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The Effects of Partial Retirement on Health

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Abstract

Recent studies analyzed the effect of retirement on mental and physical health. Some of them find that retirement yields a loss in cognitive skills while others find that retirement preserves physical health. These studies do not account for partial retirement or part-time work. This paper aims to fill this gap. We study how the amount of work hours affects the physical or mental health conditions of US residents between 50 and 75 years old in eight waves (1994-2008) of the Health and Retirement Study. To avoid the potential bias due to the fact that deteriorating health conditions can cause employees to work fewer hours, retirement eligibility ages are used as instruments for part-time or full-time work decisions. We also control for, possibly health related, unobserved heterogeneity across individuals. We find that working part-time or full-time deteriorates overall health and memory skills. On the other hand, part-time and full-time working reduces body weight, and part-time white-collar work substantially improves the word recall score. Part-time and full-time workers are also less prone to depression. In general, health status of the elderly responds to working part-time much more than it responds to working full-time, suggesting that the effect of number of hours worked on health outcomes is nonlinear.

Keywords: Older workers, phased retirement, health
JEL classification: C23, C25, C26, I12, J14, J26

1. Introduction

As in many other countries, the work force in the United States is aging. According to the Bureau of Labor Statistics, between 2010-2020, labor force participation rates of workers between the ages of 25 and 54 will decrease by 0.9 percentage points, while those of workers age 55 and over will increase by 2.8 percentage points. This implies growing costs of retirement and health benefits (Johnson, 2011). Current policy measures aim at keeping older workers in employment so that benefit claims can be decreased to ameliorate the strain on public finances. Perhaps the main policy measure is the increase of the full retirement age to 67 for those workers born in 1960 or later. This implies that older workers will spend more years in the labor market. Therefore, it is essential to know the effects of working, or retirement, on health. In fact, there is a growing literature in the effects of retirement on physical and mental health. The results of the early studies in this literature have been unsatisfactory because they provide little conclusive evidence or they only infer correlation between labor market inactivity and health and do not identify causal mechanisms (Coe and Zamarro, 2011; Rohwedder and Willis, 2010). Recent studies address the endogeneity of the retirement decision using an instrumental variables approach. Rohwedder and Willis (2010), Mazzonna and Peracchi (2010) and Bonsang et al. (2012) find that retirement has a negative effect on cognitive functioning. Charles (2004) finds that those who are retired feel less depressed or lonely. Coe and Zamarro (2011) find that retirement has no effect on depression or cognitive ability but has a positive effect on overall health. Neuman (2008) also finds that retirement has a preserving effect on general health. Most of these studies compare the health outcomes of those who are fully retired to the health outcomes of those who are working any positive number of hours, not distinguishing part-time from full-time work.

Few studies analyzed how the actual number of hours worked influences the health conditions of those who still work. In fact, the literature on partial retirement often claims that working part-time instead of full retirement could preserve mental health, as individuals retain their work related social contacts and keep their feelings of usefulness and self-esteem. Partial retirement may also preserve physical health, as individuals remain physically active (Pagán, 2009; Delsen and Reday-Mulvey, 1996). Dave et al. (2008) found that those who report to be partially retired have worse physical health outcomes than those who are fully retired. On the contrary, Neuman (2008) found that not only retirement but also a reduction in the number of hours worked (from full-time to less than full-time) preserves the general or physical health. According to Liu et al. (2009), individuals who report to be partially retired had fewer major diseases and functional limitations than those who are fully retired. The main methodological difficulty in these studies is the identification of the effect of working part-

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time on health outcomes, due to potential endogeneity: changes in health status may induce employees to work part-time rather than to work full-time or retire. The existing studies have taken different approaches to deal with this potential endogeneity problem. Liu et al. (2009) considers the effect of current work status on future health status. This approach assumes that current expectations of future health status have no effect on the current work decisions. Dave et al. (2008) selects partial retirees who did not have a health problem in the prior survey years. This identification strategy assumes that changes in health status in between the biennial survey years or in the current survey year do not affect the work decisions in the current survey year. Neuman (2008) uses retirement eligibility ages as instruments for the number of hours worked. This is similar to the approach we adopt in this study. The main difference is that we consider working part-time: Neuman sees those who work less than 1200 hours per year (or 3 day a week for 50 weeks a year) as retired - implicitly assuming partial retirement and full retirement are equivalent.

We study whether older employees who work part-time or full-time have better or worse physical or mental health outcomes than those who are fully retired. We take an instrumental variable approach using the retirement eligibility ages of the respondent and the spouse as the instruments of working part-time or full-time. Employing panel data, we also allow for fixed effects, to eliminate the time invariant factors that are potentially correlated with the number of hours worked. The data comes from the Health and Retirement Study (HRS) which includes a rich set of demographic and labor market variables and various health indicators for the same individuals over time. To measure mental health, we use self-rated memory, a test of word recall, and a depression index. To measure physical health, we use self-reported health but also derive a health index by predicting self-reported health from a set of objective measures of physical health, as in Coe and Zamarro (2011). We also use the Body Mass Index as an indicator of overweight.

We find that part-time or full-time work lowers overall health and memory skills, but leads to a much lower body mass index than full-time retirement. Part-time white collar workers appear to perform much better in the word recall test. Part-time and full-time workers are also less prone to depression. In general, health conditions respond much more to working part-time than to working full-time. This suggests that the effect of the number of hours worked on health is nonlinear. This is most pronounced for body mass index, consistent with the findings of Au and Hollingsworth (2011).

This paper proceeds as follows. Section 2 discusses the empirical model. Section 3 describes the data and the health and work effort indicators. Section 5 presents the results and robustness checks. Section 6 concludes.

2. Empirical approach

2.1. Controlling for heterogeneity

Our aim is to determine the effects of working part-time and full-time on health. The first attempt could be to estimate the parameter of interest by ordinary least squares in the following equation:

$$Y_{it} = \alpha + f^y(S_{it}) + \boldsymbol{D}_{it}\boldsymbol{\beta} + u_{it} \quad (1)$$

Y_{it} is a measure of health, for example the self-reported health or body mass index. S_{it} is the age of the individual. $f^y(S_{it})$ is a flexible and continuous polynomial in age that controls for changes in the health outcome with age. $\boldsymbol{D}_{it}$ is a vector of two dummy variables indicating working part-time and full-time. The parameter of interest is the vector $\boldsymbol{\beta}$, which measures the responses of the health outcome to working part-time and full-time.

OLS on Equation (1) leads to a consistent estimator for $\boldsymbol{\beta}$ only if $\boldsymbol{D}_{it}$ is not correlated with the error term u_{it}. One reason why this assumption may not be satisfied is that individuals might differ from each other because of time invariant idiosyncratic characteristics that are correlated with the health outcome as well as retirement behavior. We follow a fixed effects approach to allow for this, augmenting Equation (1) as follows:

$$Y_{it} = \alpha + f^y(S_{it}) + \boldsymbol{D}_{it}\boldsymbol{\beta} + \mu_i + \nu_{it} \quad (2)$$

μ_i is a time invariant individual specific unobserved variable and it is potentially correlated with $\boldsymbol{D}_{it}$ (and with S_{it}). The remaining error term ν_{it} is assumed to be uncorrelated with the control variables. The main parameters of interest, the effects of working part -time or full-time on the health measure considered, are contained in the vector β. Note that we assume throughout that these "treatment effects" are assumed to be homogeneous across the population. We will relax this assumption somewhat by estimating the model for specific demographic groups. Moreover, Murtazashvilia and Wooldridge (2008) have shown that under some additional assumptions the fixed effects instrumental variables estimator that we use remains consistent for the average treatment effect in the model with heterogeneous treatment effects. Following the main studies on this topic referred to above, however, we will not consider models with heterogeneous treatment effects.

Exploiting the panel structure of the data, μ_i is eliminated through the within group transformation:

$$\widetilde{Y}_{it} = \widetilde{f^y}(S_{it}) + \widetilde{\boldsymbol{D}}_{it}\boldsymbol{\beta} + \widetilde{\nu}_{it} \quad (3)$$

where $\widetilde{Y}_{it}$ represents $Y_{it} - \overline{Y}_i$, etc. The assumption that ν_{it} is uncorrelated with the control variables (strict exogeneity) implies that OLS on Equation (2) (the standard within group estimator for static linear panel data models with fixed effects) gives consistent estimates of $\boldsymbol{\beta}$.

2.2. Controlling for endogeneity

A potential problem in Equation (3) is that $\widetilde{\boldsymbol{D}}_{it}$ may be correlated with the unobserved $\widetilde{\nu}_{it}$ making the fixed effects estimator for $\boldsymbol{\beta}$ inconsistent. This might happen because, for example, employees with a work limiting health problem may select themselves into part-time work or full-time retirement (reverse causation). For example, examining the causal effect of health on labor market behavior, Gannon and Roberts (2011) find that in the UK, people aged 50 and over with health problems are more likely to work part-time or to retire completely than to work full-time. Bound et al. (1999) show that in the US, poor health is often followed by labor force exit. Mols et al. (2012) show that most of the patients who are diagnosed with cancer switched to part-time work or stopped working entirely in the Netherlands.

We follow an instrumental variables approach to solve the problem of potential endogeneity of hours worked, exploiting discontinuities in the probabilities to work part-time and full-time as a function of age at the eligibility ages, similar to Coe and Zamarro (2011). Instrumental variables estimation consists of two stages. In the first stage, we estimate two equations explaining the dummies $D_{it}^j, j = p, f$ for part-time and full-time work:

$$D_{it}^j = f^j(S_{it}) + \boldsymbol{I}(S_{it} \geq \bar{\boldsymbol{S}})\boldsymbol{\gamma^j} + \eta_i^j + \epsilon_{it}^j \tag{4}$$

$f^j(S_{it})$ are flexible and continuous age polynomials. $\bar{\boldsymbol{S}}$ is the vector of early and normal retirement eligibility ages for Social Security benefits and the vector $\boldsymbol{I}(S_{it} \geq \bar{\boldsymbol{S}})$ indicates whether the individual is at least as old as each of these eligibility ages. $\boldsymbol{\gamma^j}$ measures the discontinuities in the probabilities to work part-time or full-time at the eligibility ages $\bar{\boldsymbol{S}}$. Hence, this is essentially a regression discontinuity approach (Lee and Lemieux, 2010) in a fixed effects panel data model. Since the elements of D_{it}^j are binary indicators, Equation (4) is a linear probability model. The fixed effects η_i^j are time invariant, individual specific unobserved variables and they are potentially correlated with age. Exploiting the panel structure of the data, η_i^j are eliminated through the within group transformation:

$$\widetilde{D}_{it}^j = \widetilde{f^j}(S_{it}) + \widetilde{\boldsymbol{I}}(S_{it} \geq \bar{\boldsymbol{S}})\boldsymbol{\gamma^j} + \widetilde{\epsilon}_{it}^j \tag{5}$$

The predicted values from the first stage are used to estimate the main Equation (3) in the second stage:

$$\widetilde{Y}_{it} = \widetilde{f^y}(S_{it}) + \widehat{\widetilde{\boldsymbol{D}}}_{it}\boldsymbol{\beta} + \widetilde{\upsilon}_{it} \tag{6}$$

$\widehat{\widetilde{\boldsymbol{D}}}_{it}$ represents the within group transformed part-time and full-time work probabilities predicted from Equation (5). To be valid instruments, retirement eligibility ages are required to be relevant predictors of the full-time and part-time work decisions and exogenous to health status of the respondent. It is well documented that the retirement ages are strong predictors of the retirement decision and we will also check below that this is the case in our sample. Moreover, it seems quite plausible to assume that health status does not change discontinuously at the institutionally determined eligibility ages. If the selected instruments are indeed valid, the causal effect of working part-time or full-time on health status, measured by $\boldsymbol{\beta}$, is consistently estimated using least squares on equation (6). The complete two stage estimation procedure corresponds to two-stage least squares estimation.

One might be interested in how the effects of part-time or full-time work vary with demographic or labor market characteristics. Therefore, we will also estimate the effect of part-time or full-time work on health separately for each category of the following attributes: gender, education and occupation type.

3. Data

The data is taken from the Health and Retirement Study (HRS). HRS is a nationally representative panel study and surveys more than 22,000 Americans over the age of 50 every two years along with their spouses or partners. The survey was launched in 1992 and collects information on, among other things, income, work, pension plans, physical health, cognitive functioning, and health care expenditures. We use eight waves of the survey covering the period from 1994 to 2008 where data is available for all our dependent variables.

The following sample restrictions are imposed. First, we only keep those respondents who are between 50 and 75 years old. Second, we drop respondents who reported they never worked or worked but with a tenure of less than five years on all jobs. Third, we drop respondents who did not work since age 50. Fourth, we drop respondents who report to be working, disabled, unemployed, or not in the labor force after reporting retirement in a previous survey. Finally, we drop the observations of respondents who are disabled, not in the labor force, or unemployed. The reason for this restriction will be explained in Section 3.2. These sample restrictions result in a sample of 42,065 observations for 11,376 individuals.

3.1. Measuring health

Self-reported health

Self-reported health is the self-perceived general health status. It is based on the question "Would you say your health is excellent, very good, good, fair, or poor?" The values of the variable thus range from 1 (excellent) to 5 (poor). Self-assessed health is a global index of health that captures physical and mental health in one simple survey measure. Analyzing self-reported health, however, may lead to biased conclusions about the effect of work hours on health, since respondents may report an inferior health status to justify their labor market status (Bound, 1991). We therefore also consider several alternative indicators of mental and physical health, exploiting the rich health information in the HRS.

Self-rated memory and word recall score

We use self-rated memory as a subjective, and word recall as an objective measure of cognitive ability. Self-rated memory is based on the question "How would you rate your memory at the present time? Would you say it is excellent, very good, good, fair, or poor?" and hence ranges from 1 (excellent) to 5 (poor). Word recall is measured as follows. Respondents are presented with a list of 10 words to memorize. They are then asked immediately to recall as many words as possible from the list in any order. After asking other survey questions for about five minutes, they are asked for a second time to recall as many words as possible from the same list. Each immediate or delayed recall of a word is counted, giving a memory score ranging from 0 to 20.

Depression score

We use the depression indicator developed by the Center for Epidemiologic Studies (CESD-score). The indicator is created by summing binary indicators of whether the respondent experienced the following sentiments all or most of the time: depression, everything is an effort, sleep is restless, felt alone, felt sad, could not get going, did not feel happy, and did not enjoy life. This results in a depression indicator that ranges from 0 to 8.

Body mass index

We consider the body mass index (BMI) to construct indexes of overweight and obesity. BMI is given by the weight (in kilograms) divided by the square of height of the respondent (in meters). Following the existing literature, overweight is defined as BMI greater than 25 and less than or equal to 30; obesity as BMI greater than 30.

Health index

Following Coe and Zamarro (2011), we create an objective health index by predicting self-reported health from objective physical and mental health measures. In particular, we estimate the following equation:

$$H_{it} = \alpha + \boldsymbol{L}_{it}\boldsymbol{\beta} + \phi_i + \varepsilon_{it} \tag{7}$$

H_{it} is the self-reported health status. ϕ_i is a time invariant individual specific unobserved error that is potentially correlated with the control variables. $\boldsymbol{L}_{it}$ is a vector of objective measures of health including the number of limitations in the activities of daily living (ADL), the number of limitations in the instrumental activities of daily living (IADL), the total number of chronic diseases, a summary index of mobility, whether the respondent reports any overnight hospital stay within the last two years, overweight and obesity dummies, the scores of the word recall test discussed above, the score on a subtraction test for numerical skills, and the CESD score for depression.[1]

Equation (7) represents a fixed effects model. After the within group transformation, the predictions of the model, i.e. the estimates of $\widetilde{H}_{it}$, creates a *health stock* variable that is less prone to reporting bias, as it aggregates objective measures of health, and at the same time reflects one's overall well-being, as measured by the self-assessed health status (Coe and Zamarro, 2011). The estimation results for this equation are presented in Table 1. A positive coefficient indicates that an increase in the particular health indicator leads to a self-report of worse health. Most of the coefficients are significant and their signs are plausible. Onsets of physical health problems are associated with reporting poorer health and increasing depression symptoms (higher CESD score) also increase the odds of reporting poor health. A higher score on word recall is associated with reporting better health. On the other hand, the subtraction test result is not related to self-assessed health. Becoming overweight has no significant effect but becoming obese does lead to a significantly poorer self-assessment of health.

3.2. Measuring work intensity

The aim of our analysis is to examine the effect of working part-time or full-time on health around retirement age. In the HRS, part-time or full-time work can be defined in various ways. Self-reported work status, earnings, or number of hours worked per week or year are all possible indicators of work effort (see, for example, Gustman and Steinmeier, 2000b). As is common in US studies, we define part-time work as working less than 35 hours, full-time work as working 35 or more hours, and full-time retirement as working 0 hours a week.[2] The number of work hours includes the hours in the main job as well as those in a possible second job. As explained above, we exclude individuals who are disabled or out of the labor force; these individuals are not working, not searching for a full-time or part-time job, and do not report to be in retirement. We also exclude those who are unemployed. These individuals work 0 hours but they are likely to be more active than those who are retired, since they report to be searching for a full-time or part-time job.

3.3. Instruments

We use two sets of instruments for part-time and full-time work. The first set includes three instruments indicating whether respondents are eligible for social security benefits. In particular, the indicators define whether the individual is between the early and normal retirement age, between the normal retirement age but younger than 70, or older than 70. The early and normal retirement ages are presented in Table 2. The literature on the effect of retirement on health shows that retirement ages are significant predictors of retirement behavior and are not likely to explain individual health status directly (Charles, 2004; Rohwedder and Willis, 2010; Coe and Zamarro, 2011). Hence, as predictors of retirement behavior or hours of work, dummies for reaching these institutional retirement ages present themselves as natural instruments. We also use an indicator for having reached age 70, when the work decisions of individuals might change for two reasons. First, before the year 2000, Social Security benefits were reduced for those who continued to work at the normal retirement age through age 69 (earnings test). This means that some people might have preferred to return to work or increase their work hours at age 70 when they no

[1] ADL includes problems with bathing, dressing, eating, getting in/out of bed, and walking across a room. IADL includes problems with using the phone, managing money, taking medications, shopping for groceries, and preparing hot meals. Both variables take values from 0 (no problems) to 5 (many problems). The number of chronic diseases is a count of the following conditions that the respondent has according to a doctor in the current or a previous wave: high blood pressure, diabetes, cancer, lung disease, heart problems, stroke, psychiatric problems, and arthritis. The variable takes values from 0 (none of the conditions) to 8 (all conditions). The mobility index indicates problems with walking one block, walking several blocks, walking across a room, climbing one flight of stairs, and climbing several flights of stairs. The variable takes values from 0 to 5. Serial 7's subtraction test asks the respondents to subtract 7 from 100 and continue subtracting 7 from each subsequent number for a total of five trials. Each correct subtraction is counted, yielding a score from 0 to 5.

[2] Using 20 or 25 hours per week as the cut-off point does not change our qualitative results.

longer faced the earnings test. Second, individuals are allowed to delay receiving their Social Security benefits at their normal retirement age until age 70 and get compensated for this in the form of increased benefits (in an approximately actuarially fair way). This may induce some people to delay their retirement until age 70.

Following Neuman (2008), we also consider a second set of instruments which consists of the same three age indicators but then for the spouse. Whether the spouse is eligible for Social Security benefits may explain the retirement behavior of an individual whereas it has no direct effect on the health status of that individual. We discuss the robustness of our results to the choice of the instruments in Section 5.3.

Neuman (2008) also uses other instruments which are indicators of whether the individual is past the early or normal entitlement age of his or her private pension, or past the self-reported usual retirement age on the particular job. We could not adapt these instruments because there are no observations available for those who are retired. Neuman could use these instruments because he defines retirement as working less than 1,200 hours per year. Besides, HRS asks whether the respondents could reduce paid work hours in their regular work schedule. This variable could be used as an instrument for part-time work but again there are no observations available for those who are retired.

It is clear that at the Social Security eligibility ages many individuals will opt out of full-time work and therefore retirement ages are relevant instruments for the dummy variable defining full-time work in our model. However, it is less clear if individuals will also often choose to work fewer hours at the retirement ages. One possibility is the following. Since the year 2000, Social Security regulations allow individuals who have reached their normal retirement age to draw Social Security benefits and earn work income at the same time. This means that, as of their normal retirement age, individuals may prefer to work part-time rather than retire fully, to supplement their Social Security benefits with work income, especially if Social Security benefits constitute their only retirement income.

Table 3 presents the fraction of individuals in three employment states, based on reported hours of work, before the age at which they become eligible for social security, between the early and normal retirement ages, and after the normal retirement age. The table also presents the fraction of the individuals in three employment at the retirement eligibility ages of their spouse. It appears that not only the fraction of those who work full-time but also that of those who work part-time change considerably at the retirement eligibility ages or at age 70. These figures suggest that retirement ages are relevant predictors of the number of hours worked in old age.

3.4. Descriptive statistics

Table 4 presents descriptive statistics for the full sample selected using the exclusion criteria in Section 3. It also presents the statistics for the first and last wave of the survey so that changes in the statistics can be compared over time. Over the whole survey period, the average age of the sample is 62.8 years where 14.2 percent is between the early and normal retirement ages and 40.4 percent is above the normal retirement age. 46 percent have some college or a higher degree. 72.5 percent of the sample is married. About 20 percent report that their health is fair or poor. The sample does not appear to be particularly prone to depression; the average depression score is 1.16 out of 8. As objective indicators of general physical health, the average number of difficulties in daily activities or in mobility or muscle use seems low. The average number of chronic diseases is 1.54 out of 8. Almost 42 percent of the sample is overweight and 26 percent is obese. While the average score of the word recall test is just above half of its maximum, the score of the subtraction test seems much higher. 42.5 percent of the sample works 35 hours or more while another 16 percent works less than 35 hours at the time of the survey. [It is not clear to me now whether these variables are based upon reported hours of work or on self-reported employment status] The sample consists mainly of white collar workers. There are plausible changes in the statistics between the first and last waves. The most notable is that health status deteriorates across all health indicators.

4. Exploratory graphical analysis

In our empirical approach, identification of the effects of working part-time and full-time on health relies on the discontinuities in the probabilities of working part-time and full-time upon reaching the retirement eligibility ages of the respondent and his or her spouse. Here we provide exploratory graphical analysis of the jumps in the conditional mean of the treatment (the number of hours worked) and outcome (health) variables at the points of discontinuity in the assignment (retirement eligibility ages) variable .

Figure 1 presents univariate nonparametric regression of individual number of work hours against the age of the individual and against the age of his or her spouse allowing for jumps at the retirement eligibility ages. We also draw 95 percent confidence bounds around each curve. There are obvious discontinuities at the cutoff ages and the jumps are in the expected direction. The bounds never cross the curves suggesting that the jumps are statistically significant. The jumps are more pronounced at the cutoff ages of the individual than at those of their spouse, however. These suggest that part-time and full-time work probabilities change significantly at the retirement eligibility ages, which supports our identification strategy. Note that, however, the plot is based on univariate regression and does not control for the effect of the age of spouse. In the next section we present formal tests of whether the dummy variables for the discontinuities are jointly powerful enough to serve as good instruments for both part-time and full-time work status.

In Figures 2 and 3, six health indicators are plotted against the ages of the individual and spouse to inspect jumps in health status at the retirement eligibility ages of the individual and the spouse. Significant jumps are apparent at the retirement ages of the individual in self-reported health, health index, self-rated memory, and word recall score. The jumps are much less clear at the retirement ages of the spouse than at the individual's own retirement ages.

5. Results

5.1. Instrument relevance and validity

Table 5 presents the coefficient estimates from the first stage fixed effects estimation of Equation (5). [3] The errors of the linear probability model are heteroskedastic by construction of the model and the predictions of the model may lie outside the unit interval. We correct the standard errors of the estimates for heteroskedasticity and the predictions of the model lie outside the unit interval for only 16 cases. The results show that the retirement eligibility ages of the respondent significantly decrease the probability of working 35 or more hours and significantly increase the probability of working less than 35 hours. The effect on working 35-70 hours appears to be larger than that on working 01-34 hours. This is plausible since the majority of the employees opt out of full-time work when they are eligible for social security benefits, according to Table 3. The retirement ages of the spouse also appear to be predictive of the respondent's own retirement behavior. It may be that when the spouse is eligible for social security benefits, the respondent becomes less inclined to work full-time or part-time. In fact, Gustman and Steinmeier (2000a) finds that an individual values retirement more once their spouse has retired. Besides, we find that retirement ages of the spouse, in particular being between 65 and 70 years old or over 70 years old, have the same significant negative effects on the probabilities of part-time retirement and part-time work.

The table shows that the retirement age indicators are jointly significant at the 0.01 level. The table also shows that the continuous age variables are also jointly significant at the 0.01 level. Angrist and Pischke (2009, pp. 217-18) introduced an F statistic for testing weak identification when there is more than one endogenous regressor. The test is carried out by first regressing an endogenous regressor on the first-stage fitted values of the remaining endogenous regressor and other exogenous regressors. The residuals from this regression are then regressed on the instruments. Joint significance of the instruments provides evidence against weak identification for the particular endogenous regressor. Table 5 shows that weak identification is rejected for both endogenous regressors. These results show that retirement ages are important predictors of both part-time and full-time work status even when we control for a general nonlinear smooth function of age.

Table 6 presents the results of overidentification tests when we consider the retirement eligibility ages of both the respondent and the spouse, which constitute a total of six instrumental variables for two potentially endogenous regressors; Table 7 presents the same results when we consider the retirement eligibility ages of the respondent only (three instruments for two regressors). In all regressions with instrumental variables and fixed effects, the test results support the use of these instruments: the null that all moment restrictions are valid is not rejected.

[3] We also estimated specifications including dummies for marital status and white-collar jobs but these were insignificant and including them did not change anything else.

5.2. Physical and mental health

Table 6 presents the baseline results from the estimation of linear probability models with instrumental variables and fixed effects given by Equation (6). The estimation makes use of the full set of six instruments introduced above. Regarding labor market participation at the extensive margin, we find that working (either part-time or full-time) has a significant negative effect on self-reported health, in line with the findings of Coe and Zamarro (2011) and Neuman (2008) who showed that those who are retired have better self-reported health in Europe and in the US, respectively. It might be that those who work are suffering from occupational injuries or diseases or from job stress and therefore report poor health, which would imply that it is not working itself but working conditions that are responsible for poor health outcomes. This is consistent with Siegrist et al. (2006) who find that poor psychosocial quality of work is associated with early retirement among older employees across all European countries. On the other hand, working itself may also initiate adverse health effects which would be delayed or prevented if the individual was retired.

Working substantially reduces the body mass index, implying that older people who work are much less likely to be overweight or obese than those who are retired, probably because they are physically more active. Consequently, older workers might be expected to be less prone to diseases caused by overweight. In fact, Liu et al. (2009) find that partial retirees have fewer chronic diseases like heart problems or functional limitations than full retirees. Must et al. (1992); Blair and Brodney (1999); Janssen (2007) show that overweight and obesity are related to morbidity. Haslam and James (2005) argue that overweight and obesity considerably increase the risks of cardiovascular disease, diabetes, and cancer. This result is particularly important because a substantial fraction of the population is suffering from being overweight or obese. Table 4 showed that almost 42 percent of the sample is overweight and 26 percent is obese. Flegal et al. (2010) report that among those aged 60 or older, from 1999–2000 to 2007–2008, obesity increased from 31.8 percent to 37.1 percent for men, although it decreased from 35 percent to 33.6 percent for women.

We find that those who work rate their memory lower. Workers may indeed be failing to utilize their memory skills more frequently than those who are retired, but this might be because they are more frequently challenged to utilize their memory skills. Hence, working itself may not necessarily be deteriorating memory skills.

Unlike Coe and Zamarro, we find that working has no significant effect on the objective health index. Besides, we find no statistical evidence that the number of hours worked is endogenous in the regressions of word recall score and depression score. Therefore, we estimate a linear model similar to that given by Equation (3) except that we allow for fixed effects but do not use instrumental variables. The results are discussed in the next section where we employ alternative estimation methods.

Finally, Table 6 shows that the age terms are individually insignificant (due to the collinearity among them) but they are jointly significant at the 0.01 level in all regressions. This might suggest that a cubic function of age captures the evolution of health conditions through older ages better than a linear or quadratic function employed by many of the subject studies (Coe and Zamarro, 2011; Dave et al., 2008; Liu et al., 2009), although the effect of the cubic age term is very small. Results based on a quadratic age function are discussed in the next section.

Regarding labor market participation at the intensive margin, surprisingly, we find that the effect of working part-time is much larger than that of full-time in all regressions and we reject the equality of the coefficients of 01-34 hr and 35-70 hr in the self-reported health, body mass index, and self-rated memory regressions (as indicated in the table with a double dagger symbol (‡)). The reason for the results on self-reported health and self-rated memory could be that part-time workers are not only challenged with activities at work, as full-time workers, but also with activities outside work and are therefore more inclined to respond towards poor general health or memory. The result on body mass index is consistent with Au and Hollingsworth (2011). Au and Hollingsworth studied 5164 participants in the Australian Longitudinal Study on Women's Health in 2003 and 2006 to investigate the influence of employment patterns on weight gain and weight loss in young adult women. They found that women in part-time work have a higher probability of loosing weight or a lower probability of gaining weight compared to women in full-time work. The authors reason that more time spent at work contributes to weight gain through reduced time available for physical activity, overeating due to work related stress, reduced sleep, or increased preference for fast-food instead of home-cooked meals.

A potential shortcoming of our model is that it is not flexible enough to capture differences in the treatment effects across socio-economic groups. To see if such differences play a role, we run separate regressions for each category of a certain control variable. The second panel of Table 6 shows the effects of working part-time and full-time by gender, occupation type, and education level. As found for the full sample above, the effect of working part-time is often larger than that of working full-time and the difference between the two effects is sometimes statistically significant in the regressions of self-reported health, body mass index and self-rated memory (as indicated with the symbol ‡). Second, we find significant effects for white collar part-time workers in all regressions except in the regression for depression score. For example, white collar part-time workers recall about four more words than their fully retired counterparts. Rohwedder and Willis (2010) also find that retirement has a significant negative effect on the number of words recalled, using the HRS data from 2004. Our results suggest that working, instead of retirement indeed has a positive effect on word recall but this effect depends particularly on the occupation type and the number of hours worked. Moreover, white collar part-time workers also have a substantially lower body weight than their counterparts who are fully retired. Current and former blue collar workers do not appear to have significantly different body weights perhaps because former blue collar workers were always physically active during their career years and are less likely to gain weight when they retire.

5.3. Robustness checks

Age specification

Our econometric model has allowed for a cubic function of age to capture the possibly nonlinear changes in the health status due to advancing age. Table 6 showed that the three age terms are jointly significant at the 1% level. The top panel of Table 7 presents the coefficient estimates of the variables 01-34 hr and 35-70 hr when we employ a quadratic, instead of a cubic, function of age. The table shows that the effect of working part-time is slightly more significant and the effect of working full-time turns out to be significant in the regressions of health index – as in Coe and Zamarro (2011) who considered a quadratic function of age in an instrumental variable model – and word recall score, apparently because the predictive power of the retirement eligibility ages has increased, especially for full-time work hours. Note also that, according to the test for exogeneity, the number of hours worked is now endogenous in the word recall score and depression score regressions. Similarly, the effect of working full-time turns out to be significant in the self-reported health, health index, self-rated memory and word recall regressions on the sub-samples defined by gender, occupation type, and level of education. Overall, these results show that our previous findings for the effects of working part-time or full-time are robust to the age specification in the self-reported health, body mass index and self-rated memory regressions. The effects are sensitive to the age specification in the health index and word recall score regressions.

Estimation method

Our econometric model makes use of instrumental variables to circumvent the endogeneity of hours worked, and exploits the panel nature of the data to allow for fixed effects that control for unobserved individual heterogeneity. To show the extent to which the endogeneity of hours worked and individual heterogeneity affect the estimated coefficients, the middle panel of Table 7 presents the results using three alternative estimation methods. The first is pooled OLS estimation, the second is the panel FE estimation which uses the within groups estimator (the within group transformation followed by OLS), and the third is the pooled IV estimation which uses a generalized method of moments estimator. The baseline panel IV-FE estimation in Table 6 uses the two-stage least-squares estimator after the within group transformation. A first result is that the signs or magnitudes of the coefficients generally change when we control for the endogeneity of hours worked, especially when we control for fixed effects. The changes are somewhat less pronounced, for example, in the regressions of the word recall and the depression score, where we find no statistical evidence that the number of hours worked is endogenous. These results suggest that health conditions, as measured by self-reported health, body mass index and self-rated memory, not only affect the labor market participation decisions of individuals but also affect labor supply at the intensive margin. The second result is that the magnitudes of the effects decrease substantially when we control for fixed effects, regardless of whether we take an instrumental variables approach. This result suggests that individuals have health related unobserved characteristics that are also correlated with their labor market behavior. Overall, the results suggest that controlling for the endogeneity of hours worked and individual heterogeneity are essential in the analysis of the effect of labor market behavior on health outcomes at older ages.

Baseline analysis on panel IV-FE estimation in Table 6 showed that the number of hours worked is not endogenous in the regressions of word recall and depression score. Therefore, we rely on the results based on the panel FE estimation that are presented in the middle panel of Table 7. We find no significant effect for word recall score but for depression score. The table shows that part-time and full-time workers are equally less likely to be depressed than retirees. This suggests that even working at a reduced work effort helps to prevent symptoms of depression. Separate regressions for the eight symptoms that constitute the depression score show that working has a significant negative effect on the following four symptoms of depression: everything is an effort, sleep is restless, felt alone, and could not get going.

Instrument set

Coe and Zamarro (2011) and Rohwedder and Willis (2010) have used retirement eligibility ages of the respondent as instruments for retirement behavior. We have supplemented this instrument set with the retirement ages of the spouse. In order to investigate the sensitivity of the estimates for restricting the set of instruments, the third panel of Table 7 presents the results using the retirement ages of the respondent only. The overidentification test results indicate that multiple exclusion restrictions on the three instruments is not rejected meaning that the instruments are exogenous to the health status of the respondent. As in the case when we use the full instrument set, the number of hours worked appears to be exogenous in the regressions of word recall and depression score. However, the number of hours worked also appears to be exogenous in the regression of body mass index. In the other regressions, the coefficients generally preserve their signs or magnitudes but they are less precisely estimated, perhaps due to the reduction in the predictive power of the instrument set. We conclude that the retirement ages of the spouse improve the efficiency of the instrumental variables estimator yielding more significant effects.

Lagged effect of retirement

We have examined the contemporaneous effect of labor market participation and hours worked on health outcomes. A concern is that retirement, in comparison to working, may have a lagged rather than a contemporaneous effect on health. For example, cognitive skills of a retiree may deteriorate, and hence differ from those of a current worker, only after a number of years spent in retirement (Rohwedder and Willis, 2010; Bonsang et al., 2012). The bottom panel of Table 7 presents new results on the contemporaneous effects of part-time and full-time work on health when we require that part-time and full-time workers were also working part-time and full-time and retirees were also retired two years ago, i.e. when they were interviewed in the previous survey wave. We find no significant change in the results of the regressions of self-reported health and body mass index, when compared to the baseline results in Table 6. However, we do not find anymore evidence that the number of hours worked is endogenous in the regression of self-rated memory.

Definition of part-time work

In our analysis so far, we defined part-time work as working less than 35 hours per week. In the HRS survey, however, working under 35 hours can correspond to two different labor force participation statuses: ‘working part-time’ as well as ‘partly retired’. That is, the survey determines the labor force status of a respondent as ‘working part-time’ if he or she is working under 35 hours (based on reported hours of work) and does not mention retirement (based on reported retirement status), while it determines the status of the respondent as ‘partly retired’ if he is working under than 35 hours, or looking for a part-time job, and mentions retirement. Therefore, we check if the effect of working under 35 hours in our baseline analysis change among those who are partly retired and those who are working part-time at any given survey year.

Table 3 presented the fraction of individuals in part-time employment before and after the age they become eligible for social security where part-time status is based on reported hours of work. When we differentiate between the two definitions of part-time status, we find that the fraction of those partly retired increases while that of those working part-time decreases when individuals become eligible for social security. For example, the fraction of those partly retired increases from 4.48 percent among those under age 62 to 12.33 percent among those between ages 65 and 70, while the fraction of those working part-time decreases from 11.51 percent among those under age 62 to 4.79 percent among those between ages 65 and 70. A potential explanation is that, among those working less than 35 hours, more people report being retired and are therefore categorized as ‘partly retired’ at older ages.

The implication of this result for the baseline IV-FE estimation is the following. We repeat the estimation on two restricted sub-samples of the data. We require that those working less than 35 hours at any given survey year to be partly retired in the first sub-sample, and to be working part-time in the second sub-sample. With respect to the first stage results, we find that the effects of the retirement ages of the respondent on the probability of part-time work are significant and positive and larger than those presented in Table 5 in the first sub-sample, while they are insignificant and negative and smaller than those presented in Table 5 in the second sub-sample. The effects of the retirement ages of the spouse on the probability of part-time work also become less significant or insignificant in the second sub-sample. We find no significant change for the effects on the probability of full-time work. The bottom panel of Table 7 presents the second stage results from the estimations based on the two sub-samples. In the regressions of self-reported health, body mass index and self-rated memory, the signs and significance of the coefficient estimates are similar across the two sub-samples, but the magnitudes of the estimates are larger in the second sub-sample. It might be that part-time workers more often take part in work or non-work activities that are physically or mentally demanding than those partly retired, which might explain why they have a lower body weight and a tendency to report worse overall health or memory.

6. Conclusion

We analyzed the causal effect of working part-time or full-time on the physical and mental health of US residents between ages 50 and 75, controlling for fixed individual effects and potential endogeneity of labor supply. The two main findings are the following. First, relative to the retired, part-time or full-time workers rate their overall health and memory lower, while part-time white collar workers have a better word recall score. On the other hand, full-time and, especially, part-time workers have a much lower body weight. Considering that 68% of our sample consists of individuals who are overweight or obese, promoting partial retirement among the elderly workers seems essential as those who are fully retired appear to be much more prone to be overweight or obese and perhaps to the related diseases such as a heart attack. We also find that part-time and full-time workers are less prone to the symptoms of depression.

Second, the effect of working on health is larger for part-time workers than full-time workers. For example, part-time workers have a much lower body weight in comparison to full-time workers. This result suggests that the effect of number of work hours on health is nonlinear in old age. It might that part-time workers take part in work activities but also in non-work activities which when combined are physically and mentally more challenging than only taking part in full-time work activities. In this respect, analysis of time use data would be particularly useful to understand the differences in time allocation among work and non-work activities of part-time and full-time workers. It might also be worthwhile to distinguish between the effects of voluntary and involuntary retirement, since it has been shown that these transitions have different effects on the way in which a person experiences retirement and therefore possibly also on health (van Solinge and Henkens, 2007). Unfortunately this cannot be done with the data at hand. Finally, it might be useful to consider additional measures of health or other longitudinal datasets in other countries to further investigate the differences between the effects of part-time and full-time work on health.

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Table 4
Descriptive statistics

	Percent		
	All waves	1994 wave	2008 wave
Demographics			
Age (50-75) (avg)	62.84	61.13	63.39
Under 62	45.41	57.38	41.80
Btw 62 and 65	14.21	13.08	15.54
Btw 65 and 70	18.67	11.50	21.84
Over 70	21.71	18.05	20.82
High education	46.27	39.57	54.28
Married	96.94	97.08	95.49
Female	47.83	38.36	43.84
Health			
Self-reported fair or poor health	20.28	18.01	19.17
CESD depression scale (0-8) (avg)	1.16	0.89	0.97
Number of ADL limitations (0-5) (avg)	0.14	0.07	0.12
Number of IADL limitations (0-5) (avg)	0.11	0.07	0.91
Number of mobility limitations (0-5) (avg)	0.70	0.49	0.68
Number of difficulties in muscle use (0-4) (avg)	0.97	0.86	0.99
Number of chronic diseases (0-8) (avg)	1.55	1.16	1.85
Hospital stay in the previous two years	19.43	15.76	20.09
Overweight	41.58	44.48	41.56
Obese	26.15	19.82	32.60
Word recall test score (0-20) (avg)	10.71	9.28	10.78
Subtraction test score (0-5) (avg)	3.82	3.93	3.92
Employment			
Full-time worker	42.54	47.65	41.42
Part-time worker	15.97	16.47	16.03
Full-time retiree	41.50	35.88	42.55
White collar (former) worker	70.17	65.89	70.51

Notes: 1. Totals may not add due to rounding error. 2. Number of observations is 42065 and number of individuals is 11376 in the HRS waves 1994-2008. Number of observations is 5253 and 4703 respectively in the 1994 and 2008 waves.

Table 1
Results for FE model explaining self-reported health

	Self-reported health	
	Coef	p-val
Difficulty in daily activities	0.051	0.000
Difficulty in instrumental daily activities	0.038	0.009
Difficulty in mobility	0.106	0.000
Difficulty in muscle use	0.073	0.000
Number of chronic diseases	0.189	0.000
Hospital stay	0.020	0.000
Overweight	0.026	0.083
Obese	0.067	0.000
Word recall test	−0.004	0.003
Subtraction test	0.001	0.825
Depression	0.045	0.000
Constant	2.053	0.000
F statistic for overall significance	291	0.000
N observations	32274	
N individuals	9807	

Notes: 1. Linear model with fixed effects. 2. Self-reported health: 1 (Excellent), ..., 5 (poor). 3. Standard errors are corrected for possible heteroskedasticity or correlation over time for a given individual.

Table 2
Retirement ages

Year of birth	Retirement ages		
	Early	Normal	Late
1937 or earlier	62	65	70
1938	62	65 and 2 mo.	70
1939	62	65 and 4 mo.	70
1940	62	65 and 6 mo.	70
1941	62	65 and 8 mo.	70
1942	62	65 and 10 mo.	70
1943-1954	62	66	70

Source: The United States Social Security Administration.

Table 3
Employment rates at the retirement eligibility ages (%)

Eligibility age	FT worker	PT worker	FT retiree
Under 62	72.19	15.99	11.82
Between 62 and 65	36.26	19.09	44.65
Between 65 and 70	16.95	17.12	65.92
Over 70	6.64	12.87	80.48
Under 62 (S)	65.38	15.80	18.83
Between 62 and 65 (S)	35.72	18.74	45.53
Between 65 and 70 (S)	22.52	17.38	60.11
Over 70 (S)	10.43	14.52	75.05

Notes: 1. FT: full-time. PT: part-time. S: Spouse. 2. Other employment statuses of ‘disabled’, ‘not in the labor force’, and ‘unemployed’ are excluded from the analysis.

Table 5
Results for first stage FE model explaining part-time and full-time work status

	01-34 hr		35-70 hr	
	Coef	p-val	Coef	p-val
Btw 62 and 65	0.035	0.000	−0.122	0.000
Btw 65 and 70	0.040	0.001	−0.169	0.000
Over 70	0.036	0.016	−0.146	0.000
Btw 62 and 65 (S)	−0.004	0.493	−0.026	0.000
Btw 65 and 70 (S)	−0.030	0.002	−0.015	0.167
Over 70 (S)	−0.060	0.000	0.013	0.397
Age	−0.120	0.169	0.922	0.000
Age squared	0.002	0.114	−0.015	0.000
Age cubed	−0.000	0.073	0.000	0.000
Number of children	−0.000	0.977	−0.004	0.348
Constant	2.291	0.206	−17.126	0.000
F-test for six instruments		0.000		0.000
F-test for three age terms		0.000		0.000
AP test of weak identification		0.007		0.000
N observations	41688		41688	
N individuals	11326		11326	

Notes: 1. Linear probability model with fixed effects. 2. S: Spouse. 3. Standard errors are corrected for possible heteroskedasticity or correlation over time for a given individual.

Table 6
Results for IV-FE model explaining health outcomes

Model		Self-report health		Health index		Body mass index		Self-rate memory		Word recall score		Depression score	
		Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val
6 IV, FE, CA, CE, Full	01-34 hr	1.773	0.003‡	0.103	0.584	−4.666	0.004‡	1.202	0.011‡	2.452	0.222†	0.010	0.989†
	35-70 hr	0.531	0.016	0.067	0.347	−1.335	0.027	0.445	0.011	0.747	0.322	−0.087	0.766
	Age	−0.017	0.963	0.127	0.259	1.130	0.244	0.243	0.441	1.102	0.365	0.897	0.104
	Age sq	0.000	0.959	−0.001	0.338	−0.012	0.440	−0.003	0.534	−0.016	0.412	−0.015	0.090
	Age cu	0.000	0.914	0.000	0.285	0.000	0.674	0.000	0.503	0.000	0.496	0.000	0.070
	N of chd	−0.013	0.196	0.002	0.613	−0.038	0.183	0.014	0.171	0.046	0.187	−0.017	0.329
	N obs	39493		29556		38977		35720		31497		35730	
	N ind	9141		7333		9064		8446		7937		8443	
	End test		0.000		0.030		0.002		0.002		0.474		0.981
	Ove test		0.254		0.355		0.885		0.717		0.445		0.506
	F-test		0.000		0.000		0.000		0.000		0.004		0.002
Fem	01-34 hr	−0.516	0.516†	0.000	0.998	−2.050	0.351†	0.477	0.454†	2.883	0.298†	−1.732	0.203†
	35-70 hr	0.123	0.606	0.103	0.265	−1.250	0.077	0.299	0.154	0.153	0.881	−0.350	0.460
Mal	01-34 hr	2.167	0.080‡	−0.365	0.307†	−1.352	0.576†	0.356	0.669†	−1.883	0.611†	−0.410	0.765†
	35-70 hr	0.697	0.110	−0.103	0.409	−0.047	0.956	0.283	0.303	−0.049	0.970	−0.227	0.629
Whi	01-34 hr	1.210	0.019‡	0.040	0.806†	−4.594	0.002‡	0.917	0.038‡	3.940	0.038‡	−0.245	0.740†
	35-70 hr	0.205	0.372	0.034	0.651	−1.285	0.065	0.273	0.165	1.244	0.153	0.033	0.924
Blu	01-34 hr	1.828	0.105	0.170	0.619	2.081	0.471†	0.785	0.376	−0.011	0.997†	−1.127	0.460†
	35-70 hr	0.779	0.034	0.121	0.303	0.550	0.531	0.550	0.054	0.592	0.628	−0.527	0.288
Led	01-34 hr	1.795	0.028‡	−0.257	0.371	−3.553	0.086†‡	2.039	0.012‡	3.058	0.288†	−1.132	0.335†
	35-70 hr	0.466	0.084	−0.021	0.830	−0.702	0.313	0.595	0.021	0.529	0.587	−0.286	0.485
Hed	01-34 hr	1.382	0.055‡	0.315	0.219†	−5.205	0.023‡	0.172	0.759†	1.192	0.649†	0.930	0.352†
	35-70 hr	0.383	0.228	0.075	0.495	−1.826	0.058	0.197	0.414	0.777	0.488	−0.063	0.890

Notes: 1. CA: Cubic age. CE: Contemporaneous effect. Full: Full sample. 2. Linear model with instrumental variables and fixed effects. 3. Self-reported health: 1 (Excellent), ..., 5 (poor). Health index takes similar values. Body mass index takes values from 10.9 to 82.7. Higher values indicate increasing body weight. Self-rated memory: 1 (Excellent), ..., 5 (poor). Word recall score takes values from 0 to 20. Higher values indicate better memory. Depression score takes values from 0 to 8. Higher values indicate more severe depression. 4. Endogeneity test tests the null hypothesis that the variables 01-34 hr and 35-70 hr are exogenous. Overidentification test tests the null hypothesis that all instruments are uncorrelated with the unobserved error. F-test tests the null hypothesis that the coefficients of the age terms are zero. 5. Standard errors are corrected for possible heteroskedasticity or correlation over time for a given individual. 6. The regressions on categories also include age terms and number of children. 7. The dagger symbol (†) indicates the cases where we find no statistical evidence that the number of hours worked are endogenous. The double dagger symbol (‡) indicates the cases where equality of the coefficients of 01-34 hr and 35-70 hr is rejected.

Table 7
Robustness checks

Model		Self-report health		Health index		Body mass index		Self-rate memory		Word recall score		Depression score	
		Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val	Coef	p-val
6 IV, FE, QA, CE, Full	01-34 hr	1.803	0.002‡	0.138	0.447	−4.554	0.003‡	1.263	0.007‡	2.836	0.143	0.304	0.678
	35-70 hr	0.557	0.000	0.111	0.024	−1.192	0.004	0.523	0.000	1.122	0.027	0.263	0.172
	End test		0.000		0.000		0.001		0.000		0.087		0.025
	Ove test		0.276		0.349		0.893		0.709		0.404		0.673
Fem	01-34 hr	−0.360	0.642	0.037	0.876	−1.980	0.345†	0.559	0.371	3.573	0.191†	−1.310	0.323
	35-70 hr	0.323	0.012	0.147	0.008	−1.016	0.016	0.465	0.000	1.063	0.070	0.382	0.141
Mal	01-34 hr	2.172	0.060‡	−0.293	0.379	−2.363	0.309†	0.455	0.586	−1.632	0.634†	−0.120	0.928†
	35-70 hr	0.708	0.029	−0.020	0.834	−0.795	0.227	0.386	0.079	0.101	0.915	0.020	0.955
Whi	01-34 hr	1.271	0.014‡	0.059	0.718	−4.589	0.002‡	1.030	0.024	4.001	0.035	−0.124	0.867†
	35-70 hr	0.386	0.012	0.089	0.085	−1.280	0.007	0.530	0.000	1.548	0.006	0.223	0.308
Blu	01-34 hr	2.129	0.069	0.295	0.419	1.401	0.618†	0.720	0.395	−0.693	0.844†	−0.934	0.531†
	35-70 hr	0.661	0.011	0.162	0.061	0.081	0.896	0.338	0.063	0.004	0.996	−0.030	0.927
Led	01-34 hr	1.957	0.014‡	−0.136	0.613	−3.744	0.054‡	2.060	0.008‡	3.599	0.188†	−0.861	0.439
	35-70 hr	0.547	0.003	0.086	0.208	−0.856	0.067	0.601	0.000	0.840	0.187	0.054	0.834
Hed	01-34 hr	1.462	0.044‡	0.342	0.181	−4.983	0.025‡	0.269	0.643	1.337	0.607†	1.232	0.226†
	35-70 hr	0.539	0.018	0.134	0.090	−1.461	0.041	0.357	0.042	1.108	0.162	0.480	0.135
CA, CE, Full, Pool OLS	01-34 hr	−0.435	0.000‡	−0.189	0.000‡	−0.799	0.000‡	−0.186	0.000‡	0.750	0.000‡	−0.342	0.000‡
	35-70 hr	−0.478	0.000	−0.247	0.000	−0.390	0.000	−0.219	0.000	0.540	0.000	−0.455	0.000
Panel FE	01-34 hr	−0.109	0.000	−0.058	0.000‡	−0.021	0.643	−0.029	0.051‡	0.079	0.163	−0.110	0.000
	35-70 hr	−0.130	0.000	−0.079	0.000	−0.042	0.335	−0.067	0.000	0.088	0.102	−0.131	0.000
Pool 6 IV	01-34 hr	2.732	0.025‡	0.424	0.288†	5.880	0.228†	3.502	0.004‡	−7.997	0.108	−1.287	0.295†
	35-70 hr	0.789	0.035	−0.018	0.869	1.460	0.331	0.909	0.016	−3.892	0.006	−0.637	0.104
	End test		0.000		0.166		0.236		0.000		0.000		0.631
	Ove test		0.936		0.000		0.223		0.271		0.000		0.004
3 IV, FE, CA, CE, Full	01-34 hr	1.409	0.066	0.066	0.777	−2.751	0.147†	0.561	0.353	3.342	0.235†	−1.264	0.294†
	35-70 hr	0.533	0.019	0.060	0.441	−0.696	0.239	0.346	0.054	1.003	0.253	−0.223	0.536
	End test		0.003		0.021		0.302		0.026		0.477		0.433
	Ove test		0.986		0.706		0.218		0.603		0.102		0.471
6 IV, FE, CA, LE, Full	01-34 hr	2.537	0.034‡	0.359	0.270	−5.819	0.068‡	0.110	0.888†	1.096	0.721†	−0.522	0.735†
	35-70 hr	0.804	0.026	0.138	0.156	−1.572	0.095	0.189	0.437	0.130	0.896	−0.179	0.706
	End test		0.004		0.079		0.050		0.463		0.909		0.922
	Ove test		0.752		0.848		0.369		0.641		0.993		0.848
6 IV, FE, CA, CE, P ret	01-34 hr	2.083	0.006‡	0.057	0.814	−5.875	0.006‡	1.609	0.012‡	1.466	0.514†	0.319	0.743†
	35-70 hr	0.710	0.012	0.050	0.577	−1.935	0.014	0.649	0.006	0.685	0.442	0.018	0.962
P wor	01-34 hr	2.465	0.023‡	0.263	0.427	−6.386	0.025‡	2.300	0.032‡	1.824	0.638†	0.507	0.727†
	35-70 hr	−0.067	0.719	0.014	0.791	0.033	0.944	0.014	0.945	0.079	0.898	−0.302	0.309

Notes: 1. QA: Quadratic age. CA: Cubic age. CE: Contemporaneous effect. LE: Lagged effect. Full: full sample. 2. Self-reported health: 1 (Excellent), ..., 5 (poor). Health index takes similar values. Body mass index takes values from 10.9 to 82.7. Higher values indicate increasing body weight. Self-rated memory: 1 (Excellent), ..., 5 (poor). Word recall score takes values from 0 to 20. Higher values indicate better memory. Depression score takes values from 0 to 8. Higher values indicate more severe depression. 3. Endogeneity test tests the null hypothesis that the variables 01-34 hr and 35-70 hr are exogenous. Overidentification test tests the null hypothesis that all instruments are uncorrelated with the unobserved error. 4. Standard errors are corrected for possible heteroskedasticity or correlation over time for a given individual. 5. The regressions on categories also include age terms and number of children. 6. The dagger symbol (†) indicates the cases where we find no statistical evidence that the number of hours worked are endogenous. The double dagger symbol (‡) indicates the cases where equality of the coefficients of 01-34 hr and 35-70 hr is rejected.

Figure 1

Hours per week by age of the respondent and the age of spouse. Kernel smoothed local polynomials and 95 percent confidence intervals around them.

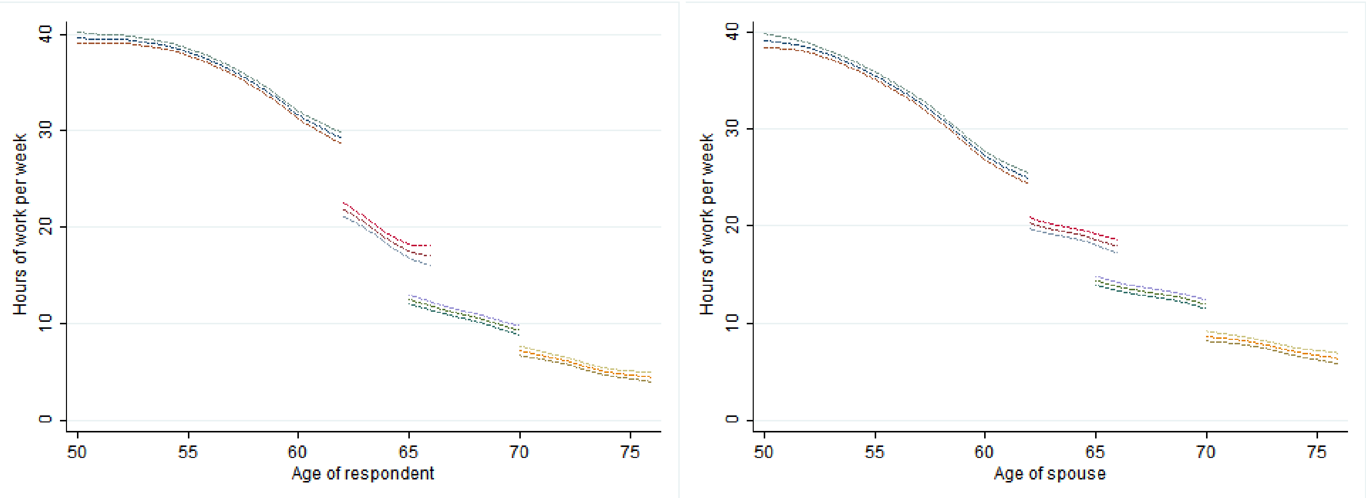

Figure 2
Health status by age of the respondent and the age of spouse. Kernel smoothed local polynomials and 95 percent confidence intervals around them.

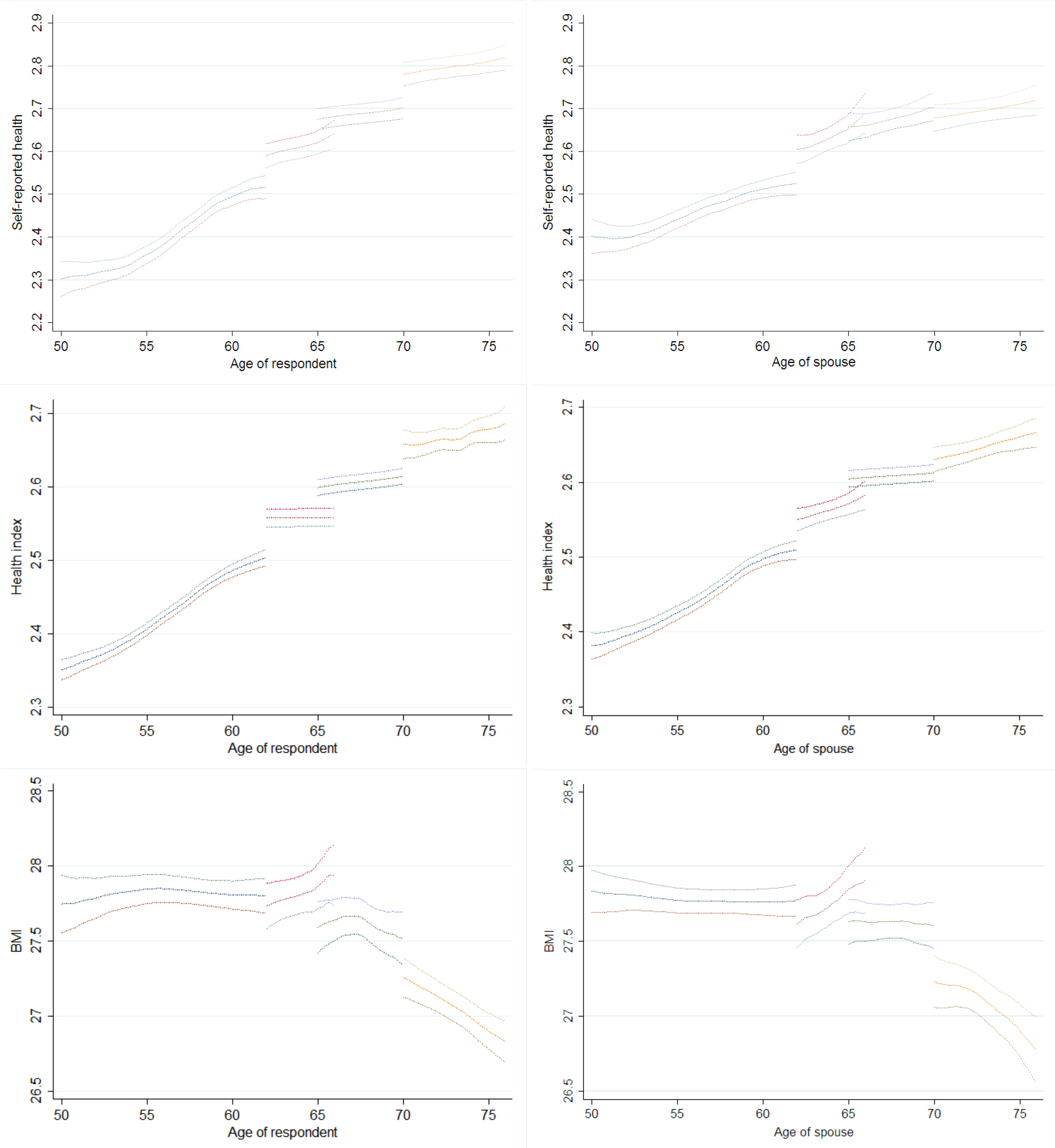

Figure 3

Health status by age of the respondent and the age of spouse. Kernel smoothed local polynomials and 95 percent confidence intervals around them.