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Using Subjective Expectations to Forecast Longevity: Do Survey Respondents Know Something We Don't Know?

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Abstract: Future old-age mortality is notoriously difficult to predict because it requires not only an understanding of the process of senescence, which is influenced by genetic, environmental and behavioral factors, but also a prediction of how these factors will evolve going forward. In this paper, I argue that individuals are uniquely qualified to predict their own mortality based on their own genetic background, as well as environmental and behavioral risk factors that are often known only to the individual. Using expectations data from the 1992 HRS, I construct subjective cohort life tables that are shown to predict the unusual direction of revisions to U.S. life expectancy by gender between 1992 and 2004; that is, the SSA revised up male life expectancy in 2004 and at the same time revised down female life expectancy, narrowing the gender gap in longevity by 25 percent over this period. Further, the subjective expectations of women suggest that female life expectancies produced by the Social Security Actuary might still be on the high side, while the subjective life expectancies for men appear to be roughly in line with the 2004 life tables.

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1 Introduction

The 20th century witnessed unprecedented improvements in life expectancy: In the United States, life expectancy at birth rose from 47 years in 1900 to 77 years in 2000 (National Center for Health Statistics, 2004).[1] Although most demographers agree that mortality rates will continue to decline in the 21st century, there is little consensus on how fast and for how long they will continue to fall (e.g. Vaupel and Lundstrom, 1994; Lee, 2003). The answers to these questions are at the heart of some of the most important issues in the economics of aging, including income adequacy in retirement, and the solvency of the social security system.

Many mortality forecasts are based on extrapolations of historical data. However, extrapolating historical trends may be misleading. For example, simple extrapolative procedures fail to incorporate information about the causes of mortality change over time. This paper provides a somewhat unorthodox alternative to using historical data to project the future path of mortality risk. The method proposed here uses data on individual subjective expectations of survival to construct subjective life tables for a particular cohort. This method has an important advantage over extrapolative methods in that subjective expectations incorporate current and future expected values of variables that influence mortality risk, such as exercise, diet and smoking habits, as well as current and expected advances in medical technology. As much of this information is private, individuals are uniquely qualified to assess how these factors will influence their personal mortality risk, which is a function of their medical history, current health status, and family history. By aggregating these individual forecasts of mortality risk across persons in a given cohort, we obtain a subjective cohort life

[1] Cutler and Meara (2004) provide an excellent overview of the causes underlying mortality improvements over the twentieth century.

table that incorporates causal mechanisms implicitly and does not explicitly depend on ad hoc historical trends.

The purpose of this paper is to explore the mortality forecasts implied by the subjective expectations of a cohort of individuals in the Health and Retirement Study (HRS) in 1992. There are three main findings: First, the subjective life tables differ significantly from the life tables put together by the Social Security Actuary (SSA) in 1992 and subsequently revised in 2004, and the deviations from the life table differ significantly by gender. In particular, the subjective life expectancies estimated for men are higher than SSA life tables predict, while the subjective life expectancies for women are a good bit lower. Second, these subjective life tables suggest a further narrowing of the gender gap in longevity in coming decades, with men living longer and women dying earlier than is currently predicted by the SSA. Part of this narrowing has already been reflected in revisions to the SSA life tables between 1992 and 2004 in which male life expectancies were revised up and female life expectancies were revised down. In essence, the subjective expectations data from 1992 predicted the direction of revisions to the SSA life tables between 1992 and 2004. The subjective expectations data also suggest that there should be a further narrowing in the gender gap in longevity for these cohorts that is not yet reflected in the SSA life tables. Finally, I demonstrate that the validity of the subjective survivor functions depends crucially on the functional form that governs changes in mortality after age 85. I show that different functional forms result in significantly different life expectancies, largely stemming from the shape of the survivor function beyond age 85; nevertheless I argue that the main findings of the paper are robust to these assumptions.

The paper proceeds as follows. Section 2 describes the unique expectations data available in the Health and Retirement Study. The third section demonstrates how these data can be used to construct individual-specific survivor functions, which are then aggregated using population weights for a cohort of men and women in the HRS. The fourth section discusses the resulting subjective life tables and compares their mortality predictions to the life tables produced by the Social Security Actuary in 1992 and then again in 2004. The final section offers concluding remarks and directions for future research.

2 The Health and Retirement Study

The data used in this analysis are from the first wave of the Health and Retirement Study (HRS). Initial interviews were conducted in 1992 and provide detailed information on the health status and socio-economic status of a nationally representative sample of persons aged 51 to 61 and their spouses.[2] A total of 12,652 individuals were included in the final HRS sample in 1992. Variables of particular importance for this paper include subjective expectations of survival to age 75 and age 85, as well as indicators of the age and sex of the respondent.

This paper uses the HRS data on survival expectations to generate sequences of survival probabilities for each individual in the sample. In particular, respondents were asked to answer the following questions:

> *I would like to ask you about the chance that various events will happen in the future. Using any number from zero to ten, where zero equals absolutely no chance and 10 equals absolutely certain, what do you think are the chances that you will live to be 75 or more? And how about the chances that you will live to be 85 or more?*

[2] Detailed documentation of the HRS is available in Juster and Suzman (1995).

When the responses to this question are divided by 10, they can be thought of as probabilities of surviving to age 75 and 85, hereafter referred to as P_{75} and P_{85}. Hurd and McGarry (1995) suggest that, on average, the subjective survival probabilities are internally consistent: The probability of living to age 75 is greater than or equal to the probability of living to age 85. They also demonstrate that the subjective probabilities are externally consistent in that they covary in reasonable ways with other variables such as health status, and that they are on average in the ballpark of the 1988 life table probabilities. Hurd and McGarry (2002) also demonstrate that subjective survival probabilities have predictive validity; that is, those who survived between waves 1 and 2 of the HRS reported significantly higher probabilities of survival in 1992 than those who died.[3]

For this analysis, I focus on men and women aged 52 and 57 for comparison to the 1940 and 1935 birth-year cohort life tables, respectively. I drop 2.5 percent of the observations that had reported subjective probabilities that were not internally consistent, i.e., the subjective probability of living to 85 was strictly greater than the subjective probability of living to age 75. Persons who report the same value for P_{75} and P_{85} are retained in the sample, but their reported probabilities are altered somewhat in order to estimate the parameters of the survivor functions.[4]

[3]More generally, there is an interesting literature on the validity and interpretation of subjective expectations data, including Bassett and Lumsdaine (2001), Bernheim (1989, 1990), Dominitz (1998), Dominitz and Manski (1997), Hamermesh (1985), and Manski (1990).

[4]For practical reasons documented in Appendix A, the subjective expectations data are adjusted for respondents who report $P_{75} = P_{85}$, and for respondents who report survival probabilities of zero or one.

3 Using Expectations Data to Predict Mortality

3.1 Constructing Individual Subjective Survivor Functions

This section describes how the subjective expectations data from the HRS can be used to generate a sequence of subjective survival probabilities–or a subjective survivor function–for each individual in the sample. The basic method proposed here involves fitting a survivor function through the points P_{75} and P_{85} on the subjective survivor function. Note that this method is very different in spirit from an alternative method proposed by Gan, Hurd and McFadden (2003) that uses a Bayesian update model to construct individual subjective survivor functions.[5]

For the purposes of this paper, I maintain the assumption that the individual survivor functions can be approximated by a particular functional form. Two functional forms are commonly used in survival analysis–the Weibull distribution and the Gompertz distribution. The Weibull distribution has been used extensively to model the lifetimes of manufactured goods, as well as the lifetimes of insects, animals, and people (Lawless, 1982). The popularity of the Weibull distribution in survival analysis owes, in part, to its flexibility in allowing decreasing or increasing hazard functions. Another attractive feature of the Weibull is that the mean and variance of the distribution have closed-form solutions (Lawless, 1982).

The Gompertz distribution has been popular among demographers because its double exponential form has been thought to reflect the underlying process of aging that leads to

[5]Gan, Hurd and McFadden (2003) use data from the Asset and Health Dynamics of the Oldest-Old (AHEAD), which is representative of the population aged 70 and older, to estimate individual specific survivor functions. As a result, a direct comparison of the mortality forecasts from the different methods for a constant cohort are unavailable.

death. Despite studies which show that the Gompertz model may not accurately characterize mortality risk among the oldest-old–i.e. mortality hazards do not appear to continue to increase at the same exponential rate among the oldest-old–this distribution is still widely used and accepted (Economos, 1982; Wilson, 1994). The Weibull and Gompertz distributions each have two parameters, which implies that they are exactly identified given two points on the survivor function, P_{75} and P_{85}. However, when P_{75} is sufficiently close to P_{85}, the exactly-identified survivor functions are implausibly flat, yielding unreasonably high probabilities of survival in old age for a significant fraction of the sample. To induce the estimated survival probabilities to be close to zero in extreme old age, I introduce a third point on the subjective survivor function to which most respondents would not likely object. In particular, I set the probability of living to age 110 near zero according to the simple conditional probability:

$$P_i(110|age_i) = \underbrace{P_x(110|85, age_i)}_{SSA\ lifetable} * \underbrace{P_i(85|age_i)}_{HRS}$$

where the first term on the right-hand side is the probability of surviving to age 110 given that a person survives to age 85 for $x \in \{male, female\}$. This term is calculated separately for men and women from the SSA cohort life tables (Bell, Wade and Goss, 1992). The second term represents the subjective probability of living to age 85 given that the respondent is age_i in 1992 (P_{85}).

The general strategy of this methodology is to estimate the parameters of the survivor function given P_{75}, P_{85} and P_{110} using nonlinear least squares (NLLS). In particular, I assume that:

$$P_{i,t} = S_{i,t}(\alpha_i, \beta_i) + \epsilon_{i,t}$$

where $P_{i,t}$ is the probability that individual i lives to age t, and $S_{i,t}$ is a general representation of a two-parameter survivor function. The error term $\epsilon_{i,t}$ is assumed to be i.i.d, mean zero, and homoskedastic. The NLLS estimators are the values of α_i and β_i that minimize the following expression:

$$\sum_{t\in\{75,85,110\}}[\mathrm{P}_{i,t} - S_{i,t}(\alpha_i, \beta_i)]^2$$

Two sets of parameter estimates are calculated, the first under the assumption that the survivor function takes the form of the Weibull survivor function (α_i^W, β_i^W), which is given by:

$$S_{i,t}^W(\alpha_i^W, \beta_i^W) = exp[-(\tfrac{t-age_i}{\alpha_i^W})^{\beta_i^W}]$$

and the second under the assumption that it takes the form of the Gompertz survivor function, which is defined as:

$$S_{i,t}^G(\alpha_i^G, \beta_i^G) = exp[\tfrac{\alpha_i^G}{\beta_i^G} exp(\beta_i^G(t - age_i))]$$

This estimation procedure assumes that each individual faces a unique sequence of survival probabilities that are generated from an individual-specific Weibull (Gompertz) survivor function. Further, each individual reports their survival probabilities with error. Under these assumptions, NLLS will provide unbiased and efficient estimates of the underlying parameters of the survivor function for each individual. As we show in the next section, an aggregate life table can be computed by applying population weights to the individual survivor functions.[6]

3.2 Constructing Subjective Cohort Life Tables

The two sets of NLLS estimates are used to generate a series of subjective survival probabilities–a Weibull and a Gompertz–for each person in the sample. To generate a representative cohort life table, these subjective probabilities are multiplied by the HRS person-level weight and summed for each age-gender group. That is, the N sample members who are age X in 1992 (call it the age-X_{1992} cohort) represent a total population cohort of $\sum_{i=0}^{N} W_i$ persons, or the sum of the person-level weights (W_i), in 1992. Going forward, the number of persons from the age-X_{1992} cohort expected to be alive at age $X + t$ is given by $\sum_{i=0}^{N} W_i S_{i,t}$. This calculation gives the number of persons in the $age - X_{1992}$ cohort that are expected to be alive at every age $x > X_{1992}$, or in nomenclature of the life tables, l_x. Once we obtain l_x for each age x, we can deduce all of the other life table functions as follows:

[6]Alternatively, if one assumed that each individual in a given age-sex cohort actually faced the same Weibull survivor function, and reported those probabilities with error, one could estimate the parameters of the aggregate survivor function by weighted nonlinear least squares on the entire cohort. Estimates of aggregate Weibull parameters using this method yielded life expectancies that were a bit higher for the 1940 cohort, but the main results of this paper still hold. Given the variation in risk factors and responses regarding expectations of survival, we maintain the assumption that each individual faces a person-specific survivor function, and we construct the life tables accordingly.

$$
\begin{aligned}
\mathrm{d}_x &= l_x - l_{x+1} \\
q_x &= \tfrac{d_x}{l_x} \\
L_x &= \tfrac{l_x + l_{x+1}}{2} \\
T_x &= \textstyle\sum_{t=0}^{\omega} L_{x+t} \\
e_x &= \tfrac{T_x}{l_x}
\end{aligned}
$$

Conceptually, the life table age-specific death rate, q_x, is simply a count of the number of persons who die between age x and age $x+1$, d_x, divided by the number of persons alive at age x, l_x. Note that this function explicitly accounts for the selection of healthier individuals into older age groups, as persons with higher mortality risk are more likely to die at younger ages and are therefore less likely to be included in the denominator l_x as x increases.

As is customary, these estimates assume that deaths are distributed uniformly over the year, so that the average number of persons alive between time t and t+1 is equal to L_x, which is the midpoint of l_x and l_{x+1}. The sum of L_{x+t} from $t = 0$ to ω, where ω is the maximum possible age, gives the total number of person-years lived by the cohort over its lifetime (T_x). Life expectancy is derived by dividing the total number of person-years lived by the cohort (T_x) by the total number of people alive at t=0 (l_x).[7]

4 Results

4.1 Men, 1940 Cohort

Although life tables could be constructed for all age cohorts, this paper presents selected life table functions only for the cohorts that align with the 1940 and 1935 cohort life tables

[7]These basic life table functions are described in more detail in Pollard, Yusuf and Pollard (1991).

published in 1992; that is, men and women aged 52 and 57 in 1992, respectively.[8] Table 1 presents the survival probabilities derived from the Weibull and Gompertz distributions for the 1940 male cohort; for comparison, the table also shows the life table estimates that were published by Social Security in 1992 and 2004. The table shows that the Gompertz survivor function is quite a bit flatter than the Weibull; as illustrated in figure 1, the Gompertz survival probabilities are significantly lower than the Weibull probabilities through age 75, then a bit higher through age 95, before dropping much faster after age 95. It appears that the survival probabilities from the Gompertz survivor function are too low at younger ages, perhaps indicating that the Gompertz distribution is not appropriate. Indeed, Wilson (1994) notes that for human survivor functions, there appears to be a shift in the exponential parameter at older ages; that is, mortality does not increase at the same exponential factor over the entire length of life, it likely decelerates in old age.[9]

Not surprisingly, the life expectancy is higher in the subjective cohort life table derived from the Weibull relative to the Gompertz life table: The Weibull estimate of life expectancy at age 52 is 28.2 years while the Gompertz life expectancy is 26.5 years. Table 1 shows that these Gompertz and Weibull life expectancy estimates are between 1/2 year and 2-1/4 years higher, respectively, than the life expectancy of 25.9 years published in the 1940 cohort life table from 1992–the year that these subjective expectations data were gathered. If these subjective life tables had been taken seriously in 1992, they may have suggested that the life expectancy estimates for this cohort were too low. Indeed, as shown in the top row of the right-hand side columns of table 1, the Social Security Actuary revised up their estimates

[8]Complete subjective cohort life tables are included in Appendix B.

[9]Vaupel et al. (2004) investigate the possibility that mortality rates actually decline beyond a certain age–a phenomenon they term negative senescence.

of life expectancy for this cohort by a significant margin of .8 years when it reestimated the 1940 cohort life table in 2004.

The revision to the life table estimates are shown in more detail in figure 2, which compares the SSA life tables published in 1992 and 2004 to the Weibull subjective survivor function. The results show that the revisions to the 1940 cohort life table in 2004 pushed the survival probabilities from the cohort life table into closer alignment with the subjective survivor function at almost every age up through the early 90s. Moreover, the figure shows that the Weibull estimates track the 2004 life table estimates almost exactly up through age 80, at which point the subjective survivor function diverges from the SSA life table. In particular, the Weibull survivor function has a much fatter right tail, implying the probability of surviving to older ages is a good bit higher than the current life table estimates predict. As discussed below, the key to estimating life expectancy for this age group lies in the assumptions underlying mortality forecasts at ages 85 and up.

4.2 Women, 1940 Cohort

Table 2 presents the survival probabilities derived from the Weibull and Gompertz distributions for the 1940 female cohort. As shown in figure 3, the comparison of the survivor functions from these two distributions mirror the male 1940 cohort: The Gompertz survivor function is flatter and has lower probabilities of survival after age 95 than the Weibull. In addition, the Weibull life expectancy of 29.9 years–shown in the first row of table 2–is about 2 years longer than the Gompertz life expectancy, implying a range of subjective life expectancies between 27.9 and 29.9 for this cohort.

That said, the subjective life expectancies for women and men in the 1940 cohort compare very differently with the SSA life tables. While the subjective life expectancies for men were higher than the SSA life tables, the subjective life expectancies for women in this cohort are a good bit lower. The four columns to the right in table 2 show that the life expectancy for women in this cohort was 30.9 years according to the SSA life tables published in 1992–or about 1 to 3 years higher than the subjective life expectancies. Therefore, the subjective expectations from 1992 suggest that the SSA life expectancies from 1992 were too high. Remarkably, the SSA revised *down* its estimate of female life expectancy for this cohort to 30.4 years as of 2004–a downward revision of 1/2 year. As shown in figure 4, the Weibull survivor function looks quite different from the life table survivor functions, with lower probabilities of survival at younger ages and higher probabilities of survival for the oldest-old. It is interesting to note that the reductions in life expectancy between the 1992 and 2004 life table estimates owes largely to a reduction in survival probabilities among those 85 and older. In contrast, the lower life expectancy implied by the Weibull stems from lower survival probabilities through about age 90.

Although the functional forms given by the Weibull and the Gompertz are very important for determining the sequence of survival probabilities, the general results hold even when looking at the raw weighted responses to the expectations questions. Tables 3 and 4 show the weighted means of the actual survey responses of P_{75} and P_{85} for men and women age 52 and 57 in 1992. These figures differ a bit from the predicted values based on the fitted Weibull and Gompertz survivor functions presented in tables 1 and 2, but yield the same basic conclusions. That is, men in both age groups had much higher estimates of their probability of surviving to age 85 than indicated in the life tables published in 1992. And, upward revisions to the SSA life table probabilities in 2004 halved the difference between SSA estimates and the subjective estimates.

Meanwhile, women reported subjective probabilities of survival that were lower than the life tables by a good margin for both P_{75} and P_{85}. In this case, the life table probability of living to 75 was revised up slightly between 1992 and 2004, while the probability of living to 85 and beyond was revised down. Taken together, the life expectancy for women in both cohorts was revised down 1/2 year in each cohort, moving the life table estimate closer to the subjective life expectancy estimates.

4.3 The Gender Gap

These results for men and women indicate that the gender differential in mortality risk was perceived in 1992 to be declining faster than predicted by the Social Security Actuary at that time. As shown in table 5, the life tables from 1992 predicted that the difference between female and male life expectancy was about 5 years for both cohorts. By 2004, revisions to the male and female life tables for these cohorts reduced the gender gap to about 3-3/4 years–a 25 percent downward revision in just over a decade. The lower panel of table 5 shows that the implied longevity differential from the subjective life tables, which range between 1-1/2 and 2 years, is still quite a bit lower than the 2004 life table estimates. These expectations suggest that the mortality differential between men and women in these cohorts could narrow even further.

The bottom line is that the subjective cohort life tables, which are based only on data collected in 1992, predicted revisions to the SSA cohort life tables between 1992 and 2004. These included upward revisions to male life expectancy, and downward revisions to female life expectancy, implying a narrowing of the gender gap.

4.4 Functional Form Assumptions

A key maintained assumption in this analysis is that the Weibull surivivor function fitted through three points on the subjective survivor function can yield a meaningful sequence of survival probabilities for each person in the HRS sample. The Weibull, as noted above, appears to yield higher probabilities of living beyond age 95, even when the estimated life expectancy is lower than the life table estimates, e.g. for women shown in Table 4. This section explores the implications of using the Weibull to fit survivor functions, particularly for comparison to the life tables produced by the Social Security Actuary.

One might argue that the Weibull is not be flexible enough to capture the shape of the human survivor function; in particular, the fat right tail associated with the Weibull is inappropriate and may be driving the results described above. To explore the importance of functional form assumptions, I fit Weibull functional forms to the SSA cohort life tables from 1992 and 2004 using the same 3 points of the survivor function used in the subjective life tables: P_{75}, P_{85}, and P_{110}. Figure 6 shows that for men, the Weibull functional form predicts higher survival probabilities both before age 75 and after age 90 than the life table probabilities.[10] As a result, life expectancies derived from these Weibull estimates are higher; indeed, as shown at the bottom of table 3, male life expectancies are roughly 1 year to 1-1/2 years higher than those computed by SSA. However, this transformation in effect makes the life table probabilities more directly comparable to the subjective life tables, and the results are somewhat reassuring. The subjective life expectancy was still quite a bit higher (1-1/4 years) than the fitted Weibull life table life expectancy from 1992, but matched the fitted Weibull life table estimate for 2004. Thus, the main result still holds: Subjective life expectancies from 1992 predicted an upward revision to male life expectancies between 1992 and 2004.[11]

For reference, the SSA life table probabilities were also fitted to the Gompertz functional

[10]This is also true for the older 1935 male cohort.

[11]The same basic result obtains for men aged 57 in 1992.

form, shown in the last row of table 3. The Gompertz, which does a much better job of fitting the right tail of the survivor function, implies a lower life expectancy than the Weibull that is closer to the actual life table life expectancies. As with the Weibull, the basic results described above continue to hold.

The results for women shown in table 4 are similar, only in this case, the life expectancy estimates from both the Weibull and Gompertz are higher than the subjective life expectancies calculated for each cohort. Nevertheless, the main result holds: SSA fitted life expectancies were revised down about the same amount as the actual life expectancies, and the subjective life expectancy is still lower than both the actual and fitted SSA life table estimates from 2004.

The memo items in table 5 show that the diminution in the gender gap in longevity is highly stable across the different fitted and actual life expectancy values. Although the fitted life table estimates of the gap are slightly higher than the actual, the percent reduction from 1992 to 2004 is 30 percent–roughly the same as the actual reduction between the 1992 and the 2004 life tables.

5 Concluding Remarks

The Weibull and the Gompertz differ dramatically in their implications about mortality risk at very old ages, with the Weibull implying higher rates of survival for the oldest old than the Gompertz. Because the 1940 and 1935 cohorts have only just now (in 2005) reached the ages 65 and 70, respectively, their mortality experience at the oldest ages has not yet been realized. Moreover, there is a wide range of opinion about the pace of future mortality improvements at very advanced ages. In one camp are those who believe that the pace of future improvements will slow because we are nearing a biological limit to human life expectancy (Olshansky and Carnes, 2001). In the other camp are those who believe that we have not yet come close to the biological limit of human life expectancy (see, e.g. Oeppen and Vaupel, 2002).[12] What is not disputed is that past forecasts of mortality improvements have been far too conservative (Oeppen and Vaupel, 2002) and that assumptions about future old age mortality are vital to estimating the expected longevity of current and future cohorts.

Future old-age mortality is very difficult to predict because it requires not only an understanding of the process of senescence, which is influenced by genetic, environmental and behavioral factors, but also a prediction of future medical advances as well as other important environmental variables. In this paper, I suggest that individuals have a unique understanding of their own individual aging processes conditional on their own genetic background and environmental and behavioral risk factors. Given this private information, individuals form expectations about future survival probabilities that may provide additional information to demographers and policymakers in their challenge to predict future mortality. I find that expectations elicited in 1992 predicted the unusual direction of revisions to U.S. life expectancy by gender between 1992 and 2004; that is, male life expectancy was revised up and female life expectancy was revised down. The subjective expectations of women suggest that female life expectancies produced by the Social Security Actuary might still be on the high side, while the subjective life expectancies for men appear to be roughly in line with the 2004 life tables.

[12]For example, estimates from a risk factor simulation model developed by Manton, Stallard and Tolley (1991) suggest that life expectancy at birth could be dramatically higher than the U.S. life tables currently predict.

Table 1
Subjective Life Tables vs. Cohort Life Tables (Social Security Actuary)
Men Aged 52 in 1992

Age	**Subjective Life Tables**				**1940 Cohort Life Table**			
	Weibull		**Gompertz**		**Published in 1992**		**Published in 2004**	
	Survival Probability S_x	*Life Expectancy* e_x	*Survival Probability* S_x	*Life Expectancy* e_x	*Survival Probability* S_x	*Life Expectancy* e_x	*Survival Probability* S_x	*Life Expectancy* e_x
52	1	**28.2**	1	**26.5**	1	**25.9**	1	**26.7**
55	0.976	25.9	0.946	24.9	0.976	23.5	0.977	24.3
65	0.848	18.9	0.773	19.4	0.853	16.1	0.86	16.8
75	**0.647**	13.2	**0.589**	13.9	**0.618**	10.1	**0.647**	10.6
85	**0.366**	9.3	**0.378**	8.8	**0.287**	6.0	**0.332**	5.7
95	0.146	6.5	0.153	4.4	0.053	3.5	0.053	3.0
105	0.029	5.8	0.008	1.5	0.002	2.2	0.001	1.9
115	0.006	4.8	0	1.0	0	1.3	0	1.1

Table 2
Subjective Life Tables vs. Cohort Life Tables (Social Security Actuary)
Women Aged 52 in 1992

Age	**Subjective Life Tables**				**1940 Cohort Life Table**			
	Weibull		**Gompertz**		**Published in 1992**		**Published in 2004**	
	Survival Probability S_x	*Life Expectancy* e_x	*Survival Probability* S_x	*Life Expectancy* e_x	*Survival Probability* S_x	*Life Expectancy* e_x	*Survival Probability* S_x	*Life Expectancy* e_x
52	1	**29.9**	1	**27.9**	1	**30.9**	1	**30.4**
55	0.979	27.5	0.946	26.4	0.986	28.3	0.986	27.8
65	0.876	20.1	0.783	20.9	0.909	20.3	0.911	19.7
75	**0.696**	13.9	**0.621**	15.0	**0.747**	13.5	**0.752**	12.7
85	**0.411**	9.9	**0.427**	9.5	**0.487**	7.8	**0.47**	7.0
95	0.178	6.8	0.193	4.8	0.153	4.2	0.118	3.5
105	0.038	5.8	0.015	1.7	0.011	2.5	0.005	2.0
115	0.008	4.8	0	1.2	0	1.3	0	1.1

Table 3: Weighted Means of P75 and P85, Men
(standard errors in parentheses)

	Age 52 in 1992			Age 57 in 1992		
	subjective expectation (n=395)	life table 1992: 1940 cohort	life table 2004: 1940 cohort	subjective expectation (n=391)	life table 1992: 1935 cohort	life table 2004: 1935 cohort
P75	**0.635**	0.618	0.646	**0.618**	0.633	0.657
	(.015)			(.015)		
P85	**0.377**	0.287	0.332	**0.366**	0.288	0.327
	(.015)			(.015)		
life expectancy		25.9	26.7		21.6	22.2
life expectancy from fitted Weibull	28.2	26.9	28.2	23.2	22.5	23.5
life expectancy from fitted Gompertz	26.5	25.6	26.9		21.4	22.4

Table 4: Weighted Means of P75 and P85, Women
(standard errors in parentheses)

	Age 52 in 1992			Age 57 in 1992		
	subjective expectation (n=472)	life table 1992: 1940 cohort	life table 2004: 1940 cohort	subjective expectation (n=415)	life table 1992: 1935 cohort	life table 2004: 1935 cohort
P75	**0.678**	0.747	0.752	**0.653**	0.761	0.764
	(.013)			(.015)		
P85	**0.428**	0.487	0.47	**0.43**	0.489	0.468
	(.014)			(.015)		
life expectancy	---	30.9	30.4	---	26.4	25.8
life expectancy from fitted Weibull	29.9	32.5	32.1	24.8	27.9	27.4
life expectancy from fitted Gompertz	27.9	31.2	30.8		26.6	26.1

Table 5: Differences in Life Expectancy by Gender: Female Life Expectancy less Male Life Expectancy

	Age 52	Age 57
Cohort Life Table, 1992	5	4.8
Cohort Life Table, 2004	3.7	3.6
percent change	-26%	-25%
Subjective Expectations (Weibull)	1.7	1.6
Memo:		
Cohort Life Table 1992, fitted Weibull	5.6	5.4
Cohort Life Table 2004, fitted Weibull	3.9	3.9
percent change	-30%	-28%
Cohort Life Table 1992, fitted Gompertz	5.6	5.2
Cohort Life Table 2004, fitted Gompertz	3.9	3.7
percent change	-30%	-29%

Figure 1
Subjective Survivor Functions: Men Aged 52 in 1992 (1992 HRS)

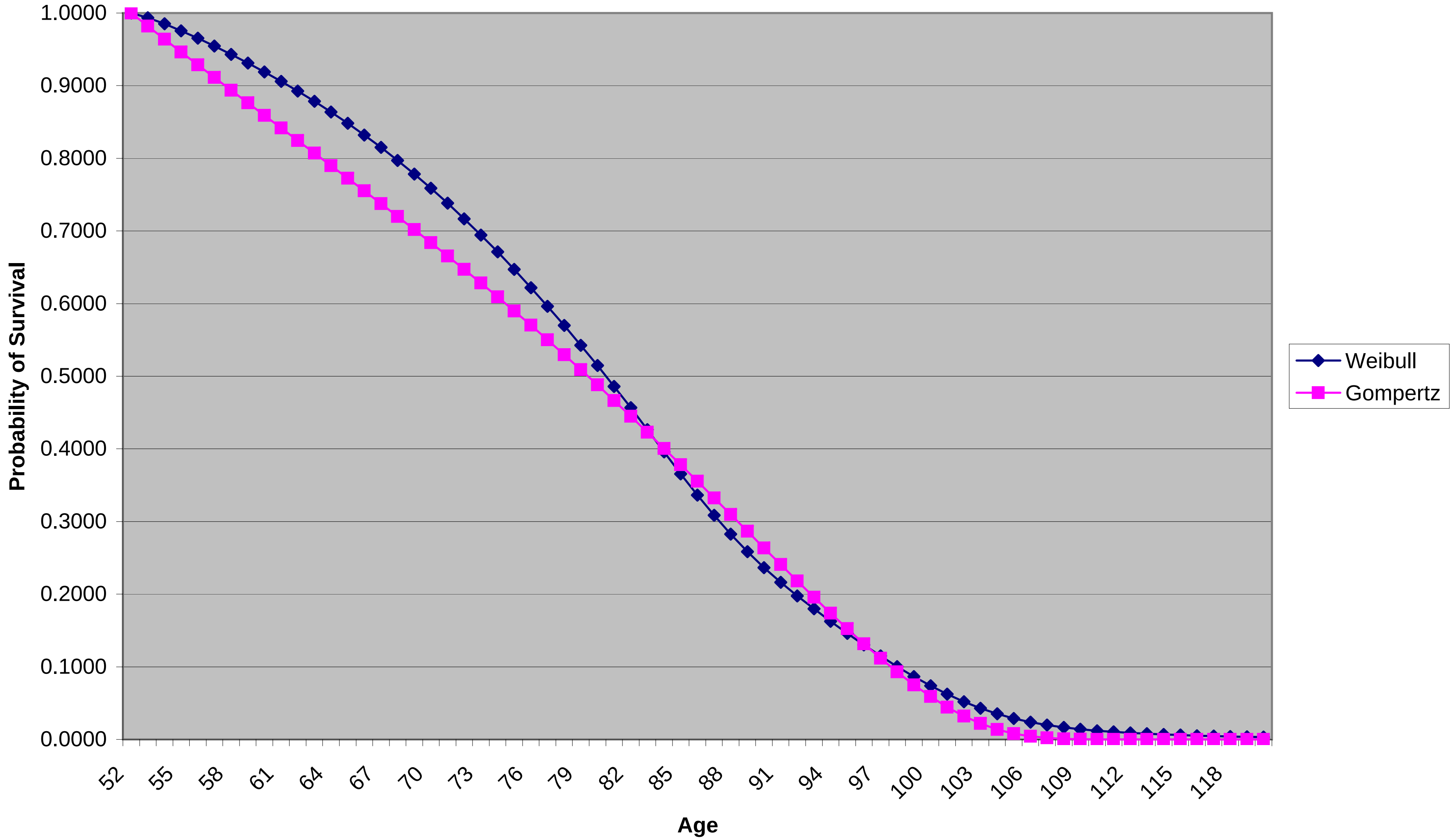


Figure 2
Survivor Functions for Men Aged 52 in 1992

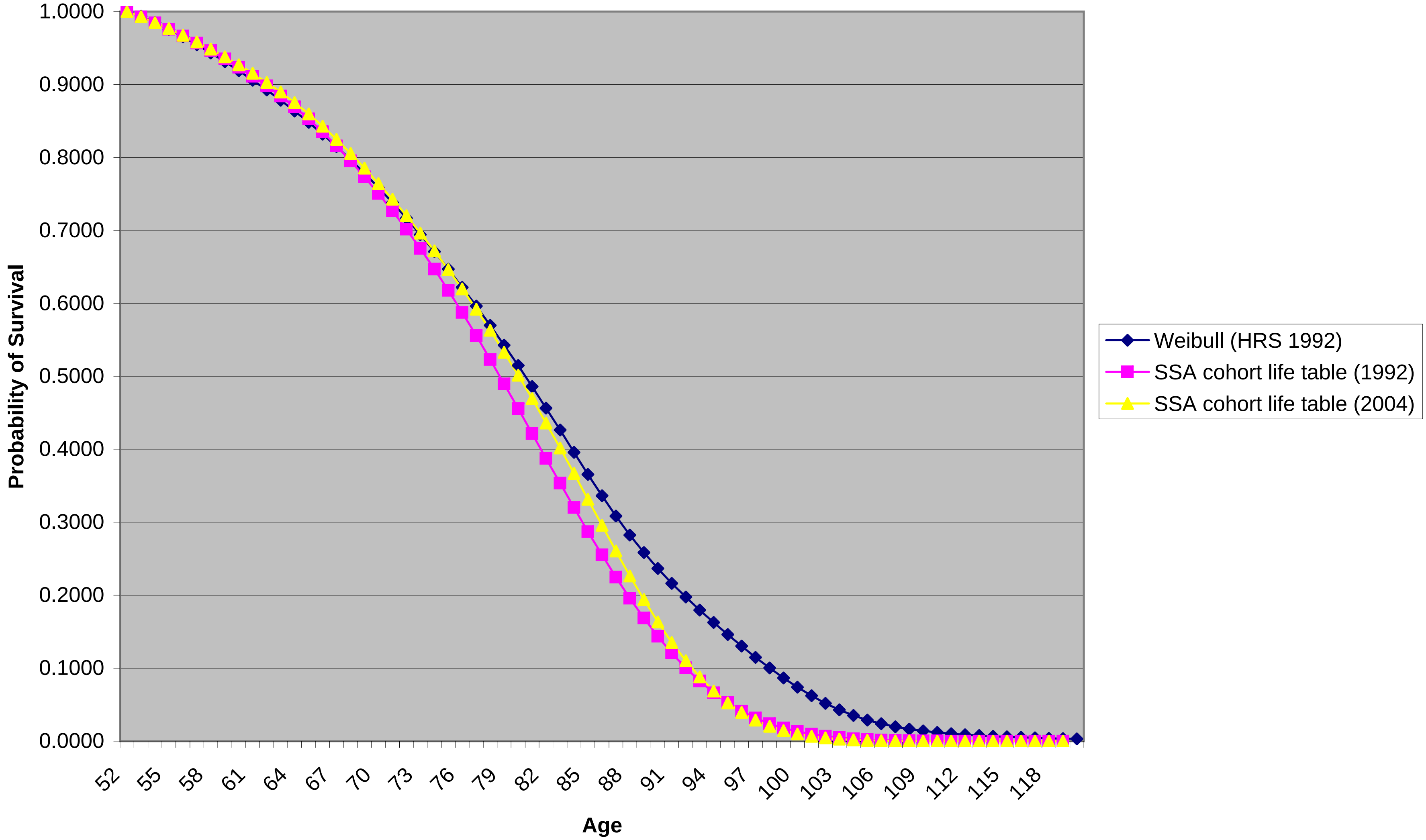


Figure 3
Subjective Survival Functions: Women Aged 52 in 1992 (1992 HRS)

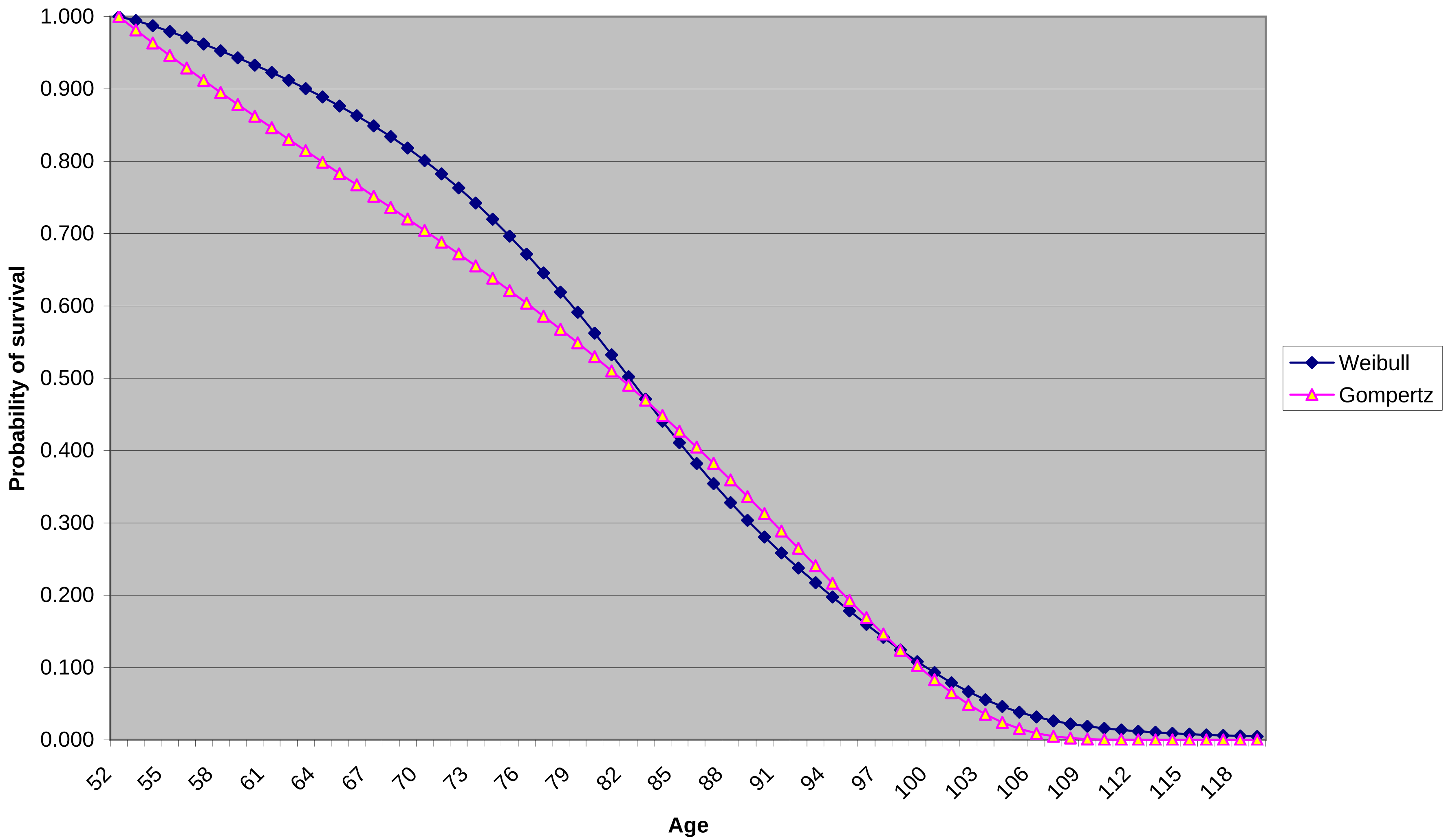


Figure 4
Survivor Functions for Women Aged 52 in 1992

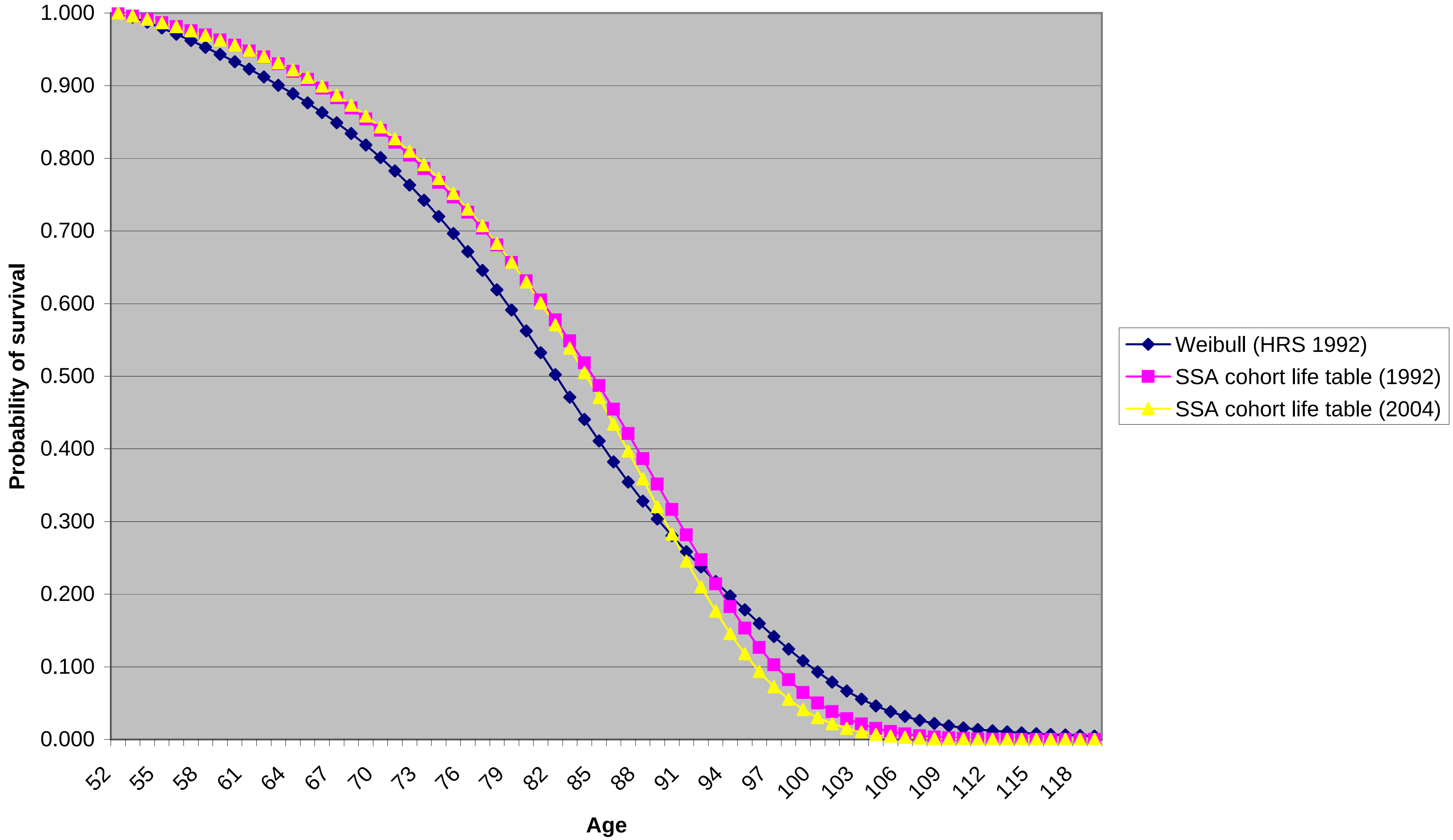


Figure 5
Weibull Subjective Survivor Functions by Gender, Age 52 (1992 HRS)

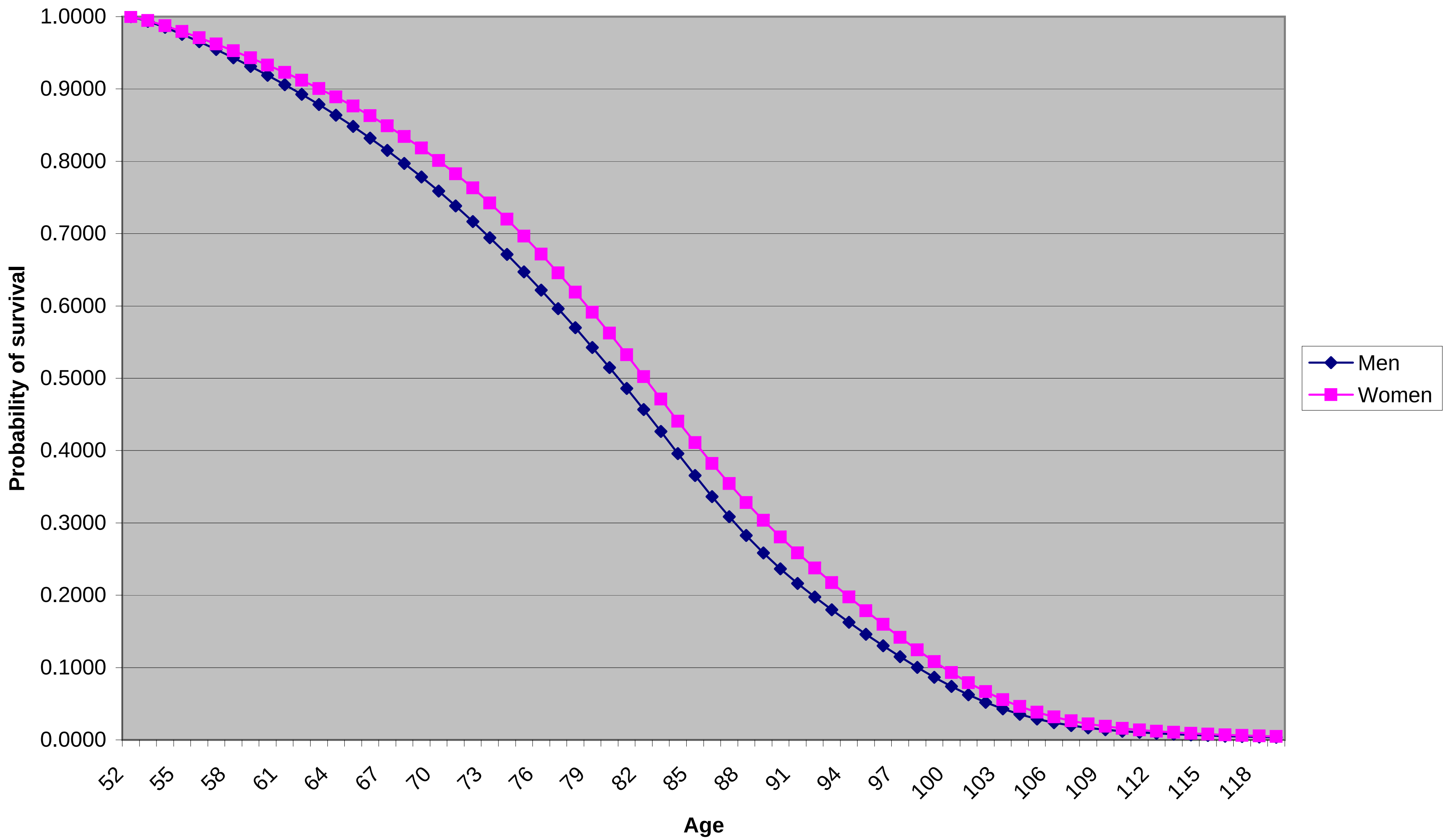
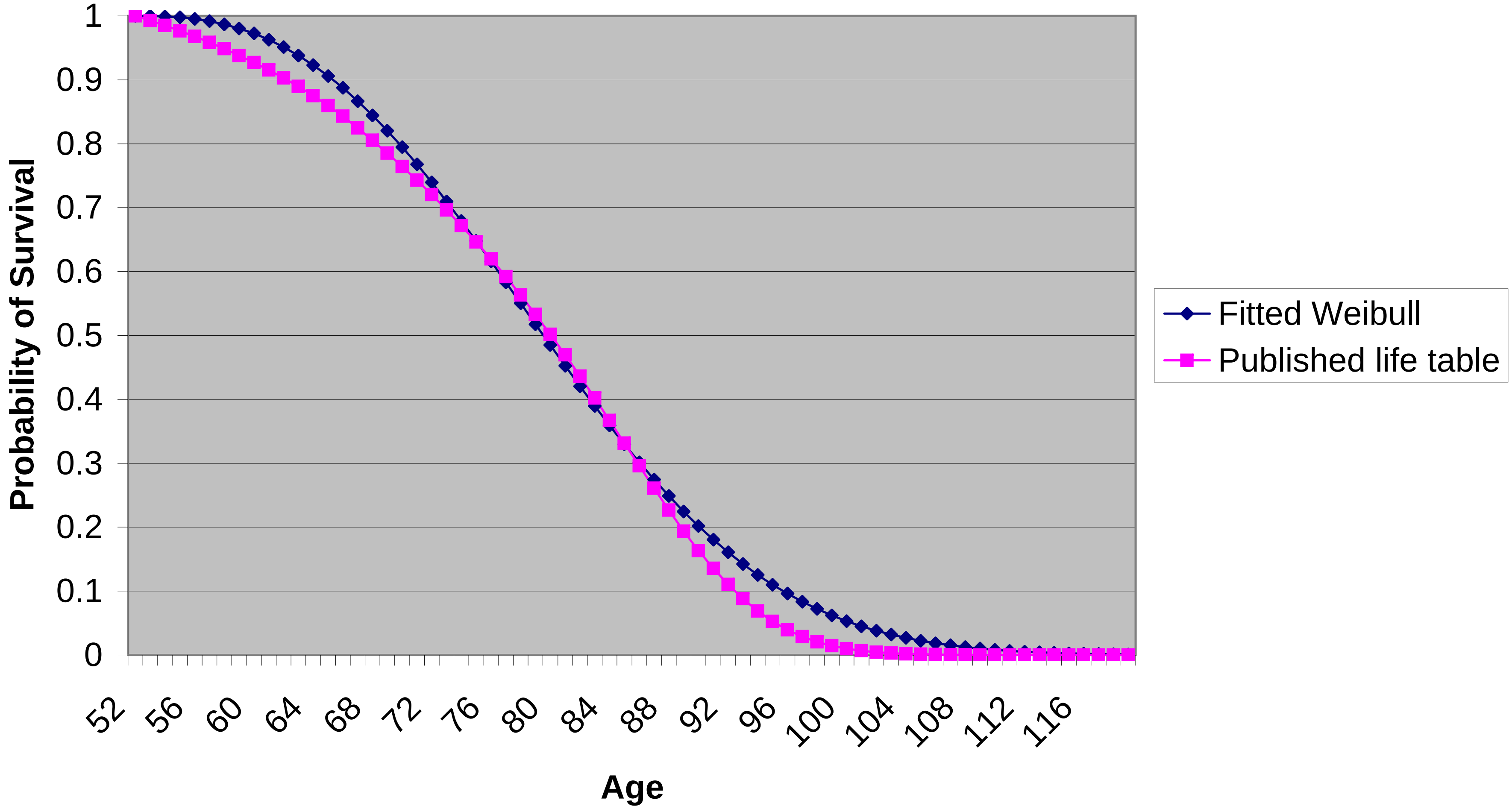


Figure 6
Fitted Weibull vs. Published Life Table
SSA 1940 Male Cohort (2004)



A Appendix

Because of the form of the survivor function, the Weibull parameters are undefined for persons who report $P_{75} = P_{85}$. However, as Hurd and McGarry (1995) note, a respondent who reports P_{75} close to P_{85} may be conveying valuable information regarding the perceived flatness of the subjective survivor function, and it would be unfortunate to be forced to exclude such a large and potentially interesting segment of the sample. The format of the expectation questions in the first wave of the HRS requires respondents to round survival probabilities to the nearest tenth. As a result, it is reasonable to assume that the "true" expectation lies in some interval around $P_{75} = P_{85}$, i.e. $P_{75} \in$ [P_{75}-.05, P_{75}+.05] and $P_{85} \in$ [P_{85}-.05, P_{85}+.05]. Hence, to retain nearly one-third of the sample who report $P_{75} = P_{85}$, I reassign the probability of living to 75 equal to the upper bound of the interval (P_{75}+.05) and set the probability of living to 85 to the lower bound of the interval(P_{85} - .05). For example, a person who reported $P_{75} = P_{85} = .5$ would be reassigned $P_{75} = .55$ and $P_{85} = .45$. This assignment rule imposes the maximum distance allowed within the interval, thereby implying more credible Weibull estimates.

In addition, in order to estimate the Weibull, probabilities of zero and 1 are reassigned .01 and .99, respectively. If $P_{75} = P_{85} = .99$, then P_{85} is set to .95, and if $P_{75} = P_{85} = .01$, then P_{75} is set to .05.

To check the robustness of the results to these assumptions, I started with the *unadjusted* reported survival probabilities and followed the same procedure for constructing subjective survivor functions.[13] Of the 472 women aged 52 in 1992, 137–or about 30 percent–reported $P_{75} = P_{85}$, and of that group, 1/3 reported both probabilities equal to 1, 1/5 reported both

[13]All adjustments were removed except for the cases where $P_{75} = P_{85} = 0$, which cannot be estimated via the Weibull without some adjustment.

probabilities equal to 0, and 1/5 reported both probabilities equal to .5. The life expectancies derived from the unadjusted survival probabilities are generally higher than the adjusted life expectancies, particularly where the probabilities of living to 75 and 85 are close to or equal to 1. For example, if reported probabilities of living to 75 and 85 are both equal to 1, the unadjusted Weibull life expectancy is roughly 10-1/2 years higher than the adjusted life expectancy for 52 year olds (54.7 years vs. 44.2 years).

In the aggregate, the unadjusted subjective life expectancies for the 1940 cohort were about 1 year higher for both men and women than the adjusted life expectancies, bringing the women more in line with the SSA life tables, but exacerbating the difference for men, and leaving the gender gap about unchanged. Therefore, these results would still predict a narrowing of the gender gap, although they would suggest that men will live even longer relative to the SSA life tables than reported in this paper.

Although the path of the survival probabilities generated by the unadjusted variables is fairly similar to that derived from the adjusted probabilities through about age 95, the unadjusted probabilities of survival are much higher between age 95 and 110 before dropping down because of the higher life expectancies and lower variances estimated for those optimistic respondents who reported that they were certain to live to age 85. The unusually high probabilities of survival at these ages lead me to favor the adjusted life table estimates reported in this paper. The problems with estimating these survivor functions point to the importance of understanding mortality rates among the oldest old, for which we have no subjective data beyond age 85. For future work in this area, it would be useful to have another point on the subjective survivor function to work with, perhaps the probability of surviving to age 95.

Table B.1
Men Aged 52 in 1992

x	qx	lx	dx	Lx	Tx	ex
52	0.0064	1015813	6532	1012547	28648439	28.2
53	0.0086	1009281	8634	1004963	27635893	27.4
54	0.0097	1000646	9661	995816	26630929	26.6
55	0.0105	990985	10393	985788	25635114	25.9
56	0.0112	980591	10993	975095	24649325	25.1
57	0.0119	969598	11534	963832	23674231	24.4
58	0.0126	958065	12055	952037	22710399	23.7
59	0.0133	946010	12581	939719	21758362	23.0
60	0.0141	933429	13129	926864	20818643	22.3
61	0.0149	920299	13710	913444	19891779	21.6
62	0.0158	906590	14330	899425	18978334	20.9
63	0.0168	892260	14994	884763	18078909	20.3
64	0.0179	877266	15706	869413	17194147	19.6
65	0.0191	861560	16466	853327	16324734	18.9
66	0.0204	845094	17272	836458	15471407	18.3
67	0.0219	827822	18122	818761	14634948	17.7
68	0.0235	809700	19010	800195	13816187	17.1
69	0.0252	790690	19928	780726	13015992	16.5
70	0.0271	770762	20866	760329	12235266	15.9
71	0.0291	749895	21810	738990	11474937	15.3
72	0.0312	728085	22745	716713	10735947	14.7
73	0.0335	705340	23655	693513	10019234	14.2
74	0.0360	681686	24524	669423	9325721	13.7
75	0.0386	657161	25345	644489	8656298	13.2
76	0.0413	631816	26116	618758	8011809	12.7
77	0.0443	605701	26850	592275	7393051	12.2
78	0.0476	578850	27577	565062	6800775	11.7
79	0.0514	551274	28333	537107	6235713	11.3
80	0.0557	522940	29143	508369	5698606	10.9
81	0.0607	493797	29973	478810	5190238	10.5
82	0.0661	463824	30673	448487	4711427	10.2
83	0.0715	433151	30985	417659	4262940	9.8
84	0.0763	402166	30680	386826	3845281	9.6
85	0.0800	371486	29727	356623	3458455	9.3
86	0.0827	341759	28279	327619	3101833	9.1
87	0.0845	313480	26483	300238	2774213	8.8
88	0.0851	286997	24415	274789	2473975	8.6
89	0.0849	262582	22285	251439	2199185	8.4
90	0.0850	240296	20435	230079	1947746	8.1
91	0.0868	219862	19073	210325	1717667	7.8
92	0.0903	200788	18138	191720	1507342	7.5
93	0.0955	182651	17435	173933	1315623	7.2
94	0.1018	165216	16812	156810	1141690	6.9
95	0.1091	148404	16188	140310	984879	6.6
96	0.1174	132216	15518	124457	844569	6.4
97	0.1265	116698	14768	109314	720111	6.2
98	0.1365	101930	13911	94975	610797	6.0
99	0.1468	88020	12924	81558	515822	5.9
100	0.1571	75096	11797	69197	434265	5.8
101	0.1665	63299	10538	58030	365067	5.8
102	0.1740	52761	9182	48170	307037	5.8
103	0.1787	43579	7788	39686	258867	5.9
104	0.1797	35792	6432	32576	219182	6.1
105	0.1767	29360	5188	26766	186606	6.4
106	0.1702	24171	4114	22114	159840	6.6
107	0.1615	20057	3239	18438	137726	6.9
108	0.1522	16818	2560	15538	119288	7.1
109	0.1440	14258	2053	13231	103750	7.3
110	0.1377	12205	1680	11365	90518	7.4
111	0.1332	10525	1401	9824	79154	7.5
112	0.1301	9123	1187	8530	69330	7.6
113	0.1278	7937	1014	7430	60800	7.7
114	0.1259	6923	872	6487	53370	7.7
115	0.1242	6051	752	5675	46883	7.7
116	0.1227	5299	650	4974	41208	7.8
117	0.1212	4649	563	4367	36234	7.8
118	0.1198	4086	489	3841	31867	7.8
119	0.1185	3596	426	3383	28025	7.8
120	0.1173	3170	372	2984	24642	7.8
121	0.1162	2799	325	2636	21658	7.7
122	0.1154	2473	285	2331	19022	7.7
123	0.1143	2188	250	2063	16691	7.6
124	0.1135	1938	220	1828	14628	7.5
125	0.1123	1718	193	1622	12800	7.5
126	0.1121	1525	171	1440	11179	7.3
127	0.1115	1354	151	1279	9739	7.2
128	0.1106	1203	133	1137	8461	7.0
129	0.1103	1070	118	1011	7324	6.8
130	0.1103	952	105	900	6313	6.6
131	0.1098	847	93	801	5414	6.4
132	0.1088	754	82	713	4613	6.1
133	0.1086	672	73	636	3900	5.8
134	0.1085	599	65	567	3265	5.4
135	0.1086	534	58	505	2698	5.1
136	0.1071	476	51	451	2193	4.6
137	0.1082	425	46	402	1743	4.1
138	0.1082	379	41	359	1341	3.5
139	0.1065	338	36	320	982	2.9
140	0.1060	302	32	286	662	2.2
141	0.1074	270	29	256	376	1.4
142	1.0000	241	241	121	121	0.5

Table B.2
Women Aged 52 in 1992

x	qx	lx	dx	Lx	Tx	ex
52	0.0054	1147588	6247	1144464	34330656	29.9
53	0.0072	1141341	8217	1137232	33186191	29.1
54	0.0081	1133123	9134	1128557	32048959	28.3
55	0.0087	1123990	9752	1119114	30920403	27.5
56	0.0092	1114237	10235	1109120	29801289	26.7
57	0.0097	1104003	10654	1098676	28692169	26.0
58	0.0101	1093348	11054	1087821	27593493	25.2
59	0.0106	1082294	11464	1076562	26505672	24.5
60	0.0111	1070831	11905	1064878	25429110	23.7
61	0.0117	1058926	12395	1052728	24364232	23.0
62	0.0124	1046530	12952	1040054	23311504	22.3
63	0.0131	1033579	13588	1026785	22271449	21.5
64	0.0140	1019991	14317	1012832	21244665	20.8
65	0.0151	1005674	15150	998099	20231832	20.1
66	0.0163	990524	16097	982475	19233733	19.4
67	0.0176	974427	17163	965845	18251258	18.7
68	0.0192	957263	18349	948089	17285413	18.1
69	0.0209	938914	19648	929090	16337325	17.4
70	0.0229	919266	21047	908742	15408235	16.8
71	0.0251	898219	22520	886959	14499492	16.1
72	0.0274	875699	24035	863682	13612533	15.5
73	0.0300	851664	25549	838890	12748851	15.0
74	0.0327	826116	27017	812607	11909962	14.4
75	0.0355	799099	28399	784899	11097355	13.9
76	0.0385	770700	29669	755865	10312455	13.4
77	0.0416	741031	30831	725615	9556590	12.9
78	0.0450	710200	31924	694238	8830975	12.4
79	0.0487	678276	33006	661773	8136737	12.0
80	0.0528	645270	34091	628225	7474964	11.6
81	0.0573	611180	35024	593667	6846739	11.2
82	0.0615	576155	35428	558441	6253071	10.9
83	0.0647	540728	34994	523231	5694630	10.5
84	0.0673	505733	34020	488723	5171399	10.2
85	0.0700	471713	33028	455199	4682676	9.9
86	0.0727	438685	31872	422749	4227477	9.6
87	0.0744	406813	30278	391674	3804728	9.4
88	0.0754	376535	28375	362348	3413055	9.1
89	0.0761	348160	26481	334920	3050707	8.8
90	0.0776	321679	24952	309203	2715787	8.4
91	0.0807	296727	23940	284756	2406585	8.1
92	0.0854	272786	23290	261141	2121828	7.8
93	0.0912	249496	22747	238123	1860687	7.5
94	0.0977	226749	22155	215672	1622564	7.2
95	0.1049	204595	21462	193864	1406892	6.9
96	0.1128	183133	20653	172806	1213029	6.6
97	0.1213	162480	19714	152623	1040222	6.4
98	0.1305	142766	18630	133451	887600	6.2
99	0.1400	124135	17385	115443	754149	6.1
100	0.1496	106751	15965	98768	638706	6.0
101	0.1584	90785	14379	83596	539938	5.9
102	0.1657	76407	12662	70076	456342	6.0
103	0.1707	63745	10881	58304	386266	6.1
104	0.1726	52864	9127	48300	327962	6.2
105	0.1712	43737	7489	39993	279661	6.4
106	0.1667	36248	6043	33227	239669	6.6
107	0.1600	30205	4833	27789	206442	6.8
108	0.1525	25372	3869	23438	178653	7.0
109	0.1454	21503	3126	19940	155216	7.2
110	0.1395	18377	2564	17095	135276	7.4
111	0.1352	15813	2138	14744	118181	7.5
112	0.1320	13675	1806	12772	103437	7.6
113	0.1296	11870	1539	11100	90664	7.6
114	0.1276	10331	1319	9671	79564	7.7
115	0.1258	9012	1133	8445	69893	7.8
116	0.1239	7879	976	7390	61448	7.8
117	0.1221	6902	843	6481	54057	7.8
118	0.1204	6059	729	5695	47577	7.9
119	0.1187	5330	633	5014	41882	7.9
120	0.1171	4697	550	4422	36868	7.8
121	0.1156	4147	479	3908	32446	7.8
122	0.1143	3668	419	3459	28538	7.8
123	0.1130	3249	367	3066	25080	7.7
124	0.1117	2882	322	2721	22014	7.6
125	0.1109	2560	284	2418	19293	7.5
126	0.1103	2276	251	2151	16875	7.4
127	0.1091	2025	221	1915	14725	7.3
128	0.1086	1804	196	1706	12810	7.1
129	0.1082	1608	174	1521	11104	6.9
130	0.1081	1434	155	1357	9583	6.7
131	0.1079	1279	138	1210	8227	6.4
132	0.1069	1141	122	1080	7017	6.1
133	0.1070	1019	109	965	5937	5.8
134	0.1077	910	98	861	4972	5.5
135	0.1071	812	87	769	4111	5.1
136	0.1076	725	78	686	3343	4.6
137	0.1066	647	69	613	2657	4.1
138	0.1073	578	62	547	2044	3.5
139	0.1066	516	55	489	1497	2.9
140	0.1085	461	50	436	1009	2.2
141	0.1071	411	44	389	573	1.4
142	1.0000	367	367	184	183.5	0.5

Appendix B

Table B.3
Men Aged 57 in 1992

x	qx	lx	dx	Lx	Tx	ex
57	0.0198	964461	19142	954890	22373741	23.2
58	0.0189	945319	17860	936389	21418851	22.7
59	0.0185	927459	17127	918895	20482462	22.1
60	0.0184	910332	16710	901977	19563567	21.5
61	0.0185	893622	16554	885345	18661590	20.9
62	0.0189	877068	16619	868758	17776245	20.3
63	0.0196	860449	16873	852013	16907487	19.6
64	0.0205	843576	17290	834931	16055475	19.0
65	0.0216	826286	17847	817362	15220544	18.4
66	0.0229	808439	18521	799178	14403181	17.8
67	0.0244	789918	19289	780273	13604003	17.2
68	0.0261	770628	20130	760564	12823730	16.6
69	0.0280	750499	21017	739990	12063166	16.1
70	0.0301	729482	21922	718521	11323176	15.5
71	0.0322	707559	22816	696151	10604655	15.0
72	0.0346	684743	23667	672909	9908504	14.5
73	0.0370	661076	24444	648854	9235595	14.0
74	0.0395	636632	25121	624071	8586741	13.5
75	0.0420	611511	25687	598667	7962670	13.0
76	0.0446	585824	26146	572751	7364002	12.6
77	0.0474	559678	26535	546410	6791251	12.1
78	0.0505	533143	26912	519687	6244841	11.7
79	0.0540	506231	27349	492557	5725154	11.3
80	0.0582	478882	27865	464950	5232597	10.9
81	0.0629	451017	28347	436844	4767647	10.6
82	0.0675	422671	28524	408409	4330803	10.2
83	0.0716	394147	28213	380040	3922394	10.0
84	0.0755	365934	27621	352124	3542354	9.7
85	0.0798	338313	27011	324807	3190230	9.4
86	0.0839	311302	26128	298238	2865423	9.2
87	0.0865	285174	24664	272842	2567185	9.0
88	0.0872	260510	22728	249146	2294344	8.8
89	0.0870	237782	20678	227443	2045198	8.6
90	0.0870	217104	18879	207664	1817755	8.4
91	0.0884	198225	17515	189468	1610091	8.1
92	0.0915	180710	16531	172445	1420623	7.9
93	0.0959	164179	15749	156304	1248179	7.6
94	0.1013	148430	15033	140913	1091874	7.4
95	0.1074	133397	14324	126234	950961	7.1
96	0.1142	119072	13594	112275	824727	6.9
97	0.1215	105479	12816	99071	712451	6.8
98	0.1291	92663	11965	86680	613380	6.6
99	0.1367	80697	11028	75184	526700	6.5
100	0.1436	69670	10005	64667	451517	6.5
101	0.1494	59665	8913	55208	386850	6.5
102	0.1533	50752	7782	46861	331642	6.5
103	0.1549	42970	6656	39642	284781	6.6
104	0.1538	36314	5584	33522	245139	6.8
105	0.1501	30730	4613	28423	211617	6.9
106	0.1446	26117	3776	24229	183193	7.0
107	0.1382	22341	3089	20796	158965	7.1
108	0.1322	19252	2544	17980	138168	7.2
109	0.1271	16708	2123	15646	120188	7.2
110	0.1233	14585	1798	13685	104542	7.2
111	0.1206	12786	1543	12015	90857	7.1
112	0.1188	11244	1336	10576	78842	7.0
113	0.1173	9908	1163	9327	68266	6.9
114	0.1161	8746	1015	8238	58939	6.7
115	0.1148	7731	888	7287	50701	6.6
116	0.1136	6843	777	6454	43414	6.3
117	0.1123	6066	681	5725	36960	6.1
118	0.1110	5385	598	5086	31234	5.8
119	0.1098	4787	525	4524	26149	5.5
120	0.1085	4262	463	4030	21624	5.1
121	0.1074	3799	408	3595	17594	4.6
122	0.1063	3391	360	3211	13999	4.1
123	0.1052	3031	319	2871	10788	3.6
124	0.1043	2712	283	2570	7917	2.9
125	0.1034	2429	251	2303	5347	2.2
126	0.1026	2178	223	2066	3043	1.4
127	1.0000	1955	1955	977	977	0.5

Table B.4
Women Aged 57 in 1992

x	qx	lx	dx	Lx	Tx	ex
57	0.0173	1016365	17600	1007565	25190927	24.8
58	0.0167	998765	16712	990409	24183363	24.2
59	0.0165	982053	16169	973968	23192954	23.6
60	0.0164	965884	15864	957952	22218986	23.0
61	0.0166	950020	15765	942137	21261034	22.4
62	0.0170	934254	15845	926331	20318897	21.7
63	0.0175	918409	16079	910369	19392565	21.1
64	0.0182	902329	16446	894106	18482196	20.5
65	0.0191	885884	16924	877422	17588090	19.9
66	0.0201	868960	17495	860212	16710668	19.2
67	0.0213	851465	18139	842395	15850456	18.6
68	0.0226	833326	18839	823906	15008061	18.0
69	0.0240	814487	19575	804700	14184155	17.4
70	0.0256	794912	20327	784749	13379455	16.8
71	0.0272	774585	21079	764046	12594707	16.3
72	0.0289	753506	21811	742601	11830661	15.7
73	0.0308	731695	22510	720440	11088060	15.2
74	0.0327	709185	23169	697600	10367620	14.6
75	0.0347	686015	23790	674120	9670020	14.1
76	0.0368	662225	24393	650029	8995900	13.6
77	0.0392	637832	25015	625324	8345871	13.1
78	0.0420	612817	25714	599960	7720547	12.6
79	0.0452	587103	26540	573833	7120587	12.1
80	0.0490	560563	27481	546823	6546754	11.7
81	0.0532	533082	28377	518894	5999932	11.3
82	0.0573	504705	28918	490246	5481038	10.9
83	0.0608	475787	28931	461321	4990792	10.5
84	0.0643	446856	28727	432492	4529471	10.1
85	0.0686	418129	28673	403792	4096978	9.8
86	0.0732	389456	28499	375206	3693186	9.5
87	0.0770	360956	27807	347053	3317980	9.2
88	0.0799	333150	26606	319847	2970927	8.9
89	0.0820	306544	25150	293969	2651080	8.6
90	0.0843	281394	23711	269539	2357111	8.4
91	0.0871	257684	22444	246462	2087572	8.1
92	0.0908	235239	21362	224559	1841110	7.8
93	0.0954	213878	20396	203680	1616551	7.6
94	0.1007	193482	19483	183741	1412871	7.3
95	0.1068	173999	18580	164709	1229131	7.1
96	0.1136	155420	17652	146593	1064421	6.8
97	0.1210	137767	16664	129435	917828	6.7
98	0.1287	121103	15586	113310	788393	6.5
99	0.1365	105517	14403	98315	675083	6.4
100	0.1439	91114	13113	84557	576767	6.3
101	0.1504	78001	11734	72134	492210	6.3
102	0.1554	66267	10297	61118	420076	6.3
103	0.1582	55970	8853	51543	358957	6.4
104	0.1583	47117	7460	43387	307414	6.5
105	0.1558	39657	6178	36568	264027	6.7
106	0.1510	33479	5055	30952	227459	6.8
107	0.1448	28425	4116	26367	196507	6.9
108	0.1384	24309	3363	22627	170140	7.0
109	0.1326	20945	2776	19557	147513	7.0
110	0.1279	18169	2324	17007	127956	7.0
111	0.1245	15845	1972	14859	110949	7.0
112	0.1219	13873	1692	13027	96090	6.9
113	0.1200	12181	1462	11450	83063	6.8
114	0.1184	10719	1269	10085	71613	6.7
115	0.1168	9451	1104	8899	61528	6.5
116	0.1153	8347	962	7865	52630	6.3
117	0.1138	7384	840	6964	44764	6.1
118	0.1123	6544	735	6177	37800	5.8
119	0.1109	5809	644	5487	31623	5.4
120	0.1095	5165	566	4882	26136	5.1
121	0.1082	4599	498	4351	21254	4.6
122	0.1070	4102	439	3882	16904	4.1
123	0.1059	3663	388	3469	13021	3.6
124	0.1048	3275	343	3103	9553	2.9
125	0.1039	2932	305	2779	6449	2.2
126	0.1030	2627	271	2492	3670	1.4
127	1.0000	2356	2356	1178	1178	0.5

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