Recessions, Older Workers, and Longevity:
How Long Are Recessions Good For Your Health?

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ABSTRACT

Although past research has found that recessions reduce contemporaneous mortality, workers nearing retirement age may experience reduced longevity attributable to lengthy unemployment spells and lost health insurance at a particularly vulnerable time. To test this hypothesis, we generate age-specific cohort survival probabilities using 1965-2008 Vital Statistics mortality data and link them to labor market conditions at earlier ages. Our results indicate that experiencing a recession in one's late 50s reduces longevity. We also find that it leads to several years of reduced employment, health insurance coverage, and health care utilization, which may contribute to the lower long-term likelihood of survival.

I. INTRODUCTION

The 2007-2009 recession and the lingering levels of high unemployment in the United States afterwards are the worst since the Great Depression. One might imagine that Americans' health would be adversely affected by the downturn, given the income losses from unemployment. Yet an extensive literature has shown that high unemployment rates are, perhaps counter-intuitively, associated with improved health outcomes. Ruhm (2000) was the first to show that mortality rates actually fall when the economy deteriorates.[1] Others have confirmed this, including Stevens, et al. (2011) who show that many age groups experience mortality declines during recessions, but that these declines are concentrated among the older population. In this paper, we extend this literature to explore the longer-term consequences of recessions, focusing on individuals who are approaching retirement at the time the downturn begins.

Individuals who are approaching retirement when a recession hits may be particularly likely to suffer long-lasting negative consequences. These individuals may have considerable difficulty finding new jobs if job training is viewed as a poor investment for older individuals given their short time horizon in the labor market or if there is age discrimination (Lahey, 2008). This may lead to a long period without a job leading up to an involuntary retirement. The U.S. Government Accountability Office (2012) found that around one-third of unemployed workers over age 55 in 2010 and 2011 had been without a job for over a year. Johnson and Butrica (2012) document that in the latest recession, older unemployed workers were substantially less likely to be re-employed than their younger counterparts. Exploring the link between labor market conditions and retirement over the past thirty years, Coile and Levine (2011a and 2011b) show that recessions are associated with increased rates of retirement, particularly at age 62, when

[1] In contrast to this finding, Sullivan and von Wachter (2009) indicate that job displacement of long-tenured men increases mortality in both the short and long-term. We describe this work in more detail subsequently.

individuals first become eligible for Social Security. They also provide suggestive evidence that subsequent retirement income may be reduced for these groups, presumably because of the reduced Social Security benefits resulting from early retirement.

Compounding the effects of reduced employment and income, the employer-provided nature of health insurance in the United States suggests that older individuals affected by the recession may lose their health insurance as well. The potentially long duration of their unemployment spells means that the period of lost coverage may be quite lengthy, for some lasting until Medicare eligibility at age 65. The loss of health insurance, and any resulting reduction in health care utilization, could pose a serious health risk for individuals in their late 50s and early 60s, who often have chronic health problems and frequently experience health shocks such as a heart attack or new cancer diagnosis (Coile, 2004).

Taken as a whole, the lost income during unemployment and retirement, in addition to decreased access to health insurance and health care in the years leading up to Medicare eligibility, could plausibly have a negative long-term impact on health outcomes. In principle, these effects could reverse the contemporaneous health gains that accompany a recession.

The purpose of this paper is to study the impact of recessions on subsequent mortality, focusing specifically on those workers approaching retirement age when the recession hits. We closely follow the empirical strategy in much of the existing literature, using unemployment rates as our key measure of recessions, and relying on variation across states and over time in the unemployment rate to identify their impact. We begin our analysis by constructing state- and age-specific survival rates between the ages of 55 and 79 from Vital Statistics Mortality data for a number of birth cohorts. We use these data to trace out the impact of a higher unemployment rate at each age on contemporaneous survival and on survival at subsequent ages. We go on to explore plausible mechanisms that could generate long-term health effects, including employment, health insurance, and health care losses, using data from the 1980 through 2011 March Current Population Surveys (CPS) and the 1991 through 2010 Behavioral Risk Factor Surveillance System (BRFSS) surveys.

Our results indicate that, for workers in their late 50s and through age 61, any short-term positive health benefits associated with a recession are temporary and ultimately more than offset by subsequent health deterioration. Interestingly, this pattern is not present for cohorts that face recessions starting at age 62, the age of entitlement to Social Security. We also find that a recession leads to lengthy periods of unemployment and to reduced health insurance coverage and health care use, lasting through the ages of early entitlement to Social Security and Medicare eligibility, respectively. Our results suggest that these programs may buffer the long-term negative health consequences of recessions. Although we cannot definitively determine that employment, insurance coverage, and health care use are the mechanisms underlying our mortality findings, we view all of them as plausible. Regardless of the mechanism, our findings underscore that the contemporaneous effect of recessions on health – which has been the focus of a substantial and important literature – is only part of the story. For those who are approaching retirement when a recession hits, an economic downturn can have long-lasting effects that more than offset the well-known contemporaneous health benefits of recessions.

II. LITERATURE REVIEW

A substantial body of research has focused on the contemporaneous effect of economic conditions on health outcomes. Ruhm (2000) was the first entry in this literature, showing that mortality rates fall when the economy deteriorates. This finding holds for a broad range of causes of death, including heart disease, flu and pneumonia, vehicle accidents, and infant and neonatal mortality. In later work, Ruhm (2003, 2005) shows that economic downturns improve other measures of health, such as the prevalence of chronic conditions, and are associated with reduced smoking, increased physical activity, and reduced obesity. [2]

More recent work by Miller et al. (2009), however, argues that the short-term effect of economic conditions on mortality must be driven by external factors rather than by changes in behavior by job losers, as the mortality effects are largest among the elderly population, which is unlikely to be directly affected by unemployment. Stevens et al. (2011) extend this work, showing that improved nursing home staffing during recessions may be a key mechanism for the improvements in elderly mortality. All of these papers focus on the contemporaneous impact of high unemployment and do not address the potential long-term impact on health outcomes.

The long-term impact of job loss on displaced workers is examined by Sullivan and von Wachter (2009), who find negative effects on mortality in both the short and long term, even as much as twenty years after the job loss. The authors posit that the long-term mortality effect may be attributable to long-term reductions in earnings. These findings are an interesting counter-point to the rest of the literature because they indicate that even if recessions improve health on average, there are important subpopulations that are negatively affected. This raises the possibility that the average short-term mortality gains could be offset over time as the contemporaneous benefits of recessions on non-workers dissipate and the long-term effects of job loss on affected subpopulations become more prominent. Reconciling our findings with those from these two disparate streams of research is a critical task that we undertake subsequently.

[2] Several recent studies have also examined the impact of recessions on health-related behavior. Using data from Iceland, Asgeirsdotter et. al. (2011) find that the Great Recession led to reductions in health-compromising behaviors and increases in some health-promoting behaviors. In the United States, Aguiar et. al. (2011) find that unemployment is associated with more time spent on TV-watching, sleeping, home production, and leisure.

Relative to Sullivan and von Wachter, our work also suggests that the long-term health effects of a recession need not be focused solely on job losers. Others may experience the job loss of a spouse, stress due to fear of job loss, lower wages, or reduced generosity in employer-sponsored health insurance or Medicaid, and may suffer health effects as a result. Our methodological approach will incorporate those potential impacts as well.

In related work, Coile and Levine (2010, 2011a, and 2011b) explore the impact of a weak labor market on retirement decisions and subsequent retiree income. They find that higher unemployment leads older workers to retire beginning at age 62. This suggests that Social Security may provide a lifeline to older workers who experience a job loss, struggle to find work, and finally withdraw from the labor force (albeit with reduced benefits) once they reach that age. Consistent with this, the authors provide suggestive evidence that Social Security income is lower when unemployment is high in the lead up to retirement. These results indicate that approaching retirement at the time of a recession can have important consequences for labor market activity and retiree income. An obvious extension of this work is to examine whether approaching retirement at the time of a recession also has health effects.

III. EFFECTS ON MORTALITY

A. Empirical Approach

Our empirical strategy builds on the work of Ruhm (2000, 2003, 2005a, and 2005b), Miller, et al. (2009), and Stevens, et al. (2011), all of whom use the same basic methodological framework for their analyses. Specifically, they estimate models of the form:[3]

$$lnM_{Ajt} = X_{jt}\cdot\beta + UR_{Ajt}\cdot\gamma + \alpha_{At} + \phi_{Aj} + \phi_{Aj}T + \varepsilon_{Ajt} \quad (1)$$

[3] This notation is largely the same as in Stevens, et al. (2011), but has been modified slightly to clarify the distinctions between their model and the one we specify subsequently.

where ln M is the natural log of the mortality rate at age A in state j and year t, X is a vector of demographic controls, and UR is the state unemployment rate. Year specific fixed effects at each age, α_{At}, captures national time effects and state specific fixed effects, ϕ_{Aj}, controls for time-invariant state characteristics at each age. State/age-specific time trends, $\phi_{Aj}T$, are also included.[4] Stevens, et al. (2011) estimates a separate regression for mortality at specific ages; we follow this approach as well. The source of identification in this model is state and year level variation in the unemployment rate. This specification is the starting point for our analysis; as we show below, we largely replicate the main features of the results from these previous studies.

We then extend this approach by altering the focus from a point-in-time analysis to a lifecycle analysis. Our goal is to estimate the long-term health effects associated with experiencing a recession in the period leading up to retirement. We need an empirical specification that looks at the contemporaneous effect of unemployment on health as well as whether that effect persists, fades away, or reverses course over time. To estimate these dynamic effects, we revise the estimation strategy to focus on the probability of survival as one ages as a function of an earlier labor market shock. As we move to survival analysis, the relevant form of data switches from pooled cross-sections to cohorts. We aim to answer the question: what was the effect on subsequent survival of nearing retirement in differing economic environments?

The model we estimate to formally incorporate these ideas takes the form:

$$S_{jca} = UR_{jcA} \cdot \gamma_{Aa} + \alpha_{Aac} + \phi_{Aaj} + \phi_{Aaj}T + \varepsilon_{jcAa} \qquad (2)$$

The first change as we move from Equation (1) to (2) is that the dependent variable is now the survival probability (S), measured in levels, not in logs, between age A and subsequent age a. To

[4] We have explored using quadratic state-specific time trends rather than state fixed effects and find results very similar to those presented below, although the CPS and BRFSS results in particular are less precisely estimated. These results are available from the authors on request.

track the impact on survival over time (i.e. determine whether the positive short-term impact returns to zero or turns negative over time), survival rates in levels are the appropriate outcome.

Second, we continue to index observations by state of residence, j (we discuss the issue of migration at length below), but now we track survival probabilities of cohorts, c, between starting age A and subsequent age a. Thus our key explanatory variable, UR_{jcA}, reflects the unemployment rate experienced by a particular birth cohort residing in a particular state when they are A years old. We estimate the impact of those labor market conditions on survival from age A to age a.

We run a separate regression for every combination of age A and age a so, while A and a are included as subscripts in the regression equation, there is no variation in A or a within a single regression. For example, to analyze the effect of the unemployment rate at age 55 on survival to age 75, we estimate the following model:

$$S_{jc75} = UR_{jc55} \cdot \gamma_{55,75} + \alpha_c + \phi_j + \phi_j T + \varepsilon_{jc} \tag{2'}$$

The unit of observation in this regression is a cohort-state cell. We use survival to age 75 as the dependent variable and the unemployment rate at age 55 as the key independent variable. The parameter of interest is $\gamma_{55,75}$, which tells us the effect of the unemployment rate at age 55 on the probability of survival to age 75. As Equation (2') makes clear, the source of variation that allows us to identify γ is across states and cohorts. In our results below, we will show how γ differs in regressions for different combinations of ages A and a.

Suppose, for example, we are focused on the impact of labor market conditions at age 55. We begin by measuring the survival probability in the year that individuals are age 55. This is the same as the mortality rate, which is what Equation (1) addresses. We then estimate the impact of the age 55 unemployment rate on survival through age 56, 57, and beyond. As we describe below, we focus on labor market conditions at ages 55 to 79 and estimate their impact on survival from the current age through age 79. Thus our analysis of the impact of labor market conditions at age 55 results in 25 regressions where the outcome is survival at each subsequent age between age 55 and 79 inclusive. As a result, we estimate substantially more regressions in the model represented in Equation (2) compared to that in Equation (1). In Equation (1), one regression is run for mortality at each age as a function of the unemployment rate at that age. Equation (2) represents 325 regressions (with 25 ages, there are n*(n+1)/2 combinations of initial unemployment rates and subsequent survival probabilities). Even when we restrict our attention to labor market conditions between ages 55 and 65, we have 220 regressions.

A third difference between this specification and Equation (1) is that we have dropped the demographic controls. We did so partly because it is not clear at what age to capture these characteristics in the context of a survival model and partly because of lack of data; no obvious source provides large samples at each age over the relevant period. As we show subsequently, omitting these variables from Equation (1) does not alter the nature of earlier findings. Fourth, we have changed our notation to indicate that we are controlling for cohort fixed effects (α_c) rather than year fixed effects (α_t) because this is a cohort-based model. This is merely a notation change, since year fixed effects are identical to cohort fixed effects our age-specific regressions.

One consideration in the specification of this model is the inclusion of the unemployment rate associated with the base age (A) only. In theory, survival in each year between, say, ages 60 and 74 might be affected by the unemployment rates in each of the intervening 15 years. Our specification omits the intervening unemployment rates, focusing on labor market conditions at the base age (i.e. age 60). We have experimented with including the full set of annual unemployment rates beginning with an initial shock at some age and continuing through the age at which survival is measured. The results of this exercise suggest that the impact of the base year unemployment rate is unaffected by including the full sequence of unemployment rates.[5]

B. Data

As one may have inferred from our econometric specification, the data requirements for our analysis are formidable. We define "nearing retirement" as being between the ages of 55 and 65. Our goal is to track survival probabilities through age 79. This means we need to calculate survival probabilities for up to 25 years for each cohort, requiring mortality data in each of those years. We use U.S. Vital Statistics data on the universe of death certificates, which are available beginning in 1968 from the National Center for Health Statistics and for a few years before that from the National Bureau of Economic Research.[6] We also have population data by state and exact age from the National Cancer Institute, available at seer.cancer.gov) beginning in 1969. We augment these data with population counts from the 1960 and 1970 Censuses, interpolating the years between those dates to generate population estimates for the intervening years.

We use these data to generate a complete set of state-specific mortality rates for each age between 55 and 79 for the 1910 through 1929 birth cohorts.[7] We use these mortality rates to construct survival rates beginning at each age between 55 and 79 and running through age 79. To do this, we begin with a survival rate of unity at, say, age 55. We then subtract the mortality rate at age 55 to estimate the probability of surviving that year. The survival probability at age 56 is

[5] These results are available from the authors upon request. As we add unemployment rates at subsequent ages in the model, our estimates of the effect of the base period unemployment rate are similar to those we report below. The coefficients on the unemployment rates at subsequent ages, however, start becoming erratic as more years of unemployment rate data are included. We believe that the results affirm our more parsimonious model specification.

[6] State identifiers in Vital Statistics Mortality data are available publicly through 2004, but permission from the Centers for Disease Control is required to use them after that. These more recent data are treated as confidential and we are unable to share them.

[7] Year of birth is not directly reported on death certificates. Instead, we subtract age from year of death. This introduces the possibility that we may be assigning individuals to an adjoining birth cohort depending on the relationship between their exact birth date and their exact date of death.

the survival probability at age 55 multiplied by one minus the mortality rate at age 56. We continue this approach through age 79 to obtain a complete set of survival probabilities between the starting age and age 79. We repeat the exact same exercise, but for each starting age between 55 and 79. These calculations are all done at the state level for each birth cohort.

This approach is very data intensive, since mortality at age 55 for the 1910 birth cohort requires death and population counts as far back as 1965. Mortality at age 79 for the 1929 cohort requires death and population counts as recently as 2008. This means we rely on data from all of our sources between 1965 and 2008 to construct the necessary survival rates to for our analysis.

To these data we append state unemployment rates, available from the Bureau of Labor Statistics starting in 1976. For earlier years, we use the state unemployment rates available from the U.S. Department of Labor in their Manpower Reports of the President (various years).[8]

C. The Role of Migration

One potentially important limitation of our data is that we construct survival probabilities by cohort and state based on annual state-specific mortality rates where states are identified by the location of death, not the location of residence at the base age. We aim to link local labor market conditions at the base age to subsequent survival probabilities, so it is the state of residence at the base age, not at the age of death, that should matter. Unfortunately, the available mortality data do not contain that any historical geographic detail. If older workers move between the age at a labor market shock and the age at which we measure their survival

[8] The source of state unemployment rates from Manpower Reports of the President in the years earlier than 1976 is not clear. Table notes in the reports list their source as "state employment security agencies cooperating with the U.S. Department of Labor." To assess the value of these data, we have compared their means to national averages, compared state patterns/values in the years just before and after 1976, examined cyclical patterns by state (looking for greater cyclicality in Michigan, for instance), and compared their values to (traditionally lower) measures of the insured unemployment rate. These exercises suggest that these data represent meaningful measures of labor market conditions and are comparable to BLS data. We have conducted our analyses using only data beginning in 1976 and obtained results that were qualitatively similar, although less precise, than those we report here.

probabilities, we will introduce measurement error. If mobility is random, then it introduces a downward bias on our results. More concerning, if healthier (or sicker) workers are more likely to move between states in response to a labor market shock, then we could observe a spurious correlation between labor market conditions and subsequent survival probabilities.

To address this concern, we measure the extent to which older workers move across state lines and the degree to which moves are related to labor market conditions. We focus on data from the Panel Study of Income Dynamics (PSID) for our analysis because we can observe labor market movements over about 40 years starting in 1968. Appendix Figure 1 displays rates of outmigration by age from the PSID as well as from the 1980, 1990, and 2000 Census for comparison. We can see that outmigration rates decline rapidly with age. Roughly 5 percent of individuals in their 50s in both data sources move to a different state over a five-year period.

We next use the PSID data to determine the extent to which outmigration rates for older individuals are related to labor market conditions. We estimate regression models of the form:

$$M_{stja} = \beta_{0a} + \beta_{1a}UR_{s,t-j} + \gamma_{s,a} + \gamma_{t,a} + \varepsilon_{stja} \quad (3)$$

Here the unit of observation is a state/year/age cell; individual observations are aggregated to construct outmigration rates. The dependent variable is the migration rate out of state s between periods t-j (where j is the period over which migration is measured, one or five years) and t, for individuals in age group a. The key explanatory variable, UR, is the unemployment rate in state s at time t-j. We include state and year fixed effects. We estimate this model separately for individuals in five-year age categories (measured in base year t-j) from 20-24 to 75-79 to see whether the responsiveness in migration to labor market conditions differs by age.[9]

[9] We aggregate the ages into five-year categories because each individual is recorded only once when we measure five-year migration, which is important for standard error calculations. This means that when we use single-year migration, individuals are observed up to five times in each regression, creating problems in the calculation of our

Rather than reporting a table of regression results, we graphically display the coefficients, β_1, over five-year intervals. Appendix Figure 2 collapses the results of 24 separate regressions, where each point represents an estimate of β_1 for each five-year age group separately for one-year and five-year outmigration. Diamonds reflect statistically significant (at the 5% level) coefficients. Although there is some variation across age groups, it is clear that only workers under age 50 leave the state when the labor market is weak. For older workers, particularly those above age 55 that are the focus of our analysis, there is no indication that migration is substantially affected by labor market fluctuations, as all coefficients are insignificant and point estimates fluctuate around zero. We conclude that it is unlikely that our results regarding the relationship between labor market conditions and longevity are driven by migration.

D. Replication Exercise

Before turning to our survival analysis, we present Table 1, which shows the results of our replication analysis of contemporaneous mortality effects based on the work of Stevens, et al. (2011).[10] We begin by attempting to replicate the results in their Figure 2, which displays the impact of a one point increase in the unemployment rate on contemporaneous mortality by exact age.[11] To reduce the amount of material to report, in Table 1 we have chosen to provide the results at exact ages between 55 and 75 in five-year intervals. The first two columns provide mean mortality rates over the 1969 through 2008 sample period (Column 1) and for the 1910 through 1929 birth cohorts (Column 2) at each age. These statistics are presented to provide some context for the magnitude of the coefficients shown in the remainder of the table.

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standard errors. We have also estimated single-year outmigration rates by single year of age, and the results are qualitatively similar those that we report here. We take the approach used here for ease of exposition.

[10] Stevens, et al. (2011) also replicate the findings in Ruhm (2000), making ours a third generation replication.

[11] We are grateful to the authors for sharing the publicly available parts of their data with us along with their detailed results so that we could have access to the coefficients and standard errors for the points listed in their Figure 2.

In Columns 3 and 4 we display the results from Stevens, et al. (2011) along with the results of our attempt to replicate those estimates. As the second line of the table indicates, we use the 1978 through 2006 sample years for all available birth cohorts in those years, as they do. Our findings are not identical to theirs, but the differences are very small; in each case, they differ by less than 0.1 of a standard deviation. Based on this, we are confident in proceeding.[12]

The remainder of the table is designed to translate our specification from that expressed in Equation (1) to that expressed in Equation (2). As we described earlier, it is unclear how to incorporate the explanatory variables (other than the fixed effects) in a longitudinal analysis, so we test the sensitivity of our results to dropping these variables. The results in Column (5) are similar to those in Column (4), so we do not believe that we are imparting bias by doing so. In Column (6) we extend our sample to include mortality and labor market outcomes between 1969 and 2008, adding nine years of data before and two years of data after that used by Stevens, et al. This has a bigger impact on the results. In general, we observe a stronger negative relationship between unemployment and mortality; the magnitude of these differences is up to a full standard deviation. The sensitivity of the results to the sample period is a finding that Stevens, et al. (2011) report as well, so we are not surprised by this finding.

The next change we make, reported in Column (7), is to restrict the data to focus on the 1910 through 1929 birth cohorts. For the most part, this does not have much of an impact other than to inflate standard errors somewhat, as one would expect given that we have reduced the amount of data used. The one noteworthy change is that for mortality at age 75, focusing on the 1910 through 1929 birth cohorts eliminates a negative and statistically significant impact. One

[12] After examining our underlying data (through 2004, subsequent data are confidential) and statistical code, we detect very small differences in population counts and the number of deaths beginning in the year 2000. This is likely attributable to minor data revisions made between the times they were downloaded for use in the two studies.

possible cause of this is that these birth cohorts hit age 75 between 1985 and 2004. This means that these cohorts did not experience the major recession of the early 1980s at that age, so the variation in the data used to estimate this model is largely based on the two mild recessions in the early 1990s and early 2000s. If we replicate the Stevens, et al. model using post-1985 data, we similarly observe a large reduction in the point estimate. As a result, we believe that this sensitivity is also attributable to the sample window used for estimation.

The final change that we make in Column (8) is to convert the dependent variable from mortality measured in logs to levels. This change has very little impact on the results. This can be seen by comparing t-statistics between Columns (7) and (8) or by comparing the ratio of the Column (8) to Column (2) statistics to create percentage change effects and then comparing that to the results in Column (7). The results in column (8), which show the same basic pattern of results as the previous literature on the contemporaneous effects of recessions, constitute estimates of Equation (2) for five cases where A=a. These results are the starting point for our analysis of long-term survival effects.

E. Results of Survival Analysis

This section reports the results of estimating statistical models based on Equation (2). In order to interpret these findings, we first present some descriptive statistics on aggregate survival rates beginning at age 55 and continuing through age 79. The age-55 survival rate is the probability of surviving through age 55 conditional on having survived up to age 55, so it is a number slightly less than one. Survival rates at subsequent ages are the probability of surviving through that age conditional on surviving up to age 55. Appendix Table 1 provides a full set of survival probabilities. In Figure 1, we present these survival rates for the 1915 and 1925 birth cohorts to demonstrate general patterns by age and birth cohort. Among members of the 1915 cohort who survived to age 55, the probability of surviving to age 79 is 50 percent. Members of the 1925 cohort live longer, unsurprisingly, surviving to age 79 at the rate of 54 percent.

As we described earlier, the number of regressions needed to estimate the model shown in Equation (2) is somewhat overwhelming (325, when we examine the effect of unemployment shocks at each age from 55 to 79 on survival to each age through age 79), presenting a challenge in terms of how to present our results. We provide the unemployment rate coefficients for all models in which the unemployment shock is measured between ages 55 and 65 (210 regressions) in Appendix Table 2, selecting these ages because the period leading up to retirement is the focus of our analysis.[13] We also present two figures that show coefficients from selected regressions and are designed to capture the critical features of these results. Estimated effects that are statistically significant at the 5 percent level are indicated by diamonds on the figures.

Figure 2 displays the contemporaneous effects, that is, the impact on current age survival of an increase in the unemployment rate at that age. This analysis is virtually identical to that reported in Column 8 of Table 1 (although mortality there is converted to survival here, so

[13] There are two potential problems in conducting statistical inference based on the analysis reported in this table. First, proper interpretation of standard hypothesis tests when so many tests are being conducted simultaneously is a concern. For each unemployment rate, we are estimating regressions with as many as 25 dependent variables. Standard levels of statistical significance are based on the probability of incorrectly rejecting a single null hypothesis, but one could also adjust significance levels to account for the probability of incorrectly rejecting *any* of the null hypotheses within a "family" of dependent variables. We have examined the sensitivity of our significance levels to this concern using Bonferroni bound adjustments, as discussed in Kling and Liebman (2004). While this approach generates fewer statistically significant results, our overall findings are robust to these adjustments.

Second, examining sequences of survival models may be a problem because much of the variation in survival up to age X is the same variation in survival up to age X+1, so we overstate the extent of independent variation across models. To address this concern, we estimate analogous hazard models that represent the marginal contribution to the survival rate at each age. Other than changing the dependent variable from survival to the mortality hazard, the model is the same. The full set of estimates is provided in Appendix Table 3; Appendix Figure 3 illustrates these findings using the example of the impact of a one-percentage-point increase in the unemployment rate at age 58. The results of this analysis suggest that our survival findings are not materially altered by rethinking the standard error calculations in this way. The results across specifications are completely consistent in both point estimates (which has to be true mechanically) and statistical significance. In fact, the results of this exercise further support the idea of the mechanisms that we have proposed since much of the survival reduction that we observe appears to be a consequence of increased mortality rates in the time period between job loss and Medicare eligibility.

negative mortality effects become positive survival effects). These results indicate that higher unemployment increases survival probabilities across all of our age groups at a roughly similar rate. Specifically, a one percentage point increase in the unemployment rate increases one-year survival probabilities by around 0.0005, or by 0.05 percentage points. With mortality rates that average around three percent, this 0.05 percentage point increase in the one-year survival rate reflects about a 1.7 percent decrease in mortality rates. A larger impact is observed around age 70. These results are generally consistent with the findings in Stevens, et al., with the exception of those in the late 70s (as described earlier, this is likely the result of different sample periods).

Figure 3 displays the long-term effects, that is, the impact of an increase in the unemployment rate at some specified age on the path of survival rates from that age through age 79. Rather than provide these effects for unemployment rate increases at each possible age, which would be overwhelming, we select five specific base ages (55, 58, 60, 62, and 65) that provide an adequate characterization of the complete set of results. Note that the first point on each line is the contemporaneous effect, as reported in Figure 2 for the relevant age. Other points show subsequent effects on survival, measured at the ages that are denoted on the horizontal axis. To condense the content of these figures as much as possible, we use a diamond on each line to reflect those effects that are statistically significant at the 5 percent level.

As we reported in Figure 2, the contemporaneous effects are typically small and positive, indicating that survival rates increase when the unemployment rate goes up. None of these contemporaneous effects displayed are statistically significant, but Figure 2 shows that they are at some ages. One interesting extension of these results is that the positive effect on survival probabilities may even increase in the few years following the rise in unemployment.

The issue we would prefer to focus on is what happens subsequently, as workers age into their retirement years. For those who experience a weaker labor market at age 55, the positive impact on survival quickly fades and becomes insignificantly different from zero through their 70s.[14] Similarly, for those who experience higher unemployment at ages 62 and 65, we see no statistically significant longer-term impact on survival. For those who experience a weak labor market at ages 58 or 60, however, an increase in the unemployment rate has long-term deleterious effects on survival. Within five or so years after the labor market shock, these cohorts have lower survival rates than others who did not experience a shock, and those lower survival rates are statistically significant and continue throughout most, if not all, of their 70s.[15,16]

The magnitude of these effects indicates that a one percentage point increase in the unemployment rate when an individual is in his or her late 50s reduces the probability of survival into his or her 70s by 0.03 to 0.04 percentage points.[17] A major recession that increases the unemployment rate by 5 percentage points (as experienced in the early 1980s and in 2008) would

[14] Meghir, Palme, and Simeonova (2012), provide another example of a different policy intervention (compulsory education in Sweden) that leads to mortality effects that go in one direction up until a certain age and then reverse.

[15] We have examined these effects separately by gender and find that the point estimates are very similar for males and females. We would prefer to also distinguish the data by level of education, but cannot since Vital Statistics only began recording the education level of the deceased in 1989 and because population estimates by exact age, state, and education level are not available to be able to create the mortality rates that serve as inputs to the survival rate.

[16] We also considered incorporating cause of death into the analysis, but our focus on survival rather than mortality complicates such an analysis. To address cause of death, we converted our methodological approach to a hazard model, where we estimate the impact of labor market conditions at an earlier age on subsequent annual mortality rates. We can then implement a competing risks hazard approach by distinguishing mortality by cause of death. The results of this analysis indicate that the two most common causes of death, cardiovascular disease and cancer, are responsive to earlier labor market conditions. This seems consistent with our other findings, since screenings and treatment for both types of health problems could be affected if one faced lapses in insurance coverage or lower income. As for other causes of death (like respiratory problems, infections, etc.), our results are hindered by lack of precision but are available from the authors upon request.

[17] Throughout the analysis, we use language focusing on the impact of increased unemployment because it is easier to think about recessions and their impact on health. Of course, the unemployment rate enters linearly in our model and so captures the impact of increases and decreases in unemployment. We have examined whether health responses to recessions and booms are symmetric by identifying the mean level of unemployment in each state over our sample period, creating an indicator variable distinguishing those states/years in which the unemployment rate was above average, and interacting this with the unemployment rate measure. Although making blanket statements about these interaction terms is complicated by the number of regressions involved, these coefficients are generally not significantly different from zero. These results are available from the authors upon request.

have a 0.15 to 0.20 percentage point impact on survival. Although these effects might appear to be very small, it is important to interpret them in the context of the number of workers who lose their jobs in a recession, the number who lose health insurance, and the number whose health may be seriously affected as a result. We place our estimates into this broader context below.

For now, we can get a sense of the power of the analysis by using the estimated standard errors to determine how large of a response would be necessary to find a statistically significant effect.[18] Standard errors rise as we consider survival at older ages because population cells become smaller. Nevertheless, by the mid 70s, a common standard error is roughly 0.015 percentage points (Appendix Table 2), so survival would need to change by about 0.03 percentage points in response to a one percentage point increase in the unemployment rate to detect a significant effect at the 5 percent level. Now consider the percentage of older workers affected by a one percentage point increase in the aggregate unemployment rate. Since older workers' jobs tend to be more secure and not all individuals are in the labor force, suppose that this increase in unemployment generates a reduction in employment of 0.3 percentage points. We would be able to detect a statistically significant impact of higher unemployment on survival if one in ten job losers who would otherwise have survived those 20 years did not survive. This is a conservative estimate because it ignores potential health effects on individuals who are not job losers, but it nevertheless conveys that the methods we are using are able to detect what one might consider to be plausible, albeit large, health consequences.

[18] Although we argue here that we have sufficient power to yield informative results in this analysis, the one place where power is a more serious concern is regarding our estimates at older ages. Standard errors for long-term survival to older ages are considerably greater than they are at younger ages. We believe that there are two explanations for this. First, survival at later ages incorporates accumulated random elements from earlier ages. Second, the number of survivors used to estimate subsequent mortality rates at older ages is smaller, so the precision with which we are able to estimate the survival probabilities in each cell falls. As such, it is difficult to interpret too strongly patterns that emerge at these older ages because none of those effects are statistically significant.

IV. EFFECTS ON EMPLOYEMENT, HEALTH INSURANCE, & HEALTH CARE USE

A. Data and Empirical Strategy

In this section of the paper, we explore potential mechanisms for the long-term increase in mortality associated with recessions that occur when individuals are in their late 50s and very early 60s. Specifically, we examine the short-term and long-term impacts of recessions on employment, health insurance coverage, and access to health care. The best data source for examining insurance coverage and employment over a long period of time is the March CPS; we pool data from the 1980 to 2011 surveys for our analysis. Although the CPS is available for earlier years, health insurance variables are not defined consistently prior to 1980.[19] For health care use, we provide evidence from the BRFSS, pooling data from the 1991 to 2010 surveys. While the BRFSS collects more information on health behaviors than on health care utilization, it does include a question about whether, during the past 12 months, the respondent needed to see a doctor, but did not because of cost. We use this as our key measure of health care access/use.[20]

Ideally, we would use the same empirical strategy for these outcomes as we did for mortality. Those regression models, however, impose formidable data requirements. We were able to meet these requirements in our survival analysis because of the availability of Vital Statistics data, which include the universe of deaths. In contrast, survey data such as the BRFSS and CPS introduce some limitations and therefore require modifications to our strategy.

The first limitation is that we are no longer able to follow a fixed panel of birth cohorts, as we do in Vital Statistics data. The BRFSS and CPS both provide repeated cross-sections, so

[19] Even within these 32 survey years, health insurance variables are not entirely consistent. We have tested the sensitivity of our results to using a narrower sample period with more consistent measures of health insurance. We obtain qualitatively similar results, but with less precision.

[20] We have also examined health care utilization variables and health outcome measures in the National Health Interview Survey (NHIS) and the BRFSS, including outcomes like doctor visits in the past 2 weeks and hospital days. Unfortunately, these sources of data did not contain sample sizes large enough to provide the necessary power to draw strong conclusions from these analyses.

of course we are not able to follow the same individuals as they age from their 50s into their 70s. In addition, we could only follow a small number of fixed birth cohorts over the twenty year period from their 50s into their 70s. For example, we could follow only the 1927 through 1932 birth cohorts in the 32 years of Current Population Surveys; we cannot follow any birth cohorts in the BRFSS. Therefore, we choose to include all observations between the ages of 53 and 79 who appear in these surveys, regardless of birth cohort.[21]

The second limitation is that these data sets are too small to precisely identify the impact of the unemployment rate at a single age on outcomes at a single age. Therefore, we pool the data into nine three-year age groups, from ages 53-55 to ages 77-79. We calculate the average unemployment rates for a cohort and state across each three-year age group and use that average as the key independent variable in our regressions. Our regression equation builds on that in Equation (2), but incorporates these modifications. It takes the form:

$$Y_{ijtg} = UR_{jtG} \cdot \gamma_{Gg} + \delta_t + \phi_j + \phi_j T + \lambda_a + \varepsilon_{ijtg} \qquad (4)$$

where Y is an outcome like employment or insurance coverage for individual i in age group g in state j and year t. UR_{jtG} is the overall unemployment rate across all ages observed at an earlier age group, G, and assigned as a variable to individuals currently in age group g. In other words, in a model where the outcome is measured at, say, ages 65-67, this is the average state unemployment rate in the three-year window when the individual was, say, 53-55. The regression is estimated separately for each combination of age groups g and G. Like the survival models, these regressions control for a full set of state fixed effects and state-specific linear

[21] For some of the observations on the oldest individuals in the 1980-1985 surveys, we do not observe the unemployment rates that they faced in their early and mid-50s, because our unemployment data begin in 1960. We have re-estimated our CPS regressions excluding these years and find that our results are not materially affected. For the last two survey years, there are observations in our sample for whom we have not yet observed all of the relevant unemployment rates for calculation of the three-year average unemployment rate in their age group. Again, we have re-estimated our regressions excluding the last two survey years and find that the results are similar.

trends. Whereas the survival regressions included cohort fixed effects, these regressions include survey year fixed effects. The only other difference is that these regressions include fixed effects for exact year of age, *a*, since each regression includes three ages. The results of interest are the γ_{Gg} coefficients. As with mortality, our results are most easily seen graphically, but here we can present them in tables given the smaller number of results. Standard errors are clustered on state.

B. Results

The first set of results, reported in Figure 4 and Table 2, shows the impact of recessions on longer-term employment outcomes.[22] The dependent variable in these models is an indicator for employment at subsequent ages and the key regressors are labor market conditions at earlier ages.[23] Unsurprisingly, all age groups experience a contemporaneous decline in employment when unemployment rates are high. Specifically, a one percentage point increase in the unemployment rate is associated with a contemporaneous 0.3 to 0.5 percentage point decline in the probability of employment in our sample. The fact that there is not a one-for-one relationship between the unemployment rate and employment in our sample is likely related to the fact that older workers are less likely to lose their jobs during recessions than younger workers.[24] The magnitude of the effect diminishes over time, but remains apparent in the data for 6 to 9 years.

[22] Although we are primarily interested in analyzing employment in order to put our other results into context, we acknowledge that retirement itself could have direct effects (either positive or negative) on physical and/or mental health. Unfortunately, it is difficult to estimate this empirically, since the potential for endogeneity is so great. For two recent examples from this literature, see Bound and Waidmann (2007) and Coe and Zamarro (2011).

[23] In theory, we could also use this table (and Tables 3-5) to examine the effect of labor market conditions on employment outcomes (or insurance coverage or health care use) in *earlier* years – for example, the effect of the age 56-58 unemployment rate on age 53-55 insurance. Such an exercise serves as a placebo test, since next period's unemployment rate should not affect today's outcomes. When we conduct this exercise, the coefficients on future labor market conditions are generally small and statistically insignificant. Results are available upon request.

[24] For example, Johnson and Butrica (2012) report that, in the most recent recession, during a period when the monthly employment rate for 25-to-34-year-olds averaged 9.4 percent, the unemployment rate for 50-to-61-year-olds averaged only 6.1 percent. Hoynes, Miller, and Schaller (2012) also find that employment of older workers is considerably less sensitive to aggregate unemployment rate fluctuations than employment of younger workers. In our own analysis of CPS data, we found that the effect of the overall unemployment rate on employment appears to fall with age, although we did not have enough precision to strongly support this interpretation.

Interestingly, we observe a statistically significant *increase* in the probability of employment in an individual's late 60s and early 70s, lasting approximately 6 years, for those cohorts that experienced recessions between the ages of 53 and 64.[25] This increase in employment after the age of normal retirement is shorter and less pronounced for those who experience recessions between the ages of 62 and 64.[26] This could suggest that some of those who experience a recession in their 50s need to remain in the labor force longer or return there later in life, to make up for lost incomes, pension accrual, or Social Security accrual. Those who experience a recession after they have reached the early entitlement age for Social Security, on the other hand, experience smaller losses and therefore do not increase their employment at older ages by as much.[27] We have repeated this exercise using the natural log of total personal income in the CPS as the dependent variable and obtained patterns very similar to those for employment.

These employment effects may have important implications for health insurance coverage for individuals prior to Medicare eligibility at age 65 because of the prevalence of employer provided insurance in the United States. We continue our analysis by examining the impact of labor market conditions on subsequent insurance coverage. We use two measures of health insurance coverage: an indicator for having any health insurance coverage, and an indicator for having any private health insurance coverage. The health insurance questions in the CPS are intended to elicit information about insurance coverage in the prior year. However,

[25] This increase in employment appears to explain a portion of the increase in private health insurance coverage between the ages of 65 and 70. When we use an indicator for having private health insurance *and* being employed as our dependent variable, we obtain coefficients that are similar to, but somewhat smaller than, those in Table 3.
[26] We have examined health insurance and employment outcomes by gender. We find some differences, with larger insurance effects for women and larger employment effects for men, but they are not statistically significant.
[27] It is worth noting that these effects are generally at least an order of magnitude larger than the effects on survival probabilities, so these results are not explained by selection bias due to the deaths of the individuals who were least likely to remain in the labor force at older ages. Working longer in response to experiencing a recession in the late 50s and very early 60s could have a positive or negative impact on long-term mortality. If it were negative, this could be a potential mechanism driving our mortality effects. We are unaware of any literature that directly addresses the link between labor market longevity and longer-term survival probabilities.

survey respondents have a tendency to provide health insurance information about the survey year instead of the prior year (Swartz, 1986). In our sample, reported Medicare coverage spikes from 16 percent among 64-year-old survey respondents to 83 percent among 65-year-old survey respondents. This spike would not occur (or would be much smaller), if people actually reported their prior year insurance status. In light of this, we treat the insurance data as if they apply to the survey year. Although this may introduce a bit of downward bias due to measurement error, year-to-year serial correlation in unemployment likely dampens the magnitude of this problem.

Figure 5 and Table 3 show coefficients from models where the dependent variable is an indicator for coverage by any form of insurance. There is a large decline in the probability of any insurance coverage in periods of elevated unemployment for all groups below the age of Medicare eligibility. The magnitude of the contemporaneous decline in the probability of insurance coverage ranges from 0.18 to 0.39 percentage points for a one point increase in unemployment. These results are consistent with earlier findings on the contemporaneous effect of unemployment on insurance coverage (Cawley and Simon, 2005; Gruber and Levitt, 2002).[28]

Interestingly, Figure 5 also shows that the largest decline in insurance coverage, based on point estimates, is seen in the time period that is approximately 3 years after the recession. This lag is long enough that it is probably not attributable to serial correlation in unemployment rates, but it might reflect the fact that COBRA coverage mitigates the loss of health insurance in the first 18 months after a job loss.[29] While the other coefficients are generally not statistically significant, the point estimates suggest that, for individuals who experience a labor market

[28]The estimates by Gruber and Levitt (2002), like ours, are based on the CPS; they estimate effects that are slightly larger than ours (0.43 to 0.57), but this difference is likely attributable to the older population in our sample. In more recent work using the Survey of Income and Program Participation, Cawley et. al. (2011) estimate larger effects of the Great Recession on insurance coverage than those implied by earlier studies.

[29]COBRA coverage was introduced by legislation starting in 1985, so it is available for most of our sample period.

downturn at ages 53-55, it can take nearly a decade – until Medicare become available at age 65 – for insurance coverage to return to its pre-recession level. The fact that Medicare eligibility begins at age 65 ensures that those who experience recessions at ages 62 to 64 experience substantially shorter spells of uninsurance. Recessions occurring after that age lead to no deficit in insurance coverage. These age patterns may help to explain the finding that recessions are associated with a reduction in long-term survival when they coincide with an individual's late 50s and very early 60s but not if they occur at older ages.

Figure 6 and Table 4 focus on private health insurance coverage.[30] For those under age 65, private insurance is likely the individual's primary source of insurance; for those over age 65, private insurance is likely to be a supplemental insurance policy that covers Medicare copayments and deductibles. About half of supplemental insurance policies are purchased through former employers and the other half are purchased individually on the Medigap market. Given the prevalence of supplemental policies, it is not surprising that average private insurance coverage does not fall much at the age of Medicare eligibility; in our data, it drops from 78 percent at ages 62 to 64 to 71 percent at ages 65 to 67. In Figure 6, we see that the decline in insurance coverage associated with higher unemployment is, not surprisingly, driven by declines in private health insurance. As with the any insurance results, the largest impact on private health insurance (based on point estimates) occurs with a lag of approximately three years, after COBRA coverage expires. The other notable result here is the statistically significant *increase* in private health insurance coverage among those aged 68-70 associated with recessions that occurred when those individuals were in their mid-50s. This is consistent with our finding that earlier labor market shocks can lead to increased labor force participation at older ages.

[30] We have also examined (but do not show) the effect of recessions on public health insurance coverage. We find no statistically significant effect, which is not surprising given the eligibility rules for Medicare and Medicaid.

If insurance coverage is lost, individuals may be more reluctant to see a doctor because of financial concerns. With the data available to us, we are able to examine whether, during the past 12 months, the respondent did not see a doctor when needed due to cost. The coefficients are reported in Table 5 and shown in Figure 7. These results suggest that increases in the unemployment rate are associated with contemporaneous increases in the probability of missing a doctor's appointment due to cost for recessions that occur before age 65, the age of Medicare entitlement. The magnitude of the contemporaneous effect ranges from a 0.181 to a 0.457 percentage point increase in the probability of a missed doctor's visit for a one percentage point increase in the unemployment rate. Consistent with our earlier findings, the elevated probability of a missed doctor visit associated with a recession persists for three to six years. This long-term effect on access to care provides a plausible mechanism for recessions to have long-term negative consequences for health. It is also worth noting that we see some evidence of *increased* access to care six to nine years after a recession (although of a smaller magnitude than the initial decrease), which is also consistent with our findings for employment and insurance coverage.

V. DISCUSSION

Our results indicate that experiencing a recession in the years preceding retirement results in a short period in which mortality is lower, but a longer period in which mortality is higher, resulting in lower survival rates at older ages. A plausible mechanism for this longer-term finding is the long period of lower rates of employment, health insurance coverage, and access to health care that we find comes with exposure to an economic downturn in one's late 50s or early 60s. These effects could go on for several years for affected workers and appear to be ameliorated by eligibility for Social Security and Medicare at ages 62 and 65, respectively.

One useful exercise that would help support the plausibility of these findings is a comparison of the relative magnitudes of their effects. We begin with the employment effects, which should be the largest in magnitude. As described earlier, a one percentage point increase in the unemployment rate at, say, ages 56-58 reduces the likelihood of any employment at those ages by 0.5 percentage points. The less than point-for-point impact occurs because older workers do not suffer as much job loss as the average worker when a recession hits; furthermore, since the relevant outcome is any employment, workers whose unemployment spells are short would not be captured here. This effect does not dissipate by ages 59-61 but falls by about half at ages 62-64 (after Social Security becomes available) and then falls again to roughly zero by 65-67 (after the Social Security normal retirement age). We believe these results are plausible and suggest long-term employment losses for many older workers who experience a job loss.

The estimated effects on health insurance coverage suggest that the same one percentage point increase in the unemployment rate at ages 56-58 reduces private health insurance coverage by around 0.25 percentage points from those ages through ages 62-64 (though the effect is only statistically significant at 59-61, suggesting the power of this analysis is somewhat limited). This indicates that roughly half of those with long-term employment losses also lose access to private health insurance. Spousal coverage may account for those who do not, as well as COBRA coverage in the short run; there is also no loss of insurance for job losers who were uninsured even when working. The impact on any health insurance coverage could also be mitigated if unemployed older workers apply for and receive Social Security disability insurance (cf. Autor and Duggan, 2003), although Medicare coverage is only available starting two years after the onset of the disability. The magnitude of the estimated effect on reporting missing a doctor visit due to cost is similar to the magnitude of the effect on insurance coverage, which would indicate that almost all of those who lose health insurance coverage experience financial barriers to care. This seems plausible, especially for an age group where doctor visits are common.

In terms of survival probabilities, we find that a one percentage point increase in the unemployment rate at, say, age 58 reduces the likelihood of surviving through age 79 by 0.045 percentage points. This means that if the entire impact on survival is generated from those initial workers who suffered long-term unemployment resulting from a recession, an additional one in ten of those workers would not survive to age 79 as a result of the labor market downturn. An alternative way to interpret these numbers is to estimate the impact on life expectancy assuming that all of the survival effect was transmitted through employment reductions. These calculations suggest that a worker who lost his or her job at age 58 as a result of a recession could be expected to live three fewer years (19 years instead of 22) as a result.[31] It is important to interpret these numbers with some caution. First, lost employment does not need to be the only mechanism for such an effect, as Miller, et al. (2009) and Stevens, et al. (2011) indicate, which would result in overstated effects for job losers.[32] Second, standard errors are associated with each of these estimates, suggesting that some confidence interval exists around these estimates. Nevertheless, incorporating these caveats, we believe that these magnitudes are plausible.

Another critical element in interpreting our results is the relationship between our findings and those of past analyses that have examined similar questions. As we described earlier, there are a number of relevant previous studies and their findings are not obviously consistent with each other. Ruhm (2000) found a general reduction in contemporaneous mortality associated with an economic downturn. Sullivan and von Wachter (2009) find that job

[31] The details of this calculation are available from the authors upon request.
[32] Sullivan and von Wachter (2009) find that a worker displaced at age 40 experiences a reduction in life expectancy of 1 to 1.5 years. Our estimate is larger than that, but we are not surprised since we are incorporating all possible reasons that increased unemployment rates may affect mortality into a single factor, a direct job loss.

displacement among long-tenured men increased mortality in the short- and long-term, particularly for those at prime working age. Miller, et al. (2009) show that higher unemployment rates generate reduced contemporaneous mortality, particularly for elderly individuals. We find negative short-term mortality effects that are consistent with Miller, et al. (2009) for workers in their late 50s and very early 60s, but then we find reduced longevity for these workers. Taken at face value, virtually all of these results appear to contradict each other.

These conflicts have been noted by the authors of previous studies and several explanations have been offered. Sullivan and von Wachter (2009) make a distinction between the average worker who loses his or her job in a recession and the high-tenure displaced workers that they study, who presumably suffer a considerably more severe economic shock resulting from their unemployment. In their view, the differential effects between the two groups (the former being considerably larger) are reasonable, so there is no conflict with Ruhm (2000). Miller, et al. (2009) argue that the differences in their findings as compared to those of Ruhm (2000) result from the fact that health improvements observed during a recession are not the result of changes in own labor force status, but are attributable to external factors, which they go on to explore in more detail in Stevens, et al. (2011).

Our own evidence builds on some of these arguments, but other discrepancies between our findings and the more recent entries into this literature also need to be reconciled. In comparing our results with those of Miller, et al./Stevens, et al., the main distinction is in terms of interpretation; they argue that the main effect of a recession is external to the employment relationship. That may be true for the short-term impact and our short-term results are very similar to their findings. On the other hand, we believe that our findings are consistent with reduced employment, health insurance coverage, and health care access plausibly explaining a significant portion of the long-term negative health impact. Since their analysis never focuses on these long-term effects, there is no direct conflict in our interpretations.

Our primary result – that recessions have negative long-term effects on survival for those approaching retirement – is also mainly consistent with the key findings of Sullivan and von Wachter (2009). One place where the papers may appear to diverge is in the relative effect of unemployment at different ages. We find that unemployment shocks at ages 57 to 61 have the biggest long-term effect on survival, while shocks at earlier (ages 55 to 56) or later (ages 62 to 65) ages have no significant long-term effect. Sullivan and von Wachter find that shocks occurring at younger ages (before age 45 or between ages 45 and 54) have a bigger effect than those at older ages (age 55 and above). Yet since we do not study the effect of shocks at younger ages, the two sets of results are not directly comparable; Sullivan and von Wachter do not provide results by exact age that could be compared against our results. A second point of divergence between the two papers is that we find positive effects of unemployment shocks on survival in the short run, while they find negative effects in both the short- and long-term. As already discussed, the effect of unemployment on an average worker may be different from that on a high-tenure worker. For example, employment and income losses may be less severe for average workers. As a result, average displaced workers may be spared the negative short-term mortality effects that plague those displaced from long-tenured positions, but both groups appear to suffer negative long-run health consequences.

Overall, our findings suggest that experiencing a recession in one's late 50s or early 60s is bad for health in the long run. Interestingly, we find that unemployment shocks at or after age 62 have no long-term negative health effects. The availability of Social Security at age 62 and Medicare at age 65 may play an important role in this finding. These programs serve as a buffer against the income and health insurance losses that often accompany unemployment. Indeed, we find that unemployment shocks trigger lengthy reductions in employment and income for older workers; Social Security starts filling in the income gap at age 62. These shocks also trigger lengthy reductions in insurance coverage and increased difficulty in accessing health care; these effects disappear once individuals reach age 65 when Medicare begins.[33]

As policy makers contemplate possible changes to Social Security and Medicare to restore them to stronger financial footing, such as raising the age of eligibility for these programs, it will be important to develop a better understanding of the role that these programs may play in mitigating the negative effects of an unemployment shock. Our analysis also suggests that recent health care legislation in the form of the Affordable Care Act of 2010 has the potential to provide important health benefits to future cohorts of older workers who happen to be approaching retirement age during a recession. To the extent that lack of health insurance in the period prior to Medicare eligibility contributes to the poor health outcomes that we observe for these workers, the guaranteed and potentially subsidized coverage that the reform law will provide should help lessen the long-term health consequences of future recessions.

[33] The fact that the impact on mortality ends at age 62 may simply mean that gaps in insurance coverage of a year or two may not substantively alter subsequent mortality.

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Table 1: Impact of Changes in Structure of Data on the Relationship between Contemporaneous Unemployment Rates on Mortality (coefficients and standard errors multiplied by 100)

	Mean Mortality Rate (1)	Mean Mortality Rate (2)	Stevens, et al. (2011) (3)	Replication (4)	Drop Explanatory Variables (5)	Expand to All Years (6)	Focus on Birth Cohorts (7)	Convert mortality rate from logs to levels (8)
Survey Years/ Birth Cohorts:	1969-2008/ variable	Variable/ 1910-1929	1978-2006/ variable	1978-2006/ variable	1978-2006/ variable	1969-2008/ variable	Variable/ 1910-1929	Variable/ 1910-1929
Age 55	0.80%	0.98%	-0.019	-0.048	-0.020	-0.237	-0.246	-0.0025
			(0.236)	(0.240)	(0.259)	(0.187)	(0.223)	(0.0021)
Age 60	1.24%	1.45%	0.148	0.128	0.079	-0.013	0.039	-0.0013
			(0.168)	(0.166)	(0.172)	(0.154)	(0.145)	(0.0020)
Age 65	1.88%	1.99%	-0.189	-0.162	-0.255	-0.417	-0.324	-0.0062
			(0.169)	(0.170)	(0.159)	(0.116)	(0.140)	(0.0028)
Age 70	2.80%	2.78%	-0.599	-0.614	-0.572	-0.670	-0.757	-0.0221
			(0.143)	(0.146)	(0.205)	(0.147)	(0.244)	(0.0067)
Age 75	4.21%	3.96%	-0.300	-0.308	-0.148	-0.229	0.034	-0.0036
			(0.152)	(0.152)	(0.110)	(0.105)	(0.171)	(0.0067)

Notes: Every cell in the table represents the coefficient on the unemployment rate in a model where the dependent variable is measured in natural logs (except where noted) and that also includes year or birth cohort fixed effects, state fixed effects, and state-specific linear trends. In cohort models, ages 55 through 58 uses all available cohorts, which do not go as far back as 1910 (i.e. for those age 55, the 1914 birth cohort is the first available). Regressions weighted by state/year/age population.

Table 2: Impact of Unemployment Rates at Specific Age Groups on Employment at Different Ages

Unemp. Rate at Age	Any Employment at Age: 53-55	56-58	59-61	62-64	65-67	68-70	71-73	74-76	77-79
53-55	-0.550**	-0.242*	-0.207	0.246	0.157	0.268**	0.546**	-0.030	-0.080
	(0.104)	(0.135)	(0.209)	(0.149)	(0.155)	(0.122)	(0.149)	(0.124)	(0.120)
56-58		-0.500**	-0.614**	-0.256*	-0.035	0.373**	0.503**	0.087	0.057
		(0.139)	(0.189)	(0.148)	(0.149)	(0.112)	(0.140)	(0.128)	(0.103)
59-61			-0.258	-0.333*	-0.297**	0.073	0.227*	0.185*	-0.099
			(0.163)	(0.169)	(0.141)	(0.129)	(0.116)	(0.108)	(0.104)
62-64				-0.541**	-0.522**	-0.313**	-0.003	0.182**	0.055
				(0.181)	(0.147)	(0.117)	(0.140)	(0.068)	(0.111)
65-67					-0.148	-0.314**	-0.275**	-0.058	0.166
					(0.168)	(0.151)	(0.120)	(0.125)	(0.100)
N	153,389	153,624	140,041	126,213	117,267	104,256	91,875	79,506	65,348
Mean of Dependent Variable	0.73	0.66	0.57	0.39	0.25	0.18	0.13	0.09	0.07

Notes: Every cell in the table represents the coefficient on the unemployment rate in a linear probability model that also includes year fixed effects, state fixed effects, and state-specific linear trends. Coefficients and standard errors are multiplied by 100. As noted in the text, the number of observations varies slightly in some specifications. The number of observations here is the most common number of observations. A double (single) asterisk represents a coefficient that is significant at the 5 (10) percent level.

Table 3: Impact of Unemployment Rates at Specific Age Groups on Any Health Insurance Coverage at Different Ages

	Any Insurance at Age:								
Unemp. Rate at Age	53-55	56-58	59-61	62-64	65-67	68-70	71-73	74-76	77-79
53-55	-0.213**	-0.352**	-0.128	-0.032	0.050	-0.020	-0.008	-0.019	-0.008
	(0.108)	(0.127)	(0.119)	(0.151)	(0.035)	(0.041)	(0.045)	(0.043)	(0.027)
56-58		-0.208	-0.121	-0.068	-0.009	0.019	0.010	0.028	-0.074**
		(0.134)	(0.122)	(0.156)	(0.045)	(0.048)	(0.039)	(0.035)	(0.028)
59-61			-0.176*	-0.386**	-0.029	0.005	-0.037	0.002	-0.054**
			(0.104)	(0.135)	(0.050)	(0.041)	(0.024)	(0.036)	(0.022)
62-64				-0.393**	-0.010	-0.029	0.024	-0.006	-0.014
				(0.145)	(0.065)	(0.055)	(0.032)	(0.043)	(0.033)
65-67					0.082	0.041	0.025	-0.016	-0.003
					(0.075)	(0.035)	(0.039)	(0.038)	(0.033)
N	136,133	132,182	117,873	102,652	93,036	81,333	70,886	61,633	51,637
Mean of Dependent Variable	0.88	0.88	0.88	0.88	0.98	0.99	0.99	0.99	0.99

Notes: Every cell in the table represents the coefficient on the unemployment rate in a linear probability model that also includes year fixed effects, state fixed effects, and state-specific linear trends. Coefficients and standard errors are multiplied by 100. As noted in the text, the number of observations varies slightly in some specifications. The number of observations here is the most common number of observations. A double (single) asterisk represents a coefficient that is significant at the 5 (10) percent level.

Table 4: Impact of Unemployment Rates at Specific Age Groups on Private Health Insurance Coverage at Different Ages

	Any Insurance at Age:								
Unemp. Rate at Age	53-55	56-58	59-61	62-64	65-67	68-70	71-73	74-76	77-79
53-55	-0.087	-0.335**	-0.128	-0.149	0.416	0.470**	0.309	-0.120	-0.349
	(0.117)	(0.157)	(0.165)	(0.200)	(0.284)	(0.188)	(0.269)	(0.247)	(0.217)
56-58		-0.209	-0.323**	-0.235	0.314	0.646**	0.420	0.035	-0.479**
		(0.142)	(0.150)	(0.191)	(0.237)	(0.188)	(0.257)	(0.287)	(0.198)
59-61			-0.302**	-0.368**	0.057	0.008	0.105	-0.112	0.134
			(0.135)	(0.154)	(0.216)	(0.214)	(0.297)	(0.322)	(0.272)
62-64				-0.311*	-0.222	-0.510**	0.054	0.110	0.418*
				(0.164)	(0.237)	(0.188)	(0.250)	(0.267)	(0.230)
65-67					-0.156	-0.334	-0.241	0.221	0.325
					(0.307)	(0.273)	(0.295)	(0.205)	(0.216)
N	136,133	131,454	117,058	101,731	90,587	78,810	68,747	59,686	50,082
Mean of Dependent Variable	0.82	0.82	0.81	0.79	0.71	0.70	0.68	0.67	0.66

Notes: Every cell in the table represents the coefficient on the unemployment rate in a linear probability model that also includes year fixed effects, state fixed effects, and state-specific linear trends. Coefficients and standard errors are multiplied by 100. As noted in the text, the number of observations varies slightly in some specifications. The number of observations here is the most common number of observations. A double (single) asterisk represents a coefficient that is significant at the 5 (10) percent level.

Table 5: Impact of Unemployment Rates at Specific Age Groups
on Skipping Doctor Visits Due to Cost in the Past 12 Months at Different Ages

	Skipping Doctor Visits Due to Cost at Age:								
Unemp. Rate at Age	53-55	56-58	59-61	62-64	65-67	68-70	71-73	74-76	77-79
53-55	0.457**	0.328**	-0.167	-0.238**	-0.183*	-0.105	0.108*	-0.018	-0.051
	(0.086)	(0.134)	(0.148)	(0.099)	(0.099)	(0.063)	(0.062)	(0.056)	(0.061)
56-58		0.196	0.225**	-0.003	-0.041	-0.158*	-0.041	0.117	-0.051
		(0.124)	(0.102)	(0.135)	(0.102)	(0.086)	(0.088)	(0.081)	(0.070)
59-61			0.364**	0.197*	0.240**	-0.175*	-0.202**	0.050	-0.023
			(0.100)	(0.112)	(0.101)	(0.100)	(0.078)	(0.075)	(0.068)
62-64				0.181**	0.061	0.060	-0.011	-0.053	-0.026
				(0.081)	(0.095)	(0.094)	(0.093)	(0.113)	(0.073)
65-67					0.126	-0.035	0.058	-0.026	-0.020
					(0.081)	(0.094)	(0.110)	(0.111)	(0.081)
N	210,803	227,861	217,473	205,682	200,904	178,795	159,516	143,812	124,055
Mean of Dependent Variable	0.131	0.119	0.108	0.100	0.064	0.047	0.043	0.040	0.037

Notes: Every cell in the table represents the coefficient on the unemployment rate in a linear probability model that also includes year fixed effects, state fixed effects, and state-specific linear trends. Coefficients and standard errors are multiplied by 100. As noted in the text, the number of observations varies slightly in some specifications. The number of observations here is the most common number of observations. A double (single) asterisk represents a coefficient that is significant at the 5 (10) percent level.

Figure 1: Survival Rates from Age 55, by Birth Cohort

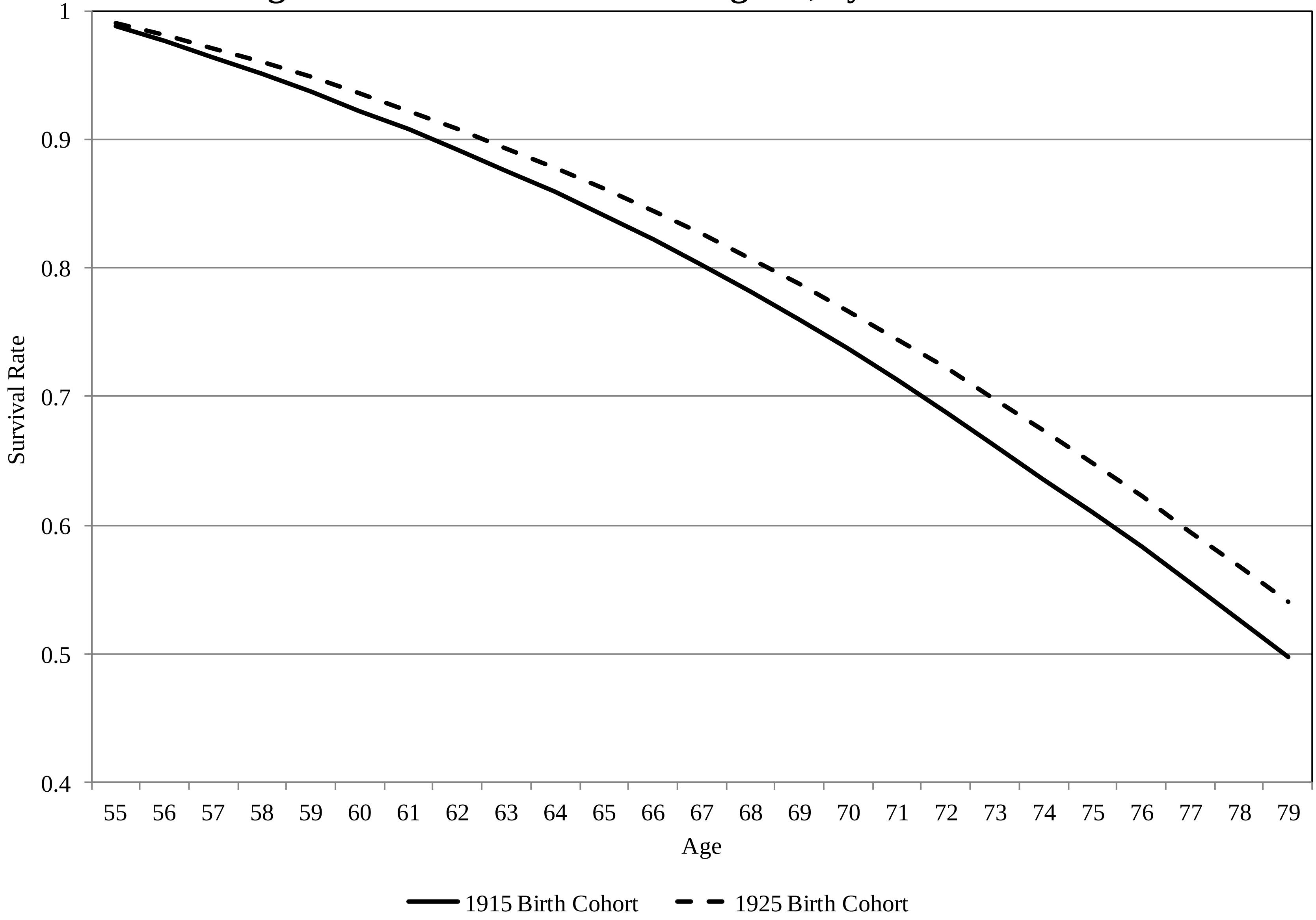
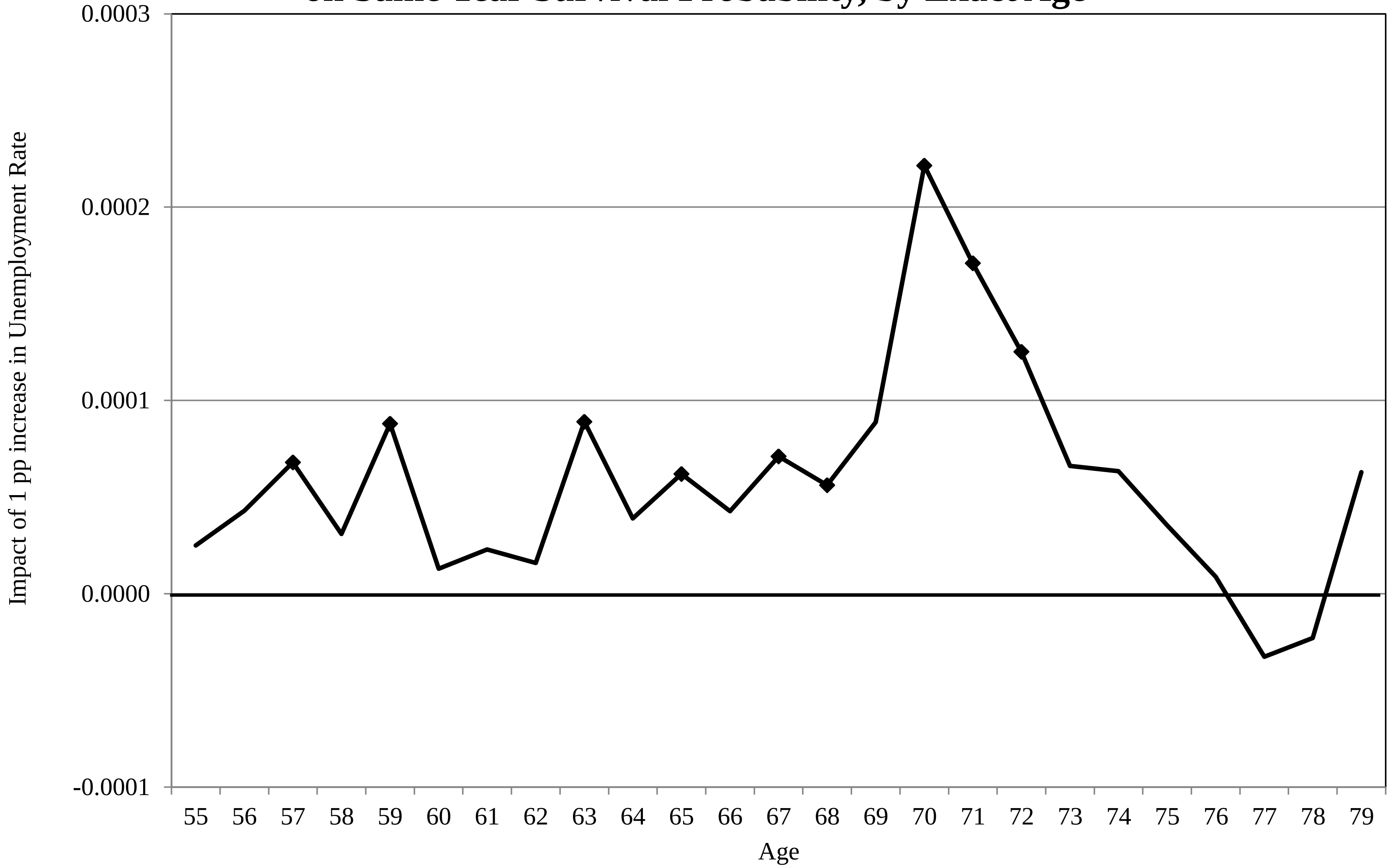


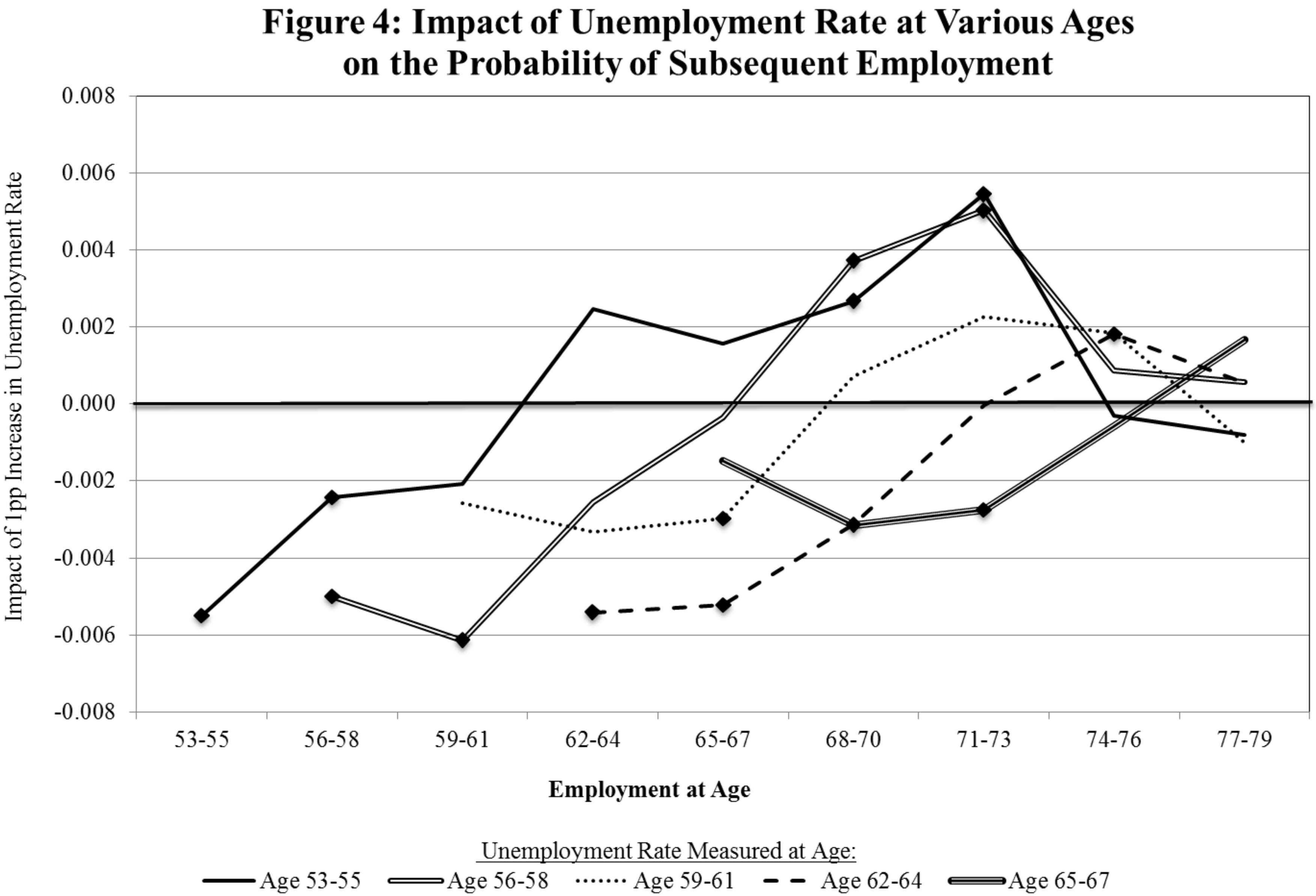
Figure 2: Impact of Unemployment Rate on Same Year Survival Probability, by Exact Age



note: diamonds represent statistically significant (at the 5% level) estimates.

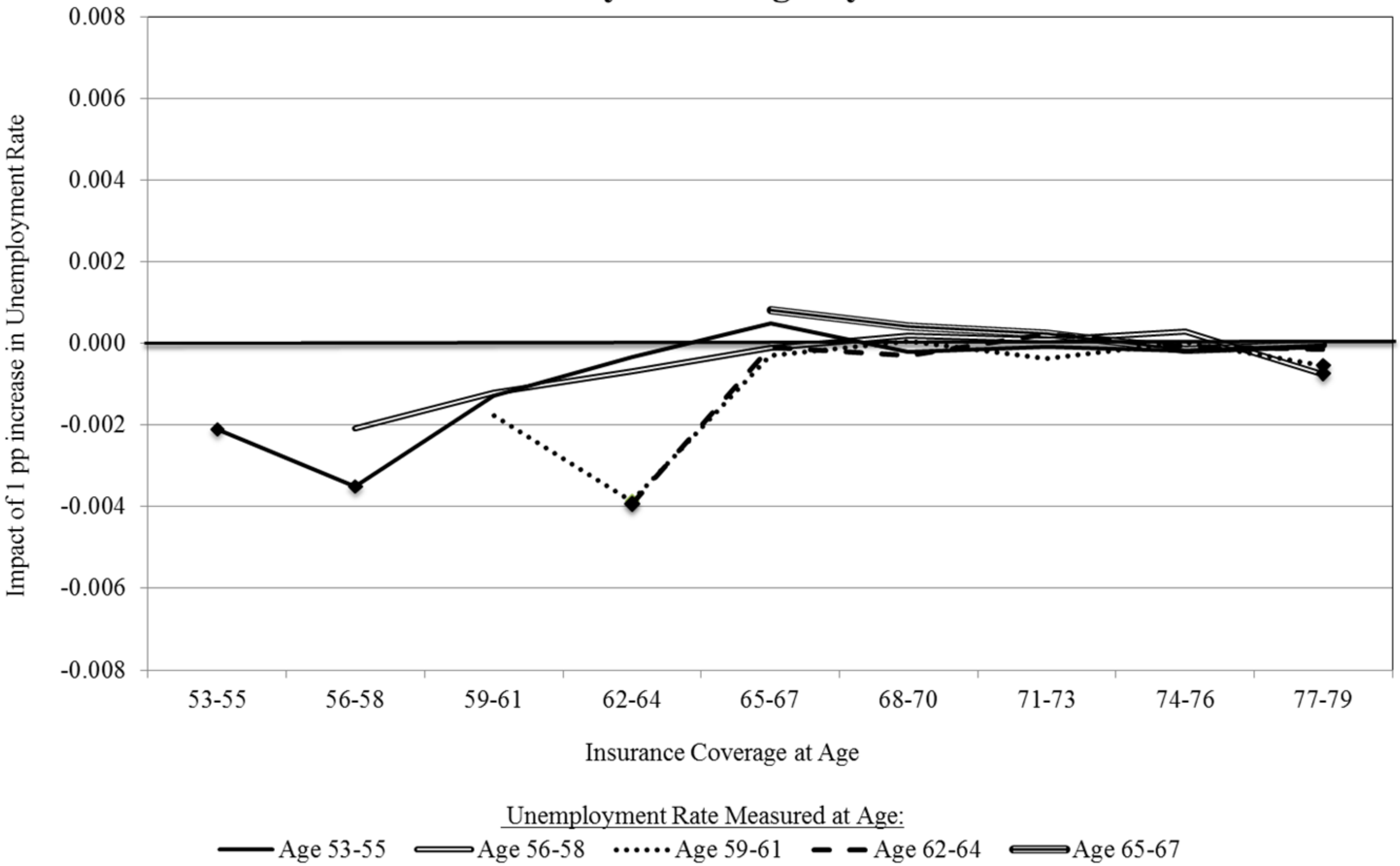
Figure 3: Impact of Unemployment Rate at Various Ages on Subsequent Survival Probabilities

note: diamonds represent statistically significant (at the 5% level) estimates.



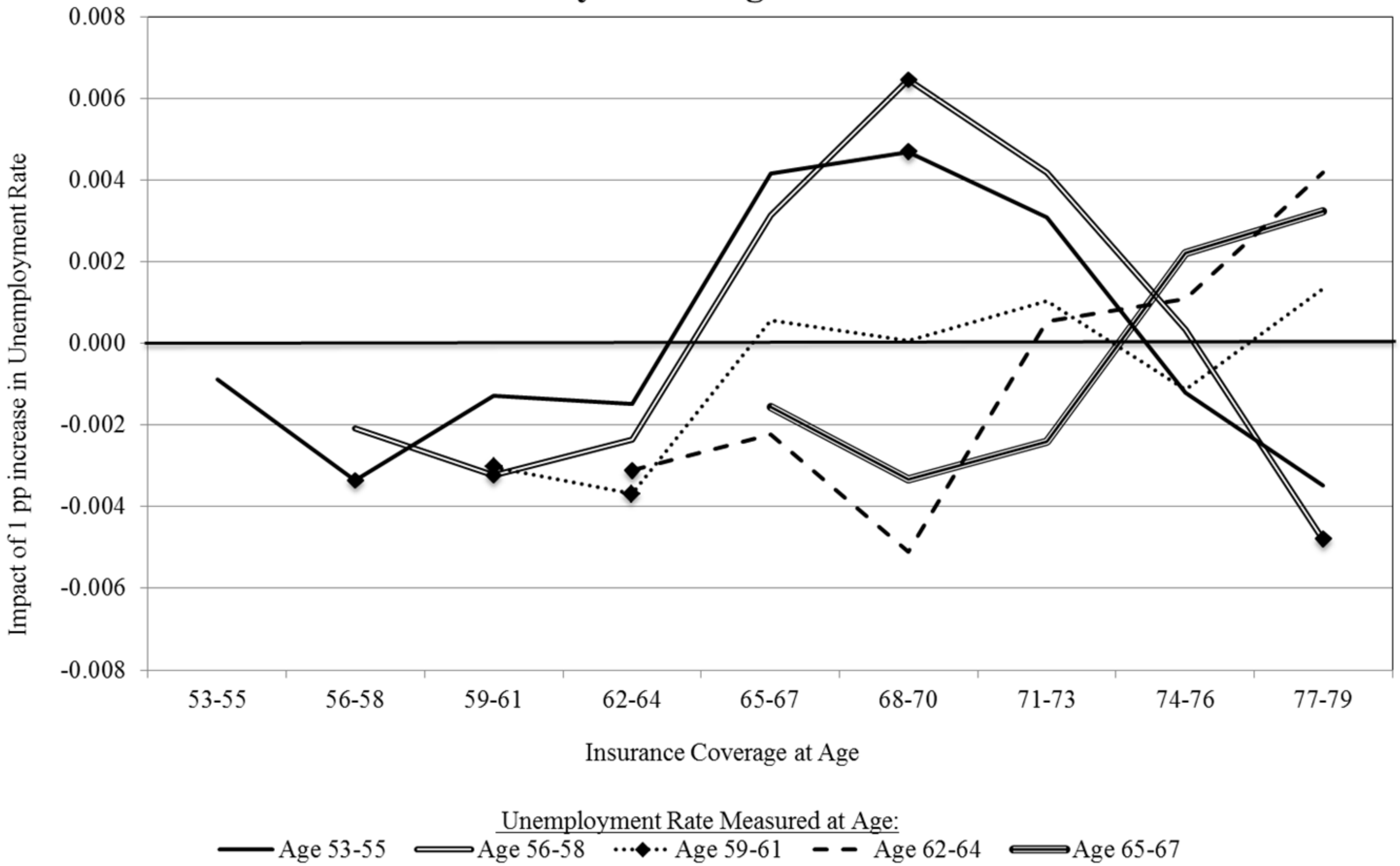
note: diamonds represent statistically significant (at the 5% level) estimates.

Figure 5: Impact of Unemployment Rate at Various Ages on the Probability of Having Any Health Insurance



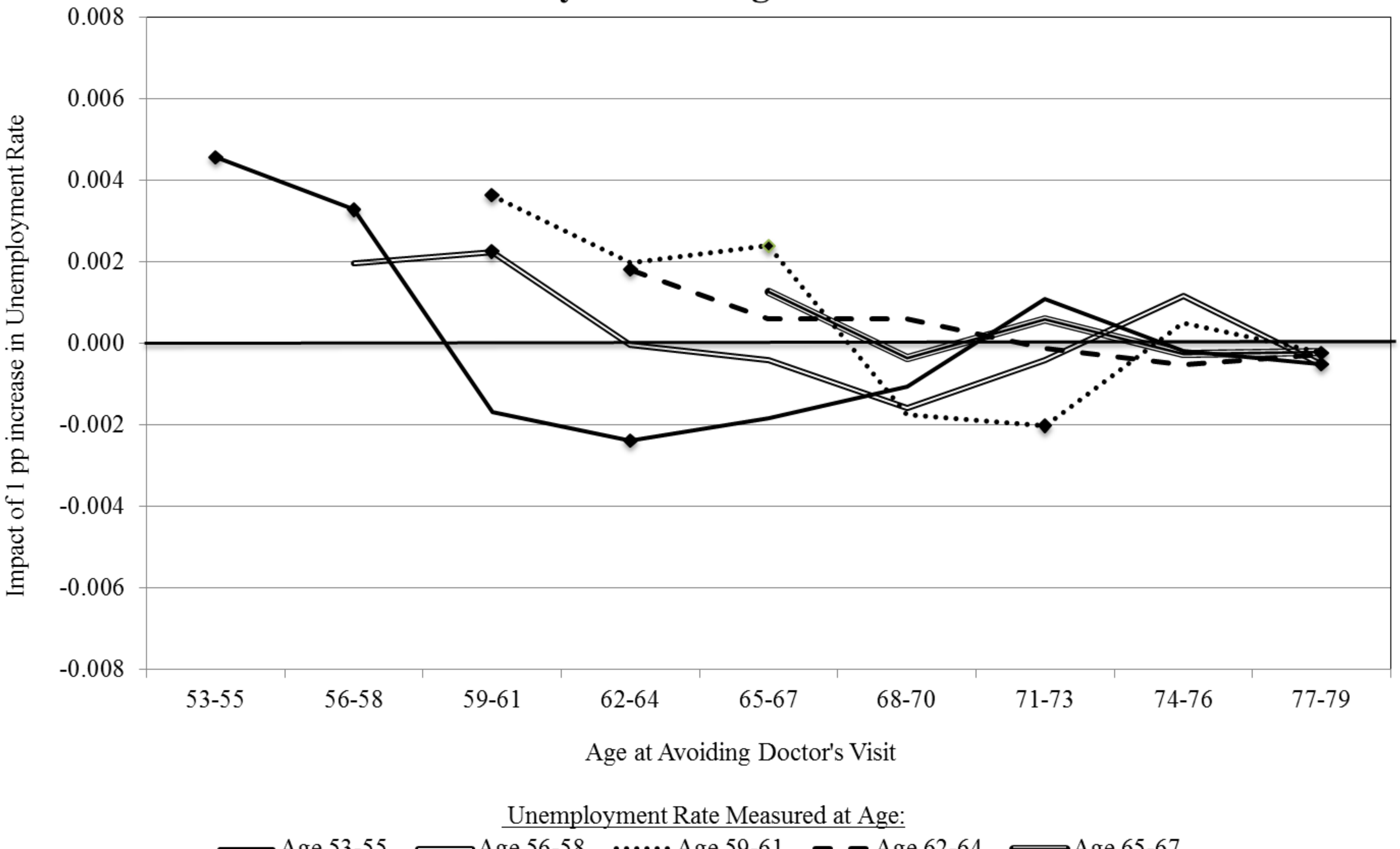
note: diamonds represent statistically significant (at the 5% level) estimates.

Figure 6: Impact of Unemployment Rate at Various Ages on the Probability of Having Private Health Insurance



note: diamonds represent statistically significant (at the 5% level) estimates.

Figure 7: Impact of Unemployment Rate at Various Ages on the Probability of Avoiding a Doctor's Visit Because of Cost



note: diamonds represent statistically significant (at the 5% level) estimates.

Appendix Table 1: Survival Probabilities

Exact	Survival Through Age:												
Age	55	56	57	58	59	60	61	62	63	64	65	66	67
55	0.990	0.980	0.969	0.957	0.945	0.932	0.918	0.903	0.888	0.872	0.855	0.838	0.820
56		0.989	0.978	0.966	0.954	0.940	0.926	0.911	0.896	0.880	0.863	0.845	0.827
57			0.989	0.976	0.964	0.950	0.936	0.920	0.905	0.889	0.871	0.853	0.834
58				0.987	0.975	0.961	0.946	0.930	0.914	0.898	0.880	0.862	0.843
59					0.987	0.973	0.958	0.942	0.925	0.909	0.890	0.872	0.852
60						0.986	0.971	0.954	0.938	0.921	0.902	0.883	0.864
61							0.985	0.968	0.951	0.934	0.916	0.896	0.876
62								0.983	0.966	0.949	0.930	0.910	0.890
63									0.983	0.965	0.945	0.926	0.905
64										0.982	0.962	0.942	0.921
65											0.980	0.959	0.938
66												0.979	0.957
67													0.978
68													
69													
70													
71													
72													
73													
74													
75													
76													
77													
78													
79													

Appendix Table 1 (continued): Survival Probabilities

	Survival Through Age:											
Exact Age	68	69	70	71	72	73	74	75	76	77	78	79
55	0.800	0.780	0.759	0.737	0.714	0.689	0.665	0.639	0.613	0.585	0.557	0.528
56	0.807	0.786	0.765	0.743	0.719	0.695	0.669	0.644	0.617	0.589	0.561	0.531
57	0.814	0.794	0.772	0.749	0.725	0.700	0.675	0.649	0.622	0.594	0.565	0.535
58	0.822	0.801	0.779	0.756	0.732	0.707	0.681	0.654	0.627	0.598	0.569	0.539
59	0.832	0.810	0.788	0.764	0.740	0.714	0.688	0.661	0.633	0.604	0.575	0.544
60	0.843	0.821	0.799	0.775	0.750	0.724	0.697	0.670	0.641	0.612	0.582	0.551
61	0.855	0.833	0.810	0.786	0.761	0.734	0.707	0.679	0.651	0.621	0.591	0.559
62	0.868	0.846	0.823	0.798	0.772	0.746	0.718	0.690	0.661	0.630	0.600	0.568
63	0.883	0.860	0.836	0.811	0.785	0.758	0.730	0.701	0.672	0.641	0.610	0.577
64	0.898	0.875	0.851	0.826	0.799	0.771	0.743	0.714	0.684	0.652	0.620	0.587
65	0.915	0.892	0.867	0.841	0.814	0.786	0.757	0.727	0.696	0.664	0.632	0.598
66	0.934	0.910	0.885	0.858	0.830	0.801	0.772	0.741	0.710	0.678	0.644	0.610
67	0.954	0.929	0.903	0.876	0.848	0.819	0.788	0.757	0.725	0.692	0.658	0.623
68	0.976	0.951	0.924	0.896	0.867	0.837	0.806	0.775	0.742	0.708	0.673	0.637
69		0.974	0.947	0.919	0.889	0.858	0.826	0.794	0.760	0.725	0.690	0.653
70			0.972	0.943	0.912	0.881	0.848	0.815	0.780	0.744	0.708	0.670
71				0.970	0.938	0.906	0.872	0.838	0.802	0.765	0.728	0.689
72					0.967	0.934	0.899	0.864	0.827	0.789	0.750	0.710
73						0.965	0.929	0.893	0.855	0.815	0.775	0.734
74							0.963	0.925	0.885	0.845	0.803	0.760
75								0.960	0.919	0.877	0.834	0.789
76									0.957	0.913	0.868	0.822
77										0.954	0.907	0.858
78											0.950	0.900
79												0.946

Appendix Table 2: Impact of Unemployment Rates at Specific Ages on Survival Rates at Different Ages

Unemp.	Survival to Age:											
at Age:	55	56	57	58	59	60	61	62	63	64	65	66
55	0.0019	0.0065	0.0144	0.0175	0.0189	0.0208	0.0162	0.0138	0.0065	0.0009	-0.0015	-0.0011
	(0.0019)	(0.0034)	(0.0049)	(0.0055)	(0.0055)	(0.0066)	(0.0074)	(0.0079)	(0.0087)	(0.0094)	(0.0098)	(0.0106)
56		0.0039	0.0121	0.0138	0.0149	0.0162	0.0100	0.0091	-0.0012	-0.0079	-0.0116	-0.0127
		(0.0026)	(0.0042)	(0.0057)	(0.0062)	(0.0075)	(0.0077)	(0.0076)	(0.0087)	(0.0093)	(0.0097)	(0.0105)
57			0.0078	0.0089	0.0096	0.0095	0.0042	0.0020	-0.0079	-0.0168	-0.0200	-0.0199
			(0.0028)	(0.0050)	(0.0062)	(0.0083)	(0.0082)	(0.0077)	(0.0083)	(0.0081)	(0.0086)	(0.0095)
58				0.0034	0.0062	0.0050	-0.0028	-0.0114	-0.0202	-0.0290	-0.0303	-0.0311
				(0.0027)	(0.0042)	(0.0061)	(0.0071)	(0.0079)	(0.0092)	(0.0098)	(0.0094)	(0.0093)
59					0.0088	0.0083	0.0027	-0.0071	-0.0167	-0.0270	-0.0272	-0.0311
					(0.0025)	(0.0039)	(0.0057)	(0.0072)	(0.0088)	(0.0103)	(0.0097)	(0.0095)
60						0.0013	0.0003	-0.0059	-0.0099	-0.0184	-0.0186	-0.0235
						(0.0020)	(0.0039)	(0.0054)	(0.0073)	(0.0094)	(0.0101)	(0.0107)
61							0.0023	0.0003	0.0002	-0.0077	-0.0114	-0.0143
							(0.0022)	(0.0037)	(0.0059)	(0.0080)	(0.0090)	(0.0103)
62								0.0016	0.0054	0.0016	0.0022	0.0036
								(0.0025)	(0.0040)	(0.0058)	(0.0059)	(0.0073)
63									0.0089	0.0100	0.0141	0.0193
									(0.0025)	(0.0047)	(0.0050)	(0.0068)
64										0.0039	0.0093	0.0160
										(0.0032)	(0.0046)	(0.0057)
65											0.0062	0.0120
											(0.0028)	(0.0051)

Notes: coefficients and standard errors multiplied by 100.

Appendix Table 2 (continued): Impact of Unemployment Rates at Specific Ages on Survival Rates at Different Ages

Unemp.	Survival to Age:												
at Age:	67	68	69	70	71	72	73	74	75	76	77	78	79
55	-0.0073	-0.0115	-0.0126	-0.0161	-0.0160	-0.0119	-0.0081	-0.0067	-0.0040	-0.0004	0.0010	0.0036	0.0070
	(0.0115)	(0.0127)	(0.0131)	(0.0139)	(0.0148)	(0.0154)	(0.0167)	(0.0193)	(0.0190)	(0.0204)	(0.0212)	(0.0221)	(0.0216)
56	-0.0183	-0.0248	-0.0254	-0.0329	-0.0338	-0.0302	-0.0254	-0.0225	-0.0217	-0.0203	-0.0212	-0.0149	-0.0119
	(0.0118)	(0.0125)	(0.0134)	(0.0143)	(0.0146)	(0.0149)	(0.0159)	(0.0172)	(0.0173)	(0.0189)	(0.0200)	(0.0204)	(0.0203)
57	-0.0234	-0.0275	-0.0282	-0.0371	-0.0386	-0.0368	-0.0326	-0.0335	-0.0323	-0.0301	-0.0325	-0.0268	-0.0226
	(0.0103)	(0.0109)	(0.0119)	(0.0130)	(0.0129)	(0.0132)	(0.0135)	(0.0146)	(0.0154)	(0.0167)	(0.0183)	(0.0192)	(0.0204)
58	-0.0361	-0.0388	-0.0406	-0.0529	-0.0573	-0.0571	-0.0560	-0.0559	-0.0563	-0.0575	-0.0594	-0.0554	-0.0514
	(0.0095)	(0.0110)	(0.0121)	(0.0127)	(0.0132)	(0.0136)	(0.0144)	(0.0156)	(0.0165)	(0.0179)	(0.0201)	(0.0209)	(0.0218)
59	-0.0344	-0.0332	-0.0330	-0.0447	-0.0503	-0.0511	-0.0520	-0.0510	-0.0503	-0.0497	-0.0467	-0.0451	0.0418
	(0.0092)	(0.0104)	(0.0115)	(0.0128)	(0.0141)	(0.0143)	(0.0147)	(0.0151)	(0.0157)	(0.0173)	(0.0193)	(0.0200)	(0.0214)
60	-0.0255	-0.0235	-0.0216	-0.0273	-0.0348	-0.0352	-0.0378	-0.0365	-0.0355	-0.0389	-0.0353	-0.0339	0.0293
	(0.0104)	(0.0107)	(0.0111)	(0.0122)	(0.0140)	(0.0140)	(0.0142)	(0.0144)	(0.0157)	(0.0177)	(0.0190)	(0.0200)	(0.0215)
61	-0.0189	-0.0142	-0.0157	-0.0170	-0.0211	-0.0232	-0.0282	-0.0288	-0.0277	-0.0276	-0.0244	-0.0258	0.0247
	(0.0107)	(0.0110)	(0.0118)	(0.0118)	(0.0131)	(0.0131)	(0.0134)	(0.0129)	(0.0147)	(0.0165)	(0.0166)	(0.0175)	(0.0192)
62	0.0025	0.0064	0.0049	0.0029	0.0041	0.0036	0.0004	-0.0030	-0.0019	-0.0015	0.0001	-0.0070	-0.0140
	(0.0081)	(0.0091)	(0.0098)	(0.0108)	(0.0113)	(0.0108)	(0.0121)	(0.0124)	(0.0127)	(0.0141)	(0.0139)	(0.0150)	(0.0157)
63	0.0208	0.0241	0.0221	0.0220	0.0254	0.0237	0.0231	0.0171	0.0143	0.0134	0.0127	0.0056	-0.0035
	(0.0086)	(0.0095)	(0.0098)	(0.0103)	(0.0108)	(0.0107)	(0.0119)	(0.0121)	(0.0125)	(0.0132)	(0.0133)	(0.0141)	(0.0139)
64	0.0207	0.0239	0.0216	0.0234	0.0297	0.0254	0.0263	0.0182	0.0143	0.0114	0.0086	0.0009	-0.0101
	(0.0076)	(0.0086)	(0.0096)	(0.0103)	(0.0118)	(0.0124)	(0.0139)	(0.0145)	(0.0150)	(0.0157)	(0.0155)	(0.0165)	(0.0166)
65	0.0175	0.0204	0.0157	0.0185	0.0234	0.0193	0.0186	0.0116	0.0092	0.0050	-0.0009	-0.0077	-0.0183
	(0.0071)	(0.0082)	(0.0096)	(0.0109)	(0.0132)	(0.0147)	(0.0159)	(0.0169)	(0.0181)	(0.0193)	(0.0195)	(0.0201)	(0.0207)

Notes: coefficients and standard errors multiplied by 100.

Appendix Table 3: Impact of Unemployment Rates at Specific Ages on Mortality Rates at Different Ages

Unemp.	Survival to Age:											
at Age:	55	56	57	58	59	60	61	62	63	64	65	66
55	-0.0019	-0.0047	-0.0082	-0.0033	-0.0015	-0.0025	0.0046	0.0024	0.0078	0.0065	0.0024	0.0000
	(0.0019)	(0.0023)	(0.0024)	(0.0021)	(0.0022)	(0.0021)	(0.0028)	(0.0032)	(0.0028)	(0.0032)	(0.0038)	(0.0034)
56		-0.0039	-0.0085	-0.0018	-0.0012	-0.0017	0.0064	0.0008	0.0112	0.0077	0.0038	0.0022
		(0.0026)	(0.0027)	(0.0021)	(0.0022)	(0.0023)	(0.0025)	(0.0036)	(0.0027)	(0.0035)	(0.0038)	(0.0034)
57			-0.0078	-0.0011	-0.0008	0.0001	0.0055	0.0022	0.0108	0.0101	0.0036	0.0008
			(0.0028)	(0.0028)	(0.0024)	(0.0030)	(0.0022)	(0.0032)	(0.0023)	(0.0031)	(0.0038)	(0.0037)
58				-0.0034	-0.0029	0.0013	0.0083	0.0093	0.0099	0.0100	0.0022	0.0020
				(0.0027)	(0.0027)	(0.0029)	(0.0021)	(0.0032)	(0.0029)	(0.0036)	(0.0034)	(0.0036)
59					-0.0088	0.0004	0.0060	0.0102	0.0107	0.0113	0.0011	0.0052
					(0.0025)	(0.0024)	(0.0028)	(0.0035)	(0.0033)	(0.0039)	(0.0036)	(0.0034)
60						-0.0013	0.0010	0.0064	0.0045	0.0091	0.0012	0.0060
						(0.0020)	(0.0031)	(0.0033)	(0.0037)	(0.0037)	(0.0039)	(0.0030)
61							-0.0023	0.0020	0.0002	0.0081	0.0049	0.0035
							(0.0022)	(0.0026)	(0.0037)	(0.0035)	(0.0039)	(0.0030)
62								-0.0016	-0.0039	0.0038	-0.0004	-0.0015
								(0.0025)	(0.0031)	(0.0033)	(0.0030)	(0.0032)
63									-0.0089	-0.0014	-0.0043	-0.0058
									(0.0025)	(0.0035)	(0.0027)	(0.0040)
64										-0.0039	-0.0055	-0.0072
										(0.0032)	(0.0028)	(0.0035)
65											-0.0062	-0.0060
											(0.0028)	(0.0034)

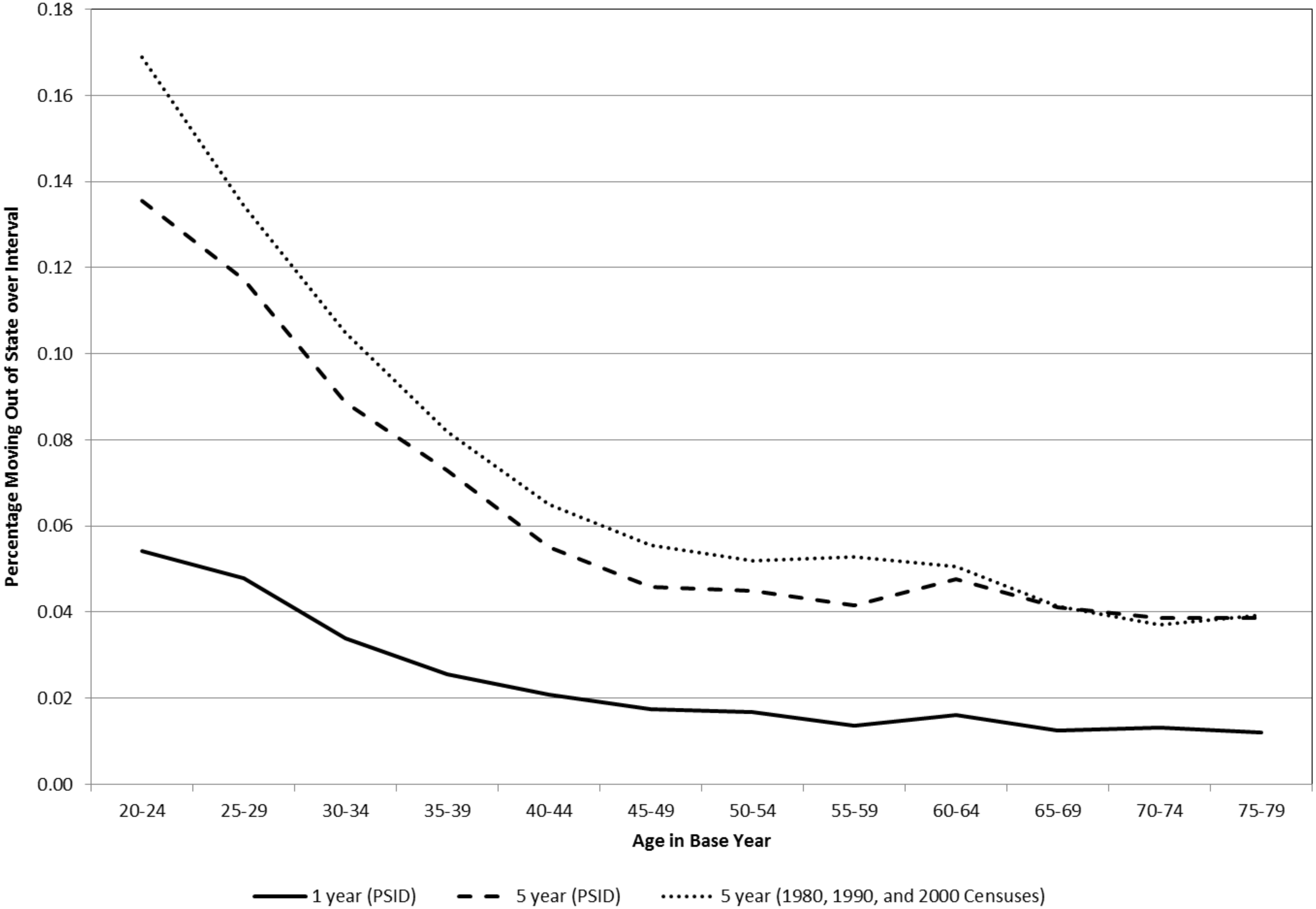
Notes: coefficients and standard errors multiplied by 100.

Appendix Table 3 (continued): Impact of Unemployment Rates at Specific Ages on Mortality Rates at Different Ages

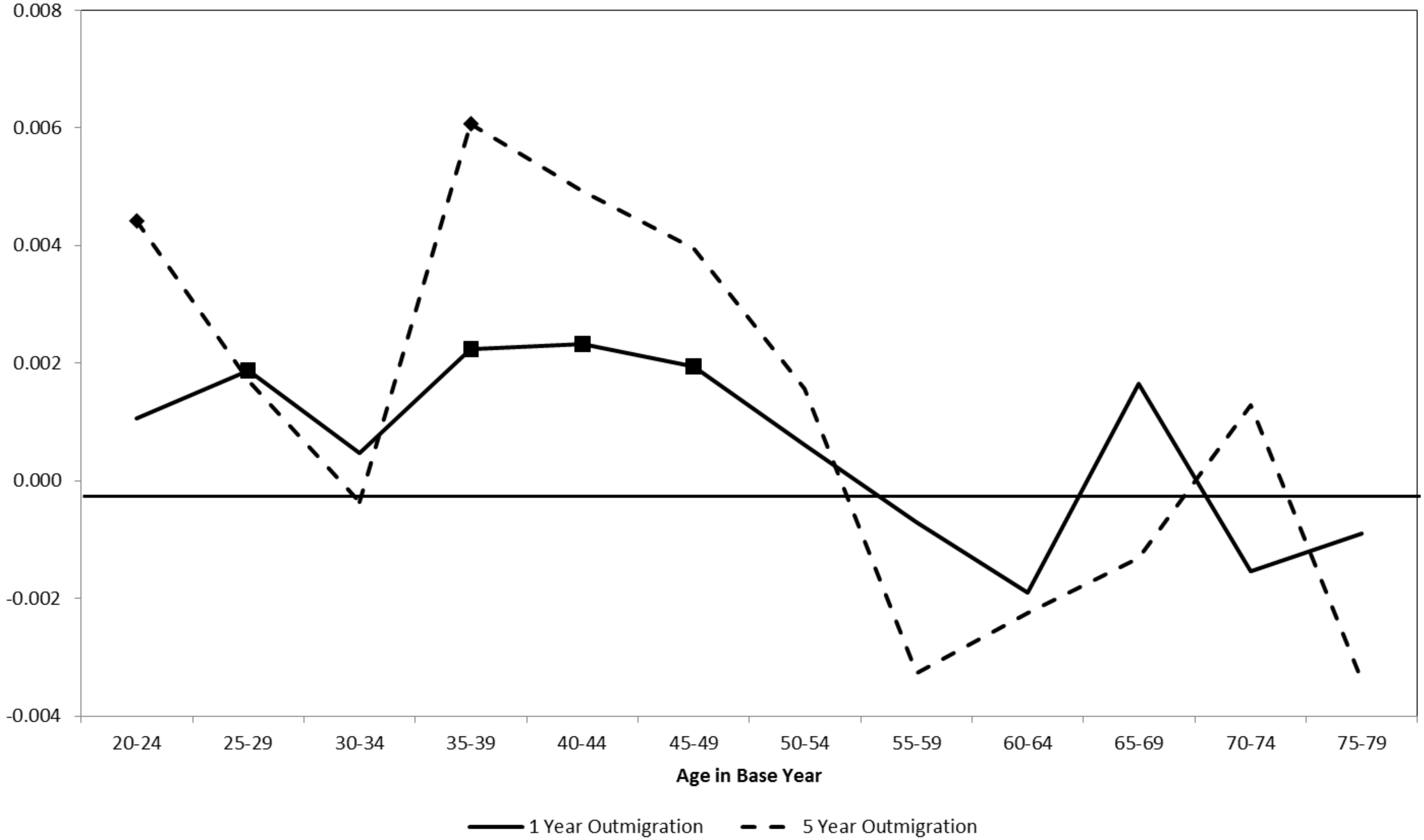
Unemp. at Age:	Survival to Age: 67	68	69	70	71	72	73	74	75	76	77	78	79
55	0.0073	0.0055	0.0013	0.0047	0.0003	-0.0041	-0.0051	-0.0011	-0.0056	-0.0055	-0.0042	-0.0074	-0.0120
	(0.0035)	(0.0039)	(0.0039)	(0.0030)	(0.0044)	(0.0040)	(0.0056)	(0.0061)	(0.0057)	(0.0060)	(0.0068)	(0.0075)	(0.0089)
56	0.0066	0.0085	0.0007	0.0104	0.0026	-0.0030	-0.0055	-0.0030	-0.0017	-0.0008	0.0012	-0.0112	-0.0093
	(0.0037)	(0.0039)	(0.0042)	(0.0035)	(0.0046)	(0.0041)	(0.0047)	(0.0052)	(0.0050)	(0.0065)	(0.0057)	(0.0060)	(0.0082)
57	0.0043	0.0056	0.0013	0.0120	0.0032	-0.0004	-0.0047	0.0025	-0.0012	-0.0012	0.0049	-0.0079	-0.0087
	(0.0037)	(0.0033)	(0.0039)	(0.0036)	(0.0049)	(0.0045)	(0.0047)	(0.0048)	(0.0044)	(0.0060)	(0.0060)	(0.0057)	(0.0081)
58	0.0064	0.0044	0.0026	0.0167	0.0079	0.0027	0.0014	0.0017	0.0029	0.0056	0.0068	-0.0012	-0.0042
	(0.0034)	(0.0032)	(0.0041)	(0.0038)	(0.0053)	(0.0044)	(0.0046)	(0.0044)	(0.0050)	(0.0064)	(0.0066)	(0.0071)	(0.0078)
59	0.0045	-0.0002	0.0001	0.0153	0.0094	0.0033	0.0040	0.0001	0.0011	0.0022	-0.0014	0.0026	-0.0026
	(0.0036)	(0.0030)	(0.0041)	(0.0047)	(0.0046)	(0.0050)	(0.0046)	(0.0048)	(0.0046)	(0.0061)	(0.0063)	(0.0060)	(0.0076)
60	0.0028	-0.0014	-0.0020	0.0074	0.0112	0.0022	0.0056	-0.0009	-0.0001	0.0073	-0.0027	0.0027	-0.0047
	(0.0039)	(0.0035)	(0.0041)	(0.0049)	(0.0046)	(0.0046)	(0.0041)	(0.0049)	(0.0044)	(0.0060)	(0.0065)	(0.0067)	(0.0070)
61	0.0053	-0.0047	0.0020	0.0023	0.0061	0.0037	0.0082	0.0013	0.0003	0.0019	-0.0026	0.0062	0.0019
	(0.0040)	(0.0029)	(0.0039)	(0.0042)	(0.0040)	(0.0050)	(0.0043)	(0.0047)	(0.0055)	(0.0060)	(0.0056)	(0.0059)	(0.0073)
62	0.0010	-0.0045	0.0017	0.0019	-0.0010	0.0005	0.0043	0.0041	-0.0008	-0.0002	-0.0015	0.0139	0.0087
	(0.0034)	(0.0032)	(0.0029)	(0.0034)	(0.0033)	(0.0040)	(0.0042)	(0.0041)	(0.0049)	(0.0059)	(0.0054)	(0.0061)	(0.0071)
63	-0.0021	-0.0041	0.0020	-0.0008	-0.0044	0.0011	-0.0003	0.0070	0.0036	0.0006	0.0013	0.0125	0.0179
	(0.0031)	(0.0032)	(0.0027)	(0.0029)	(0.0035)	(0.0041)	(0.0046)	(0.0038)	(0.0047)	(0.0053)	(0.0056)	(0.0058)	(0.0060)
64	-0.0053	-0.0038	0.0025	-0.0030	-0.0078	0.0042	-0.0020	0.0096	0.0049	0.0035	0.0049	0.0136	0.0220
	(0.0030)	(0.0030)	(0.0034)	(0.0031)	(0.0044)	(0.0041)	(0.0050)	(0.0039)	(0.0046)	(0.0050)	(0.0057)	(0.0058)	(0.0061)
65	-0.0060	-0.0033	0.0050	-0.0038	-0.0058	0.0044	0.0006	0.0086	0.0036	0.0060	0.0098	0.0128	0.0221
	(0.0029)	(0.0034)	(0.0040)	(0.0032)	(0.0050)	(0.0046)	(0.0054)	(0.0040)	(0.0050)	(0.0054)	(0.0061)	(0.0061)	(0.0060)

Notes: coefficients and standard errors multiplied by 100.

Appendix Figure 1: Outmigration Rates, by Age

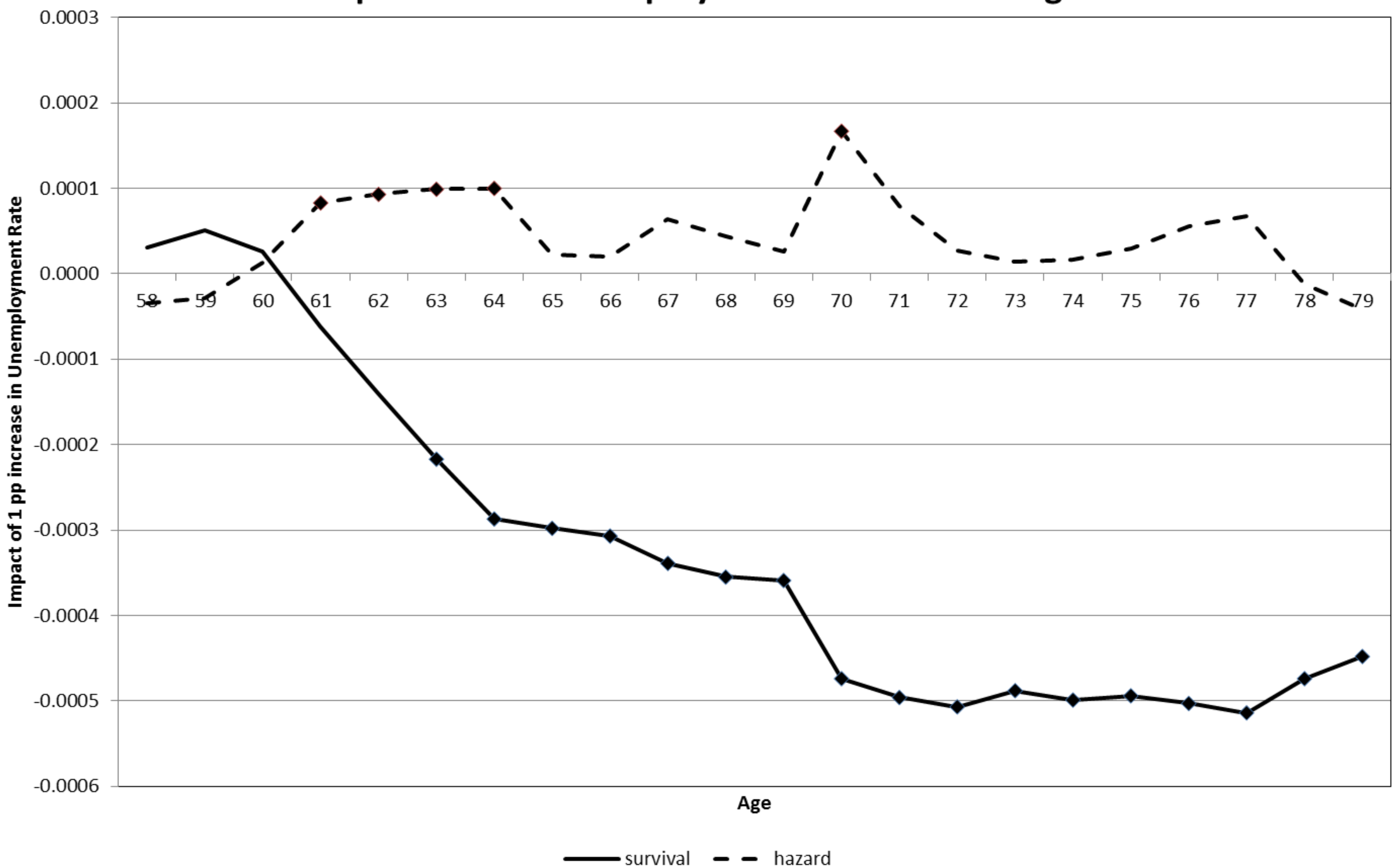


Appendix Figure 2: Impact of Labor Market Conditions on State-Level Outmigration, by Age



note: diamonds represent statistically significant (at the 5% level) estimates.

Appendix Figure 3: Relationship between Survival and Hazard Estimates in Response to an Unemployment Rate Shock at age 58



note: diamonds reflect statistically significant coefficients.