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Appendix A Computation

Worklife expectancies presented in Table 1 through Table 10 are computed using the “LPE” model. This model computes a person’s probability of working in any particular year by combining his or her probabilities of life (L), participation (P), and employment (E) into a joint probability. This appendix documents the source and derivation of these probabilities and demonstrates the computation of a sample worklife expectancy statistic.

Probability of Life

The first building block of our worklife expectancy statistics is the probability of life (the “L” of the LPE model). As we project the probability that a given person will be employed several years in the future, we must weight this by the probability he or she will still be alive.

To do this, we employ the Life Survivors Data from Figure 19 in Appendix B.⁶⁰ Extracted from the National Center for Health Statistics (Arias, 2004), this table projects the number of persons of each gender still alive at a given age. For both genders, the starting point was 100,000 live births.

We can use these values to determine the probability that a person of age x will live to age y . For example, the probability that a male aged 25 (x) will live to the age of 70 (y) is determined by dividing the number of survivors at the age of 70 by the number at the age of 25, or $70,087 \div 97,746 = 0.717$. That is, the formula applied to determine the probability of life at age y , given a current age of x , for each future year is as follows:

$$P(L) = \frac{Surv_y}{Surv_x}$$

Thus, when computing a worklife statistic for a given age (x), the above formula is applied for each subsequent age, substituting the appropriate number of survivors at age y , while holding the number at age x constant. This is demonstrated in Figure 18 in the “LPE Applied” section of this appendix.

⁶⁰ This table is gender-, not education-specific for the United States population as a whole. Thus, the probabilities of life are not education-specific.

CPS Employment Rates

As described in the Data Sources section, the Annual Social and Economic Supplement (ASEC), or March supplement, of the Current Population Survey (CPS) is the source of the probabilities of participation and employment used to derive the CPS worklife expectancy statistics. Specifically, the public use data files⁶¹ from this survey for 1996 through 2005 were pooled to produce the needed statistics, as summarized in Table 11 and Table 12 in Appendix C.

To ease the discussion and computation of these statistics, the joint probability of participation and employment (PE) is more simply stated as the fraction (in decimal terms) of the respective population that is employed. Thus, a PE rate of 0.750 for a particular group of the population indicates that 75% of the people in this group are employed, with the remaining 25% being either unemployed or out of the labor force.

The process of pooling the observations from the 10 years of CPS data to compute PE rates is documented in Table 13 through Table 62 of Appendix X. For demonstrative purposes, Figure 14 presents an extract from Table 20 for Males between the age of 25 and 34 with a High School degree and a not severe work disability.

Figure 14 Computation of PE Rate from Pooled CPS Years⁶²

Year	Est. Population (000)		n
	Total	Employed	
1996	131	102	70
1997	230	174	105
1998	146	110	69
1999	121	105	61
2000	117	90	59
2001	116	93	53
2002	151	96	108
2003	109	84	76
2004	115	84	79
2005	143	96	94
Totals	1,379	1,034	774
PE	0.750		

In this exhibit, one line is listed for each of the 10 pooled years. The “Total” column reflects the estimated total population size (in thousands) for this particular cell, using the

⁶¹www.bls.census.gov/cps_ftp.html#cpsmarch.

⁶² Male, high school graduates, not severe disability, 25-34 years old.

CPS official weights. The “Employed” column provides the estimated number of people (in thousands) in this cell that was employed at the time of the respective survey. Finally, the “n” column depicts the actual number of cell observations in the CPS. Using 2005 as an example, approximately 143,000 (Total) males were between the age of 25 and 34 with a high school degree and a not severe work disability. Of this group, 96,000 (Empl.) were employed in March of 2005. The Census Bureau derived these quantities from a sample size of 94 (n) individuals.

These three quantity columns are summed for the 10 pooled years, resulting in totals of 1,379,000 (Total), 1,034,000 (Empl.), and 774 (n). The average PE rate for these years is then computed simply by dividing the total number employed (1,034,000) by the total estimated population size (1,379,000), or 0.750. Stated more simply, for the 10 years ended in 2005, approximately 75% of males between the age of 25 and 34 with a high school degree and a not severe work disability were employed.

This process is repeated for each potential combination of gender, age, education, and disability status. The resulting employment rates are extracted from Table 13 through Table 62 and summarized in Table 11 and Table 12.

Insufficient Observations

An observant reader might notice that the above description of the PE computation process meticulously computes the total number of observations (n) in the 10 pooled years, but makes no use of it. Actually, this quantity plays an important role in monitoring our PE statistics to protect against potential distortion from small sample sizes.

When considering the categorization for two genders, four levels of education, eight age groups, and three disability categories, our computations subdivide our sample into 192 different cells. As a result, some of the cells for those with a work disability will have a limited number of observations – perhaps so limited as to give an unreliable estimate of the true rate of employment.

To remedy this situation, we identified all cells with fewer than 40 pooled observations, and imputed a revised estimate as follows:

- A “Disability Ratio” for the appropriate gender and age group was computed by comparing the average employment rate for persons with a work disability to the rate for those with no work disability. This ratio is computed for each of the severe and not severe work disability categories.
- This Disability Ratio is multiplied by the corresponding rate of employment for a person of the same age, education, and gender with no work disability.

Figure 15 details the seven cells adjusted in this manner. For each cell, we present the original sample size, the employment rate computed from that sample size, the rate for those with no work disability, the disability ratio, and the imputed PE rate substituted for the original estimate. Consider the third entry for an example. Males between 16 and 24, with at least a baccalaureate degree and a not severe work disability, had only 29 (n) observations. Using the CPS weights, these 29 individuals showed an employment rate of 0.689 (Original Rate). The observed employment rate for males of the same age and education, but with no work disability was 0.812 (Non-Dis. Rate). In general, all males with a not severe work disability of this same age have rates of employment that are 94.9% (Disab. Ratio) of their counterparts without a disability. Since the sample size is small, we discard the original rate and impute the employment rate to be used by multiplying the nondisabled rate by the disability ratio, resulting in 0.771 (Imputed Rate).

Figure 15 Adjustment for Insufficient Observations

Gender	Education	Disability Status	Age		Original Rate	Non-Dis. Rate	Disab. Ratio	Imputed Rate
			Group	n				
Males	High School Graduate	Severely Disabled	85 to 89	35	0.000	0.035	0.0%	0.000
Males	College, Less Than Bacc.	Severely Disabled	85 to 89	13	0.000	0.062	0.0%	0.000
Males	Baccalaureate Plus	Not Severely Disabled	16 to 24	29	0.689	0.812	94.9%	0.771
Males	Baccalaureate Plus	Severely Disabled	16 to 24	21	0.447	0.812	25.2%	0.205
Males	Baccalaureate Plus	Severely Disabled	85 to 89	14	0.000	0.117	0.0%	0.000
Females	Baccalaureate Plus	Severely Disabled	16 to 24	34	0.377	0.827	33.1%	0.274
Females	Baccalaureate Plus	Severely Disabled	85 to 89	28	0.000	0.022	0.0%	0.000

Age Cut-off

The Census Bureau exercises great caution in coding the CPS data it makes available to researchers to protect the confidentiality of its respondents. One of the many measures it takes is to “top-code” the age of the respondent. That is, since the number of respondents over a given age is likely to be quite small, Census must guard against a researcher being able to identify the respondent from the advanced age reported along with other demographic data. To do this, they set a maximum (top-code) age, and record the age for all respondents at or older than this value to the maximum. Thus age-specific data are no longer possible starting with this age.

Through 2001, the top-coded age was 90, thus making it possible to extract PE rates through the age of 89. In 2002, the top-code was dropped to 80, and then raised to 85 in 2004. To maintain consistency with the prior edition of The Tables and with the data available in the ACS, we maintained categorization through the age of 89, but continued to discard any top-coded data. This leaves us with no observations for 2002 – 2005 for the 85-89 age bracket, resulting in the PEs being computed from the remaining six years. For 2002 and 2003, we had only partial data (75-79) for the 75-84 age bracket. Since the bracket would have been distorted by using only the younger values, we assumed no observations for these two years.

Obviously, the use of the 85-89 age bracket cannot be continued in future editions of The Tables unless Census reinstates the top-coding to the age of 90. However, this does not appear likely. The low employment rates at this age, combined with reductions for the probability of life, would result in an impact of at most 0.1 years for most worklife expectancy statistics if this category were eliminated.

CPS Extraction

The process employed to derive the quantities and PE rates detailed in Appendix C is identical to that used by the Census Bureau in its disability cross-tabulations.⁶³ One could compute the PE rate for any specific year of a cell by dividing the total employed by the estimated population size from a cell in Table 13 through Table 62. The resulting rate should match that shown by the Census Bureau in its Table 2 of cross-tabulations, using the “Percent Employed – Total” column of the Census table. The exceptions here will be for the 75-84 and 85-89 age groups, which are not included in the Census Table 2.

Note also, that when using Census Table 2, statistics for those with a not severe work disability must be imputed using data from the “With a work disability” and “With a severe work disability” categories. Since the former category includes persons with both a severe and a not severe work disability, subtracting the latter from it results in a category of workers with a not severe work disability.

For those that wish to replicate the extraction from the CPS data files, Figure 16 identifies the key variables used to select and categorize the responses.

Figure 16 CPS Extraction Variables

Variable	Description
A-Sex	Gender, where 1 identifies Males and 2 identifies females
A-HGA	Highest grade achieved: 31-38 indicate less than a high school degree, 39 indicates a high school degree or equivalent, 40-42 indicates some college below baccalaureate, and 43-46 indicates baccalaureate or higher
A-Age	Age
PEMLR	Monthly Labor Force Recode, where values of 1 or 2 indicate employed workers
MarSupWt	March supplement weight – approximate population size represented by each observation
Dis-HP	Health problem or a disability which prevents or limits working; corresponds to the 1 st disability criteria in Figure 1 when equal to 1

⁶³ www.census.gov/hhes/www/disability/disabcps.html.

Variable	Description
Dis-CS	Retire or leave a job for health reasons; corresponds to the 2 nd disability criteria in Figure 1 when equal to 1
Vet-Typ1	Veterans disability payments; corresponds to the 3 rd disability criteria in Figure 1 when equal to 1
RsnNotW	Illness or disability reason for not working; corresponds to the 4 th disability criteria in Figure 1 when equal to 1
PEMLR	Monthly Labor Force Recode, prevented from working due to disability; corresponds to the 5 th disability criteria in Figure 1 when equal to 6
MCare	Medicare coverage; corresponds to the 6 th disability criteria in Figure 1 when equal to 1 and age below 65
SSIVal	Supplemental Security income; corresponds to the 7 th disability criteria in Figure 1 when non-zero and age below 65

ACS Employment Rates

The Data Sources section of this publication (page 23) provides the definition of the ACS disability categories. The data used to derive the employment statistics were extracted from the ACS public use files available from the Census Bureau⁶⁴ for the four years ending 2004. These data are tabulated and pooled in much the same way as described for the CPS data in the CPS Employment Rates section earlier in this appendix. Thus, we will exclude any of the redundant portions of the documentation.

Table 63 and Table 64 in Appendix D present a summary of the ACS employment rates. The detail of the extraction from each of the four years is presented in Table 66 through Table 105 of the same appendix. The pooling computation for the four years of data is similar to that presented in Figure 14 for the CPS data. Due to the increased sample size available from the ACS, the employment rates are grouped into five-year age buckets instead of the 10-year buckets used for the CPS.

Severe Disability

As described in the Data Sources section, a Severe Physical or Severe Cognitive disability is defined by a positive response to either the Self-Care or Go Outside Home limitation questions. However, an analysis by Stern and Brault (2005) identified a problem with the Go Outside Home question that was corrected in 2003. This change in questions made a significant impact on the rates of employment between the 2001-2002 period and the 2003-2004 period.⁶⁵ Given the fact that Stern and Brault show that the

⁶⁴ http://factfinder.census.gov/home/en/acs_pums_2004.html.

⁶⁵ The impact on the impairment only values was insignificant.

earlier period is distorted, we adjusted our tabulation of the ACS data to impute the severe disability rates solely from the 2003-2004 period.

Table 65 in Appendix D presents the derivation of the rates used to impute the severe disability employment rates. As shown in this table, the overall rates of employment were determined for 2003 and 2004 by gender and level of education, but regardless of disability status or age. Then the rates were computed for the same period, genders, and education levels, but for the Physical and Cognitive Severe categories. An imputation rate was then computed as the ratio of the respective severe disability rates to the rates for all persons.

For example, using males with less than a high school degree from Table 65, we see that the employment rate for all persons regardless of disability and age is 0.675 (67.5%). The corresponding rate for Physical Severe is 0.101, which is 14.9% of the all person rate of 0.675. This 14.9% represents the imputation rate that is applied against the age-specific rates for males with less than a high school education, regardless of disability, to derive the age-specific rates for Physical Severe disability.

To continue this example, consider the ACS PE Rate Summary in Table 63. Here, the PE rate for a male of age 25-29 with less than a high school degree can be extracted as 0.765 for “All Persons.” Applying the 14.9% imputation rate identified in the previous paragraph, we derive a Physical Severe employment rate of 0.114 ($0.765 \times 14.9\%$) for the same category.

ACS Extraction

For those wishing to replicate the extraction of the ACS data from the Census public use data files, Figure 17 presents the variables used in the process.

Figure 17 ACS Extraction Variables

Variable	Description
AGEP	Age
SCHL	Educational attainment: 01-08 indicate less than high school degree, 09 indicates a high school degree, 10-12 indicate some college below baccalaureate, and 13-16 indicate baccalaureate or higher.
ESR	Employment Status: use 1, 2, 3, or 6 to identify the civilian labor force and 1 or 2 to indicate employment.
SEX	1 for male or 2 for female
PWGTP	Weight – approximate population size represented by each observation
DPHY	Physical Disability: 1 for yes, 2 for no
DREM	Cognitive Disability: 1 for yes, 2 for no

Variable	Description
DEYE	Sensory Disability: 1 for yes, 2 for no
DOUT	Go Outside Home Disability: 1 for yes, 2 for no
DDRS	Self-Care Disability: 1 for yes, 2 for no

LPE Applied

Using the procedures described in the “Probability of Life” (L) section and the values derived for employment rates (PE) from the CPS and ACS, we can now compute the worklife expectancy statistic using the LPE approach. Figure 18 presents a sample computation for a 60-year-old male with at least a baccalaureate degree and no disability using the ACS tabulations. Each row represents one year of potential employment. The columns of the exhibit are as follows:

- **Start Age** – Age at the beginning of this computation row
- **End Age** – Age at the end of this computation row
- **Base Age Survivors** – Number of survivors from Figure 19 for a 60-year-old male (constant for all rows)
- **At End Age Survivors** – Number of survivors from Figure 19 for a male at the age represented by the “End Age” column of the respective row
- **Prob. Of Life (L)** – Probability that a 60-year-old male will live to the age indicated in the “End Age” column, computed by dividing “At End Age Survivors” by “Base Age Survivors”
- **Prob. Of Emp. (PE)** – Extracted from Table 63 for males with at least a baccalaureate degree and no disability
- **Prob. Of Work (LPE)** – Probability a male with a baccalaureate degree and no disability will be employed in the respective year, computed by multiplying “Prob. of Life (L)” by “Prob. Of Emp. (PE).”

The “Prob. Of Work (LPE)” column is summed to derive the worklife expectancy. For our example, the result of 7.1 years (rounded) is reflected in Table 4 for a 60-year-old male with at least a baccalaureate degree and no disability under the ACS.

Figure 18 Computation of Worklife Expectancy⁶⁶

Start Age	End Age	Survivors		Prob. of Life (L)	Prob. Of Empl. (PE)	Prob. Of Work (LPE)
		Base Age	End Age			
60	61	84,637	83,612	0.988	0.673	0.665
61	62	84,637	82,483	0.975	0.673	0.656
62	63	84,637	81,255	0.960	0.673	0.646
63	64	84,637	79,946	0.945	0.673	0.636
64	65	84,637	78,556	0.928	0.673	0.625
65	66	84,637	77,071	0.911	0.422	0.384
66	67	84,637	75,501	0.892	0.422	0.376
67	68	84,637	73,809	0.872	0.422	0.368
68	69	84,637	72,012	0.851	0.422	0.359
69	70	84,637	70,087	0.828	0.422	0.349
70	71	84,637	68,039	0.804	0.278	0.224
71	72	84,637	65,864	0.778	0.278	0.216
72	73	84,637	63,621	0.752	0.278	0.209
73	74	84,637	61,202	0.723	0.278	0.201
74	75	84,637	58,680	0.693	0.278	0.193
75	76	84,637	56,028	0.662	0.195	0.129
76	77	84,637	53,251	0.629	0.195	0.123
77	78	84,637	50,398	0.595	0.195	0.116
78	79	84,637	47,454	0.561	0.195	0.109
79	80	84,637	44,370	0.524	0.195	0.102
80	81	84,637	41,252	0.487	0.145	0.071
81	82	84,637	38,102	0.450	0.145	0.065
82	83	84,637	34,798	0.411	0.145	0.060
83	84	84,637	31,719	0.375	0.145	0.054
84	85	84,637	28,478	0.336	0.145	0.049
85	86	84,637	25,296	0.299	0.097	0.029
86	87	84,637	22,212	0.262	0.097	0.025
87	88	84,637	19,266	0.228	0.097	0.022
88	89	84,637	16,494	0.195	0.097	0.019
89	90	84,637	13,925	0.165	0.097	0.016
Totals						7.096

⁶⁶ 60-year-old male with no disability (ACS) and at least a baccalaureate degree.