The Impact of the SSA Cohort Tables on Work Life Expectancy: An Application of the Skoog-Ciecka-Krueger Transition Probabilities

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Abstract

This paper presents an overview of the calculations underlying the probability mass functions for work life expectancy and analyses the impact of substituting the Social Security Administration's cohort life tables in place of the period life tables that the published work life expectancy estimates are based upon.

I Introduction

Each year the Social Security Administration (SSA), in conjunction with the presentation of its *Annual Report of the Board of Trustees* to Congress, prepares cohort life tables that are specific to individual birth years and which are based on a combination of actual and projected mortality rates for each birth cohort. These cohort tables differ from the period tables – such as those published by the National Center for Health Statistics (NCHS) – that most forensic economists rely on. Period life tables present what would happen to a synthetic cohort through time if it experienced the age-specific death rates for a particular period throughout the life of the cohort. The latest NCHS period tables were published in January 2014 based on the 2009 mortality experience (Arias, 2014).[1]

A comparison of the 2006 NCHS period and the SSA cohort and period life tables underlying the 2010 Trustees' *Report* was presented in Tucek (2011). Tucek concluded that there was little difference between the two sets of period life tables, and that most of the differences between the NCHS period and SSA cohort tables were due to improved mortality after age 55 in the cohort tables. Tucek addressed the question of the significance of these differences on three types of economic losses: (1) lost earnings; (2) household services; and (3) lost pension benefits. He found that the differences were bigger for males than for females and concluded that they were only material with respect to the lost pension benefits. He also noted that there is nothing in most forensic economists' training that would permit a professional opinion on the adequacy of the projected mortality improvements found in the SSA's cohort tables and reached no conclusion concerning which set of tables were more appropriate on the basis of his reported results.

In assessing the impact of the differences on the estimation of lost earnings, Tucek relied on the LPE (Life/Participation/Employment) methodology. The probability of life (the "L" in "LPE") was based on the 2006 NCHS period life tables and the SSA's cohort life tables corresponding to the 2010 Trustees' *Report.* The probabilities of labor force participation and employment (the "P" and the "E") were based on data compiled by the Bureau of Labor Statistics (BLS) showing population, labor force and employment totals by gender for all levels of educational attainment for the years 1994 through 2009.

While the LPE approach is a valid methodology, it is not widely used by forensic economists. Slesnick, Luthy and Brookshire (2013) report that only 3.0 percent of their survey's respondents relied on the LPE methodology, while 62.7 percent relied on work life expectancy (WLE) tables published in economics journals.[2] The most recent and comprehensive set of such WLE tables are those found in Skoog, Ciecka, and Krueger (2011) – hereinafter "S-C-K". In addition to providing WLE estimates for eight levels of educational attainment, the authors have provided estimates of the distributional characteristics of the resulting probability mass functions (PMF). An example of such a PMF appears in Figure 1, for an initially active 54-year old male with a high school degree.

Perhaps even more important than these statistics, S-C-K have made available, via supplemental material found on the website of the *Journal of Forensic Economics*, the transition probabilities underlying their published WLE estimates. These transition probabilities enable a forensic economist to generate the PMF corresponding to a specific plaintiff's circumstances and to extend the loss analysis beyond mere use of a tabulated WLE value. For example, in conjunction with an appropriate life table, the transition probabilities can be used to calculate directly the probability of being alive and active in the labor force by age. These probabilities can in turn be used to calculate expected losses over the plaintiff's remaining life, rather than front-loading the losses through the WLE or somehow allocating the remaining years of work life through a specific age such as the full Social Security retirement age.[3] Moreover, the availability of the S-C-K transition probabilities allows the forensic economist to estimate WLE, and the associated PMF, based on a different mortality table other than the 2006 tables the published S-C-K tables are based upon.

Following an overview of the Markov increment/decrement model of labor force activity, this paper compares the 2006 NCHS period life tables with the 2009 NCHS tables and with the cohort tables underlying the SSA Trustees' 2013 *Report*, and then presents an analysis of the change in the mean WLEs that result if the Trustees' 2013 cohort tables are substituted for the 2006 NCHS period tables. A description of the Excel spreadsheets underlying the analysis is provided in Appendix A. The spreadsheet corresponding to persons with a GED can be found at http://www.valueeconomics.com/. This spreadsheet can be easily modified to estimate the WLE corresponding to any of the S-C-K transition probabilities using any desired life table.[4]

II Overview of The Markov Process Model of Labor Force Activity

S-C-K concisely and completely describes the specification of the Markov increment/decrement model of labor force activity at pages 171-175 of their paper. A summary of their model notation appears in Table 1. Though not specified by the notation, the variables and expressions in Table 1 are gender specific. Table 2 presents the model's global and boundary conditions, and the main recursions that determine the PMFs for initially active and inactive labor force participants. The calculations specified by the relationships listed in Table 2 can be implemented in a variety of ways, for example by program code written in SAS, APL or Visual Basic, or via a spreadsheet like Excel.

Regardless of the computational platform chosen, the key to successful implementation of the model is to realize (1) that the PMFs must be calculated in order of declining age and (2) that the PMFs for initially active labor force participants depend on the PMFs for initially inactive participants, and *vice versa*. This can be seen by considering the main recursion corresponding to a 60-year old active labor force participant for 2.5 years of remaining WLE:

$$\rho_{YA}(60,a,2.5) = {}^{a}\rho^{a}_{60} \cdot \rho_{YA}(61,a,1.5) + {}^{a}\rho^{i}_{60} \cdot \rho_{YA}(61,i,2)$$

Clearly, $\rho_{YA}(60,a,2.5)$ cannot be calculated until the active and inactive PMFs for age 61 are known. Similarly, $\rho_{YA}(61,a,1.5)$ and $\rho_{YA}(61,i,2)$ cannot be calculated until the active and inactive PMFs for age 62 are known. The recursive nature of the calculations and the interdependency between the active and inactive PMFs, along with the role of the boundary conditions, are illustrated in Figures 2 and 3 for initially active and inactive labor force participants, respectively. These figures summarize the logic underlying the spreadsheet found at http://www.valueeconomics.com/.

The transition probabilities provided as supplemental material by S-C-K are the raw transition probabilities and are not conditioned on the probability of survival; they must be multiplied by 1 minus the probability of death to correspond to the measures in Table 1. The transition probabilities start at age 16 and end with age 110. While this effectively defines the Markov model's earliest beginning age ("BA") as 16 years, for education levels greater than GED the published tables begin at ages greater than 16 years. Similarly, all of the tables end at age 75, even though it is possible to extend the calculations to later ages. The primary reason for this is that the paucity of data at older ages (and at younger ages for higher education levels) makes the resulting WLE estimates less reliable even though the underlying calculations relying on the published transition probabilities are correct.

Finally, the S-C-K WLE tables are based on the assumption of mid-year transitions. This assumption does not affect the calculation of the probabilities portrayed in the PMF or its distributional parameters such as its standard deviation; only the mean, median and modal WLEs for initially active persons are affected. Specifically, end-of-year transitions increase the mean WLE expectancies by one half of a year while start-of-year transitions decrease the mean WLE expectancies by one-half year. For initially inactive persons, the timing of the transition assumption has no effect.

III Comparison of NCHS Period Life Tables With the SSA's Cohort Tables

In terms of life expectancy, the SSA cohort tables present a marked improvement when compared to the 2006 or 2009 period tables. This is illustrated in Figure 4, which shows the 2009 NCHS and SSA increases in life expectancy from the 2006 NCHS table for 20-, 30-, 40-, 50- and 60-year-old males and females. The 2006 to 2009 NCHS increases (white bars) are much smaller than the 2006 NCHS to SSA increases (black bars). The difference between the white and black bars equals the difference in life expectancy between the SSA cohort tables and the corresponding 2009 NCHS tables. Two patterns are apparent for the SSA increases: (1) the differences are greater for males for all starting ages and (2) the change in remaining life expectancy decreases as the starting age increases for both males and females.

These patterns are the result of the differences in the survival probabilities shown in Figure 5 for males and females. The pattern is the same as found in Tucek (2011): the change in survival probabilities decreases as the starting age increases and the differences in survival probabilities are greater for males for all starting ages. For both males and females, the change in survival probability is relatively minor until after age 55, and reaches a peak some time after age 80.

IV Impact of Cohort Tables on Mean WLE Estimates

Given the across-the-board improvement in mortality risk contained in the SSA cohort life tables starting at or around age 55, it is a foregone conclusion that substituting those tables in place of the 2006 NCHS period life tables will result in increased estimates in the remaining life expectancies for both males and females across all levels of educational attainment and for both active and inactive initial labor force status. The percent increases from the S-C-K mean WLEs for 20-, 30-, 40-, 50- and 60-year-old males and females are summarized in Table 3. The increases range from a low of 0.87 percent (50-year old initially active female with 0 to 12 years of education and no degree) to a high of 7.67 percent (60-year old initially inactive male with a GED). In each instance the percent increase is greater for males than for females, and greater for an initially inactive male or female than for an initially active male or female. For males, the increases grow larger with age in all instances except for initially active males with a Bachelor's or Master's degree. For these males, the percent increases are flat until age 60 and then jump. For females there is a tendency for the percent increases to rise starting at age 50 for most levels of educational attainment. For both males and females the largest increase corresponds to age 60 across all levels of educational attainment and for both active and inactive initial labor force status.

Table 4 addresses the statistical significance of the differences. The entries equal the difference between the mean WLE estimates calculated using the SSA cohort tables and the S-C-K bootstrap estimates of the mean WLE, divided by the S-C-K bootstrap standard error of the mean estimate. Values greater than 1.00 are in bold font; there are 74 such entries. The 33 values in the outlined cells are greater than 1.65.

Skoog and Ciecka (2004) have concluded that the bootstrap estimates based on 1997-1998 transition probabilities and the 1995 NCHS life tables are normally distributed. Given this assumption about the more recent S-C-K tables, the differences corresponding to the 33 outlined entries are significantly different from zero at a 95 percent confidence level.[5] The differences corresponding to the 86 non-bolded entries are likely not significantly different than zero.

V Impact on Economic Loss Calculations

Whether or not the increase in WLE is subjectively small (*e.g.,* 0.87 percent) or large (*e.g.,* 7.67 percent), or whether or not the difference is deemed to be statistically significant from zero, at bottom the fundamental question is what impact the increase has on economic loss estimates. Tucek (2011) addressed this question by looking at the impact on the present value of a $10,000 annual loss discounted at net discount rates ranging from 0.5 to 3.0 percent in increments of 50 basis points for 20-, 30-, 40-, 50- and 60-year-old males and females. . Using the LPE method, he found that for males, the differences between the NCHS period tables and the SSA period table ranged from 0.60 to 1.52 percent. For females, the range was 0.16 to 0.67 percent. Tucek concluded these differences were probably not materially significant.

A similar approach was followed in determining the material significance of the differences summarized in Table 3. In addition to projecting an annual loss of $10,000, future income was projected using an age-earnings profile for each combination of gender and level of educational attainment.[6] An example of such a profile is found in Figure 6 for females with a Bachelor's degree. Present values were calculated using net discount rates ranging from 0.0 to 3.0 percent in increments of 50 basis points.

In place of the LPE method, the earnings losses were adjusted for WLE via three approaches. The first approach is front loading – the losses were assumed to occur with certainty from the beginning age to the end of WLE and then stop. The second approach is uniform loading – the losses were assumed to occur with certainty from the beginning age through age 67, but were reduced by the ratio of WLE to 67 minus the beginning age. In the third approach, the projected losses were reduced by multiplying by the probability of being an active labor force participant, using the S-C-K transition probabilities in conjunction with the 2006 NCHS life tables and the 2013 SSA life tables. Under this approach, the earnings loss and the probabilities of being active were extended to age 100. Appendix B presents the calculations needed to determine the probability of being active at each age.

The percent increases in the present value follow similar patterns across both genders and across all levels of educational attainment. These patterns are illustrated in Figure 7, which shows the present value increases for a female with a Bachelor's degree. The top half of the figure corresponds to a 30-year old female and shows that the increase in the present value declines as the net discount rate increases whether the individual is initially active or inactive, or whether the earnings loss is modeled as a straight $10,000 per year or is based on the age-earnings profile.[7] The lower half of Figure 7 shows the present value increase by age, with a fixed net discount rate of zero. Again, this pattern is displayed by both genders and across all levels of educational attainment: the increase in the present value is flat or rises only slightly until age 60, at which point the increase takes a jump.

Tables 5, 6 and 7 present the maximum increase in the present value by age for both males and females by initial labor force status and for each level of educational attainment. Table 5 corresponds to front loading and Table 6 corresponds to uniform loading. Table 7 corresponds to the WLE adjustment based on the probability of being an active labor force participant. Tables 8, 9 and 10 present the same information for the minimum increase in the present value.

An examination of these tables reveals the following findings. First, in every case, the increase in the present value for an initially inactive labor force participant always exceeds that of the corresponding increase for an initially active participant. Second, for all cases, the percent increase is flat or slightly rising until age 60, at which point the increase jumps. Third, and consistent with this pattern and with the pattern exhibited by the increases in WLE in Table 3, the largest increase occurs at age 60.

Finally, and perhaps most important, Tables 5, 6 and 7 reveal that the increase is greater than 5 percent only for 60-year old initially inactive males. This threshold is exceeded for initially inactive 60-year-old males for all levels of educational attainment when the WLE adjustment is based on uniform loading, regardless of how earnings are modeled. For front loading, it is exceeded only for initially inactive 60-year-old males with a GED, some college, or with a professional or PhD degree whether the income is modeled as a straight $10,000 per year or is based on the age-earnings profile. When the WLE adjustment is based on the probability of being an active labor force participant, the threshold is exceeded for initially inactive 60-year-old males for all levels of educational attainment except for 0-12 years of education and for professional or PhD degree. Additionally, none of the instances in which the 5 percent threshold is exceeded correspond to those instances identified in Table 4 as corresponding to an increase in the estimated WLE that is statistically different from zero. These statistically significant instances correspond to the outlined cells in Tables 5, 6 and 7.

Table 11 shows the present value increases for initially inactive 60-year-old males for all levels of educational attainment across all net discount rates, for both front loading and for the WLE adjustment based on the probability of being an active labor force participant. The present value increases corresponding to uniform loading are not shown because, as noted earlier, they do not vary with the net discount rate. A shown in Table 11, whenever the increase in the present value exceeds 5 percent for a zero net discount rate, it often does so across the entire range of net discount rates. There are six exceptions to this pattern, all corresponding to the WLE adjustment based on the probability of being an active labor force participant.

VI Summary and Conclusions

As noted earlier, the SSA cohort life tables' improvement in the mortality risk starting at or around age 55 means that substituting those tables in place of the 2006 NCHS period life tables will result in increased estimates of the remaining life expectancies for both males and females across all levels of educational attainment and for both active and inactive initial labor force status. The results presented above show that, at least for the ages studied, a significant and material difference in WLE is not likely. A five percent threshold was exceeded only for initially inactive 60-year-old males, and none of these instances corresponded to an increase in the underlying WLE estimate that was significantly different from zero. Conversely, even though use of the SSA cohort tables resulted in statistically significant increases in the underlying WLE estimates in some instances, none of these instances resulted in a present value increase greater than 5 percent.

Of course, use of a different threshold level will result in a different conclusion about the likelihood of a material increase in the present value of lost income. For example, because none of the present value increases exceeded 8 percent, a 10 percent threshold would lead to the conclusion that use of the SSA cohort table would not be expected to result in a material difference in the present value of lost income. Taken in isolation, this conclusion appears reasonable since a 10 percent difference in estimated damages is not likely to provide an incentive for either party to go to trial. Nevertheless, there may be other factors – such as differences in the estimated level of base earnings – that do provide such an incentive. In these circumstances, the issue of which life table to use may be both relevant and material.

It is important to note that none of the above analysis or discussion speaks to the issue of whether the mortality improvements contained in the SSA cohort life tables are valid. Reaching a professional judgment on this issue would require a detailed analysis of the methods and assumptions underlying the SSA Trustee's projection of the mortality improvements. Not only is the requisite data and information not found in the SSA Trustee's *Report*, there is also nothing in most forensic economists' training that would permit such a review.

Finally, those who would rely on the SSA life tables as a basis for WLE estimates should realize that a tabulation of such estimates would be massive and relatively useless. The SSA cohort tables vary both by gender and birth year. Consequently, a table showing the WLE's of persons age 20, 21, 22, ... , 75 that is valid in 2014 would be based on birth years 1994, 1993, 1992, ... , 1939. Come 2015, the table would be out-of-date and need to be recreated using birth years 1995, 1994, 1993, ... , 1940. The only practical way to utilize the SSA cohort tables to estimate or account for WLE is to perform the requisite calculations on a case-by-case basis.

[1] In addition to the cohort tables, the SSA also prepares a set of period life tables by calendar year. The SSA does not publish the life tables underlying the Trustees' *Report*, but will make them available upon request. Excel versions of the tables for each *Report* from 2010 through 2013 may be downloaded from http://www.valueeconomics.com/. Extended versions of the NCHS period tables are also found there.

[2] Tables published by the Bureau of Labor Statistics were relied on by 4.8 percent of the survey respondents, while 4.2 percent relied on years to final labor force separation. Only 7.8 percent of the respondents ended the loss calculation at some fixed retirement age. The remaining 17.5 percent reported using a combination of these techniques.

[3] These are the three principle ways in which the concept of WLE is used to estimate earnings loss. Front-loading always overstates the estimated loss while uniform loading through a specific age can either overstate or understate the loss. See Skoog and Ciecka (2006).

[4] This spreadsheet, and its seven counterparts, successfully replicates all of the measures in the S-C-K tables excluding the bootstrap means and standard errors in the tables' two rightmost columns. Note that while the SSA cohort and NCHS period life tables used in these spreadsheets extend through age 119, closing the life tables at age 100 does not change the resulting mean or median WLEs.

[5] Because there is an *a priori* expectation that use of the SSA life table will result in a higher estimated WLE, a one-tail test is appropriate.

[6] The age-earnings curves are based on the average of mean and median earnings found in Expectancy Data (2013). The curves are calculated as a linear spline connecting the midpoints of each bracket, with the final line segment extended to provide income projections beyond the last bracket. For 0-to-12 years of education, the profiles are based on the averages of the means and medians corresponding to "less than 9th grade" and "9th-12th grade, no diploma". Similarly, the profiles for professional or PhD degree are based on the averages of the means and medians corresponding to "professional degree" and "doctorate degree".

[7] The WLE adjustment underlying Figure 7 is based on the probability of being an active labor force participant. Front loading results in a similar pattern. Uniform loading results in a constant percent increase across all net discount rates. The reason for this is that the difference in the two present values is determined by the ratio of the respective WLE estimates to the length of time to the assumed age at which the loss ends – 67 years in this analysis.

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Table 1 - Notation for the Markov Increment/Decrement Model

Variables

a = Labor force status is active.

i = Labor force status is inactive.

x = Age.

y = Years of labor force participation.

BA = The youngest age at which labor force partcipation can occur, i.e., the beginning age.

TA = The age at which all persons will have left the labor force or died, i.e., the truncation age.

Expressions

${}^{\cdot\, d}\rho_x$ = Probability of dying within one year at age x.

${}^{a\, a}\rho_x$ = Probability of remaining in the active state for 1 year at age x.

${}^{a\, i}\rho_x$ = Probability of moving from the active state at age x to the inactive state at age x+1.

${}^{i\, i}\rho_x$ = Probability of remaining in the inactive state for 1 year at age x.

${}^{i\, a}\rho_x$ = Probability of moving from the inactive state at age x to the active state at age x+1.

$\rho_{YA}(x,a,y)$ = Probability that an initially active person of age x will accumulate y additional years of labor force participation.

$\rho_{YA}(x,i,y)$ = Probability that an initially inactive person of age x will accumulate y additional years of labor force participation.

(Note: $\rho_{YA}(x,a,y)$ and $\rho_{YA}(x,i,y)$ are the probability mass functions for initially active and inactive persons of exact age x, respectively.)

Table 2 - The Markov Increment/Decrement Model

Global Conditions

(1a) $\rho_{YA}(x,a,y) = \rho_{YA}(x,i,y) = 0$ if $y<0$ or $y>TA - x - 0.5$

Specifies that probability of additional years of labor force activity that is negative or greater than the truncation age equals zero.

(1b) $\rho_{YA}(TA,a,0) = \rho_{YA}(TA,i,0) = 1$

Specifies that the remaining work life after the truncation age equals zero with certainty.

(1c) ${}^{a}\rho^{d}_{x} = {}^{i}\rho^{d}_{x} = {}^{\cdot}\rho^{d}_{x}$ for $x = BA, \ldots, TA\text{-}1$

The probablity of dying within one year is independent of labor force status.

(1d) ${}^{a}\rho^{d}_{TA-1} = {}^{i}\rho^{d}_{TA-1} = 1$

The probablity of dying after one minus the truncation age equals one.

Boundary Conditions for x = BA, . . . , TA-1

(2a) $\rho_{YA}(x,a,0) = 0$

Given an initially active state, the probability of zero remaining years of labor force activity equals zero.

(2b) $\rho_{YA}(x,a,0.5) = {}^{a}\rho^{d}_{x} + {}^{a}\rho^{i}_{x} \cdot \rho_{YA}(x+1,i,0)$

Given an initially active state, the probability of 0.5 years of remaining labor force activity equals the probability of dying plus the probability of tranistioning to the inactive state and remaining there.

(2c) $\rho_{YA}(x,i,0) = {}^{i}\rho^{d}_{x} + {}^{i}\rho^{i}_{x} \cdot \rho_{YA}(x+1,i,0)$

Given an initially inactive state, the probability of zero years of remaininglabor force activity equals the probability of dying plus the probability of remaining in the inactive state.

Main Recursions for x = BA, . . . , TA-1

(3a) $\rho_{YA}(x,a,y) = {}^{a}\rho^{a}_{x} \cdot \rho_{YA}(x+1,a,y-1) + {}^{a}\rho^{i}_{x} \cdot \rho_{YA}(x+1,i,y-0.5)$, $y = 1.5, 2.5, 3.5, \ldots, TA\text{-}x\text{-}0.5$

Given an initially active state, the probability at age x of y years of remaining labor force activity equals the probability of transitioning to the active state times the probability of y-1 years of activity at age x+1, plus the probability of transitioning to the inactive state times the probability of y-0.5 years of inactivity at age x+1.

(3b) $\rho_{YA}(x,i,y) = {}^{i}\rho^{a}_{x} \cdot \rho_{YA}(x+1,a,y-0.5) + {}^{i}\rho^{i}_{x} \cdot \rho_{YA}(x+1,i,y)$, $y = 1, 2, 3, \ldots, TA\text{-}x$

Given an initially inactive state, the probability at age x of y years of remaining labor force activity equals the probability of transitioning to the active state times the probability of y-0.5 years of activity at age x+1, plus the probability of transitioning to the inactive state times the probability of y years of inactivity at age x+1.

Table 3 - SSA Cohort Tables versus 2006 NCHS Period Tables
Percent Increase in Mean Work Life Expectancy

	Males		Females		Males		Females	
Age	**Initially Active**	**Initially Inactive**	**Initially Active**	**Initially Inactive**	**Initially Active**	**Initially Inactive**	**Initially Active**	**Initially Inactive**
	0-12 Years of Education, No Degree				**Associate's Degree**			
20	1.87%	1.95%	1.00%	1.07%	2.34%	2.44%	1.20%	1.22%
30	1.92%	2.15%	0.92%	1.05%	2.39%	2.55%	1.15%	1.26%
40	1.97%	2.47%	0.87%	1.03%	2.48%	2.87%	1.06%	1.24%
50	1.94%	3.27%	0.90%	1.37%	2.58%	3.51%	1.17%	1.55%
60	2.70%	5.53%	1.28%	2.99%	3.32%	6.21%	1.32%	2.11%
	GED Degree				**Bachelor's Degree**			
20	2.48%	2.56%	1.08%	1.11%	2.07%	2.14%	1.38%	1.47%
30	2.58%	2.88%	1.04%	1.14%	2.05%	2.15%	1.40%	1.55%
40	2.68%	3.39%	0.91%	1.13%	2.09%	2.29%	1.33%	1.58%
50	2.98%	4.48%	1.05%	1.65%	2.05%	2.66%	1.50%	1.98%
60	4.05%	7.67%	1.29%	2.66%	2.74%	5.12%	1.93%	3.40%
	High School Diploma				**Master's Degree**			
20	2.17%	2.26%	1.23%	1.30%	na	na	na	na
30	2.20%	2.43%	1.18%	1.32%	2.58%	2.73%	1.42%	1.52%
40	2.27%	2.70%	1.12%	1.36%	2.60%	2.76%	1.35%	1.57%
50	2.26%	3.16%	1.24%	1.84%	2.56%	3.07%	1.51%	2.01%
60	3.18%	6.02%	1.61%	3.20%	3.33%	5.23%	1.87%	3.37%
	Some College, No Degree				**Professional of PhD Degree**			
20	2.13%	2.21%	1.36%	1.38%	na	na	na	na
30	2.14%	2.31%	1.31%	1.42%	3.48%	3.70%	2.35%	2.51%
40	2.16%	2.58%	1.28%	1.52%	3.53%	3.79%	2.38%	2.78%
50	2.18%	3.08%	1.39%	1.88%	3.56%	4.18%	2.72%	3.56%
60	3.01%	5.61%	1.77%	3.40%	4.54%	6.72%	3.21%	4.53%

Table 4 - SSA Cohort Tables WLE Minus S-C-K Bootstrap WLE Divided by S-C-K Bootstrap Standard Error

Age	Males Initially Active	Males Initially Inactive	Females Initially Active	Females Initially Inactive	Males Initially Active	Males Initially Inactive	Females Initially Active	Females Initially Inactive
	0-12 Years of Education, No Degree				**Associate's Degree**			
20	**1.46**	**1.59**	0.48	0.63	**2.85**	**2.33**	**1.40**	0.82
30	**1.27**	1.00	0.40	0.45	**2.45**	**1.85**	**1.23**	0.67
40	0.97	0.96	0.29	0.35	**1.90**	**1.26**	0.86	0.37
50	0.73	0.61	0.36	0.26	**1.21**	0.86	0.63	0.16
60	0.82	0.68	0.24	0.60	0.93	**1.14**	0.54	0.09
	GED Degree				**Bachelor's Degree**			
20	**2.51**	**2.10**	0.29	0.33	**2.58**	**3.07**	**1.20**	**1.13**
30	**2.32**	**1.43**	0.27	0.42	**2.14**	**2.85**	**1.40**	**1.58**
40	**1.97**	**1.20**	0.24	0.28	**1.55**	**1.56**	1.00	**1.13**
50	**1.50**	**1.23**	0.20	0.21	0.89	0.83	0.79	0.74
60	**1.39**	**1.63**	0.14	0.29	0.54	0.90	0.59	0.67
	High School Diploma				**Master's Degree**			
20	**2.32**	**2.19**	**1.72**	**1.75**	na	na	na	na
30	**1.97**	**1.61**	**1.50**	**1.31**	**2.90**	**2.88**	**1.02**	0.79
40	**1.69**	0.98	**1.39**	**1.17**	**2.13**	**2.43**	0.73	0.59
50	**1.20**	0.83	**1.06**	0.79	**1.38**	**1.25**	0.53	0.31
60	0.79	1.00	0.80	0.75	0.90	0.88	0.23	0.35
	Some College, No Degree				**Professional of PhD Degree**			
20	**2.34**	**2.36**	**1.74**	**1.58**	na	na	na	na
30	**2.13**	**1.81**	**1.25**	**1.21**	**3.57**	**3.17**	0.67	0.61
40	**1.62**	**1.12**	1.00	0.91	**2.68**	**2.26**	0.50	0.50
50	**1.19**	0.75	0.79	0.90	**1.87**	**1.60**	0.39	0.50
60	**1.18**	0.95	0.52	0.67	**1.30**	**1.12**	0.29	0.28

Bold values are greater than 1.00. Values in outlined cells are greater than 1.65.

Table 5 – Maximum Present Value Increase Due to SSA Cohort Tables
WLE Adjustment Based on Front Loading

	$10,000 per Year								Age-Earnings Profile							
	Males		Females		Males		Females		Males		Females		Males		Females	
	Initially		Initially		Initially		Initially		Initially		Initially		Initially		Initially	
Age	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive
	0-12 Years of Education, No Degree				Associate's Degree				0-12 Years of Education, No Degree				Associate's Degree			
20	1.81%	1.89%	0.96%	1.02%	**2.27%**	**2.36%**	1.15%	1.19%	2.19%	2.31%	1.08%	1.13%	**2.64%**	**2.77%**	1.37%	1.43%
30	1.84%	2.06%	0.90%	1.02%	**2.32%**	**2.48%**	1.11%	1.21%	2.02%	2.28%	0.97%	1.09%	**2.40%**	**2.59%**	1.21%	1.32%
40	1.89%	2.33%	0.80%	0.99%	**2.37%**	2.70%	1.02%	1.18%	1.95%	2.42%	0.82%	1.03%	**2.34%**	2.67%	1.06%	1.22%
50	1.78%	2.84%	0.83%	1.27%	2.36%	3.15%	1.09%	1.44%	1.82%	2.85%	0.85%	1.28%	2.38%	3.07%	1.12%	1.46%
60	2.31%	3.87%	0.98%	1.65%	3.00%	4.87%	1.22%	1.70%	2.31%	3.89%	0.99%	1.67%	3.10%	4.95%	1.25%	1.72%
	GED Degree				Bachelor's Degree				GED Degree				Bachelor's Degree			
20	**2.39%**	**2.47%**	1.04%	1.09%	**2.02%**	**2.08%**	1.36%	1.41%	**2.87%**	**2.98%**	1.20%	1.28%	**2.31%**	**2.43%**	1.54%	1.63%
30	**2.48%**	2.76%	0.99%	1.08%	**2.00%**	**2.09%**	1.34%	1.48%	**2.66%**	2.99%	1.04%	1.15%	**2.00%**	**2.10%**	1.34%	1.52%
40	**2.57%**	3.16%	0.88%	1.07%	1.98%	2.19%	1.26%	1.47%	**2.65%**	3.23%	0.90%	1.09%	1.87%	2.07%	1.20%	1.43%
50	2.73%	3.93%	0.95%	1.43%	1.88%	2.45%	1.38%	1.81%	2.78%	3.93%	0.94%	1.43%	1.80%	2.31%	1.32%	1.73%
60	3.44%	5.89%	1.11%	1.77%	2.43%	3.85%	1.63%	2.51%	3.54%	5.99%	1.15%	1.76%	2.42%	3.82%	1.61%	2.48%
	High School Diploma				Master's Degree				High School Diploma				Master's Degree			
20	**2.12%**	**2.20%**	**1.20%**	**1.26%**	na	na	na	na	**2.52%**	**2.65%**	**1.42%**	**1.50%**	na	na	na	na
30	**2.14%**	2.32%	1.15%	1.28%	**2.48%**	**2.62%**	1.35%	1.48%	**2.28%**	2.51%	1.24%	1.39%	**2.48%**	**2.60%**	1.39%	1.55%
40	**2.16%**	2.51%	1.06%	1.27%	**2.48%**	**2.65%**	1.28%	1.48%	**2.16%**	2.55%	1.09%	1.30%	**2.34%**	**2.48%**	1.26%	1.46%
50	2.10%	2.92%	1.15%	1.64%	2.41%	2.82%	1.42%	1.87%	2.07%	2.88%	1.16%	1.65%	2.33%	2.67%	1.40%	1.82%
60	2.78%	4.49%	1.38%	2.24%	2.99%	4.31%	1.68%	2.50%	2.80%	4.48%	1.41%	2.25%	2.83%	4.32%	1.65%	2.49%
	Some College, No Degree				Professional or PhD Degree				Some College, No Degree				Professional or PhD Degree			
20	**2.07%**	**2.15%**	**1.30%**	1.35%	na	na	na	na	**2.52%**	**2.65%**	**1.59%**	1.66%	na	na	na	na
30	**2.61%**	**2.77%**	1.27%	1.37%	**3.39%**	**3.59%**	2.26%	2.43%	**2.79%**	**2.98%**	1.40%	1.52%	**3.69%**	**3.93%**	2.39%	2.50%
40	2.80%	3.19%	1.20%	1.40%	**3.42%**	**3.65%**	2.29%	2.65%	2.82%	3.23%	1.25%	1.46%	**3.33%**	**3.73%**	2.37%	2.58%
50	2.84%	3.88%	1.32%	1.77%	**3.40%**	3.92%	2.58%	3.33%	2.86%	3.85%	1.35%	1.78%	**3.15%**	3.98%	2.66%	3.29%
60	3.49%	5.42%	1.55%	2.40%	4.11%	5.76%	2.93%	3.99%	3.56%	5.49%	1.60%	2.43%	3.59%	5.96%	2.58%	4.21%

Outlined cells correspond to increases in WLE that are significantly different than zero.

Table 6 – Maximum Present Value Increase Due to SSA Cohort Tables
WLE Adjustment Based on Uniform Loading

Maximum Present Value Percent Increase from 2006 NCHS Life Tables

$10,000 per Year

Age	Males Initially Active	Males Initially Inactive	Females Initially Active	Females Initially Inactive	Males Initially Active	Males Initially Inactive	Females Initially Active	Females Initially Inactive
	0-12 Years of Education, No Degree				Associate's Degree			
20	1.87%	1.95%	1.00%	1.07%	**2.33%**	**2.42%**	1.18%	1.22%
30	1.92%	2.15%	0.95%	1.08%	**2.40%**	**2.56%**	1.15%	1.26%
40	2.00%	2.50%	0.85%	1.09%	**2.47%**	2.84%	1.07%	1.24%
50	1.94%	3.31%	0.92%	1.52%	2.52%	3.48%	1.17%	1.59%
60	2.70%	5.66%	1.19%	2.89%	3.40%	6.38%	1.40%	2.22%
	GED Degree				Bachelor's Degree			
20	**2.47%**	**2.54%**	1.07%	1.14%	**2.07%**	**2.14%**	1.39%	1.45%
30	**2.58%**	2.88%	1.03%	1.14%	**2.06%**	**2.15%**	1.38%	1.53%
40	**2.71%**	3.37%	0.94%	1.15%	2.07%	2.30%	1.32%	1.55%
50	2.97%	4.45%	1.04%	1.66%	2.01%	2.69%	1.48%	1.98%
60	3.96%	7.86%	1.31%	2.70%	2.78%	5.16%	1.85%	3.28%
	High School Diploma				Master's Degree			
20	**2.18%**	**2.27%**	**1.23%**	**1.30%**	na	na	na	na
30	**2.21%**	2.41%	1.19%	1.34%	**2.55%**	**2.71%**	1.40%	1.53%
40	**2.26%**	2.66%	1.12%	1.35%	**2.58%**	**2.77%**	1.34%	1.55%
50	2.26%	3.25%	1.25%	1.86%	2.56%	3.03%	1.52%	2.05%
60	3.20%	5.98%	1.61%	3.26%	3.35%	5.25%	1.90%	3.20%
	Some College, No Degree				Professional or PhD Degree			
20	**2.13%**	**2.21%**	**1.34%**	1.39%	na	na	na	na
30	**2.70%**	**2.87%**	1.32%	1.43%	**3.48%**	**3.70%**	2.33%	2.51%
40	2.93%	3.37%	1.26%	1.48%	**3.54%**	**3.79%**	2.39%	2.77%
50	3.05%	4.32%	1.42%	1.96%	**3.58%**	4.17%	2.73%	3.59%
60	3.99%	7.21%	1.77%	3.22%	4.49%	6.69%	3.23%	4.62%

Age-Earnings Profile

Age	Males Initially Active	Males Initially Inactive	Females Initially Active	Females Initially Inactive	Males Initially Active	Males Initially Inactive	Females Initially Active	Females Initially Inactive
	0-12 Years of Education, No Degree				Associate's Degree			
20	1.87%	1.95%	1.00%	1.07%	**2.33%**	**2.42%**	1.18%	1.22%
30	1.92%	2.15%	0.95%	1.08%	**2.40%**	**2.56%**	1.15%	1.26%
40	2.00%	2.50%	0.85%	1.09%	**2.47%**	2.84%	1.07%	1.24%
50	1.94%	3.31%	0.92%	1.52%	2.52%	3.48%	1.17%	1.59%
60	2.70%	5.66%	1.19%	2.89%	3.40%	6.38%	1.40%	2.22%
	GED Degree				Bachelor's Degree			
20	**2.47%**	**2.54%**	1.07%	1.14%	**2.07%**	**2.14%**	1.39%	1.45%
30	**2.58%**	2.88%	1.03%	1.14%	**2.06%**	**2.15%**	1.38%	1.53%
40	**2.71%**	3.37%	0.94%	1.15%	2.07%	2.30%	1.32%	1.55%
50	2.97%	4.45%	1.04%	1.66%	2.01%	2.69%	1.48%	1.98%
60	3.96%	7.86%	1.31%	2.70%	2.78%	5.16%	1.85%	3.28%
	High School Diploma				Master's Degree			
20	**2.18%**	**2.27%**	**1.23%**	**1.30%**	na	na	na	na
30	**2.21%**	2.41%	1.19%	1.34%	**2.55%**	**2.71%**	1.40%	1.53%
40	**2.26%**	2.66%	1.12%	1.35%	**2.58%**	**2.77%**	1.34%	1.55%
50	2.26%	3.25%	1.25%	1.86%	2.56%	3.03%	1.52%	2.05%
60	3.20%	5.98%	1.61%	3.26%	3.35%	5.25%	1.90%	3.20%
	Some College, No Degree				Professional or PhD Degree			
20	**2.13%**	**2.21%**	**1.34%**	1.39%	na	na	na	na
30	**2.70%**	**2.87%**	1.32%	1.43%	**3.48%**	**3.70%**	2.33%	2.51%
40	2.93%	3.37%	1.26%	1.48%	**3.54%**	**3.79%**	2.39%	2.77%
50	3.05%	4.32%	1.42%	1.96%	**3.58%**	4.17%	2.73%	3.59%
60	3.99%	7.21%	1.77%	3.22%	4.49%	6.69%	3.23%	4.62%

Outlined cells correspond to increases in WLE that are significantly different than zero.

Table 7 – Maximum Present Value Increase Due to SSA Cohort Tables
WLE Adjustment Based on the Probability of Being Active

	$10,000 per Year								Age-Earnings Profile							
	Males		Females		Males		Females		Males		Females		Males		Females	
	Initially		Initially		Initially		Initially		Initially		Initially		Initially		Initially	
Age	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive
	0-12 Years of Education, No Degree				Associate's Degree				0-12 Years of Education, No Degree				Associate's Degree			
20	1.87%	1.95%	1.00%	1.06%	**2.33%**	**2.42%**	1.18%	1.22%	1.94%	1.99%	1.12%	1.17%	**2.42%**	**2.47%**	1.32%	1.35%
30	1.92%	2.15%	0.95%	1.08%	**2.40%**	**2.56%**	1.15%	1.26%	1.83%	2.01%	1.02%	1.14%	**2.24%**	**2.37%**	1.19%	1.28%
40	2.00%	2.50%	0.85%	1.08%	**2.47%**	2.84%	1.07%	1.24%	1.76%	2.18%	0.88%	1.11%	**2.15%**	2.46%	1.05%	1.21%
50	1.94%	3.31%	0.92%	1.51%	2.52%	3.48%	1.17%	1.59%	1.59%	2.68%	0.93%	1.49%	2.08%	2.88%	1.11%	1.51%
60	2.70%	5.66%	1.19%	2.88%	3.40%	6.38%	1.40%	2.21%	2.15%	4.49%	1.14%	2.61%	2.80%	5.23%	1.30%	2.04%
	GED Degree				Bachelor's Degree				GED Degree				Bachelor's Degree			
20	**2.46%**	**2.54%**	1.07%	1.13%	**2.07%**	**2.14%**	1.39%	1.45%	**2.24%**	**2.29%**	1.06%	1.10%	**2.16%**	**2.19%**	1.46%	1.50%
30	**2.58%**	2.87%	1.03%	1.14%	**2.06%**	**2.15%**	1.38%	1.53%	**2.12%**	2.33%	0.95%	1.03%	**1.92%**	**1.98%**	1.33%	1.45%
40	**2.71%**	3.37%	0.94%	1.15%	2.07%	2.30%	1.32%	1.55%	**2.04%**	2.52%	0.81%	0.99%	1.77%	1.96%	1.21%	1.43%
50	2.97%	4.45%	1.04%	1.66%	2.01%	2.69%	1.48%	1.98%	2.03%	3.05%	0.86%	1.37%	1.63%	2.20%	1.36%	1.84%
60	3.96%	7.85%	1.31%	2.70%	2.78%	5.16%	1.85%	3.28%	2.63%	5.40%	1.05%	2.02%	2.29%	4.21%	1.75%	3.10%
	High School Diploma				Master's Degree				High School Diploma				Master's Degree			
20	**2.18%**	**2.26%**	**1.23%**	**1.30%**	na	na	na	na	**2.20%**	**2.25%**	**1.36%**	**1.40%**	na	na	na	na
30	**2.21%**	2.41%	1.19%	1.34%	**2.55%**	**2.71%**	1.40%	1.53%	**2.03%**	2.18%	1.23%	1.35%	**2.18%**	**2.28%**	1.17%	1.27%
40	**2.26%**	2.65%	1.12%	1.35%	**2.58%**	**2.77%**	1.34%	1.55%	**1.93%**	2.24%	1.10%	1.32%	**2.01%**	**2.16%**	1.03%	1.19%
50	2.26%	3.25%	1.25%	1.85%	2.56%	3.03%	1.52%	2.05%	1.78%	2.57%	1.19%	1.77%	1.88%	2.25%	1.13%	1.53%
60	3.20%	5.98%	1.61%	3.26%	3.35%	5.25%	1.90%	3.20%	2.51%	4.73%	1.52%	3.05%	2.49%	3.91%	1.39%	2.33%
	Some College, No Degree				Professional or PhD Degree				Some College, No Degree				Professional or PhD Degree			
20	**2.13%**	**2.21%**	**1.34%**	1.39%	na	na	na	na	**2.32%**	**2.37%**	**1.43%**	1.46%	na	na	na	na
30	**2.70%**	**2.87%**	1.32%	1.43%	**3.48%**	**3.70%**	2.32%	2.51%	**2.67%**	**2.80%**	1.29%	1.38%	**3.01%**	**3.13%**	1.60%	1.70%
40	2.93%	3.37%	1.26%	1.48%	**3.54%**	**3.79%**	2.38%	2.77%	2.71%	3.10%	1.16%	1.35%	**2.76%**	**2.95%**	1.48%	1.73%
50	3.05%	4.32%	1.42%	1.96%	**3.58%**	4.16%	2.73%	3.59%	2.70%	3.82%	1.25%	1.72%	**2.62%**	3.07%	1.64%	2.21%
60	3.98%	7.21%	1.77%	3.21%	4.49%	6.68%	3.22%	4.61%	3.45%	6.17%	1.51%	2.69%	3.28%	4.92%	1.89%	2.74%

Outlined cells correspond to increases in WLE that are significantly different than zero.

Table 8 – Minimum Present Value Increase Due to SSA Cohort Tables
WLE Adjustment Based on Front Loading

$10,000 per Year

Age	Males		Females		Males		Females	
	Initially		Initially		Initially		Initially	
	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive
	0-12 Years of Education, No Degree				Associate's Degree			
20	1.05%	1.12%	0.65%	0.72%	1.17%	1.24%	0.62%	0.65%
30	1.21%	1.41%	0.67%	0.78%	1.37%	1.52%	0.69%	0.77%
40	1.41%	1.86%	0.64%	0.84%	1.63%	1.96%	0.72%	0.87%
50	1.47%	2.53%	0.72%	1.14%	1.85%	2.69%	0.88%	1.23%
60	2.08%	3.66%	0.90%	1.59%	2.64%	4.53%	1.10%	1.59%
	GED Degree				Bachelor's Degree			
20	1.36%	1.43%	0.66%	0.71%	1.02%	1.08%	0.73%	0.78%
30	1.60%	1.86%	0.68%	0.77%	1.16%	1.25%	0.82%	0.96%
40	1.86%	2.44%	0.67%	0.85%	1.35%	1.57%	0.89%	1.09%
50	2.25%	3.46%	0.79%	1.27%	1.48%	2.04%	1.08%	1.51%
60	3.08%	5.47%	1.00%	1.71%	2.15%	3.62%	1.43%	2.34%
	High School Diploma				Master's Degree			
20	1.13%	1.20%	0.71%	0.76%	na	na	na	na
30	1.31%	1.47%	0.76%	0.89%	1.40%	1.53%	0.80%	0.92%
40	1.52%	1.86%	0.79%	0.98%	1.62%	1.80%	0.87%	1.08%
50	1.68%	2.51%	0.93%	1.45%	1.83%	2.25%	1.12%	1.57%
60	2.49%	4.17%	1.23%	2.12%	2.59%	3.98%	1.48%	2.34%
	Some College, No Degree				Professional or PhD Degree			
20	1.10%	1.17%	0.73%	0.77%	na	na	na	na
30	1.57%	1.73%	0.81%	0.90%	1.81%	1.99%	1.28%	1.44%
40	1.96%	2.35%	0.86%	1.05%	2.14%	2.36%	1.51%	1.85%
50	2.27%	3.34%	1.06%	1.50%	2.47%	2.97%	1.93%	2.70%
60	3.05%	5.04%	1.39%	2.27%	3.41%	5.13%	2.45%	3.56%

Age-Earnings Profile

Age	Males		Females		Males		Females	
	Initially		Initially		Initially		Initially	
	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive
	0-12 Years of Education, No Degree				Associate's Degree			
20	1.33%	1.43%	0.75%	0.81%	1.46%	1.57%	0.78%	0.82%
30	1.36%	1.59%	0.72%	0.83%	1.45%	1.62%	0.76%	0.85%
40	1.47%	1.93%	0.66%	0.87%	1.62%	1.94%	0.76%	0.91%
50	1.50%	2.54%	0.74%	1.15%	1.86%	2.62%	0.90%	1.25%
60	2.07%	3.68%	0.91%	1.61%	2.73%	4.61%	1.12%	1.61%
	GED Degree				Bachelor's Degree			
20	1.72%	1.82%	0.79%	0.85%	1.28%	1.38%	0.88%	0.96%
30	1.75%	2.05%	0.72%	0.82%	1.20%	1.29%	0.84%	1.00%
40	1.92%	2.50%	0.69%	0.87%	1.27%	1.48%	0.84%	1.06%
50	2.29%	3.47%	0.79%	1.27%	1.40%	1.93%	1.03%	1.44%
60	3.18%	5.56%	1.05%	1.71%	2.13%	3.59%	1.41%	2.31%
	High School Diploma				Master's Degree			
20	1.44%	1.54%	0.88%	0.94%	na	na	na	na
30	1.42%	1.63%	0.83%	0.98%	1.43%	1.55%	0.84%	0.99%
40	1.52%	1.90%	0.81%	1.02%	1.53%	1.68%	0.86%	1.06%
50	1.65%	2.47%	0.94%	1.45%	1.75%	2.12%	1.10%	1.53%
60	2.51%	4.17%	1.26%	2.13%	2.45%	3.99%	1.45%	2.34%
	Some College, No Degree				Professional or PhD Degree			
20	1.45%	1.56%	0.96%	1.01%	na	na	na	na
30	1.73%	1.91%	0.91%	1.02%	2.06%	2.27%	1.39%	1.51%
40	1.98%	2.39%	0.90%	1.10%	2.09%	2.41%	1.55%	1.80%
50	2.28%	3.31%	1.08%	1.51%	2.28%	3.01%	1.99%	2.66%
60	3.12%	5.10%	1.44%	2.29%	2.97%	5.31%	2.16%	3.76%

Table 9 – Minimum Present Value Increase Due to SSA Cohort Tables
WLE Adjustment Based on Uniform Loading

$10,000 per Year

	Males		Females		Males		Females	
	Initially		Initially		Initially		Initially	
Age	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive
	0-12 Years of Education, No Degree				Associate's Degree			
20	1.87%	1.95%	1.00%	1.07%	2.33%	2.42%	1.18%	1.22%
30	1.92%	2.15%	0.95%	1.08%	2.40%	2.56%	1.15%	1.26%
40	2.00%	2.50%	0.85%	1.09%	2.47%	2.84%	1.07%	1.24%
50	1.94%	3.31%	0.92%	1.52%	2.52%	3.48%	1.17%	1.59%
60	2.70%	5.66%	1.19%	2.89%	3.40%	6.38%	1.40%	2.22%
	GED Degree				Bachelor's Degree			
20	2.47%	2.54%	1.07%	1.14%	2.07%	2.14%	1.39%	1.45%
30	2.58%	2.88%	1.03%	1.14%	2.06%	2.15%	1.38%	1.53%
40	2.71%	3.37%	0.94%	1.15%	2.07%	2.30%	1.32%	1.55%
50	2.97%	4.45%	1.04%	1.66%	2.01%	2.69%	1.48%	1.98%
60	3.96%	7.86%	1.31%	2.70%	2.78%	5.16%	1.85%	3.28%
	High School Diploma				Master's Degree			
20	2.18%	2.27%	1.23%	1.30%	na	na	na	na
30	2.21%	2.41%	1.19%	1.34%	2.55%	2.71%	1.40%	1.53%
40	2.26%	2.66%	1.12%	1.35%	2.58%	2.77%	1.34%	1.55%
50	2.26%	3.25%	1.25%	1.86%	2.56%	3.03%	1.52%	2.05%
60	3.20%	5.98%	1.61%	3.26%	3.35%	5.25%	1.90%	3.20%
	Some College, No Degree				Professional or PhD Degree			
20	2.13%	2.21%	1.34%	1.39%	na	na	na	na
30	2.70%	2.87%	1.32%	1.43%	3.48%	3.70%	2.33%	2.51%
40	2.93%	3.37%	1.26%	1.48%	3.54%	3.79%	2.39%	2.77%
50	3.05%	4.32%	1.42%	1.96%	3.58%	4.17%	2.73%	3.59%
60	3.99%	7.21%	1.77%	3.22%	4.49%	6.69%	3.23%	4.62%

Age-Earnings Profile

	Males		Females		Males		Females	
	Initially		Initially		Initially		Initially	
Age	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive
	0-12 Years of Education, No Degree				Associate's Degree			
20	1.87%	1.95%	1.00%	1.07%	2.33%	2.42%	1.18%	1.22%
30	1.92%	2.15%	0.95%	1.08%	2.40%	2.56%	1.15%	1.26%
40	2.00%	2.50%	0.85%	1.09%	2.47%	2.84%	1.07%	1.24%
50	1.94%	3.31%	0.92%	1.52%	2.52%	3.48%	1.17%	1.59%
60	2.70%	5.66%	1.19%	2.89%	3.40%	6.38%	1.40%	2.22%
	GED Degree				Bachelor's Degree			
20	2.47%	2.54%	1.07%	1.14%	2.07%	2.14%	1.39%	1.45%
30	2.58%	2.88%	1.03%	1.14%	2.06%	2.15%	1.38%	1.53%
40	2.71%	3.37%	0.94%	1.15%	2.07%	2.30%	1.32%	1.55%
50	2.97%	4.45%	1.04%	1.66%	2.01%	2.69%	1.48%	1.98%
60	3.96%	7.86%	1.31%	2.70%	2.78%	5.16%	1.85%	3.28%
	High School Diploma				Master's Degree			
20	2.18%	2.27%	1.23%	1.30%	na	na	na	na
30	2.21%	2.41%	1.19%	1.34%	2.55%	2.71%	1.40%	1.53%
40	2.26%	2.66%	1.12%	1.35%	2.58%	2.77%	1.34%	1.55%
50	2.26%	3.25%	1.25%	1.86%	2.56%	3.03%	1.52%	2.05%
60	3.20%	5.98%	1.61%	3.26%	3.35%	5.25%	1.90%	3.20%
	Some College, No Degree				Professional or PhD Degree			
20	2.13%	2.21%	1.34%	1.39%	na	na	na	na
30	2.70%	2.87%	1.32%	1.43%	3.48%	3.70%	2.33%	2.51%
40	2.93%	3.37%	1.26%	1.48%	3.54%	3.79%	2.39%	2.77%
50	3.05%	4.32%	1.42%	1.96%	3.58%	4.17%	2.73%	3.59%
60	3.99%	7.21%	1.77%	3.22%	4.49%	6.69%	3.23%	4.62%

Table 10 – Minimum Present Value Increase Due to SSA Cohort Tables
WLE Adjustment Based on the Probability of Being Active

$10,000 per Year

	Males		Females		Males		Females	
	Initially		Initially		Initially		Initially	
Age	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive
	0-12 Years of Education, No Degree				Associate's Degree			
20	0.90%	0.98%	0.50%	0.55%	1.11%	1.19%	0.60%	0.64%
30	1.06%	1.25%	0.53%	0.64%	1.32%	1.46%	0.67%	0.77%
40	1.25%	1.65%	0.51%	0.70%	1.54%	1.85%	0.69%	0.83%
50	1.29%	2.37%	0.62%	1.10%	1.68%	2.44%	0.85%	1.22%
60	2.11%	4.66%	0.93%	2.32%	2.65%	5.27%	1.17%	1.90%
	GED Degree				Bachelor's Degree			
20	1.10%	1.16%	0.54%	0.59%	1.05%	1.11%	0.67%	0.72%
30	1.32%	1.55%	0.58%	0.67%	1.19%	1.27%	0.76%	0.89%
40	1.56%	2.06%	0.57%	0.74%	1.35%	1.55%	0.79%	0.99%
50	1.85%	2.98%	0.71%	1.23%	1.38%	1.93%	1.01%	1.43%
60	2.94%	6.39%	1.05%	2.22%	2.19%	4.22%	1.46%	2.69%
	High School Diploma				Master's Degree			
20	1.06%	1.13%	0.61%	0.66%	na	na	na	na
30	1.23%	1.39%	0.66%	0.78%	1.44%	1.58%	0.77%	0.89%
40	1.42%	1.74%	0.67%	0.86%	1.65%	1.82%	0.81%	0.99%
50	1.50%	2.28%	0.85%	1.34%	1.76%	2.17%	1.05%	1.49%
60	2.47%	4.91%	1.27%	2.68%	2.66%	4.36%	1.52%	2.68%
	Some College, No Degree				Professional or PhD Degree			
20	1.05%	1.12%	0.65%	0.69%	na	na	na	na
30	1.57%	1.72%	0.72%	0.82%	1.88%	2.07%	1.15%	1.30%
40	1.93%	2.31%	0.75%	0.94%	2.18%	2.41%	1.33%	1.64%
50	2.16%	3.22%	0.96%	1.41%	2.42%	2.93%	1.76%	2.50%
60	3.18%	5.99%	1.39%	2.62%	3.52%	5.51%	2.44%	3.69%

Age-Earnings Profile

	Males		Females		Males		Females	
	Initially		Initially		Initially		Initially	
Age	Active	Inactive	Active	Inactive	Active	Inactive	Active	Inactive
	0-12 Years of Education, No Degree				Associate's Degree			
20	1.04%	1.09%	0.58%	0.63%	1.30%	1.35%	0.73%	0.76%
30	1.08%	1.25%	0.59%	0.70%	1.32%	1.43%	0.72%	0.81%
40	1.16%	1.52%	0.54%	0.73%	1.40%	1.67%	0.69%	0.83%
50	1.11%	2.00%	0.64%	1.12%	1.44%	2.09%	0.82%	1.18%
60	1.75%	3.80%	0.92%	2.19%	2.25%	4.40%	1.10%	1.77%
	GED Degree				Bachelor's Degree			
20	1.17%	1.21%	0.58%	0.63%	1.24%	1.28%	0.77%	0.80%
30	1.21%	1.39%	0.57%	0.65%	1.19%	1.25%	0.76%	0.87%
40	1.29%	1.69%	0.53%	0.68%	1.20%	1.37%	0.74%	0.92%
50	1.36%	2.18%	0.63%	1.08%	1.15%	1.63%	0.93%	1.33%
60	2.08%	4.54%	0.90%	1.78%	1.86%	3.54%	1.39%	2.56%
	High School Diploma				Master's Degree			
20	1.20%	1.25%	0.71%	0.76%	na	na	na	na
30	1.22%	1.36%	0.70%	0.82%	1.35%	1.44%	0.71%	0.80%
40	1.28%	1.55%	0.67%	0.85%	1.36%	1.50%	0.66%	0.81%
50	1.23%	1.88%	0.82%	1.30%	1.35%	1.69%	0.82%	1.18%
60	2.01%	3.99%	1.21%	2.53%	2.08%	3.38%	1.17%	2.04%
	Some College, No Degree				Professional or PhD Degree			
20	1.28%	1.33%	0.77%	0.80%	na	na	na	na
30	1.64%	1.77%	0.75%	0.84%	1.81%	1.93%	0.91%	1.01%
40	1.85%	2.20%	0.73%	0.89%	1.81%	1.99%	0.91%	1.13%
50	1.97%	2.94%	0.88%	1.28%	1.86%	2.27%	1.17%	1.68%
60	2.84%	5.25%	1.23%	2.26%	2.69%	4.20%	1.55%	2.34%

Table 11 – Present Value Increase Due to SSA Cohort Tables
60-Year-Old Initially Inactive Males

Level Of Educational Attainment	$10,000 per Year 0.00%	0.50%	1.00%	1.50%	2.00%	2.50%	3.00%	Age-Earnings Profile 0.00%	0.50%	1.00%	1.50%	2.00%	2.50%	3.00%
Front-Loaded WLE														
0-12 Years of Education, No Degree	3.87%	3.84%	3.80%	3.77%	3.73%	3.70%	3.66%	3.89%	3.86%	3.82%	3.79%	3.75%	3.72%	3.68%
GED Degree	5.89%	5.82%	5.75%	5.68%	5.61%	5.54%	5.47%	5.99%	5.92%	5.84%	5.77%	5.70%	5.63%	5.56%
High School Diploma	4.49%	4.43%	4.38%	4.32%	4.27%	4.22%	4.17%	4.48%	4.43%	4.37%	4.32%	4.27%	4.22%	4.17%
Some College, No Degree	5.42%	5.36%	5.29%	5.23%	5.16%	5.10%	5.04%	5.49%	5.42%	5.36%	5.29%	5.23%	5.16%	5.10%
Associate's Degree	4.87%	4.81%	4.75%	4.70%	4.64%	4.59%	4.53%	4.95%	4.89%	4.83%	4.77%	4.72%	4.66%	4.61%
Bachelor's Degree	3.85%	3.81%	3.77%	3.73%	3.69%	3.66%	3.62%	3.82%	3.78%	3.74%	3.70%	3.66%	3.63%	3.59%
Master's Degree	4.31%	4.26%	4.20%	4.14%	4.09%	4.03%	3.98%	4.32%	4.27%	4.21%	4.15%	4.10%	4.04%	3.99%
Professional or PhD Degree	5.76%	5.65%	5.55%	5.44%	5.34%	5.23%	5.13%	5.96%	5.85%	5.74%	5.63%	5.52%	5.42%	5.31%
Adjusted for Probability of Being an Active Labor Force Participant														
0-12 Years of Education, No Degree	5.66%	5.47%	5.29%	5.13%	4.96%	4.81%	4.66%	4.49%	4.37%	4.24%	4.13%	4.01%	3.91%	3.80%
GED Degree	7.85%	7.59%	7.33%	7.08%	6.84%	6.61%	6.39%	5.40%	5.24%	5.09%	4.95%	4.81%	4.67%	4.54%
High School Diploma	5.98%	5.78%	5.59%	5.41%	5.23%	5.07%	4.91%	4.73%	4.59%	4.46%	4.34%	4.22%	4.10%	3.99%
Some College, No Degree	7.21%	6.98%	6.76%	6.56%	6.36%	6.17%	5.99%	6.17%	6.00%	5.83%	5.68%	5.53%	5.39%	5.25%
Associate's Degree	6.38%	6.18%	5.98%	5.79%	5.61%	5.44%	5.27%	5.23%	5.08%	4.93%	4.79%	4.66%	4.53%	4.40%
Bachelor's Degree	5.16%	4.98%	4.82%	4.66%	4.50%	4.36%	4.22%	4.21%	4.09%	3.97%	3.86%	3.75%	3.64%	3.54%
Master's Degree	5.25%	5.09%	4.93%	4.78%	4.63%	4.49%	4.36%	3.91%	3.81%	3.72%	3.63%	3.54%	3.46%	3.38%
Professional or PhD Degree	6.68%	6.47%	6.26%	6.06%	5.87%	5.68%	5.51%	4.92%	4.79%	4.66%	4.54%	4.42%	4.31%	4.20%

Outlined cells correspond to percent increases greater than 5 percent.

Figure 1 – Probability Mass Function

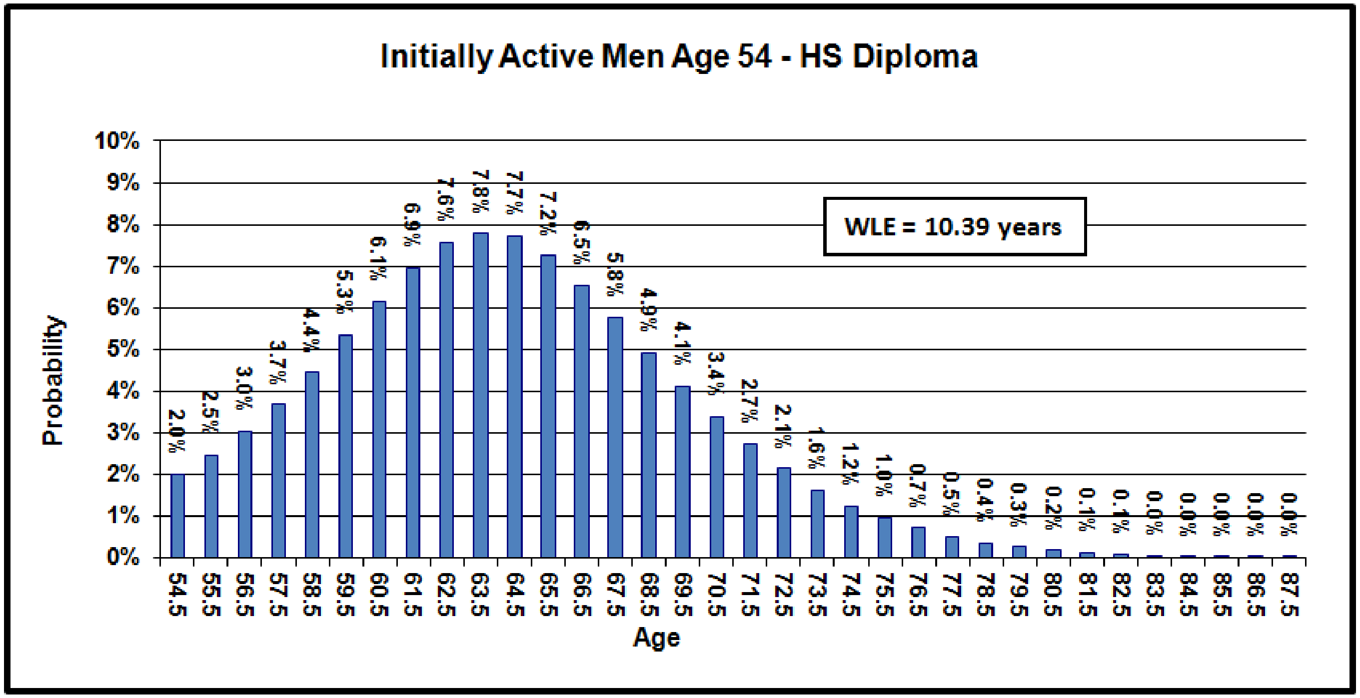


Figure 2 – Markov Increment/Decrement Model for Initially Active Labor Force Participants

Years of Remaining Labor Force Participation

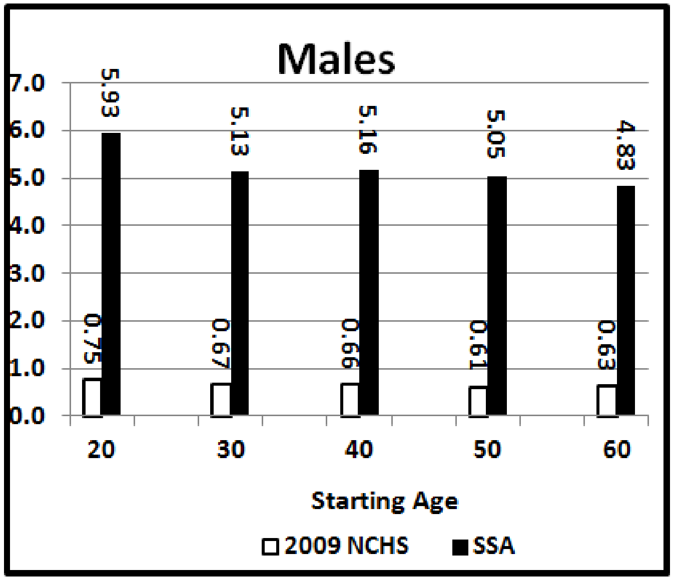
Column → Row ↓	B Age	C 0	D 0.5	E 1.5	F 2.5	G 3.5	H 4.5
9	110	Probability of zero years of activity after age 110 equals zero due to midyear transition assumption. See boundary condition (2a).	Probability of 0.5 years of activity after age 110 equals one.	All subsequent probabilities for this age equal zero. (Truncation age exceeded.) →			
10	109	All subsequent probabilities for zero years of activity equal zero due to midyear transition assumption. ↓	${}^{a}\rho^{i}_{109} \cdot \rho_{YA}(110,i,0) + {}^{a}\rho^{d}_{109}$ Note that $\rho_{YA}(110,i,0)$ equals 1 and appears in cell C9 of Figure 3. This is boundary condition 2(b).	${}^{a}\rho^{a}_{109} \cdot \rho_{YA}(110,a,0.5)$ + ${}^{a}\rho^{i}_{109} \cdot \rho_{YA}(110,i,1)$ Note that $\rho_{YA}(110,i,1)$ equals 0 and appears in cell D9 of Figure 3. This is main recursion 3(a).	Truncation age is exceeded and all subsequent probabilities for this age are zero. →		
11	108		${}^{a}\rho^{i}_{108} \cdot \rho_{YA}(109,i,0) + {}^{a}\rho^{d}_{108}$ Note that $\rho_{YA}(109,i,0)$ appears in cell C10 of Figure 3. This is boundary condition 2(b).	${}^{a}\rho^{a}_{108} \cdot \rho_{YA}(109,a,0.5)$ + ${}^{a}\rho^{i}_{108} \cdot \rho_{YA}(109,i,1)$ Note that $\rho_{YA}(109,i,1)$ appears in cell D10 of Figure 3. This is main recursion 3(a).	${}^{a}\rho^{a}_{108} \cdot \rho_{YA}(109,a,1.5)$ + ${}^{a}\rho^{i}_{108} \cdot \rho_{YA}(109,i,2)$ Note that $\rho_{YA}(109,i,2)$ appears in cell E10 of Figure 3. This is main recursion 3(a).	Truncation age is exceeded and all subsequent probabilities for this age are zero. →	
12	107		${}^{a}\rho^{i}_{107} \cdot \rho_{YA}(108,i,0) + {}^{a}\rho^{d}_{107}$ Note that $\rho_{YA}(108,i,0)$ appears in cell C11 of Figure 3. This is boundary condition 2(b).	${}^{a}\rho^{a}_{107} \cdot \rho_{YA}(108,a,0.5)$ + ${}^{a}\rho^{i}_{107} \cdot \rho_{YA}(108,i,1)$ Note that $\rho_{YA}(107,i,1)$ appears in cell D11 of Figure 3. This is main recursion 3(a).	${}^{a}\rho^{a}_{107} \cdot \rho_{YA}(108,a,1.5)$ + ${}^{a}\rho^{i}_{107} \cdot \rho_{YA}(108,i,2)$ Note that $\rho_{YA}(108,i,2)$ appears in cell E11 of Figure 3. This is main recursion 3(a).	${}^{a}\rho^{a}_{107} \cdot \rho_{YA}(108,a,2.5)$ + ${}^{a}\rho^{i}_{107} \cdot \rho_{YA}(108,i,3)$ Note that $\rho_{YA}(108,i,3)$ appears in cellF11Z of Figure 3. This is main recursion 3(a).	Truncation age is exceeded and all subsequent probabilities for this age are zero. →
13	106	↓	Pattern repeats through age 17, the beginning age. ↓	Pattern repeats through age 17, the beginning age. ↓	Pattern repeats through age 17, the beginning age. ↓	Pattern repeats through age 17, the beginning age. ↓	Pattern repeats through age 17, the beginning age. ↓

Figure 3 – Markov Increment/Decrement Model for Initially Inactive Labor Force Participants

Years of Remaining Labor Force Participation

Column → / Row ↓	B	C	D	E	F	G	H
	Age	0	1	2	3	4	5
9	110	Probability of zero years of activity after age 110 equals one since probability of dying within a year equals one. See boundary condition (2c).	All subsequent probabilities for this age equal zero. (Truncation age exceeded.) →				
10	109	${}^{i}p^{d}_{109} + {}^{i}p^{i}_{109} \cdot p_{YA}(110,i,0)$ See boundary condition (2c).	${}^{i}p^{a}_{109} \cdot p_{YA}(110,a,0.5) +$ ${}^{i}p^{i}_{109} \cdot p_{YA}(110,i,1)$ Note that $p_{YA}(110,a,0.5)$ equals one and appears in cell D9 of Figure 2. This is main recursion 3(b).	Truncation age is exceeded and all subsequent probabilities for this age are zero. →			
11	108	${}^{i}p^{d}_{108} + {}^{i}p^{i}_{108} \cdot p_{YA}(109,i,0)$ See boundary condition (2c).	${}^{i}p^{a}_{108} \cdot p_{YA}(109,a,0.5) +$ ${}^{i}p^{i}_{108} \cdot p_{YA}(109,i,1)$ Note that $p_{YA}(109,a,0.5)$ appears in cell D10 of Figure 2. This is main recursion 3(b).	${}^{i}p^{a}_{108} \cdot p_{YA}(109,a,1.5) +$ ${}^{i}p^{i}_{108} \cdot p_{YA}(109,i,2)$ Note that $p_{YA}(109,a,1.5)$ appears in cell E10 of Figure 2. This is main recursion 3(b).	Truncation age is exceeded and all subsequent probabilities for this age are zero. →		
12	107	${}^{i}p^{d}_{107} + {}^{i}p^{i}_{107} \cdot p_{YA}(108,i,0)$ See boundary condition (2c).	${}^{i}p^{a}_{107} \cdot p_{YA}(108,a,0.5) +$ ${}^{i}p^{i}_{107} \cdot p_{YA}(108,i,1)$ Note that $p_{YA}(108,a,0.5)$ appears in cell D11 of Figure 2. This is main recursion 3(b).	${}^{i}p^{a}_{107} \cdot p_{YA}(108,a,1.5) +$ ${}^{i}p^{i}_{107} \cdot p_{YA}(108,i,2)$ Note that $p_{YA}(108,a,1.5)$ appears in cell E11 of Figure 2. This is main recursion 3(b).	${}^{i}p^{a}_{107} \cdot p_{YA}(108,a,2.5) +$ ${}^{i}p^{i}_{107} \cdot p_{YA}(108,i,3)$ Note that $p_{YA}(108,a,2.5)$ appears in cell F11 of Figure 2. This is main recursion 3(b).	Truncation age is exceeded and all subsequent probabilities for this age are zero. →	
13	106	Pattern repeats through age 17, the beginning age. ↓	Pattern repeats through age 17, the beginning age. ↓	Pattern repeats through age 17, the beginning age. ↓	Pattern repeats through age 17, the beginning age. ↓	Pattern repeats through age 17, the beginning age. ↓	Truncation age is exceeded and all subsequent probabilities for this age are zero. →

Figure 4 – Change from 2006 NCHS Life Expectancy



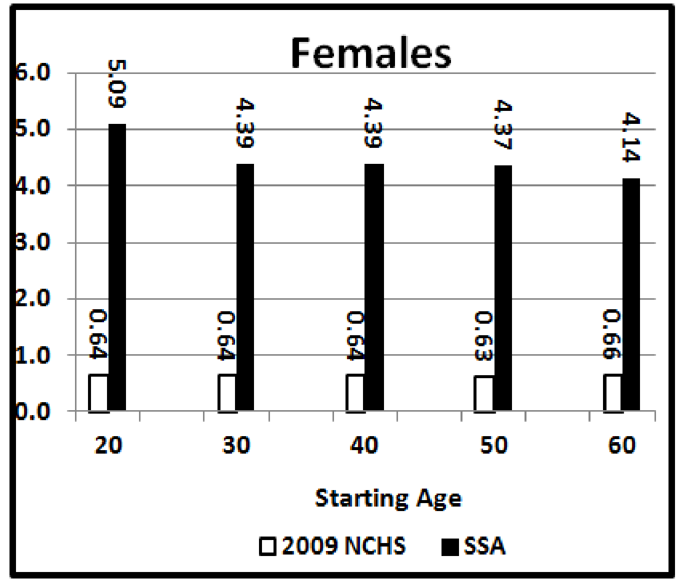


Figure 5 – SSA Cohort Change from 2006 NCHS Survival Probability

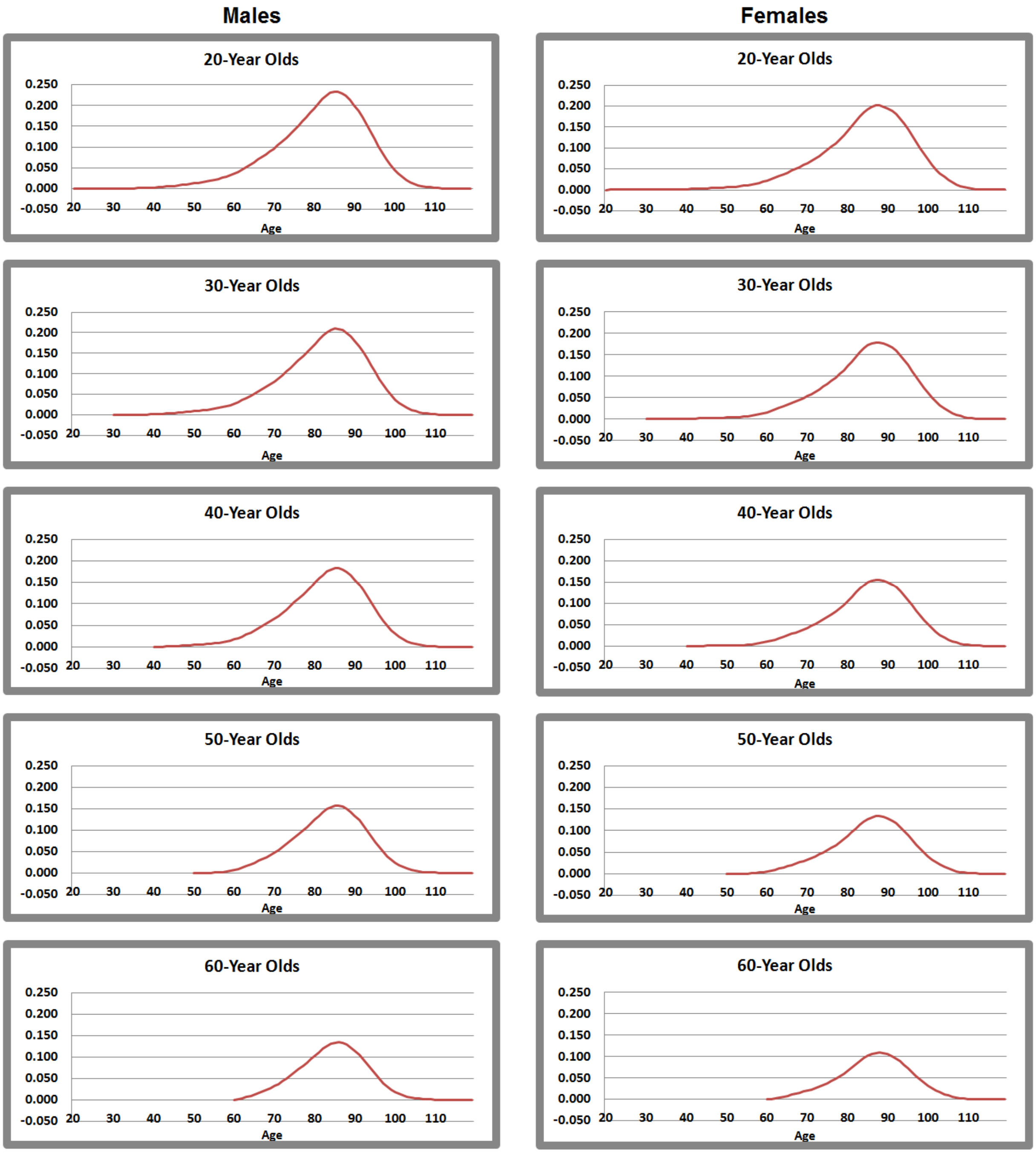


Figure 6 – Females with a Bachelor's Degree

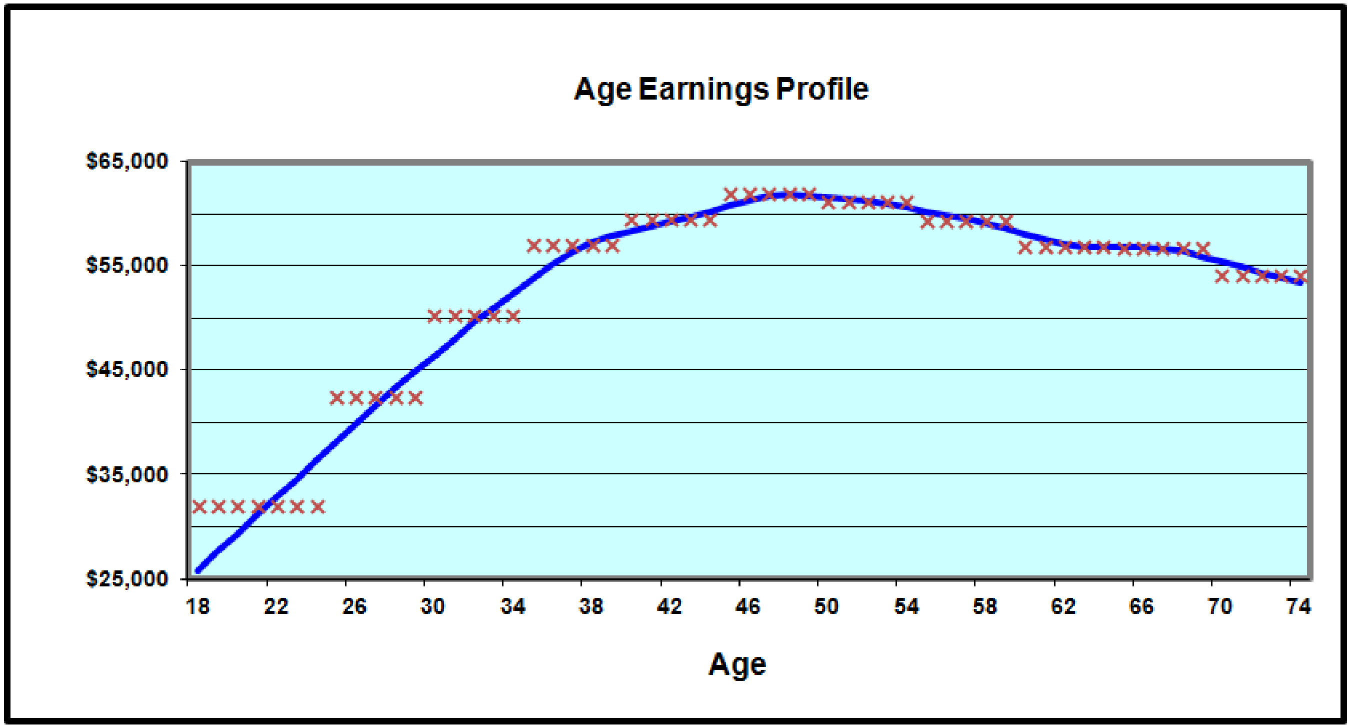
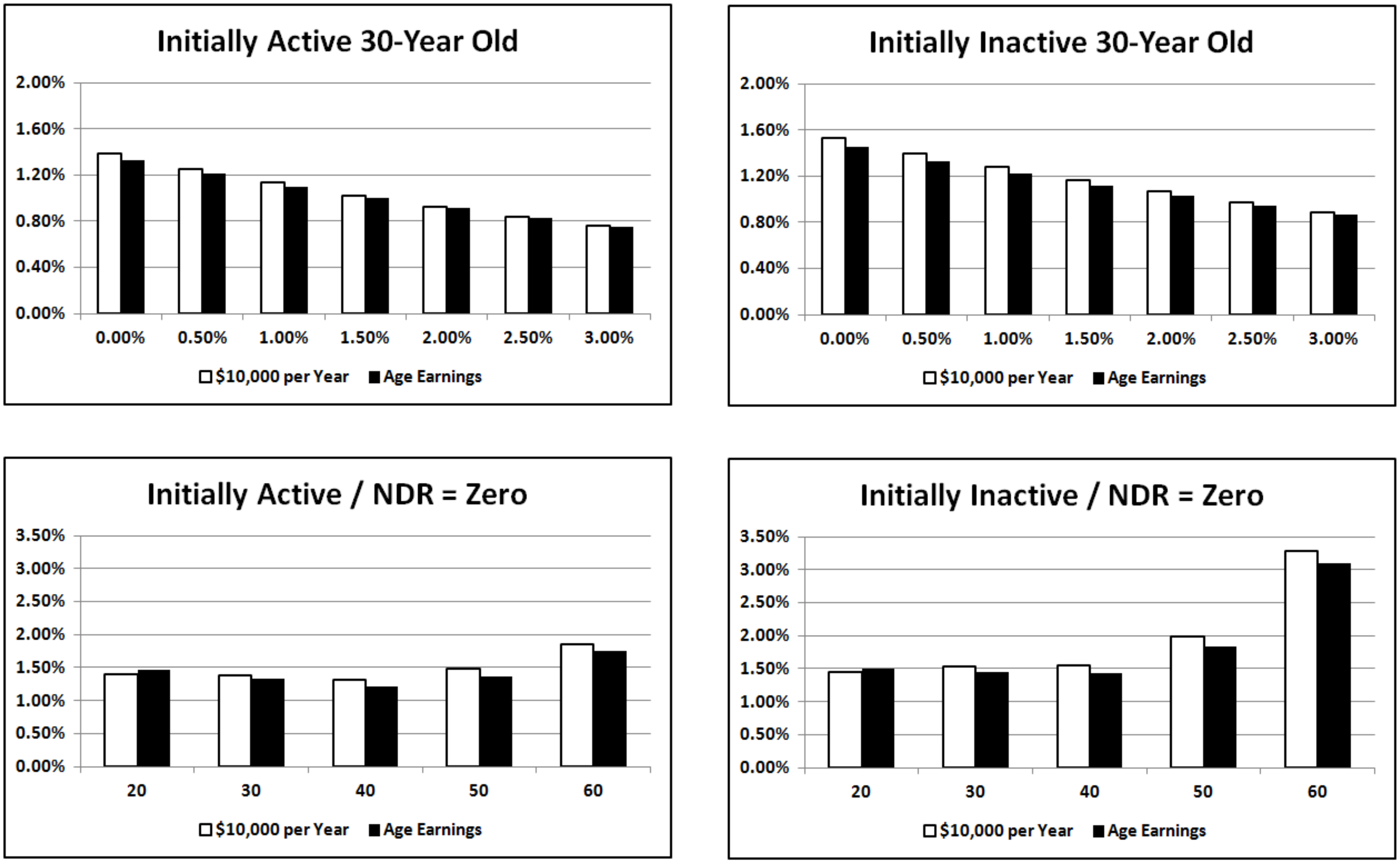


Figure 7 – Females with a Bachelor's Degree
WLE Adjustment Based on the Probability of Being an Active Labor Force Participant
Present Value Percent Increase Due to SSA Cohort Table



Appendix A: Description of the Excel Files Used to Generate the Probability Mass Functions

The spreadsheets that generate the probability mass functions (PMFs) for males and females with a given level of educational attainment all follow the same format and all use a variety of life tables. In addition to the PMFs, the spreadsheets calculate the mean and median work life expectancies (WLEs), along with the 10th, 25th, 75th and 90th percentiles. Various dispersion measures (the standard deviation and measures of skewness and kurtosis) are also calculated. Except for the skewness and kurtosis measures, the spreadsheets replicate the S-C-K published values. For the skewness and kurtosis measures, the differences are insignificant and are due to rounding differences.

The transition probabilities used in the spreadsheets are the same as those underlying "The Markov Process Model of Labor Force Activity: Extended Tables of Central Tendency, Shape, Percentile Points, and Bootstrap Standard Errors", Gary R. Skoog, James E. Ciecka and Kurt V. Krueger, Journal of Forensic Economics 22(2), 2011, pp. 165-299. These transition probabilities are provided as supplemental material on the Journal's website. The transition probabilities for persons with each spreadsheet's specific level of educational attainment are found in the "Transition Probabilities" tab.

The life tables available for use in the spreadsheets are listed in the "Make Selection" tab. On this tab, the user selects both the life table and the sex/education combination used in the spreadsheet calculations. Only the probabilities of dying within one year (the q_x) are used in the spreadsheet calculations. These probabilities are found in the "P(Death)" tab.

The selected sex/education combination determines the transition probabilities used. While the "Make Selection" tab will alert the user to errors resulting from multiple entries, it will not check for consistencies between the selected life table and the sex/education combination.

A summary of the calculated results appears in the "Summary" tab. Note that the contents of this tab change each time the entries in the "Make Selection" tab are changed. The user should copy the values in this tab to another spreadsheet in order to preserve the results.

The calculation of the PMFs for persons who are initially active in the labor force appears in "Active PMFs" tab. The calculation of the PMFs for persons who are initially inactive in the labor force appears in the "Inactive PMFs" tab. The mean and median WLEs, the 10th, 25th, 75th and 90th percentiles, and the dispersion measures are also calculated in these tabs. The PMFs for each age appear in the range C9..CT103 in these tabs. The resulting mean WLE values appear in columns CU and CV. In the "Active PMFs" tab, column CU contains the WLE calculated under the assumption that labor force transitions occur at the end of each one-year period. The values in column CV correspond to the assumption that transitions occur at mid-year. This is the assumption made in S-C-K. Only one set of calculated WLEs appears in the "Inactive PMF" tab since the PMFs do not depend on the timing of the transitions. (See footnote 8 of S-C-K at page 172).

Note that the resulting mean WLE values shown extend beyond the age ranges published in S-C-K. Even though the calculations are correct, the results are not as reliable due to the paucity of data at older ages and, for higher education levels, at younger ages. A comparison of the calculated WLEs with the published values is found in the range CW40..CZ103 in the "Active PMFs" and "Inactive PMFs" tabs. Note that the calculated values should only match the published values when the correct 2006 life table is chosen in the "Make Selection" tab. Note also that when the correct life table is chosen the difference between the published values and the calculated values corresponding to end-of-year transitions in the "Active PMFs" tab equals 0.5 years.

The "P(Death)" tab contains the probabilities of dying within one year (q_x) used in the spreadsheet. Based on the selection made in the "Make Selection" tab, column B is populated with the q_x's used in the calculations in reverse chronological order starting in row 131. Note that to modify the spreadsheet to utilize a different life table, rows 1 through 122 should be replaced with the life table description and the q_x's in one or more of columns D, F, H, J, L, N, P, Q, R, T, V, X, Z, AB or AD. Any new description will automatically appear in the "Make Selection" tab. Note also that q_x for age 110 is set equal to 1 in row 131 for all life tables.

The "Transition Probabilities" tab contains the S-C-K transition probabilities referenced above. The labels in cells B3 and I3 are used to populate the "Make Selection" tab.

Each spreadsheet can be modified to produce results for a different level of educational attainment by replacing the values in the "Transition Probabilities" tab. Note that the transition probabilities in this tab and in the S-C-K supplemental materials file are the raw transition probabilities and are not adjusted by multiplying by $1-q_x$ as shown in equations 5(a) through 5(d) of S-C-K. This adjustment is made in the "Mort Adj Transition Prob" tab.

The "SCK WLEs" tab contains the published values from the S-C-K tables. It is up to the user to ensure that these values are consistent with any changes made to the "Transition Probabilities" tab. Note that in the Excel version of the published values provided by S-C-K, the value provided at times will contain more than two digits to the right of the decimal point. Such values in the "SCK WLEs" tab have been rounded to two decimal places in order to conform to the published tables and to eliminate spurious results in the calculation of the difference between the published values and the values produced by the spreadsheet.

The "Int Act Men Age 54" tab gives an example of a graph of the PMF for a 54 year-old male who is initially active in the labor force. Note that the values in this tab were produced by selecting the extended 2006 life tables for males and the transition probabilities for initially active males. The values in this tab are not updated if different choices are made in the "Make Selection" tab.

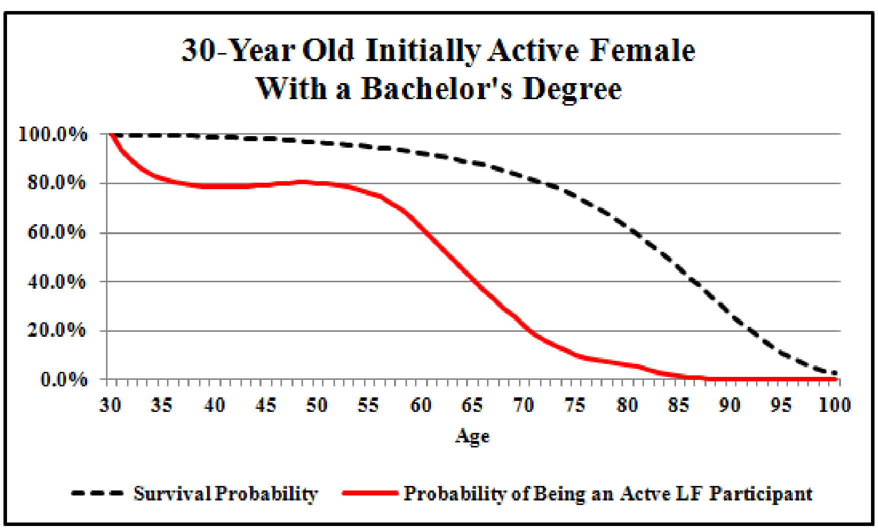
The "Mod Inst" tab gives instructions for modifying the spreadsheet to produces estimates for a different level of educational attainment.

Appendix B: The Probability of Being an Active Labor Force Participant

The probabilities that make up each individual PMF correspond to the probability that the remaining years of labor force activity will equal a specific number of years. The sum of the products of these probabilities with the corresponding number of years equals the mean WLEs reported by S-C-K and calculated by the spreadsheets underlying this paper. An alternative approach to calculating the mean WLE's is to sum the probabilities of being active at a given age. These two approaches are equivalent and are analogous to the two ways of calculating life expectancy. Remaining life expectancy can be calculated by summing the products of living an integer number of years and, at most, one fractional year times the corresponding probabilities, or it can be calculated by summing the probability of living from a given age to all successive ages, or to the age that the life table is closed. These survival probabilities are the probabilities that a forensic economist would use to reduce a future stream of pension payments to account for mortality risk.

A comparison of the survival probability of a 30-year old female with the probability of being an active labor force participant (assuming she is initially active and possesses a Bachelor's degree) is shown below:

Figure B-1



In the same way that survival probabilities can be used to reduce a future stream of cash flows for mortality risk, the probabilities of being active can be used to reduce a future earnings stream for the risk of not being an active labor force participant.

Calculating the probability of being active is most easily understood in the context of modeling the size of a synthetic cohort of initially active individuals as the cohort ages, while at the same time calculating the number of deaths and the number of living inactive individuals. (For the corresponding probability of an initially inactive person, the synthetic cohort corresponds to initially inactive persons and the number of active persons and the number of deaths are also calculated.) This approach is similar to the calculations underlying a period life table, in which the number of deaths and remaining living persons from an initial cohort is calculated as the cohort ages.

Starting with 100,000 active females at age 30, the number of actives (A_{30}) is set equal to 100,000, and the number of living inactive (IA_{30}) and deaths (D_{30}) both set equal to zero. At age 31, these values are recalculated as follows:

(1) $A_{31} = A_{30} \cdot {}^{a}\rho^{a}_{30} + IA_{30} \cdot {}^{i}\rho^{a}_{30}$;
(2) $IA_{31} = A_{30} \cdot {}^{a}\rho^{i}_{30} + IA_{30} \cdot {}^{i}\rho^{i}_{30}$; and
(3) $D_{31} = (A_{30} + IA_{30}) \cdot (L_{31}/L_{30})$, where Lx is the number of living persons age x taken from the life table.

In the above, ${}^{a}\rho^{a}_{x}$, ${}^{i}\rho^{i}_{x}$, ${}^{a}\rho^{i}_{x}$, and ${}^{i}\rho^{a}_{x}$, are the S-C-K transition probabilities conditioned on the probability of survival. That is, they have been multiplied by 1 minus the probability of death and represent the probability at age x of transitioning from active to active, inactive to inactive, active to inactive, and inactive to active, respectively. Note that 1 minus the probability of death equals L_x/L_{x-1}.

At age 32, the values are recalculated again, as follows:

(1) $A_{32} = A_{31} \cdot {}^{a}\rho^{a}_{31} + IA_{31} \cdot {}^{i}\rho^{a}_{31}$;
(2) $IA_{32} = A_{30} \cdot {}^{a}\rho^{i}_{31} + IA_{31} \cdot {}^{i}\rho^{i}_{31}$; and
(3) $D_{32} = (A_{31} + IA_{31}) \cdot (L_{32}/L_{31})$.

The probability of being an active labor force participant at age x is calculated as A_x/A_{30}. Note that it is not necessary to calculate the number of deaths in step (3). However, doing so allows one to check the calculations in steps (1) and (2) since $D_x = 100{,}000 - A_x - IA_x$ for all ages.

The calculations outlined above produce the probability of being active for a female who is exactly 30 years old. It would be an extreme coincidence if the date of the injury, death or other triggering event corresponded exactly to a plaintiff's or decedent's birthday. More often than not, the probability of being active is needed for a person who is not an integer number of years old. The solution to this problem is relatively straightforward and is similar to that explained by Tucek (2011) in connection with the survival probability of a person with a non-integer age. Suppose, for example, we were dealing with a female who was 30.4 years old instead of exactly 30 years old. The desired probability of being active may be calculated by first calculating the probabilities of being active for a 30-year-old female and for a 31-year-old female, and then calculating a weighted average of these two sets of probabilities, with the weights being determined by the fractional part of the individual's age. Note that the largest weight is assigned to the set of active probabilities closest to the individual's age. In our example, the probability of a 30-year-old being active would be assigned a weight of 0.6, while the probability of a 31-year-old being active would be assigned a weight of 0.4.

As noted above, the sum of the probabilities of being active equal the mean WLE. For an initially active person, this sum corresponds to end-of-year transitions. To arrive at a value consistent with the mid-year transition assumption underlying the S-C-K tables, 0.5 years needs to be subtracted from the sum. Alternatively, the probability of being active at age x can be restated as the average of the result of the above calculations at ages x and x+1. (That is, the restated value for age 30 is the average of the initially calculated values for ages 30 and 31.) Coincidentally, these restated values correspond to the assumed cash flow timing under mid-year discounting. No restatement is necessary for initially inactive persons in order to arrive at the correct WLE. However, the averaging process is needed to match the probabilities of being active with mid-year discounting.