Health and Work of Older Workers

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1 Introduction

Health and work among older workers is not a new theme. Part of this literature can be placed in the literature on the incentive effects of social security (see for instance the surveys by Hurd 1990, and Lumsdaine & Mitchell 1999). An important conclusion of this literature is that financial incentives are very important for the retirement decision, but also health. As a matter of fact, health appears to be the most important determinant of older persons labor supply in a large number of studies. This result is, however, not undisputed. There are difficulties with the measurement of health and empirical analyses complicated by the fact that health and work are jointly determined. This was already acknowledged in the early literature (Quinn 1977) and there are quite a number of studies that have addressed this issue since then. There is, however, still much controversy about how to measure health, how to deal with measurement errors and how to model the interrelation between health and work. This survey aims to add to this discussion. I provide a framework for the interrelation between health and work and use this to discuss, assess and compare the most important contributions in the literature.

Research on health and work covers a wide area. This includes the literature on Health Insurance and the labor market and the literature on the incentive effects of Disability Insurance programs[1]. This survey will leave this literature largely untouched. We refer the interested reader to the excellent surveys by Currie & Madrian (1999), Gruber & Madrian (2002) and Bound & Burkhauser (1999). This review focuses primarily on a part of the retirement literature that is concerned with the effect of health on work; little attention will be given to the literature that focuses on the effect of work on health. The prime reason is that an extensive discussion of this part of the literature would require more space. The model presented below could of course also be used to discuss issues involved in estimating the effect of work on health. We briefly return to this at the end of this review.

[1] Somewhat further related is the literature on the cross population comparability of health measures in social surveys. Here the issue is whether different (cultural) groups use different reference points when they respond to the same survey question. Part of this literature is reviewed in King et al (2004). We will discuss related issues when we focus on the validity of self-reports concerning the ability to work. See the next sections.

2 A model for health and work

The key variables of the model are the individual labor market status and health status. We use S_{it} as an indicator for the observed labor market state of person i at time t. S_{it} can be a simple dummy variable (e.g. indicating whether someone works or not) or a more refined variable that distinguishes between various labor market states (e.g. Full-time Work, Part-time Work, Retired, Unemployed etc). Without being too explicit about the functional form of the labor supply model one could write:

$$\Pr(S_{it} = j \mid Z_{it}, H^*_{it}, \xi^j_i) = F_j(Z_{it}, H^*_{it}, \xi^j_i) \tag{2.1}$$

The vector Z may include exogenous variables like age, gender and education, but also previous labor market status[2], previous health outcomes and measures for the incentives effects of Social Security, Pension plans and Health Insurance coverage.

There is a huge literature on the effects of Social Security and Pension plans on retirement behavior. See the survey by Lumsdaine & Mitchell, 1999 for the most relevant papers in this area. Here it suffices to say that there is a consensus that financial incentives are important for the retirement decision and that generous retirement schemes of the Social Security and Pension System have induced many older workers to retire early, in the US, but even more so in the European countries (see e.g. the country projects of Blondahl and Scarpetta 1998; Gruber & Wise, 1998). A recent survey of Gruber & Madrian (2002) on the effects of health insurance coverage concludes that health insurance is a central determinant of retirement decisions in the US. In particular, continuation of health care coverage after retirement has a strong positive effect on the retirement probability.

Central for this survey is the role of health H^*_{it}. Poor health may restrict workers in their ability to perform the task required for work and may therefore induce people to retire early. Poor

[2] In this case the model concerns transitions between labor market states

health may also change the value of leisure directly. The net effect could therefore be either positive or negative. Moreover, health observed at advanced ages is an outcome of an individual's health endowed at birth, previous choices concerning health and human capital and shocks throughout life. This has two consequences. Firstly, work outcomes (wages, hours worked and work environment) at advanced ages are also a result of previous outcomes regarding health and work. Relevant for the discussion here is that health and even elements of Z (in particular retirement opportunities and financial incentives individuals face[3]) may be endogenous for the retirement decision. Secondly, health is an endogenous variable because it may be jointly determined with work at time t, but perhaps more importantly, the health outcome at advanced ages may be the result of current and past work choices and past health. We will return to this later. First we discuss some issues related to the measurement of health in social surveys.

For work decisions, health as far as it is related to work is of importance (Bazzoli 1985, Bound, 1991) and therefore ideally H^*_{it} should be a measure of an individual's capacity to perform his/her work. In social surveys one usually has access to information on subjective health measures, like "How good is your health", "How good is your health compared to others of your age" and "Does your health limit you in the kind and amount of work that you can do" and more objective indicators like whether an individual has certain chronic conditions, ADL measures, health care use measures etc. We will use the generic symbol H_{it} for observed measures in surveys. The problem with subjective and objective measures of an individual's *general* health is that they are a noisy measure of the relevant work related health measure. This will generally lead to a downward bias of the effect of health in (2.1)[4]. In principle, a direct question regarding 'health-related work' would be perfect for this, but the responses to this question may be biased towards poor health for those out of work. There

[3] This would imply (for instance) that people with a great preference for leisure sort themselves into jobs that offer atractive retirement options. This relates to the discussion of the effect of health insurance. We refer to the survey's by Gruber & Madrian (2002) and Currie & Madrian (1999).
[4] The attentuation bias will occur when the measurement error is not systematic.

may, for instance, be economic motives or individuals may rationalize inactivity by claiming that they can't work. Reporting health as a major determinant for inactivity is socially more accepted and eligibility conditions for some Social Security Benefits, notably Disability Insurance Benefits, are contingent upon bad health. The *justification bias* or *state-dependent reporting* will lead to an upward bias if not appropriately controlled for. See Bound, 1991, discussed below, for an excellent discussion on this subject. We return to the relevance of state-dependent reporting and possible solutions in one of the subsections below.

H^*_{it} is a latent variable that is typically not observed in Social surveys and usually researchers include an observed measure H_{it} in 2.1. As argued above, work and health outcomes may be generated jointly and a possible solution to this 'classical' endogeneity problem is to extend equation (2.1) with a model for the impact of work on observed health:

$$H_{it} = H(S_{it}, H_{it-1}, X_{it}, \eta_i) \tag{2.2}$$

Equation (2.2) is a health production function that relates current health to past health, possibly also current labor market status and a set of additional controls (X). The latter set may include earlier labor market choices or health outcomes. η is an individual unobserved specific effect that may be correlated with the ξ^j of equation (2.1).

We require an additional equation that relates the unobserved health (H^*) to observed health (H) to close the model for health and work. The specifics of this 'reporting' model differ per application and we therefore leave it implicit here. We will be more specific later.

Models for the production of health, such as Grossman (1972) and other models based on his seminal work (e.g. Cropper 1977; Ehrlich & Chuma 1990; Sickles & Yazbeck 1998) can be used as a theoretical basis for the model above. The consequence of this interpretation is that it will be difficult

to identify the causal effect of health on work and the other way around. With correlated unobserved specific heterogeneity (η and ξ^j) we require independent variation in one of the variables to assess the causal effect of this variable on the other, or some assumptions on the structure of the model. An example of the former is an exogenous change in health, due to an unforeseen shock. Example of the latter is to assume that there is no instantaneous effect of labor market status on health[5]. Alternatively, one may employ fixed effects methods and estimate (2.1) and/or (2.2) separately.

The various contributions in the literature range from simple models where health is treated as a purely exogenous variable to more complicated models that explicitly deal with the simultaneous nature of the health and/or problems related to the measurement of health.

3 A review of the literature on the effect of health on work and the measurement of health

Early contributions of the effect of health on work

Early papers on this subject (e.g. Quinn, 1977) already noted that the cross-sectional evidence regarding the impact of health on retirement should not be taken at face value. Indeed, it was argued that responses to health question could be biased towards poor health for those out of work (e.g. Lambrinos 1981, Parsons 1980,1982) and that in addition health should be treated as an endogenous variable (e.g. Anderson & Burkhauser 1985). The general response was to replace the subjective measure by measures that were believed to be less sensitive to the justification bias, such as sickness absenteeism records (Burkhauser 1979), observed future mortality of sample respondent (Parsons 1980, Anderson & Burkhauser 1985), more refined health indices derived from multiple indicators (Lambrinos 1981, Bazzoli 1985, Breslaw & Stelcner 1987), or lagged health (Bazzoli 1985). The general conclusion from

[5] This of course also depends on the specifics of the `reporting` model. Here I assume that H is a good

these studies is that economic variables gain in importance and that health becomes less important in retirement models once more objective health measures are used. One interesting exception is the study by Anderson & Burkhauser (1985). Their paper was (to my knowledge) the first to use a more objective health measure (future mortality of survey respondents) and at the same time control for the simultaneous relationship between health and work. They found that the choice of health measure did not significantly influence the wage elasticity in the joint model, but that it did in a single equation retirement model. The health effects were about four times as large when the subjective measure was used, regardless of whether the simultaneous nature of health and work was taken into account. Much could be improved upon their identification strategy, but from this one could at least conclude that endogeneity and measurement each create its own biases and that a more fundamental discussion is required to assess the relative importance of each. Bound (1991) provided this.

Bound (1991) constructs a model for labor supply, wages and health. The health model includes an equation for objective health (mortality) and subjective health. Reporting is assumed to be influenced by wages, rather then by labor market status. Bound shows that in the context of his model each of the solutions proposed in the literature leads to different biases. The use of mortality as a proxy for true health will tend to underestimate the effect of health and overestimate the effect of financial incentives. If mortality is used to instrument subjective health, the impact of health will be correctly estimated in the labor supply model, but the effect of financial incentives will be overstated[6]. Lagged health does not account for changes in health between the time of measurement and the time of retirement and is therefore subject to the same criticism as other more objective indicators such as mortality. The sign of the biases is ambiguous if a subjective health measure is included and treated as an exogenous variable. He makes two important final observations. First, external information is required to resolve the

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instrument for H^*.

[6] Note, once more, that this holds in this model where health reporting depends on wages. This result does not hold, for instance, in a model where health reporting depends on an individual's labor market status (Kerkhofs & Lindeboom 1995)

fundamental identification problem. Second, objective and subjective measures lead to biases in opposite direction therefore could use both to bound the actual effects of health and other variables on labor force behavior of the elderly. Below we review some contributions that have followed either of these approaches.

Studies on the reliability of self reported and objective measures of health[7]

A simple test on the reliability of self-assessed measures is to compare the individual responses with objective medical reports on the individual's ability to perform work. There is evidence for justification bias or state-dependent reporting if the outcome varies across labor market states. More specifically, when would expect to find responses to be biased towards poor health for those out of work. The difficulty with this test is of course that one in general does not observe an accurate measure of the individual's 'true', work related health. As an alternative one could use an objective measure observed in the survey and relate these to the subjective responses for different groups in the labor market. In essence this is the approach taken by Kerkhofs & Lindeboom (1995), Kreider (1999) and O'Donnell (1999). They take the group of workers as a benchmark and use more objective health measures, such observed chronic health disorders (Kreider 1999. O'Donnell 1999) or an outcome of a medical test score (Kerkhofs & Lindeboom 1995) to filter out the bias relative to the group of workers. The idea is that workers have no incentives to report with error. The fundamental assumption is that the objective health measure acts as a sufficient statistic for the effect of work on true health and that therefore remaining systematic differences between subjective and objective measures across labor market states can be attributed to reporting behavior.

The main problem with these approaches is that they will fail in case there are unobservables

[7] We focus on the validity of self-reports concerning the ability to work. There is a literature on the cross population comparibility of health measures in social surveys. Here the issue is whether different (cultural) groups use different reference points when they respond to the same survey question. See for instance Sadana et al (2001) and Murray et al (2001) for reviews of thislietrature.

that affect both health and work. In that case differences between workers and non-workers may reflect differences in reporting behavior and other behavioral differences that may exist between workers and non-workers. To solve this one needs to add a model for health (dynamics). We return to this later.

Baker et al (1991) use data from the Canadian Natational Population Health Survey (NHPS) and match these with data from the Ontario Health Insurance Plan (OHIP) to assess the accuracy of self-reports on chromic conditions (observed in NHPS) and objective medical records (observed in OHIP). They find that there are substantial errors in the self reports on the prevalence of chronic conditions. They next relate the classification error to individual characteristics and labor market status and find that the errors are smaller for those in work and that the errors are larger when there is more room for personal subjective assessment. The errors are smaller the more severe the condition. So, one may conclude from this that indicators for the prevalence of chronic are not free of reporting errors either and that when used in labor supply models, this may lead to qualitatively similar biases when self-reports on general or work related health are used.

Johansson & Skedinger (2004) use administrative data from the Swedish Public Employment System (PES) and survey data to examine the accuracy of the health assessment. They argue that the official PES classification is also subject to systematic reporting errors. The PES has quantitative targets with respect to the placement of unemployed workers into jobs and it can more easily achieve this goal by placing individuals with low qualifications on subsidized jobs for disabled workers. They assume that the 'severity' of unemployment (measured by the accumulated months of unemployment) should have a stronger effect on the PES classification than on the individual self-report and find evidence for misreporting by PES officials.

Benitez-Silva et al. (2004) test the hypothesis of Rational Unbiased Reporting of Disability status (labeled as RUR). Their test is based on a comparison of the disability insurance administrators (SSA) award decision (a) with the measure for self-reported disability (d). The idea is

that the SSA sets a standard of disability and that this standard becomes common knowledge (a social standard). If individuals exaggerate their health problems, then one would expect the rate of self-reported disability to exceed the fraction of those who are ultimately awarded benefits. The hypothesis is tested on a sub sample of individuals who applied for Disability Insurance and for whom both the SSA's award or deny decision is observed. It is concluded that for the U.S. one can not reject the hypothesis that the self-reported disability is an unbiased indicator of the SSA's award decision. It is interesting to contrast this finding with the study of Johansson & Skedinger (2004). Both studies compare official outcomes with self-reports, but come to different conclusions. The study of Benitez-Silva et al. (2004) takes the official outcome as the 'true' benchmark, whereas Johansson & Skedinger (2004) take the unemployment status and time spent in unemployment as the benchmark. The latter study seems to discredit the validity of formers assumption, at least for Sweden. It remains for both, but this also holds for the papers by Kerkhofs & Lindeboom (1995), Kreider (1999) and O'Donnell (1999), that the results depend on untestable assumptions. To 'solve' this, additional external information on the true health status is needed. The method proposed by King et al (2004) and the application of this method for measures of Work Disability by Kapteyn et al (2004) are two interesting examples.

King et al (2004) use vignettes to assess the relevance of systematic measurement errors in self-reports on health. The idea is that self-reports on disability may differ between different groups and that this may be for health reasons and because people speak different 'languages'. Cultural differences, but also justification bias, may lead to differential reporting for a given level of true health. Health of hypothetical persons are described in vignettes and respondents evaluations are used to identify the extent to which differences in self-reports between socio-demographic groups depend on reporting behavior. Kapteyn et al (2004) apply the method on Dutch and US data and find that about half of the difference between the self–reported rates of work disability in the two countries can be explained by reporting behavior.

Empirical models for health and work

There is a set of papers that implicitly or explicitly use the conceptual model (2.1) and (2.2) of the previous section. Sickles & Taubman (1986) have a joint model for health and retirement in which health is allowed to affect work, but not the other ways around[8]. Their health measure is the response to the question „How does your health compare with that of others of the same age?“ They conclude that health plays a prominent role for the retirement decision. Stern (1989) constructs a latent variable model for labor supply, true health and reported health. Labor supply is influenced by unobserved true health, reported health depends on true health and labor market status, and unobserved true health depends on labor force participation. Not all parameters of the model are identified. It is possible to test for the endogeneity of health, but it is not possible to separately test for justification bias. Stern finds that both the subjective work related health and an individual's assessment of his/her general health status have strong and independent effects on labor supply. The results of his exogeneity test indicate that work related health is an exogenous predictor of labor force participation. Much of the results may have been driven by the specifics of his model and the identification strategy. Kerkhofs et al (1999) estimate a retirement model with a range of different health constructs. These health constructs are derived from estimates of a model for health dynamics. They conclude that health and labor supply are endogenously related and that the size of the health effect crucially depends on the health measure used. The incentive effects in the retirement model are relatively insensitive to alternative specifications of health. A similar strategy is followed by Dwyer & Mitchell (1999).

Dwyer & Mitchell (1999) start with a retirement model like (2.1), where the retirement age depends on financial incentives and true health. They add an equation that relates observed health to true health and instrument the true health with a range of more objective indicators. The idea is that

one could use the objective indicators to correct for justification bias if the objective indicators are sufficiently correlated with true health. As argued previously, health as far as it relates to work is relevant for work and therefore objective indicators are likely to be imperfectly correlated with true work related health. Moreover, this procedure only works if there are no direct effects of labor market status on the different response categories[9]. They find that health effects vary with measures used but that they always have a strong effect on retirement. They find that self-rated health measures are not endogenously determined with labor supply and that they are not correlated with financial incentive variables in the retirement equation. From the latter they conclude that there is no evidence in support of the justification bias.

Blau & Gilleskie (2001) estimate a model for transitions between labor market states and health. There is no explicit model for the relation between observed health and the theoretical latent concept H^* relevant for the work decisions. Their approach is to explore several alternative specifications of health, with each specification nested in the next one. The health measures include self-reported measures of general health and disability, the prevalence of chronic conditions and ADL difficulties. There error terms of the health model and the work model (η an ζ in (2.1) and (2.2)) are stochastically related and the health and work model is estimated jointly. Their results indicate that health is an important factor for the retirement decision and that each of the health measures provides a significant improvement of the fit of the model. They conclude that health and retirement models should avoid arbitrary specifications with a single measure of health and that health should be treated as an endogenous variable.

Bound et al (1999) specify a model for transitions between work states and a dynamic model for health. Controlling for current health, past health can affect work decisions simply because it may take time to adjust working time. Moreover, with lagged health one can examine whether

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[8] They substitute H for H^* in (2.1) and take a reduced form specification for (2.2).
[9] For this see below the discussion of Bound et al (1999)

changes in health affect labor supply decisions, rather than the level of health. They construct a latent variable model to construct an index of health. This health index model relates observed self-reported general health to a set of detailed health measures. Estimates of this model are used to instrument the endogenous error-ridden self-reported measure. The set of detailed health measures are taken as exogenous for self-reported health. It should be added that this in this way one can correct for endogenous nature of health, but that it does not necessarily eliminate the justification bias. To add on the last aspect, if H is observed as an ordered response to K health categories:

$$H_i = k \quad \text{iff} \quad c_{k-1} < I_i^* < c_k \,,\; k = 1,..,K \tag{3.1}$$

It matters whether the justification bias acts on the index function I^* or on the reporting thresholds c_l. The nature of the justification bias is that the individual response depends on labor market status and that it may affect different response categories in a different way. If this is the case, then one needs to model the thresholds c_l as a function of labor market states, rather then via I^*. This is the strategy followed by Kerkhofs & Lindeboom (1995, 2004). Bound et al (1999) implicitly assume that the justification bias only affects the index function (i.e. that all thresholds are shifted in parallel). They find that health is a very important factor of labor force participation behavior for older men and women and that the relationship between health and labor force behavior is dynamic. Respondents whose health has declined recently are more likely to leave the labor force. Lagged health affects labor force behavior, even after controlling for current health. Disney at al (2004) and Au et al (2004) applied the method of Bound et al (1999) to British and Canadian data, respectively. They confirm the results of Bound et al (1999).

Kerkhofs & Lindeboom (2004) specify and estimate a model for work, health production and health reporting[10]. The model for health and work is like (2.1) and (2.2). The work model (2.1) involves choices on Work, or leaving the labor force via an employer provided Early Retirement (ER) scheme, a Disability Insurance (DI) Scheme or an Unemployment Insurance (UI) scheme. Past work choices affect health in the health production model (2.2). The health reporting model assumes that an individual's response to a health question depends on the true health H*, but that justification bias leads to differential reporting via the response thresholds:

$$H_{it} = k \quad \Leftrightarrow \quad c_{k-1}(S_{it}) < H_{it}^{*} < c_{k}(S_{it}), \quad \text{for } k = 1,..,\mathrm{K} \tag{3.2}$$

As in Kerkhofs & Lindeboom (1995) it is assumed that one can instrument H^* with an objective measure of health (H^O) and that this objective health measure acts as a sufficient statistic for the effect of work on true health (see above). So,

$$\mathrm{E}(H^{*} \mid H_{it}, X_{it}^{*}, \eta_{i}^{*}) = \alpha \cdot H_{it}^{O} + X_{it}^{*}\beta^{*} + \eta_{i}^{*} \tag{3.3}$$

Note that with the assumption stated above, the right hand side of (3.3) does not depend on S. Therefore, conditional on H^O, any variation across labor market status in responses to the health question can be ascribed to reporting behavior. One way to model this is to allow the response thresholds to depend on labor market status S, so that after substituting (3.3) into (3.2) gives:

$$H_{it} = k \quad \Leftrightarrow \quad c_{k-1}(S_{it}) < \alpha H_{it}^{\mathrm{O}} + X_{it}^{*}\beta + \nu_{i}^{*} < c_{k}(S_{it}), \quad \text{for } k = 1,..,\mathrm{K} \tag{3.4}$$

[10] They distinguish four labor market states Employed, on Unempoyment Insurance, on Disability Insurance and on an employer provided Early Retirement Scheme.

Lindeboom & Kerkhofs (2004) use estimates of (3.4) to translate the observed subjective health measure into a health index that is free of state-dependent reporting errors[11]. In turn this cleansed health index is used in the model for work decisions. The health reporting model (3.4) is estimated jointly with the model for work (2.1) and health production (2.2). They find strong effects of financial incentives on the work decisions of older workers and that the different retirement options acts as substitutes. Furthermore they find that there are strong effects of health on work choices and that the biases in the self reports are large and systematic, notably for Disability Insurance recipients. The health production model reveals that increased work efforts eventually lead to a deterioration of health.

Some of the contributions above (Bound et al 1999, Disney et al 2004) found that health shocks may be important for the retirement decision. Moreover, variation in the timing of an unanticipated health shock may provide exogenous variation in health status that can be used to identify causal effect of health on labor force behavior[12]. We therefore briefly discuss some studies that focus on the effects of health events on labor supply.

McLellan (1998) studies how changes in health affect health insurance coverage and labor supply for middle aged Americans. He uses the first two waves of the HRS and uses the detailed health information to define three broad classes of health problems: major health events that have acute and long-term functional implications; new chronic illnesses which are less likely to affect functional status today, but which may have substantial long-term implications; and accidents. He looks at determinants of these health factors and at the effects of these health factors on subsequent insurance coverage and labor supply. He finds that new health events of all kinds are more prevalent

[11] One could for instance take the workers as the reference group and use the workers thresholds (c_k) to generate unbiased responses for respondents out of work.
[12] See for instance the paper by Abbring & van den Berg (2003), who deals with treatment effects in event history models.

for individuals with low Socio-Economic Status. The health events observed are heterogenous in nature and in their consequences for functional status and expectations about future functional status. Different kinds of health problems have different effects on insurance coverage and labor supply. Major health events have large effects on the retirement decisions, new chronic illnesses have also a significant, though milder, effect on labor supply and accidents have no effect on labor supply[13].

Riphahns (1998), investigates the effect of health shocks on employment and economic well-being of older German workers. She finds that a health shock increases the probability of leaving the labor force or becoming unemployed. The financial effects of the health shocks are relatively small. McGarry (2002) looks at the effect of health and changes in health on the individual's subjective probability of continued work. She controls for justification bias by focusing on workers alone. This is a correct procedure; provided that workers do not respond in anticipation to future, early retirement. Health is treated as an exogenous regressor. She finds that subjective health has a strong impact on the subjective probability of continued work. The effect of subjective health remains large when more objective health measures are included. She also finds that health changes are important for changes in retirement expectations.

Structural models for health and work

Estimates of the structural, i.e. preference, parameters of a behavioral model can be very powerful for the understanding of behavior regarding labor and health, as well as for the evaluation of alternative policy proposals. Quite a few of these models have been developed and estimated in the retirement literature (For references see e.g. Heyma 2004). The contributions in the field of health and work are rare. Notable exceptions are Sickles &Yazbeck (1998) and Bound et al (2005).

[13] He also finds that health events are associated with reduced coverage in private insurance health coverage and an increased coverage in government insurance programs. The increase in the government insurance programs more than offsets the decrease in private insurance coverage

Sickless and Yazbeck (1998), specify and structurally estimate a model for the demand for leisure and the production of health for older males. They use a stochastic dynamic programming framework, where individuals are assumed to maximize lifetime utility subject to budget and time constraints and a health production function. Hours of leisure and levels of consumption of health related and health neutral goods and services are the choice variables in the model. They use an index for general health, derived from a range of subjective and objective health measures. They find that health positively influences the demand for leisure and that health related consumption and leisure improve health.

The paper by Bound et al (2005) looks at the interrelation between health, financial resources and labor supply for older men. The labor choices are staying in the career job, taking a bridge job, leaving the labor market and applying for Disability Insurance and leaving the labor market and not applying for Disability Insurance and leaving the labor force. Their health model is a latent variable model, where latent true health depends on a range of detailed health indicators. As in Bound et al (1999) it is assumed that the detailed health measures are strictly exogenous with respect to labor market choices and that the justification bias acts additively on the index function. Solving the dynamic programming model requires knowledge of the future path of the state variables, including the detailed health measures. It is assumed that these are not affected by labor market choices and that they remain constant. The authors find that both health and economic resources play an important role. Those in good health are unlikely to retire, unless their resources allow them to do so, but an individual in poor health is more likely to retire, regardless of the available financial resources. They look at the sensitivity of their results for alternative specifications of health and conclude that this has a significant effect on the behavioral effects of poor health found in their model.

4 Discussion and conclusions

One can conclude from the above that the discussion on the interrelation between health and work among older workers has not been closed. Measurement issues remain important. The recent work suggests that we still have to learn more about the validity of subjective and more objective measures and that external information, from, for instance, vignettes can be very useful. Moreover, recent studies suggest that a measure should be used that acknowledges the different dimensions of health and their importance for work. Some of the studies above suggested that at later ages changes in health become more important for work decisions. Sudden, unanticipated, changes in health and variation in the timing of the occurrence of the health event may help in identifying the causal effect of health on work.

This review has focused primarily on the effect of health on work at later ages. Recent research (Adams et al 2003, Smith 2004) suggests that this is the most important mechanism driving the association at later ages. There are, however, also studies that find that work outcomes at later ages are important for health (See e.g. Kerkhofs & Lindeboom 1997, or Charles 2001). Still much can be learned in this area. Health observed at later ages is the result of life cycle choices concerning work and health and past health (including the initial health) will influence current health. There is a growing literature that focuses on the effect of early life outcomes on later health and socio-economic status (see for instance the literature reviewed in Case et al 2004). Early life conditions are found to be very important for health and socio-economic status at later ages. This means that the budget constraint at later ages can not be treated as strictly exogenous. This is important for the interpretation of the effects found in the studies listed above and for public policy in an ageing society.

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