers. (There were, in fact, nine respondents who did indicate more than one response with a "Yes" answer.) Despite these problems, the numbers are revealing:

	Yes	No
...on a *pro bono* basis for consulting?	15.56%	84.44%
...at a discounted rate?	8.91	91.09
...at your normal rate for services?	5.26	94.74

Of those who did consulting for this type of case, the majority did not charge. The total percentage who did any type of consulting cannot be determined by adding up the percentages indicating "Yes" since, as suggested above, some individuals could respond "Yes" to more than one question. Of all 172 individuals who responded to any part of the question, 133 indicated "No" to all three parts. This implies that 22.67% worked on cases related to the attack on the World Trade Center Towers.

***Question 20**: If you checked "Yes" to <u>any</u> of the three situations above, what unusual or unique factors did you have to deal with in your analysis?*

Selected Written Comments from Survey Respondents on Question 20:

- Individual was close to an advanced degree which would have increased her salary substantially.
- Attorneys want to treat each case as a special case, whereas Feinberg wants to streamline and use guidelines.
- I wanted to maintain objectivity by charging, but at a discount.
- I have volunteered to work pro bono for up to 3 cases per quarter. Have yet to have a case.

- Some dependents were citizens of other countries, such as India.
- All my cases (about 30) are high wage/income people. Average is $600,000/year; several are about $6,000,000 year; one is $14,000,000/year.
- The part that collateral source payments are deductible.
- The Special Master's procedure is quite limiting using normal style. The incentive of attorney to get a big number was higher than normal. I felt compelled to push the envelope given how the Special Master does his job.
- One case was a rare 9/11 survivor - severely impaired and ultimately had to discontinue employment.
- An attorney wanted me to use a growth rate as experienced in the financial sector from 1997-2000. I believed this to be much too high as a basis for projections over the next 20 years.
- No unique problems, just the more structured and detailed report format.
- I did work for families of my students, but not in a formal way for their lawyers.

***Question 21**: What is the highest educational degree you have obtained?*

This is a new question with 173 individuals responding. The answers were quite varied and included numerous combinations of degrees. It was decided to limit the number of options to the three which are listed below, along with the percentages.

	(S6)
Ph.D., DBA and Ph.D./J.D.	67.05%
MA, MBA, and ABD	25.43
BA, BS, and CPA	7.51

About two-thirds of the respondents have the equivalent of a Ph.D. degree, while approximately one-fourth have an equivalent to a Masters degree. Some have suggested that answers be analyzed by level of education (or other variables), but this was not undertaken. As discussed in the previous survey, such an analysis could raise sensitive issues and affect response rates of future surveys.

***Question 22**: Suppose a fellow economist calls you up and says that he/she is testifying for the first time and would like to pick your brain based on your experience in the courtroom. What would be the one or two tips you would pass on to make this first appearance a bit smoother and less traumatic for your fellow economist? (The topics may include any area: methodology, personal appearance, manner of presentation, etc.)*

Selected Written Comments from Survey Respondents on Question 22:

- Dress conservatively, make eye contact with the jury, and keep your testimony as simple as possible. Treat jurors like students. Do not respond with anger to hostile cross-examination. Remain calm, competent, and confident.
- Tell the truth – "I don't know" is within limits of frequency, a legitimate answer to some questions. Do not be a "smart aleck" on the stand. The expert's demeanor and manner count as much, if not more, as what he/she says of "substance."
- Write the questions for the attorney. Use as many illustrations/graphs as possible.
- I would send them one of my old reports as a "goby." I might also send them a report of other economists. Would refer them *to Determining Economic Damages* by Martin , *Journal of Forensic Economics*, and *Journal of Legal Economics*.
- Know the details of the case file and your report very thoroughly. Review your report and all its calculations. Suggest to the attorney that you want to prepare some Q & As to elicit your testimony and have a conference (by telephone or in person) with him or her shortly before you testify to go over these questions and your answers.
- Sit back in the witness chair and talk to the jury, not the attorney. Have worked out in your mind how to explain economic issues like discounting to present values or net discount rates before you enter the courtroom. Find everyday example so that the jury can relate to what you are telling them.
- Never, ever try to fool a jury. Talk plainly. Look them in the eye. Be nice to the attorney on the other side during oral explanation. My motto - low numbers bring high awards.
- 1) "Foundation" or analysis should be empirically established, e.g., in particular earnings pre-accident including fringe benefits, earnings post accident dependent on rehabilitation expect. Also, structural basis of work-life expectancy and discount rate. 2) In deposition or court, answer each question confidently and if you don't know the answer to a question or there is a shortcoming to the analysis - reveal such. 3) Maintain independence - you are neither the plaintiff's or defendants' expert. You are an "objective" evaluator determining a monetary loss.
- Don't be too accommodating to the attorney hiring you. Maintain your professional standards and reputation as first priority. Don't try to be a lawyer advocate. Stick to your professional expertise and scrupulously avoid being drawn into partnership on behalf of your client.
- Just remember you know far more about economics than either the defense or plaintiff's attorney. When a question is asked, answer to the jury. Don't look to your attorney for help. Zero in on one or two of the jury who seem to understand what is happening. I usually ask my attorney who are the bright ones on this jury and zero in on them. It makes me comfortable to know someone seems to know what I am saying.
- Read the literature concerning accepted methodology and have support for the methods used. Listen to questions carefully and don't be afraid to ask that a question be repeated. Don't react emotionally to "bait" offered by opposing counsel. Never advocate. Your report is intended to expand the information available to the

judge or jury, not to decide the case. Don't underestimate the capacity of a jury, but at the same time, keep it simple.

- I come from a research university. My advice to the novice (assuming he/she also is a university professor) is to act as if the courtroom were a classroom and you are there to instruct the judge and jury in a very serious matter of great importance to the plaintiff or defendant. You should treat your testimony as if it were a teaching experience.
- Answer all questions (your lawyer and the others) truthfully, directly and fully. It is not your job to win the case -- don't get yourself disqualified in your first at-bat. Keep your answers brief. You are not the centerpiece.
- Try to take a look at the courtroom beforehand, even if it is just a quick glance through the door before you enter. First impressions are important and you don't want to fumble around trying to figure out on which side of the judge you will be sitting. You need to walk in already knowing where you need to go. Talk slowly and answer the question only. Make your attorney do the work of guiding you through direct until you get a better feel (through experience) as to how to take a little control and assert your views a little bit while appearing to just be responding to the question at hand.
- Readily answer hypothetical questions where the answers are of apparent value to the opposite side. In other words, don't hedge in either direct examination or cross-examination.
- I am utterly uninterested in seeing scarce resources - my time and that of others wasted on this. It has been asked and answered. We are not the experts here - our lawyers are. There are interesting areas of FE to probe like the Gamboa tables, the role of the 9/11 guidelines, mitigation that should take precedence. Generally, too much is made of "comparability with past surveys" in this survey. Break the mold!
- Anxiety is expected and normal and fades over time. Maintain composure regardless of internal turmoil. Resist temptation to be defensive or argumentative, but on the other hand do not yield to opposing counsel's suggestion simply to avoid confrontation or hostile attacks. The best preparation for a positive trial outcome is an unassailable report that is complete in terms of scenarios and research.
- Take your time in answering questions. Think them through and do not hurry your response. Provide only the information requested. "Yes" or "No" are often the appropriate answers. "That depends" is also an appropriate response. Provide additional detail when it is needed to clarify your response. Face the judge and or jury when you testify. Avoid nervous habits on the witness stand. Do not be afraid to say I do not have enough information to respond to that question, or that is beyond my area of expertise. Wear a good suit.
- Be sure you discover the essentials of the case so that you are not surprised to find out when you testify that important considerations that you should have known about were not told to you by the attorney. Obtain as much direct information as you can about the details upon which your analysis is based such as employment records, fringe benefit brochures, etc. Be up front about sources and materials you relied upon besides specific records for the claimant.
- Put everything into clearly organized tables. Tell the attorney with whom you are working to create large prints of your tables and have an easel to put them on in front of the jury (judge). Have the attorney qualify you, then have you identify your tables, then invite you to explain them. Walk through the tables slowly explaining everything. Use a colored marker to circle the important number conclusions.

***Question 23**: Please use the space below to outline or discuss any ethical dilemmas or issues you believe to be important for forensic economics practitioners.*

Selected Written Comments from Survey Respondents on Question 23:

- Some economists do whatever the employing attorney wants, even if it clearly biases the jury. For example, project earnings growth at 4 or 5 percent without discounting "just to show the jury what a person might earn over his/her lifetime." Then acknowledge on cross-examination that future income should be discounted to present value. As the work of Kahneman and Tversky has shown, putting a big number in front of a jury, even if it is meaningless, will bias their estimate upward (a process called anchoring).
- This one may be more practical than ethical. I find attorneys on both sides demanding (a) more documentation by the expert, and (b) more defense of the documents by the expert. Those document demands are both on "case specific" and "public" documents. Much of it is simply for debating points (to see if the expert is really prepared.) But much is also Daubert-related. I would like to see this issue addressed in the forensic journals.
- Too many reports don't allow another economist to understand how opinion is arrived at.
- Stop arguing over hedonic damages. There is not a single economist there who writes against hedonic damages who would allow his family to accept only lost wages as compensation in the event of his wrongful death! Stop disguising "punitive" damages as hedonic damages. Call them what they are - hedonic damages!
- CPA's flooding this field seem to be making an old problem much worse. Some "experts" will simply take important assumptions from their attorney and make calculations. I believe this to be unethical. Some economists and many CPA's do not.
- What to do in case the attorney provides assumptions that you think are questionable. If the assumption is contrary to economic methodology, it should be questioned. The dilemma arises if the attorney states either: a) the assumption is based on legal parameters (which may or may not be the case), or b) the assumption is

based on the inability of the attorney to obtain adequate information.

- Dealing with experts, typically accountants, with conflict of interest because of their auditing roles.
- Be careful to inform attorney retaining you that any information he shows you is not privileged and all information in your file must stay there.
- Attorney requests vs. proper economics, e.g., using a retirement age when I almost always use worklife. Sometimes they still request retirement even when not indicated. If there is enough foundation to use retirement age I'll do so, but there must be good foundation for specific attorney request.
- Their reports should be transparent enough for other economists to replicate their computations. Statistical assumptions should have statistical foundations. Be careful about earning capacity. "Capacity" is a vaguely defined word. We all have the "capacity" to be president of the U.S., but the probability is slim!
- Attorneys list you as an expert without your knowledge or consent. Attorneys fail to supply all the information available regarding the economic issues. Opposing economist has information you don't have.
- I am always uncomfortable when an expert's report turns up that is outside my area of expertise, but who I know to be not very competent from general experience on other cases. I usually suggest to the attorney that he might want to look into matters to be sure everything is solid.
- Do not permit an attorney to modify a report unless you believe you are in error. Don't permit an attorney to try to "script" your testimony.
- Cases of disability that indicate the plaintiff may be compromised in terms of performing their job safely (e.g., nurse, nuclear plant operator) and are still on the job. The expert faces a dilemma between protecting the public interest and not further diminishing an injured person's remaining capacity to work (and maybe being accused of trying to increase plaintiff's damages). This is a very real situation that occurs from time-to-time.
- There is too much latitude in the forensic economics profession. Any Ph.D. economist can write a report and testify. There are no standards. Credentialing is an anathema in the economics profession and deservedly so for research economists. However, forensic economics (at least PI/WD) needs to be standardized and practitioners certified after suitable, demonstrated learning. Unfortunately, courts do not know which FE's to believe because lawyers shop FE's and FE's often provide what clients want rather than a professionally determined product.
- I personally believe that we have to be proactive in confronting charlatans and "hired guns" in FE. I think that with caps on non-economic damages and punitive damages increasing, FE's that promise "big numbers" and no ethics will prosper and discredit us all. I will do anything to discredit such individuals as long as it is legal and out front.
- Work for ethical, competent and hardworking attorneys only and you'll avoid most, if not all, of the ethical problems that confront experts. Many ethical issues arise when trying to establish a growing practice since most experts at this stage will be reluctant to thin away business and may feel pressure to please a client who sends lots of business.
- I believe that our ethical issues are well covered in the NAFE "Statement of Ethical Principles of Practice" and the AAEFE "Statement of Ethical Principles."
- Defense FE's who "cherry pick" damage models to get a lower number. Rather, they should attempt to accurately assess economic damages of injury victims regardless of plaintiff's expert's opinion.
- The difficult tradeoff between precision and complexity on the one hand and simplicity and being easy to understand on the other. As research in FE progresses, we discover more precise ways to conduct damages but at a loss of clarity.
- Assumed to be a "hired gun" if you do mostly forensic work. There are some advantages to having a large forensic base, namely the firm can afford to invest in numerous resources and data and is exposed to so many diverse cases. As well, the "hired gun" reputation can be avoided by using a consistent approach regardless of the "side" that one is hired by, and in fact adhering to this consistency usually enhances the client base.
- What to do when you have written a valuation report for a case that has not been tried and you later discover a flaw in your methodology. The report has already been given to opposing counsel.
- I think that the purchase of expertise through some of the certification courses is a serious issue that can make for some really unprofessional analyses. This, combined with some of the software packages that I have seen utilized, makes for some real credibility problems.
- Accepting work that one is really qualified to do. Working cooperatively with other experts, such as vocational rehabilitation and life care planning experts, and not making alterations to their opinions even if you may disagree with them. Unless the FE is also qualified to critique the work of such experts, I believe it is not ethical to make such alterations.
- I am increasingly dismayed by economists on both sides who work the numbers to achieve the maximum/minimum possible. They don't disclose assumptions. Don't show their work. Introduce taxes in a state where it is clearly not allowed. Make statements and judgments regarding the capacity of the plaintiff that are outside their expertise.
- Being consistent in methodology when retained by the plaintiff side vs. the defense. When attorneys say to you "this is off the record" when in reality nothing is "off the record". When attorneys provide documentation that they later tell you that they want back or they don't want in our file but once the expert has seen or reviewed it, it is discoverable.
- When the documents come from the litigant and not through the lawyer and you receive documents you

shouldn't have received (e.g. personal tax returns). When you have spoken to another expert on the same side (different area of expertise), then the lawyer excuses that other expert. You swear to tell the truth, the whole truth and you can't mention taxes, collateral sources, etc.

- Requests by retaining attorneys who want expert to cut fees when outcome in trial/settlement is below expectations. Defense experts who advise how to attack plaintiff's experts on personal issues or otherwise unrelated to appraisal-specific issues. Holier than thou defense experts.
- From time to time the NAFE should publish some summaries of actual cases involving timely and universal issues. We are in a changing environment and it would be interesting to see how some of the social and economic issues of our time are being presented to the courts.
- Certain attorneys may have specific requested tasks. As long as the forensic economist is careful to state the assumptions on which a projections is based and answers all questions honestly, I believe that it is OK to honor the attorney's request. The economist is still being objective in this situation (in my opinion). Forensic economists should leave a well-explained roadmap of sources, assumptions, and computation procedures so that an opposing economist has the opportunity to verify sources and replicate projections.
- FE practitioners should update their analytic methodologies and techniques in accordance with advances in the field regularly found in the published literature (academic, industry, and government). Current opinions presented in reports should be based more on such evolving advances and less on old "consensus" opinion, much of which reflects the inertia that often sets in when years (decades) of experience begins to calcify. Continuing use of 65 as the age for the end of worklife, because it is the age of attainment for maximum social security benefit, for many people provides a good example.

***Question 24**: Please use the blank space below for any additional comments you wish to make about this survey.*

Selected Written Comments from Survey Respondents on Question 24:

- This survey is a good thing to do. It gives FE's a sense of correctness in areas where he/she agrees with the majority, and pause for reflection when he/she does not agree.
- I would like to see questions regarding retainer fees, unpaid balances at time of trial or deposition, different hourly rates for reports and depositions, fixed fee for service vs. charging according to time required.
- See question 22. Where was wage growth, real and nominal directly addressed? Where was the treatment of age earnings profiles - when it is done, how and why? In reporting results, please consider breaking responses out by training (economists and others), experience, level of education, and practice concentration. Reach out to people who do this work outside of NAFE and evaluate the selectivity bias of NAFE membership. I would like to see all responses scanned into a big PDF file and made available. It should be typed into a word processing file to avoid handwriting recognition.
- I would like to see a few questions about how other practitioners approach issues in household services, personal consumption allowances, age earnings factors and disability-related data and techniques.
- I find the publication of the results of this survey to be very useful.
- The survey is generally well structured. However, in the future you may wish to organize it in such a way that it lends itself to further statistical analyses by the way the questions are posed. For example, questions on ranking could lead into a Likert scale analysis.
- Some of these questions are less relevant in Canada than the U.S. but I've answered all of them except the one about TIIS. Good Luck!

Summary and Conclusions

Twenty-four percent of NAFE members responded to this survey questionnaire; they stated an average of 19.6 years in forensic practice. Many of the results have been compared to results from previous survey studies in 1990, 1993, 1996, and 1999. The authors are most appreciative of the thoughtfulness that was evident in quantitative responses and in descriptive comments.

The 2003 survey results are useful to a forensic economist, especially as they may be compared to past survey results. The differential between the MCPI and the CPI had fallen from 2.7 percent in 1990 to 1.6 percent in 1999. This downward trend was reversed in the 2003 survey results, as this differential climbed to 1.9 percent. The net discount rate for thirty future years had been approximately one percent in surveys from 1990-1996 but increased to 2.13 percent in 1999. (The net discount rate question was directly asked beginning in 1999.) The 2003 surveyed rate decreased to 1.89 percent but remained significantly above the surveyed values prior to 1999.

Many responses in 2003 reinforced the 1999 survey responses. Those using TIIS rates for discounting increased from 14.12 to 20.96 percent of respondents but remained a minority. The replacement services method of calculating household services remained the most popular approach with 54 percent of respondents using this method; those favoring other methods were spread among several alternatives. Approximately 80 percent of respondents remained unwilling to estimate hedonic damages. In response to a new question, 63.6 percent stated that they had never worked on issues related to punitive damages. From 85-95 percent of respondents had not worked in cases related to the 9/11/01 disaster.

Responses to questions relating to forensic practice did not vary significantly from the 1999 responses, even though the 2003 questions focused on number of cases versus income.

Approximately two-thirds of cases were plaintiff-side versus defense-side. Personal injury and wrongful death were almost 70 percent of all cases, as was true in 1999. The per-

centage of cases from the respondents' home state was 82.08 percent. A significant trend in the sources of income for forensic economists was confirmed by the 2003 survey results. In the 1990 survey, 45.16 percent of income came from faculty salaries, 34.28 percent from forensic economic consulting, and 10.12 percent from other consulting activities. In the 1999 survey, these percentages changed dramatically to 26.45 percent, 50.95 percent, and 14.82 percent, respectively. The 2003 survey percentages were 22.94 percent, 52.87 percent, and 13.89 percent, respectively. Two-thirds of the earned income of NAFE respondents now comes from consulting activities.

Finally, 2003 respondents ranked worklife expectancy, personal consumption, and household services as the three most important areas for future research in forensic economics. These were also the top three categories ranked by 1999 respondents. Responses to this 2003 survey are directly relevant to two of these three topics.

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Taxation Considerations in Economic Damages Calculations

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Abstract

Present value cash flow calculations for economic damages should be performed on an after-tax basis, regardless of whether the damages award will be subject to taxation. Pre-tax calculations can arrive at incorrect results, particularly where accounting income and cash flow do not match. If the damages award will be subject to taxation, then the analytically correct approach is to take the result of the after-tax damages calculation and simply "gross-up" for expected taxes, rather than perform the present value calculations on a pre-tax basis.

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As the relevant literature discusses quite extensively,[1] economic damages in commercial litigation cases are typically determined as the difference between two scenarios: a non-breach/non-injury (or hypothetical "but-for") scenario and a breach/injury (or "actual") scenario. Elements that are common to the two scenarios can be ignored -- as they simply net out in any comparison -- but the analysis must incorporate all elements that are different. Then the analysis must identify the cash flows associated with the two scenarios' various elements.

Finally, if the cash flows occur over an extended period of time, they must be adjusted for the time value of money. Future cash flows are adjusted back in time using a discount rate to produce their equivalent present value as of

[1] See, for example: John D. Taurman and Jeffrey C. Bodington, "Measuring Damage to a Firm's Profitability: Ex Ante or Ex Poste?", *The Antitrust Bulletin* (Spring 1992); James Plummer and Gerald McGowin, "Key Issues in Measuring Lost Profits," *Journal of Forensic Economics* (6(3) 1993); Vincent E. O'Brien and Joan K. Meyer, "A Guide to Calculating Lost Profits," *The National Law Journal*, (January 29, 1990); William B. Tye, Stephen H. Kalos, and A. Lawrence Kolbe, "How to Value a Lost Opportunity: Defining and Measuring Damages from Market Foreclosure," *Research in Law and Economics* (Volume 17); Franklin M. Fisher and R. Craig Romaine, "Janis Joplin's Yearbook and the Theory of Damages," *Journal of Accounting, Auditing and Finance* (Winter 1990); R.F. Lanzillotti and A.K. Esquibel, "Measuring Damages in Commercial Litigation: Present Value of Lost Opportunities" *Journal of Accounting, Auditing and Finance* (Winter 1990); James M. Patell, Roman L. Weil, and R. Craig Romaine, "Accumulating Damages in Litigation: The Roles of Uncertainty and Interest Rates," *Journal of Legal Studies* (June 1982).

some common date.[2] Discounting thereby allows dollars from different years – which can be thought of as different "currencies" -- to be expressed in a common measure so that they can sensibly aggregated and/or compared. Properly performed, the damaged party would be indifferent between the lump sum present value as of this common date and a specified stream of payments extending into the future.

Concerning the choice of this common date (i.e., to which the cash flows will be discounted), an important complication arises, especially when a considerable lag exists between the time of the breach/injury and the time of trial/award. One approach is to first discount all cash flows back to the initial breach/injury date, then compound them forward -- often at a rate that is specified by the applicable legal statute -- to the trial/award date. Another approach is to discount all future cash flows -- with "future" defined from the perspective of the time of trial/award -- back to the trial/award and separately compound all past cash flows forward to the trial/award date. Depending on the different rates specified for discounting and compounding, and depending on the types of cash flows involved, this at first seemingly mere mechanical difference can have a drastic impact upon the results.[3]

Yet another distinction is that the first approach described above is often -- though not always -- conducted from an *ex ante* perspective (i.e., drawing on only the information that was known at the time of the breach/injury) whereas the latter approach is conducted from an *ex post* perspective (i.e., utilizing all available information known to the analyst). Sometimes different discount and compound rates are used for different parts of the calculation, corresponding to which cash flows are "known" and "unknown" as of certain dates.[4]

Many aspects of the summary contained in the preceding four paragraphs are expounded upon in great detail in the relevant literature. However, a surprising paucity of research focuses on the adjustment of the cash flows to an after-tax basis.[5] This article's goal is to demonstrate the importance of this adjustment, regardless of whether the damages award will be subject to taxation. Note that the article's goal is not, however, to discuss case law precedent regarding taxation issues in damage awards.

Background

In a typical commercial litigation matter, but for a contract breach or injury, the plaintiff would be able to earn certain cash flows, and would incur income taxes on the accounting income associated with those cash flows. As a result of the breach or injury, it will earn some other stream of cash flows, which will also include income tax effects. If liability is found, the plaintiff will also receive an economic damage award, which similarly is subject to income taxation. This article postulates -- and a review of the previously cited relevant professional literature generally confirms -- that the damage award should be set to create an after-tax equivalence between the non-breach scenario and the sum of the damage award and the breach scenario. That is, the plaintiff should be in the same position after taxes with its award, that it would have been in on an after-tax basis with no breach.

As a general rule, net present value calculation should be computed on an after-tax basis, using an after-tax discount rate. Brealey and Myers state:

> *"You should always estimate cash flows on an after-tax basis. Some firms do not deduct tax payments. They try to offset this mistake by discounting the cash flows before taxes at a rate higher than the opportunity cost of capital. Unfortunately, there is no reliable formula for making such adjustments to the discount rate."*[6]

Thus, in simple algebraic terms, the equivalency postulate for economic damages is:

NPV(AT Non-Breach Cash Flows) = NPV (AT Breach Cash Flows) + (1-T)*Award

where "T" represents the tax rate applied to the damage award.

Thus, from a theoretical perspective, "making the plaintiff whole" requires "grossing-up" the difference in after-tax net present values for the tax. That is:

Award = [NPV(AT Non-Breach Cash Flows) - NPV(AT Breach Cash Flows)]/(1 - T)

Two alternative methods may be contemplated. Pre-tax cash flows could be discounted at a pre-tax discount rate; or, pre-tax cash flows might be discounted at an after-tax dis-

[2] Typically the calculation is performed as the difference of the two scenarios' present values, rather than the present value of the two scenarios' differences in each year. Arithmetically, the latter approach will produce the same result as the former if the same discount rate is applied to both scenarios for all cash flows. But if the two scenarios entail cash flows of a significantly different nature and riskiness, then this could merit using a different discount rate, as the discount rate determination is generally tied to the cash flows' risk. For example, the breach scenario could entail not only a lower magnitude of cash flows but also a greater uncertainty, and hence these cash flows should be discounted back in time at a higher rate that would be appropriate for the non-breach scenario. In such a case the present values of the two scenarios should be computed separately and then their difference should be taken, as opposed to computing the present value of the difference between the two scenarios' cash flow in each year. Situations that would merit such an approach, however, are likely to be rare.

[3] For a more detailed discussion of this issue, see: Franklin M. Fisher and R. Craig Romaine, "Janis Joplin's Yearbook and the Theory of Damages," *Journal of Accounting, Auditing and Finance* (Winter 1990); R.F. Lanzillotti and A.K. Esquibel, "Measuring Damages in Commercial Litigation: Present Value of Lost Opportunities" *Journal of Accounting, Auditing and Finance* (Winter 1990).

[4] Without commenting at length on this distinction, the division between deeming historical cash flows as "known" and future cash flows as "unknown" is somewhat artificial. For example, even if -- with the aid of hindsight -- historical input prices, output prices, interest rates, etc., are all known, the but-for cash flows that would have resulted in the past are still not known with certainty, since a myriad of other factors may have conspired to affect the cash flows in a manner that is beyond the scope of the analysis.

[5] For example, in Patrick A. Gaughan, *Measuring Commercial Damages* (2000), only two pages in a 403-page book discuss taxation considerations, and in the Roman L. Weil, Michael J. Wagner, and Peter B. Frank (eds.), *Litigation Services Handbook: The Role of the Accountant as Expert* (1995), only two pages in one article out of 12 articles on commercial damages discuss taxation considerations.

[6] Richard Brealey and Steward Myers, *Principles of Corporate Finance* (second edition, 1984), page 86.

count rate. Unfortunately, both of these approaches have the potential to produce inaccurate results.

The following sections demonstrate that the former approach always produces an inaccurate estimate of damages (on either a pre-tax or after-tax basis), whereas the latter approach will produce an accurate estimate of pre-tax damages only when accounting income is equal to cash flow and when tax rates are constant over time.

Evaluation of Alternative Approaches in the Commercial Damages Context

Three simple cash flow scenarios ("cases") illustrate the impacts of these less-accurate alternatives. All cases involve a ten-year stream of income, depreciation, capital expenditures and taxes, and rely on the same set of economic and financial parameters, i.e., inflation, tax rate, and weighted-average cost of capital ("WACC") as the basis for the discount rate. All cases assume that the only differences between income and cash flow are capital expenditures and depreciation (thereby ignoring a plethora of other factors such as working capital changes, deferred taxes, etc. that should ideally be reflected in a more detailed cash flow analysis, if feasible).

Exhibit 1 assumes that depreciation and capital expenditures are the same in each period, such that cash flow and taxable income are the same. Exhibit 2 retains the same pattern of capital expenditures, but in which, more typically, the depreciation expenses lag the capital expenditures. Exhibit 3 assumes that depreciation expenses will exceed capital expenditures. Each case has cash flows evaluated on both a pre-tax and an after-tax basis.

For each case, net present value is calculated three ways. In the first section of calculations for each case, after-tax cash flow returns to all capital (i.e., asset cash flows) are discounted at the after-tax WACC, and then also grossed up for taxes (by dividing the prior result by the sum of 1 minus the tax rate). In the second section, pre-tax cash flow returns to all capital (asset cash flows) are discounted at both the after-tax WACC and the pre-tax WACC.[7]

In Exhibit 1, the net present value of after-tax cash flows, discounted at the 10.3% after-tax WACC, is $33.48. Making this value a damage award expressed on a pre-tax basis would require grossing up for taxes to $53.14 (i.e., $33.48 divided by the sum of 1 minus the tax rate). This value represents the conceptually correct damage award, which can be then compared to the alternative calculation methodologies sometimes employed in damages analyses.

In this very simple case, the $53.14 value also results from taking the net present value of the pre-tax cash flows at the 10.3% after-tax WACC yet not grossing up for taxes. Thus, in simple circumstances, where income equals cash flow, discounting pre-tax cash flows at the after-tax WACC may produce an exactly equivalent value for economic damages. Another simplifying factor in this hypothetical case that allows discounting pre-tax cash flows at the after-tax WACC to yield the correct result is that the tax rate is constant throughout the ten-year period, and also identical to the tax rate applicable to the award. As Harold Dilbeck notes:

> *Some forensic experts propose to discount before-tax cash flows at the after-tax discount rate. Performing this calculation in this manner produces the algebraic equivalent of computing the present value using after-tax numbers and then dividing the result by one minus the tax rate. It produces a correct arithmetical result for taxable awards, provided tax rates remain constant over all periods, including the period of the award. This procedure accomplishes the gross-up and the discounting in one step. It obscures, however, the difference between the taxability of lost earnings and investment income and the taxability of the award itself; we therefore advise against this arithmetically equivalent, but obscure, approach.*[8]

By contrast, discounting the pre-tax cash flows at a pre-tax rate produces a value of $39.97, a value that is higher than the after-tax NPV, but lower than the grossed-up after-tax NPV. Thus, this alternative approach fails in even the first simple example (i.e., where income equals cash flow, and tax rates are constant throughout the entire period), as suggested by Brealey and Myers.

Turning to Exhibit 2, in which the depreciation expenses lag the capital expenditures (although the total is the same for the period as a whole), the after-tax NPV of the cash flows is $31.78, or $50.45 grossed up for income taxes, which is again the conceptually correct measure of damages. (The decline in net present value relative to Exhibit 1 results from the delay associated with earning the depreciation tax shields.) Yet the net present values of the pre-tax cash flows using either a pre-tax ($39.97) or an after-tax rate ($53.14) remain the same as they were in Exhibit 1. This error arises because the pre-tax analysis implicitly discounts only income and capital expenditures, without recognizing the changed timing of the depreciation's tax effects from the depreciation.

[7] The following passage explains the derivation of the pre-tax discount rate from the after-tax discount rate, and also offers a word of caution in its application (echoing the similar caution expressed in footnote 4): "This presents a problem when a pre-tax discounted cash flow analysis is required. Although not completely correct, the easiest way to convert an after-tax discount rate to a pre-tax discount rate is to divide the after-tax rate by (1 minus the tax rate). This adjustment should be made to the entire discount rate and to its component parts (i.e., the equity risk premium). Take note that this is a 'quick and dirty' way to approximate pre-tax discount rates." (Ibbotson Associates, *Stocks, Bonds, Bills, and Inflation: 2001 Yearbook*, Valuation Editions, p. 77)

[8] Harold Dilbeck, "The Time Value of Money, *Litigation Services Handbook: The Role of the Accountant as Expert*" (1995), Roman L. Weil, Michael J. Wagner, and Peter B. Frank (eds.), p. 38:3.

Exhibit 1: Commercial damages example–Balanced capital expenditures and depreciation

Economic Parameters:

Inflation	***3.0%***
After-Tax (AT) WACC	***10.3%***
Tax Rate	***37.0%***
Pre-Tax (PT) WACC	***16.3%***

	Year0	Year1	Year2	Year3	Year4	Year5	Year6	Year7	Year8	Year9	Year10
After-Tax Asset Cash Flows											
Earnings Before Interest & Depreciation (EBIDT)		10.00	10.30	10.61	10.93	11.26	11.59	11.94	12.30	12.67	13.05
Depreciation		(10.00)	(1.00)	(1.03)	(1.06)	(1.09)	(1.13)	(1.16)	(1.19)	(1.23)	(1.27)
Pre-Tax Income		-	9.30	9.58	9.87	10.16	10.47	10.78	11.10	11.44	11.78
Income Taxes		-	(3.44)	(3.54)	(3.65)	(3.76)	(3.87)	(3.99)	(4.11)	(4.23)	(4.36)
Net Income		-	5.86	6.03	6.22	6.40	6.59	6.79	7.00	7.21	7.42
Capital Expenditures		(10.00)	(1.00)	(1.03)	(1.06)	(1.09)	(1.13)	(1.16)	(1.19)	(1.23)	(1.27)
Net Asset Cash Flow	-	-	5.86	6.03	6.22	6.40	6.59	6.79	7.00	7.21	7.42
Net Present Value @ AT WACC	$33.48										
Gross Up for Taxes	*$53.14*										
Pre-Tax Asset Cash Flows											
Earnings Before Interest & Depreciation (EBIDT)		10.00	10.30	10.61	10.93	11.26	11.59	11.94	12.30	12.67	13.05
Depreciation		(10.00)	(1.00)	(1.03)	(1.06)	(1.09)	(1.13)	(1.16)	(1.19)	(1.23)	(1.27)
Pre-Tax Income		-	9.30	9.58	9.87	10.16	10.47	10.78	11.10	11.44	11.78
Income Taxes		-	-	-	-	-	-	-	-	-	-
Net Income		-	9.30	9.58	9.87	10.16	10.47	10.78	11.10	11.44	11.78
Capital Expenditures	-	(10.00)	(1.00)	(1.03)	(1.06)	(1.09)	(1.13)	(1.16)	(1.19)	(1.23)	(1.27)
Net Asset Cash Flow	-	-	9.30	9.58	9.87	10.16	10.47	10.78	11.10	11.44	11.78
Net Present Value @ AT WACC	*$53.14*										
Net Present Value @ PT WACC	$39.97										

Exhibit 2: Commercial damages example–Depreciation expense lags capital expenditures

Economic Parameters:

Inflation	***3.0%***
After-Tax (AT) WACC	***10.3%***
Tax Rate	***37.0%***
Pre-Tax (PT) WACC	***16.3%***

	Year0	Year1	Year2	Year3	Year4	Year5	Year6	Year7	Year8	Year9	Year10
After-Tax Asset Cash Flows											
Earnings Before Interest & Depreciation (EBIDT)		10.00	10.30	10.61	10.93	11.26	11.59	11.94	12.30	12.67	13.05
Depreciation			(1.11)	(1.24)	(1.38)	(1.56)	(1.78)	(2.06)	(2.45)	(3.04)	(5.54)
Pre-Tax Income		10.00	9.19	9.37	9.54	9.70	9.81	9.88	9.85	9.62	7.51
Income Taxes		(3.70)	(3.40)	(3.47)	(3.53)	(3.59)	(3.63)	(3.66)	(3.65)	(3.56)	(2.78)
Net Income		6.30	5.79	5.90	6.01	6.11	6.18	6.22	6.21	6.06	4.73
Capital Expenditures		(10.00)	(1.00)	(1.03)	(1.06)	(1.09)	(1.13)	(1.16)	(1.19)	(1.23)	(1.27)
Net Asset Cash Flow	-	(3.70)	5.90	6.11	6.34	6.58	6.84	7.13	7.46	7.88	9.00
Net Present Value @ AT WACC	$31.78										
Gross Up for Taxes	*$50.45*										
Pre-Tax Asset Cash Flows											
Earnings Before Interest & Depreciation (EBIDT)		10.00	10.30	10.61	10.93	11.26	11.59	11.94	12.30	12.67	13.05
Depreciation			(1.11)	(1.24)	(1.38)	(1.56)	(1.78)	(2.06)	(2.45)	(3.04)	(5.54)
Pre-Tax Income		10.00	9.19	9.37	9.54	9.70	9.81	9.88	9.85	9.62	7.51
Income Taxes		-	-	-	-	-	-	-	-	-	-
Net Income		10.00	9.19	9.37	9.54	9.70	9.81	9.88	9.85	9.62	7.51
Capital Expenditures	-	(10.00)	(1.00)	(1.03)	(1.06)	(1.09)	(1.13)	(1.16)	(1.19)	(1.23)	(1.27)
Net Asset Cash Flow	-	-	9.30	9.58	9.87	10.16	10.47	10.78	11.10	11.44	11.78
Net Present Value @ AT WACC	*$53.14*										
Net Present Value @ PT WACC	$39.97										

Exhibit 3: Commercial damages example–Depreciation exceeds capital expenditures

Economic Parameters:		
	Inflation	***3.0%***
	After-Tax (AT) WACC	***10.3%***
	Tax Rate	***37.0%***
	Pre-Tax (PT) WACC	***16.3%***

	Year0	Year1	Year2	Year3	Year4	Year5	Year6	Year7	Year8	Year9	Year10
After-Tax Asset Cash Flows											
Earnings Before Interest & Depreciation (EBIDT)		10.00	10.30	10.61	10.93	11.26	11.59	11.94	12.30	12.67	13.05
Depreciation		(11.00)	(2.00)	(2.03)	(2.06)	(2.09)	(2.13)	(2.16)	(2.19)	(2.23)	(2.27)
Pre-Tax Income		(1.00)	8.30	8.58	8.87	9.16	9.47	9.78	10.10	10.44	10.78
Income Taxes		0.37	(3.07)	(3.17)	(3.28)	(3.39)	(3.50)	(3.62)	(3.74)	(3.86)	(3.99)
Net Income		(0.63)	5.23	5.40	5.59	5.77	5.96	6.16	6.37	6.58	6.79
Capital Expenditures		(10.00)	(1.00)	(1.03)	(1.06)	(1.09)	(1.13)	(1.16)	(1.19)	(1.23)	(1.27)
Net Asset Cash Flow	-	0.37	6.23	6.40	6.59	6.77	6.96	7.16	7.37	7.58	7.79
Net Present Value @ AT WACC	$35.72										
Gross Up for Taxes	*$56.70*										
Pre-Tax Asset Cash Flows											
Earnings Before Interest & Depreciation (EBIDT)		10.00	10.30	10.61	10.93	11.26	11.59	11.94	12.30	12.67	13.05
Depreciation		(11.00)	(2.00)	(2.03)	(2.06)	(2.09)	(2.13)	(2.16)	(2.19)	(2.23)	(2.27)
Pre-Tax Income		(1.00)	8.30	8.58	8.87	9.16	9.47	9.78	10.10	10.44	10.78
Income Taxes		-	-	-	-	-	-	-	-	-	-
Net Income		(1.00)	8.30	8.58	8.87	9.16	9.47	9.78	10.10	10.44	10.78
Capital Expenditures	-	(10.00)	(1.00)	(1.03)	(1.06)	(1.09)	(1.13)	(1.16)	(1.19)	(1.23)	(1.27)
Net Asset Cash Flow	-	-	9.30	9.58	9.87	10.16	10.47	10.78	11.10	11.44	11.78
Net Present Value @ AT WACC	*$53.14*										
Net Present Value @ PT WACC	$39.97										

Thus, because capital expenditures are incurred in advance of depreciation expenses, damage estimates using a pre-tax method are inaccurate, whether an after-tax or a pre-tax discount rate is applied.

Turning to Exhibit 3, in which the capital expenditures are consistently lower than depreciation expenses, the direction of the bias from using pre-tax cash flows is unclear. As shown in this example, the conceptually correct after-tax methodology produces an after-tax value of $35.72, or $56.70 grossed up for income taxes. (These values are higher than in Exhibit 1 because of the reduction in cash taxes associated with higher depreciation expenses.)

For pre-tax cash flows, the NPV based on an after-tax WACC ($53.14) remains as it was in Exhibit 1, and is lower than the grossed-up after-tax figure, indicating that this method biases damage estimates downward. However, applying the pre-tax discount rate to the pre-tax cash flows still produces a value below the conceptually correct approach (before grossing up for taxes).

Conclusions and Recommended Guidelines

From the foregoing discussion, several recommended guidelines follows:

1. The conceptually correct and reliable approach is to discount after-tax cash flows at an after-tax discount rate.
2. If the damages award is to be subject to taxation, then "gross up" the damages calculation result so as to make it the basis for an award. That is, divide the result of the after-tax damages calculation by the sum of one minus the tax rate (which is expected to apply to the damages award).
3. If for whatever reason(s) the present value calculation is not able to be performed on an after-tax basis, then discount pre-tax cash flows at an after-tax discount rate. If accounting income and cash flow happen to match one another, then this approach will yield an accurate measure of the pre-tax damages. Otherwise, the results from this approach are unreliable, with an unclear bias.

Although discounting pre-tax cash flows at a pre-tax discount rate may have an intuitive appeal ("apples and apples"), the results are inaccurate, although their bias at least appears to be consistent. As a measure of pre-tax damages, this approach yields results that are biased downward; as a measure of after-tax damages, this approach yields results that are biased upward.

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A Compensated Demand Approach to Wrongful Termination and Personal Injury Cases

Jeff Ankrom[A]

Abstract

The usual approach in wrongful termination and personal injury cases is to calculate the difference between the before termination/injury salary and the post termination/injury salary. This difference is the basis for loss. Typically, no adjustment is made for the fact that new jobs may involve not only less hourly pay, but also less work. Without such adjustment, it can be shown that wrongfully terminated and injured employees who find new employment at lower wages are usually overcompensated.

The purpose of this note is to show how to properly value loss using a simple compensated demand framework. It is consistent with microeconomic theory (while the usual approach of comparing two salaries is not) and can be explained to a jury by appealing to the intuitive notion that most people will accept lower pay if it means less work. It is not difficult to devise a simple survey to estimate the needed compensated demand parameters, and I provide an example of such a survey in this paper.

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Wrongful termination (WT) cases do not always involve outright termination. Some employees find themselves working in the same workplace but with both less responsibility and pay. An example might be a school principal remaining in the system as a teacher after being relieved of administrative duties. Personal injury (PI) cases typically result in workers taking employment at reduced pay and reduced working hours, perhaps because the injury means that the worker cannot remain standing or sitting for long hours.

The usual approach in these cases is to calculate the difference between the before loss salary and the post loss salary. In the teacher/principal example, the difference between the two salaries is used as the measure of annual loss. Typically, no adjustment is made for the fact that post loss employment involves not only less pay, but also less work. Without such adjustment it can be shown that wrongfully terminated and injured employees are incorrectly compensated.

The purpose of this note is to show how to properly value loss using a simple compensated demand framework. It is consistent with microeconomic theory (while the usual approach of comparing two salaries is not) and can be explained to a jury by appealing to the intuitive notion that most people will accept lower pay if it means less work. Despite the abstract nature of the compensated demand model, it is not difficult to devise a simple survey to estimate the needed compensated demand parameters. I provide an example of such a survey below.

Consider Figure 1, where the standard income/leisure model is depicted.[1] Two budget constraints are shown, one for a lower "teacher" wage and another for the higher "principal" wage. The former represents the post termination budget constraint while the latter represents the before termination budget constraint. P represents the higher salary/more work position, while T represents the lower salary/less work position. Employees can maximize utility by freely choosing hours both before and after termination or injury. The case depicted involves a relatively large substitution effect.

If the indifference curves look as they do in Figure 1, the amount of income needed to return the wrongly dismissed principal to the original indifference curve is known as the compensating variation (CV).[2] It is found by sliding the teacher budget line to the northeast until it is tangent to the original (principal) indifference curve at P'. P' reveals the level of income that allows the teacher the same level of satisfaction as was earned as a principal. Note that the amount of income needed to compensate (the CV) is less than the difference between Yp and Yt, the usual measure of loss. In Figure 1, this is shown as the difference between Yt and the income associated with P', or Yt'. With a large substitution effect (and small income effect), the wrongly terminated employee wants to work less and is overcompensated.

The loss of income Yp – Yt' is associated with increased leisure, and isolates the substitution effect in microeconomic theory. The individual has chosen a life with more time off, so that the value of Yp – Yt' is exactly equal to the value of the increased leisure time, or the amount of overcompensation for wrongful termination.

The discussion raises another issue about earnings capacity. In Figure 1, P* and T* (where the budget lines intersect the vertical axis) represent the maximum amount of earnings possible for each employee, the case where the principal and teacher choose no leisure. It can be seen as a human capital measure of earnings capacity. The difference between P* and T* is also the estimate of loss often asked of economists in these cases. It is not the appropriate loss measure if leisure is a good in the worker's utility function, but it again illustrates how loss is conceived by courts outside the income/leisure model of microeconomic theory.[3]

The presentation to this point is a just a simple application of microeconomic theory. But the situation becomes more interesting when wrongful termination or personal injury cases involve time constraints. Most jobs are defined by the hours they keep and workers cannot maximize utility by choosing the optimal number of days or hours. Teachers in Ohio work 184 days and principals work 225 days. If you are terminated as a principal and returned to teaching, you are not free to choose labor supply. So the standard CV analysis of Figure 1 must be extended when workers cannot maximize utility.

In Figure 2, P and T are not points of tangency on the respective budget constraints. Facing a lower wage along with a labor constraint (Lt for teachers and Lp for principals), the CV cannot be determined in the conventional way. Either AT or BP is the compensation needed to make whole the employee depicted here.[4]

The model raises other intriguing possibilities. If the *same* indifference curve passes through both P and T, the conclusion is that no compensation is merited for the wrongful termination. It is not even clear in that case what the phrase "wrongful termination" means. The loss in utility associated with the fall in salary is exactly made up by the gain in utility associated with a reduction in hours of work.

Despite the seemingly abstract nature of this discussion, points P and T in Figure 2 may be directly observable. How could points A and B be found? A simple survey could be given to a representative group of workers with questions like the following:

Scenario #1

You are a school administrator making $72,000 per year, working 225 days per year. If you could work as an administrator, but only 184 days per year, at what salary would you be indifferent between the two choices? (To simplify the question fill in the salary blank in the table below.)

I am indifferent between:

$72,000 salary And working 225 days	And	$_____ salary And working 184 days

Scenario #2

You are a teacher making $45,000 per year, working 184 days per year. If you were to work as a teacher 225 days per year, at what salary would you be indifferent between the two choices? (To simplify the question fill in the salary in the table below.)

I am indifferent between:

$45,000 salary And working 184 days	And	$_____ salary And working 225 days

The first question locates A in Figure 2 and the second locates point B.

How flat are indifference curves in the real world? A complete answer to that question is not possible in this short paper. The answer varies with each individual. But this paper has shown that the conventional method assumes that

[1] I continue here with the example of a wrongfully terminated employee, though the principle applies as well (or even better) in personal injury cases. I am grateful to an anonymous referee for pointing out the general nature of the compensated demand framework in both applications.

[2] An excellent discussion is found in Varian, Hal R., *Intermediate Microeconomics*, New York: W. W. Norton and Company, 1997, 251-253.

[3] I am again indebted to an anonymous referee for providing this insight.

[4] Whether to use BP or AT as the appropriate measure of loss depends on whether we use the Hicks or the Slutsky method to isolate substitution effects (which amounts to isolating income effects). There is no consensus on this issue. Again, Varian (Ch. 8) has the best discussion of this issue.

indifference curves are flat, an assumption surely without merit.

The above survey was administered to 53 public school teachers in Springfield, Ohio. The average response in the first scenario was $60,317 and $55,472 for the second. Using the conventional method of determining loss in the above scenario yields a benchmark of $27,000. But the method devised in this paper yields a smaller number. The distance AT in Figure 2 is $15,317 and BP is $16,528. The implied value of additional leisure time gained is around 40% of the conventionally measured loss. Economists in wrongful termination and personal injury cases routinely calculate loss as the difference between Yp and Yt in Figures 1 and 2. Using a compensated demand framework, I have shown that this approach likely overstates loss. Furthermore, it is not difficult to get the information needed to properly measure loss in WT and PI cases.

Figure 1

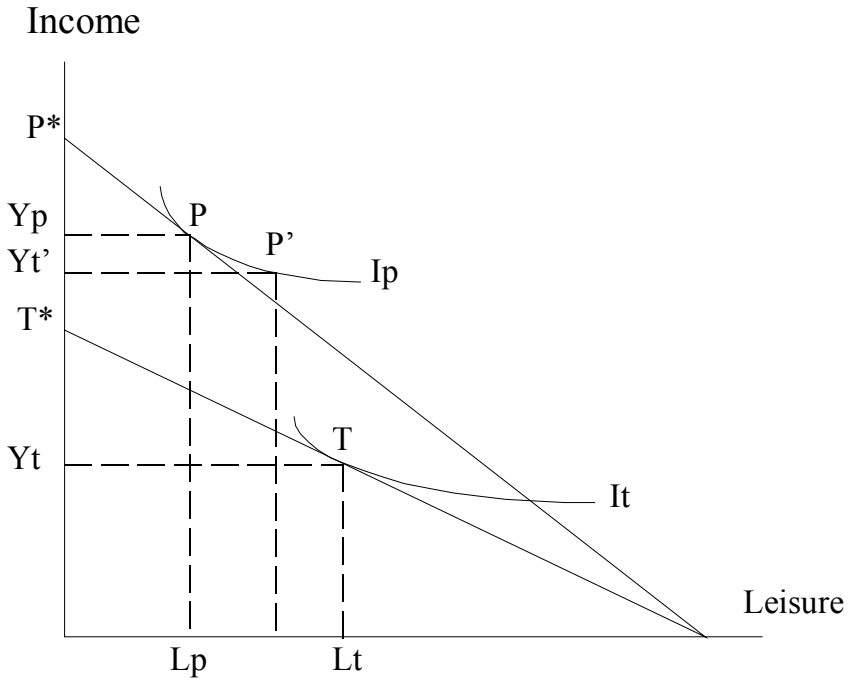
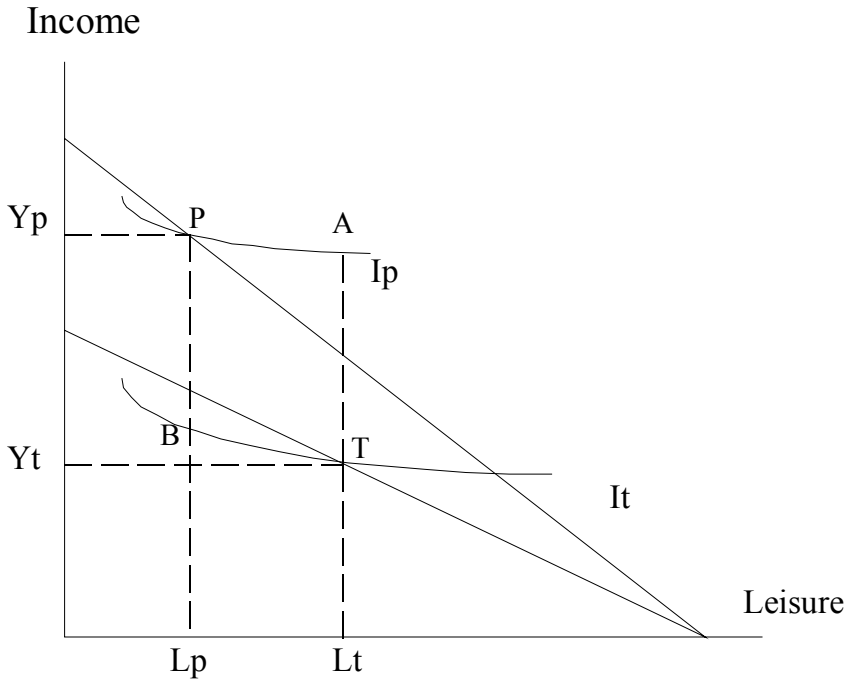


Figure 2



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The Literature Corner: Recent Publications of Interest to Forensic Economists

James D. Rodgers[A] and Robert J. Thornton[B]

Abstract

In this regular feature of the *Litigation Economics Review*, we provide an annotated listing of recent publications that are likely to be of interest to forensic economists. In compiling such a list, we search the non-forensic economics literature, a literature that because of time constraints or different disciplinary interests is not likely to be visited frequently (or maybe not at all) by many of us. As always, we select articles based on their potential relevance to forensic economists in their work and in their research, and therefore exclude any articles not passing the well-known WTF test. Although some of the publications that we note might also be periodically brought to the attention of NAFE members via the LISTSERV, not all NAFE members subscribe to the LISTSERV. Also, information about recent publications provided on the LISTSERV is somewhat sporadic and dependent on the time and goodwill of those providing the information. Finally, in a regular feature such as this, we are able to summarize, categorize, and link the publications in a way that is not always possible with the LISTSERV.

We always welcome suggestions (such as "Have you seen this article?" or "Why don't you two take a hike?") from our readers. Please note, though, that the article descriptions in The Literature Corner are necessarily brief and cannot convey all the richness of detail and qualifications appearing in the articles themselves. Also, although most of the works we highlight will generally have appeared in the last year, we have elected to follow no strict statute of limitations.

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In this issue we highlight articles of interest in the areas of earnings, disability, education, retirement, employment, consumption expenditures, the value of life, and employment discrimination. Articles are arranged by topical area.

Consumption Expenditures

Paulin, Geoffrey D., and Abby L. Duly. "Planning Ahead: Consumer Expenditure Patterns in Retirement," Monthly Labor Review, Vol. 125, No. 7, July 2002, pp. 38-58.

When making a deduction for personal consumption in wrongful death cases, there is the question of how much to deduct for the decedent's personal consumption in what would have been the decedent's retirement years, or the issue may arise as a question about the empirical validity of some offset assumption, such as that retirement pension income would have offset the decedent's personal consumption. Hence, research on the spending patterns of persons after retirement is quite relevant for the forensic economist. In this article the authors study the impact of retirement on consumer spending by comparing expenditure patterns of families near retirement with those of retirees. The article also describes related research studies, the data from the U.S. Consumer Expenditure Survey, and the demographic characteristics of the "pre-retired" and the "retired." Finally,

regression analysis is used to explore differences in expenditure patterns caused by demographic and income differences for pre-retired and retired consumers. For single men, single women and married couples, regression analysis is used to predict the probability of purchasing various categories of goods and services and to see whether these probabilities differ significantly for the pre-retired and the retired. For single men, the only statistically significant difference is for transportation, with outlays dropping significantly. For single women and married couples, none of the differences in probability of purchase is statistically significant.

Paulin, Geoffrey D., and Yoon G. Lee. "Expenditures of Single Parents: How Does Gender Figure In?" Monthly Labor Review, Vol. 125, No. 7, July 2002, pp. 16-37.

In recent decades the proportion of single-parent families has of course been rising. In all, single-parent families with their own children under the age of 18 now account for about 28% of all family households. This article compares levels of expenditures and budget shares in single-mother and single-father households. The data used are from the interview component of the Consumer Expenditure Survey. For the most part, the authors found that expenditure patterns are pretty much the same for both genders, once demographic and economic characteristics (especially income) are taken into account.

Disability

Beegle, Kathleen, and Wendy A. Stock. "The Labor Market Effects of Disability Discrimination Laws," Journal of Human Resources, Vol. 38, No. 4, Fall 2003, pp. 806-859.

The Americans with Disabilities Act (ADA) was passed in 1990 with the intention of improving the labor market outcomes for persons having disabilities. The fundamental assumption underlying the ADA was that there is labor market discrimination against persons with disabilities and a lack of access to employment opportunities. The ADA was designed to established, inter alia, equal access to employment in both the public and private sectors for persons with disabilities. Critics of the ADA countered that the act raises the cost of hiring workers with disabilities and may, as a consequence, worsen the labor market outcomes of disabled persons relative to those with no disabilities. Beegle and Stock present evidence of the effects of anti-discrimination laws that support the critics. The evidence is based on variation in the legal environment induced by state-level discrimination laws passed prior to the ADA. They find that disability discrimination laws are associated with (a) lower labor force participation rates for the disabled in states with such laws compared to states without them and (b) lower relative earnings. Curiously, however, the state laws were not associated with lower relative employment rates for the disabled. Beegle and Stock speculate that the laws induced disabled workers to shift to lower paying jobs or the composition of disabled workers shifted toward those with lower productivity.

Boden, Leslie I., and Monica Galizzi. "Income Losses of Women and Men Injured at Work," Journal of Human Resources, Vol. 38, No. 3, Summer 2003, pp. 722-57.

This study analyzes the post-injury earnings losses of workers injured on the job during 1989-90 in the state of Wisconsin. The authors find that women and men have similar levels of lost earnings at the time of the injury. However, in the three and one-half year period following the injury, women lose an average of 9.2% of their earnings, while men lose only 6.5%. Differences in observed personal, employer, and injury characteristics do not seem to explain the gender differences in lost earnings. The data suggest that women are employed less after injury, but this can account for only about half of the gender earnings gap. It is possible that injuries may cause a greater reduction in women's hours of work, but the evidence is only suggestive. The authors conclude that gender discrimination is a plausible explanation.

Charles, Kerwin Kofi. "The Long-Term Structure of Earnings Losses among Work-Limited Disabled Workers," Journal of Human Resources, Vol. 38, No. 3, Summer 2003, pp. 618-646.

This article investigates the dynamic effects of disability on earnings. Panel data from the Panel Study of Income Dynamics for 1968-93 and fixed effects methods are used to assess how earnings of disabled workers deviate from expected levels over many years before and after the onset of disability. The article also examines how worker characteristics, particularly age, affect earnings losses from disability. Disabled men experience sharp drops in earnings that pre-date the measured date of onset. Earnings recover rapidly soon after onset, however, and then follow a modest downward trend, resulting in annual earnings losses of about 12% per year. Being older at onset, nonwhite, more chronically disabled and less educated all cause the losses from disability to be larger and the recovery smaller. Many of the differences across groups appear to derive from industry affiliation after onset. All the findings of the paper are consistent with a human capital explanation of the disability process.

Symposium. "Disability and Employment," Industrial Relations, Vol. 42, No. 1, January 2003.

The low employment level of persons with disabilities was an important factor behind the passing of the Americans with Disabilities Act (ADA) of 1990. Since that time, scholarly interest in disability and employment issues has grown enormously, with much of the research dealing with the effects of the ADA. This symposium consists of three such articles, along with an introduction by the symposium editors (Douglas Kruse and Thomas Hale). Below we summarize two that we believe forensic economists will find useful.

Lee, Barbara A. "A Decade of the Americans with Disabilities Act: Judicial Outcomes and Unresolved Problems." Industrial Relations, Vol. 42, No. 1, January 2003, pp. 11-30.

This article is useful for forensic economists wishing a brief overview of the requirements and effects of the Americans with Disabilities Act (ADA) Lee first presents a short review of the literature on disability and the ADA, in particular that part of the Act dealing with cost and compliance. She then discusses litigation trends under the ADA both prior to and after a number of significant rulings by the Supreme Court. As to the effects of the ADA, in the abstract to her article she states: "A decade after its enactment the Americans with Disabilities Act (ADA) has not resulted in the substantial employment gains for individuals with disabilities that its proponents had predicted. It also has not resulted in many legal victories for disabled individuals who have challenged alleged discriminatory actions by their employees."

Kruse, Douglas, and Lisa Schur. "Employment of People with Disabilities Following the ADA." Industrial Relations, Vol. 42, No. 1, January 2003, pp. 31-66.

The purpose of the ADA was to increase employment among the disabled. However, because it can raise the cost to employers of hiring people with disabilities due to the need to make reasonable accommodations and also because of the risk of lawsuits, some have argued (and some prior studies have purportedly found) that the ADA may actually decrease employment of the disabled. This article looks at employment trends of people with disabilities since the passage of the Act using Survey of Income and Program Participation (SIPP) data. The authors find evidence of decreased employment among those reporting work disabilities in the first few years following passage of the ADA, but increased employment when using an alternative (one that may be more appropriate) measure of ADA coverage. These findings indicate that the definition of disability used is crucial in measuring the impact of the Act. The authors also find that workers with disabilities tend to be strongly affected by labor market tightness and that the adage "last hired, first fired" applies to many of them.

Yelin, Edward H., and Laura Trupin. "Disability and the Characteristics of Employment," Monthly Labor Review, Vol. 126, No. 5, May 2003, pp. 20-31.

The authors of this article use the California Work and Health Survey, conducted annually from 1998-2000, to examine the "work situations" of persons with disabilities: i.e., their employment rates, the strength of their attachment to the labor force, terms of hire, and working conditions. Not surprisingly, they find that persons with disabilities have lower employment rates than the non-disabled. Moreover, the difference between employment rates of the two groups is greater for those with lower levels of education. Persons with disabilities also experience rates of job loss that are nearly double the rates of job loss of those without disabilities, and the former group are much less likely to report a promotion or to have found a better job. Once employed, though, persons with and without disabilities do not seem to differ with respect to working conditions. Both groups seem about equally likely to be self-employed, to be working a regular day shift, to have regular working hours, and even to have wide latitude in making decisions.

Earnings

Anderson, Deborah J.; Melissa Binder; and Kate Krause. "The Motherhood Wage Penalty Revisited: Experience, Heterogeneity, Work Effort, and Work-Schedule Flexibility," Industrial and Labor Relations Review, Vol. 56, No. 2, January 2003, pp. 273-294.

It is well known that on average mothers earn less than women without children. Several possible explanations have been offered in the past for this phenomenon, among them: unobserved heterogeneity among mothers in the timing of their return to work; human capital differences; wives subordinating their own careers to those of their husbands; mothers being less productive at work because they have dissipated their energy caring for their children (the work-effort hypothesis). In this article the authors analyze data from the 1968-88 National Longitudinal Survey of Young Women and estimate a 10% "motherhood wage gap." They find that human capital differences and unobserved heterogeneity explain 55-57% of the gap, but find little support for the work-effort hypothesis.

Antecol, Heather, and Kelly Bedard. "The Relative Earnings of Young Mexican, Black, and White Women," Industrial and Labor Relations Review, Vol. 56, No. 1, October 2002, pp. 122-135.

In recent years there has been renewed interest in the relatively poor labor market outcomes faced by

disadvantaged groups in the U.S., but most of the studies have focused on men. In this article the authors analyze data from the National Longitudinal Survey of Youth. They find that young Mexican women earned 9.5% less than young white women in 1994, the primary reason being differences in education. They also find that young black women earned 13.2% less than young white women in this same year, but in this case differences in labor force attachment seems to be the most important determinant.

Black, Dan A.; Hoda R. Makar; Seth G. Sanders; and Lowell J. Taylor. "The Earnings Effects of Sexual Orientation," Industrial and Labor Relations Review, Vol. 56, No. 3, April 2003, pp. 449-469.

Using data from the General Social Survey from 1989-96, the authors find that gay men earn 14% to 16% less than married heterosexual men, and also perhaps somewhat less than single heterosexual men. By contrast, lesbian women earn between 20% and 34% more than comparable single and married heterosexual women. The authors rationalize the earnings difference for gay men compared to married heterosexual men by use of Gary Becker's explanation that single men (including, presumably, many gay men) should be expected to earn less than similar married men because these single men specialize less intensively in market production. To support a family, married men are driven to accept job transfers, accept more stressful jobs, and work longer hours. In the case of lesbian women, the authors argue that they will have made decisions taking into account that they are unlikely to form traditional households in which they specialize in household production.

Carpenter, Christopher, "New Evidence on Gay and Lesbian Household Incomes," Contemporary Economic Policy, Vol. 22, No. 1, January 2004, pp. 78-94.

Unlike the previous study, which focuses on the earnings of persons, this study focuses on household income. One key issue addressed in the article is whether same-sex unmarried partner (SSUP) households are truly gay or lesbian. The author uses the Centers for Disease Control Behavioral Risk Factor Surveillance System (BRFSS) as an alternative data source to the 1990 Decennial Census, and makes extensive comparisons between these two data sources. He finds that same-sex female households experience large and robust resource penalties relative to married couples. He also finds that household income in different-sex cohabitating households and same-sexed male households is lower than household income in married couple households.

Haugen, Steven E. "Characteristics of Minimum Wage Workers in 2002," Monthly Labor Review, Vol. 126, No. 9, September, 2003, pp. 37-40.

About 3 out of 5 workers (some 72.7 million) in 2002 were paid by the hour; and about 570,000 reported earning exactly $5.15 per hour, the prevailing federal minimum wage, while 1.6 million reported being paid below the minimum wage. Half of the workers earning $5.15 per hour or less were under age 25 and about one-fourth were aged 16 to 19. About 3 out of 5 workers paid less than the minimum wage were employed in food service occupations. Under the tip credit provisions of the federal minimum wage, an employee who receives tips can be paid a wage below $5.15, provided that the employee's tips, combined with a cash wage of at least $2.13 per hour, equal at least $5.15. The highest proportion of workers with wages at or below $5.15 per hour worked in retail trade. The proportion of hourly paid workers earning the federal minimum wage or less has trended downward since 1979, from about 15% (roughly 8% for men and 20% for women) of workers to about 3% (roughly 2.5% for men and 3.5% for women) in 2002.

Education

Gill, Andrew M.; and Duane E. Leigh. "Do the Returns to Community College Differ between Academic and Vocational Programs?" Journal of Human Resources, Vol. 38, No. 1, Winter 2003, pp. 134-155.

Do graduates of a four-year college who started at a two-year college suffer any labor market disadvantage relative to those who started at a four-year college? This study finds that the answer is "no." Policies that encourage students to begin their college careers at a community college appear to have little negative impact on ultimate labor market opportunities. How effective are community college programs in boosting labor market earnings? This study finds that there is a substantial increased earnings payoff of 31% for white males and 45% for black males. Finally, do community college students sort themselves between transfer tracks and terminal training in accord with comparative advantage? The answer again appears to be "yes." Self-selection is positive for both terminal and transfer programs.

Lochner, Lance, and Enrico Moretti. "The Effect of Education on Crime: Evidence from Prison Inmates, Arrests, and Self-Reports," American Economic Review, Vol. 94, No. 1, March 2004, pp. 155-189.

The authors note that there are many theoretical reasons to expect that education reduces crime. By raising earnings, education raises the opportunity cost of crime and the cost of time spent in prison. Education may also make individuals less impatient and more risk averse, further reducing the incentive

to commit crimes. The authors use data from the U.S. Census Bureau on incarceration, state-level data on arrests from the Uniform Crime Reports, and self-report data from the NLSY to explore empirically the relationship between schooling and criminal participation. All three data sources produce the same conclusion: education significantly reduces criminal activity. A significant part of the measured effect of education on crime can be attributed to the increase in wages associated with schooling. The authors note further that there is a social benefit to increased schooling not taken into account by the individuals themselves. They estimate that a 1% increase in the high school completion rate among all men ages 20-60 would save the United States as much as $1.4 billion per year in reduced costs from crime incurred by victims and society at large, or about $1,170 - $2,100 per high school dropout.

Plug, Erik. "Estimating the Effect of Mother's Schooling on Children's Schooling Using a Sample of Adoptees," American Economic Review, Vol. 94, No. 1, March 2004, pp. 358-368.

In the forensic literature on probability of educational attainment (See John Kane and Lawrence M. Spizman, "An Update on the Educational Attainment Model for a Minor Child," *Journal of Forensic Economics*, Vol. 14, No. 2 (Spring/Summer, 2001), pp. 155-66, and references therein cited), the coefficients on father's education are uniformly smaller than those of the education of the mother. This means that the education of the father seems to have less influence than that of the mother on the probability of various levels of educational attainment for both male and female children. (See Tables 3, 4 and 5 of the above-referenced paper.) These empirical results in Kane/Spizman run counter to the findings of Plug because, as Plug would argue, they do not control for inherited abilities and associative mating. With data from the Wisconsin Longitudinal Survey for the years 1957 and 1992, Plug focuses on adoptive children. He reasons that "if adopted children share only their parents' environment and not their parents' genes, any relation between the schooling of adoptees and their adoptive parents is driven by the influence parents have on their children's environment, and not by parents passing on their genes. Controlling for inherited abilities and associative mating … the association between mother's (but not father's) and child schooling disappears." (p. 358)

Employment

Ahituv, Avner, and Marta Tienda. "Employment, Motherhood, and School Continuation Decisions of Young White, Black, and Hispanic Women," Journal of Labor Economics, Vol. 22, No. 1, January 2004, pp. 115-158.

This paper examines the empirical relationship between early employment activity and school continuation decisions. The data used in the analysis are from the National Longitudinal Survey of Youth (NLSY), a nationally representative random sample of 12,866 men and women aged 14-21 as of January 1, 1979, who were interviewed annually for the subsequent 16 years. In a very sophisticated model that estimates schooling, labor supply and birth decisions jointly, it is found that the rate of school withdrawal increases as work intensity rises. This result helps explain the premature departure of Hispanic girls from secondary school and the premature departure of young black women from college. While some work is not deleterious to school performance, excessive youth employment induces long-run wage stagnation for early school leavers and potentially increases race and ethnic inequities.

DeSimone, Jeff. "Illegal Drug Use and Employment," Journal of Labor Economics, Vol. 20, No. 4, October 2002, pp. 952-977.

What effect does illegal drug use – in particular, marijuana and cocaine – have on an individual's likelihood of employment? Previous studies have reported mixed evidence. The author uses data from the National Longitudinal Survey of Youth from 1984 and 1988. His results indicate that the use of each drug substantially reduces the likelihood of employment, with cocaine use having an employment effect that is 50-100% greater than the employment effect associated with marijuana use. The author also notes that the reduction in employment that drug use brings about also has many other effects, such as increased turnover and lower return on human capital investment.

Gottschalk, Peter, and Michael Hansen. "Is the Proportion of College Workers in Noncollege Jobs Increasing?" Journal of Labor Economics, Vol. 21, No. 2, April 2003, pp. 449-472.

Conventional wisdom, coffee pot chatter, and barroom musings (we definitely can attest to this third source) all seem to suggest that the answer to the question posed in the article's title is "yes." However, the subject has been up to this point virtually ignored in the economics literature. One reason, of course, is the somewhat subjective nature of any classification scheme for college and noncollege jobs. In this article the authors provide a more rigorous definition of and framework for what

constitutes noncollege jobs. They find that the proportion of college-educated workers in noncollege jobs actually declined from the mid-1980s to the mid-1990s. Furthermore, they find no evidence to support the claim that the proportion of college graduates forced to accept noncollege jobs was rising over this period.

Hecker, Daniel E. "Occupational Employment Projections to 2012," Monthly Labor Review, Vol. 127, No. 2, February 2004, pp. 80-105.

This very detailed article (most of it consists of tables) presents the latest projections of employment by the U.S. Bureau of Labor Statistics for the period 2002-2012. In addition to presenting changes in the structure of employment at the major occupational group level (e.g., professional occupations and service occupations), the article also provides information on "detailed" occupations (e.g., barbers, teachers, funeral directors, etc.). Forensic economists who are asked to project earnings losses in personal injury and wrongful death cases will therefore find this article quite useful. It should be noted, though, that the projections contained in this article are also the ones used to provide the background for future employment opportunities discussed in the *Occupational Outlook Handbook*.

Kletzer, Lori G., and Robert W. Fairlie. "The Long-Term Costs of Job Displacement for Young Adult Workers," Industrial and Labor Relations Review, Vol. 56, No. 4, July 2003, pp. 682-698.

Using data from the NLSY, the authors estimate the long-term costs of job displacement for young adults. Earnings losses were large for the first three years after displacement. However, earnings losses for young adults were relatively short-lived, compared to the results found in other studies for more mature workers. Relative to what would have been expected had it not been for job loss, the shortfall of annual earnings was 9% for men and 12.5% for women, with the shortfall of hourly wages 21.2% for men (who apparently worked more hours, thereby keeping the annual earnings shortfall to only 9%). The composition of earnings losses also appears to differ between younger and older workers. For the latter, the total losses represent actual, immediate earnings losses, whereas for the former, the loss of opportunities for rapid earnings growth is more important.

Toossi, Mitra. "Labor Force Projections to 2012: The Graying of the U.S. Workforce," Monthly Labor Review, Vol. 127, No. 2, February 2004, pp. 37-57.

This article describes the way the U.S. labor force will change over the next 8 years. In the words of the author, "The labor force will continue to age, with the annual growth rate of the 55-years-and-older group projected to be nearly 4 times that of the overall labor force; as the participation rates of older age groups increase, the older population's share of the workforce will rise." (p. 37)

Employment Discrimination

Polsky, Gregg D., and Stephen F. Befort. "Employment Discrimination Remedies and Tax Gross Ups," Iowa Law Review, Vol. 90, October 2004, pp. 3-56.

This article is "must reading" for computing economic damages in an employment discrimination case. A successful plaintiff in an employment discrimination case may also be awarded attorney fees under federal anti-discrimination statutes. The award for economic damages of back and front pay and the award of attorney fees may cause the plaintiff to incur tax liabilities so large as to exceed the size of the economic damage award itself. Polsky and Befort examine the issue of tax gross ups as a method of overcoming the adverse tax consequences of an award. In the words of the authors, "This article considers whether a successful employment discrimination plaintiff may be entitled, under current law, to receive an augmented award (a "gross up") to neutralize certain adverse federal income tax consequences. The question of whether such a gross up is allowed, the resolution of which can have drastic effects on litigants, has received almost no attention from practitioners, judges and academics. Because of the potentially enormous impact of the alternative minimum tax (AMT) on discrimination lawsuit recoveries, however, the gross up issue is now beginning to appear in reported cases." (p. 3)

Retirement

Bahizi, Pierre. "Retirement Expenditures by Race and Hispanic Origin," Monthly Labor Review, Vol. 126, No. 6, June 2003, pp. 20-22.

This brief article describes the expenditure differences of Whites, Hispanics, and Blacks during retirement. The author uses data from the Consumer Expenditure Interview Survey from 1996-2001 and finds (not surprisingly) that there are differences among the groups in the percentages of their expenditures allocated to food, housing, transportation, healthcare, and entertainment. For example, Hispanic retirees spend a larger percentage of their expenditures than the other two groups on food, shelter (rent), and transportation. Blacks spend a larger percentage on used cars, personal care expenditures, apparel, and tobacco products. White retirees, finally, spend a larger share on food away from home, entertainment, and public transportation. Of course some of these expenditure differences are no doubt due to income, but (alas!) the author does not say how much.

Johnson, Richard. "The Puzzle of Later Male Retirement," Economic Review, Vol. 87, No. 3, 2002, pp. 5-26.

This is a nice overview article on recent trends in male retirement in the U.S. As is well known, until about 1985 the proportion of older men who worked for pay showed a downward trend. Since that time, the proportion has either been stable or it has been rising. Various theories (not mutually exclusive) have been put forth to explain why American men are retiring later: changes to Social Security, the decline of defined-benefit pensions, and the slower growth of the overall U.S. labor force, which would increase employment opportunities for older men. The author reviews the trends in older men's labor supply and tests to see which of these theories seems to best explain the change in retirement trends. He finds that reductions in the Social Security penalties associated with working can partially explain lower retirement rates at age 65, but there seems to be little effect associated with the reduction of social security benefits. All in all, a good part of the reversal of the previous downward trend observed about 1985 "remains a puzzle" in the words of the author.

Value of Life

Viscusi, W. Kip. "The Value of Life: Estimates with Risks by Occupation and Industry," Economic Inquiry, Vol. 42, No. 1, January 2004, pp. 29-48.

The author presents new estimates of the "value of life." These estimates take into account differences in occupational risk within specific industries. The bias in value-of-life estimates from using industry risk without taking into account differences in occupational risk is found to be very large. For example, in Viscusi's full sample log wage equations, the value of life is $5.0 million in year 2000 dollars, whereas it is $10.7 million based solely on industry risk. For blue-collar male workers, the value of life using occupational-industry risks is $7.5 million, but $10.0 million using industry risks alone. Blue-collar females have a value of life of $9.1 million using occupational-industry risks, but only $7.2 million using industry risks alone. Viscusi notes two problems remaining with his refined estimates of the value of life. As he puts it, "First, particularly for females, the fatality risk coefficients had mixed signs and were not statistically significant. Second, even for males, the wage-risk trade-offs for the full male sub-sample were not higher than the implicit values for blue-collar workers, whereas in theory workers self-selecting into blue-collar jobs should have a lower value of life." (p. 47).