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§1272 Supplemental Calculation of Lost Earnings Using the LPE Method

Section 1270 provided an example of the use and rationale of the LPE method (Life, Participation, Employment). This section is provided as a supplement to the discussion in Section 1270. The remainder of this section plus the accompanying tables and figures were prepared by David Tucek, General Partner of Value Economics, LLC, located in St. Louis, MO. Mr. Tucek holds an MBA and an MA in Economics and has over twenty years experience as an expert witness.

Introduction and Overview

An example of an earnings loss calculation using the LPE method appears in Table 47. This example pertains to a 25-year-old male plaintiff injured on December 31, 2008. The trial is scheduled to begin on August 1, 2010, so future losses for 2010 correspond to five months of earnings. The plaintiff was employed and had a Bachelor's degree at the time of the injury.

Column A of Table 47 shows the year corresponding to each earnings loss and column B shows the plaintiff's age at year end. The lost earnings for each period are shown in column C. The present value factor in column D is based on a 2 percent net discount rate and assumes mid-period discounting. The present value of the lost earnings, with no reduction for the probabilities of survival, labor force participation or employment, equals column C divided by column D and is shown in column E. The cumulative present value of the total lost earnings appears in column F.

The probabilities of survival, labor force participation and employment are shown in columns G, H and I respectively. It is assumed that the plaintiff will be alive up to the date of the trial, so the survival probabilities are set equal to one for the past loss period. For the future loss period, the survival probability for each year equals the probability of surviving from the day before the trial until the corresponding year end. The probabilities of labor force participation and employment correspond to the expected values for a male with a Bachelor's degree for each given age.

The product of columns E, G, H and I is shown in column J, and equals the present value of the lost earnings adjusted for the risk that the plaintiff might die, might not participate in the labor force even if he survives, or might be unemployed even if he is alive and participating in the labor force. The cumulative total of the risk-adjusted lost earnings appears in column K. The present value of the total risk-adjusted earnings loss equals $1,568,529. This is 16.2 percent below the present value of the earnings under the assumption the plaintiff would have been employed with certainty through age 67.

Source of the Survival Probabilities

In this example, the probabilities in column G of the future loss section of Table 47 correspond to the plaintiff's probability of surviving from July 31, 2010 (age 26.3) to the end of each successive year. For example, the 0.99942 value for 2010 in column G of Table 47 equals the probability of a male born on April 15, 1984 surviving until December 31, 2010 (age 26.7), given he was alive on July 31, 2010. Put another way, it is the probability of a 26.3-year-old male surviving until age 26.7. Similarly, the 0.99805 value shown for 2011 is the probability of a 26.3 year-old male surviving until age 27.7.

The survival probabilities in the future loss section of Table 47 are derived from the 2005 United States life table for all males. (See Arias, 2010). This is a period life table: rather than being based on the actual experience of a cohort of individuals born in the same year, a period table presents what would happen to a synthetic cohort through time if it experienced the death rates specified in the table. Starting with an initial synthetic cohort of 100,000 persons, the life table shows values for l(x), the number of persons surviving to exact age x. The probability of

surviving n years after age x is calculated as l(x+n) divided by l(x).

The 2011 survival probability shown in Table 47 equals l(27.7) divided by l(26.3): it is the fraction of the males alive at age 26.3 who survive until age 27.7. As in this example, the dates involved in personal injury or wrongful death actions will almost never correspond to the plaintiff's or decedent's birthdays. Consequently, it is necessary to interpolate the tabulated values of l(x) for non-integer ages. In Table 47, the underlying interpolated values of the l(x) are based on the assumption that the deaths between integer ages are uniformly distributed – this is equivalent to assuming that the survival curve determined by the l(x) is a straight line between integer values of x. The details of the interpolating calculations are fully explained elsewhere. (See Tucek, 2009).

Source of the Probabilities of Labor Force Participation and Employment

The data underlying the labor force participation and employment probabilities appear in Table 48. These data are based on the Current Population Survey and are produced by the Bureau of Labor Statistics in an unpublished table titled "Table 10. Employment status of the civilian non-institutional population by educational attainment, age, sex, race, and Hispanic or Latino and Non-Hispanic ethnicity."[1]

The average values over the 1994-to-2009 period for each age category appear in columns (2), (3) and (4) of Table 49. These averages are used to calculate the probability of labor force participation given life and the probability of employment given labor force participation shown in columns (5) and (6), respectively. The resulting probabilities are shown graphically in Figures 1 and 2, along with the corresponding linear spline through the midpoint of each age range.[2] The probabilities in columns H and I of Table 47 are determined by the spline segments.

Comparison With Work Life Expectancy Approach

The work life expectancy of our injured plaintiff was 36.8 years as of the date of the injury. If losses are calculated to the end of this interval (through age 61.5), the present value of the total past and future lost income is $1,701,162, about 8.5 percent higher than the estimate produced by the LPE method. If, instead of front-loading the losses through the end of work life expectancy, the 36.8 years of expected earnings is spread uniformly through age 67, the present value of the total past and future lost income is $1,630,734. This is only about 4.0 percent higher than the LPE estimate.

The LPE method does not consider whether the individual was an active or inactive labor force participant at the time the injury or death occurred. In this example, if an initially inactive labor force status is assumed, front loading the loss through the shorter (35.4 years) work life expectancy produces a total loss of $1,654,908. Uniformly spreading the 35.4 years of earnings through age 67 produces a total loss of $1,569,457.

Variations in Methodology

The calculations explained above are not the only way the required survival, labor force participation, and employment probabilities can be calculated. For example, in interpolating the l(x) for a fractional age, it could be assumed that the survival curve between l(x) and l(x+1) is an exponential or hyperbolic function, rather than linear. (See Tucek, 2009). Likewise, instead of using a linear spline to obtain the labor force participation and employment probabilities, one could fit a low-order polynomial (e.g., a quadratic) to the observed data. Indeed, one could simply use the step functions shown in Figures 1 and 2, though it seems implausible to assume that the desired probability remains constant over a wide interval and sharply increases or decreases at ages 20, 25, 35, 45, 55 and 65.

The last, open-ended age range for the population, labor force and employment data presents a special problem and, consequently, merits some discussion. In this example, the midpoint for the "Age 65 and Greater" range was set equal to 70 years so that the distance between the last two midpoints was consistent with distance between the previous three. There is nothing magical about this: the midpoint could just as easily been set to 67, for example. However, selecting some midpoint for the final age range seems to be superior to assuming that the participation and employment probabilities do not decline after age 65. Likewise, it is superior to simply extrapolating the spline segment connecting the points corresponding to ages 50 and 60: in this example, doing so results in a positive probability of labor force participation through age 105.

Finally, one modification of the LPE methodology replaces the "P" and the "E" with a single probability of employment given survival. The step function and spline for this modified employment probability looks similar to what appears in Figure 1. The employment probabilities under this approach would appear as a single column in Table 47, replacing columns H and I.

Endnotes

1. These data can be downloaded from http://www.valueeconomics.com/data.html.

2. Note that the age range “Age 65 and Greater” does not have a well-defined midpoint. For purposes of this example, it has been set to age 70. See the discussion below.

References

Arias, Elizabeth, 2010. *United States Life Tables, 2005*, National Vital Statistics Report, Volume 58, Number 10, National Center for Health Statistics.

Ciecka, James, and Skoog, Gary. “The Markov (increment-decrement) Model of Labor Force Activity: Extended Tables of Central Tendency, Variation and Probability Intervals”, *Journal Of Legal Economics*, Spring 2001, pp. 23-87.

Tucek, David G., October, 2009. “Calculating Survival Probabilities”, *Journal of Legal Economics*, Volume 16, Number 1, pp. 111-126.

Table 47 - Example of Lost Earnings Calculation Using the LPE Method

Net Discount Rate: 2.00% | Date of Birth: 4/15/1984 | Date of Injury: 12/31/2008 | Trial Date: 8/1/2010

	A	B	C	D	E	F	G	H	I	J	K
	Year	Age at Year End	Lost Earnings*	Present Value Factor	Present Value of Total Lost Earnings	Cumulative Present Value	Survival Probability	Probability of Labor Force Participation	Employment Probability	Risk-Adjusted Present Value of Total Lost Earnings	Cumulative Risk-Adjusted Present Value
Past	2009	25.7	$39,485	1.00000	$ 39,485	$ 39,485	1.00000	0.88331	0.94962	$ 33,120	$ 33,120
''	2010	26.7	$24,022	1.00000	$ 24,022	$ 63,507	1.00000	0.89646	0.95438	$ 20,552	$ 53,673
				Total Past Earnings:	$ 63,507				Total Past Earnings:	$ 53,673	
Future	2010	26.7	$17,158	1.00413	$ 17,087	$ 80,594	0.99942	0.89646	0.95438	$ 14,611	$ 68,283
''	2011	27.7	$42,875	1.01413	$ 42,278	$ 122,872	0.99805	0.90961	0.95913	$ 36,813	$ 105,096
''	2012	28.7	$44,979	1.03441	$ 43,483	$ 166,355	0.99668	0.92276	0.96389	$ 38,547	$ 143,643
''	2013	29.7	$47,492	1.05510	$ 45,012	$ 211,367	0.99532	0.93591	0.96864	$ 40,615	$ 184,259
''	2014	30.7	$50,005	1.07620	$ 46,464	$ 257,831	0.99391	0.94906	0.97340	$ 42,663	$ 226,922
''	2015	31.7	$52,518	1.09772	$ 47,843	$ 305,674	0.99250	0.95066	0.97366	$ 43,952	$ 270,874
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''	2050	66.7	$63,073	2.19532	$ 28,731	$ 1,864,221	0.78556	0.45762	0.96657	$ 9,983	$ 1,537,118
''	2051	67.7	$61,696	2.23923	$ 27,552	$ 1,891,774	0.76995	0.40519	0.96649	$ 8,308	$ 1,545,426
''	2052	68.7	$60,308	2.28401	$ 26,404	$ 1,918,178	0.75323	0.35276	0.96642	$ 6,780	$ 1,552,206
''	2053	69.7	$58,909	2.32969	$ 25,286	$ 1,943,464	0.73536	0.30034	0.96634	$ 5,397	$ 1,557,603
''	2054	70.7	$57,511	2.37629	$ 24,202	$ 1,967,666	0.71623	0.24791	0.96626	$ 4,152	$ 1,561,755
''	2055	71.7	$56,113	2.42381	$ 23,151	$ 1,990,817	0.69580	0.19548	0.96619	$ 3,042	$ 1,564,798
''	2056	72.7	$54,714	2.47229	$ 22,131	$ 2,012,948	0.67389	0.14305	0.96611	$ 2,061	$ 1,566,859
''	2057	73.7	$53,316	2.52174	$ 21,143	$ 2,034,090	0.65056	0.09063	0.96604	$ 1,204	$ 1,568,063
''	2058	74.7	$51,917	2.57217	$ 20,184	$ 2,054,274	0.62570	0.03820	0.96596	$ 466	$ 1,568,529
''	2059	75.7	$50,519	2.62361	$ 19,255	$ 2,073,530	0.59932	0.00000	0.96589	$ -	$ 1,568,529
			Total Lost Earnings through Age 67:		$ 1,872,257				Total FutureEarnings:	$ 1,514,856	
									Total Past Earnings:	$ 53,673	
									Total Lost Earnings:	$ 1,568,529	

*Past lost earnings for 2010 correspond to seven months.

Table 48: Civilian Population, Labor Force and Employment in 000's -- All Males with a Bachelor's Degree - Historical

Year	Civilian Population 16 to 19	Civilian Population 20 to 24	Civilian Population 25 to 34	Civilian Population 35 to 44	Civilian Population 45 to 54	Civilian Population 55 to 64	Civilian Population >= 65
1994	0	902	3,761	3,802	2,518	1,290	1,284
1995	3	795	3,914	3,730	2,720	1,314	1,370
1996	3	809	3,947	3,706	2,926	1,421	1,498
1997	2	761	3,956	3,818	3,019	1,493	1,549
1998	2	777	3,936	4,016	3,215	1,553	1,597
1999	5	780	3,957	4,129	3,366	1,617	1,701
2000	3	813	4,102	4,077	3,594	1,706	1,729
2001	6	870	4,034	4,156	3,725	1,833	1,733
2002	5	865	4,080	4,129	3,790	2,098	1,849
2003	5	931	4,107	4,244	3,848	2,367	1,893
2004	10	970	4,093	4,214	3,915	2,517	1,996
2005	9	931	4,058	4,170	3,863	2,640	2,048
2006	10	960	4,107	4,227	3,987	2,850	2,110
2007	11	1,050	4,235	4,341	4,059	3,107	2,161
2008	13	1,099	4,347	4,290	4,128	3,180	2,381
2009	12	1,115	4,329	4,215	4,009	3,331	2,515
Average:	6.2	901.8	4,060.2	4,079.0	3,542.6	2,144.8	1,838.4

	Civilian Labor Force 16 to 19	Civilian Labor Force 20 to 24	Civilian Labor Force 25 to 34	Civilian Labor Force 35 to 44	Civilian Labor Force 45 to 54	Civilian Labor Force 55 to 64	Civilian Labor Force >= 65
1994	0	766	3,590	3,697	2,408	953	327
1995	2	687	3,726	3,620	2,589	987	337
1996	2	687	3,757	3,580	2,768	1,065	361
1997	2	656	3,779	3,694	2,876	1,138	347
1998	2	658	3,754	3,893	3,037	1,188	362
1999	2	671	3,760	4,006	3,178	1,241	402
2000	3	707	3,923	3,944	3,389	1,288	412
2001	3	740	3,837	4,023	3,520	1,408	410
2002	3	727	3,891	3,981	3,583	1,626	445
2003	4	789	3,855	4,102	3,606	1,819	463
2004	7	829	3,866	4,044	3,641	1,960	487
2005	6	797	3,811	4,003	3,618	2,088	530
2006	7	817	3,870	4,056	3,747	2,249	532
2007	8	888	4,035	4,176	3,816	2,436	540
2008	9	924	4,125	4,117	3,900	2,466	641
2009	6	927	4,075	4,043	3,779	2,587	696
Average:	4.1	766.9	3,853.4	3,936.2	3,340.9	1,656.2	455.8

Year	Civilian Employed 16 to 19	Civilian Employed 20 to 24	Civilian Employed 25 to 34	Civilian Employed 35 to 44	Civilian Employed 45 to 54	Civilian Employed 55 to 64	Civilian Employed >= 65
1994	0	719	3,497	3,610	2,331	920	314
1995	2	644	3,635	3,547	2,523	958	321
1996	1	645	3,673	3,502	2,707	1,038	346
1997	2	627	3,709	3,619	2,812	1,111	336
1998	2	629	3,696	3,842	2,979	1,162	350
1999	2	632	3,690	3,936	3,118	1,208	391
2000	3	677	3,856	3,883	3,337	1,266	399
2001	3	691	3,740	3,935	3,433	1,367	396
2002	3	680	3,761	3,861	3,463	1,560	431
2003	4	734	3,713	3,956	3,493	1,746	446
2004	7	778	3,748	3,927	3,540	1,884	476
2005	6	750	3,708	3,919	3,524	2,020	516
2006	7	772	3,780	3,978	3,667	2,193	520
2007	7	831	3,938	4,098	3,742	2,374	529
2008	8	863	4,006	4,028	3,811	2,381	620
2009	4	834	3,864	3,829	3,582	2,437	655
Average:	3.8	719.1	3,750.9	3,841.9	3,253.9	1,601.6	440.4

Source: BLS Table 10. Employment status of the civilian noninstitutional population by educational attainment, age, sex, race, and Hispanic or Latino and Non-Hispanic ethnicity for each year shown.

Table 49: Civilian Population, Labor Force and Employment -- All Males with a Bachelor's Degree - by Age

Average Values for 1994 to 2008 (000's)

	(1) Midpoint of Age Range	(2) Civilian Population	(3) Civilian Labor Force	(4) Civilian Employed	(5) Probability of LF Particpation Given Life	(6) Probability of Employment Given LF Part
Age 16 to 19	18.0	6.2	4.1	3.8	0.66667	0.92424
Age 20 to 24	22.5	901.8	766.9	719.1	0.85043	0.93773
Age 25 to 34	30.0	4,060.2	3,853.4	3,750.9	0.94906	0.97340
Age 35 to 44	40.0	4,079.0	3,936.2	3,841.9	0.96499	0.97604
Age 45 to 54	50.0	3,542.6	3,340.9	3,253.9	0.94307	0.97394
Age 55 to 64	60.0	2,144.8	1,656.2	1,601.6	0.77218	0.96702
Age 65 and Greater	70.0	1,838.4	455.8	440.4	0.24791	0.96626

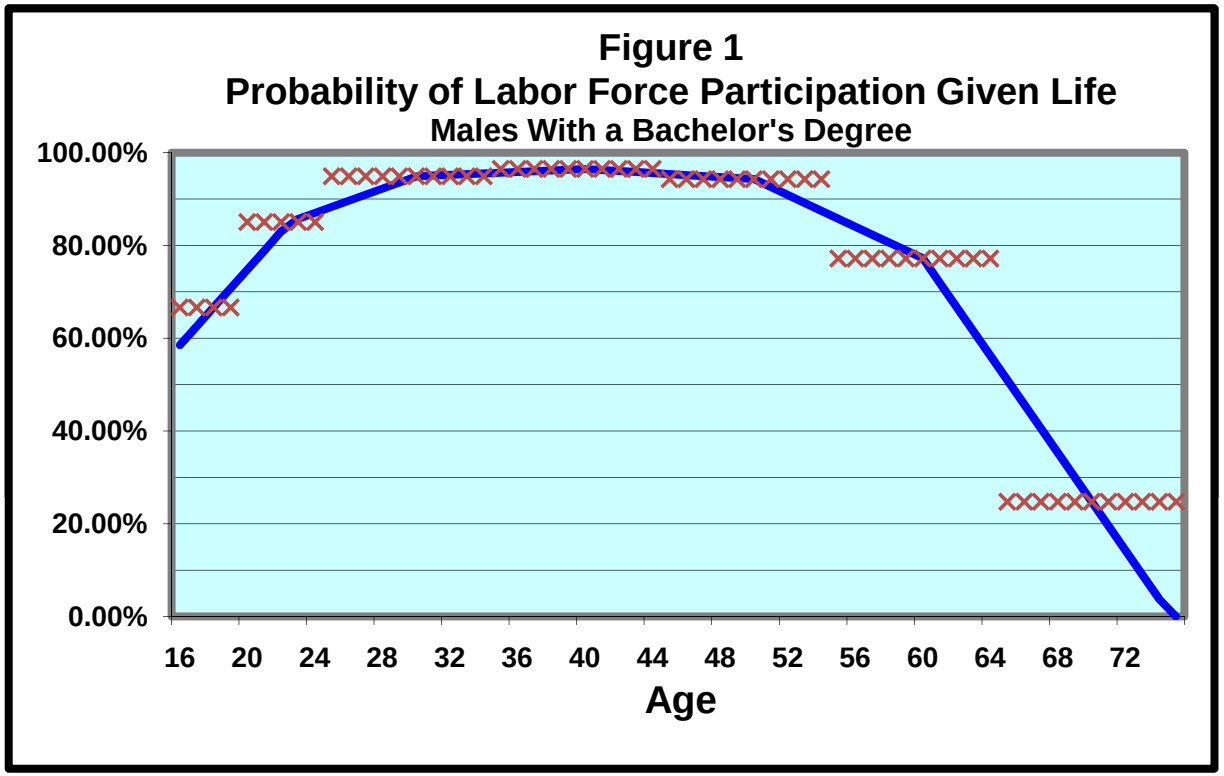
Figure 1
Probability of Labor Force Participation Given Life
Males With a Bachelor's Degree
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
16
20
24
28
32
36
40
44
48
52
56
60
64
68
72
Age

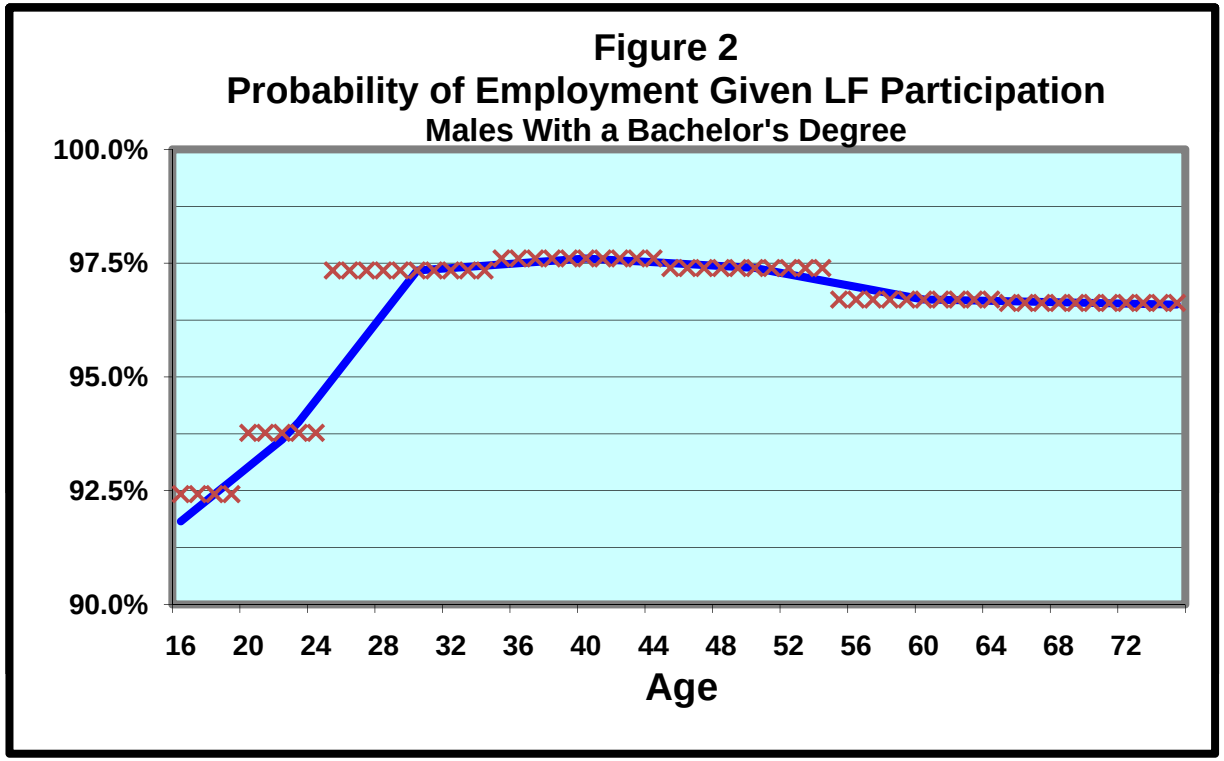
Figure 2
Probability of Employment Given LF Participation
Males With a Bachelor's Degree
100.0%
97.5%
95.0%
92.5%
90.0%
16
20
24
28
32
36
40
44
48
52
56
60
64
68
72
Age