RECESSIONS, JOB LOSS, AND MORTALITY

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ABSTRACT

Objectives. We analyzed how the business cycle, recessions in particular, and job loss jointly shape mortality risks among older Americans.

Methods. Using data from the Health and Retirement Study (HRS), we selected individuals who were employed and therefore at risk of job loss during the observation period from 1992-2010. We tested whether the business cycle moderates the effect of job loss on mortality and whether individuals who experience and who do not experience job loss are differentially affected by the recessions.

Results. Job loss during recessions is strongly predictive of mortality (HR = 1.7; 95% confidence interval = 1.2, 2.5). Job loss during normal times or booms is not associated with mortality. For employed workers, we found no effect of recessions on mortality risks on average, but some evidence suggesting that economy-wide and local economic contractions have offsetting effect on mortality.

Conclusion. Recessions increase mortality risks among older Americans losing their jobs. During recessions, health professionals and policy makers should target screening efforts and resources to this group.

INTRODUCTION

A rich empirical literature has demonstrated that job loss causes economic strain,[1–6] stress,[7–9] mental illness,[10–12] cardiovascular disease,[13,14] and increased mortality risks[15,16] in the U.S. population. While studies on the effect of individual job loss suggest adverse health effects, macro-level studies indicate that recessions, i.e., periods of high job loss rates and persistent unemployment, are associated with better health outcomes and lower mortality rates.[17–22] The present study attempts to reconcile these seemingly contradictory results and clarify how recessions and job loss jointly impact mortality risks among older Americans.

Using data from the Health and Retirement Survey for the period from 1992 to 2010, we study mortality in a representative sample of individuals who have been employed and at risk of experiencing job loss at some point during the observation period. We exploit macro-economic variation over the observation period to assess whether the effect of job loss on mortality is moderated by the business cycle and test whether job loss is particularly hazardous if it occurs during a recession. Furthermore, we separately analyze individuals who do and individuals who do not experience job loss, to test whether these groups are differentially affected by recessions.

We address two gaps in research on the impact of job loss and recessions on mortality. First, previous research has not examined whether the effect of job loss varies with the state of the business cycle in the U.S., or has analyzed the effect of job loss during recessions only.[15] Martikainen and colleagues have examined the mortality effect of job loss in one boom period and one bust period in Finland,[23] but it is not clear whether these findings are applicable to the U.S., which lacks the welfare state institutions that protect unemployed workers against the adverse effect of job loss in Skandinavian countries.[3,4,16,24–26] Second, because prior research on

the mortality effects of recessions has almost exclusively focused on aggregate associations between macro-economic variables and mortality rates, it has left the role of individual labor market processes undefined. By examining whether employed and laid-off/displaced workers are differentially affected by recessions, we assess whether individual labor market states and transitions matter for understanding the association between recessions and mortality.

We hypothesize that losing your job in a recession leads to a persistent increase in mortality risks thereafter.[15,27,28] Recessions affect the economic prospects of labor market participants by making job losses more frequent and vacancies scarce.[2,29] Individuals losing their job during recessions face bleak re-employment prospects, because more jobless workers compete for fewer job openings. This mismatch between job seekers and vacancies results in longer unemployment spells, and if a new job is found, worse job quality, including lower pay and increased risk of involuntary part-time employment.[2,29–31] Compared to younger workers, older workers in particular face difficulties finding re-employment after job loss and therefore have a harder time to make up for lost earnings and savings.[32–34] Recent research also suggests that recessions force older workers via unemployment into early retirement.[35,36] Job loss and recessions therefore put older workers at risk of a permanently lowered standard of living,[37] and the resulting economic strain and stress should lead to an increase in short- and long-term mortality risks.[38]

It is less clear, whether and how individuals who do not lose their job should be affected by recessions. Earlier work has argued that recessions are a cause of economic strain and stress, because they destroy private wealth and extend the threat of job loss to workers who typically consider their jobs to be secure, which should increase mortality risks even among individuals not experiencing job loss.[27,39–43] However, recessions also imply reduced labor demand that may

lead to a reduction in working hours among the employed, reduced workplace stress and accidents, and increased leisure time to be invested into activities enhancing health and well-being.[18,19,44]

Consistent with the latter argument, influential studies have documented a pattern of "pro-cyclical mortality" among working age and elderly Americans, i.e. periods of recession are associated with lower mortality rates and boom periods are associated with higher mortality rates.[17,18,21] Studies using data on more recent recessions, however, find no association between recessions and mortality rates among Americans aged 45-64.[45,46] Moreover, evidence on the labor market and health mechanisms mediating the relationship between recessions and mortality remains contradictory.[28,45,47] Finally, since it is now standard practice to identify the impact of the business cycle on mortality from deviations of state-level macroeconomic variables from their annual economy-wide mean,[18–20,45–47] little is known about the impact of economy-wide macroeconomic variation which is a defining feature of the business cycle. If state-level and economy-wide changes have different effects on mortality, as at least on influential study indicates,[18] drawing conclusions from state-level variation about the impact of recessions is misleading. We will explore this issue empirically below.

METHODS

The analyses rely on waves A through M (1992-2010) of the Health and Retirement Survey (HRS), a multi-cohort panel survey representative of the U.S. population aged 50+ that records individual data on labor market outcomes, health and mortality every two years.[48] We restrict the sample to individuals who have been in a dependent employment relationship and therefore at risk of job loss at some point during the observation period. In keeping with

conventions in the economic and epidemiological literature on job loss,[13–15] we focus on normative or non-marginal employment spells and discard jobs that lasted less than one year, paid zero earnings and in which individuals worked less than 36 weeks per year or less than 16 hours per week.

Individuals are classified as treated if they experience job loss due to lay-off or firm closure in between the age 45 and their cohort-specific full retirement age, around age 66. Individuals are classified as controls, if they do not experience job loss during the observation period, i.e., they either remained employed or had other exits from work, mainly retirements. We dropped control spells that ended before age 45 and control spells that started after the individual's full retirement age. If individuals had multiple job losses from eligible employment spells, we selected the first spell. After imposing these restrictions, the primary analysis sample comprised of 9,382 individuals, among whom 1,653 (18%) experience job loss (see Table 1). 289 job losses occur in recessionary local labor market contexts as defined below (Table A1, Appendix). Our outcome is all-cause mortality. We observe 1,295 deaths.

[Table 1]

In keeping with econometric studies on the effect of recessions on mortality, we operationalize the business cycle as variation in local labor demand, which we measure using four unemployment rates from which we extract a common factor: annual county unemployment rates which are available for the entire active workforce only (Bureau of Labor Statistics, BLS); annual commuting zone unemployment rates calculated from the county unemployment rates (BLS); monthly state-level unemployment rate among 45-66 year olds (calculated from the Current Population Survey, CPS, seasonally adjusted); annual state-level unemployment rate

among 45-66 year olds (CPS). Commuting zones are regional aggregates of counties based on commuting patterns that may better capture the economic area defining individual economic opportunities.

Each measure provides unique information that is either locally, temporally, or demographically specific to labor market conditions older workers face, but neither measure combines all three features. We therefore employed factor analysis to extract a common, latent variable capturing local labor demand for older workers. We constructed a dataset for all 51 states and 3,145 counties for the period from January 1992 to December 2011. We removed geographic unit means and unit linear trends from each series to isolate cyclical variation and then extracted the first factor using common factor analysis. The first factor had an Eigenvalue of 3.3 and explained 98% of the variability in the input variables, summarizing variation in local labor demand for older workers in one statistic. A factor score, varying over counties and calendar months, was obtained using the regression method.

Initial analyses indicated a highly non-linear effect of local labor demand. We therefore split the factor score into six quantiles. Figure A1 (Appendix) summarizes the distribution of the unemployment measures used in the factor analysis within each quantile of the factor score. Job losses on labor markets falling into the 5^{th} (second to highest) quantile (Q5) occurred under labor market conditions still close to the de-trended historical mean for 1992-2011. Job losses in the 6^{th} (highest) quantile (Q6) occurred at (de-meaned and de-trended) mean unemployment rates around 2.3 percentage points above the historical mean, similar to conditions experienced by job losers during the Great Recession (2007-09). Table A1 in the Appendix list the incidence of job losses and recessionary labor market conditions in each year in the analysis sample. HRS respondents are observed under recessionary conditions (Q6) in the years from 1992-1994 and

after 2008. The identifying variation for the interaction between job loss and recessionary labor market conditions comes from job losses that occurred during 1992-1994, because the follow-up period to study job losses that occurred during the Great Recessions is still too short in the HRS data.

We modeled time in months from entry into survey to death or censoring in a discrete-time framework using complementary log-log regression. Parameter estimates from this model have a hazard ratio interpretation.[49] To flexibly adjust for variation in the baseline hazard, we control for time at risk by adjusting for 19 12-month period dummies. We run two types of models: First, we assess whether recessions moderate the impact of job loss on mortality. The respective model includes a dummy variable for job loss, indicator variables for the labor demand quantiles, and interactions between job loss dummy and labor demand indicators. Second, we split the sample into treated and controls to estimate whether the local labor demand indicators have an effect on mortality. Job loss and labor demand indicators are specified as monthly, time-varying variables. For individuals experiencing job loss, the labor demand indicators stays fixed at the value in the month job loss occurs for the remainder of the observation period, because we expect that job loss causes a persistent increase in mortality risks. For either type of analysis, the baseline model adjust for birth cohort (6 categories), age at first interview in months and its square, year of first interview (3), gender (2), ethnicity (4), birth place (10), and parental education (4), and state of residence (measured in the wave prior to job loss, other job exits or censoring).

To adjust for compositional differences between treated and controls or between individuals observed in different business cycle states, we control for an extensive set of socio-economic and health-related predictors of job loss and mortality measured at the wave prior to

job loss, other exit or censoring: household (HH) wealth, HH income, individual earnings, health insurance coverage, hours worked, weeks worked, marital status, BMI, number of alcoholic drinks per day, current smoker, ever smoked, self-rated depression, self-rated health, change in self-rated health, self-rated cognitive function, and ever diagnosed with cancer, diabetes, heart problems, high blood pressure.

To adjust for time-varying confounders, such as changes in medical treatment, we also adjust for calendar year fixed effects and census-division linear trends, both standard control variables used in econometric studies on the association between macro-economic variables and mortality rates. We also ran models replacing the state fixed effects with county fixed effects. Because the large number of county fixed effects relative to deaths resulted in convergence problems, adjustment for county fixed effects was only possible in the full analysis sample. All analyses were conducted using Stata Version 13 (StataCorp, College Station, TX).

RESULTS

Individuals who experience and who do not experience job loss differ somewhat in their baseline characteristics (Table 2). Job losers are younger, have lower levels of education, earnings, household wealth and income, are less likely to have health insurance coverage and more likely to be current or former smokers, but are less likely to report pre-existing health conditions (cancer, diabetes, heart problems, hypertension).

[Table 2]

Panel A of Table 3 reports the effects of job loss on mortality for the six labor demand quantiles. Model 1 (M1) controls for demographic characteristics fixed at birth or entry into the

survey as well as state of residence. Model 2 (M2) adds demographic, socio-economic, behavioral risk factors and health variables. Model 3 (M3) adds year fixed effects and census division-specific linear trend.

The estimates in Panel A provide no indication of a systematic effect of job loss on mortality during normal economic times or booms. Hazard ratios vary around 1 and do not reach statistical significance. However, job losses during recessionary conditions are associated with substantially elevated mortality risks (M1). After adjusting for an extensive set of individual level confounders (M2), the effect still remains sizeable (full results in Appendix Table A2), and it increases in size and precision once we adjust for year fixed effects and census division linear trends (M3). Our preferred estimate (M3) indicates that compared to individuals not experiencing job loss, mortality risks of individuals losing their job during a recession are elevated by a factor of 1.7 (95% confidence interval [CI] = 1.2, 2.5). Adjusting confidence intervals for clustering of observations at the county-level yielded virtually identical estimates.

[Table 3]

As a robustness check, we re-estimated Model 1 replacing state with county fixed effects, including only those counties where these effects were identified, which reduced sample size by 7%. This hardly affected results; the effect of job loss during a recession increased marginally (HR = 1.9; CI = 1.3, 2.7), and further increased to 2.2 (CI = 1.5, 3.2) after adjusting for year fixed effects. Adding further variables resulted in non-convergence of the maximum likelihood estimator. We found no significant differences between the effect of lay-offs during recessions and displacements (due to firm closure) during recessions. We also did not find significant gender differences in the effect of job loss during recessions.

Next, we split the dataset into controls and treated and estimated the effect of the labor demand indicators in each subsample. We adjust these estimates for confounding using the same control variables as in the preceding analysis. Among the treated, there is clear and consistent evidence of counter-cyclical mortality (Table 3, Panel B). Mortality hazards increase as the business cycle enters a downturn, with a particularly sharp increase during recessions, the only estimate reaching statistical significance. This effect is robust to inclusion of an extensive set of control variables, year fixed effects and census division linear trends. The robustness of results is also an indication that compositional differences over the business cycle among the treated are not driving the interaction effect between recessions and job loss reported in Panel A of Table 3.

For individuals at risk of but not experiencing job loss, our results are sensitive to the strategy used to identify the effect of cyclical variation. Models 1 and 2 exploit variation in labor demand over time within counties. In Model 3, the year fixed effects capture the impact of time-varying, economy-wide macro-economic and other shocks on mortality, while local labor demand indicators capture the effect of local labor demand deviations from annual economy-wide means. To clarify the joint impact of year fixed effects and local labor demand shocks, we re-estimated Model 3 omitting the linear trends, because they are mechanically correlated with the year fixed effects. Dropping the trends did not affect the local labor demand coefficient estimates.

Figure 1 plots the estimated annual mortality hazards together with the national unemployment rate for workers aged 45-66. None of the year fixed effects are individually significant at the 5% level, because they are highly collinear with the local labor demand indicators, but they are jointly significant at the 10% level (p-value = 0.059). We observe elevated mortality hazards in the early 1990s, in 2003-4, and especially after 2007 (Figure 1), i.e.

during or immediately after economy-wide recessions, and relatively low mortality rates in the late 1990s and early 2000s. Both series are highly correlated (r=0.84). While the year fixed effects absorb all unobserved, economy-wide factors causing year-to-year changes in mortality risks, for example due to medical innovation, they display a striking countercyclical pattern. The spike in mortality hazards during the Great Recession in particular suggests that the annual mortality hazards in part reflect macro-economic events, especially since many individual level factors unrelated to the business cycle that could account for changes in mortality hazards over time are already accounted for.

[FIGURE 1]

These results indicate that recent recessions may be associated with increased mortality risks among individuals at risk of but not experiencing job loss (Figure 1). This effect is fully offset by reductions in mortality risks in local labor markets experiencing particularly strong contraction relative to the annual mean (Table 3, M3), indicating that the adverse effects of economy-wide contractions are localized in labor markets experiencing weaker than average levels of contraction. A plausible mechanism is that working hours among the employed drop more in labor markets experiencing stronger than average contraction compared to labor markets experiencing weaker than average contractions, freeing up more leisure time that is invested into activities enhancing health and well-being.[18,19] Because the economy-wide and local incidence of recessionary demand conditions is highly correlated over time and because they have opposite effects on mortality, they cancel each other out on average, which is why we observe hazard ratios close to 1 in Models M1 and M2 (Table 3, Panel C).

DISCUSSION

We have analyzed the joint impact of recessions and job loss on mortality in a representative sample of older Americans who were observed in a non-marginal, dependent employment relationship in the period from 1992 to 2010. Compared to individuals not experiencing job loss, mortality risks among individuals losing their job in a recession are elevated by a factor of 1.7 (95% CI = 1.2, 2.3), which is similar in size to the effect on mortality of having a GED certificate rather than a postgraduate degree in this sample. This result is consistent with a recent study indicating that men losing their jobs during mass lay-offs in Pennsylvania during the early 1980s recession experienced persistent increases in mortality risks.[15] We show that this effect exists in a representative sample of older American men and women and in a more recent context, but also that job loss increases mortality risks during recession only, and not during normal economic times or booms. Consequently, policy makers and health professionals should focus screening efforts and resources on individuals particularly vulnerable to the effects of recessions, i.e., older workers losing their job.

Extrapolating our findings to the Great Recession, we might expect even larger adverse effects for older workers who have lost their job, because the labor market downturn was stronger and more persistent compared to the recession in the early 1990s, on which our estimates are effectively based.[2,29] A mitigating factor may have been improvements in medical care to the extent that the health conditions caused by job loss, e.g. cardiovascular and mental illness, have become more treatable.[50–52] However, to the extent that job loss entails restrictions in care access, individuals experiencing job loss may not have fully benefited from these advances in treatment.[52,53] Further research needs to clarify which health conditions are affected

by job loss during recessions and whether access to health care following job loss moderates this relationship.

For individuals at risk of but not experiencing job loss, our results indicate that economy-wide contractions are associated with higher mortality hazards while local economic contractions relative to the economy-wide annual mean were associated with lower mortality hazards. Because these effects cancel each other out during recessions, recessionary labor market conditions are on average not associated with mortality among individuals that did not experience job loss. While it has been common practice in recent studies to identify the effect of the business cycle from local (e.g. state-level) deviations of macro-economic variables from their economy-wide annual mean,[18–20,44–47] this approach may be uninformative about the aggregate impact of the business cycle if local and national cyclical variation have different effects on mortality. Ruhm's similarly found that mortality for some causes of death including heart disease may be counter-cyclical with respect to economy-wide and pro-cyclical with respect to local macro-economic fluctuations.[18] Future research should focus on exploring the impact of both local and national cyclical variation theoretically and empirically.

Finally, one should consider our results in the context of the comparatively weak U.S. social safety net. A recent study found stronger effects of unemployment on mortality among less educated workers in the U.S. compared to Germany.[16] Other studies on Western European countries also report weaker if any effects of job loss on health and mortality.[23,25,54,55] These cross-national differences suggest that welfare state institutions, such as generous unemployment insurance and universal health care access, could weaken the effect of job loss on health.[16,25,26] An important direction for future research is to test whether different features of the U.S. safety

net for the unemployed have protective health effects and whether these effects vary with the state of the business cycle.

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TABLES AND FIGURES

Table 1. Characteristics of the Analysis Sample by Treatment Status (n=9,382). Health and Retirement Study 1992-2010.

	No Job Loss	Job Loss
Individuals	7,729	1,653
Total person years	97,427	22,304
Deaths	1,076	219
Mean years of follow-up	12.6	13.5
Crude death rate per 1000 person-years	11.0	9.8

Table 2. Characteristics of Respondents in Analysis Sample by Treatment Status. Health and Retirement Study 1992-2010.

		All	Job Loss (T)	No Job Loss (C)	(T) – (C)
Average Age at First Interview (years)		53.5	52.8	53.7	-0.9
Birthyear	1919-1930	2.3	0.5	2.7	-2.2
	1931-1935	17.8	13.1	18.8	-5.7
	1936-1940	26.4	28.3	26.0	2.3
	1941-1945	19.4	23.6	18.5	5.1
	1946-1950	17.8	20.3	17.2	3.1
	1951-1955	12.7	11.5	13.0	-1.5
	1956-1966	3.5	2.7	3.7	-1.0
First Interview Year: 1919-1930		62.0	63.2	61.8	1.4
	1931-1935	17.4	18.9	17.0	1.9
	1936-1940	20.6	17.8	21.2	-3.3
Female		54.3	54.6	54.3	0.3
Ethnicity	White	74.2	73.9	74.3	-0.3
	Black	15.3	13.7	15.7	-2.0
	Hispanic	8.6	10.0	8.2	1.8
	Other, n.a.	1.9	2.4	1.8	0.5
Place of Birth: New England		4.7	5.3	4.6	0.7
	Mid Atlantic	14.5	14.3	14.6	-0.2
	East North Central	18.0	18.2	17.9	0.3
	West North Central	9.7	8.0	10.1	-2.0
	South Atlantic	16.7	16.5	16.7	-0.3
	East South Central	8.7	8.6	8.7	-0.1
	West South Central	9.0	7.8	9.2	-1.4
	Mountain	3.3	3.1	3.3	-0.2
	Pacific	6.2	6.9	6.0	0.9
	Outside U.S.	9.3	11.2	8.9	2.3
Parental education: <High School		40.4	41.8	40.1	1.7
	=High school	34.0	33.9	34.1	-0.2
	>High school	20.3	18.0	20.8	-2.8
	Missing	5.3	6.4	5.1	1.3
Own Education: <High School		15.0	17.4	14.5	2.9
	GED	5.1	7.2	4.6	2.6
	High school	50.1	52.4	49.6	2.8
	Some college	5.8	4.9	6.0	-1.1
	Bachelor	13.6	12.1	13.9	-1.8
	Postgraduate	10.5	6.0	11.5	-5.5
Average weeks employed per year		50.7	51.3	50.6	0.7
Average hours worked per week		41.3	41.3	41.3	0.0
Individual Earnings :Q1		20.0	24.3	19.1	5.2
	Q2	20.0	23.2	19.3	3.9
	Q3	20.0	19.4	20.2	-0.8
	Q4	20.0	18.4	20.3	-1.9
	Q5	20.0	14.8	21.1	-6.3
Household Wealth: Q1		24.4	28.3	23.5	4.8
	Q2	15.6	17.4	15.2	2.2
	Q3	20.0	19.9	20.0	-0.1
	Q4	20.0	18.3	20.4	-2.1
	Q5	20.0	16.1	20.8	-4.8

Continued

Table 2 continued

	All	Job Loss (T)	No Job Loss (C)	(T) – (C)
Household Income: Q1	20.0	18.8	25.3	6.5
Q2	20.0	19.6	21.7	2.0
Q3	20.1	20.1	19.9	-0.2
Q4	20.0	20.8	16.6	-4.1
Q5	19.9	20.7	16.5	-4.1
Health Insurance Coverage	89.9	91.2	83.7	-7.4
Married, Partnered	75.6	75.7	75.0	-0.8
Divorced, Separated	14.1	13.7	15.9	2.2
Widowed	6.8	7.1	5.3	-1.8
Never Married	3.5	3.5	3.8	0.3
Body Mass Index: Q1	19.9	20.2	18.6	-1.7
Q2	20.1	20.2	19.6	-0.6
Q3	20.0	19.9	20.4	0.5
Q4	20.3	20.2	20.7	0.5
Q5	19.3	19.2	19.8	0.6
Missing	0.4	0.3	0.8	0.5
Number of Drinks per Day: 0	54.7	55.4	51.3	-4.1
<1	11.5	10.5	16.3	5.8
1-2	24.6	25.2	22.1	-3.1
3-4	6.6	6.5	6.8	0.3
>4	2.6	2.4	3.5	1.1
Ever Smoked	60.5	59.7	64.1	4.4
Current Smoker	21.6	20.3	27.6	7.3
Self-Rated Memory: Excellent	9.9	9.5	12.2	2.8
Very Good	29.8	29.6	30.6	1.0
Good	41.8	42.2	40.2	-2.0
Fair	16.2	16.6	14.5	-2.1
Poor	2.2	2.1	2.5	0.3
Ever Diagnosed With: Cancer	7.3	7.6	5.8	-1.8
Diabetes	12.7	13.2	10.2	-3.0
Heart Problems	11.9	12.7	7.9	-4.9
High Blood Pressure	40.8	42.1	34.8	-7.2
Average Depression Score on 8-item CES-D Scale	1.1	1.1	1.2	0.1
Self-Reported Health: Excellent	16.6	16.4	17.5	1.2
Very Good	35.0	35.5	32.5	-3.0
Good	32.1	31.8	33.5	1.7
Fair	13.8	13.9	13.7	-0.1
Poor	2.5	2.4	2.7	0.3
Self-Reported Health Change: Much better	2.6	2.5	3.5	1.1
Somewhat better	7.9	7.9	8.0	0.1
Same	68.2	68.9	64.8	-4.2
Somewhat worse	14.2	14.6	12.4	-2.2
Much worse	1.2	1.2	1.1	-0.1
Missing	5.8	4.8	10.2	5.3

Note. Numbers in table are sample percentages unless otherwise distinguished.

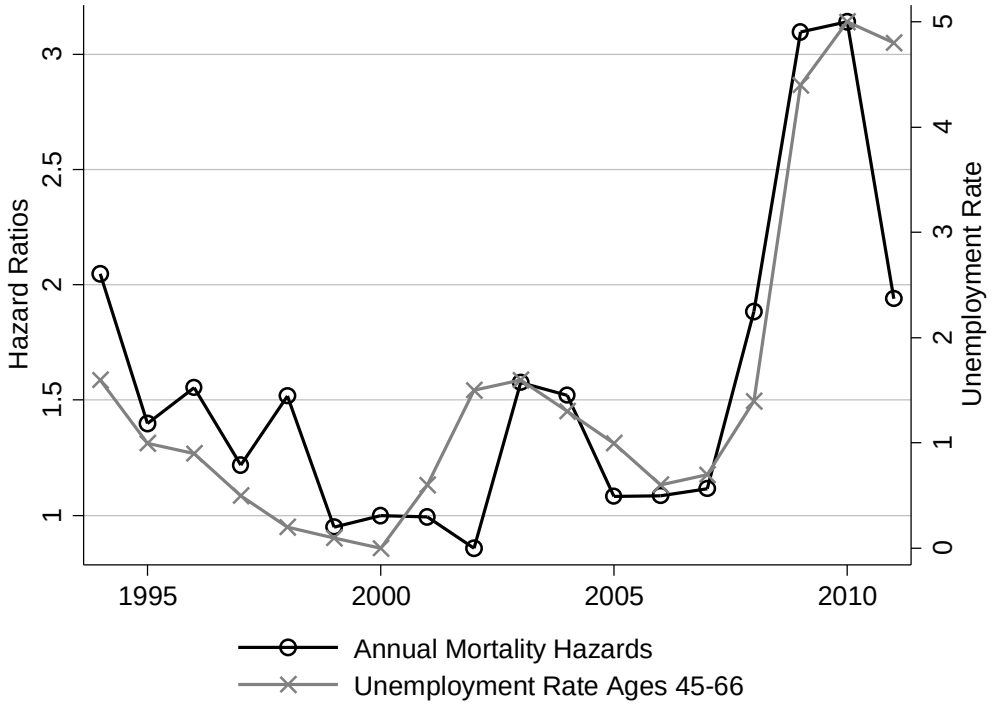
Table 3. Effect of Job Loss and Local Labor Demand on Mortality Hazard. Health and Retirement Study, 1992-2010.

	Model 1: Demographic Characteristics and State Fixed Effects		Model 2: Model 1 + Socioeconomic Characteristics and Risk Factors		Model 3: Model 2 + Year Fixed Effects + Census Division Trends	
	exp(b)	95% CI	exp(b)	95% CI	exp(b)	95% CI
	A. Full Sample (9,382 individuals; 1,295 deaths), Ref.: Individuals not Experiencing Job Loss					
Q1 = Boom	0.85	(0.57, 1.26)	0.83	(0.56, 1.25)	0.74	(0.49, 1.12)
Q2	1.04	(0.69, 1.57)	1.05	(0.69, 1.60)	0.96	(0.63, 1.47)
Q3	1.16	(0.76, 1.78)	0.94	(0.61, 1.43)	0.87	(0.56, 1.34)
Q4	1.00	(0.68, 1.45)	0.98	(0.67, 1.44)	0.95	(0.64, 1.40)
Q5	1.16	(0.80, 1.68)	0.89	(0.61, 1.29)	0.89	(0.60, 1.31)
Q6 = Recession	1.82**	(1.29, 2.58)	1.53*	(1.07, 2.19)	1.68**	(1.15, 2.46)
Model DF	93		146		172	
	B. Individuals Experiencing Job Loss (N=1,653; 219 Deaths)					
Q1 = Boom	Ref.		Ref.		Ref.	
Q2	1.04	(0.59, 1.84)	1.17	(0.65, 2.10)	1.25	(0.69, 2.25)
Q3	1.30	(0.74, 2.28)	1.17	(0.65, 2.11)	1.25	(0.69, 2.26)
Q4	1.31	(0.77, 2.23)	1.18	(0.67, 2.10)	1.24	(0.70, 2.23)
Q5	1.59	(0.96, 2.66)	1.21	(0.69, 2.13)	1.28	(0.72, 2.27)
Q6 = Recession	2.51***	(1.51, 4.19)	2.08*	(1.16, 3.72)	2.30**	(1.27, 4.16)
Model DF	79		132		157	
	C. Individuals Not Experiencing Job Loss (N=7,729; 1,076 Deaths)					
Q1 = Boom	Ref.		Ref.		Ref.	
Q2	0.97	(0.81, 1.17)	0.98	(0.81, 1.18)	0.93	(0.76, 1.13)
Q3	0.94	(0.76, 1.17)	0.94	(0.76, 1.17)	0.86	(0.68, 1.09)
Q4	0.99	(0.77, 1.26)	1.00	(0.78, 1.28)	0.88	(0.67, 1.17)
Q5	0.98	(0.72, 1.32)	1.00	(0.74, 1.35)	0.70	(0.47, 1.04)
Q6 = Recession	1.08	(0.79, 1.47)	1.07	(0.79, 1.46)	0.54*	(0.31, 0.95)
Model DF	86		139		164	

Note. CI = confidence interval; DF = degrees of freedom. Estimates from complementary log-log regression. Local labor demand is defined by six quantiles (Q1-Q6) of a factor score extracted from four unemployment rate measures. Demographic characteristics: birth cohort, gender, ethnicity, birth place, parental education, first interview year, age at first interview. Socio-economic characteristics: education, household wealth, household income, individual earnings, weeks worked, hours worked, health insurance coverage, marital status. Risk factors: BMI, ever smoked, currently smoking, drinks per day, depressive symptoms, self-rated health, change in self-rated health, self-rated cognitive function, ever diagnosed with cancer, diabetes, high blood pressure, heart problems.

* $P < .05$; ** $P < .01$; *** $P < .001$.

Figure 1. Year Fixed Effects Estimates (Annual Mortality Hazards), Adjusted for Variation in Local Labor Demand.



Note. The hazard ratios are estimates of the year fixed effects from a regression that is identical to the one reported in the third column of Table 3, Panel C (Model 3) except that census division-specific linear trends were omitted. The estimated hazard ratio for 2011 may be unreliable because data is only available for a small fraction of respondents in that year, since most individuals had their last interview in 2010. The reference year for the year fixed effects is 2000. Plotted alongside is the national unemployment rate for individuals aged 45-66, normalized to zero in the year 2000. The correlation coefficient for both series is 0.84 (0.91 without the 2011 observation).

APPENDIX

Appendix

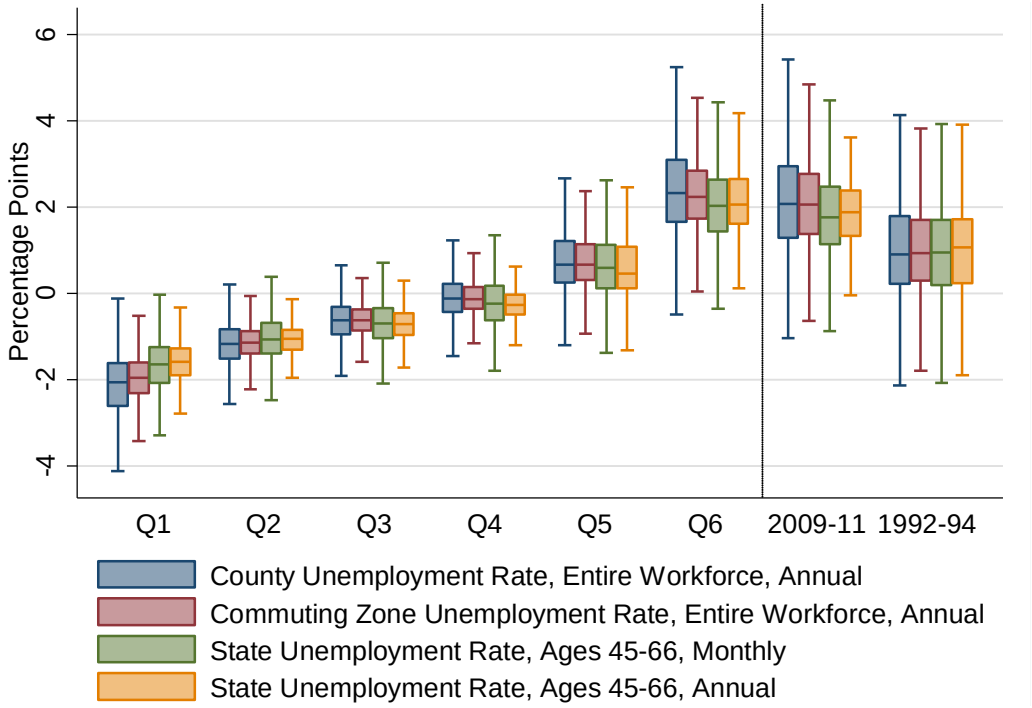
Table A1. Aggregate Unemployment Rates, Recessionary Conditions and Job Losses.

Year	Unemployment Rate 45-66 Year Olds (calculated from Current Population Survey)	% of HRS Sample Observed in Recessionary Local Labor Market Conditions (Q6)	Number of Job Losses in HRS Sample	Number of Job Losses in Recessionary Labor Market Conditions (Q6) in HRS Sample
1990	3.4			
1991	4.9			
1992	5.5	81.6	56	48
1993	5.2	51.7	158	89
1994	4.1	10.6	148	24
1995	3.5	3.0	123	1
1996	3.4	2.8	98	
1997	3.0	2.7	91	
1998	2.7	2.4	83	
1999	2.6	2.1	96	
2000	2.5	2.0	79	
2001	3.1	2.0	84	
2002	4.0	2.0	81	
2003	4.1	2.1	61	1
2004	3.8	1.8	52	
2005	3.5	1.6	96	
2006	3.1	1.6	63	
2007	3.2	1.5	63	
2008	3.9	1.5	76	
2009	6.9	70.6	98	83
2010	7.5	80.7	38	38
2011	7.3	65.9*	5*	5*
2012	6.7			
2013	5.9			

Note. *Most individuals interviewed in the last HRS wave (M) included in the analysis were interviewed in 2010, making the 2011 estimates unreliable. We observe job losses under recessionary labor market conditions as defined by the 5th quintile of the factor score in the early 1990s and between 2008 and 2011. Since the follow-up period from the Great Recession (2007-2009) is too short, the identifying variation for the interaction between job loss and recessionary conditions comes from job losses that occurred in the early 1990s. As Figure A1 shows, the labor market downturn in the aftermath of the early 1990s recession was clearly less severe than the labor market downturn during the Great Recession.

Appendix

Figure A1. Distribution of Unemployment Rate Variables Used in Factor Analysis within Quintiles of the Resulting Factor Score. 1992-2011.



Note. The box plots display the distribution of the unemployment rate variables used as inputs in the factor analysis. The factor analysis was performed on data for all U.S. counties and states over the period from January 1992 to December 2011. Each variable was de-meaned and de-trended prior to factor analysis. The resulting factor variable varies at the county-month level and was split into six quantiles. The groups of box plots labeled "Q1" through "Q6" display the distribution of the unemployment rate variables within the factor score quantiles for all counties/states over the entire observation period from January 1992 to December 2011. The groups of box plots to the right of the dashed line display the distribution of the unemployment variables for two periods during which we observe recessionary labor market conditions (see Table A1): the aftermath of the early 1990s recession, January 1992 (beginning of observation period) to December 1994, and the Great Recession, January 2009 to December 2011 (end of observation period).

Table A2. Full Regression Output for Table 3, Panel A, Model 2. Health and Retirement Study 1992-2010.

Complementary log-log regression

Number of obs = 1436776
Zero outcomes = 1435481
Nonzero outcomes = 1295

LR chi2(146) = 1993.080
Log likelihood = -9377.9597
Prob > chi2 = 0.000

	exp(b)	Std. Err.	z	P>z	[95% Conf.	Interval]
Local Labor Demand Indicators (Ref.: Q1)						
Q2	0.968	0.091	-0.350	0.729	0.806	1.163
Q3	0.936	0.101	-0.620	0.538	0.757	1.156
Q4	1.000	0.122	0.000	0.999	0.788	1.269
Q5	0.952	0.142	-0.330	0.739	0.710	1.275
Q6	0.870	0.117	-1.040	0.297	0.669	1.131
Job Loss	0.832	0.171	-0.890	0.373	0.556	1.246
Local Labor Demand Indicators x Job Loss						
Q2 x Job Loss	1.267	0.368	0.820	0.415	0.717	2.238
Q3 x Job Loss	1.125	0.334	0.400	0.692	0.629	2.011
Q4 x Job Loss	1.180	0.333	0.590	0.556	0.679	2.051
Q5 x Job Loss	1.065	0.302	0.220	0.823	0.612	1.856
Q6 x Job Loss	1.835	0.520	2.140	0.032	1.053	3.197
Baseline Hazards (Ref.: Year 2)						
1	0.037	0.019	-6.340	0.000	0.013	0.103
3	0.873	0.176	-0.670	0.501	0.589	1.296
4	1.382	0.253	1.760	0.078	0.965	1.979
5	1.294	0.246	1.350	0.176	0.891	1.878
6	1.580	0.304	2.380	0.018	1.083	2.304
7	1.758	0.342	2.900	0.004	1.201	2.574
8	2.081	0.392	3.890	0.000	1.439	3.011
9	1.991	0.371	3.700	0.000	1.382	2.870
10	1.757	0.338	2.930	0.003	1.206	2.562
11	2.698	0.483	5.550	0.000	1.900	3.832
12	3.339	0.601	6.700	0.000	2.346	4.752
13	3.557	0.651	6.930	0.000	2.484	5.092

Continued

Table A2 continued

	exp(b)	Std. Err.	z	P>z	[95% Conf.	Interval]
14	3.292	0.621	6.320	0.000	2.275	4.764
15	4.193	0.757	7.940	0.000	2.944	5.973
16	5.385	0.981	9.240	0.000	3.768	7.697
17	6.435	1.279	9.370	0.000	4.359	9.500
18	11.934	2.694	10.980	0.000	7.667	18.576
19	90.961	33.267	12.330	0.000	44.417	186.280
First Interview Age	1.002	0.014	0.160	0.875	0.976	1.029
First Interview Age^2	1.000	0.000	0.330	0.742	1.000	1.000
Birth Cohort (Ref.: 1919-1930)						
1931-1935	0.872	0.145	-0.820	0.412	0.630	1.209
1936-1940	0.833	0.195	-0.780	0.433	0.526	1.317
1941-1945	0.838	0.248	-0.600	0.551	0.469	1.497
1946-1950	0.697	0.283	-0.890	0.374	0.315	1.544
1951-1955	0.810	0.432	-0.400	0.692	0.285	2.303
1956-1966	0.776	0.636	-0.310	0.757	0.156	3.868
First Interview Year (Ref.: 1992-1997)						
1998-2003	0.815	0.154	-1.080	0.280	0.562	1.181
2004-2009	1.180	0.434	0.450	0.653	0.574	2.426
Female (Ref.: Male)	0.598	0.043	-7.210	0.000	0.520	0.687
Ethnicity (Ref.: White)						
Black	0.943	0.087	-0.640	0.520	0.787	1.129
Hispanic	0.648	0.095	-2.970	0.003	0.486	0.862
Other	1.217	0.299	0.800	0.424	0.752	1.971
Birth Place (Ref.: New England)						
Mid Atlantic	0.752	0.147	-1.460	0.145	0.513	1.103
East North Central	0.743	0.147	-1.500	0.134	0.504	1.096
West North Central	0.586	0.134	-2.340	0.019	0.375	0.917
South Atlantic	0.817	0.160	-1.030	0.303	0.557	1.200
East South Central	0.662	0.144	-1.900	0.057	0.433	1.013
West South Central	0.587	0.129	-2.420	0.016	0.381	0.904
Mountain	0.603	0.164	-1.860	0.063	0.354	1.027
Pacific	0.674	0.164	-1.620	0.105	0.419	1.085
Outside U.S.	0.510	0.112	-3.080	0.002	0.332	0.783

Continued

Table A2 continued

	exp(b)	Std. Err.	z	P>z	[95% Conf.	Interval]
Highest Parental Educational Degree (Ref.: <High School)						
High School	1.003	0.071	0.050	0.963	0.873	1.153
>High school	1.060	0.099	0.620	0.536	0.882	1.273
Missing	1.150	0.132	1.220	0.221	0.919	1.439
State FIPS Code (Ref.: 1)						
4	0.696	0.247	-1.020	0.308	0.347	1.397
5	1.663	0.512	1.650	0.099	0.909	3.041
6	0.851	0.229	-0.600	0.548	0.502	1.442
8	1.090	0.356	0.260	0.793	0.574	2.068
9	0.502	0.189	-1.830	0.067	0.240	1.049
11	2.119	1.091	1.460	0.145	0.773	5.813
12	0.846	0.214	-0.660	0.507	0.516	1.388
13	0.893	0.245	-0.410	0.680	0.522	1.528
17	0.757	0.207	-1.020	0.309	0.443	1.295
18	0.776	0.222	-0.890	0.376	0.443	1.360
19	1.048	0.364	0.140	0.892	0.531	2.069
20	0.787	0.408	-0.460	0.644	0.285	2.172
22	0.763	0.308	-0.670	0.503	0.345	1.685
24	0.575	0.189	-1.690	0.092	0.302	1.094
25	0.676	0.232	-1.140	0.255	0.345	1.325
26	0.808	0.218	-0.790	0.429	0.476	1.371
27	0.655	0.231	-1.200	0.231	0.327	1.309
28	0.672	0.202	-1.320	0.186	0.373	1.211
29	0.892	0.272	-0.370	0.709	0.490	1.624
31	0.670	0.291	-0.920	0.356	0.286	1.568
32	1.076	0.817	0.100	0.923	0.243	4.765
33	0.710	0.276	-0.880	0.378	0.332	1.521
34	0.883	0.250	-0.440	0.662	0.507	1.540
36	0.622	0.172	-1.720	0.085	0.362	1.068
37	0.761	0.226	-0.920	0.357	0.426	1.361
38	0.835	0.370	-0.410	0.684	0.350	1.990
39	0.803	0.236	-0.750	0.455	0.451	1.430
40	1.277	0.457	0.680	0.494	0.633	2.576
41	0.746	0.266	-0.820	0.412	0.371	1.501
42	0.676	0.199	-1.330	0.182	0.380	1.202
45	0.850	0.283	-0.490	0.625	0.443	1.631
47	0.959	0.261	-0.150	0.878	0.563	1.634

Continued

Table A2 continued

	exp(b)	Std. Err.	z	P>z	[95% Conf.	Interval]
48	1.182	0.323	0.610	0.540	0.692	2.019
51	0.559	0.168	-1.930	0.053	0.311	1.008
53	0.784	0.289	-0.660	0.510	0.381	1.616
54	0.809	0.258	-0.660	0.507	0.433	1.513
55	0.896	0.275	-0.360	0.719	0.491	1.634
56	0.865	0.436	-0.290	0.773	0.322	2.322
Own Education (Ref.: <High School)						
GED	1.181	0.093	2.110	0.035	1.012	1.377
High school	1.003	0.121	0.020	0.983	0.791	1.271
Some college	1.171	0.158	1.170	0.242	0.899	1.527
Bachelor	0.902	0.102	-0.910	0.362	0.723	1.125
Postgraduate	0.998	0.131	-0.020	0.988	0.771	1.292
HH Wealth (Ref.: Q1)						
Q2	0.934	0.081	-0.780	0.435	0.787	1.108
Q3	0.827	0.073	-2.160	0.031	0.697	0.983
Q4	0.810	0.076	-2.250	0.025	0.674	0.973
Q5	0.833	0.088	-1.720	0.086	0.677	1.026
Individual Earnings (Ref.: Q1)						
2	0.980	0.089	-0.220	0.823	0.820	1.171
3	1.047	0.106	0.450	0.651	0.859	1.276
4	1.039	0.119	0.340	0.736	0.831	1.300
5	1.036	0.144	0.260	0.799	0.789	1.361
HH Income (Ref.: Q1)						
Q2	1.001	0.096	0.010	0.995	0.829	1.208
Q3	0.917	0.104	-0.760	0.447	0.735	1.146
Q4	0.982	0.126	-0.140	0.890	0.764	1.264
Q5	0.834	0.129	-1.170	0.241	0.616	1.130
Health Insurance Coverage	0.919	0.090	-0.860	0.389	0.759	1.114
Marital Statues (Ref.: Married, Partnered)						
Divorced, Separated	1.253	0.113	2.500	0.012	1.050	1.495
Widowed	0.947	0.114	-0.460	0.649	0.748	1.198
Never Married	1.439	0.217	2.420	0.016	1.071	1.933
Weeks Worked	1.027	0.011	2.610	0.009	1.007	1.048
Hours Worked	1.003	0.003	0.870	0.382	0.997	1.009

Continued

Table A2 continued

	exp(b)	Std. Err.	z	P>z	[95% Conf.	Interval]
BMI (Ref.: Q1)						
Q2	0.747	0.066	-3.290	0.001	0.628	0.889
Q3	0.804	0.072	-2.440	0.015	0.676	0.958
Q4	0.741	0.066	-3.360	0.001	0.622	0.883
Q5	0.767	0.073	-2.770	0.006	0.636	0.925
Missing	1.671	0.859	1.000	0.318	0.610	4.579
Number of Drinks per Day (Ref.: 0)						
<1	1.288	0.103	3.170	0.002	1.101	1.507
1-2	0.812	0.069	-2.440	0.015	0.687	0.960
3-4	0.930	0.116	-0.580	0.562	0.728	1.188
4+	1.531	0.240	2.710	0.007	1.125	2.082
Ever Smoked	1.449	0.112	4.780	0.000	1.245	1.687
Current Smoker	1.843	0.127	8.880	0.000	1.610	2.109
Self-Rated Memory (Ref.: Excellent)						
Very Good	0.908	0.087	-1.010	0.314	0.752	1.096
Good	0.792	0.075	-2.450	0.014	0.657	0.954
Fair	0.761	0.084	-2.470	0.014	0.612	0.946
Poor	0.571	0.116	-2.750	0.006	0.383	0.851
Ever Diagnosed with (Ref.: No Diagnosis)						
Cancer	1.501	0.141	4.310	0.000	1.248	1.805
Diabetes	1.814	0.137	7.860	0.000	1.564	2.104
Heart Problems	1.315	0.101	3.560	0.000	1.131	1.528
High Blood Pressure	1.134	0.070	2.030	0.043	1.004	1.281
CES-D Score	1.001	0.018	0.070	0.946	0.967	1.037
Self-Rated Health (Ref.: Excellent)						
Very Good	1.321	0.141	2.600	0.009	1.071	1.629
Good	1.706	0.185	4.920	0.000	1.379	2.110
Fair	2.225	0.279	6.380	0.000	1.740	2.846
Poor	3.735	0.665	7.400	0.000	2.635	5.294
Self-Rated Health Change (Ref.: Much Better)						
Somewhat Better	0.739	0.129	-1.730	0.083	0.525	1.040
Same	0.730	0.106	-2.180	0.029	0.550	0.969
Worse	0.760	0.122	-1.710	0.087	0.555	1.041
Much Worse	0.557	0.137	-2.370	0.018	0.344	0.903
Missing	1.183	0.295	0.670	0.500	0.726	1.928
Constant	0.000	0.000	-2.430	0.015	0.000	0.111