How Long do You Expect to Live?: Subjective Life Expectancy in Chile

Whitney Schott

Extended Abstract for PAA Submission

September 2008

I. Introduction

Understanding individuals' expectations of health and mortality can be useful not only for economic models of individual savings and consumption behavior (Hamermesh 1985), but also for governments planning public pension and health programs. A population's expectations of its own mortality may affect the average propensity to save for retirement, or to practice positive or negative health behaviors, such as regularly exercising, seeking preventive health care, or drinking and smoking. With information on a population's expectations of mortality, government planners may have a better sense of the extent to which individuals may be prepared for retirement or willing to practice certain health behaviors.

Some recent surveys have incorporated questions on individuals' expectations regarding their own mortality, such as the Health and Retirement Study (HRS) sponsored by the National Institute of Aging in the U.S. Analyzing these data on individual subjective conditional expectations of longevity, Hurd and McGarry (2002) suggest that such data can provide information beyond what might be captured by other subjective assessments of health status, such as self-assessed general health status or self-reported disease conditions. Self-assessed health status has been shown to be a significant predictor of mortality, incorporating both observed and unobserved characteristics of the individual. In particular, general health status may be a good predictor of mortality if it includes information on current symptoms that may be undiagnosed, an individual's assessment of the importance of his or her ailments, and/or family history (Idler 1997). Subjective life expectancy may also be a comprehensive measure of health status if it can be found to incorporate information on general health status as well as risk behaviors and other factors, such as parental longevity (Hurd and McGarry 2002). Smith et al. (2001) have found some evidence that an individual's longevity expectations are indeed a fairly accurate index of survival probability. To the extent that expected age of mortality can act as a significant predictor of mortality and reflect unobserved factors beyond what may be incorporated in a general health status measure, it may prove an important, complementary measure of health status.

This paper explores subjective life expectancy as reported in survey data from Chile in order to determine how well individuals estimate their own life expectancy, as compared to life table values, and examines characteristics are associated with varying expectations of age at death.

II. Data

The *Encuesta Protección Social* (EPS), or Social Protection Survey, conducted in Chile in 2002, 2004 and 2006, follows a panel of individuals over time. While the first (2002) round of survey data only represents participants in the government-instituted private pension program, the 2004 and 2006 samples are nationally representative. The survey includes questions on health and insurance status at each point in time, as well as household demographic characteristics, labor market status, income, and extensive information on participation and knowledge of the country's private pension program. The combined panel for this analysis is from the nationally representative 2004 and 2006 samples, consisting of 18,474 distinct individuals, of whom there are observations for both years for 14,696 individuals. Some background data collected from these individuals in 2002 is also incorporated. EPS asks individuals the question, "Until what age do you believe you will live?"[1] This manner of posing a question on subjective life expectancy differs from the approach of the HRS, which instead asks individuals to estimate the likelihood that they will live to the age of 75 and to the age of 85. There are several advantages to the EPS approach to the question of subjective life expectancy. First, we are able compare individuals' subjective life expectancy to actual life table values across the age structure of the population, conditional on age at the time of survey. This comparison is not possible with HRS data, as it only evaluates subjective probabilities of reaching two future ages. Second, it is a relatively straight-forward question in that it may require less cognitive ability than asking an individual to evaluate his or her chances of living to a certain age.[2] As a result, we may expect more consistency in reporting across age, socio-economic status (SES), and other categories by which cognitive ability may vary.

III. Methodology

First, in order to explore how well individuals' expectations match actual life expectancy values from life tables, I calculate subjective life expectancies conditional on age in 2004 and compare them to actual life table values from 2004 using a WHO life table for Chile reflecting the mortality conditions of 2004. I calculate the mean expected age of death for each life table age category by sex, completed education level and income quintile. Second, in order to examine what factors may be associated with an individual's estimation of life expectancy, I conduct

[1] The question in Spanish is phrased as follows "Hasta qué edad usted cree que va a vivir?"
[2] Hurd and McGarry 2002 report substantial data bunching around the probability of surviving to age 75 or age 85 of .5 in waves 1 and 2 of HRS. Some bunching occurs in EPS data around five year increments, but in particular, at older ages, to which many individuals (perhaps correctly) expect to live.

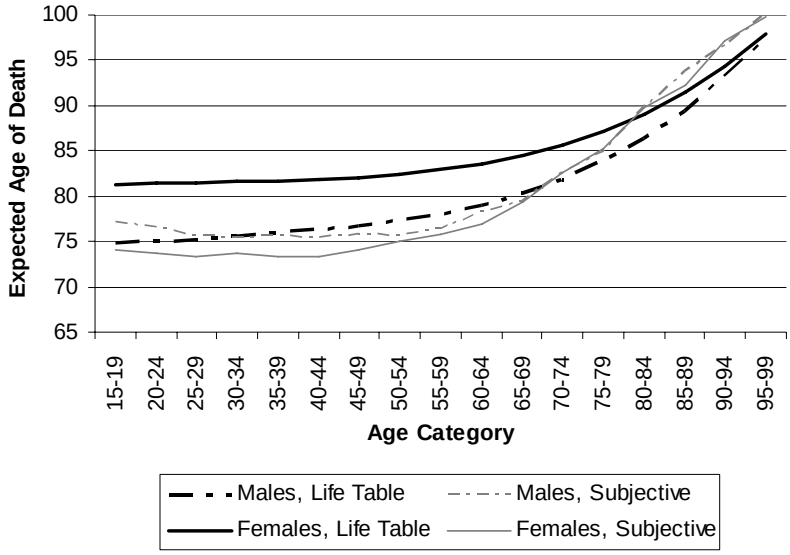
ordinary least squares regressions of subjective life expectancy on individual and household characteristics as well as health behaviors and parental mortality. Finally, I estimate coefficients using fixed effects in order to estimate what variables help explain change in subjective life expectancy over time, controlling for individual characteristics.

IV. Life Table Comparison

According to WHO life table values reflecting mortality trends in Chile for 2004, life expectancy at birth for males and females combined is 77.3 years. The mean subjective life expectancy across ages for both sexes combined comes close to that number, at 76.3 years. Men are more optimistic than women, expecting to live to age 77.0, while, on average, women expect to live to 75.5. According to life table values, females who have survived to age 15 (the minimum age at survey in EPS data) can expect to live to age 81.3 years, while their surviving male counterparts can expect to live to 74.8. Overall, survey data suggest that Chilean women under-estimate their life expectancy, while men are overly optimistic.

Comparing to life table values for life expectancy by age category, we can see that men continue to be more optimistic than women, while women tend to be overly pessimistic in their subjective estimates (figure 1). Across age categories, men over-estimate their expected years remaining by 0.69 years on average, while women's estimates are 4.73 years too low, on average (figure 2). While it may be that women are not aware that they have a slight advantage over men in terms of greater longevity, their estimates fall short even of the combined life expectancy of both males and females. These results are consistent with previous findings in the literature that men tend to over-estimate their life expectancy, and women tend to under-estimate life expectancy (Hurd and McGarry 1995 and 2002, Elder 2007).

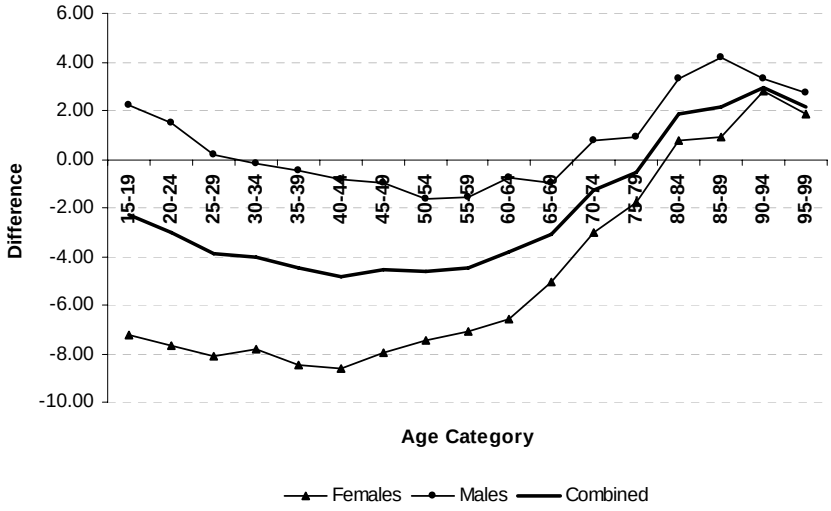
Figure 1. Life Table and Subjective Expected Age of Death, Chile, 2004



Note: Averages for each life table age category are reported

Interestingly, there exists a crossover age category for both men and women (around age 70 for men and 80 for women), after which both tend to be overly optimistic regarding their longevity. It appears that as individuals approach survival to the life table age of life expectancy at birth, they become overly optimistic about their future survival. It may be that as individuals outlive many of their peers, they believe they will fare even better in the future.

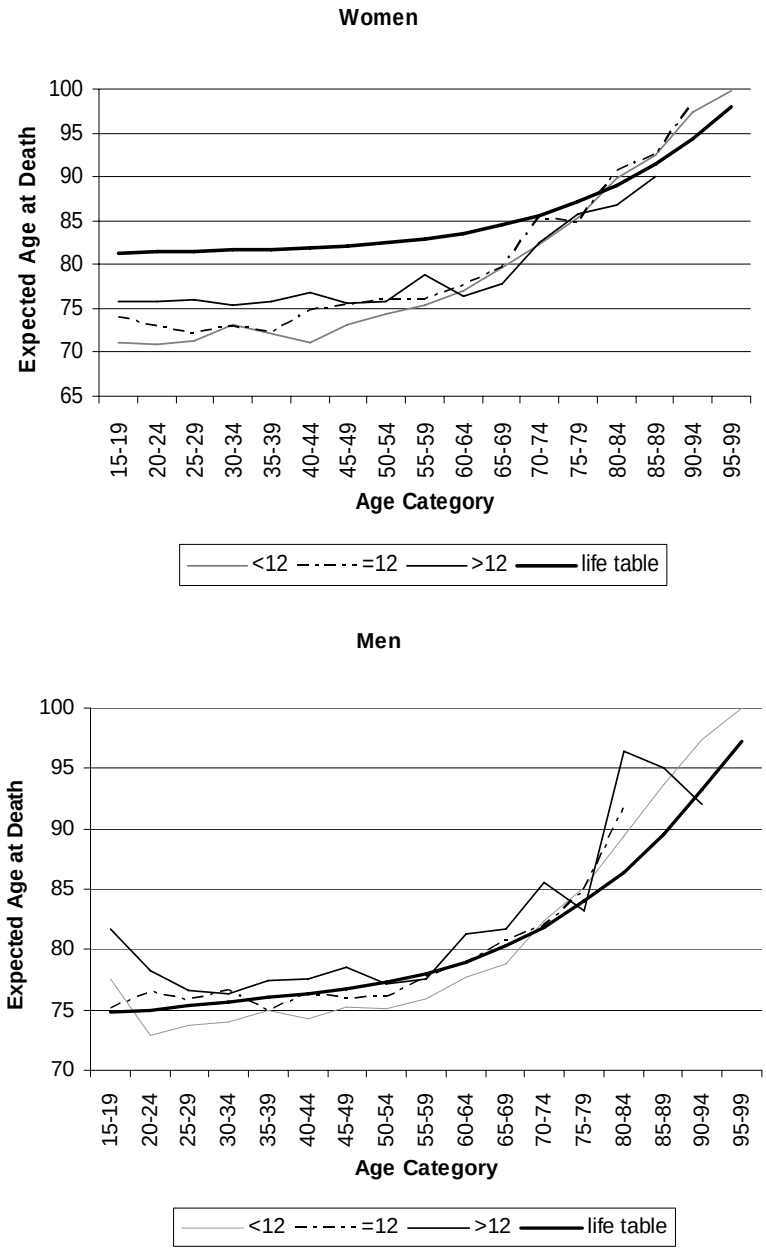
Figure 2. Difference between Subjective and Life Table Expected Years Remaining, Chile, 2004.



.

Upon first glance, the conditional subjective life expectancy measure appears to demonstrate somewhat of a gradient in SES. At younger ages (prior to age 60), women with fewer than 12 completed grades of schooling are more pessimistic about their life expectancy than women with more than 12 completed grades of schooling (figure 3). Women with exactly 12 completed grades of schooling fall somewhere in the middle of the two averages. A gradient also appears for male estimations of life expectancy prior to age 75: males having completed

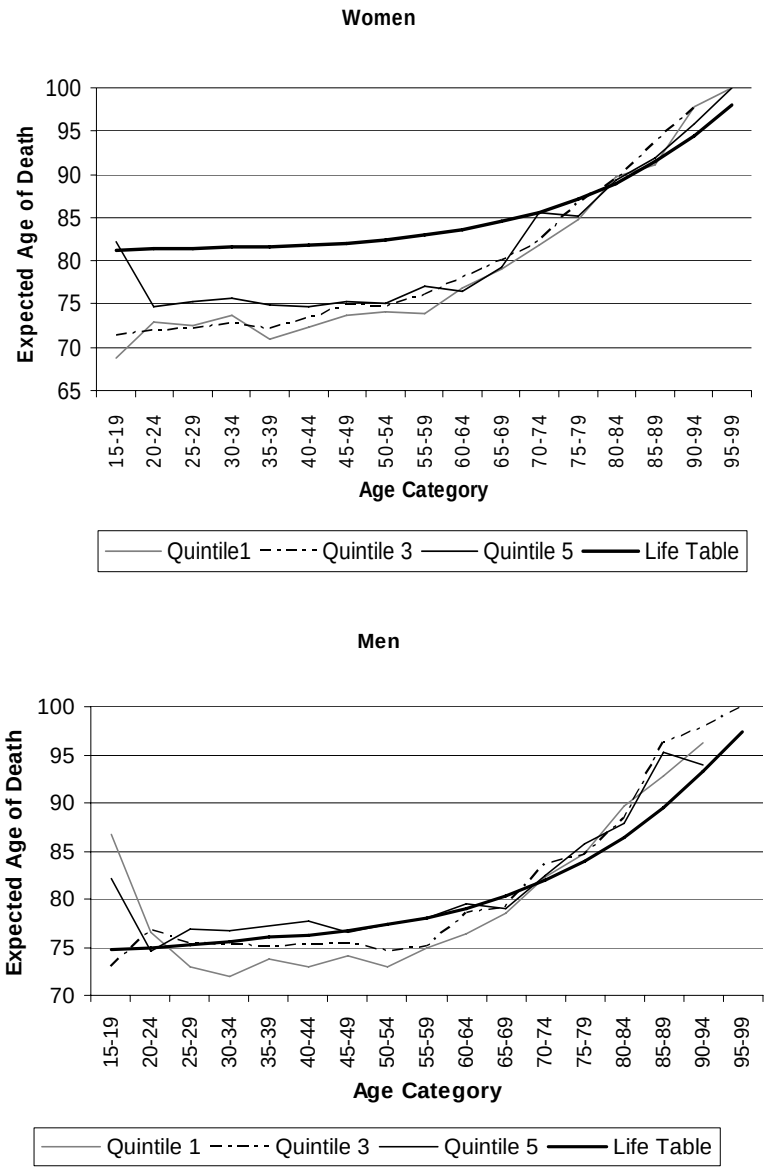
Figure 3. Expected Age at Death by Completed Education Level, Chile, 2004.



over 12 years of education are overly optimistic throughout their lifespan. Those with only 12 years of completed schooling more closely approximate life table values.

In regards to household income, women under age 60 from households with incomes in the lowest quintile similarly have lower expectations of their longevity when compared with women from the top income quintile. A relatively small gradient exists across the three income quintiles shown. Males show a similar pattern, though very young men (ages 15 to 24) from the lowest income quintile are more optimistic than their counterparts from the top income quintile. In order to determine whether this gradient persists when controlling for other observed factors, I conduct regression analysis and present findings in the following section.

Figure 4. Expected Age at Death by Income Quintile, Chile 2004



V. Regression Results

In order to explore what factors may be associated with subjective estimates of life expectancy in Chile, I conduct ordinary least squares regressions of subjective life expectancy on a number of explanatory variables. The first model includes basic individual characteristics, controlling for age,[3] sex, completed grades of education, marital status (married or living with partner), job type, income quintile, place of residence (Santiago, which is highly urban, representing 42 percent of the population, versus residence in another area of Chile), and whether the individual owns his or her home. The second model incorporates health risk factors, such as smoking and drinking, whether an individual exercises regularly, self-assessed health status, and having been diagnosed with specific illnesses, the third model extends the analysis to include parental mortality status, and the fourth model includes the interaction of sex with parental mortality status. A complete table of regression results will be included in the final version of this paper.

In a simple model containing only basic individual characteristics, women are significantly more pessimistic about their longevity, and a slight gradient in SES status appears to play a role in individual expectations.[4] In this model, sex, completed grades of education, income quintile and Santiago residence are significant, along with whether an individual is unemployed and whether he or she is married or living with a partner. The pessimism of women in regards to their estimated age at death comes to the fore in this simple model: being female is associated with an expected age at mortality that is 13 months lower than males, all else equal. This gender paradox of women expecting to live fewer years when in reality their life expectancy is higher, will be explored further in model 4. Educational differences also persist when controlling for these basic individual characteristics. While the coefficients on income quintile are mixed in their level and significance, a slight gradient at higher incomes appears to exist – individuals in the fourth income quintile expect to live almost 8 months longer than those in the lowest quintile, and those in the fifth income quintile expect to live about 10 months longer. Not surprisingly, living in Santiago is associated with expectations of living longer, consistent with previous findings in developing or middle-income countries where mortality is lower in urban areas where there is presumably better access to medical facilities and other public health

[3] I include age, age squared, and age cubed, in order to more closely approximate the life expectancy curve, which is relatively steady and then increasing at higher ages.
[4] Regression results will be updated for final paper; these results reflect a regression of 2004 data only.

infrastructure (Hill 1995). Being unemployed is associated with an expected age of mortality that is 10 and a half months lower than individuals who are public or private employees, all else equal. Individuals who are married or living with a partner expect to live 6 months longer.

Individual risk behaviors, general health status and two major diseases are significant to estimations of expected age at mortality. Model 2 incorporates a number of risk behaviors, including smoking, drinking, exercising, and general health status, as well as diagnoses of specific diseases. Interestingly, once these risk factors are controlled for, the slight gradient in income previously observed disappears. In addition, unemployment status becomes insignificant, suggesting that this variable may have been capturing disability or health status in the simple model. However, all other variables from the simple model maintain their significance, including completed grades of schooling, so that the gradient in education persists.

In terms of specific health behaviors, we can see that drinking and smoking are highly significant: heavy drinkers (having more than 2 drinks per day) expect to live almost 10 months less than non-heavy drinkers, and moderate- to heavy-smokers (120 cigarettes per month or more) expect to live 13 months less than light- and non-smokers, all else equal. Conversely, those who exercise at least 3 times per week expect to live 7 months longer than those who do not, all else equal. General health status is also significantly associated with subjective expectations of longevity, suggesting that individuals may take self-assessed health status into account. Those with poor to very poor health expect to live almost three years less, and those with good to excellent health expect to live almost 2 years longer than their counterparts with "regular" self-assessed health status. It is worth noting that being obese or overweight is not significantly associated with subjective expected mortality.

Only two major illnesses are associated with a significantly lower estimate of expected life: cardiovascular disease and depression.[5] It is not surprising that having been diagnosed with cardiovascular disease is associated with an expectation of longevity that is 10 months shorter, given that cardiovascular disease is the leading cause of death in Chile (WHO 2004). It is indeed interesting that having been diagnosed with depression, an illness that negatively affects one's mood and outlook on the future, is associated with a subjective life expectancy of almost two years less. It is also true that depressed individuals are at higher risk of suicide, which would

[5] In regression results not shown, a dummy for having been diagnosed with any of these other illnesses was included instead of each disease diagnosis separately, excluding depression and cardiovascular disease; this composite variable was significantly associated with expecting to live 6 months less.

clearly decrease one's longevity dramatically. Also, in this model, all of the previously identified significant variables maintain their significance, except for the initially observed positive correlation with income quintile and unemployment status, which remain insignificant.

In model 3, parental mortality is significantly associated with subjective life expectancy. This model incorporates variables for whether one's father and mother are still living and whether, if no longer living, they died at an age below the average observed in the data. Individuals whose fathers are still living estimate that they will live almost a year longer, all else equal, while individuals whose fathers died at an age below the average estimate that they themselves will die over a year sooner. Coefficients in the model on mother's mortality status are smaller in level, with having a living mother significantly associated with living 6 months longer, but having a mother who died at an age below the average in the data is insignificant. Given that women tend to outlive men, it makes sense that one might weigh father's mortality a bit higher than mother's mortality in estimating one's own longevity. Once again, in this model, the previously identified significant variables (except income and unemployment status) maintain their significance.

Finally, model 4 attempts to disentangle the gender paradox that appears in the previous three models, and suggests that the interaction of being female with parental mortality explains much of women's pessimism in regards to their mortality expectations. When including interaction variables, we see that the association with being female is almost entirely absorbed by the interaction of being female and parental mortality or being married/cohabitating, so that being female alone is no longer significantly associated with mortality expectations. The association with expected mortality of having a living father, which now measures the association for males only, increases to about 2 years, so that having a living father holds significant weight for males in mortality expectations. The same variable, however, interacted with being female, is associated with an expectation of equal magnitude, but in the opposite direction. Having a living mother, a mother who died at an age below average, or a father who died at an age below average, become insignificant for both males and females. Therefore, we see that women's pessimism relative to men is concentrated among those whose fathers are still living. While this interaction does not entirely resolve the gender paradox, it disentangles some of the associations, and highlights the importance of father's mortality in subjective mortality expectations.

Fixed effects estimates are less likely to be biased, as they control for individual characteristics that do not change over time. However, with a difference of only two years between observations, there may be relatively fewer changes in health from 2004 to 2006 that might lead an individual to revise his or her expectations regarding mortality. In a fixed effects regression, having good health status is significantly associated with higher expected mortality, and having poor health status, having been diagnosed with high blood pressure, and being underweight are significantly associated with lower expected mortality. Since there are not separate observations of parental mortality in these two years, we are not able to explore how individuals may revise expectations in response to changes in parental mortality.

VI. Discussion

Overall, we have seen that women tend to be more pessimistic in their assessment of how long they will live, while men tend to come closer to actual life table estimates. Both sexes tend to over-estimate their life expectancy, once they have exceeded the age of actual life expectancy at birth. This result may signal that individuals are aware of general statistics on life expectancy at birth, but may be unaware of how many years one can expect to live once surpassing the age of life expectancy at birth.

While a slight gradient appears to exist in SES when comparing subjective estimates to life table values, the income gradient disappears in regression analysis when controlling for health behaviors, risk factors and parental longevity. On the other hand, completed grades of education maintains importance when controlling for these factors, and an additional completed grade of education is significantly associated with 1-2 months greater subjective life expectancy, so that six years of completed grades are associated with over a year of additional life. Several health risk behaviors, such as drinking and smoking, general health status, and father's mortality experiences, are significantly associated with subjective health status. In most cases specific illnesses are not associated with subjective health status, with the exception of having been diagnosed with cardiovascular disease or depression. While women are more pessimistic regarding their expectations of longevity, this association appears to be most important among women and men whose fathers are still living. Risk behaviors, health status and parental mortality experiences are associated with subjective life expectancy in the direction that we would expect, when they are significant. Therefore, subjective life expectancy may indeed

incorporate important health information beyond just risk factors, and may complement other health status measures.

To the extent that individuals truly expect to live to the age that they report in the survey, we can conclude that Chileans overall have a relatively realistic vision of their likely longevity, and may make decisions about retirement and health behavior using a long-term time horizon, as is appropriate given life expectancy values from life tables. Results here are consistent with the hypothesis that individuals accurately adjust their expectations when they practice both positive and negative health behaviors or have good or poor health status.

The limitations to this analysis are several. First, there may be unobserved characteristics leading to an individual's estimate of subjective life expectancy. In particular, the most extensive model was only able to explain about 16 percent of the variance in expected age at death. Some unobserved characteristics could be highly associated with health status and mortality outcomes. If an individual tends to be pessimistic in general, he or she may give lower estimates of life expectancy, which may have no direct link to his or her actual health status. On the other hand, individuals who are superstitious may inflate their estimates of life expectancy, fearing that mentioning a low value could cut short their lives. In addition, the data may reflect selection bias, as some individuals did not furnish a response to the expected age of mortality question. For example, non-respondents were more likely to be disabled, to be in poor health, and to have been diagnosed with some major illness, though they were less likely to be heavy drinkers and smokers. If non-respondents are systematically less healthy than respondents, then expected age of mortality could be mis-estimated, and its associations with certain health characteristics may also be mis-estimated.

Further research into subjective life expectancy might assess how well this measure predicts actual mortality, using data from further waves of the EPS. If subjective life expectancy is a powerful predictor of actual mortality in these data, it would provide further evidence in support of using subjective life expectancy as a health measure, and could provide important information to researchers and policymakers. In addition, it would be interesting to compare the factors that are important in explaining the variance in subjective life expectancy to those that help explain self-assessed health status. Such analysis would reveal whether subjective life expectancy truly incorporates additional health information beyond what is taken into account in self-assessed health status.

References

Elder, Todd E. "Subjective Survival Probabilities in the Health and Retirement Study: Systematic Biases and Predictive Validity." Working Paper 2007-159. Michigan Retirement Research Center, University of Michigan. (October 2007).

Hamermesh, Daniel S. "Expectations, Life Expectancy, and Economic Behavior." *The Quarterly Journal of Economics* 100, no. 2 (May, 1985): 389-408.

Hill, K. (1995). The decline of child mortality. In J. L. Simon (Ed.), The State of Humanity. Oxford: Blackwell

Hurd, Michael D. and Kathleen McGarry. "Evaluation of the Subjective Probabilities of Survival in the Health and Retirement Study." *The Journal of Human Resources* 30, no. 0, Special Issue on the Health and Retirement Study: Data Quality and Early Results (1995): S268-S292. (1995)

Hurd, Michael D. and Kathleen McGarry. “The Predictive Validity of Subjective Probabilities of Survival.” *The Economic Journal.* 112 (October 2002), 966–985.

Idler, Ellen L. and Yael Benyamini. “Self-Rated Health and Mortality: A Review of Twenty-Seven Community Studies.” *Journal of Health and Social Behavior*, Vol. 38, No. 1. (Mar., 1997), pp. 21-37.

Manski, Charles F. "Measuring Expectations." *Econometrica* 72, no. 5 (Sep., 2004): 1329-1376.

Perry, Michael. "Estimating Life Cycle Effects of Subjective Survival Probabilities in the Health and Retirement Study." Working paper 2005-103 Michigan Retirement Research Center, University of Michigan. (September 2005).

Smith, V. Kerry, Donald H. Taylor Jr., and Frank A. Sloan. "Longevity Expectations and Death: Can People Predict their Own Demise?" *The American Economic Review* 91, no. 4 (Sep., 2001): 1126-1134.

World Health Organization (2004). Country data on causes of death. Department of Measurement and Health Information. www.who.int/healthinfo/statistics/bodgbddeathdalyestimates.xls