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2015s-34

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Série Scientifique/Scientific Series

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Montréal
Juillet 2015

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ISSN 2292-0838 (en ligne)

Partenaire financier
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Employer downsizing and older workers' health*

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Résumé/abstract

We estimate the effects of employer downsizing on older workers' health outcomes using different approaches to control for endogeneity and sample selection. With the exception of the instrumental variables approach, which provides large imprecise estimates, our results suggest that employer downsizing increases the probability that older workers rate their health as fair or poor; increases the risk of showing symptoms of clinical depression; and increases the risk of being diagnosed with stroke, arthritis, and psychiatric or emotional problems. We find weaker evidence that downsizing increases the risk of showing high levels of C-reactive protein (CRP), a measure of general inflammation. We find that downsizing affects health by increasing job insecurity and stress, but that its effects remain statistically significant after controlling for these pathways, suggesting that other mechanisms such as diminished morale and general demotivation also affect worker health. Our findings suggest that employers ought to consider actions to offset the detrimental health effects of reducing personnel on their remaining (older) workers.

Mots clés/keywords : Older workers, employer downsizing, health outcomes.

Codes JEL/JEL Codes *:* I12, M51

* This research was supported by the National Institute on Aging, under grant R01AG040176. We thank Nancy Campbell, Orla Hayden, Prodyumna Goutam and Nelly Mejia for excellent research assistance, and Clifford Grammich for excellent editorial assistance. Errors are our own.
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1. Introduction

Previous research has found that job loss can adversely affect health, especially for older workers. Job loss has been linked to increased risk of heart problems and stroke (Gallo et al., 2004 and Gallo et al., 2006); of depression and mental illness (Browning and Heinesen, 2012; Burgard et al., 2007 and Gallo et al., 2000); hospitalizations due to drinking, car accidents, and suicide attempts (Browning and Heinesen, 2012 and Eliason and Storrie, 2009b); and overall mortality (Browning and Heinesen, 2012; Eliason and Storrie, 2009a and Sullivan and Von Wachter, 2009).

Fewer studies have focused on the potential health effects of working for an employer experiencing economic difficulties. For example, workers that remain employed at a firm following a mass layoff or personnel downsizing may suffer psychological stress due to increased uncertainty about the future. Diminished morale and work demotivation might also increase due to changes in the work environment. These factors are likely to affect a large fraction of the population, much larger than the one affected by unemployment. For instance, data from the Health and Retirement Study (HRS) indicates that about 6% of workers who were 50 to 55 years old in 2008 reported to be unemployed in 2010, whereas 44% reported that they continued to be employed but with employers that had permanently downsized their workforce. These numbers suggests that we should pursuit a better understanding of the effects that worsened or uncertain employment conditions can have on those who remain employed.

This paper makes several contributions to the existing literature on how employers' economic distress might affect workers' health. While previous research has explored how increased levels of job insecurity affect workers' health, many measures of job insecurity may correlate with unobserved health conditions. For instance, a worker expectation of job loss can increase if he feels physically unable to perform the tasks their job requires. This potential reverse causality makes it difficult to disentangle the causal effect of job insecurity on workers' health. Our first contribution to the literature is studying the effect of employer downsizing (i.e. a permanent reduction in employment) on individuals' health, rather than focusing on subjective measures of job insecurity. Downsizing is an indicator for economic distress that is likely determined by influences other than workers' health, although studying its effects presents its own challenges. Most notably, we found evidence of positive selection of workers who remain

employed at downsizing employers. Higher education and longer tenure are associated with an increased probability of keeping one's job, as is better health. Since we focus on the health effects of downsizing for workers who retained their jobs, we posit that our estimates are a lower bound of the effects downsizing would have on the average worker, in the absence of positive surviving selection.

Our second contribution to the literature is using richer longitudinal information on health measures and job characteristics than in previous studies. This improves our ability to perform additional robustness checks in our analysis, including fixed effects and instrumental variables estimates, and strengthens the validity of our estimates as causal effects. The availability of a large set of health measures also allows us to study a more complete set of outcomes, including biomarkers collected from dried-blood samples. An important advantage of using these biomarkers is that they are not contaminated by self-report bias.

Our third contribution to the literature is using data that is representative of older workers in the United States (U.S.). With a few exceptions (e.g., Lee et al., 2004), previous work has mostly focused on data from a single employer or industry (e.g., Ferrie et al., 2002) to study how employment conditions (mostly job insecurity) affects health. Results from studies using data from single employers or industries might not generalize to a larger population. Also in contrast with previous work, we focus our study on older workers (50 years and older), for whom worsened or uncertain employment conditions may have a higher toll on their health. No prior work has analyzed specifically this subpopulation despite being the focus of considerable policy interest given the potential of longer working lives to alleviate pressures from population aging.

Our work proceeds as follows. In Section 2 we review the relevant literature for this study. In Section 3 we present the data. We show that the incidence of downsizing in the self-reported data is consistent with the best-available estimates from administrative records. We also discuss the key descriptive statistics by employer downsizing status and show that they are consistent with our hypothesis of positive selection of workers at downsizing employers. To provide further evidence of this, we fit a selection model and show that healthier workers are more likely to remain employed at downsizing employers. In section 4 we present the estimation methods and robustness checks, as well as the empirical results. Overall, we fit four different models. Our baseline model is an ordinary least-squares (OLS) regression of health outcomes on

downsizing, controlling for observed individual and job characteristics. Because there is evidence of positive selection of workers at downsizing employers, we include in a robustness-check analysis additional controls for workers' health conditions prior to downsizing. We also estimate two additional models: an individual fixed-effects model for a subset of outcomes measured longitudinally, and an instrumental variables approach using county-level deviations from employment growth trends as instruments for downsizing status. With the exception of the instrumental variables approach, which provides large standard errors and statistically insignificant estimates, all our models show that downsizing negatively affects workers' health, particularly their mental health. In Section 5 we discuss stress and job insecurity as possible mechanisms through which downsizing may affect workers' health. We summarize our work in Section 6.

2. Literature Review

Several studies in psychology, organizational behavior, and economics have analyzed the adverse effects of job loss and job insecurity on health. Identifying the causal impact of job loss and job insecurity on health is complicated by reverse causality (e.g., workers with lower health status might be more likely to lose their jobs) and by unobserved characteristics that may correlate with job status and health (e.g., anxiety-prone workers might be more likely to report higher levels of job insecurity as well as lower levels of health or psychological well-being). Studies on job loss have circumvented this issue by identifying exogenous sources of variation in job status such as plant closures (e.g., Kuhn, Lalive and Zweimuller, 2009; Schmitz, 2011; Browning and Heinesen, 2012) or mass layoffs (e.g., Sullivan and Von Wachter, 2011). Generally, these studies have found job loss negatively affected health and increased mortality risk (e.g., Browning and Heinesen, 2012 and Sullivan and Von Wachter, 2009).[1]

Estimates of causal effects of job insecurity on health are harder to find. A number of studies have examined cross-sectional associations between employment insecurity and health. Cheng et al. (2005), using data from Taiwan, find that perceived job insecurity has detrimental effects on self-rated health, mental health, and vitality. László et al. (2010), in a study pooling data on individuals across 16 European countries, similarly find that job insecurity negatively affects self-rated health. Recognizing the limitations of cross-sectional analysis, most such

[1] In contrast, Schmitz (2011) finds no impact of job loss on health.

studies have used longitudinal data (e.g. Ferrie et al., 2002; Hellgren and Sverke, 2003 and Burgard, Brand and House, 2009). The general consensus from these studies is that job insecurity adversely affects self-rated health and depressive symptoms (Burgard, Brand and House, 2009) and mental health (Hellgren and Sverke, 2003). Perhaps most relevant to our study, Ferrie et al. (2002), in considering physiological measures in addition to self-rated health, self-reported morbidity, and psychiatric morbidity, find perceived job insecurity negatively affects mental health and leads to a lower body-mass index and higher blood pressure for women.

While longitudinal studies present a significant improvement over simple correlational studies for ascertaining causality, a potential problem with this identification strategy is that changes in health status can also affect job insecurity. A small number of studies have examined sources of exogenous variation in job insecurity to identify the causal impact of insecurity on health. Ferrie et al (1998) using the privatization of some government departments in the United Kingdom as an indicator of job insecurity, and finds it adversely affected health. Caroli and Godard (2014), using a sample of male workers from 22 European countries, find job insecurity, as indicated by the levels of employment protection in each country, to have a significant negative impact on headaches, eyestrain and skin problems.

The work most closely related to our study is Reichert and Tauchmann (2011). They use data from Germany and instrument perceived job insecurity through a measure of employer downsizing and find a negative impact of job insecurity on mental health. As they do, we focus on the effects of employer downsizing on health. Employer downsizing can be considered an event exogenous to worker's unobserved characteristics and therefore less likely to be subject to omitted variable bias or reverse causality. In contrast to Reichert and Tauchmann, we use firm downsizing directly as the main factor affecting health rather than as an instrument. We follow this approach because there are many mechanisms through which downsizing can affect health. For example, it may affect work load, stress levels, and morale for the remaining workers. Researchers have coined the term "survivor syndrome" to refer to the inimical effects of downsizing on the employees who remain at a company. Bose and Bohle (2002) note that the survivor syndrome "is characterised by demoralisation, risk aversion, diminished organisational commitment and poorer health."

Several other studies have also analyzed the effects of downsizing on health either directly or indirectly (e.g. Dekker and Schaufeli, 1995; Vahtera, Kivimaki and Pentti, 1997; Parker, Chmiel and Wall, 1997; Hellgren, Sverke and Isaksson, 1999; Kivimaki et al, 2000; and Hellgren and Sverke, 2003). However, most use data from a single employer and focus only on mental health. As noted earlier, we analyze a nationally representative sample of U.S. workers who are 50+ years old and therefore their health might be more susceptible to adverse working conditions; and we consider a comprehensive list of physical outcomes beyond mental health, including measures from blood samples.

3. Data

We use data from the Health and Retirement Study (HRS).[2] The HRS is a biennial longitudinal survey of the U.S. population over the age of 50. The HRS collects information about work status, earnings, job characteristics, and health conditions, among other variables. We use data from waves 1994 to 2010 and restrict our analysis to respondents who are working for pay and are not self-employed. In addition, we limit our sample to individuals with valid county identifiers that can be matched with employment information from the Quarterly Census of Employment and Wages (QCEW). The QCEW match is necessary because we use deviations from the trend in county-level employment growth as instruments to downsizing, as we describe below. Our initial selection resulted in 15,206 individuals and 45,913 individual-wave observations. After excluding observations with invalid responses for the employer downsizing variable (described below), the sample included 14,041 individuals and 39,920 individual-wave observations. Finally, after excluding observations with missing values for other control variables, the sample included 13,443 individuals and 37,208 individual-wave observations. However, the final sample sizes in our analyses vary depending on the number of valid responses for each outcome.

The HRS asks respondents whether their employers have downsized since the last interview or since they started working if they were hired between waves. The question is worded as follows: *"Has your employer experienced a permanent reduction in employment since [last interview month and year/ month and year respondent started job/ 2 years ago]?"*, with

[2] We combine information from the HRS raw files, including biomarkers, with information from the RAND HRS Data file. The RAND HRS Data file is an easy-to-use longitudinal data set based on the HRS raw data. We also use restricted-access HRS data containing state-of-residency information.

interviewers coding references to downsizing and permanent layoffs as "yes" and those to temporary layoffs as "no". The accuracy of our findings depends on the reliability of the employer downsizing variable, which is self-reported by the worker. Ideally, we would benchmark workers' reports to their employers' administrative data. Given that this is not available, we looked in the job-creation and job-destruction literature for benchmarks. We found consistent evidence (see column 4 in Table 1) that at least in the late 1990s and early 2000s- the fraction of firms that destroyed employment but did not close (i.e. downsizing firms) was around 25%.[3] This figure is similar to the fraction of workers in the HRS that report their employer has downsized. Figure 1 shows that the fraction of workers in the HRS that reported downsizing oscillated around 20% but increased sharply in 2010 to almost 40%. Thus, the average reported rate of downsizing in the HRS is consistent with the available information in studies that use firms' employment records.

We study a large set of health outcomes available in the HRS. These are of four groups: i) subjective bad-health indicator, ii) mental-health indicators; iii) reported diagnoses; and iv) biomarkers. HRS asks respondents to rate their health on a five-point scale (1=Excellent, 2=Very Good, 3=Good, 4=Fair, 5=Poor). The first outcome, a subjective bad-health indicator, is constructed as being equal to one if the respondents report his or her health as fair or poor. The second group of outcomes, mental-health indicators, records whether a respondent experienced a series of negative or positive sentiments during the last week. Negative indicators measure whether the respondent experienced all or most of the time the following sentiments: depression, "everything is an effort," sleep is restless, felt alone, felt sad, and "could not get going." Positive indicators measure whether the respondent all or most of the time felt happy and enjoyed life (RAND, 2011). These questions are a shortened version of the 20-item Center for Epidemiologic Studies Depression (CES-D) Scale used to identify individuals at risk of clinical depression. A similar mental-health index can be constructed by adding the affirmative answers to the five negative indicators and the negative answers to the two positive indicators. We follow the recommendations from the HRS Health Working Group (Steffick, 2000) and coded individuals scoring 4 or higher on the shortened 8-items index as having symptoms indicating potential clinical depression (similar to scoring 16+ on the full CESD index).

[3] A better benchmark would be the share of employment in downsizing employers, but this figure is not available.

Table 2 shows the raw means of the first two groups of outcomes, the subjective bad health indicator and the mental-health indicators, by employer downsizing status. The table indicates that workers at downsizing employers are more likely (15.3%) to rate their health as bad (i.e., fair or poor) than are workers at other employers (13.4%). Table 2 also shows a positive association between downsizing and experiencing negative sentiments, and a negative association between downsizing and experiencing positive sentiments. As a consequence, there is also a positive association between downsizing and the probability of showing symptoms of clinical depression (11.6% at downsizing employers and 9.1% at non-downsizing employers).

The third set of outcomes, reported diagnosed conditions, indicate whether respondents have ever been diagnosed by a doctor to have : 1) high blood pressure or hypertension; 2) diabetes or high blood sugar; 3) cancer or a malignant tumor of any kind except skin cancer; 4) chronic lung disease except asthma; 5) heart attack, coronary heart disease, angina, congestive heart failure, or other hearth problems; 6) stroke or transient ischemic attack (TIA); 7) emotional nervous or psychiatric problems; and 8) arthritis or rheumatism (RAND, 2011). Table 3 provides the raw means of these variables by employer downsizing status. Employer downsizing is associated with particularly increased risks of reported diagnoses for diabetes, stroke, and emotional or psychiatric problems.

Finally, in our last group of outcomes we use biomarker data available in dried blood spots collected from respondents in 2006 and 2008. This allows us to analyze information on the level of A1c, which measures average blood glucose level; on the level of C-reactive protein (CRP), which measures general inflammation; and on the level of Cystatin C, which measures kidney function. We also use the diastolic and systolic blood-pressure and pulse measures collected in 2006 and 2008, as well as measures of height and weight. To measure physical dysregulation, we defined a set of 12 high-risk indicators using the thresholds reported in Crimmins et al. (2010). Table 4 shows the definitions and incidence of each high-risk indicator by employer downsizing status. There are no statistically significant differences in the raw incidences of high-risk indicators by employers downsizing status.

We also construct a number of worker and employer variables as controls for the empirical analysis. They include gender, education levels, tenure at job, occupation category (blue-collar, white-collar, or pink-collar), fringe benefits, and employers' industry, among others.

Table 5 shows the raw means of worker variables and Table 6 shows them for employer variables. These tables show many statistical significant differences in the raw means of these variables by employer downsizing status, indicating that there are important differences between workers and employers that experience downsizing and those that do not. We describe in detail below why this sample selection implies that we should take our findings as a lower bound of the effects that downsizing has on the average older worker.

4. Effects of downsizing on workers' health

4.1 Baseline Model

We estimate a series of ordinary least-squares (OLS) models, one for each health indicator of interest. In general, we estimate the following specification:

$$h_{i,t} = \alpha + \beta d_{it} + \theta X_{it} + \epsilon_{i,t} \qquad (1)$$

The term $h_{i,t}$ denotes a health outcome for individual i in period t. The term d_{it} equals 1 if the individual reported that his or her employer has downsized since the last wave or since they started working there if employment started between waves. The term X_{it} includes the worker and employer observed characteristics described in Table 5 and in Table 6. The term $\epsilon_{i,t}$ denotes the error component. All regressions are weighted and standard errors are clustered at the individual level.[4]

There are differences in the estimation of the baseline model among the four groups of outcomes we discussed before. In each wave, the HRS asks respondents to rate their health, so we potentially have repeated measures for each respondent. The same is true for mental health indicators. For reported diagnosed conditions, each respondent is included in the analysis for a given condition until first reporting a positive diagnosis. After that, the respondent is excluded from the sample. Thus, we study the incidence or the probability of ever being diagnosed with one of the conditions included in the analysis. The biomarkers are measured only once per individual, either in 2006 or in 2008. Thus, each respondent has only one observation in the analysis (and thus standard errors are not clustered).

[4] We use the wave-specific person-level analysis weights, provided by the RAND HRS, for analyzing the subjective bad health indicator, the mental health indicators, and the reported diagnosed conditions. We use the weights provided by HRS for the biomarker surveys for the analysis of biomarkers of physiological dysregulation.

The key identifying assumption in the baseline model is that downsizing is orthogonal to the error component, once we control for the observed characteristics, or $E(\epsilon_{i,t}|X_{it}, d_{i,t}) = 0$. One threat to the validity of this assumption is that employer downsizing might be a sign of overall deterioration of the (local) economy, which can also affect individuals' health. To address this issue, we add to our controls (X_{it}) the average employment growth rate in the five years prior to the survey year for the respondent's county of residency and as calculated from the QCEW.

Another threat to the identification assumption is sample selection. Although downsizing can be an external shock, the selection of individuals who are dismissed and of those who survive may not be independent of individuals' unobserved characteristics that correlate with health. In our analysis, we focus on individuals who have remained employed at downsizing employers. We call them a sample of "downsizing survivors." This represents a problem if $E(\epsilon_{i,t}|X_{it}, d_{i,t} = 1, survivor = 1) \neq E(\epsilon_{i,t}|X_{it}, d_{i,t} = 0)$. The direction of the potential bias is uncertain. For example, one may think management is more likely to fire less-productive workers who are also less healthy on average. Similarly, less-healthy workers might be less likely to manage the increased levels of stress and uncertainty at a downsizing employer and thus more likely to quit. Because our dependent variables are defined in terms of negative outcomes, this positive selection of survivors means that $E(\epsilon_{i,t}|X_{it}, d_{i,t} = 1, survivor = 1) - E(\epsilon_{i,t}|X_{it}, d_{i,t} = 0) < 0$. Conversely, one may think that healthier workers are likely to leave a firm in distress because they are more able to look for other jobs. In this case, the sample of survivors would be on average sicker than those who left, or $E(\epsilon_{i,t}|X_{it}, d_{i,t} = 1, survivor = 1) - E(\epsilon_{i,t}|X_{it}, d_{i,t} = 0) > 0$. Table 5 provides evidence in favor of the first case, i.e., that there is a positive selection among workers who survive downsizing (in comparison to workers at non-downsizing employers). Workers remaining at employers that have recently downsized are younger, more educated, more likely to be white-collar and full-time employees, and have higher tenure at their jobs. This positive selection implies that our estimated effects would be a lower bound on the effect that employer downsizing would have on the average worker's health.

Table 6 shows that downsizing employers also differ from other employers. Downsizing employers are more likely to be in manufacturing, transportation, finance, or public administration. They are also more likely to be larger in size (although the employer-size

variable has a high incidence of missing values). Interestingly, downsizing employers are more likely to provide health insurance and pension benefits, which might indicate higher-quality jobs and thus of a positive selection of workers at these employers. Also interestingly, there is no consistent evidence that jobs at downsizing employers require more physical effort or heavy lifting. In regression analysis, we can adjust for differences in the composition of downsizing and non-downsizing employers to disentangle the effect of downsizing on workers' health from the effects of working on specific industries, of having access to health insurance, and of the physical demands of the job.

To provide further evidence of the selection of healthier workers in downsizing establishments, we estimated the following multinomial logit model:

$$\Pr(Y_{it+1} = k) = \frac{e^{\alpha_k + \beta_k d_{it} + \gamma_{1,k} CD_{it} + \gamma_{2,k}(d_{it} \times CD_{it}) + \lambda_{1,k} NC_{it} + \lambda_{2,k}(d_{it} \times NCD_{it}) + \Theta_k X_{it}}}{\sum_{i=1}^{3} e^{\alpha_k + \beta_k d_{it} + \gamma_{1,k} CD_{it} + \gamma_{2,k}(d_{it} \times CD_{it}) + \lambda_{1,k} NC_{it} + \lambda_{2,k}(d_{it} \times NCD_{it}) + \Theta_k X_{it}}} \qquad (2)$$

Here, we define the outcomes Y_{it+1} as the three potential employment transitions from wave t to wave $t+1$, which are i) $k = 1$ if the worker continues working at the same employer; ii) $k = 2$ if the worker is employed at a different employer (including self-employment); and iii) $k = 3$ if the worker is not working. As before, the term d_{it} equals one if the individual reported that his or her employer has downsized since the last wave, and zero otherwise. The term CD_{it} equals one if the individual has symptoms of clinical depression and zero otherwise. The term NC_{it} measures the number of conditions ever diagnosed by a doctor. Finally, as before, the term X_{it} includes other observed characteristics for worker and employer.

We are interested in estimating how the two measures of health, CD_{it} and NC_{it}, affect the probability of each type of employment transition, and whether these effects are larger or smaller at downsizing employers. We are also interested in how downsizing affects the overall probability of each employment transition. Table 7 shows the predicted average marginal effects, obtained after fitting the model in equation (2)[5]. We find that reported downsizing is associated with a reduction of 4.1 percentage points in the probability of continued employment at the current employer in the next wave (or a reduction of 5.7% with respect to the sample mean). Consequently, downsizing is associated with an increase of 1.6 percentage points (16.7%) in the

[5] For identification purposes, all coefficients for k = 1 (continued employment at current employer) were set to zero. Standard errors were clustered at the individual level. Predicted average marginal effects were calculated using the *margins* command in STATA.

probability of working at different employer by the next wave, and an increase of 2.5 percentage points (or 13.9%) in the probability of not working by the next wave. We also find that having symptoms of clinical depression is associated with a decrease in the probability of continued employment at the current employer by 5.4 percentage points (or 7.5%). This effect is much stronger at downsizing employers (7.1 percentage points) than at other (non-downsizing) employers (4.8 percentage points).We find similar results regarding the number of diagnosed conditions. Each additional diagnosed condition is associated with a 1.8 percentage points reduction in the probability of continued employment at the current employer. The effects are stronger at downsizing employers (2.5 percentage points) than at other employers (1.5 percentage points). These findings indicate that healthier workers are more likely to retain their jobs and that this positive selection is stronger when employers are downsizing. This implies that our findings are likely to capture lower bounds on the health effects that downsizing would have on the average worker.

4.2 Robustness checks

We fit a set of alternative models to test the robustness of our results. First, in addition to controlling for observable demographics and employment characteristics in the baseline equation (1), as a robustness check we also control for the workers' health conditions prior to downsizing. We augment the baseline model by including as additional controls the vector H_{it-1}, which contains all the health outcomes we study (except for the biomarkers), but measured in the previous wave (prior to downsizing). The goal of controlling for H_{it-1} is to account for health conditions that may affect who remains at a downsizing employer. However, controlling for H_{it-1} poses some problems as well. In particular, downsizing might have affected health in the previous wave if it had already started or if the worker was aware of its impending occurrence. In this case, controlling for H_{it-1} would capture some of the effects of downsizing on health leading to smaller estimates. Put differently, adding H_{it-1} to the regression may control for compositional effects among survivors but also capture some of the effect of downsizing on workers. Therefore, we treat this specification as a robustness check rather than our main specification.

We conduct two additional robustness checks. First, we exploit the panel nature of the data to estimate an individual fixed-effect (FE) model, as shown in equation (3) below where γ_i

denotes individuals' time-invariant component. We can only estimate this model for the probability that a worker would rate his or her health as bad and for the mental health indicators. We cannot estimate a FE model for reported diagnosed conditions, since each respondent is included in the analysis for a given condition only until reporting a positive diagnosis. Also, we cannot estimate model a FE for the biomarkers because we only have one observation per individual.

$$h_{i,t} = \alpha + \beta d_{it} + \theta X_{it} + \gamma_i + \epsilon_{,i,t} \quad (3)$$

Using a FE model helps control for individual unobserved time-invariant factors that may correlate with health and reported downsizing. However, identification of the parameter of interest comes from individuals who have worked at an employer and survived the downsizing process. Thus, the FE estimator is akin to an average treatment effect on the treated (ATT), i.e. the downsizing survivors. In contrast, the estimator from equation (1) is closer to an average treatment effect (ATE) estimator. Given that positive selection at downsizing employers, we would expect the ATT to be smaller than the ATE.

Finally, we use an instrumental variables (IV) approach. The IV approach does not solve the issue that healthier workers are more likely to survive downsizing. However, it does address the potential problem that reporting employer downsizing can be endogenous. We do not think this is a major issue in our data, because the incidence of employer downsizing reported in the HRS is consistent with information from administrative records, as discussed earlier. Also, downsizing occurs in all labor markets, both those expanding and those contracting, and thus employment trends at the county level—the source of our instrument—only explains a small fraction of total downsizings. Nevertheless, we pursued this avenue as an additional robustness check. We mentioned above that we use average employment growth rate in the five years prior to the survey year, denoted by $\mu_{c,t}$ in equation (4) below, to control for county-level employment trends. We use as an instrument the deviation from that trend in the year of the survey, divided by the standard deviation of previous employment growth rates. In other words, our instrument $z_{c_{,t}}$ for individuals residing in county *c* and taking the HRS survey in year *t* is calculated as in

equation (5) below, where $g_{c,t}$ is total annual employment (E) growth in county c, or $g_{c,t} = (E_{t-1} - E_t)/E_{t-1}$.[6]

$$\mu_{c,t} = \frac{1}{5}\sum_{j=t-5}^{t-1} g_{c,j} \quad (4)$$

$$z_{c,t} = \frac{g_{c,t} - \mu_{c,t}}{\sqrt{\frac{1}{4}\sum_{j=t-5}^{t-1}(g_{c,j} - \mu_{c,t})^2}} \quad (5)$$

4.3 Results

Table 8 shows the estimated coefficients of employer downsizing on regressions for each of the health outcomes of interest. We start in column 1 by showing the bivariate analysis. As expected from the comparison of raw means in Tables 2, 3 and 4, employer downsizing is associated with a higher probability that an individual will rate his or her health as bad. Downsizing is also associated with a deterioration of mental health indicators. Finally, there is evidence that downsizing is associated with an increased probability of being diagnosed with diabetes, stroke, and a psychological or emotional problem. There is no evidence that employer downsizing is associated with increased levels in the markers for physiological dysregulation.

Column 2 of Table 8 shows the coefficients of downsizing once we control for the long-term trend in county of residence total employment growth, $\mu_{c,t}$. The goal in this intermediate model is to disentangle the effect of downsizing from potential effects of deterioration in local labor markets. Interestingly, after controlling for $\mu_{c,t}$ the estimated effects of downsizing on workers' health remain relatively unchanged. The coefficient for $\mu_{c,t}$ (not shown) is in general negative and statistically significant, meaning that higher long-term employment growth in the county of residence is associated with lower incidence of negative health outcomes. Downsizing status is also negatively associated with $\mu_{c,t}$ (not shown), indicating that workers are less likely to report employer downsizing in counties with higher long-term employment growth. On average, for each percentage point of additional long-term growth in employment, the probability that a worker reports his or her employer has downsized is reduced by 0.61 percentage points. However, the fact that the estimated effects of downsizing on health remain robust to controlling for $\mu_{c,t}$ reveals that local employment growth explains only a small fraction of the total variance

[6] Bartel and Sicherman (1993) use a similar approach to study the effects of the permanent rate of technological innovation and of deviations from that trend on workers' retirement decisions.

in the probability of reporting downsizing. Put differently, downsizing occurs at large in both growing and shrinking local labor markets.

Column 3 of Table 8 adds the workers and employer observable characteristics. This is the baseline model we specified in equation (1). After adding these controls, the estimated effects became larger in magnitude. This suggests that selection due to observable characteristics is favorable to those who experienced downsizing, i.e., they have characteristics and jobs which are associated with better health. This provides evidence of a positive selection of workers who remained employed at downsizing employers. Controlling for observable characteristics exacerbates that positive selection effect, and explains the increase in the magnitude of estimated coefficients for downsizing. As discussed above, positive selection of workers implies that our estimates are a lower bound on the health effects of downsizing for the average worker. We find that individuals at downsizing employers are 3.6 percentage points or 26% (using the sample means as the base) more likely to rate their health as bad. They are also more likely to feel depressed (by 2.8 percentage points or 29%), feel that everything is an effort (by 3.4 percentage points or 20%), have restless sleep (by 4.1 percentage points or 16%), feel lonely (by 1.9 percentage points or 17%), feel sad (by 3.5 percentage points or 24%), and feel that they could not get going (by 3.0 percentage points or 24%). They are also less likely to feel happy by (2.7 percentage points or -2%) and to report enjoying life (by 1.7 percentage points or -1%). Overall, workers at downsizing employers are more likely to show symptoms of clinical depression according to the CES-D scale (by 3.5 percentage points or 36%). Individuals at downsizing employers are also more likely to report being recently diagnosed with stroke (by 0.6 percentage points or 43%), with psychiatric or emotional problems (by 1.7 percentage points or 26%) and with arthritis (by 2.7 percentage points or 10%). Regarding the markers for physiological dysregulation, there is some evidence (at the 10% confidence level) that individuals at downsizing employers are more likely to have high levels of CRP (4.7 percentage points or 13%), which is a marker of general inflammation of the body.

Table 9 shows the results from our first robustness check, which consists in augmenting the baseline model by controlling with individual lagged health outcomes (except for the biomarkers of physiological dysregulation, which are only measured once). Note that the sample sizes for the estimations of the augmented models are smaller than for the baseline models in Table 8 because we require respondents to have observations in the previous wave. Thus, for

comparison purposes, we re-estimated the baseline models constrained to the same sample as in the models augmented with lagged health outcomes. With the smaller sample size, some of the coefficients in the baseline model diminish, although they remain statistically significant. One exception is the coefficient of downsizing on the probability of having high levels of CRP, which is no longer statistically significant. We find that controlling for health outcomes in the prior wave leads to a reduction in the estimated effects of downsizing by about 66%. One interpretation of this result could be that less healthy workers are more likely to remain at a downsizing employer. However, the evidence on positive selection presented in Section 3 and the evidence from observable characteristics that workers in downsizing employers are younger, have longer tenure, and are more likely to be full-time employees contradicts this argument. Similarly, we showed that controlling for workers' and employers' characteristics helps to control for the potential positive selection and increases the estimated effects from downsizing. Therefore, we interpret the reduction in the estimated effects after controlling for lagged health outcomes as a sign that downsizing affected workers' health in the previous wave. One possibility is that the employer was already downsizing by the previous wave. Another possibility is that workers may have anticipated downsizing, after a period of economic distress, low sales, etc. Evidence from the U.S. and from Europe suggests that downsizing and closures are not surprise events, but rather workers anticipate them (Lengermann and Wilhuber, 2002; Schwerdt, 2011). Therefore, by controlling for past health conditions we are obtaining a conservative estimate of the total effect of downsizing on health.

We now present the results from the two additional robustness checks, the fixed effect model and the IV approach. Table 10 shows the results for the fixed effects models. As mentioned above, they can only be estimated for the probability that a worker would rate his or her health as bad and for the mental health indicators. When performing fixed effects estimators, we cannot use person weights as they do not stay constant over time. Thus, we re-estimate the baseline model without weight for comparison purposes. We find that the estimates using a fixed effects model are smaller than in the baseline model, and only remain significant for the probability of reporting bad health, for feeling that everything is an effort, for feeling sad (at the 10% confidence level), for feeling that one could not get going and for the probability of showing symptoms of clinical depression. The effects on the other mental health indicators are also smaller than before and not statistically significant. As discussed earlier, one reason for the

discrepancy between the baseline and fixed effects models may be that the FE model is closer to an ATT estimator while the baseline model is closer to an ATE estimator. Given the positive selection of workers at downsizing employers, we should expect the ATT to be smaller than the ATE. Another explanation for the discrepancy might be that , given the age of the respondents, the length of the panel for most workers is relatively short, and healthier people are likely to stay in the sample longer (i.e. to remain employed). Thus, the FE model (or the within estimator) will place a higher weight on the information from healthier respondents than the baseline model, which uses both within- and between-individual variation.

Table 11 shows the results from the IV approach. Looking at the first stage, positive deviations from long-term employment growth are negatively associated with reports of downsizing. This association is statistically significant and relatively strong, particularly for mental health indicators. The F-statistic values from the first-stage regressions in the models for mental health indicators are above the standard benchmark of 10 (Staiger and Stock, 1997). The strength of the instrument is reduced for the regressions on diagnosed conditions and is significantly smaller for the analyses of the biomarkers of physical dysregulation (where the sample size is smaller). Despite the statistical strength of the instrument for mental health indicators, the main effects do not achieve statistical significance although they are larger in magnitude than in the baseline model. This is because the standard errors are also much larger than in the baseline model. As mentioned earlier, downsizings occur both in counties with growing employment and in those with declining employment. Thus, the R-squared of the first-stage regression is only 0.10, which may explain the large standard errors of the IV estimates. Importantly, we cannot reject the null hypothesis that self-reported downsizing status can be considered as an exogenous variable. Similar results also hold for the rest of the health outcomes. In general, the IV estimates are larger than in the baseline model but they are not statistically significant. In every case we cannot reject the null-hypothesis of exogeneity of the downsizing variable.

5. Mechanisms

There are many ways that downsizing can affect individuals' health. Here we analyze two of them: increased job instability (uncertainty) and increased levels of stress at the current job.

We also analyze the extent to which the estimated health effects of downsizing can be explained by these two mechanisms.

The HRS elicits the subjective probability of job loss through the following question: *"Sometimes people are permanently laid off from jobs that they want to keep. On the (same) scale from 0 to 100 where 0 equals absolutely no chance and 100 equals absolutely certain, what are the chances that you will lose your job during the next year?"* The median of the responses is zero, which indicates that most workers feel relatively safe in their jobs. There is also bunching of responses at 10% and 50%, and, to a lesser extent, around 90%, indicating that responses might be rounded around some focal points. Panel A in Table 12 shows the coefficient of employer downsizing in a regression of the subjective probability of job loss on downsizing and on similar controls as in the baseline model. It also shows the coefficient of downsizing on similar regressions where the outcomes are indicator variables for whether the subjective probability of job loss is zero percent, 50 percent or 100 percent. We find that reported employer downsizing is associated with increased levels of job insecurity. On average, the expected probability of job loss for an individual at downsizing employers is 8.7 percentage points (or 53% using the sample mean) higher than that for individuals at other employers. Similarly, downsizing reduces the likelihood that the subjective probability of job loss is zero percent by 11.9 percentage points (or -24%), and increases the likelihood that it is 100 percent by 1.8 percentage points (or 90%).

Panel B of Table 12 shows that downsizing is also related to increased levels of stress on the job. Using a similar regression analysis as in Panel A, we find that workers at downsizing employers are 5 percentage points (or 25% using sample means) more likely to strongly agree to the statement *"My job involves a lot of stress."* Accordingly, they are also 4.9 percentage points less likely (-11%) to disagree and 1.2 percentage points less likely (-20%) to strongly disagree with the statement.

Although stress levels are related to job loss expectations, there is substantial variation in job loss expectations across stress levels, as shown in Figure 2. Thus, although there is some overlap, these two variables are measuring two mechanisms through which downsizing might potentially affect workers health. Table 13 presents additional regressions where we augment the baseline model by controlling for job loss expectations and for stress levels in order to analyze to

what extent these two factors can account for the negative health effect of downsizing. We re-estimate the baseline model because the question regarding the subjective probability of job loss was not collected in the 2008 wave of the HRS. In general, after controlling for job loss expectations and for the levels of stress at work, the negative health effects of downsizing diminish by about one-third but remain statistically significant. The fact that downsizing remains a significant predictor suggests there are other factors through which downsizing affects workers health. These might include reductions in morale, job satisfaction, and motivation at work.

6. Putting the effect sizes in context

A helpful way of evaluating how much employer downsizing affects health is to compare its effects to those of other controls included in the baseline model. Figure 3 presents those comparisons for four outcomes: self-reported bad health, showing symptoms of clinical depression, the risk of being diagnosed with stroke, and the risk of being diagnosed with psychiatric or emotional problems. We compare the coefficients of downsizing with the effects of being married, of having a high-school or college degree, and of being a blue-collar or a pink-collar worker. As shown in Figure 3, across the four outcomes the effects of downsizing are much larger than those associated with being a blue-collar or a pink-collar worker. They are about half the size of those associate with having a college degree (but with opposite sign) for showing symptoms of clinical depression and of being diagnosed with a stroke. Downsizing has effects about one-fifth the size (with opposite sign) of college education on reporting bad health. Finally, across the four outcomes, downsizing has an effect that is at least half as big (with opposite sign) of the effect associated with being married. In short, the effect of downsizing on workers' health is comparable to that of other important demographics such as marital status, educational attainment, and type of occupation.

7. Conclusions

We find that employer downsizing increases the probability that older workers would rate their health as fair or poor, that it increases the risk of showing symptoms of clinical depression, and that it increases the risk of being diagnosed with stroke, psychiatric or emotional problems, and arthritis. There is also weaker evidence that downsizing can increase the risk of showing high levels of C-reactive protein (CRP), a measure of general inflammation. Health effects of

employer downsizing also appear comparable to the effects of other worker characteristics, such as being married or a blue-collar worker.

We find that downsizings affect health through increased job insecurity and increased levels of stress. The effects of downsizing remain statistically significant but are smaller after controlling for these factors, suggesting that other mechanisms such as reductions in morale and motivation also affect the health of workers. Therefore, our findings suggest that employers should think consider how to offset the detrimental health effects of downsizing on the (older) workers they retain.

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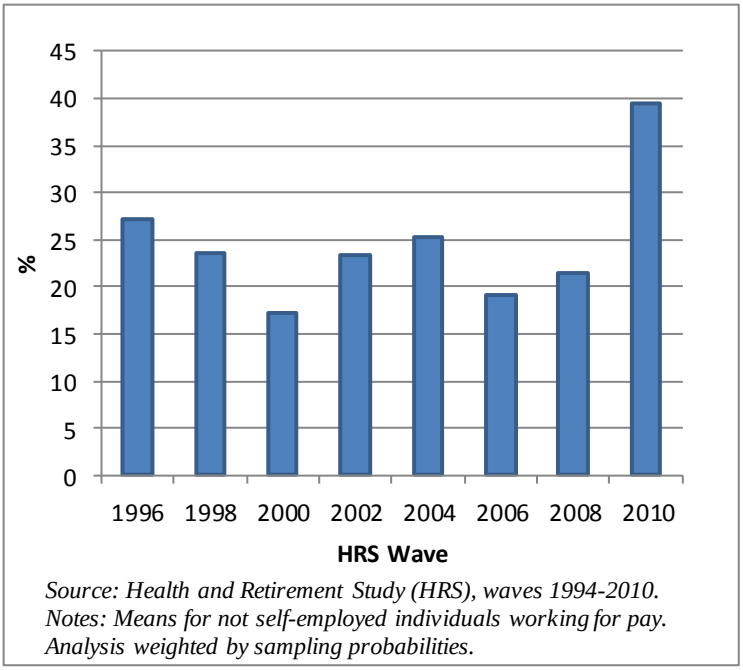
Figure 1: Mean reported rate of employer downsizing by HRS wave



Source: Health and Retirement Study (HRS), waves 1994-2010.
Notes: Means for not self-employed individuals working for pay.
Analysis weighted by sampling probabilities.

Figure 2: Subjective probability of job loss and stress level

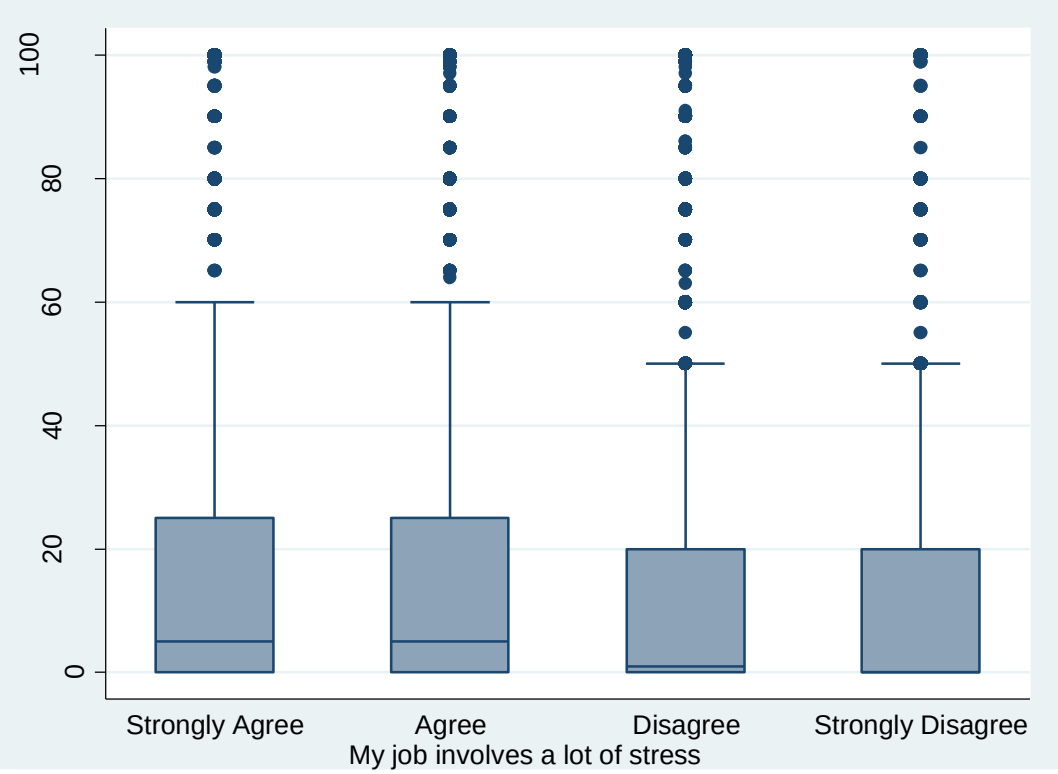


Figure 3: Comparison of size effects

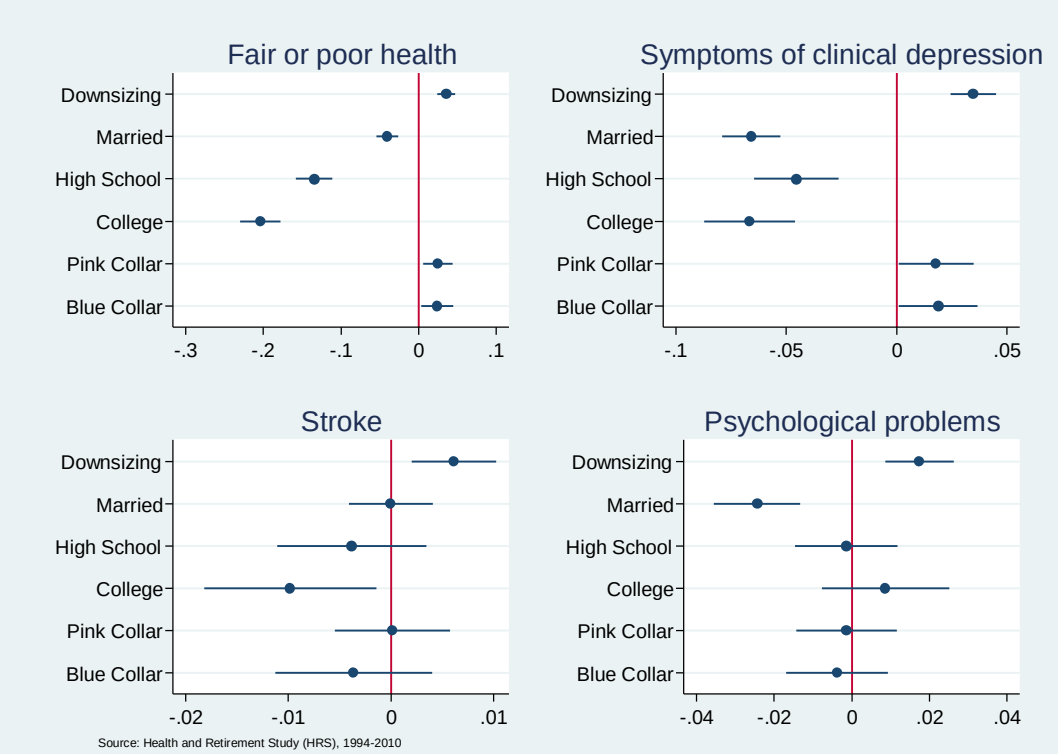


Table 1: Employer downsizing incidence

Study	Geographic coverage	Frequency & period	% Firms that destroyed jobs in each quarter/year		% Firms that gained jobs in each quarter/year	
			Continuing firms	Closures	Expanding firms	Openings
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Spletzer (2000)	West Virginia	Quarterly: 1990Q4-1994Q2	24.0	3.2	24.7	3.5
		Annual: 1990Q4-1994Q2	25.7	10.7	27.9	12.2
		Biennial: 1990Q4-1994Q2	24.9	18.1	28.2	21.0
		Triennial: 1990Q4-1994Q2	23.6	24.5	27.0	27.9
Pivetz, Searson and Spletzer (2001)	US	Quarterly: 1999Q4	22.8	5.0	24.9	6.1
Pinkston and Spletzer (2002)	California	Annual: March 1999-March 2000	25.4	13.0	30.1	15.0
Pinkston and Spletzer (2004)	US	Quarterly: 1998Q1-2001Q4	23.7	5.3	24.1	5.6
		Annual: 1998-2002	26.3	12.0	28.1	13.0
Clayton and Spletzer (2009)	US	Quarterly: 2005Q1	21.8	5.0	21.8	5.0

Source: Cited articles

Table 2: Self-reported health and mental health indicators, by employer downsizing status

Variables	All sample	Non-Downsizing	Downsizing	Difference	P-value
Employer downsizing (0=No; 1=Yes)	0.254				.
Self-reported bad health (0=No; 1=Yes)	0.139	0.134	0.153	0.019	0.000
Mental health indicators (0=No; 1=Yes)					
Felt depressed	0.098	0.094	0.109	0.015	0.001
Felt everything is an effort	0.167	0.161	0.183	0.022	0.000
Sleep was restless	0.264	0.257	0.284	0.028	0.000
Was happy	0.889	0.895	0.869	-0.026	0.000
Felt Lonely	0.110	0.108	0.116	0.008	0.089
Felt sad	0.148	0.142	0.164	0.022	0.000
Could not get going	0.126	0.121	0.140	0.019	0.000
Enjoyed Life	0.935	0.940	0.922	-0.017	0.000
Symptoms of clinical depression	0.097	0.091	0.116	0.025	0.000

Source: Health and Retirement Study (HRS), waves 1994-2010.
Notes: Means for not self-employed individuals working for pay. Analysis weighted using wave-specific sampling weight for each respondent. Self-reported bad health is based on a 5 point scale self-reported health question. Those who report fair or poor health are defined as being in bad health.

Table 3: Conditions ever diagnosed by a doctor, by employer downsizing status

Variables	All sample	Non-Downsizing	Downsizing	Difference	P-value
Number of conditions ever diagnosed (#)	1.301	1.297	1.314	0.017	0.314
Probability of first diagnosis					
High blood pressure	0.290	0.287	0.298	0.011	0.140
Diabetes	0.079	0.076	0.088	0.012	0.005
Cancer	0.046	0.046	0.045	-0.002	0.607
Lunge disease	0.028	0.027	0.029	0.002	0.541
Hearth problems	0.073	0.074	0.071	-0.002	0.544
Stroke	0.014	0.013	0.017	0.004	0.032
Psychiatric or emotional problems	0.065	0.060	0.079	0.018	0.000
Arthritis	0.278	0.276	0.286	0.010	0.165

Source: Health and Retirement Study (HRS), waves 1994-2010.

Notes: Means for not self-employed individuals working for pay. Analysis weighted using wave-specific sampling weight for each respondent. Individuals' observations are included up to the time of first diagnosis.

Table 4: Biomarkers of health, by employer downsizing status

Variables	All sample	Non-Downsizing	Downsizing	Difference	P-value
Measurements above threshold? (0=No; 1=Yes)					
High A1c (>6.40%)	0.125	0.126	0.118	-0.008	0.617
High C-reactive protein (>3 mg/L)	0.356	0.349	0.381	0.032	0.219
High Cystatin C (1.55 mg/L)	0.027	0.027	0.028	0.001	0.861
Low high-density lipoprotein or HDL (<40 mg/L)	0.178	0.178	0.178	0.000	0.994
High total cholesterol (>240 mg/L)	0.206	0.202	0.219	0.016	0.478
Low total cholesterol (<160 mg/L)	0.108	0.111	0.096	-0.015	0.339
High diastolic blood pressure (>90 mmHg)	0.209	0.210	0.204	-0.006	0.788
Low diastolic blood pressure (<60 mmHg)	0.016	0.017	0.013	-0.004	0.536
High systolic blood pressure (>140 mmHg)	0.250	0.253	0.238	-0.014	0.533
High pulse (>90 per min)	0.059	0.060	0.052	-0.008	0.522
High body-mass index or BMI (>30)	0.427	0.430	0.416	-0.013	0.621
Low body-mass index or BMI (<20)	0.017	0.019	0.008	-0.010	0.073

Source: Health and Retirement Study (HRS), waves 2006-2008.

Notes: Means for not self-employed individuals working for pay. Analysis weighted using wave-specific sampling weight for each respondent.

Table 5: Worker characteristics, by employer downsizing status

Variables	All sample	Non-Downsizing	Downsizing	Difference	P-value
Age	58.883	59.275	57.731	-1.544	0.000
Female	0.502	0.511	0.475	-0.036	0.000
Married	0.728	0.725	0.737	0.012	0.079
Tenure at job	12.558	11.448	15.818	4.370	0.000
Employment status					
Full-time job	0.750	0.719	0.840	0.121	0.000
Part-time job	0.117	0.127	0.088	-0.040	0.000
Partial retirement	0.133	0.154	0.072	-0.081	0.000
Education					
Less than High School	0.103	0.114	0.073	-0.041	0.000
High school	0.596	0.596	0.597	0.001	0.895
College	0.300	0.290	0.330	0.040	0.000
Occupation					
White Collar	0.438	0.432	0.456	0.024	0.001
Pink Collar	0.169	0.186	0.121	-0.064	0.000
Blue Collar	0.188	0.183	0.200	0.017	0.004
Missing	0.205	0.199	0.223	0.024	0.000

Source: Health and Retirement Study (HRS), waves 1994-2010.
Notes: Means for not self-employed individuals working for pay. Analysis weighted using wave-specific sampling weight for each respondent.

Table 6: Job characteristics, by employer downsizing status

Variables	All sample	Non-Downsizing	Downsizing	Difference	P-value
Industry					
Agric/forest/fish	0.010	0.011	0.006	-0.005	0.000
Mining and construction	0.032	0.034	0.027	-0.007	0.003
Manufacturing	0.130	0.107	0.195	0.087	0.000
Transportation	0.057	0.053	0.069	0.016	0.000
Wholesale	0.035	0.037	0.026	-0.011	0.000
Retail	0.081	0.087	0.064	-0.023	0.000
Finan/ins/realest	0.053	0.053	0.054	0.002	0.630
Business, repair and personal services	0.064	0.069	0.049	-0.019	0.000
Entertn/recreatn	0.014	0.015	0.012	-0.003	0.026
Prof/related svcs	0.262	0.278	0.214	-0.064	0.000
Public administration	0.051	0.050	0.054	0.004	0.227
Missing	0.211	0.205	0.229	0.024	0.000
Fringe Benefits					
Health Insurance	0.686	0.653	0.784	0.131	0.000
DB pension plan	0.325	0.284	0.447	0.163	0.000
DC pension plan	0.415	0.386	0.502	0.116	0.000
Employer size					
Missing	0.450	0.436	0.491	0.055	0.000
< 5 workers	0.061	0.071	0.030	-0.041	0.000
5-14 workers	0.087	0.098	0.056	-0.041	0.000
15-24 workers	0.047	0.052	0.036	-0.016	0.000
25-99 workers	0.130	0.135	0.115	-0.019	0.000
100-499 workers	0.127	0.124	0.135	0.012	0.027
500+ workers	0.098	0.086	0.136	0.051	0.000
Physical effort at work					
All/most of the time	0.173	0.174	0.171	-0.003	0.589
Most of the time	0.133	0.133	0.133	0.001	0.914
Some of the time	0.304	0.307	0.294	-0.013	0.057
None of the time	0.358	0.354	0.372	0.018	0.014
Heavy lifting at work					
All/most of the time	0.078	0.076	0.085	0.009	0.038
Most of the time	0.056	0.055	0.060	0.005	0.128
Some of the time	0.241	0.242	0.240	-0.001	0.862
None of the time	0.586	0.589	0.578	-0.012	0.119
Does not apply	0.009	0.008	0.010	0.002	0.195

Source: Health and Retirement Study (HRS), waves 1994-2010.
Notes: Means for not self-employed individuals working for pay. Analysis weighted using wave-specific sampling weight for each respondent.

Table 7: Effect of downsizing, symptoms of clinical depression and number of conditions on employment transitions (marginal effects from Multinomial Logit Model)

	At same employer	At different employer	Not working
Sample Mean	*0.7237*	*0.0964*	*0.1799*
Downsizing	-0.041***	0.016***	0.025***
	(0.008)	(0.005)	(0.006)
Symp. clinical depression			
All employers	-0.054***	0.000	0.054***
	(0.011)	0.007	(0.010)
Downsizing employers	-0.071***	0.016	0.053***
	(0.021)	(0.016)	(0.011)
Non-downsizing employers	-0.048***	-0.005	0.053***
	(0.012)	(0.007)	(0.011)
# Conditions			
All employers	-0.018***	-0.003*	0.021***
	(0.003)	(0.002)	(0.002)
Downsizing employers	-0.025***	-0.001	0.026***
	(0.005)	(0.004)	(0.004)
Non-downsizing employers	-0.015***	-0.004**	0.019***
	(0.003)	(0.002)	(0.002)

Source: Health and Retirement Study (HRS), waves 1994-2010.
*Notes: Controls include: gender, cubic function of age, education attainment (less than high school, high school, college or more), occupation type (white collar, pink collar or blue collar) employment status (full-time, part-time, partial retirement), employer's size, employer's industry, tenure at job, employer-provided health insurance, employer-sponsored pension plans, level of physical effort at work, level of heavy lifting required at work, state and wave dummies and lagged health conditions. Regressions were weighted using wave-specific sampling weight for each respondent. Standard errors are clustered at the individual level. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

Table 8: Baseline model

Outcomes	Bivariate model		Intermediate model		Baseline model		Sample size
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	
Self-reported bad health	0.019***	0.006	0.018***	0.006	0.036***	0.006	37,201
Mental health indicators (0=No; 1=Yes)							
Felt depressed	0.015***	0.005	0.016***	0.005	0.028***	0.005	35,168
Felt everything is an effort	0.022***	0.006	0.022***	0.006	0.034***	0.006	35,160
Sleep was restless	0.027***	0.008	0.029***	0.008	0.041***	0.008	35,166
Was happy	-0.026***	0.005	-0.026***	0.005	-0.027***	0.006	35,134
Felt Lonely	0.008	0.005	0.009	0.005	0.019***	0.005	35,164
Felt sad	0.022***	0.006	0.023***	0.006	0.035***	0.006	35,157
Could not get going	0.019***	0.005	0.019***	0.005	0.030***	0.005	35,159
Enjoyed Life	-0.017***	0.004	-0.017***	0.004	-0.017***	0.004	35,161
Symp. clinical depression	0.025***	0.005	0.025***	0.005	0.035***	0.005	35,069
Probability of first diagnosis							
High blood pressure	0.011	0.008	0.008	0.008	0.006	0.008	30,211
Diabetes	0.012***	0.004	0.011**	0.004	0.007	0.005	35,237
Cancer	-0.002	0.003	-0.002	0.003	0.000	0.003	35,934
Lunge disease	0.002	0.003	0.001	0.003	0.003	0.003	36,466
Hearth problems	-0.002	0.004	-0.003	0.004	0.001	0.004	35,194
Stroke	0.004*	0.002	0.004*	0.002	0.006***	0.002	36,828
Psychiatric or emotional problems	0.018***	0.005	0.017***	0.005	0.017***	0.005	35,769
Arthritis	0.010	0.008	0.008	0.008	0.027***	0.008	30,058
Controls							
Long-term average county employment growth	No		Yes		Yes		
Worker and employer characteristics	No		No		Yes		

Outcomes	Bivariate Model		Intermediate Model		Baseline Model		Sample Size
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	
Measurements above threshold? (0=No; 1=Yes)							
High A1c	-0.008	0.017	-0.008	0.017	-0.011	0.017	3,012
High C-reactive protein	0.031	0.026	0.031	0.026	0.047*	0.027	2,929
High Cystatin C	0.001	0.008	0.001	0.008	0.005	0.008	2,910
Low high-density lipoprotein (HDL)	-0.000	0.023	-0.000	0.023	-0.002	0.023	2,506
High total cholesterol	0.016	0.023	0.016	0.023	0.014	0.023	2,902
Low total cholesterol	-0.015	0.016	-0.015	0.016	-0.014	0.017	2,902
High diastolic blood pressure	-0.006	0.023	-0.006	0.023	-0.010	0.023	2,965
Low diastolic blood pressure	-0.004	0.006	-0.004	0.006	-0.001	0.006	2,965
High systolic blood pressure	-0.015	0.023	-0.015	0.023	-0.009	0.023	2,965
High pulse	-0.008	0.012	-0.008	0.012	-0.004	0.013	2,965
High body-mass index (BMI)	-0.015	0.027	-0.015	0.027	-0.010	0.028	2,897
Low body-mass index (BMI)	-0.010*	0.006	-0.010*	0.006	-0.009	0.006	2,897
Controls							
Long-term average county employment growth	No		Yes		Yes		
Worker and employer characteristics	No		No		Yes		

Source: Health and Retirement Study (HRS), waves 1994-2010.

*Notes: Self-reported bad health is based on a 5 point scale self-reported health question. Those who report fair or poor health are defined as being in bad health. Refer to Table 4 for the list of thresholds for each biomarker. Worker and employer characteristics include: gender, cubic function of age, education attainment (less than high school, high school, college or more), occupation type (white collar, pink collar or blue collar) employment status (full-time, part-time, partial retirement), employer's size, employer's industry, tenure at job, employer-provided health insurance, employer-sponsored pension plans, level of physical effort at work, level of heavy lifting required at work, and state and wave dummies. Regressions were weighted using wave-specific sampling weight for each respondent. Standard errors are clustered at the individual level. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

Table 9: Robustness check - Controlling for lagged health outcomes

Outcomes	Baseline Model		Controlling for lagged health outcomes		Sample Size
	Coef.	S.E.	Coef.	S.E.	
Self-reported bad health	0.029***	0.007	0.016***	0.005	27,751
Mental health indicators (0=No; 1=Yes)					
Felt depressed	0.027***	0.006	0.019***	0.006	27,293
Felt everything is an effort	0.035***	0.007	0.025***	0.006	27,289
Sleep was restless	0.038***	0.009	0.026***	0.008	27,293
Was happy	-0.031***	0.006	-0.021***	0.006	27,268
Felt Lonely	0.018***	0.006	0.009*	0.005	27,290
Felt sad	0.037***	0.007	0.026***	0.006	27,288
Could not get going	0.027***	0.006	0.019***	0.006	27,289
Enjoyed Life	-0.019***	0.005	-0.012**	0.005	27,288
Symp. clinical depression	0.033***	0.006	0.023***	0.005	27,226
Probability of first diagnosis					
High blood pressure	-0.000	0.010	0.000	0.005	21,418
Diabetes	0.004	0.005	0.000	0.003	25,963
Cancer	-0.001	0.004	0.001	0.002	26,598
Lunge disease	0.001	0.003	-0.000	0.002	27,088
Hearth problems	-0.001	0.005	-0.003	0.003	25,937
Stroke	0.007***	0.002	0.004***	0.002	27,405
Psychiatric or emotional problems	0.009*	0.005	0.005*	0.003	26,442
Arthritis	0.024**	0.010	0.015***	0.006	21,152
Controls					
Long-term average county employment growth	Yes		Yes		
Worker and employer characteristics	Yes		Yes		
Lagged health outcomes	No		Yes		

Source: Health and Retirement Study (HRS), waves 1994-2010.
*Notes: Self-reported bad health is based on a 5 point scale self-reported health question. Those who report fair or poor health are defined as being in bad health. Worker and employer characteristics include: gender, cubic function of age, education attainment (less than high school, high school, college or more), occupation type (white collar, pink collar or blue collar) employment status (full-time, part-time, partial retirement), employer's size, employer's industry, tenure at job, employer-provided health insurance, employer-sponsored pension plans, level of physical effort at work, level of heavy lifting required at work, and state and wave dummies. Regressions were weighted using wave-specific sampling weight for each respondent. Standard errors are clustered at the individual level. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

Outcomes	Baseline Model		Controlling for lagged health outcomes		Sample Size
	Coef.	S.E.	Coef.	S.E.	
Measurements above threshold? (0=No; 1=Yes)					
High A1c	-0.014	0.018	-0.006	0.015	2,838
High C-reactive protein	0.038	0.027	0.034	0.027	2,763
High Cystatin C	0.004	0.009	0.003	0.009	2,743
Low HDL	-0.003	0.023	-0.004	0.023	2,365
High total cholesterol	0.015	0.024	0.015	0.024	2,741
Low total cholesterol	-0.013	0.017	-0.015	0.017	2,741
High diastolic BP	-0.004	0.024	-0.004	0.024	2,797
Low diastolic BP	-0.002	0.007	-0.002	0.007	2,797
High systolic BP	0.001	0.024	0.003	0.024	2,797
High pulse	-0.000	0.013	-0.003	0.013	2,797
High BMI	-0.007	0.028	-0.000	0.027	2,733
Low BMI	-0.009	0.006	-0.010	0.006	2,733
Controls					
Long-term average county employment growth	Yes		Yes		
Worker and employer characteristics	Yes		Yes		
Lagged health outcomes	No		Yes		

Source: Health and Retirement Study (HRS), waves 2006-2008.
*Notes: Self-reported bad health is based on a 5 point scale self-reported health question. Those who report fair or poor health are defined as being in bad health. Worker and employer characteristics include: gender, cubic function of age, education attainment (less than high school, high school, college or more), occupation type (white collar, pink collar or blue collar) employment status (full-time, part-time, partial retirement), employer's size, employer's industry, tenure at job, employer-provided health insurance, employer-sponsored pension plans, level of physical effort at work, level of heavy lifting required at work, and state and wave dummies Regressions were weighted using wave-specific sampling weight for each respondent. Standard errors are clustered at the individual level. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

Table 10: Robustness check - Individual fixed effect model

	Baseline Model		FE Model		Sample Size
	Coef.	**S.E.**	**Coef.**	**S.E.**	
Self-reported bad health	0.029***	0.005	0.013***	0.005	37,201
Mental health indicators (0=No; 1=Yes)					
Felt depressed	0.029***	0.004	0.008	0.005	35,168
Felt everything is an effort	0.034***	0.005	0.018***	0.006	35,160
Sleep was restless	0.037***	0.006	0.009	0.007	35,166
Was happy	-0.025***	0.005	-0.002	0.005	35,134
Felt Lonely	0.024***	0.005	0.003	0.005	35,164
Felt sad	0.033***	0.005	0.010*	0.006	35,157
Could not get going	0.027***	0.005	0.015***	0.006	35,159
Enjoyed Life	-0.017***	0.003	-0.004	0.004	35,161
Symp. clinical depression	0.034***	0.004	0.012**	0.005	35,069
Controls					
Long-term average county employment growth	Yes		Yes		
Worker and employer characteristics	Yes		Yes		
Lagged health outcomes	No		No		

Source: Health and Retirement Study (HRS), waves 1994-2010.

*Notes: Self-reported bad health is based on a 5 point scale self-reported health question. Those who report fair or poor health are defined as being in bad health. Worker and employer characteristics include: gender, cubic function of age, education attainment (less than high school, high school, college or more), occupation type (white collar, pink collar or blue collar) employment status (full-time, part-time, partial retirement), employer's size, employer's industry, tenure at job, employer-provided health insurance, employer-sponsored pension plans, level of physical effort at work, level of heavy lifting required at work, and state and wave dummies. Standard errors are clustered at the individual level. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

Table 11: Robustness check - Instrumental variables approach

Outcomes	First stage		Main regression		Sample Size
	Coef.	F-statistic	Coef.	S.E.	
Self-reported bad health	-0.361***	9.425	0.078	0.255	37,201
Mental health indicators (0=No; 1=Yes)					
Felt depressed	-0.419***	11.357	0.102	0.214	35,168
Felt everything is an effort	-0.417***	11.290	-0.093	0.251	35,160
Sleep was restless	-0.416***	11.223	0.145	0.306	35,166
Was happy	-0.432***	12.180	0.126	0.217	35,134
Felt Lonely	-0.416***	11.223	-0.033	0.223	35,164
Felt sad	-0.419***	11.357	0.082	0.257	35,157
Could not get going	-0.417***	11.290	0.148	0.221	35,159
Enjoyed Life	-0.418***	11.357	-0.154	0.170	35,161
Symp. clinical depression	-0.431***	12.041	0.109	0.207	35,069
Probability of first diagnosis					
High blood pressure	-0.304**	5.198	0.813	0.526	30,211
Diabetes	-0.381***	9.860	-0.275	0.200	35,237
Cancer	-0.366***	9.181	0.088	0.132	35,934
Lunge disease	-0.313***	7.129	-0.324*	0.185	36,466
Hearth problems	-0.340***	7.618	-0.059	0.215	35,194
Stroke	-0.353***	9.060	0.020	0.071	36,828
Psychiatric or emotional problems	-0.375***	9.734	0.082	0.188	35,769
Arthritis	-0.309**	5.712	0.247	0.410	30,058

Outcomes	First stage		Main Regression		Sample Size
	Coef.	F-statistic	Coef.	S.E.	
Measured Biomarkers					
High A1c	-0.254	0.1936	0.966	2.791	3,012
High CRP	-0.156	0.0729	4.593	16.67	2,929
High Cysc	-0.163	0.0784	1.501	5.401	2,910
Low HDL	-0.002	0.000	25.654	10,08	2,506
High Total Cholesterol	-0.152	0.0676	4.846	18.50	2,902
Low Total Cholesterol	-0.152	0.0676	-0.879	4.495	2,902
High Diastolic BP	-0.241	0.1681	0.713	2.809	2,965
Low Diastolic BP	-0.241	0.1681	0.468	1.293	2,965
High Systolic BP	-0.241	0.1681	-0.014	2.030	2,965
High Pulse	-0.241	0.1681	-0.799	2.379	2,965
High BMI	-0.222	0.1444	0.955	3.506	2,897
Low BMI	-0.222	0.1444	-0.174	0.786	2,897

Source: Health and Retirement Study (HRS), waves 1994-2010.

*Notes: Self-reported bad health is based on a 5 point scale self-reported health question. Those who report fair or poor health are defined as being in bad health. Controls include: gender, cubic function of age, education attainment (less than high school, high school, college or more), occupation type (white collar, pink collar or blue collar) employment status (full-time, part-time, partial retirement), employer's size, employer's industry, tenure at job, employer-provided health insurance, employer-sponsored pension plans, level of physical effort at work, level of heavy lifting required at work, state and wave dummies and lagged health conditions. Regressions were weighted using wave-specific sampling weight for each respondent. Standard errors are clustered at the individual level. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

Table 12: Effect of employer downsizing on job loss expectation and job stress level

	Sample mean	Effect	Standard error	Sample size
A. Job loss expectations (denoted by p) - OLS model				
Average value	16.436	8.715***	0.451	30,837
Fraction p=0	0.461	-0.119***	0.009	30,837
Fraction p=50	0.118	0.071***	0.006	30,837
Fraction p=100	0.020	0.018***	0.003	30,837
B. Current job involves lots of stress – OLS model				
Strongly agree	0.203	0.050***	0.007	36,304
Agree	0.389	0.011	0.008	36,304
Disagree	0.357	-0.049	0.008	36,304
Strongly disagree	0.052	-0.012	0.003	36,304

Source: Health and Retirement Study (HRS), waves 1994-2010.
*Notes: Controls include: gender, cubic function of age, education attainment (less than high school, high school, college or more), occupation type (white collar, pink collar or blue collar) employment status (full-time, part-time, partial retirement), employer's size, employer's industry, tenure at job, employer-provided health insurance, employer-sponsored pension plans, level of physical effort at work, level of heavy lifting required at work, state and wave dummies and lagged health conditions. Regressions were weighted using wave-specific sampling weight for each respondent. Standard errors are clustered at the individual level. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

Table 13: Health effects of Employer downsizing after controlling for job loss expectations and stress levels

Outcomes	Baseline model		Controlling for job loss expectations and stress level		Sample Size
	Coef.	S.E.	Coef.	S.E.	
Self-reported bad health	0.033***	0.006	0.024***	0.006	30,785
Mental health indicators (0=No; 1=Yes)					
Felt depressed	0.027***	0.005	0.015***	0.005	30,774
Felt everything is an effort	0.030***	0.007	0.019***	0.007	30,770
Sleep was restless	0.038***	0.008	0.024***	0.008	30,775
Was happy	-0.023***	0.006	-0.011*	0.006	30,741
Felt Lonely	0.022***	0.006	0.014**	0.005	30,772
Felt sad	0.034***	0.006	0.021***	0.006	30,765
Could not get going	0.030***	0.006	0.020***	0.006	30,770
Enjoyed Life	-0.016***	0.005	-0.008	0.005	30,767
Symp. clinical depression	0.031***	0.005	0.018***	0.005	30,692
Probability of first diagnosis					
High blood pressure	0.002	0.009	-0.003	0.009	25,270
Diabetes	0.007	0.005	0.003	0.005	29,272
Cancer	0.004	0.004	0.003	0.004	29,774
Lunge disease	0.003	0.003	0.001	0.003	30,201
Hearth problems	0.000	0.005	-0.003	0.005	29,184
Stroke	0.006***	0.002	0.006***	0.002	30,497
Psychiatric or emotional problems	0.019***	0.005	0.015***	0.005	29,654
Arthritis	0.031***	0.009	0.025***	0.009	25,013
Controls					
Long-term average county employment growth	Yes		Yes		
Worker and employer characteristics	Yes		Yes		
Lagged health outcomes	No		No		

Source: Health and Retirement Study (HRS), waves 1994-2010.
*Notes: Self-reported bad health is based on a 5 point scale self-reported health question. Those who report fair or poor health are defined as being in bad health. Worker and employer characteristics include: gender, cubic function of age, education attainment (less than high school, high school, college or more), occupation type (white collar, pink collar or blue collar) employment status (full-time, part-time, partial retirement), employer's size, employer's industry, tenure at job, employer-provided health insurance, employer-sponsored pension plans, level of physical effort at work, level of heavy lifting required at work, and state and wave dummies. Regressions were weighted using wave-specific sampling weight for each respondent. Standard errors are clustered at the individual level. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

Outcomes	Baseline Model		Controlling for job loss expectations and stress level		Sample Size
	Coef.	S.E.	Coef.	S.E.	
Measurements above threshold? (0=No; 1=Yes)					
High A1c	0.015	0.025	0.011	0.026	1,618
High C-reactive protein	0.057	0.037	0.053	0.037	1,556
High Cystatin C	0.010	0.014	0.013	0.014	1,537
Low HDL	0.001	0.033	-0.005	0.034	1,253
High total cholesterol	0.048	0.033	0.054	0.033	1,543
Low total cholesterol	0.004	0.024	-0.002	0.025	1,543
High diastolic BP	-0.005	0.032	-0.005	0.032	1,597
Low diastolic BP	0.014	0.010	0.016	0.010	1,597
High systolic BP	-0.015	0.032	-0.021	0.033	1,597
High pulse	-0.025	0.019	-0.027	0.018	1,597
High BMI	0.021	0.039	0.016	0.039	1,549
Low BMI	-0.010	0.009	-0.011	0.008	1,549
Controls					
Long-term average county employment growth	Yes		Yes		
Worker and employer characteristics	Yes		Yes		
Lagged health outcomes	No		No		

Source: Health and Retirement Study (HRS), waves 2006-2008.
*Notes: Worker and employer characteristics include: gender, cubic function of age, education attainment (less than high school, high school, college or more), occupation type (white collar, pink collar or blue collar) employment status (full-time, part-time, partial retirement), employer's size, employer's industry, tenure at job, employer-provided health insurance, employer-sponsored pension plans, level of physical effort at work, level of heavy lifting required at work, and state and wave dummies. Regressions were weighted using wave-specific sampling weight for each respondent. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.*

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